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Germany can increase its raw material import security of supply

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DIW Weekly Report 49+50 2022

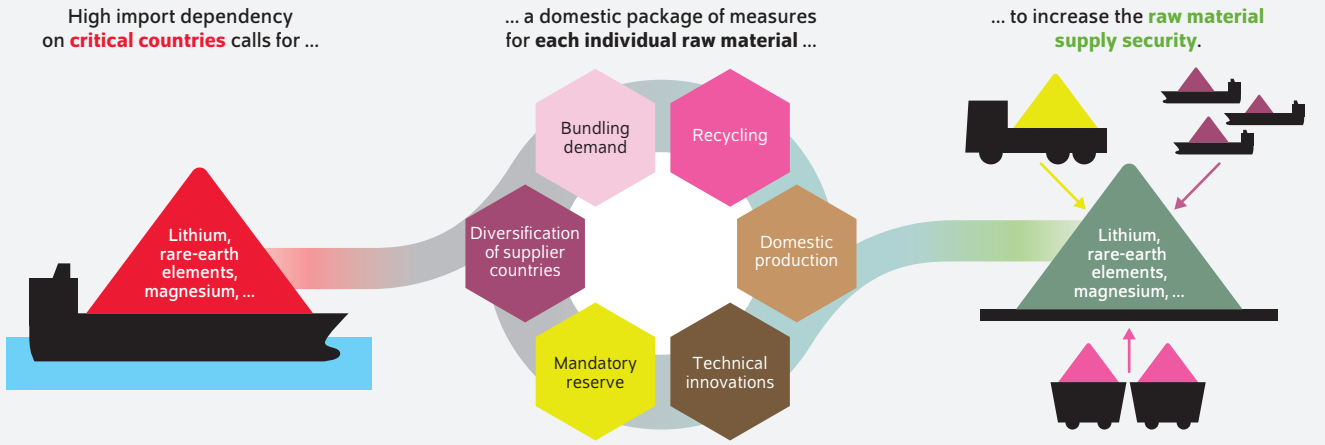
AT A GLANCE

Germany can increase its raw material import security of supply

By Lukas Menkhoff and Marius Zeevaert

- Germany and the EU often import mineral raw materials from less democratic countries
- The partially extreme dependency on these raw material imports should be limited in the short and long term
- Analysis of individual critical raw materials as well as of supplier countries shows potential for action
- Greater diversification, better recycling, more domestic production, and technical innovations should be complemented by a mandatory reserve and joint EU purchasing
- Economic policy makers and companies have recognized the need for action; now it is a matter of swift—ideally Europe-wide—implementation

Appropriate measures can reduce heavy dependency on critical raw materials



Source: Authors' depiction.

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FROM THE AUTHORS

"The production of critical raw materials is concentrated in some cases up to 80 or even over 90 percent in individual countries. This means there is a very large market concentration that needs to be counteracted by short- and long-term measures."

— Marius Zeevaert —

MEDIA

Audio interview with Marius Zeevaert (in German)
www.diw.de/mediathek

Germany can increase its raw material import security of supply

By Lukas Menkhoff and Marius Zeevaert

ABSTRACT

Over 90 percent of Germany's raw materials supply is imported and many of these imports come from only a small handful of producer countries. Often, these producer countries tend to be less democratic. In this respect, supply risks are extremely high in some cases, including for mineral raw materials such as rare-earth elements, lithium, and magnesium. To increase raw material import security of supply, various economic policies can be undertaken. European customers could bundle their procurement of raw materials to counter the market power of the few suppliers and more diversification potentials in imports could be used. Raw material storage should also be reconsidered and supplemented by a mandatory minimum reserve. In the long term, raw material imports can be reduced by recycling more and expanding domestic mineral raw material production. Finally, technical innovations should be initiated to replace raw material imports. These measures should be coordinated at a European level as much as possible.

For decades, two separate worlds seemed to exist in parallel: the world commodities markets and international politics. For example, the Soviet Union reliably sold raw materials to their enemy in the West during the Cold War. However, it has become clear throughout 2022 that the availability of raw materials is being used to exert political pressure. A reliable supply is not guaranteed, so government and business leaders are aware that more efforts must be made to secure raw materials.

Well over 90 percent of all the raw materials used in Germany are imported. Thus, raw material security of supply means the import of a specific raw material is guaranteed in the short term. Most of these raw materials are imported from different regions of the world, including from countries that are not considered reliable supplier countries from a European perspective. Over the course of the 2022 Russian war on Ukraine, this unreliability has become clear in the case of natural gas and oil. However, this applies even more to mineral raw materials when measured by import share.[1]

EU Commission has evaluated supply security of many raw materials as critical

Since 2011, the European Commission has published a list of "critical raw materials" every three years.[2] A raw material is considered critical when two criteria are fulfilled: It must be of high importance to the economy and high risk must be associated with its supply.[3] Raw materials are primarily important when they are indispensable for modern technology (semiconductors, battery technology, space flight). The supply risk considers the willingness of countries to supply, the means and routes of transportation, or the lack of competition between suppliers.

1 There are other dependencies in Europe and Germany in addition to energy source materials and mineral raw materials, for example on electronic and medical primary products.

2 European Commission, *Study on the EU's List of Critical Raw Materials – Final Report* (Brussels: 2020) (available online; accessed on November 28, 2022. This applies to all other online sources in this report unless stated otherwise). All raw materials that are neither an energy source material nor an agricultural raw material are considered.

3 European Commission, *Methodology for Establishing the EU List of Critical Raw Materials* (2019) (available online).

DOI: https://doi.org/10.18723/diw_dwr:2022-49-2

Thirty of the 83 observed raw materials are considered critical. The rest are not unimportant, but simply less critical. For example, gold is considered uncritical in both dimensions, while silver is important but its supply is low risk. Teak is subject to supply risk but considered less economically important. The critical group includes the rare-earth elements in particular, but for instance also magnesium, lithium, cobalt, and bauxite.

EU and German government preparing measures for more raw material security

In response to the new global economic environment, the EU Commission announced an action plan for critical raw materials for spring 2023. It will likely be more specific than previous recommendations and go further than previous starting points, including on import diversification. The German Federal Government is also considering national measures, both long and short term (Box).[4]

Short-term measures assume that imports of critical raw materials will continue to be necessary, suppliers will fundamentally remain the same, and volumes may even increase, for example to cope with the energy transition. In the short-term, three different measures are possible: One option is bundling demand to counteract the market power of a few suppliers. Another measure is a greater diversification of supplier countries, which tends to reduce the power of individual suppliers and also cushions import declines in the event of a supplier default. Finally, a mandatory minimum reserve to temporarily ensure the security of supply can be required.

In the long term, raw material security can be increased by partially replacing raw material imports with three measures. One of them is improved recycling, which can be reached through stricter legally binding recycling quotas, for instance.[5] Furthermore, countries can make greater use of their own production facilities, and, finally, promote technical innovations that reduce the use of or completely replace critical raw materials.[6]

Box

Raw materials strategy of the EU and the German Federal Government

As early as 2008, the European Commission launched a Raw Materials Initiative (RMI). Accordingly, the EU is striving to diversify supplier countries, to recycle raw materials, and to achieve greater material efficiency. A study on critical raw materials has been produced every three years since 2011, and the latest edition from 2020 is used to define critical raw materials in this Weekly Report.[1] The number of raw materials considered has increased with each issue, most recently to 83 raw materials. Of these 83 raw materials, 30 are considered "critical," meaning they are both important to Europe and have a high supply risk.

Germany first drew up a raw materials strategy in 2010. As a result, the *Deutsche Rohstoffagentur* (DERA) was founded as a part of the Federal Institute for Geosciences and Natural Resources (*Bundesanstalt für Geowissenschaften und Rohstoffe*, BGR), which itself is an agency of the Federal Ministry for Economic Affairs and Climate Action (*Bundesministerium für Wirtschaft und Klimaschutz*, BMWK). The DERA gathers information on mineral raw materials and energy commodities, evaluates them, and advises German companies. The raw materials strategy was last updated in 2020 and mentions, among other things, "having the possibilities of additional state measures for securing raw materials examined in a commissioned study."[2] This study has been available since August 2022.[3]

1 EU Commission, *Critical raw materials* (2020) (available online).

2 Cf. Bundesministerium für Wirtschaft und Klimaschutz, *Rohstoffstrategie der Bundesregierung* (2020) (in German; available online).

3 Cf. Ernst & Young, *Staatliche Instrumente zur Erhöhung der Versorgungssicherheit von mineralischen Rohstoffen.*

Coordinated European approach and joint procurement of raw materials are advantageous

For all six measures mentioned, it would be beneficial for Germany if other EU Member States cooperated. This becomes very clear when comparing the raw material import dependency between Germany and the EU. Both Germany and Europe are 100-percent import dependent regarding 14 of 27 critical raw materials from the EU list. For three others, they are each over 95 percent dependent on imports (Figure 1). In addition, there are seven raw materials on which Germany is completely import dependent, while the EU is only up to 80 percent dependent. Both Germany and the EU import 50 to 80 percent of two raw materials. Only when it comes to borates does Germany have a lower import dependency than the EU. Overall, the EU is more independent than Germany in seven cases, and vice versa Germany only in one case. This asymmetry applies to most other EU countries on a similar level, which creates a strong incentive for European cooperation.

European cooperation could begin with joint purchases of imported raw materials to counteract the market power of the few suppliers of critical raw materials. When including individual rare-earth elements (like cerium and dyprosium), the number of critical raw materials on the EU Commission list increases from 30 to 44. For all 44 raw materials, the largest supplier country in each case already has a significant

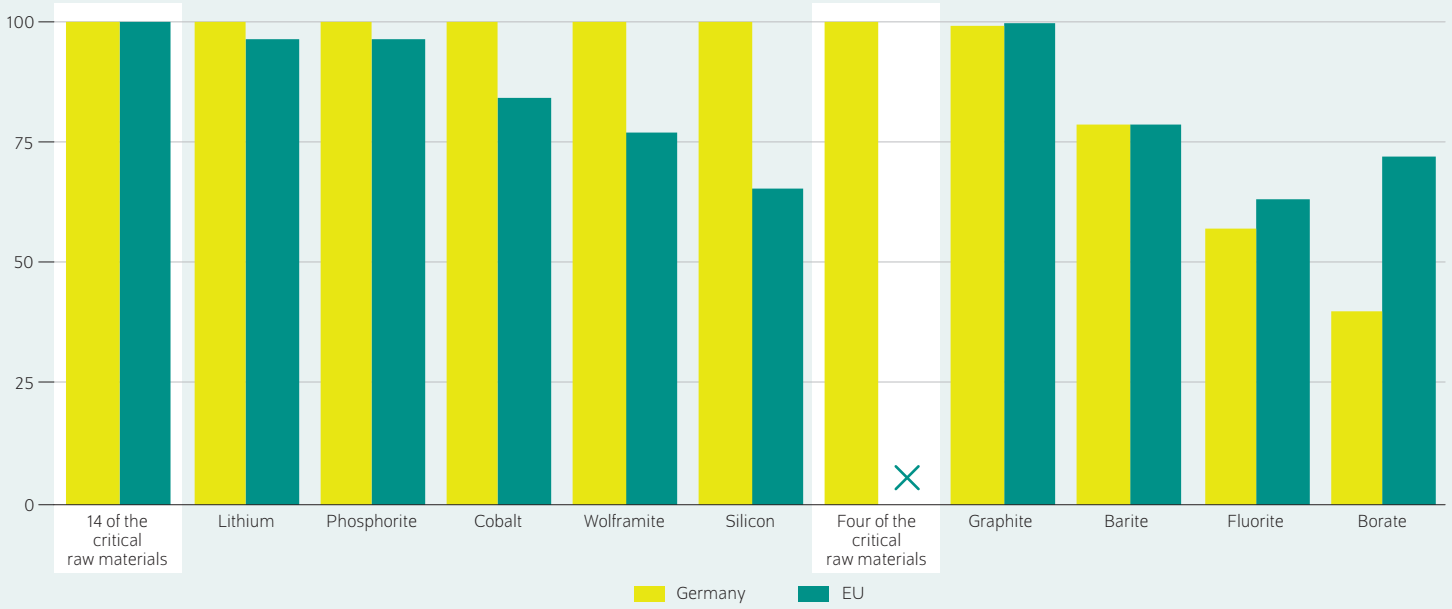
4 Such as using subsidies and loan guarantees to secure raw materials, cf. Julia Löhr, "Ein Gesetz für die Rohstoffsicherheit," *Frankfurter Allgemeine Zeitung*, October 17, 2022 (in German; available online).

5 Sachverständigenrat für Umweltfragen, *Umweltgutachten 2020: Für eine entschlossene Umweltpolitik in Deutschland und Europa* (2020) (available online).

6 For example, a large battery that is made without critical materials, cf. Marcus Theurer, "Die grüne Mega-Batterie aus Franken," *Frankfurter Allgemeine Zeitung*, November 13, 2022 (in German; available online).

Figure 1

Share of imports of mineral raw materials used in the EU and in Germany
In percent



Notes: There is complete dependency on imports of antimony, beryllium, bismuth, gallium, germanium, natural rubber, niobium, phosphorus, platinum metals, the rare-earth elements, tantalum, titanium, vanadium, and magnesium. Germany is fully dependent on hadnium, indium, coking coal, and strontium imports, while the EU is independent. For data reasons, only 27 of the 30 critical raw materials are included.

Sources: Eurostat; World Mining Data; UNFAO; EU Commission; US Geological Survey; British Geological Survey; authors' calculations.

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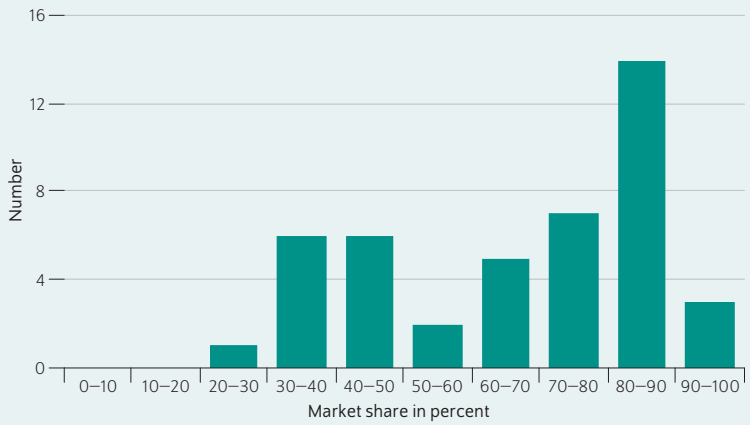
In many cases, Germany is more dependent on imports of critical raw materials than the EU.

Figure 2

Market concentration of critical raw materials
Number of raw materials; market shares of the most important supplier country globally in percent



Note: Thirty critical raw materials including subcategories (for example, the rare-earth elements) were observed.

Source: EU Commission (2020).

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The largest supplier country has immense market power for many raw materials.

market share. The smallest share of global production is 28 percent, while the largest is 93 percent (Figure 2). The median is 74 percent.

Diversification can increase security of supply

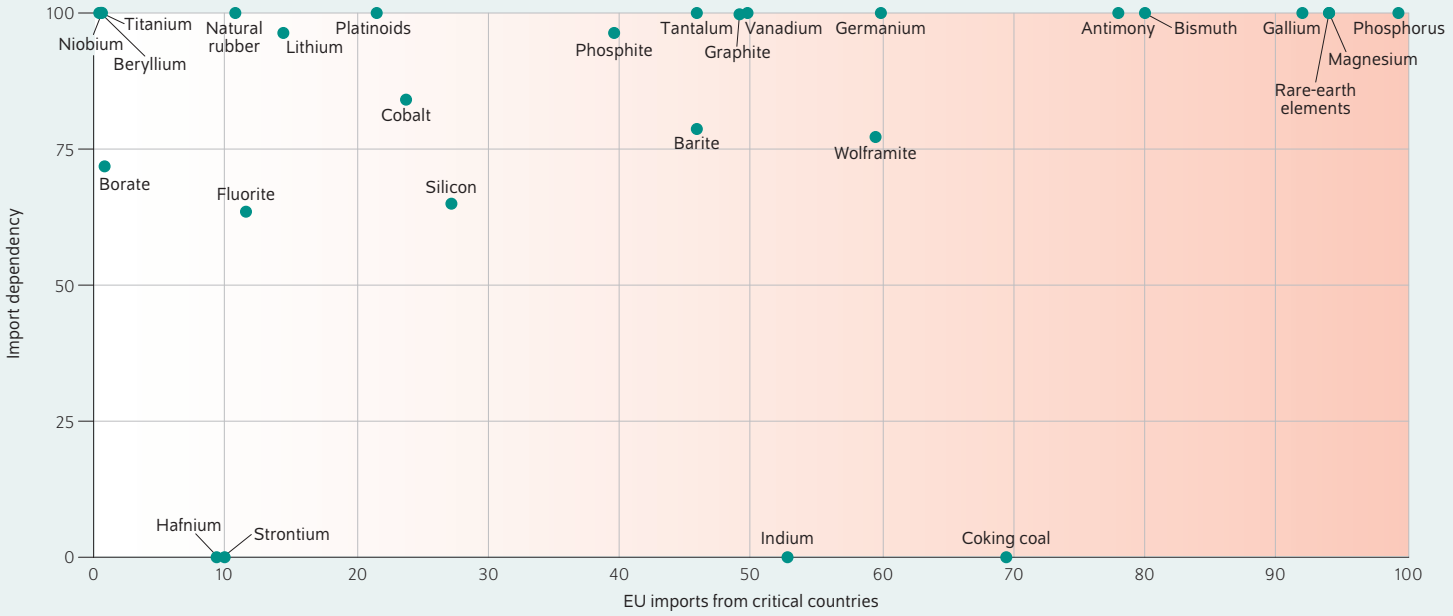
Diversifying imports so as not to depend on the whims of one or a few suppliers is a helpful measure. However, the short-term diversification potential for a major consumer, like the EU Member States, is limited when one single supplier dominates the world market by up to 74 percent.

In addition to the economic dimension, there is also a political dimension when important supplier countries are also considered politically unreliable (Figure 3).[7] The World Bank's Voice and Accountability Index is used to classify countries as critical supplier countries. Countries are considered critical if their score is worse than that of Turkey, which has the lowest score among all OECD members by far. Many of the critical raw materials imported are almost entirely from countries with little democracy, particularly

7 The World Bank provides a Voice and Accountability Index for almost all countries in the world over long periods of time, providing good coverage in terms of content and geography. Cf. World Bank, *Worldwide Governance Indicators* (2022) (available online).

Figure 3

Import dependency of critical countries
Share of EU imports in percent[1]



1 Share of total imports of a raw material from countries with a Voice and Accountability Index score lower than Turkey's.

Sources: Eurostat; World Mining Data; UNFAO; EU Commission; US Geological Survey; British Geological Survey; World Bank.

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A high share of EU imports of many raw materials are from especially critical countries.

from China.[8] In such cases, one starting point could be to attract other producer countries as suppliers.

However, the potential to import less from countries whose Voice and Accountability Index score is lower than Turkey's is limited in the short term. This can be illustrated by the difference between EU import shares from critical countries and their shares of global production (Figure 4).[9] Accordingly, there are only a few mineral raw materials that Europe imports disproportionately large amounts of from less democratic countries (positive range). For these minerals, there is a short-term potential for diversification by importing more from democratic countries. Conversely, it can be seen that large amounts of many raw materials are imported disproportionately from democratic countries (negative change), and thus the potential for changing the supplier countries is lower.

More raw material extraction in Europe remains controversial

The most secure area to obtain raw materials from is the EU itself. For example, of the 30 critical raw materials considered, twelve are currently produced in the EU, but often only in very small quantities.[10] Five other raw materials have deposits that have not yet been exploited in the EU. For three other raw materials, EU deposits are expected, but have not yet been quantified.

However, there is resistance to any kind of raw material extraction and environmental exploitation, which cannot be avoided even with a climate-friendly energy transition. As understandable as this resistance may be from the perspective of those affected, it is incompatible in macroeconomic terms with the goal of reducing dependency on critical raw material imports. Society must consider how best to balance the three goals of high income (as a high-tech location), raw material security (through less dependence on non-democratic countries), and protection of its domestic environment

8 Cf. Melinda Fremery and Thomas Obst, "Globalisierungskrise: Welche Abhängigkeiten bestehen bei kritischen Gütern und Rohstoffen aus China?" *IW-Kurzbericht* 48 (2022) (in German; available online).

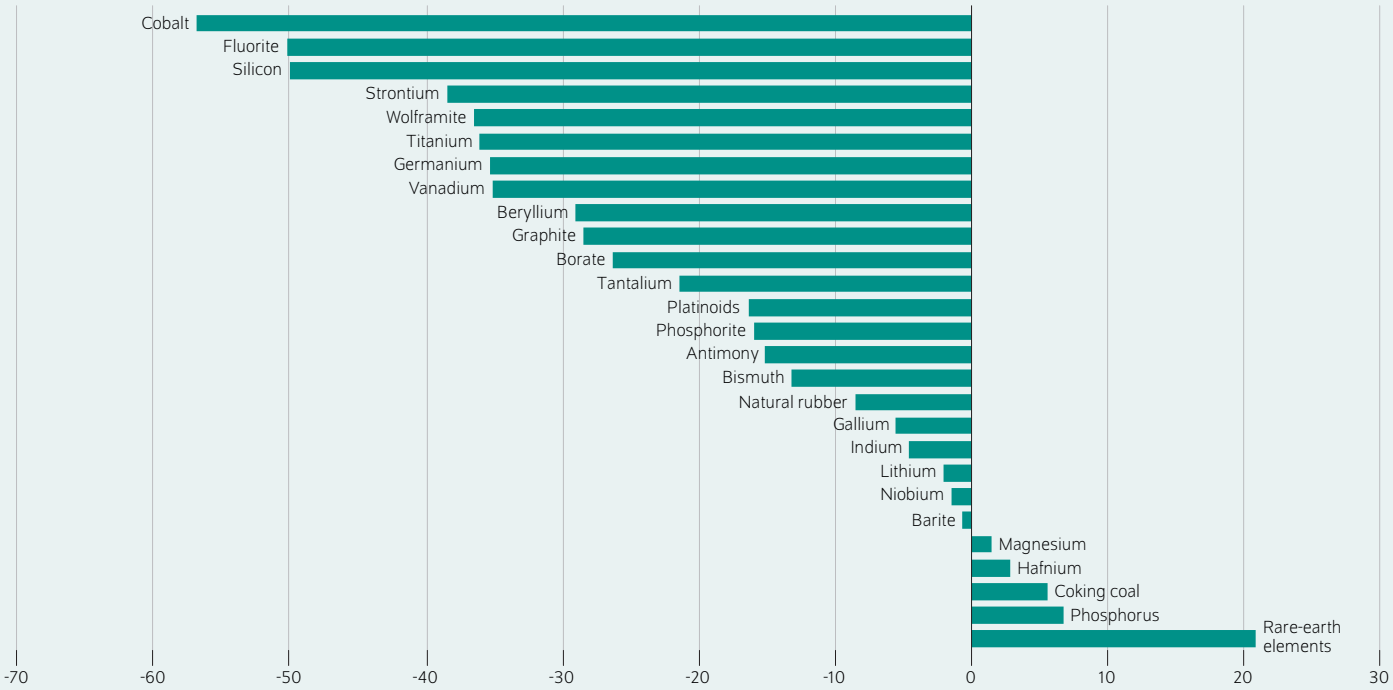
9 Cf. Lisandra Flach et al., *Wie abhängig ist Deutschland von Rohstoffimporten?* (Munich: Ifo-Institut, 2022) (in German; available online).

10 U.S. Geological Survey, *Mineral Commodity Summaries* (2022) (available online); Austrian Finance Ministry, *World Mining Data* (2022) (available online); Minerals4EU, *European Minerals Yearbook* (2022) (available online); EU Commission, *Critical Raw Materials Factsheets* (2020) (available online).

Figure 4

Short-term diversification potential

Difference between EU import and global production shares of critical countries, in percentage points



Legend: A positive difference for a raw material means that the share that the EU imports from critical countries is higher than their share of global production.

Sources: Eurostat; World Mining Data; UNFAO; EU Commission; US Geological Survey; British Geological Survey.

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The short-term diversification potential is often limited.

(by avoiding raw material extraction) (Figure 5). These conflicting goals can be mitigated (through recycling, for example), but choices must be made.

The current stance of the German Federal Government as formulated in the raw materials strategy remains insufficient, as it seems very passive considering the current situation: "The German government will support initiatives of the European Commission aimed at reviving the primary extraction of necessary metallic raw materials for e-mobility and the energy transition, such as copper, lithium, and nickel, in the member states of the European Commission."[11]

Situation of each raw material is unique

For all critical raw materials, it makes sense to bundle demand, to introduce mandatory minimum reserve requirements, to recycle, and to promote substitution through innovation. However, whether and how a diversification of imports and domestic production can be employed, differs between the raw materials. This can be seen using the rare-earth elements, magnesium, and lithium as examples.

The 17 **rare-earth elements** are used in numerous key technologies and are especially vital in the construction of electric vehicles and wind turbines. The EU is almost completely dependent on imports of these raw materials: Ninety-four percent of EU imports come from especially critical countries, led by China (Figure 6).

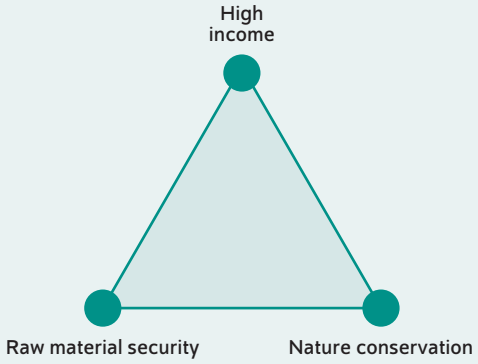
A short- to medium-term diversification of rare-earth elements will be difficult for the EU. In addition to China, Myanmar, the USA, and Australia produce large amounts of rare-earth elements, but their exports are low because they primarily serve domestic customers.[12] Thus, it will be expensive or impossible for European customers to purchase American and Australian rare-earth elements. Apart from China, only one country, Thailand, has a significant surplus

11 Bundesregierung, *Rohstoffstrategie der Bundesregierung, Sicherung einer nachhaltigen Rohstoffversorgung Deutschlands mit nicht energetischen mineralischen Rohstoffen* (Berlin: 2020) (in German; available online).

12 For trade data on rare-earth elements, see Eurostat, *EU Handel seit 1988 nach HS2-4-6 und KN8* (in German; available online) and UN Comtrade, *Trade Data* (2022), for production and reserves data, see U.S. Geological Survey, *Mineral Commodity Summaries*. Since different data sources were used in this case as well as for other raw materials, the delineations of the respective raw materials are sometimes different. The respective shares are therefore only comparable to a limited extent.

Figure 5

Conflicting goals in achieving a raw material supply



Source: Authors' depiction.

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The goals of a high income, secure raw material supply, and nature conservation must be balanced.

of rare-earth elements and could help the EU diversify in the medium term. However, the International Energy Agency forecasts that global demand for rare-earth elements just to meet the Paris climate goals is expected to increase sevenfold by 2040.[13] Thus, for long-term raw material diversification, production expansion in democratic supplier countries is crucial.

In addition to the critical countries of China, Russia, and Vietnam, Brazil, India, and Australia, in particular, have large reserves of rare-earth elements (Figure 6). Therefore, it is in Europe's interest to strengthen the expansion of production capacities in these countries to secure long-term raw material supply security. To this end, the EU should examine the extent to which it can provide concrete support for exploration projects in these countries and should reduce trade barriers with them.

A further option for decreasing dependency on raw material imports is to begin or expand production in the EU. For example, some critical raw materials, such as fluorite, are already being produced in Germany or other EU countries, but extracting a significantly larger amount would be geologically possible. One example is **magnesium**, which is currently used in the manufacture of transmission housings for cars, among other things, because of its material properties. Since magnesium is also needed for fuel cells that can convert hydrogen into electricity, it plays an important role in achieving climate targets.[14]

China produces 90.7 percent of magnesium globally and 93.3 percent of EU imports are from China (Figure 7).[15] When magnesium production fell in 2021 due to energy-saving requirements in China, EU dependency led to a tense supply situation and the threat of plant closures in the automotive industry.[16] This dependency is unnecessary, as there is an extraordinarily high number of magnesium deposits globally. While there are no precise estimates of reserves per country, this is because magnesium can be extracted from seawater, dolomite rock and other minerals. However, there have been initial efforts from companies to mine magnesium in EU countries, and the EU should consider providing more support for these projects. For magnesium and some of the other 30 critical raw materials, the high costs of domestic production are the reason for strong import dependency, not a lack of deposits in the EU.

Despite the focus on raw materials from critical countries, EU dependencies on democratic countries should also be addressed, as these countries can also use their market power to fetch higher prices or completely stop exports, as the example of Indonesia showed for nickel in 2020.

Lithium is also one of the 30 especially critical raw materials according to the EU. Lithium is used in electric car batteries and is thus particularly important for achieving the climate targets. Accordingly, the International Energy Agency is forecasting that the global demand for lithium could increase by over 40-fold by 2040 if a sustainable development scenario is followed.[17] It is therefore concerning that the EU sourced 63 percent of its lithium imports from Chile in 2020. Such a high share gives the country significant market power. One look at the global export countries shows that Australia, China, and Argentina are also potential supplier countries (Figure 8). However, in addition to Chile, only China exports large amounts of lithium. Because more Chinese imports would not make raw material imports more secure, the focus should be on increasing cooperation with other potential suppliers. Moreover, lithium production can be increased in Europe, too, such as in Spain.[18] There are also large deposits of lithium in Germany in the Upper Rhine Rift, although the area is considered earthquake prone. If modern, environmentally-friendly methods can be utilized to mine lithium there safely, German import dependency could be markedly reduced.[19]

13 International Energy Agency, *The Role of Critical Minerals in Clean Energy Transitions* (Paris: IEA, 2021) (available online).

14 EU Commission, *Critical Raw Materials for Strategic Technologies and Sectors in the EU – A Foresight Study* (2020) (available online).

15 The data refer to (further) processed and recycled magnesium.

16 Deutsche Rohstoffagentur, *Rohstoff-Engpass: Chinas Magnesium-Metallexport eingebrochen – Versorgung auf dem Weltmarkt bleibt angespannt* (2021) (in German; available online).

17 International Energy Agency, *The Role of Critical Minerals in Clean Energy Transitions*

18 Linda Osusky, "Spanische Mine könnte bald ans Netz gehen," *Tagesspiegel*, November 9, 2022 (in German; available online).

19 In various scenarios of rising lithium demand, the German Mineral Resources Agency estimates that Europe could at best supply itself with around 30 percent from domestic production by 2030, plus a few percentage points from recycling, so that the overwhelming majority of lithium would still have to be imported. Cf. Deutsche Rohstoffagentur, "DERA stellt Ergebnisse der Rohstoffbewertung Lithium vor: Hohe Angebotskonzentration bei Lithium – Schlüsselrohstoff und limitierender Faktor für die Verkehrswende und Speicherung regenerativer Energie," press release from June 24, 2022 (in German; online verfügbar).

Figure 6

Diversification of the rare-earth elements, magnesium, and lithium

Share of countries of EU imports, global exports, global production, and reserves known worldwide, in percent

Sources: Eurostat, UN Comtrade, British Geological Survey, US Geological Survey, World Mining Data.

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The rare-earth elements, magnesium, and lithium offer various possibilities for reducing dependency.

Learning from other countries

Countries such as Japan and South Korea are in a largely comparable situation to Germany. They have already taken wide-reaching measures: For example, both countries require mandatory minimum reserves of critical raw materials. In Japan, the minimum reserve must cover 180 days of use. South Korea recently founded a state-owned commodities company to support exploration. Both countries have targeted recycling support and subsidize research relevant to critical raw materials substitution.[20]

The United States supports its domestic production of rare-earth elements with state investments and tax incentives for refineries and production sites. As a result, production was able to increase from zero tons in 2017 to 39,000 tons in 2020, or about 15 percent of global production. The EU could implement these types of measures for critical raw materials with their own European reserves, for example magnesium. Support will be more difficult for raw materials for which the EU does not have reserves. In such cases, investments in new mines and refineries in countries considered reliable could be considered. Strategic partnerships similar to energy partnerships should also be considered.[21]

20 Cf. these and other examples in Ernst & Young, *Staatliche Instrumente zur Erhöhung der Versorgungssicherheit von mineralischen Rohstoffen. Bericht an das BMWK* (2022) (in German; available online).

21 See Bundesministerium für Wirtschaft und Klimaschutz, *Jahresbericht 2020* (2021) (in German; available online).

Conclusion: Quick and Europe-wide coordinated action necessary

Policymakers have recognized the clear pressure to take action to secure the raw material supply. Even if no major supplier country of the raw materials under consideration, first and foremost China, stops or cuts exports to Europe, the extreme concentration of suppliers combined with the import requirements of the German and European economies is a vulnerable combination. Because measures such as recycling expansion occur over a long period of time, it seems reasonable to use all available measures simultaneously.

Three measures in particular are available in the short term that will not reduce the import need: One, bundling demand at a national, or better, European, level. Two, systematic information on suppliers and, based on this, the use of current diversification potentials. Third, a government-initiated and centrally coordinated build-up of minimum reserves to ensure emergency supplies, similar to energy commodities.

At the same time, it is worth considering reducing the import demand for raw materials in the long term. To this end, recycling can be promoted more strongly. A further measure, especially for indispensable raw materials, would be expanding European production, in which Germany, as the largest industrialized country in Europe, should participate appropriately. Finally, technologies that do not require or require fewer imported raw materials should be supported.

There are clear benefits to implementing these measures in a coordinated manner at a European level. However, the processes required to do so are often protracted, if they are even realistic in the first place. In this respect, it is advisable to not only focus on European cooperation but to also begin to implement measures at a national level as quickly as possible.

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LEGAL AND EDITORIAL DETAILS

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