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Guus Boeren, *The next frontier: charting out a pathway towards European resource independence* (June 2022)

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The Next Frontier:

Charting out a Pathway towards European Resource Independence

Name: Guus Boeren

Student number: s3044327

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Introduction

For many years, the maxim of 'Wandel durch handel' stood at the centre of foreign policy in many European capitals, especially Berlin (Moens, 2022a). The theory was that through increased trade political change could be induced. The policy, that finds its roots in the German Ostpolitik of the 1970s, has come under immense scrutiny since the Russian Federation launched its invasion of Ukraine, on the 24th of February 2022 (Strupczewski, 2022). The move, which is absolutely unprecedented in modern times, trembled the foundations of the European security architecture. The Danes have chosen to join the European Union's Common Security and Defence Policy (CSDP) by abandoning their opt-out (Murray, 2022). Olaf Scholz has announced Germany's 'Zeitenwende' and investment of 100 billion euros in their military capabilities (Von der Burchard, 2022). The EU has, for the first time in its history, financed the purchase of weapons for use in an active combat zone (Biron, 2022). These monumental decisions are just a small selection of fundamental changes in Europe's foreign policy.

The Russian invasion of Ukraine has thus already had massive repercussions for the European Union and its foreign and security policy. The aforementioned principle of 'Wandel durch handel' has also been challenged. Where Russian fossil fuels were, for a long time, the lifeline of the European economy, the European Union is now on its way towards a future independent of Russian coal, oil and gas. In its fifth package of sanctions, the EU imposed an import ban on Russian coal and the sixth package of sanctions included a phase-out of Russian oil (European Commission, 2022; Council of the European Union, 2022). Furthermore, the EU has announced its REPowerEU Plan. This plan aims to reduce Europe's dependence on Russian natural gas by two thirds this year and completely end the its dependency on Russian fossil fuels by 2027 (European Commission, n.d.-b).

While the stance towards Russian fossil fuels has completely changed, the EU and its member states are continuing to make the same mistakes. The rise of technologies has resulted in a new frontier of dangerous European interdependence. The EU is over-reliant on other countries for the raw materials and natural resources needed in its industry. These so-called 'critical raw materials' are vital to industries and the economy and are at risk of supply chain disruptions (Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, 2017). One example of this is, is the chemical element bismuth. Bismuth is an important element for the production of pharmaceutical and medical products and alloys. For bismuth the European Union is incredibly dependent on China, 93% of its bismuth imports originate from the PRC. In total the European Commission has identified 30 of these high-risk materials, with most being dependent on import (European Commission, 2020a).

The current crisis has shown that resource independence is critical to the security of Europe. The Russian Federation is currently holding many member states hostage because of their overdependence on Russian natural gas (Moens, 2022b). The European Union and its member states must reduce their dependency on foreign powers by securing a safe supply of raw materials and resources as this would allow a stronger EU posturing to hostile actors and result in a more secure union. This paper attempts to assist this endeavour by attempting to answer the following research question: How can the European Union improve its resource independence? It does this by firstly outlining and evaluating the issue of European resource dependence, which includes an analysis of the multi-level decision-making process surrounding this issue. Secondly, it proposes solutions for the problem of resource dependence and investigates the consequences of these solutions. These analyses will be done by consulting academic literature, reports and policy documents.

The European Union's Current Resource Conundrum

The current geopolitical situation has proven that Europe must take its future into its own hands. The Russian Federation's vile violation of the rules-based system, international law and the principles of territorial integrity and sovereignty has made it clear to European law-makers that Russia can no longer be seen as a reliable partner. The aforementioned REPowerEU-plan shows this and brings this to the realm of policy (European Commission, n.d.-b). Whereas the current crisis has forced the EU to react, any inevitable future crises should be tackled in a more 'a priori'-manner. The current energy crisis should of course be acted upon in a decisive manner, but the a future resource crisis can still be prevented.

Natural materials like metals and minerals are a key component in many products. From phones to lamps and from hydrogen fuel cells to windmills, many technologies depend on these raw materials. The European Green Deal and the 'Digital Decade'-strategy, both priorities for the current Von Der Leyen Commission, will cause a sharp increase in Europe's demand for these raw materials. It is expected that 57 times more lithium will be needed in 2050 as a result of the digital and green transitions. The demand for cobalt, graphite and dysprosium will all increase by 15, 14 and 12 times respectively (European Commission, 2020b). In order for Europe to fulfil its ambitions a steady and secure supply of these, and many more, materials is needed.

Currently, the European Commission has identified 30 so-called 'critical raw materials' (CRMs). These CRMs are defined as raw materials that have a high economic importance and a high risk of supply disruptions. The European Commission has created an in-depth methodology that assesses raw materials and their criticality on the basis of these two principles. The economic value of the materials is determined by analysing the share of use of a material in a specific sector, the value added by that material in a sector and its potential to be substituted through the use of other materials. The supply risk is calculated with the help of an elaborate formula that uses factors like global supply, import reliance, recycling possibilities and EU domestic production (Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, 2017). An overview of the factors contributing to the criticality of a material provide a great starting point for any discussion regarding the reduction of a material's criticality. These factors also make clear that the conundrum of critical raw materials is truly a multi-faceted one. It involves trade, internal market, sustainability, industrial processes. While this makes the problem very complex it also presents a plethora of opportunities for policy solutions in different areas to tackle this problem.

As mentioned the critical raw materials also have a security element to them. Of the thirty identified critical raw materials, the largest share of EU supply is accounted for by EU member states for only five of these CRMs (Figure 1). For most of its critical raw material demand, the EU is thus dependent on import from third countries. This dependence knows various levels with risks associated to each level, from only 30% of silicon metal demand originating from Norway to 98% of the EU's rare earth elements (REE) demand being provided by China. As the global production of these materials is highly concentrated the supply of some of these materials, i.e. rare earth elements, is not diverse (Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs).

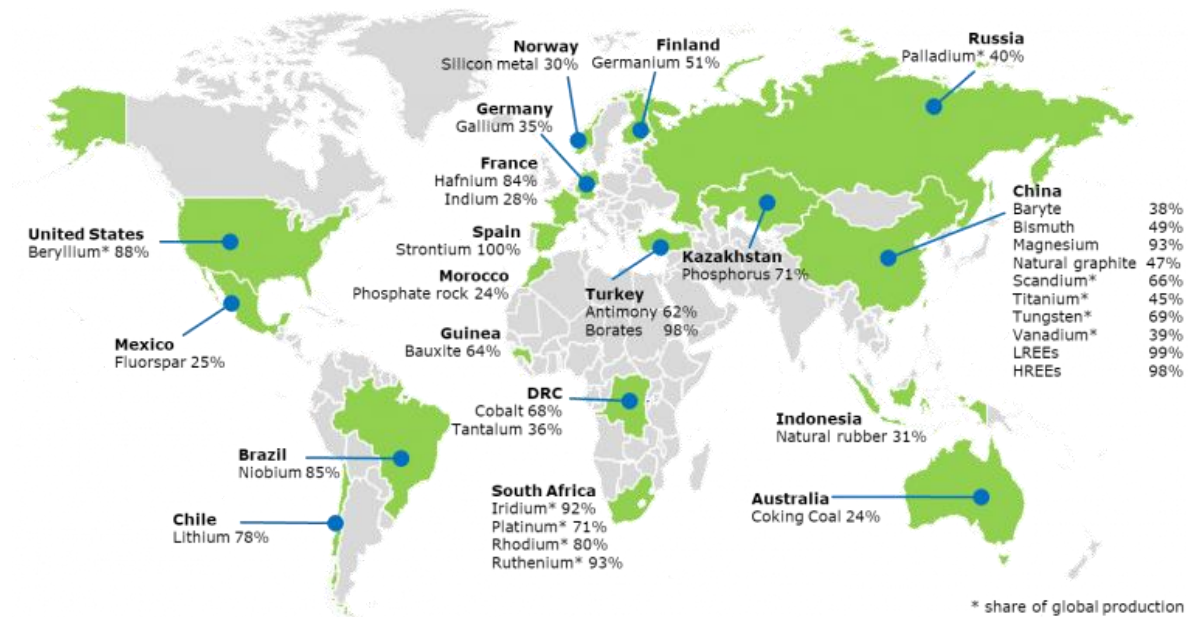


Figure 1. Countries accounting for the largest share of EU supply of critical raw materials (Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, n.d.)

The risk of this overreliance on one supplier has become abundantly clear after the Russian invasion. The dependence on Russian oil has led Hungary to delay (and downgrade) the European ban on Russian oil (Barigazzi & Moens, 2022). Russia is also blackmailing Europe to pay for its gas in rubles and has already cut off gas supplies to Poland, Finland, Bulgaria, the Netherlands and Denmark for their incomppliance (Tamma & Hernandez, 2022; Hernandez & Weise, 2022). In addition, the EU is inadvertently still supporting the Russian war effort through their fossil fuels imports. In the first two months after the invasion, the EU imported fossil fuels from Russia worth 44 billion euros (Guy, 2022). With an increasingly aggressive Chinese posturing, the EU is walking into the same trap as for ten of the EU's critical raw materials the largest share of supply comes from China. One study by Rabe, Kostka and Smith Stegen (2017) has assessed the risks associated with China's supply of critical raw materials on European wind and solar industries. It concluded that the EU's wind sector is especially vulnerable to a disruption in Chinese supply of rare earth elements like neodymium and dysprosium as there currently exists no real alternatives (Rabe, Kostka & Smith Stegen, 2017). The study is an important illustration of the risks for European industries and societies. With the increasing importance of solar and wind energy in Europe as a result of the European Green Deal and other sustainable policies, the supply of critical raw materials must thus be secured.

Another risk associated with the supply of critical raw materials, is the fact that the global production of these materials is concentrated in countries with low governance levels, based on the World Governance Indicators. This low level of governance causes the raw materials supplied by these countries to pose a higher risk of supply disruptions. (Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, 2021).

Luckily, the European Commission is aware of the risks. The 2021 Strategic Foresight Report explicitly mentions and recognises the need for 'Securing and diversifying supply of critical raw materials'. In addition, the Commission has developed a ten-point action plan to ensure a sustainable supply of raw materials. The Commission identified four main goals for the action plan namely: to develop resilient value chains for the EU's industries; to reduce the dependency on primary critical raw material by using the principles of circularity, sustainability and innovation; to strengthen the domestic sourcing and processing raw materials and to diversify supply with responsible sourcing from third countries while strengthening rules-based open trade (European Commission, 2020a). The action plan aims to achieve these goals by proposing actions that stimulate mining and processing

projects in the EU, promote sustainable and responsible extraction of raw materials and secure a diversified supply of critical raw materials (European Commission, 2022b).

The first point of the aforementioned action plan of the European Commission was the founding of the European Raw Materials Alliance (ERMA) (European Commission, 2020b). This coalition of stakeholders (including among others EU countries and regions, industrial actors, civil society, NGOs, universities) has been created to guarantee, as stated on their website, 'a reliable, secure and sustainable access to raw materials' (ERMA, n.d.-a). Currently, its first most pressing goal is to increase European resilience in the value chain of rare earths and magnets as it has been identified as the most crucial sector in the current industrial ecosystem. The alliance will expand its scope to other critical raw materials over time (European Commission, 2020a).

With the ERMA the European Commission has created a multi-level framework in which multiple stakeholders can work together on the problem of resource independence. Their cooperation is moulded by two workstreams. In the first one, the stakeholders identify the raw material challenges (i.e. pinpointing bottlenecks in industrial supply chains) and present tailor-made solutions to these challenges. This workstream also aims to promote communication and engagement between stakeholders. The second workstream is an investment channel for raw materials projects. Here, stakeholders come together to select and prioritise investment opportunities surrounding raw materials. It also provides financing strategies, mechanisms and EU funding opportunities (ERMA, n.d.-b).

Because of the multi-faceted nature of the critical raw materials conundrum, the issue should be tackled in a truly multi-level manner, as is already done with the ERMA. Some policy areas regarding critical raw materials fall under the exclusive competences of the EU while others are in full competence of the member states or are shared competences. Activities like mining legislation and permitting and natural resource management fall within the full competence of the individual member states. Concerns regarding the environment and common safety concerns are shared competences in which both the EU and its member states have a say. Raw material policies regarding the internal market, like competition rules or international trade agreements are within the exclusive competences of the European Union (Joint Research Centre, n.d.).

As it stands the Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (DG GROW) is the key coordinator of the critical raw materials policy. It creates and publishes the list of critical raw materials (the Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, n.d.). But as the overview of specific competences shows, the European Commission can only take particular actions on its own. Mineral extraction policies are the sole competence of the member states. The consequence of this is that policy frameworks across EU countries vary (Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, 2021).

Creating a Resource Independent Europe

While the Action Plan on Critical Raw Materials serves as an excellent start to achieve resource security and independence, more actions by the European Union and its member states can and should be taken to ensure a safe and sustainable European resource ecosystem. This section aims to come up with new solutions and policies to tackle the issue of European resource dependence. It will also analyse these solutions and their consequences.

One of the proposed solutions to securing a safe supply of critical raw materials is the increase in the EU's domestic extraction and processing capabilities. The Commission's action plan is mostly built around this solution and aims to improve the conditions for more domestic production of critical raw materials. The action plan calls for the development of sustainable financing criteria for the extractive sector and the identification of mining and processing projects. It also calls for the

development of expertise in the mining, processing and extraction sectors, the deployment of programs for resource exploration and the promotion of responsible mining practices (European Commission, 2020b). Boosting a European mining effort has two main advantages. First, of course the supply of critical raw materials will become more secure as the EU decreases its dependence on imports. Second by extracting and processing these materials inside Europe, the European Union has more control over the conditions in which they are produced, meaning that they can uphold the highest standards of environmental, labour and safety regulations.

Currently, the European Union does enjoy advantages of a few mines within its territory but these are not enough to satisfy its own demand. New extraction opportunities should therefore be found and developed. While, mineral exploration is a crucial component of the EU's strategy, investments in mineral exploration remains low in the European Union when compared with other parts of the world (Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, 2021). The lack of junior companies has been identified as a key factor behind this low exploration budget. The European Union can support these junior companies by creating favourable economic and financial conditions in order for these companies to be founded and grow in Europe. Investing into research regarding mineral exploration an even more favourable environment can be created (Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, 2021). A key component in the search for new exploitation sites, is public attitude. Generally, European citizens favour new mining projects favourably, however there is a very large anxiety among civilians regarding the environmental impact of these activities. The EU and its member states should therefore engage and cooperation with local actors to prevent misunderstandings, create trust in new projects and take away any negative emotions (Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, 2021).

The EU should also think outside the box when it comes to its own extraction opportunities. While EU membership for Ukraine is probably way down the road, there is also an resource incentive to let Ukraine be a member of the European family. Ukraine is a large producer of titanium and graphite, as well as gallium and scandium in smaller volumes (European Commission, 2020a). The European Union's enlargement and neighbourhood policy should thus gain a resource component, as some candidate member states have large reserves of natural resources. Serbia for example has large lithium reserves (Krstajic, 2019). While, fast-tracking EU membership, a contentious topic in recent months, is not an option, the EU increase their cooperation with and investment in the natural resource extraction industries of its candidate member states in order to ensure high economic benefits when they eventually join the European Union.

A second potential solution is increasing and accelerating the move towards a circular economy. Circularity can prove to be a viable option for reducing import dependencies. For some materials, recycling is already a proved, viable concept. For example, 44% of European vanadium demands is supplied by end-of-life recycling. While for other materials, like borate, recycling plays absolutely no role (Joint Research Centre, 2017). This low level of end-of-life recycling input rate of most materials provides the European Union with a great opportunity. It could tackle both its environmental problem by minimising waste as well as improving their supply of critical raw materials by reusing these materials. It is for this exact reason why the circular economy has gotten so much attention lately, and is seen by the European Union as a crucial part of the European Green Deal (European Commission, n.d.-a).

Even though the idea behind a circular economy is relatively simple, the execution is not. Cimprich et al. (2022) have assessed that the adoption of circularity strategies by companies depend on a number of different factors and differ per situation. They therefore suggest that solutions to critical raw material problems must be tailor-made for each sector and material (Cimprich et al., 2022). The European Union could play an important role in this process. With its enormous pool of

information and oversight into many industrial sectors, it can help specific value-chains by providing them with best practices and support in order to best tackle the problem. With ERMA the EU already has a perfect institution in place to streamline this process. ERMA's activity is divided into 'clusters' that focus on specific value chains. Currently, ERMA has two clusters 'Rare Earth Magnets & Motors' and 'Materials for Energy Storage and Conversion', with more clusters said to be added in the future (ERMA, n.d.-b.). This 'cluster-approach' fits in perfectly with the idea of tailored, sectoral solutions as each cluster can provide a framework and network in which industries, governments and other societal actors can share and debate best practices and solution. The Joint Research Centre (2017) has conducted exactly an study such as recommended above. It analysed multiple EU sectors (extractive waste, landfills, electrical and electronic equipment, batteries, automotive sector, renewable energy, defence and chemicals and fertilisers) on its circular use of critical raw materials. From this analysis it distilled multiple best practices per sector (Joint Research Centre, 2017). As the EU only has minimal competencies with regards to changing business models of individual companies, this facilitating role could prove to be the so-called 'Egg of Columbus' for the EU balancing both its limited competencies and its great ambitions while preventing a deterioration of political will as a grave intervention in the market will be prevented. This combination of adding new clusters to ERMA as well as conducting more research into the possibilities for a circular economy in these specific clusters is something the EU should consider. The EU could also create additional frameworks for businesses through which they can assess their own supply chain. This adds another level of specificity to the sectoral approach. Again, the ERMA could be the frontrunner in the creation of this framework.

On top of the facilitating role in making industrial processes more circular, the EU and its member states should play a more active role in the development and creation of recycling infrastructure, for both businesses and consumers. It can do this by supporting research and development into cost-effective and efficient recycling technologies (Joint Research Centre, 2017). Through its various financing programs, the EU could stimulate academic research into the subject as well as enable member states to investigate local opportunities. The individual member states should also work on constructing this infrastructure and provide its inhabitants with options to carefully recycle and reuse products.

The above-mentioned solutions will only prove to be realistic when multi-level cooperation, communication and sufficient knowledge and data will become the norm. In this regard the European Commission has already made a great start with the ERMA, a platform where cooperation between actors and intelligence sharing are at the heart. However, further cooperation with non-EU countries is also needed. Joint research efforts with countries like the United States, Japan and others with similar interests could provide new opportunities for the European Union (Rabe, Kostka & Smith Stegen, 2017). Through this Europe could create a broader coalition of countries that together aim towards a secure supply of critical raw materials. The United States, for example, is the world's leading producer of beryllium, whereas Japan is a large player in titanium production (European Commission, 2020a). The current EU-US-Japan Trilateral on Critical Raw Materials could expand in both competencies, like increased cooperation in resource exploration, and countries, like Canada or Australia.

Furthermore, the EU and its member states must increase the communication on critical raw materials to increase the awareness among its civilians. Public awareness campaigns on the topic of climate change, like the Dutch 'Zet ook de knop om'-campaign, are becoming increasingly important. The 'Zet ook de knop om'-campaign aims to create public awareness around the issue of energy scarcity and to decrease the Dutch, and by extension European, dependence on Russian gas by helping civilians save energy (Ministerie van Economische Zaken en Klimaat, n.d.). A similar campaign could be launched for the issue of resource independence. As previously assessed, the circular

economy has a high potential to drastically decrease Europe's dependence on imports. It has been observed that materials, like vanadium, mostly used in products handled by businesses have the highest level of recycling whereas materials like indium, that is used in display panels, is recycled very little (Joint Research Centre, 2017). Through public awareness campaigns where the importance of recycling is explained and concrete tips are given to recycle could prove to be a success. As the circular economy needs the participation of all societal actors, public awareness campaigns can fuel the discussion and exchange of knowledge needed to come up with solutions.

In addition to general public awareness campaigns, more specific efforts to improve the knowledge surrounding critical raw materials should be made. Köhler, Bakker & Peck (2013) argue that the critical raw material approach should be made widespread in the higher education of engineers as this could lead to new technological innovations and train engineers to work under conditions of constrained material choices (Köhler, Bakker & Peck, 2013). Currently, specialised masters concerning raw materials do already exist (EIT Raw Materials, n.d.). However, it is important that all engineering studies, especially in the fields of industrial engineering and material design, are being taught about the principles of circularity, sustainability and criticality as it teaches future engineers to tackle the problems of their time. With more attention given to the subject, both in higher education and public perception, the subject will become more mainstream giving rise to greater political discussions, and hopefully decisions, increased innovation as well as increased collection and recycling rates.

Conclusion and Summary of Recommendations

It is becoming increasingly clear that in order to ensure a safe and secure Europe, the European Union and its member states can no longer overly depend on unreliable partners. With the demand for natural resources and raw materials only increasing, as a result of Europe's green and digital ambitions, a trustworthy and sustainable supply of raw materials is needed. Currently, Europe is overly dependent on third countries for its supply of critical raw materials. The dependency on these materials, that possess both a high importance to the economy and risk for supply disruptions, are at risk of being abused by foreign powers in geopolitical games. The Russian invasion of Ukraine and Russia's subsequent use of Europe's energy dependence show that resource independence are key to an autonomous and free Europe.

With the issue of resource independence covering so many policy areas that fall under different competences, multi-level cooperation is needed. The ERMA is the European Commission's attempt to formalise a framework in which this cooperation between different actors can take place. The EC's Action Plan on Critical Raw Materials has shown that it takes the issue of resource dependence seriously and is actively taking steps in reducing it. However, the action plan only serves as a starting point. Further actions and policies are needed to effectively achieve resource independence and thus a more secure Europe. This report proposed and analysed multiple policy solutions to this issue.

The first recommendation focusses on the increase of domestic mining in the European Union. Here, the focus should lie on increasing resource exploration as that is currently the main repressor of increased mining activities. Apart from increasing resource exploration in current EU member states the EU should include a resource component in its enlargement and neighbourhood policy as countries like Ukraine and Serbia possess vast quantities of natural resources.

It is also recommended that the European Union accelerate its move towards a circular economy. The recycling of critical raw materials provides a great opportunity for the EU and therefore must be supported. The European Union must expand the role of ERMA, facilitate sectoral,

circular solutions and invest in the development and construction of the relevant recycling and circular economy infrastructure.

For both these solutions, communication and cooperation are incredibly important. The EU should launch public awareness campaigns that both explain the issue of critical raw materials and ready people for a circular economy, in the hopes of increasing recycling percentages. It should also aim to improve higher education on critical raw materials to ensure a new generation of sustainable and conscious engineers.

Lastly, the EU should try to expand its current trilateral and bilateral cooperation with allied countries on critical raw materials to a more in-depth cooperating framework where Europe and its allies ensure a secure supply of critical raw materials for each other.

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