RAFAŁ KAMPROWSKI
Uniwersytet im. A. Mickiewicza w Poznaniu
ORCID: 0000-0002-9610-4394

DOI : 10.14746/rie.2022.16.14

The raw materials policy of the European Union for rare earth elements

Introduction

The main objective of the article is to identify and discuss the role of rare earth elements (REE) in building the raw materials security of the European Union. The dominant narrative in the literature and analyses mainly concern the countries with a dominant position in the rare earth elements market. This is important and relevant inasmuch as they play a key role in ensuring stable extraction, exploitation and exports of REEs. Relatively little attention is given, however, to other countries or groups of countries which mostly depend on the supply of REEs from countries such as the People's Republic of China or the United States of America. The European Union is the best example of this, and the subject of this article. As one of the global leaders in the production of electric car engines or wind turbines, the EU remains dependent on the People's Republic of China, supplying over 90 percent of raw materials.

The article is divided into three main parts. The first one discusses the issue of raw materials policy, including REEs. After establishing the definition framework, the core of the considerations focuses on presenting the initiatives of EU institutions and bodies in order to strengthen the position of the EU on the global supply market for REEs. The final part of the article recapitulates the considerations, indicates the main challenges posed by and problems resulting from the EU's raw materials policy, and articulates the final conclusions.

The article verifies the research hypothesis, which assumes that, as the global demand for REEs increases, the initiatives of the European Union are more and more clearly aimed at the exploration of primary deposits located in individual member states. This research objective is addressed by the following research questions: to what extent is the issue of REEs present in EU initiatives?; what are the main challenges and risks for the EU's raw materials policy in terms of REEs?

In the course of the research process, descriptive method, source analysis and synthesis were used. The descriptive method made it possible to identify the variability of the economic, social and political context for the phenomenon under study. The application of source analysis helped to review and consolidate the scattered data from various sources. Analysis made it possible to present a holistic view of the EU's initiatives to strengthen its role in the global competition for REEs.

The concept and essence of raw materials policy and raw materials security

Raw materials policy can be broadly defined in terms of its objectives. It is traditionally understood as a series of initiatives taken by a state to protect strategically important industries from disruptions to the physical flow of raw materials critical for the economy (The Congress of the United States, 1977, p. 10). These sources of disruptions may be political (wars and conflicts) or economic (embargoes imposed). The raw materials policy pursued by an entity is thus designed to ensure raw materials security by providing an adequate amount of reserves of a given raw material. Nowadays, however, the definition presented above needs to be extended. It does not suffice to rely on the availability of a given raw material, but its price also needs to be taken into account. Price fluctuations resulting from various crises can create a significant problem for an entity relying on only one supplier or one raw materials technology.

Raw materials security, which is the foundation of raw materials policy, should be considered as an element of economic security (Ostant, 2014, p. 371). It represents the potential of an economic system to secure access to economic resources from both domestic and foreign sources. An additional indicator of the extent to which an entity ensures raw materials security involves the promotion of exploration and appraisal work in order to identify deposits that can be discovered and developed (Galos, Szamałek, 2011, p. 39). It is also worth highlighting two approaches to raw materials security, namely market-based and political. The former emphasises the security of supplies of a given raw material for industrial plants in amounts which guarantee a high level of production capacity. The political approach, on the other hand, emphasises the influence raw materials have on the military potential of a state, as tools of conflict management (Zamęcki, 2011, p. 63).

Another factor that influences the development of raw materials security is the proper preparation of the pre-investment and around-investment stages by the entity concerned. The former includes the acquisition of technologies making exploitation, extraction and processing of raw materials possible. The latter, equally important, stage concerns cooperation with the private sector, local government and NGOs. A given raw material will not be obtained if there is no technology available to extract it. Extraction, in turn, has to be conducted with respect for the environment and the opinions of local residents, as well as take into account sustainability standards.

In the process of developing raw materials security, the most important element of raw materials policy is the identification of raw materials of key, strategic and critical dimensions. The first group includes raw materials of fundamental importance for the stable functioning of the economy and meeting the life needs of society. These are primarily the raw materials a given entity has plenty of. Strategic raw materials include those of which at least 90 percent are not sourced domestically. The risk of their supply from external sources being limited is another important factor. This group features raw materials that are essential for national defence, national security and key raw materials for the development of technological innovations. The last group includes critical raw materials. These include those key or strategic raw materials the acquisition of which is highly risky, whether from internal or external sources. These

raw materials cannot be obtained, for example, due to planning circumstances or social protests (Radwanek-Bąk, Galos, Nieć, 2018, pp. 156–157).

The modern development of both civilian and military technologies and the advancing miniaturisation of devices, coupled with their increasing power and efficiency, have highlighted the importance of REEs. The range of elements classified as REEs depends on the criterion adopted by a given researcher. Nevertheless, there are seventeen elements which are the core of the group – fifteen lanthanides plus scandium and yttrium. As noted by Frank. H. Spedding in one of the first articles comprehensively approaching the elements in question, their name is not related to their rare occurrence in the earth, but in the difficulties involved in the process of their separation (Spedding, 1951, p. 26). The uniqueness of REEs is a direct result of their properties. These include high electrical conductivity, resistance to high temperatures, and lustre. REEs are used in the automotive, ceramic and metallurgical industries. In addition, they are used in the production of automotive catalytic converters, permanent magnets, optical filters, liquid crystal displays, lasers and phosphors (Jha, 2014, p. 54; Stewart, 2018, p. 136). REEs are also a key component of green technologies. They are used in the construction of wind farms, photovoltaic panels and electric motors. More recently, they have also been used in the medical and pharmaceutical industries as anticancer agents, in kidney dialysis, and when building life-support machines (Morin-Crini, Lichtfouse, Crini, 2021, p. 41).

This part of the discussion can be concluded by indicating that today and in the years to come, technological development will depend on the use of REEs. This raises a number of challenges for the raw materials policies of individual states and economic and political unions, including the European Union.

The European Union and rare earth elements

The European Union’s decision-making bodies became interested in REEs at the beginning of the twenty-first century, responding to a profound change in the global supply chain that occurred in the mid-1990s. The United States of America, the world’s leading producer of REEs, became dependent on importing these valuable elements from the People’s Republic of China. At the turn of the twentieth century, the largest mine in the USA extracting the elements in question, the Mountain Pass Mine, closed down. China took advantage of this and, over a short period of time, became the main producer and exporter of REEs, accounting for almost 95 percent of world production. China’s success resulted from its much lower extracting and processing costs and its failure to comply with environmental standards, among other things.

The European Commission observed the monopolistic role of the People’s Republic of China and the increasing demand for REEs and in November 2008, issued a Communication to the European Parliament and the Council, entitled The raw materials initiative: meeting our critical needs for growth and jobs. Its authors also highlighted the role of REEs, noting that the EU is heavily reliant on imports of these valuable elements, with no substitutes for them. It was also stressed that some of the elements are supplied by countries such as China, Russia and African countries,

which could lead to disruptions in the supply chain due to market and political turbulence in these countries (Komunikat Komisji Europejskiej, 2008, p. 4). More active geological research in member states, more efficient use of substitutes and recycled resources of primary raw materials, and ensuring, through dialogue, a level playing field in access to REEs in third countries were identified as opportunities for the European Union to reduce the existing dependency (Komunikat Komisji Europejskiej, 2008, pp. 8–11). This document has become a kind of milestone for future initiatives by the European Union’s institutions seeking greater diversification of the supply of REEs.

As a result of the actions suggested in the 2008 Initiative, and in the face of the price increase crisis triggered in 2010 by China halting exports of REEs to Japan, the European Commission presented a list of critical raw materials for the European Union in 2011. As originally intended, the list is updated every three years. A review of its successive updates clearly indicates a growing demand for these raw materials in the European Union. The first one from 2011, listed fourteen critical raw materials. The subsequent 2014 study expanded this group to twenty. In 2015, the methodology was changed, and REEs were divided into ‘heavy’ and ‘light’. In September 2020, the European Commission published the latest list of critical elements which included as many as thirty raw materials. The study shows that China accounts for 98 percent of REEs supplied to the European Union. In the communication, the European Commission also stressed that, in order to attain the climate neutrality member states seek to achieve by 2050, the European Union will need up to 18 times more lithium and 5 times more cobalt by 2030 and almost 60 times more lithium and 15 times more cobalt by 2050. These elements are the main components of electric and energy storage batteries. The demand for REEs used for their magnetic properties in wind turbines will in turn increase tenfold by 2050 (Komunikat Komisji Europejskiej, 2020, p. 5). The analysis presented in the communication highlights a very important issue. In order to achieve an ambitious climate transition, the European Union will need increasing amounts of REEs. Given the objective of obtaining partial independence from Chinese supplies and the EU’s lack of capacity to extract, process, recycle, refine and separate REEs from its own deposits, there is considerable risk that the climate neutrality project will not be implemented to the extent intended.

The issue of raw materials, including REEs, is also addressed by the innovation programme planned for 2013–2020, Horizon 2020. It stresses more efficient use of raw materials and the search for new, innovative methods of obtaining them. This document is important inasmuch as it defines the EU’s approach to REEs. In contrast to the leaders in their production, it emphasises the social dimension. This is evidenced by the inclusion of raw materials issues in the societal challenges package, and emphasising aspects such as recycling in their extraction, sustainable management of resources, and stressing innovation. The matter was further pursued in the European Innovation Partnership for Raw Materials. Presented in 2020, the document identifies the need to find substitutes for raw materials as a key challenge for the European Union and reiterates the need to source the elements needed through recycling (Komunikat Komisji Europejskiej, 2020, p. 25). From the point of view of this article, the intention to select ten innovative pilot plants for the extraction, processing and recycling of raw

materials, and to search for substitutes for at least three key uses of critical raw materials provides an important refinement of earlier declarations (Komunikat Komisji Europejskiej, 2020, p. 48).

In September 2020, the European Commission presented an action plan on critical REEs. It identified actions to facilitate the transition towards a climate-neutral economy while strengthening the EU’s position in the event of disruption to supply chains of raw materials from third countries. The launch of a European Raw Materials Alliance was considered a priority. Other goals concentrate on sustainable financing of the mining and extraction sectors, research into waste treatment, including the extraction of elements, substitutes for critical raw materials, the development of rare elements mining and processing projects, and the extraction of existing deposits of REEs. The need to develop strategic international partnerships to diversify the supply of critical and rare raw materials was a significant direction identified. Canada and African countries were indicated as partners. While this decision was clearly correct, the author of this paper believes it to be overdue. There are significant deposits of REEs in Africa, primarily in the Democratic Republic of Congo. However, for at least two decades, Chinese corporations have been signing mining contracts in most African countries, primarily due to the cheap labour and unclear regulations there. In return, China has offered preferential loans and assistance in building modern infrastructure. Compared with the African direction, a partnership with Canada could prove extremely profitable. Canada resembles the European Union in its philosophy of sourcing REEs, which is primarily driven by social and environmental concerns. High hopes are pinned on a project by Canadian company Geomega, which is planning to open a plant to recycle REEs from permanent magnets using a new processing technology that does not create acidic waste. Located in Quebec, the plant will be able to process production waste as well as end-of-life magnets while recovering approximately 95 percent of their original properties (Argusmedia, 2019).

Further initiatives culminated in the launch of the European Raw Materials Alliance (ERMA). Its main objectives are to develop supply chains that respect the ecosystem, strengthen the sourcing of raw materials by individual EU countries, and diversify raw materials’ supplies from third countries. The ERMA brings together industrial players, member states as well as individual regions, trade unions, research and technology organisations, investors and NGOs (ERMA, 2020).

Conclusion

In response to the monopolistic position of the People’s Republic of China on the global rare earth elements market, the European Union has had to develop its own strategy to provide an alternative to the supply of raw materials from a politically uncertain source. Guided by the social good, respect for the environment and climate, the EU has put particular emphasis on obtaining valuable raw materials through their recycling. The EU can draw on the experience of the United States of America in this aspect; the Joe Biden administration has implemented a new policy, thereby gradually reducing its dependence on foreign sources of REEs by recovering the raw materials

from waste heaps. This contributes to both improving national security and opening up new jobs in the United States.

According to experts, the demand for REEs will continue to grow as production of electric vehicles, for example, increases. Global consumption in this sector alone is forecast to increase from 5,000 tonnes in 2019 to 70,000 tonnes per year in 2030 (European Raw Materials Alliance, 2021, p. 4). The European Raw Materials Alliance has already identified fourteen projects focusing on mining: Finland, Norway, and Sweden; separation: Poland; metallurgy: Estonia; recycling: Belgium and France; and manufacturing: Germany and Slovenia. If fully realised, the projects would make it possible to meet around 20 percent of European demand for REEs, which would be an important step in gradually achieving independence from China. At the Digital Summit held in Tallinn, European Commission President Ursula von der Leyen said that the EU must avoid the mistake of falling into the same dependence on China with REEs as it did with oil and gas from Russia (Szucs, 2022). This statement may be all the more relevant as, in its 2021–2025 plan, the People’s Republic of China has announced a reduction in exports of precious elements to meet domestic needs arising from the attainment of climate neutrality by 2060. Another challenge for the realisation of the above plans is the social reception of the opening of mines, or plants for processing REEs. Between 2018 and 2020, massive protests took place in Spain and Portugal against the establishment of new industrial plants in these countries.

Bibliography

Argusmedia (2019), *Canada‘s Geomega to recycle rare earth magnets*, 28.08.2019, https://www.argusmedia.com/en/news/1966820-canadas-geomega-to-recycle-rare-earth-magnets, 06.11.2022.

ERMA (2020), *European Raw Materials Alliance – about us*, https://erma.eu/about-us/, 03.11.2022.

European Raw Materials Alliance (2021), *Rare Earth Magnets and Motors: A European Call For Action. A report by the Rare Earth Magnets and Motors Cluster of the European Raw Materials Alliance*, Berlin.

Galos K., Szamałek K. (2011), *Ocena bezpieczeństwa surowcowego Polski w zakresie surowców nieenergetycznych*, „Zeszyty Naukowe Instytutu Gospodarki Surowcami Mineralnymi i Energią Polskiej Akademii Nauk”, nr 81.

Jha A. R. (2014), *Rare Earth Materials. Properties and Applications*, CRC Press, Boca Raton.

Stewart J. E. (2018), *Optical Principles and Technology for Engineers*, CRC Press, Boca Raton.

Komunikat Komisji Europejskiej (2008), *Inicjatywa na rzecz surowców – zaspokajanie naszych kluczowych potrzeb w celu stymulowania wzrostu i tworzenia miejsc pracy w Europie*, Bruksela.

Komunikat Komisji Europejskiej (2020), *Odporność w zakresie surowców krytycznych: wytyczanie drogi do większego bezpieczeństwa i bardziej zrównoważonego rozwoju*, Bruksela.

Morin-Crini N., Lichtfouse E., Crini G. (2021), *Emerging Contaminants. Occurrence and Impact*, Springer Nature, Cham.

Ostant W. (2014), *Bilans bezpieczeństwa energetycznego Polski w kontekście rządowych planów budowy siłowni jądrowej*, in: *Bezpieczeństwo energetyczne. Rynki surowców i energii. Teraźniejszość i przyszłość*, t. 1: *Polityka – gospodarka – zasoby naturalne i logistyka*, red. P. Kwiatkiewicz, Fundacja na rzecz Czystej Energii, Poznań.

Radwanek-Bąk B., Galos K., Nieć M. (2018), *Surowce kluczowe, strategiczne i krytyczne dla polskiej gospodarki*, „Przegląd Geologiczny”, vol. 66, no. 3.

Spedding F. H. (1951), *The Rare Earths*, „Scientific American”, vol. 185, no. 5.

Szucs A. (2022), *EU cannot become as dependent on Chinese rare earth elements as on Russian energy: EU's von der Leyen*, 10.10.2022, https://www.aa.com.tr/en/europe/eu-cannot-become-as-dependent-on-chinese-rare-earth-elements-as-on-russian-energy-eu-s-von-der-leyen/2707611, 07.11.2022.

The Congress of the United States (1977), *U.S. Raw Materials Policy: Problems and Possible Solutions*, U.S. Government Printing Office, Washington D.C.

Zamęcki Ł. (2011), *Znacznie i wymiary bezpieczeństwa państwa w zakresie surowców nieenergetycznych*, „Zeszyty Naukowe WSOWL”, no. 3(161).

Summary

This article deals with one of the dimensions of the European Union’s raw materials policy, including rare earth elements (REE). The core and overarching goal of the raw materials policy implemented by a given entity is to ensure security in terms of raw materials. Taking into account the current geopolitical situation and the ongoing war in Ukraine, the main part of discussion regarding raw materials security focuses on issues related to the supply of energy sources, including gas or coal. Rare earth elements, however, remain on the side-lines of these considerations. Rare earth elements are the foundation of modern technological development in many areas and fields. Due to their role, they have been the object of political rivalry between the People’s Republic of China and the United States of America for at least twenty years. The question of the place and role of the European Union in this system remains open. The research intention of the considerations in this article is to indicate the role of REEs in the raw materials policy implemented by the European Union. The research shows that, despite the relatively late involvement of the European Union in the identification of key REEs and the development of their supply chain, a clear professionalisation of EU practices has been observed for several years. It is also indicated that among the most important challenges for the European Union’s raw materials policy are factors such as excessive dependence of the supply chain on the People’s Republic of China and difficulties in obtaining REEs within the territory of European Union member states.

Key words: rare earth elements, raw materials policy, raw materials security, European Union

Polityka surowcowa Unii Europejskiej w zakresie metali ziem rzadkich

Streszczenie

Niniejszy artykuł traktuje o jednym z wymiarów prowadzonej przez Unię Europejską polityki surowcowej, której przedmiotem są metale ziem rzadkich. Centralnym i najważniejszym celem polityki surowcowej realizowanej przez dany podmiot jest zapewnienie bezpieczeństwa surowcowego. Uwzględniając obecną sytuację geopolityczną i trwającą w Ukrainie wojnę, główna oś narracji dotycząca bezpieczeństwa surowcowego koncentruje się na kwestiach związanych z dostawami źródeł energii, m.in. gazu czy węgla. Na swoistym marginesie prowadzonych rozważań pozostają jednak metale ziem rzadkich. Stanowią one fundament współczesnego rozwoju technologicznego wielu obszarów i dziedzin. Ze względu na swoją

rolę, od przynajmniej dwudziestu lat, stały się one przedmiotem rywalizacji politycznej między Chińską Republiką Ludową a Stanami Zjednoczonymi Ameryki. Otwartą pozostaje kwestia dotycząca miejsca i roli Unii Europejskiej w tym układzie. Zamierzeniem badawczym podjętych w niniejszym artykule rozważań jest wskazanie roli metali ziem rzadkich w realizowanej przez Unię Europejską polityce surowcowej. Z przeprowadzonych badań wynika, iż pomimo stosunkowo późnego zaangażowania się Unii Europejskiej w identyfikację kluczowych metali ziem rzadkich oraz opracowania łańcucha ich dostaw od kilku lat można zaobserwować wyraźną profesjonalizację podejmowanych praktyk. Wskazano również, iż wśród czynników stanowiących najważniejsze wyzwanie dla polityki surowcowej Unii Europejskiej w omawianym zakresie zaliczyć można nadmierne uzależnienie łańcucha dostaw od Chińskiej Republiki Ludowej oraz trudności w pozyskiwaniu metali ziem rzadkich na terenie państw członkowskich Unii Europejskiej.

Słowa kluczowe: metale ziem rzadkich, polityka surowcowa, bezpieczeństwo surowcowe, Unia Europejska

Article submitted: 21.07.2022, accepted: 10.10.2022.