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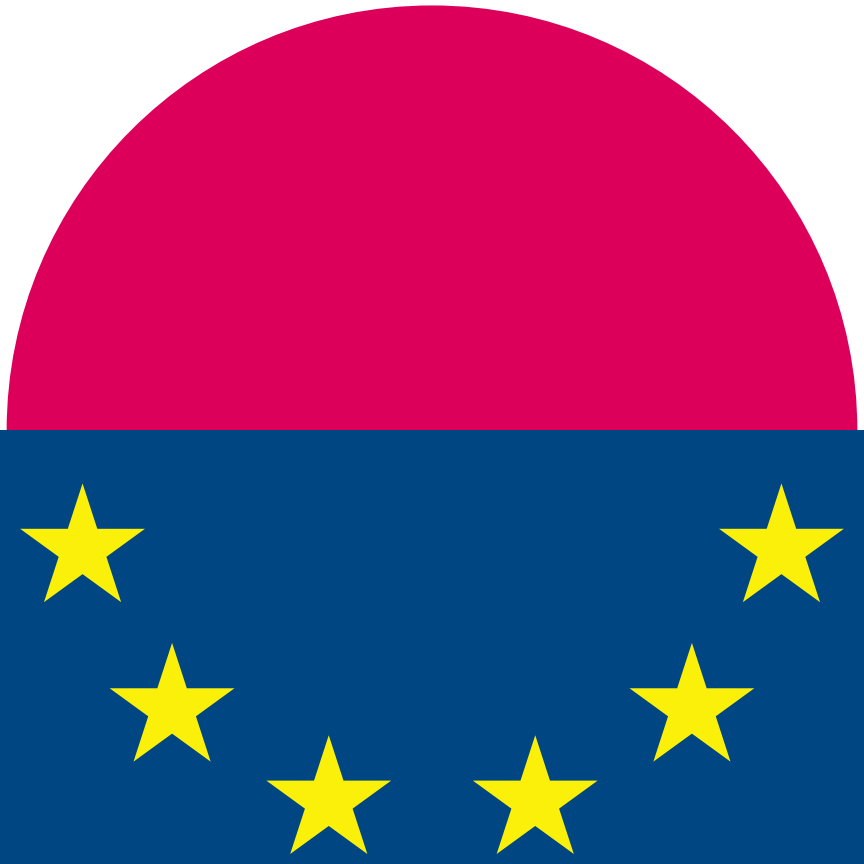

EU-Japan Critical Raw Materials Alliance

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At a Glance

Both Japan and the European Union face critical import dependencies in the raw materials sector. Especially in the field of rare earth elements (REE), the EU is largely exposed, while Japan has managed to reduce its vulnerability, although it remains at a critical level. With their combined market size and different politico-economic approaches, the EU and Japan could complement one other in their efforts to reduce this exposure.

Therefore, this paper proposes large-scale cooperation between Japan and the EU to reduce the risk of REE supply. The prerequisite for this cooperation is that the EU establishes a Critical Raw Materials Agency, which could act as a counterpart to the Japan Organization for Metals and Energy Security (JOGMEC). Unlike JOGMEC, the European agency should not be involved in the operational extraction of raw materials, but should focus on the EU's strengths, which are of a financial nature.

The EU-Japan Critical Raw Materials Alliance should include:

- **EU-Japan public-private funds:** The EU and Japan should pool their financial firepower to support targeted diversification projects with purchase guarantees, contracts for difference, and concessionary loans.

- **Joint procurement and stockpiling:** Japan and the EU could benefit from cooperation in procurement and stockpiling, thus further stabilising the supply of critical minerals and mutually supporting one other in the event of an emergency. For the EU's multi-level system, this would require the transfer of necessary competencies to a prospective European Raw Materials Agency.

- **Joint environmental and technological initiatives:** To provide transparency on meeting ESG criteria, the Japanese and European governments should work together to include local stakeholders in the process and to provide an open framework of communication. In addition, joint innovation programmes should be launched to accelerate the development of recycling, separation, and refinement technology for REE.

- **Critical Raw Materials Club:** If the above-mentioned measures do not suffice in the event of intensified global trade conflicts, a Critical Raw Materials Club should be founded by Japan and the EU and ideally joined by as many members as possible of the OECD, ASEAN, etc. Trade barriers would be created vis-à-vis third countries to ensure a level playing field of REE, providing incentives for REE suppliers to extract and process rare earths within the club.

Contents

1. Introduction

Both Japan and the European Union have greatly benefited from a world with free trade and open markets. But openness has also led to vulnerabilities, which can be seen in the field of critical raw materials supply, particularly in the high import dependence on rare earth elements (REE). With their combined market size and different politico-economic approaches, the EU and Japan could complement one other in their efforts to reduce this exposure.

EU and Japan could complement each other

The transition to climate neutrality and an increasing demand in raw materials are two sides of the same coin. For example, it is expected that the demand for REE in the EU will be six times higher in 2030 than in 2020 as the baseline.[1] Furthermore, according to the International Energy Agency (IEA), demand for rare earths in 2040 is expected to be 3.4 times higher than in 2020 (global, STEP scenario).[2] REE are used in small quantities as so-called technological spice metals for a large variety of products, such as permanent magnets for electric motors and electricity generators, lighting phosphors, catalysts, batteries, glass and ceramics, and are mostly imported as part of finished goods. An interruption in the supply of REE can have a cascade effect on the entire value chain. The reliable supply of REE has a hard security dimension, too. They are essential for the functioning of modern high-tech armies, given that a American Virginia-class submarine requires some four tonnes of REE, an Arleigh Burke-class destroyer more than two tonnes and an F-35 fighter jet over 400 kilogrammes.[3]

In general, there are three pillars for raw materials supply: domestic raw materials, imported raw materials, and raw materials from the circular economy.[4] An example for the circular economy approach is the plant in Bitterfeld built by the German company Remloy, a subsidiary of the German technology company Heraeus, to recycle neodymium-iron-boron magnets.[5] However, since the life cycles of several products are far from complete and huge amounts have to be added to the cycle first, extraction of new raw materials will continue to play by far the greatest role in the green and digital transition. In the European Union, only singular initiatives of REE extraction and processing have been undertaken thus far.[6] For example, the construction of a permanent rare earth magnet facility by the Canadian company Neo Performance Materials in Estonia received an 18.7 million Euro grant under the EU's Just Transition Fund in 2022.[7] Also, the Swedish mining company LKAB discovered Europe's largest deposit of REE in the Kiruna area in 2023.[8] With the EU's Critical Raw Materials Act, Europe will witness more initiatives in the future.

Extraction will play by far the biggest role

Japan, on the other hand, is already far ahead when it comes to securing a reliable supply of REE with its raw materials agency Japan Organization for Metals and Energy Security (JOGMEC). A time series comparison by Ernst and Young based on capital asset pricing models shows that the European Union is affected by price fluctuations on the minerals market to a far greater extent than Japan.[9]

Japan's increased commitment to work on developing alternative rare earth resources and to diversify supply sources was prompted by an incident in 2010. China's rare earth exports were subject to export taxes and quotas, which had been reduced year by year since 2006. Export quotas for the second half of 2010 were announced in July 2010, amounting to a significant reduction of about 72 percent compared to the same period of the previous year. In September, a fishing boat collision occurred off the Senkaku Islands and the Chinese government took several measures that appeared to be retaliatory; this led to a sudden stagnation of China's rare earth exports to Japan. Since November of that same year, rare earth exports to Japan had gradually returned to normal. However, export restrictions, such as the rare earth export quotas, remain in place, and in March 2012, Japan, the United States, and the EU filed a complaint with the WTO. In 2014, the WTO Appellate Body upheld the claims of Japan, the United States, and the EU and resulted in the Chinese government deciding to abolish the relevant measures.[10]

Private companies are also engaging in their own de-risking. According to the IW-future panel of the German Economic Institute, some 90 percent of German industrial companies take risk mitigation measures, including high material efficiency, long-term supply contracts and the diversification of suppliers.[11] For example, the German company Tradium provides stockpiling in an old Second World War bunker in Frankfurt am Main for critical raw materials – including the REE praseodymium, neodymium, terbium, and dysprosium.[12] Direct involvement in minerals extraction is proving to be difficult even for large corporations, however. For instance, the car manufacturers Volkswagen and Stellantis and the mining company Glencore planned to support a one-billion-dollar purchase of two mines of nickel sulfide and copper in Brazil in 2023 in order to ramp up their battery production.[13] Yet, the deal fell through only a few months later due to disagreement on the purchase amount in the wake of a global decline in the price of nickel.[14] With a market-share of some 15 percent, the Australian company Lynas Corporation Limited (Lynas) is the largest non-Chinese mining company in the field of REE extraction.[15] Nevertheless, in this difficult market environment, Lynas only continues to be solvent due to support from Japan since 2011.

Involvement in extraction is difficult even for larger corporations

The different levels of engagement are also reflected in the current numbers of the REE supply in the EU and Japan. With a share of 85 and 100 percent respectively, the EU is almost entirely dependent on imports of processed light rare earth elements (LREE) as well as of heavy rare earth elements (HREE) from China, as depicted in figure 1. This predominantly corresponds to the quasi-monopoly China has on the processing of HREE (100 percent) and LREE (85 percent) of the global supply. In its *Study on the Critical Raw Materials for the EU 2023*, the European Commission reports: "[The] EU is highly dependent on the rare earths imports, particularly heavy rare earths."[16] By contrast, Japan's import share of processed REE from China only amounts to 58 percent.

China has a quasi-monopoly on the processing of REE

The German Mineral Resources Agency (DERA) and the U.S. Geological Survey (USGS) also underline the prominent position held by China in the global supply of REE.[17] DERA reports that while there has been a significant decrease in the global country concentration of REE extraction due to a buildup of REE mining in the United States, the concentration of REE processing in China has markedly increased.[18] As shown in figure 1, the bottleneck of REE supply remains energy-intensive processing.

At the end of June 2024, China announced stricter controls on the trade with REE, probably in the context of the provisional tariffs on battery electric vehicles from China. At the end of 2023, China had already prohibited the technology transfer of REE processing in fields where it is leading the way technologically.[19] These indicators increase the pressure to act among highly dependent countries. Still, a focus on critical dependencies of the EU and Japan should not distract from the fact that China is also heavily dependent on certain raw material imports from overseas, such as the extraction of cobalt from DR Congo, nickel from Indonesia and the Philippines, as well as lithium from Latin America and Australia.[20]

Figure 1: Supply of rare earth elements

Mineral	Area of usage	Supply shares worldwide		Import reliance (for JPN/EU)		Import share China (for JPN/EU)		Required quantity in tonnes per year (for JPN/EU)	Substi-tutability (for JPN/EU)
		E*	P**	E*	P**	E*	P**		
HREE [a]	Permanent magnets for electric motors and electricity generators, lighting phos-phors, catalysts, batteries, glass and ceramics	China: 70% [b]	China: 100%	EU: 100%	EU: 100%	EU: 43% [c]	EU: 100%	EU: N/A	EU: low [d]
LREE [e]		China: 68.3% [f]	China: 85% Malaysia: 11%	EU: 80%	EU: 100%	EU: 43% [g]	EU: 85%	EU: N/A	
REE [h]		China: 62%	China: 92%	Japan: N/A	Japan: 93% [i]	Japan: N/A	Japan: 58% [j]	Japan: 17,401t	Japan: low [k]

Own illustration based on estimations by the European Commission[21], the Japan Organization for Metals and Energy Security (JOGMEC)[22], and the International Energy Agency (IEA)[23].

**E = Extraction stage **P = Processing stage*

a) HREE = heavy rare earth elements (dysprosium, erbium, europium, gadolinium, holmium, lutetium, terbium, thulium, ytterbium, yttrium according to the EU definition).

b) Estimated share based on EU estimations of China's share in individual elements: dysprosium 84.4%, erbium 68.3%, europium 68.3%, gadolinium 68.3%, holmium 68.3%, lutetium 68.3%, terbium 84.4%, thulium 68.3%, ytterbium 68.3%, yttrium 68.3%.

c) Main EU suppliers of heavy rare earth elements at the extraction stage are Japan (55%), China (43%), the USA (two percent) and UK (one percent). However, the quantity of imports of unprocessed minerals can be neglected in comparison to processed minerals.

d) Both light rare earth elements and heavy rare earth elements have a recycling rate in the European Union of about one percent (EU Commission 2023: 118). Their usage is critical for several industrial production processes, ranging from permanent magnets to chips production. For some applications, substitutes are available, but are less effective resulting in less economically competitive goods.

e) LREE = light rare earth elements (cerium, lanthanum, neodymium, praseodymium, and samarium according to the EU definition).

f) Estimated share based on EU estimations of China's share in individual elements: cerium 68.3%, lanthanum 68.3%, neodymium 68.3%, praseodymium 68.3%, samarium 68.3%.

g) Estimated share based on EU estimations of China's share in individual elements: cerium n/a, lanthanum 43%, neodymium 43%, praseodymium 43%, samarium 43%.

h) Here, the chemical definition applies according to which REE are a collective term for 17 elements that include the two elements scandium and yttrium, which belong to Group 3 of the periodic table, and the 15 lanthanide elements (lanthanum, cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, and lutetium). Scandium and promethium are not summarised under HREE or LREE according to the EU definition, but under REE.

i) Calculated based on total imports and demand. Japan Organization for Metals and Energy Security (JOGMEC) (2021).

j) The dependence on China by material is as follows: rare earth elements 49%, cerium oxide 87%, cerium compounds 39%, lanthanum oxide 100%, yttrium oxide 94%, other compounds 82%.

k) The recycling rate of REE in Japan is unknown.

This paper aims to show potential ways of cooperation between the EU and Japan to reduce the risk of REE supply. As highlighted above, both teams are at different stages in the race, but are aiming for the same goal. For example, the EU would first need to establish a European raw materials agency as a counterpart to the Japanese JOGMEC, as will be illustrated later. However, taking the ambition of the EU's Critical Raw Materials Act seriously, cooperation with like-minded partners should already be part of the operationalisation of its early stages. Therefore, in the following chapter, the causes for the high dependency will be analysed first, followed by an overview of the EU's and Japan's current initiatives. In chapter 3, possible cooperation strategies will be outlined and assessed together with their implications for the domestic institutional structure. These include EU-Japan public-private funds; joint procurement and stockpiling; joint environmental and technological initiatives; and the option of pooling these measures under the umbrella of a critical raw materials club, which should be open to other partner countries. In chapter 4, conclusions will be drawn from the different options and final recommendations will be made.

Cooperation with like-minded partners is essential

2. Background to the Dependence on China and the Status of Response

As seen in the introduction, the EU and Japan largely depend on China not only for REE resources themselves, but also for separation and refining capabilities. This chapter presents the background to China's dominant position in the REE supply chain and the status of the EU's and Japan's response, as well as outlining their current policy initiatives.

2.1 The Causes of Dependency

REE reserves total 120,000 thousand REO tonnes (worldwide as of 2020). The reserves are distributed in countries including China (34 percent), Vietnam (18 percent) and Brazil (18 percent). However, the REE deposits, known as ion adsorption ores (in Japanese イオン吸着鉱), which can produce heavy rare earth elements (dysprosium, terbium, etc.) at extremely low cost, are concentrated in Southern China. Despite this issue of an uneven distribution of REE deposits, the main cause for the high dependency is the uneven distribution of economical mining and processing bases. Even if REE reserves are available, the problem is that extraction cannot be made commercially profitable. Bottlenecks in ensuring the economic viability of the mining and refining process can be classified into 1) cost issues, 2) technology issues, and 3) environmental issues; with all three being strongly interlinked.

Uneven distribution of mining and processing leads to high dependency

1) Cost Issues

A) Low-Cost Production by China

China started REE mining operations in the 1970s and has been managing them under state leadership. In 1990, REE were designated as "protected and strategic minerals". It gained advantages on the global market thanks to various industrial policies, lower labour cost, and weak environmental regulation. In recent years, China has promoted productivity improvement and strengthened the prevention of technology outflow by restructuring Chinese rare earth companies and reviewing rare earth-related export regulations. In addition, the procurement costs of these also affect profitability and price competitiveness, as large amounts of water and energy are used for mining and processing.

B) Volatility of REE Sales Prices

China, the largest producer and consumer of REE, has been greatly influencing the market price. In June 2015, Molycorp Inc. of the United States filed for Chapter 11 bankruptcy due to worsening market conditions caused by the relaxation of China's REE export regulations. According to IEA, massive state-induced production expansion of REE by Chinese companies have led to sales prices of REE from Lynas and MP Materials to fall by more than 30 percent in the second half of 2023. These price effects are possible due to the unique characteristics of REE, particularly the small market size and the limited amount of distribution.

2) Technology Issues

A) Technology Development

In order to compete with China's low-cost and stable-quality REE production, technological development is required to reduce manufacturing costs and ensure profitability. Technological development is also essential for efficiently expanding the use of recycled materials and responding to environmental regulations.

B) Lack of Skilled Personnel

For example, there are companies in Japan that have high smelting technology, but most of them have relocated overseas as a result of manufacturing costs including labour and electricity costs. Therefore, maintaining and passing on refining technology has become an issue. Furthermore, as the number of students aiming to work in resource-related companies is declining and it is becoming more difficult to secure workforce, issues have been flagged about the expansion of resource-related human resources, including young researchers and those who have both the language skills and technical expertise to be active in international projects.

3) Environmental Issues

A) Environmental Regulation

The extraction and smelting of REE requires large amounts of water and energy. In addition to cost issues, other issues include the generation of hazardous waste like uranium, and the need to take measures against dust and soil run-off. The cost of such waste disposal increases as environmental regulations become stricter.

B) No Level Playing Field

In this situation, companies are taking measures, such as evaluating compliance with ISO and national regulations through regular audits and reducing carbon dioxide emissions by expending additional capital resources. It is not possible to avoid the impact of those activities on business profitability, and it is thus more economically rational to smelt overseas where regulation is less strict.

In summary, the EU and Japan need to overcome three obstacles: 1) the development of cheap products in China backed by government support, 2) technological capabilities and insufficient skilled human resources, and 3) compliance with various regulations, such as on the environment. Investors are expected to respond flexibly to changes in this business environment. Creating these incentives should lie at the heart of government policies.

2.2 Policy Initiatives of Japan and the EU

Japan

Since the REE shock in 2010, Japan has been working to diversify and stabilise its rare earth procurement sources. Specifically, in March 2011, the Japanese Sojitz Corporation and the Japan Organization for Metals and Energy Security (JOGMEC) decided to invest and lend a total of 250 million US dollars to Lynas, which develops REE resources.[24] An additional investment of nine million US dollars was made in 2022.[25] A long-term contract was concluded to supply more than 8,500 tonnes of REE products per year for ten years. In addition, Sumitomo Corporation has been working on procuring REE mined in Kazakhstan and Vietnam, and in February 2023, the company signed an exclusive sales agency contract for Japan with MP Materials.[26]

Japan has been stabilising its procurement since 2010

The percentage of Japan's total rare earth imports that derive from China has declined from 68.7 percent (2011) to 58.5 percent (2020).[27] However, demand for REE is expected to further increase in the future due to a growing demand for permanent magnets and other products, making it even more necessary to diversify mining supply sources and establish stable separation and refining capabilities.

In October 2021, the Sixth Basic Energy Plan was announced. It states, "As to mineral resources, financial support for Japan's interest in rare metals, etc. with a concern of supply disruption will be enhanced. By securing overseas interests and promoting base metal recycling, securing mineral resources of equivalent amount in domestic demand will be aimed by 2050. In addition, development of domestic marine mineral resources such as seafloor polymetallic sulphides and rare-earth yttrium rich mud, etc. will be addressed."[28]

The initiatives envisaged in the plan include 1) rare metal stockpiling; 2) strengthening the supply of venture capital through investment, loans, and debt guarantees by JOGMEC; 3) technological development and capital investment for rare metal recycling; 4) support for strengthening supply chains for important minerals based

on the Economic Security Promotion Act; 5) strengthening relations with resource-rich countries and cooperation with like-minded countries; 6) domestic undersea resource development.[29]

EU

Since 2011, the European Commission has been publishing a list of critical raw materials that was updated every three years according to the EU Raw Materials Initiative (RMI) of 2008.[30] For the latest update, the comprehensive *Study on the Critical Raw Materials for the EU 2023*[31] proposes 34 raw materials for the critical raw materials list 2023.[32] Of these, 16 are defined as strategic, including REE for magnets.[33] As part of the Action Plan on Critical Raw Materials from 2020[34], the EU founded the European Raw Materials Alliance (ERMA)[35] that serves as a platform to bring together relevant European stakeholders, including industry, member states, and research.[36]

In 2024, the EU passed the Critical Raw Materials Act that should contribute towards securing a reliable supply of critical raw materials for the green and digital transition.[37] It comprises three pillars:

EU's Critical Raw Materials Act aims to ensure a reliable supply

1) Benchmarks for EU-Capacities by 2030

For strategic raw materials, the EU sets the following benchmarks for domestic capacities by 2030:

- at least ten percent of the EU's annual consumption for extraction;
- at least 40 percent of the EU's annual consumption for processing;
- at least 25 percent of the EU's annual consumption for recycling;
- no more than 65 percent of the EU's annual consumption from one single third country.

Moreover, the act aims to streamline the permitting timeframes and offer access to financial support for selected strategic projects.

2) Risk Management

The act should enhance the EU's supply chain monitoring capabilities with stress tests and a risk preparedness obligation for large companies. Furthermore, the regulatory framework aims to facilitate coordination of strategic stocks in the EU, a joint procurement of member states, and a boost to the circular economy for critical raw materials in the single market.

3) International Partnerships

In order to diversify its supply, the EU should conclude trade agreements; seek strategic partnerships; use Global Gateway as a tool to accompany critical raw materials diversification projects with infrastructure investments; set up an EU export credit facility; and tackle unfair trade practices.

EU should conclude trade agreements

For coordination purposes, the act proposes setting up a European Critical Raw Materials Board of EU countries and the Commission. At its first meeting on May 24, 2024, when the act entered into force, it opened the call for the above-cited strategic project applications in the EU.[38]

To implement the agenda of the action plan and the Critical Raw Materials Act, the EU has concluded several partnerships[39] and alliances.[40] Moreover, the EU, the USA and others launched the Minerals Security Partnership Forum (MSP) in 2024, joined by the Critical Raw Materials Club announced by the European Commission.[41]

3. Assessment of Cooperation Strategies and Policy Recommendations

Under these circumstances, the EU (DG Grow) and Japan (JOGMEC) concluded the Administrative Arrangement on Cooperation in Critical Raw Materials Supply Chains in July 2023.[42] The agreement calls for:

1. *information exchange on the entire supply chain, including exploration, extraction, refining, and recycling, as well as on the development of alternative materials and the improvement of resource efficiency, and*

2. *exchange of views on supply chain risk management, resource recycling, and project support.*

With this agreement, EU-Japan collaboration on critical minerals is making progress, but more concrete measures for collaboration should be promoted to speed up efforts for securing critical mineral resources.

A European Raw Materials Agency should be established

As the basis for the collaboration measures listed below, the EU must first establish a counterpart to the Japanese raw materials agency JOGMEC. A European Raw Materials Agency should therefore be created to address risk management at European level.[43] It should focus on the EU's core competencies, which are of a financial nature. Involvement in the operational extraction of raw materials, for example, as JOGMEC provides, should not be undertaken by the European agency. Competencies that could be managed more efficiently at European level should be transferred from national agencies (e.g. DERA in Germany) but taking into consideration the principle of subsidiarity. In particular, the fields of action that can distort the European single market (compatibility with Article 119 TFEU, state aid law, prohibition of discrimination and four fundamental freedoms, e. g. with respect to access to the state-administered stockpile),[44] should be located at European level.

The following will present four bundles of measures where the EU and Japan could profit from cooperation.

3.1 EU-Japan Public-Private Funds [Short-Term to Mid-Term]

The development of important mineral resources requires financial firepower. Both Japan and the EU should join forces to develop funds to meet the demand for

financial resources. Regarding fund membership, JOGMEC has already established the necessary investment functions. Participating as a member in an additional joint Japanese-European fund would increase investment costs and would thus entail no additional value for Japan. However, there is a possibility of joint investments by JOGMEC and by a newly established European fund.

In cooperation with JOGMEC, the prospective European Raw Materials Agency could assist mining companies in diversification projects. As explained, the European agency's role should be limited to financial assistance (e.g. purchase guarantees, contracts for difference, concessionary loans) because of the EU's limited competencies in the operational field compared with JOGMEC. In practice, the European Raw Materials Agency and JOGMEC could co-finance the exploration, extraction and refining of REE by a mining company in a third country in exchange for the right to purchase a respective share of the extracted and refined rare earths. The cooperation should also include guarantees for untied financial loans (in Germany UFK Guarantees) to protect creditors of raw material projects abroad against economic and political credit default risks.[45]

Both agencies could support mining companies

Given that financial support from governments alone will not suffice for sustainable operation, it is essential to integrate the private sector. For example, with regard to Japan's deep-sea mineral resource development such as the strategic innovation programme Development of Innovative Technologies for Exploration of Deep Sea Resources[46], it has been illustrated that a private company or even a single country would be unable to extract deep-sea rare earth mud for financial reasons.[47] It is therefore important for the government to reduce the financial risk that private companies cannot cover and to encourage companies to invest. In fact, the Japanese investment in the Australian company Lynas was also facilitated via a joint investment by a trading company (Sojitz) and the government (JOGMEC).

The funds could also be used for mining-related infrastructure development. For example, Japan has a track record of using Official Development Assistance (ODA) to support the development of ports in Madagascar[48], associated with Sumitomo Corporation's nickel production project. Japan could profit from cooperating with the EU on the African continent since the EU has deeper relations with African countries. Selected projects of the EU's Global Gateway strategy could also help to establish long-term partnerships with third countries. In cooperation with Japan, the EU could diversify the supply of REE in Africa with the Africa-Europe Investment Package of approximately 150 billion US dollars dedicated to strengthening cooperation with African partners.[49]

Funds could be used to develop infrastructure

3.2 Joint Procurement and Stockpiling [Mid-Term]

Both the EU and Japan could benefit from cooperation in procurement and stockpiling, thus further stabilising the supply of critical minerals and mutually supporting one other in the event of an emergency. Moreover, the EU and Japan could increase the deterrent effect against weaponising REE and using them for economic coercion, as in the case of the European Anti-Coercion Instrument. Joint stockpiling will provide supply chain resilience in case of short-term disruption.

In 2020, Japan revised its Basic Policy on Stockpiling of Metals and Minerals, and revised the stockpiling targets set for both private stockpiling and national stockpiling in line with those for national stockpiling alone. Despite the fact that government approval is required for the plan, JOGMEC is responsible for procuring stock, and for the release of stockpiles as a "last resort" in the event of supply disruption. In general, the specific ore types and quantities for which stockpiles and the prices for purchase or sale, as well as matters which may enable their inference, are being held undisclosed, as disclosure could negatively impact the market and as the stockpiling information is crucial from national security perspective. In addition, the stockpiling target volume is decided in a flexible way depending on the procurement risk for each ore. In the event of an emergency, upon request from Japanese companies and at the discretion of JOGMEC, it flexibly releases stockpiles to the companies.

By contrast, the EU would first need to build up a stockpiling and procurement capacity. For the EU's multi-level system, this would require the transfer of necessary competencies to a prospective European Raw Materials Agency. It should not only be possible to coordinate the initiatives of the member states' raw materials agencies, but also to integrate them into its procurement and stockpiling as part of a multi-level system. This structure with the European Raw Materials Agency at the top of decision-making is imperative to guarantee its functioning in times of emergency.

EU would need to build capacity

In practice, it would be conceivable for the EU to set quotas for procurement from strategically important sources, where a price above the global market price is paid. If necessary, these quotas can also be offset against mutual purchase guarantees. Private companies should be included in the EU strategy as service providers for stockpiling, from whom the EU could buy capacities. The goal of stockpiling should be to build up a strategic reserve for extreme geo-economic scenarios like an REE embargo, and not primarily to stabilise market prices. If the strategic reserve is opened, the preferred allocation instrument should be an auction. In case of an embargo, a fair distribution ratio must be agreed upon beforehand between the EU and Japan with guarantees to act accordingly.

Regarding the financing of these measures, some authors suggest conducting individual risk assessments of companies to estimate their mandatory contribution.[50] We expect these risk assessments to impose an inadequately high bureaucratic burden on companies considering that the market interventions we propose are limited; they only prepare for emergencies and only relate to specific critical dependencies. We would rather consider REE as a strategic resource in the national interest, similar to strategic reserves of oil and gas.

High bureaucratic burden must be avoided

Japan and the EU should note that the requirement for stocked resources might not be high depending on the type of minerals, since various mixtures of minerals are different according to their intended use in products. Therefore, when developing the stockpiling plan, it will be necessary to carefully examine the volume and types. Also, compatibility with existing multinational cooperation frameworks needs to be considered. Specifically, Indo-Pacific Economic Framework (IPEF) member countries have agreed to discuss how to make stockpiling to be mutually available and to secure the alternative procurement routes in the event of an emergency.[51] If IPEF and the Japan-EU cooperation framework complement one other, it will strengthen the supply chain in a way that is geographically broader.

3.3 Joint Environmental and Technological Initiatives [Short-Term to Mid-Term]

Companies should also be encouraged to take the risk of investing in a business where meeting ESG criteria is difficult and could thus lead to costs that are very difficult to calculate. Companies that develop critical minerals have been actively promoting ESG initiatives and disclosing information on the status of periodic audits based on international standards such as ISO 9001/14001/45001 and regulations in each country, as well as introducing best practices for environmental measures.

The development of new mining sites also requires large financial resources for infrastructure development, such as securing water and electricity. In light of the expected ripple effects for related industries, support from the respective government, such as subsidies and tax credits for necessary capital investment and environmental measures, should be taken into account. What is more, in order to provide transparency on meeting ESG criteria, the Japanese and European governments should work together to include local stakeholders in the process and to provide an open framework of communication.

Development of mining sites requires large funding

In terms of technological cooperation possibilities, the Japanese New Energy and Industrial Technology Development Organization (NEDO) is working on the "development of separation and refinement technology for REE from unused resources and used materials"[52], and other efforts are underway to strengthen separation and refinement capabilities and to develop recycling technologies. The above-cited financial support should be used for joint innovation programmes to accelerate technology development and joint human resources development.

For example, initiatives should be taken into consideration that promote research on recycling rare earth metals, especially rare earth magnets, following the examples of financial support for private sector initiatives in Canada and the United Kingdom.[53] It is important to bear in mind, however, that recycling will only be able to approach the aspired 25 percent rate in the EU by 2030 when more products with high concentration of REE, like wind turbines and EVs, reach their end-of-life.[54]

Research into recycling should be supported

3.4 Critical Raw Materials Club [Mid-Term to Long-Term]

The positive incentives for suppliers to strengthen the mining and processing capacities of REE outlined above may suffice. Having said that, we also need to be prepared for intensified global trade conflicts, in which other countries use supplies of REE as a weapon. In this case, an instrument providing long-term economic security for investments by domestic producers in REE is needed.

One such option would be a critical raw materials club founded by Japan and the EU and ideally joined by as many members as possible of the OECD, ASEAN, etc. REE would be traded barrier-free between the club members. The ambition of this concept distinguishes itself from the EU's Critical Raw Materials Club initiative and goes beyond the idea of a "hybrid club" by Francesco Findeisen, which starts with loose commitments and becomes more ambitious over time.[55]

Trade barriers would be created vis-à-vis third countries to ensure a level playing field of REE, providing incentives for REE suppliers to extract and process rare earths within the club. One way of creating the barriers is through harmonised norms and standards by developing common criteria of "trustworthiness" among like-minded club members. The criteria should reflect shared values among club members, such as the environmental footprint and labour rights. Another option is common external tariffs on REE and products that fail to comply with the criteria.

In addition, these non-price criteria could provide incentives for the demand-side. For example, introducing the criteria into the conditions for certain incentives (e. g. EV subsidies) or public procurement could motivate demand-side entities such as the automotive industry to procure REE from suppliers in the club that comply with the criteria – otherwise they would source REE only taking its price into account.

The criteria should be objective and independent of the country so that there is less worry about excessive friction or retaliation with countries of concern, and that more countries will be expected to join the club. Specifically, the more club members, the more integrated the market will be. This, in turn, will provide greater market opportunities for end-product providers on the demand side, lowering the cost per product using REE, and making them price-competitive with the products from non-member countries. The criteria should comply with the WTO's non-discrimination rule.

Criteria should be country-independent

Business matching between the REE suppliers and downstream manufacturers will be effective. This matching effort will speed up manufacturers' procurement of REEs from member states. This, in effect, will diversify the REE's supply chain.

Some of the above-cited measures (stockpiling, procurement, joint technological initiatives, etc.) could be integrated into the club. Therefore, the institutionalisation of the critical raw materials club should go beyond a mere buyers' cartel. Instead, it should be an open invitation to key allies, including the Indo-Pacific.[56] The club should also facilitate inbound investment from like-minded countries and joint investments in third countries. For example, one of the major factors that enabled Japan to reduce its dependence on China for rare earths was the acquisition of shares in Australia's company Lynas by JOGMEC and others (as of June 2024, the shareholding ratio was 3.35 percent). This was facilitated by the Australian government having accepted investment from Japanese companies in the Foreign Investment Review Board (FIRB).

Key allies, including those in the Indo-Pacific, should be invited

In summary, the option of a critical raw materials club could be politically costly and make production more expensive at the early stages, as the trade barriers to be erected will increase the cost of REE. However, as the club would develop objective non-price criteria, collaboration among club members could contribute towards restoring the level playing field for economic competition. This would enable Japan, the EU and other members of the club to jointly deter market-destructive efforts at unreasonably lower prices by non-club member countries.

4. Conclusion

As we face a growing geopolitical risk, including critical minerals being used as a means of economic coercion, the EU and Japan need to deepen their cooperation and promote efforts at national level to reduce their dependency on China. The establishment of EU-Japan public-private funds, joint procurement and stockpiling, collaboration on environmental measures and technology development, and the establishment of a critical raw materials club, would be comprehensive policy tools to gradually achieve this goal.

To advance these efforts, the EU should at first establish a European Raw Materials Agency and strengthen its commitment on the part of the member states. In Japan, various initiatives are now already underway, led by JOGMEC, to ensure a stable supply of critical minerals, such as investing in the Australian mining company Lynas and national stockpiling. But it is important to strengthen refining and recycling technologies through cooperation with like-minded countries in order to further promote the establishment of a more resilient critical minerals supply chain under national leadership.

Refining and recycling technologies must be strengthened

By coordinating efforts that leverage the strengths of the EU and Japan, both will be able to increase their resilience against economic coercion, such as export controls on critical minerals and refined products, and will also help to prevent the coercion itself. State-led collaborative efforts, especially in terms of investment, may help private companies to gain access to natural resources and expertise, while reducing business risks, and to expand market access opportunities for intermediate and final products.

When examining the cooperation framework, it is necessary to consider the several characteristics of REE and other policy developments. For example, as highlighted in the previous chapters, the market size of REE is small and only a limited amount of distribution is available, and the requirement of respective REE vary depending on the business needs. These aspects need to be considered when the EU and Japan develop the proposed joint stockpiling plan.

The REE market has unique characteristics

Consideration should be taken of how the EU-Japan cooperation mechanism will be compatible with other multinational collaboration frameworks such as IPEF, so as to maximise supply chain resilience and the deterrent effect through the cooperation framework.

Appendix

Initiatives of the Sixth Basic Energy Plan

1) Rare Metal Stockpiling

In July 2020, the Ministry of Economy, Trade and Industry revised the Basic Policy for Stockpiling of Metal Mineral Products. Previously, stockpiling targets were set for both private and national stockpiles, but are now set for national stockpiles alone. The stockpiling will be flexible according to the situation surrounding the resources; for example, setting a longer stockpiling target period for mineral resources with high risks such as political instability in the producing countries, while setting a lower target period for mineral species and items if the supply is relatively stable.

2) Strengthening the Supply of Venture Capital Through Investment, Loans, and Debt Guarantees by JOGMEC

In May 2022, the JOGMEC Act was amended, in which the upper limit of JOGMEC's investment ratio was raised from 50 percent to 75 percent. Moreover, another methodology that includes debt guarantees can be applied. The resources covered here are: REE, cobalt, lithium, nickel, and platinum group metals.

3) Technological Development and Capital Investment for Rare Metal Recycling

NEDO is promoting "technology development for separating and refining REE from parts and materials". 1.76 billion yens will be spent from 2023 to 2027 to develop technology for separating and refining heavy REE from unused resources and used parts and materials with high efficiency and low environmental impact.

In addition, the Key Technology Development Programme (K Programme) based on the Economic Security Promotion Act is promoting technological development to build the foundational technology for stable use of heat-resistant super alloys with reduced rare metal content (essential for high-temperature and high-pressure extreme environments, such as power generation gas turbines and jet engines) as products in about ten years' time. The budget amounts to 7.5 billion yens.

4) Support for Strengthening Supply Chains of Important Minerals Based on the Economic Security Promotion Act

In January 2023, JOGMEC announced the Policy for Ensuring a Stable Supply of Critical Minerals and began supporting private companies with diversifying and strengthening the supply chain of critical minerals and ensuring a stable supply. For the time being, support will be limited to manganese, nickel, cobalt, lithium, and graphite, which are raw materials for batteries, and rare earth metals, and are used for permanent magnets. The support will be provided for 1) exploration and feasibility studies, 2) mine development, 3) smelting and other projects, and 4) technology development.

In March 2023, JOGMEC established a stable supply support fund and secured 105.8 billion yens for the stable supply of critical minerals. Two projects had been awarded as of June 2024.

5) Strengthening Relations with Resource-Rich Countries and Cooperation with Like-Minded Countries

In June 2023, the Basic Policy for the Realisation of GX was formulated. Based on the premise of the previous stable energy supply and considering environmental changes such as GX, the public and private sectors will work together to develop a strategic, continuous, and comprehensive resource diplomacy.

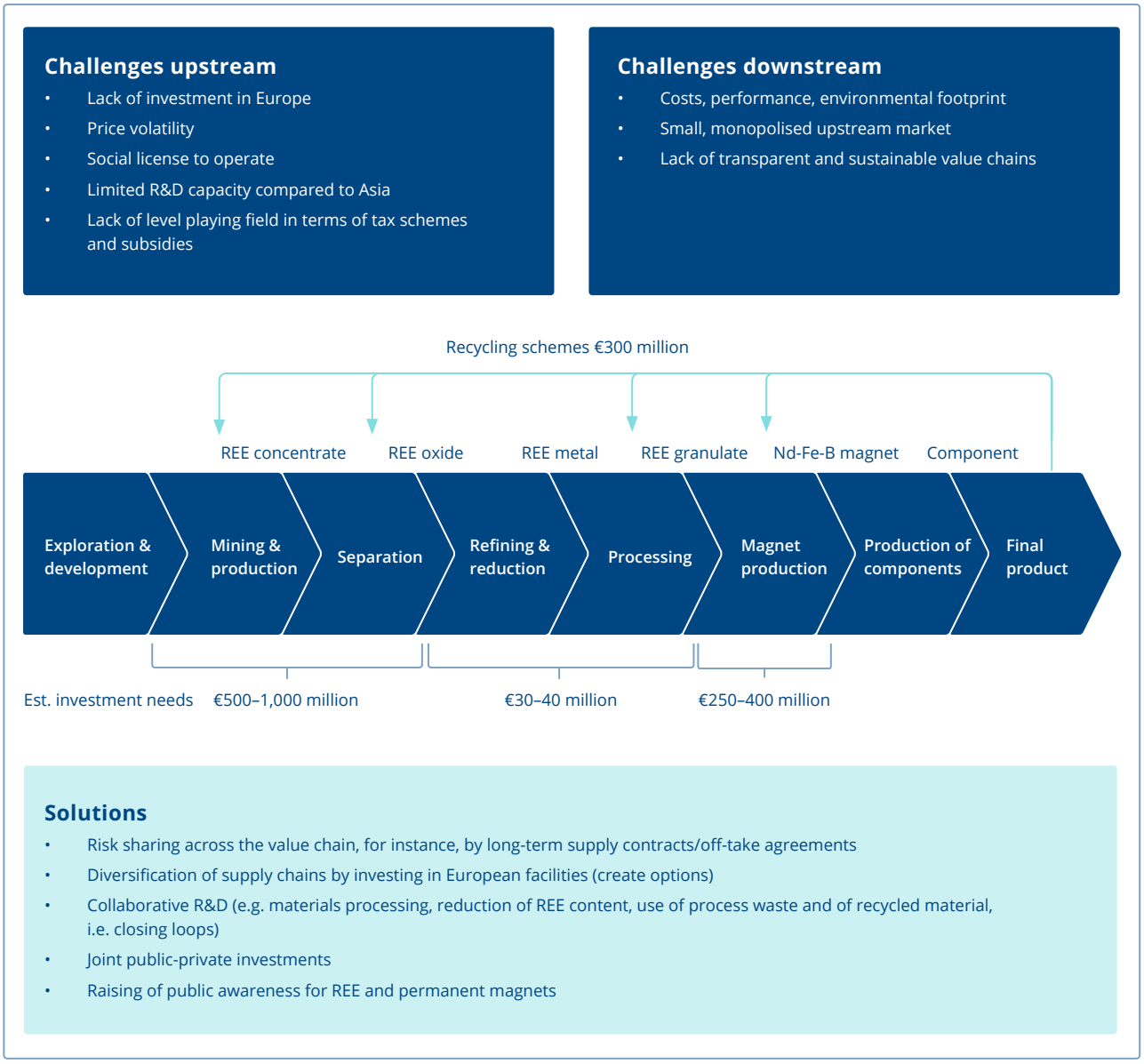
6) Domestic Undersea Resource Development

In February 2024, the Plan for the Development of Marine Energy and Mineral Resources was revised. Technological development will be promoted for the commercialisation of methane hydrate, oil and natural gas, seafloor hydrothermal deposits, cobalt-rich crusts and manganese nodules, as well as REE mud.

Estimated Investment Needs in the European Union Until 2030

The Rare Earth Magnets and Motors Cluster of the European Raw Materials Alliance (ERMA) estimated the investment needs for the REE value chain if the EU were to reach 20 percent domestic supply by 2030.

Figure 2: REE value chain in the EU



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