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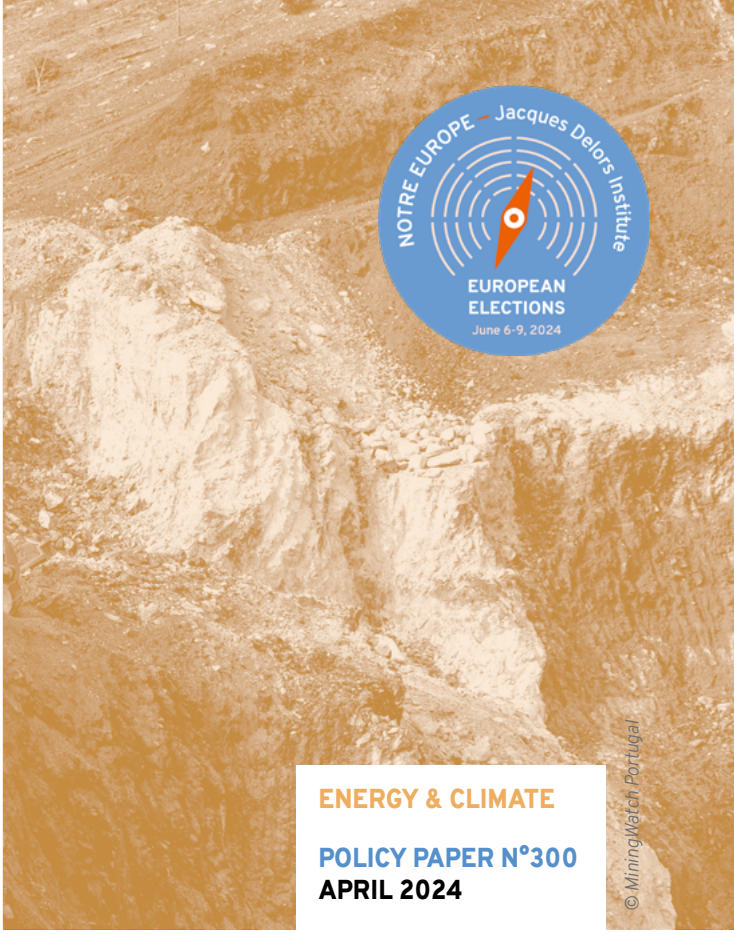

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Strengthening EU green sovereignty through the Critical Raw Materials Act

Why the EU needs it, what is foreseen, how to make the most of it?

ENERGY & CLIMATE

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#EUGreenDeal
#CriticialRawMaterials

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Executive summary

"Without critical raw materials, there will be no Green Deal, no future technology development in Europe", declared European Commission's Executive Vice-President Šefčovič in February 2024. The energy transition requires a new green industrial and energy security paradigm, in which critical raw materials (CRM) supply chains will play an important role. As demand for clean techs (solar, wind, batteries, etc.) increases, so does the associated demand for critical raw materials (cobalt, lithium, etc.). Current European supply will fall short of the expected demand in the absence of further policy action. Additionally, the supply is fragile and concentrated, especially in China, creating a high risk of disruption and worrying external supply dependencies for the EU. Lastly, CRM related activities, such as extraction and processing, can be highly sensitive for the environment, and are often conducted in countries with weak social safeguards and insufficient governance frameworks to monitor human rights, social impacts, and environmental degradations.

Geopolitical and geoeconomic considerations together with the need to preserve future innovation capacity bring about a need to strengthen EU sovereignty on CRMs. This would also be an opportunity to enforce high EU environmental and social standards. The potential is substantial. With over 50 investment cases identified on CRM for energy in Europe, the EU could potentially cover 40% of its demand in lithium, cobalt, and rare earth elements by 2030. Yet Europe is lagging behind its main competitors in developing and scaling cutting-edge CRM technologies.

The adoption of the EU Critical Raw Materials Act in 2024 is a strong political signal of the EU's commitment on CRMs. This policy paper sets out the global CRM supply situation to contextualize why the EU needs to act. It then focuses on the domestic implications of the CRMA, and how it can strengthen EU sovereignty during the green transition. It will present the main features of the CRMA and assess it in light of the challenges of building a CRM ecosystem in Europe.

Key messages and recommendations :

- **The CRMA is a landmark legislation that clearly sets CRMs as a key security and resilience priority for the EU.** However, it can only be the first step towards a more comprehensive policy mix composed of appropriate financing tools, strengthened governance, and updated products and waste-related regulations and associated policies. Effective implementation of the CRMA would strengthen EU green industrial and energy sovereignty. With increased resilience, it would contribute to better shielding the Single Market from external shocks.

- **EU CRM funding tools fall short of the scale and speed needed to truly fulfil EU CRM potential, and achieve greater resilience and sovereignty**. The window of opportunity lies in the next few years. With the CRMA, the Commission needs to take action to support crowding in private investment. To that end, in addition to greater involvement of **EIB and Invest EU implementing partners in CRMs** (providing blended finance, public guarantees **including through the creation of a new European Green Guarantee scheme**) and the development of criteria for the inclusion of CRM mining and refining activities in the **taxonomy**, the Commission should propose to establish a **European Critical Raw Materials Fund**. The Fund could be partly financed by revenues of ETS1. New policy instruments to effectively and swiftly crowd-in private investments in sustainable CRMs should be a priority for the next mandate. They should provide investors with simplicity, scale and speed, and limit distortions on the Single Market.

- Under the CRMA, new obligations are introduced for Member States : setting up a national point of single contat, drawing up national exploration programmes including mineral mapping,... **Ambitious and efficient implementation of the CRMA will call for additional governance efforts,** improving transparency, access to information, formalizing best practices for public participation, developing technical assistance, capacity building, and knowledge sharing platforms for policy-makers and other stakeholders. A new **EU CRM Observatory** could support this task and centralize new data, relevant information and ressources..

- **Resource management measures supporting efficiency, substitution, circularity and sufficiency should be fully integrated into the CRM policy mix.** This will involve updating EU product and waste-related legislation to favour recycling targets, raising awareness among stakeholders about the supply risk associated with CRMs, and the prioritization of low CRM resource use techniques, designs, and products for EU and national funding and financial incentives. According to Transport & Environment, smaller batteries, reduced use of private cars, and innovative chemistry (sodium-ion) could reduce battery metals needs by a third, and up to half in their most ambitious scenario. Smaller batteries are the largest driving factor, representing a quarter of the reduction.

These elements should be fully integrated to a new European energy security strategy. Detailed recommendations are in the conclusion part.

Introduction

"Without critical raw materials, there will be no Green Deal, no future technology development in Europe", declared Executive Vice-President Šefčovič in February 2024[1].

The recent acceleration of EU energy transition efforts, with the EU Green Deal, the war in Ukraine, and increased global competition in the green industry is laying the ground for a new energy security paradigm, dominated by clean technologies and metal resource use considerations. As a result, we may have entered the age of raw materials scarcity: the development and commercialization of new technologies in electronics, automotive, and many other sectors are constantly increasing the demand for these materials. These technologies include low-carbon solutions that are crucial for the energy transition, and involve raw materials that are now deemed "critical". For example, electric batteries require cobalt, copper, lithium, nickel, and rare earth elements – REE, windmills require copper and REE. Demand for lithium, one of the most requested materials, is expected to be 42 times higher in the clean energy sector in 2040 as compared to 2020 (see Table 1 below). The current extraction and production levels are insufficient to meet the growing European demand, let alone in the clean energy sector[2]. In addition, the existing project pipeline is falling short of meeting the demand increase expected by the International Energy Agency (IEA) in its 2050 net-zero scenario[3]. Finally, the central role of China (see annex) and its control of processing technologies raises many issues, about its willingness to let Europe reach independence sovereignty or in case of a sudden interruption of supply in case of a war with Taiwan.

This raises concerns, especially in a continent like the European Union (EU) with very limited production as well as insufficient or outdated data about domestic reserves and resources. The European Critical Raw Materials Act (CRMA), proposed in 2023 and adopted in 2024, aims to address this shortage and ensure European strategic autonomy by "strengthening domestic supply chains", and "reinforcing international engagement to develop mutually beneficial partnerships with third countries". This paper will focus on the domestic implications of the CRMA. More specifically, the CRMA sets clear priorities and targets to build European capacities, improve resilience, promote innovation and a more sustainable and circular economy[4].

While the adoption of the CRMA has been welcomed by many actors[5] as a key milestone towards greater resilience and sovereignty for Europe, it also raises important questions. The most obvious one is to know whether it has the means of its ambition, as we may be at the dawn of new mining age in Europe. But it also brings up even more complicated issues about the need for new mines on European soil, the lack of capacity leading to lentghy permitting processes, the social acceptance the social acceptance of such projects, concerns about potential environmental degradations, and ways to mitigate them. It also raises the question of the insufficiencies of the current materials recycling and circular economy policies and the lack of measures promoting sufficiency[6]. Finally, it raises the question of dependency on

1 European Commission, 2024. Keynote speech by Executive Vice-President Šefčovič at the European Investment Bank Group Forum. Press corner.
2 This could be the case for lithium, as different analysis point out: Paoli L., Gül T. (2022) "Electric cars fend off supply challenges to more than double global sales", IEA, 30/01 and "Lithium is essential for the transition to a net zero future", Bacanora Lithium, 2022.
3 IEA (2023) Critical Minerals Market Review 2023.
4 "European Critical Raw Materials Act", European Commission.
5 According to several interviews conducted in the context of the development of this report.
6 See for instance the négaWatt Minimal project.

mines located abroad, with little possible oversight of environmental, social, and governance (ESG) criteria and important human rights violations.

This paper will explore the current weaknesses of the European situation in terms of access to critical raw materials necessary for the energy transition, focusing on five materials that are crucial for the energy transition and are poised to experience very important demand growth in the coming years: cobalt, copper, lithium, nickel, and rare earth elements (REE). It will then assess the progress and gaps of the EU framework with the recent adoption of the CRMA, which aims at strengthening the resilience and sustainability of EU critical raw materials supply chains. While the CRMA covers both the external and internal dimensions of sustainable CRM supply chains, this paper will focus on the domestic dimension of the CRMA. Lastly, it will provide policy recommendations to make the most of the newly adopted CRMA.

I • Global CRM state-of-play and challenges

I THE GAP BETWEEN PRODUCTION AND THE GROWING DEMAND FOR CRITICAL RAW MATERIALS

– Towards a material-intensive energy system?

Cobalt, copper, lithium, nickel and rare earth elements (REE) are essential components for technologies allowing an acceleration of the phase-out of fossil fuels. Their main usages in the clean energy sector are summarized below in Table 1. It is usually estimated that an electric vehicle needs 6 times more critical materials than a conventional one. Logically, as the need for products linked to these technologies is rapidly growing, so is the demand for materials, leading the IEA to predict "the shift from a fuel-intensive to a material-intensive energy system". The IEA projects that to reach net zero globally by 2050, clean energy technologies will require six times more minerals as compared to 2020, and 4 times by 2040[7] (see Table 1 and Annex). The current production levels are not enough to meet the demand forecast: for instance, the company S&P Global Market Intelligence forecasts a global lithium deficit of 4,000 lithium carbonate equivalent and anticipates a compound annual growth rate of battery for electric vehicles of 27% between 2023 and 2027[8] (see also Table 5 on the EU dependency).

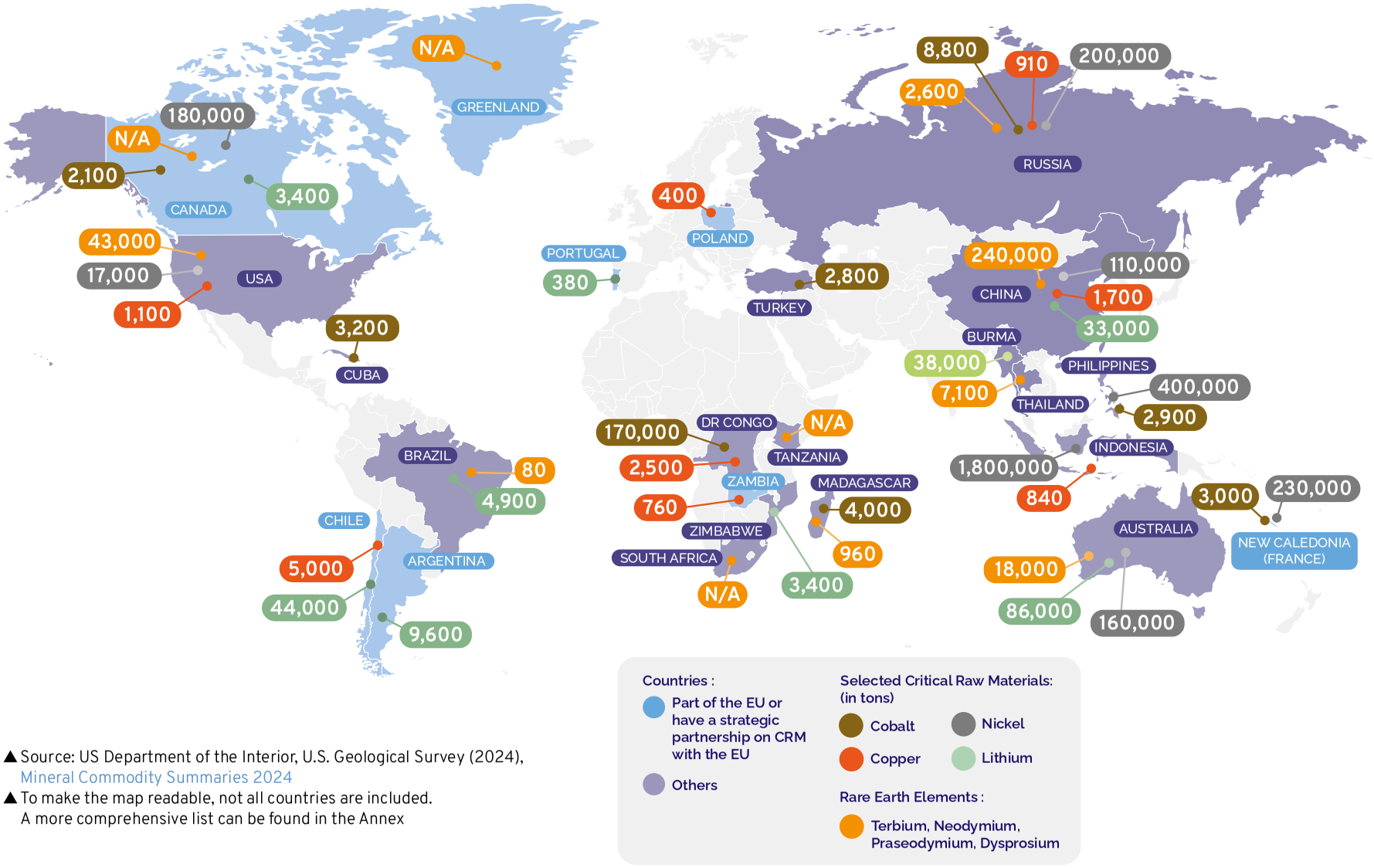
7 IEA (2022), The Role of Critical Minerals in Clean Energy Transitions.
8 "Lithium: the Czech Republic's 'white gold' rush", *DW*, 09/15/2023.

TABLE 1. Demand of materials for clean energy technologies

Material		World total production, tons (rounded)	Estimated world total reserves, tons (rounded)	Clean technologies in high need of the material	Main usage	Projected growth in demand, in 2040 relative to 2020 (2020 =1)
Cobalt		230,000	11,000,000	EVs and battery storage	Greater performance, longevity, and higher energy density of batteries	21
Copper		22,000	1,000,000	Solar PV Wind Bioenergy Electricity Networks EVs and battery storage	Essential element for almost all electricity-related technologies	2
Lithium		180,000	28,000,000	EVs and Battery storage	Greater performance, longevity, and higher energy density of batteries	42
Nickel		3,600,000	>130,000,000	EVs and battery storage Geothermal Hydrogen	Greater performance, longevity, and higher energy density of batteries	19
Rare Earth Elements	Neodymium	350,000	110,000,000	Wind	Powerful magnets for wind turbines and EVs	3
	Praseodymium			EVs and battery storage Wind		
	Dysprosium			Wind		
	Terbium			Wind		

▲ Sources: US Department of the Interior, U.S. Geological Survey (2024), Mineral Commodity Summaries 2024 and IEA (2022), The Role of Critical Minerals in Clean Energy Transitions.

Selection of the main countries producing critical clean energy materials



▲ Source: US Department of the Interior, U.S. Geological Survey (2024), Mineral Commodity Summaries 2024

▲ To make the map readable, not all countries are included. A more comprehensive list can be found in the Annex

To address the material demand for the clean energy transition, the IEA is calling for a swift expansion of mining capacity, especially lithium. These future developments are unlikely to significantly change the current geopolitical situation: the Agency foresees new lithium capacity in Canada, Australia, and Chili, and further cobalt development in the Democratic Republic of the Congo (DRC), while Australia and Chile would continue to dominate the global supply of copper[9]. New mines are also potentially about to open in Europe (see Map 2). There are currently 50 investment cases for CRM projects for energy purposes for 2030, including more than 20 lithium mining projects (see Map 2). More specifically, a country like France announced in September 2023 a new inventory of national mining resources. France also recently agreed on partnerships with Mongolia, Angola, and Zambia to explore new mineral reserves, and is planning to open a new lithium in the Auvergne region, with a EUR 1 billion investment and a planned capacity of 34,000 tons of lithium hydroxide, that is to say enough for the batteries of 700,000 electric vehicles[10]. Notable mine projects also include Covas de Barroso in Portugal and Cinovec in the Czech Republic[11].

– The challenges of new mines

The possible opening of new production sites can create many issues, including in the mines mentioned above. **If not built and managed sustainably, new mines can have serious impacts on the local ecosystems (see below) and tend to be rejected by local populations who fear for their environment.** The development of new types of mining, typically deep-seabed mining, currently banned in the EU, also poses serious questions in terms of sustainability and ethics, including environmental, legal social, and rights-based issues[12]. Norway is the first country in the world to approve commercial-scale deep-sea mining of materials such as cobalt, lithium, and others of an area of 280,000 sq km, feeding fears of marine devastation if projects are to follow[13]. In November 2023, EU members of the Parliament wrote a letter asking their Norwegian counterparts to reject the project for environmental reasons[14]. Their request was not met and international negotiations are still taking place on this issue[15]. In addition, the development time for a mineral supply project is estimated by the IEA to be more than 16 years on average, which means that production from new reserves cannot meet short-term demand. They also require important financial support[16].

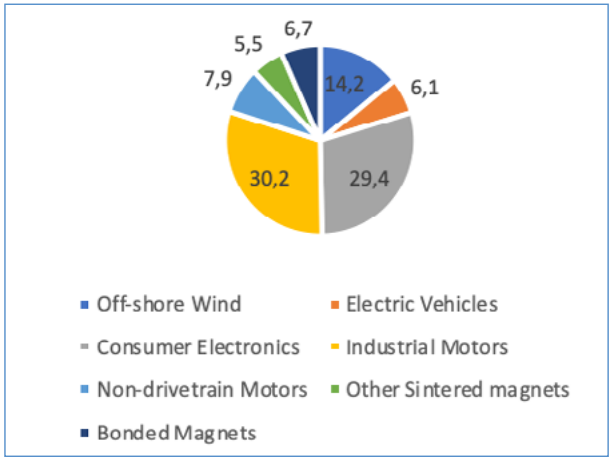
– An increasing pressure on CRMs due to conflicts of usage

Conflict of usage may also create pressure on the materials supply for clean energy. For instance, the rare earth elements market is driven not only by clean technology demand, but also by consumer electronics (semi-conductors, mobile

9 IEA (2023) "Chapter 3. Mining and material production" in Energy Technology Perspectives 2023
10 «France prepares major mining inventory in push for critical raw materials», *Euractiv*, 26/10/2023, «Minéraux stratégiques: loe BRGM accompagne la Zambie et l'Angola», BRGM, 28/04/2024, and «Un colossal projet de mine de lithium en Auvergne divise la population, qui craint un impact sur les sols et l'accès à l'eau», *Le Monde*, 15/03/2024
11 Sadden E. (2023) "New lithium mining, refining projects set to strengthen Europe's battery supply chains" S&P Global Commodity Insights, 11/12 "Lithium: the Czech Republic's 'white gold' rush", *DW*, 15/09/2023, and Europe is Embarking on a Mining Renaissance. Winning Over Locals is Proving a Challenge, *The Wall Street Journal*, 10/08/2023
12 Levin, L.A., Amon, D.J. & Lily, H. (2020) Challenges to the sustainability of deep-seabed mining. *Nat Sustain 3*, 784–794 https://doi.org/10.1038/s41893-020-0558-x
13 "Deep-sea mining: Norway approves a controversial practice", *BBC*, 09/01/2024
14 The letter can be found here: "Letter to the Norwegian Parliament: Act to prevent Deep Sea Mining from happening in Norwegian waters"
15 France's Ministry of Europe and Foreign Affairs (2024) International Seabed Authority Council - France calls for expanding the coalition against deep-sea mining, *News*.
16 IEA (2023) "Chapter 3. Mining and material production", *op. cit.*

phones, audio systems, and TV), defense, aerospace, and automobile industries or increasing usages in the medicine sector, with neodymium magnets and MRI used as a substitute for radiations to obtain internal views of the human body. Figure 1 shows the different usages of the neodymium magnet in the USA in 2020. Clean technologies (electric vehicles and off-shore wind) only represent a little over 20% of the total. Looking forward, the resistance of neodymium to high temperatures also makes it a more and more demanded metal in the defense sector, for communication equipment, night-vision goggles, precision-guided weapons, and stealth technologies. Altogether, the market is expected to grow by approximately 10% by 2030 – that is much more than the demand growth projected (3% by 2040). However, in case of supply disruptions, other usage may prevail over clean energy[17].

FIGURE 1. Different usages of neodymium magnet in the USA (2020)



▲ Source: *US Department of Energy, quoted in* Heim, James W., II, and Randy L. Vander Wal. 2023. "NdFeB Permanent Magnet Uses, Projected Growth Rates and Nd Plus Dy Demands across End-Use Sectors through 2050: A Review" *Minerals* 13, no. 10: 1274. https://doi.org/10.3390/min13101274

I FRAGILE AND CONCENTRATED SUPPLY THAT CREATES A HIGH RISK OF DISRUPTION

– Who is controlling CRMs?

As shown in Map 1 and Annex, production and reserves of these **critical materials are spread across the world, with a handful of countries that play a central role.** Table 2 lists the countries with the largest production or reserves of the materials studied here, and Table 3 lists the countries with three or more critical materials available (please refer to the Annex for a more comprehensive list). Logically, the countries with the largest surface are all listed here. In addition, two countries stand out for specific reasons:

- **DRC**, though it "only" has proven and significant reserves of cobalt and copper (out of the five materials analysed here), it enjoys the absolute largest production and reserves of cobalt, making it an indispensable actor in the global energy transition,
- **China**, which can be considered the **epicentre of the global clean energy production of most green technologies and of their deployment.** While it already enjoys a central position in terms of REE production and is home to many critical materials, it also plays a critical role in the processing of these materials: it is the

17 Prescient & Strategic Intelligence (2022), Rare Earths Metal Market Outlook by Type.

most important world player in terms of critical materials processing, as shown in Table 4. The country is also the biggest world producer of solar cells, lithium batteries, and electric vehicles[18] and is investing massively abroad to secure raw materials supply, especially in Africa. For instance, it announced in 2024 a new USD 7 billion investment in DRC's mining infrastructure[19].

TABLE 2. Countries with the largest production and reserves of selected materials

Country	Material	Production		Estimated reserves20	
		Total (tons)	Share of the global production (%)	Total (tons)	Share of the global reserves (%)
DRC	Cobalt	170,000	74%	6,000,000	54.5%
Chile	Copper	5,000	22.7%	190,000	19%
Australia	Lithium	86,000	46.5%	6,200,000	22.1%
Chile	Lithium	44,000	23.7%	9,300,000	33.2%
Indonesia	Nickel	1,800,000	50%	55,000,000	42.3%
China	Rare Earth Elements	240,000	68.6%	44,000,000	40%

▲ Source: US Department of the Interior, U.S. Geological Survey (2024), Mineral Commodity Summaries 2024, op. cit.

TABLE 3. Countries with some of the largest production or reserves of at least three critical materials for the energy transition

Country	Materials				
	Cobalt	Copper	Lithium	Nickel	REE
Australia	X	X	X	X	
Brazil			X	X	X
Canada	X	X	X	X	X
China		X	X	X	X
Indonesia	X	X		X	
Russia	X	X		X	X
USA	X	X	X	X	X

▲ Source: US Department of the Interior, U.S. Geological Survey (2024), Mineral Commodity Summaries 2024

18 You Xiaoying (2023) "The 'new three': How China came to lead solar cell, lithium battery and EV manufacturing", *China Dialogue*, November 7th.
19 "Chinese companies to invest up to USD 7 billion in Congo mining infrastructure", *Reuters*, 27/01/2024.
20 Considered here « a working inventory of mining companies », as indicated in US Department of the Interior, U.S. Geological Survey (2024), 07.

TABLE 4. China's global share in terms of processing of key minerals (%)

Cobalt	Copper	Lithium	Nickel	REE
70%	42.3%	58%	40%	>80%

▲ Source : IRENA (2023), Geopolitics of the Energy Transition. Critical Materials

– Categorizing the risks of disruption

Such concentrated production locations make the global supply of raw materials more fragile, with many different risks potentially threatening the supply security of materials: when considering processing capacities and the central role of China, their supply is more concentrated than fossil fuels, which amplifies political and physical risks. Typically, since 2020, the world has experienced many different unpredictable events that impacted global exchange, that could unexpectedly occur again and disrupt the raw materials supply chain. These include, among others, the Covid-19 pandemic and subsequent lockdowns that cut some countries like China from the rest of the world[21]. Russia's war on Ukraine also resulted in inflation intensification and impacted markets about metals that are produced in Russia, including nickel, a metal for which some European countries were highly dependent on Russia: 84% of the nickel imported to Finland comes from Russia. In addition, the price of nickel jumped to its 10-year high in February 2022[22].

Finally, temporary events from different origins can also occur and block international trade routes. For instance, the Suez Canal blockage for a few days in 2021 had an impact though limited, on China battery manufacturers[23]. Prices of the minerals can also threaten their supply. Some countries are advocating for OPEC-type cartels to be able to adjust the prices: in 2022, Argentina, Bolivia, Brazil Chile were said to be in advanced talks about a similar cartel for lithium (but without China). Some countries are also planning to nationalize their lithium mines and also aspire to take more values from their resources by increasing their processing capacities[24].

More generally, the International Renewable Energy Agency (IRENA) has categorized potential shocks into six categories:

- External shocks: natural disasters pandemics, wars, mine accidents, and others,
- Resource nationalism: tax disputes, expropriation, foreign investment screening, and others,
- Export restrictions: export quotas, export taxes, obligatory minimum export prices, licensing, and others,
- Mineral cartels: co-ordination of production, pricing, market allocation, and others,
- Political instability and social unrest: labor strikes, violence, corruption, and others,
- Market manipulation: short squeezing, market cornering, spoofing, insider trading, etc[25].

21 The end of Chinese lockdowns and the reopening of Trade", *Financial Times*, 23/01/2023.
22 OECD (2022) The supply of critical raw materials endangered by Russia's war on Ukraine, 04/08/2022.
23 "Suez Canal blockage: China to see minor raw material disruptions, but accident further exposes 'risks' of global supply chains", *South China Morning Post*, 29/03/2021.
24 Is this the dawn of a 'lithium OPEC'?, *Forbes*, 08/08/2023
25 Quoted from IRENA (2023) Geopolitics of the Energy Transition. Critical Materials

Therefore, countries are competing to secure access to critical raw materials, though some of the developed and emerging economies already benefit from important reserves (all countries listed in Table 2 and Table 3 are emerging or developed economies, except DRC). The USA has allocated USD 3 billion to fund the domestic refining of nickel, lithium, cobalt, and REEs through its Infrastructure Investment and Jobs Act (2021)[26], and an additional USD 35 million for the development of REE allows and magnet production[27]. The US also published in 2022 a list of 50 minerals considered critical – interestingly, copper is not part of the list[28]. The same year, the Inflation Reduction Act (IRA) committed to increasing the domestic supply of critical minerals for clean energy, with the equivalent of 10% of the production cost awarded as a tax credit to mining companies producing critical minerals. For instance, to qualify, 40% of the minerals used for an EV battery must be "extracted or processed in any country with which the United States has a free trade agreement in effect", or be "recycled in North America". The objective is to reach 80% by 2027[29]. However, this list has drawn many critics, being considered as too long for proper supply security to apply to all of these materials[30]. The UK published a "Critical Minerals Strategy", similar to the US' and EU's, which lists priority materials and aims at accelerating the growth of its domestic capacities, collaborating with international partners, and enhancing international markets[31].

Meanwhile, **China has managed over the past 20 years to become a hub on global raw materials supply chains and is trying to keep this strategic situation, while securing access to new resources abroad to fuel its demand for new minerals, notably through its Belt and Road Initiative**[32]. As Table 4 shows, China is dominant in the processing of most key minerals, and Europe is already highly dependent on Chinese supply, with a reliance that comes close to 100% in terms of rare earth elements[33]. China is also actively securing mining resources in many countries, especially in Latin America and Africa, and with a special hunger for lithium. In 2023, Chinese companies were leading 3 projects in Mexico, one in Bolivia, one in Chile, 13 in Argentina, 2 in Mali, one in DRC, 4 in Namibia, and 4 in Zimbabwe, and at various stages of new projects. Some smaller deals target nickel and cobalt, mostly in Indonesia and Australia. However, Chinese investments are raising concerns of some governments, especially Australia and Canada (the latter passed an Investment Canada Act in 2022 that aims to better govern foreign investments in the national critical mineral sector), but also Mexico or Chile[34].

To secure foreign supply, the EU has signed **strategic partnerships** with countries benefiting from important reserves and productions. The Strategic Partnerships usually consist in a Memorandum of Understanding (MOU) and a roadmap, that aim at fostering the integration of sustainable CRM value chains, as well as the cooperation on environment, social and governance (ESG) criteria. More concretely, they involve the deployment of project infrastructure, research and innovation,

26 Govinfo.gov (2021, amended in 2024) Infrastructure Investment and Jobs Act
27 White House (2022), Fact Sheet: Securing a Made in America Supply Chain for Critical Minerals
28 USGS (2022) U.S: Geological Survey Releases 2022 List of Critical Minerals, 22/02.
29 USA Senate and House of Representatives in Congress (2022) An Act To provide for reconciliation pursuant to title II of S. Con. Res. 14, 16/08, and Beole G. (2023) The strategic approach to critical raw materials" ABN-AMRO, 29/03.
30 Cullen S. Hendrix (2023) The US strategy on critical minerals needs clearer priorities, 01/08/2023.
31 Gov.UK (2023) Resilience for the Future: The UK's Critical Minerals Strategy, 13/03.
32 Müller M. (2024), The Great Extraction, *Internationale Politik Quarterly*, 01/03.
33 *Ibid.*
34 S&P Global (2023) China's global reach grows behind critical minerals

capacity building and training[35]. Current partnerships include: Canada (signed in 2021), Ukraine (2021), Kazakhstan (2022), Namibia (2022), Argentina (2023), Chile (2023), Zambia (2023), DRC (2023), Greenland (2023)[36], and very recently Norway (2024), and one is said to be about to be signed with Australia[37]. These partnerships are also demanding rigorous environmental, social, and governance (ESG) standards from the partner country[38]. Table 5 shows however that in 2023, the EU was still dependent on many countries with which no strategic partnership exists.

TABLE 5. Overview of EU sourcing shares of materials (selected materials) (2023)

Material	Main EU Supplier (extraction stage)	Main EU supplier (processing stage, incl. recycling)	Import dependency (extraction/processing)
Lithium	No data	Chile 79% Switzerland 7% Argentina 6%	81% /100%
Cobalt	No data Global primary supplier : Congo 63%	Finland 62% Belgium 29% DRC 2%	81%/1%
Nickel	Finland 38% Canada 24% Greece 19%	Russia 29% Finland 17% Norway 10%	31%/75%
Copper	Poland 19% Chile 14% Peru 10%	Germany 17% Poland 14% Spain 11%	48%/17%
Heavy REE	Japan 55% China 43% USA 2%	China 100%	100%/100%
Light REE	No data	China 85%	80/100%

▲ Source: Transport & Environment Briefing, October 2023.

I ESG AND THE "DARK SIDE OF THE ENERGY TRANSITION"

– Environmental degradations that need (and can) be addressed

In addition to these challenges, the **EU race for critical minerals should address the environmental and social that mining generates**, – what it has now become a cliché to call the "dark side of the energy transition"[39]. This "dark side" points

35 EU Raw Materials Coalition (2023) How to strengthen the EU's Critical Raw Materials Strategic Partnerships, November.

36 EU and Greenland sign strategic partnership on sustainable raw materials value chains, *Pub Affairs Brussels*, 01/12/2023

37 "EU Commission to sign partnership with Australia on critical raw materials", *Euractiv*, 27/03/2024

38 "EU Strategic Partnerships", *Transport & Environment Briefing*, October 2023.

39 See among many other usages of this expression: Canelas, Joana & Carvalho, Antonio. (2023). The dark side of the energy transition: Extractivist violence, energy (in)justice and lithium mining in Portugal. 100. 103096. 10.1016/j.erss.2023.103096. , Marin A. Goya D. (2021) "Mining- The dark side of the energy transition", *Environmental Innovation and Societal Transitions*, vol. 41; Decembrer, pp. 86 – 88, "Kramarz T., Park S. Johnson C. (2021), "Governing the dark side of renewable energy: A typology of global displacements", *Energy Research 1 Social Science*, Vol. 74, April, https://doi.org/10.1016/j.erss.2020.101902

out the paradox that, to accelerate the energy transition, the industry has to rely on extraction processes and businesses that, in some countries, can be extremely damaging to the environment and populations. This is a controversial issue, and it regularly brings up the question of whether the energy transition is a proper solution to address climate change and other environmental crises.

Mining can have many impacts on the local environment. First, it is an energy-intensive industry, which results in many GHG emissions[40]. In addition, the establishment of a mine, if not done sustainably, can lead to the destruction of landscapes (with an obvious impact on biodiversity), water pollution, degradation of air quality, and contamination of crops. Many studies have been conducted to assess the impact of mining in countries with weak governance. For instance, in Congo, the development of cobalt mines required deforestation with millions of trees cut and resulted in the Tschangalale Lake being contaminated with high levels of cobalt, a radioactive element. The contamination later spread to the local population who would eat fish or drink the lake's water. In addition, studies report a "hazy air surrounding the mines, full of dust and grit, and toxic to breathe", with an increased risk of birth defects (limb abnormalities and spina bifida)[41]. Lithium also has disastrous consequences for the local environment. It affects water availability: a study published in 2020 assessed for instance that water storage declined at a rate of 1.16 mm/year in Salar de Atacama, Chile[42]. Nickel from the Philippines generates toxic waste which is (legally) dumped in oceans[43].

– The social consequences of mining in countries with weak governance

The social consequences of mining are also concerning in many countries and difficult to summarize. **When mines are not following sustainability standards, the local populations are the most exposed to the environmental damages mentioned above. Many of the mining projects are located in territories of indigenous populations – this is the case for over 80% of the lithium projects and more than half of the nickel and copper projects**[44]. Miners are often exposed to very poor working conditions. In DRC cobalt mines, there have been confirmed reports of patriarchy, human trafficking, forced labor, as well as child labor and abuse, while women are exposed to sexual abuse and prostitution, with situations described as "modern slavery"[45]. Recent reports also mention Zimbabwean children who cannot afford school fees and are attracted by the salary offered in lithium mines[46]. These conditions are aggravated in illegal mines, with companies taking advantage of the grey zones generated by political instability in countries like Myanmar[47]. The develop-

40 On the energy consumption of mining for all types of materials, see Aramendia E., Brockway, Taylor P.G. and Norman J. (2023) "Global energy consumption of the mineral mining industry: Exploring the historical perspective and future pathways to 2060", *Global Environmental Change*, vol. 83, December, https://doi.org/10.1016/j.gloenvcha.2023.10274

41 "The Environmental Impacts of Cobalt", *Earth.org*, 28/03/2023.

42 Liu W., Agusdinata D.B. (2020) "Interdependencies of lithium mining and communities sustainability in Salar de Atacame, Chile", *Journal of Cleaner Production*, volume 260, 1 July, https://doi.org/10.1016/j.jclepro.2020.120838

43 Examples used from Steyn E. (2024), "The importance of critical minerals should not condone their extraction at all costs", *The Conversation*, 27/02.

44 "Scale of conflict between mineral mines and indigenous peoples revealed", Institute for development studies, 09/08/2023.

45 Sovacool B. (2021) "When subterranean slavery supports sustainability transitions? power, patriarchy, and child labor in artisanal Congolese cobalt mining", *The Extractive Industries and Society*, vol. 8, March, pp. 271 – 293, https://doi.org/10.1016/j.exis.2020.11.018

46 "Schoolchildren in Zimbabwe drop out for lithium mines", *China Dialogue*, 07/03/2024.

47 "China-Backed Illegal Rare Earth Mining Surging in Northern Myanmar", *The Irrawaddy*, 22/07/2022.

ment of mines can also create important displacements[48]. Recent reports mention for instance 400 households being forced out, following a previous wave of 209 other households having to leave in the region of Kolwezi, called the "cobalt capital of the world" in DRC[49].

– …However, CRMs' impact remains limited as compared to fossil fuels'

However, these important and **serious damages should not overshadow the many benefits that low-carbon technologies bring, and the fact that the mining needs for clean energy are extremely limited as compared to the ones for fossil fuel energy** (according to the IEA, in 2021, 7.5 billion tons of coal were extracted from the ground, while the total amount of materials needed for the energy transition by 2040 should be lower than 30 million tons[50]). **They also call for a better implementation of environmental and social standards, and more scrutiny from different actors. The development of EU mines would allow better monitoring and enforcement of high environmental and social standards, as well as strengthened sovereignty.**

II • EU CRMA: progress, tools and remaining policy gaps

This section will focus on the EU's domestic solutions and value chains, from extraction to recycling and broader circularity challenges. Indeed, as shown in the previous section, CRMs are often imported from countries with weaker governance models, insufficient enforcement of environmental standards, and low monitoring of social aspects. Besides, in troubled geopolitical times, the EU needs to increase its autonomy and sovereignty through strengthened domestic supply chains.

The Critical Raw Materials Act was proposed by the European Commission (EC) as part of its Green Deal Industrial Plan in 2023, and adopted by the Council and the European Parliament in 2024. The goal is to ensure a secure, resilient, and sustainable CRM supply for the EU. More specifically, its three objectives are to:

- **Lower the risk of supply disruption through Strategic Projects** within and outside the EU, as well as improve resource efficiency to mitigate the increase of consumption
- **Foster sustainable sourcing and improving circularity**
- Improve the EU's ability to monitor and mitigate CRM supply risk

The potential for EU domestic CRM supply chains is substantial. As of May 2023, the European Raw Materials Alliance (ERMA),[51] had identified over 50 investment cases on materials for energy storage and conversion in Europe, for a total investment need beyond € 15 billion. If these projects were realised, ERMA estimated that the EU could cover 40% of its demand in lithium by 2030, and over 40% for cobalt and rare earth elements.

However, Europe is lagging behind its main competitors in developing and scaling cutting-edge CRM technologies. Investment in EU CRM mining and processing projects contrasts with the boom in battery gigafactories. EU battery manufactu-

48 Kramarz T., Park S., Johnson C. (2021), "Governing the dark side of renewable energy…", *op. cit.*
49 "Mine in 'world cobalt capital' displaces locals and monks under questionable circumstances", *Mongabay*, 23/10/2023.
50 Figures quoted by Ferreira F., Odell S. (2023), "How does the environmental impact of mining for clean energy metals compare to mining for coal, oil and gas?", *MIT Climate Portal*, 08/05.
51 The ERMA is a network launched in 2020 as part of the 2020 Action Plan on Critic bringing together public and private actors across the value chain, from primary raw materials to recycling,

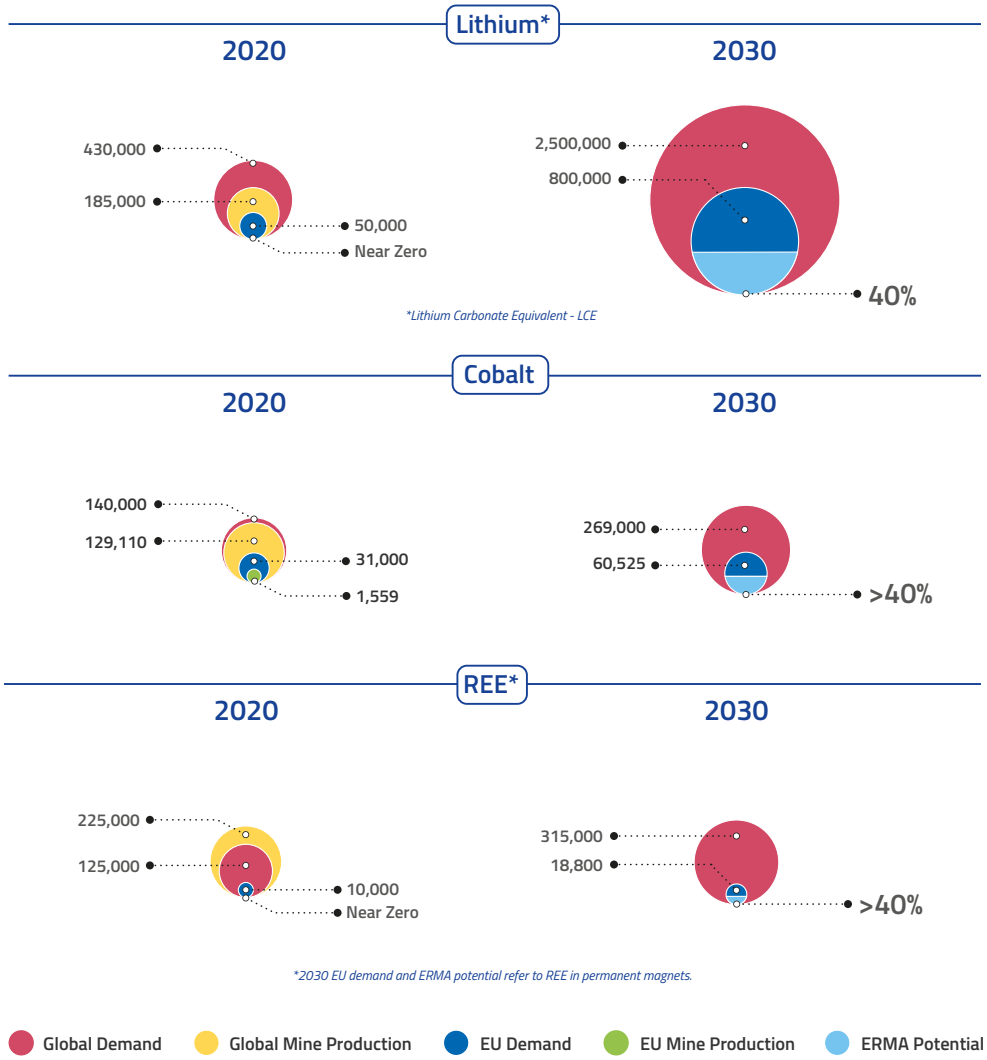
rers are at risk of struggling to secure CRMs, hampering their competitiveness.[52] In December 2023, China announced an export ban on the technology to make rare earth magnets, adding to the existing ban on the export of rare earth extraction and refining technology[53]. China is the top processor of rare earth, and Western companies, which once led in this field before ceding production to China, may need to develop new techniques to overcome China's domination.

Map 2: Geographic distribution of current and potential raw materials projects identified through the ERMA investment pipeline[54]

Figure 1. Geographic distribution of current and potential raw materials projects identified through the ERMA investment pipeline. Some projects are not shown on this map due to confidentiality, but are included in the ERMA supply data reported in this document and in the high-level ERMA investment needs shown in Figures 2 and 4.

52 Davis, R. 2024. Doing more with less: A European Critical Raw Materials Strategy for Cleantech Competitiveness. Cleantech for Europe.
53 Reuters, 2023. China bans exports of rare earth processing tech over national security. December
54 European Raw Materials Alliance, 2024. Materials for Energy Storage and Conversion. A European Call for Action. A report by the Materials for Energy Storage and Conversion Cluster of the ERMA.

Figure 2: Global and EU demand and production data for 2020, compared with forecasted 2030 global and EU demand and potential supply from projects identified through the ERMA investment pipeline, for lithium, cobalt and REE (in metric tonnes).



▲ European Raw Materials Alliance, 2024. Materials for Energy Storage and Conversion. A European Call for Action. A report by the Materials for Energy Storage and Conversion Cluster of the ERMA.

I OVERVIEW OF THE CRMA

– Strategic and critical raw materials list

The EU CRM list is an important element guiding the EU strategy to secure access to the identified materials and reduce consumption as well as dependencies. The first EU CRM list was published by the Commission in its 2011 Communication on raw materials and was updated every three years (2014, 2017, 2020) since then.

With the CRMA, a list of 34 CRMs becomes part of an EU regulation for the first time. The 2023 update includes Critical Raw Materials (CRMs) that meet two conditions: they have high economic importance and display high supply risk. The list involves 17 Strategic Raw Materials (SRMs), which are important for technologies related to the green and digital transition, as well as defence and aerospace.

Although the CRMA is part of the Green Deal Industrial Plan, and thus strongly anchored into the EU green transition, the CRMs listed are not limited to energy-related challenges.

– Extraction, Processing and Recycling benchmarks

The major policy breakthrough of the CRMA is the introduction of benchmarks on EU extraction, processing, and recycling capacities, expressed as a share of EU demand by 2030. Although indicative, it further supports the EU strategy to enhance domestic sourcing of primary and secondary raw materials, allowing quantitative indicators for monitoring purposes. A demand moderation objective is included, though with no associated figure.[55] The CRMA benchmarks are the following:

- EU extraction capacity can cover at least 10% of annual consumption of SRMs
- EU processing capacity can produce at least 40% of EU's annual consumption of SRMs
- EU recycling capacity can produce at least 25% of the EU's annual consumption of SRMs

Additionally, the CRMA introduces a diversification objective of no third country providing 65% or more of the EU's annual consumption. This external aspect of the CRMA will be left aside in this section.

By 2026, the EC (European Commission) will present indicative projections of annual consumption of each CRM in 2030, 2040, and 2050. It will monitor progress towards the benchmarks and the demand moderation objective every three years. For now, benchmarks are not differentiated by minerals. It could be interesting to adopt more differentiated benchmarks once we get a better understanding of vulnerabilities, potential for capacity increase and consumption trends by CRM.

– EU Strategic Projects for extraction, processing and recycling

Lengthy and uncertain permitting procedures increase the risk profile of CRM projects, especially for exploration and extraction projects. As highlighted in Part 1, mining is a very environmentally sensitive activity that needs to be thoroughly regulated, and lead times until the start of operation average 16 years. A new extraction project involves an exploration permit, then a mining permit, an environmental permit, as well as building and land permits at the very least[56]. Additional permits may be required depending on the location and site specificities in terms of biodiversity. The process involves consultation with various stakeholders and local communities.

The main instrument created by the CRMA to achieve the above benchmarks is the status of the Strategic Project (SP), which will give access to accelerated permitting processes. Once a project is considered strategic, the duration of national permit granting processes will be limited to 27 months for extraction projects, and 15 months for processing or recycling. As a way to accelerate permit granting, Member States must set up **national points of single contact,** and ensure these units have enough qualified staff as well as sufficient financial, technical and technological resources.

55 European Council, 2024. CRMA proposal - final text.
56 See the example of Sweden on MineFacts, The permitting process. Retrieved on 05/04/2024

The CRMA establishes a European Critical Raw Materials Board, chaired by the European Commission (EC) and composed of representatives of all the Member States and of the EC[57]. The Board will discuss and issue an opinion on promoters' applications to become Strategic Projects. **The Strategic Project status is granted by the EC,** considering the opinion of the Board[58] based on the following criteria:

- contribution to the security of supply of the EU,
- technical feasibility,
- environmental and social sustainability,
- Cross-border benefits on downstream sectors (for EU projects).

The EC also has the power to withdraw the status of a Strategic Project if a project is deemed to no longer fulfill the selection criteria.

In addition to accelerated permitting, the CRMA calls on establishing enabling conditions for Strategic Projects. The Commission is required to provide support to crowd-in private investments, including supporting Strategic Projects that struggle to access finance. The type of instrument to be deployed by the Commission to achieve this is not specified in the CRMA, but the 2023 CRM Communication mentioned InvestEU and the taxonomy. Additionally, the host Member State will have to provide administrative support to promoters, as well as assistance regarding public participation of affected communities.

– Sustainability and circularity

In addition to securing access to CRM, an important objective of the CRMA is to ensure that the supply is as sustainable as possible. EU environmental regulations, such as the Habitat Directive, must be respected to get the Strategic Project status under the CRMA. Additionally, the CRMA will aim at improving the sustainability of CRMs through strengthened environmental impact monitoring, as well as improved circularity through the benchmark to enhance EU recycling capacity to 25% of EU consumption by 2030.

The CRM should increase transparency on environmental impacts. The Commission will define a list of CRMs that are deemed to have significant environmental impacts and set up an obligation to declare the associated environmental footprint. Additionally, the CRMA will enable the Commission to recognize existing sustainability certification schemes. A public database will be created displaying the register of recognized schemes and allowing feedback collection from all relevant stakeholders on the schemes' implementation. The environmental footprint is for now limited to monitoring purposes only, so is the sustainability certification. One could imagine that it could be used to select and promote the most virtuous projects in the future.

The CRMA complements existing legislation related to raw materials' circularity,[59] improving circularity planning and reporting obligations for Member

57 EP (European Parliament) representatives may attend as observers upon invitation by the Chair. Other stakeholders, industry, SMEs, civil society, academia, trade unions, EU agencies may also be invited as observers or provide written contributions. Observers cannot participate to the formulation of advice. Sub-groups can be set up on financing, public participation, exploration, circularity – resource efficiency – substitution, risk monitoring, strategic stocks.

58 Contrary to Strategic Projects in the NZIA, Strategic CRM Projects are approved by the EC and not national authorities. The EC should publish a delegated act providing a single application template for promoters within 6 months. Strategic Projects promoters have reporting and information obligations to the EC.

59 The End-of-Life Vehicles Directive (2000), the Waste Framework Directive (2008), the Waste electrical and electronic equipment directive (2012), and the new Batteries regulation (2023), already set reporting requirements on the presence of CRMs in waste streams.

States. CRMA's implementing acts will specify the list of products, components, and waste streams that will be considered as having relevant CRM recovery potential. Based on this list, Member States will have to adopt, implement, and report on national programmes to enhance resource efficiency, waste prevention, collection and processing, uptake of the use of secondary CRMs through public procurement, and deployment of circular designs. Specific reporting obligations will apply to the quantity of components involving CRMs from electrical and electronic waste, enhancing requirements under the Waste Electrical and Electronic Equipment Directive (2012).

Circularity will be fostered with new measures aimed at recovering CRMs from extractive waste and improving data collection of CRMs in permanent magnets. The CRMA complements the Extractive Waste Directive, by requiring operators of facilities generating extractive waste to assess the recovery potential of CRMs. Member States also need to set up a database of closed extractive waste facilities with potential of recoverable CRMs, as well as adopt and implement measures to promote the recovery of CRMs from extractive waste, including from closed facilities.

Permanent magnets containing CRMs are potentially present in devices such as wind energy generators, heat pumps, or electric motors. The CRMA mandates that these devices bear a new label indicating the presence of one or more permanent magnets, as well as their type. The label should be linked to a unique product identifier containing further information, including access and safe removal of the permanent magnets. It will be included in the product passport for products covered by the Ecodesign Regulation. In 2031 at the latest, minimum shares of recycled CRMs used in new permanent magnets will be introduced.

I ASSESSMENT OF THE CRMA WITHIN THE WIDER EU CRM FRAMEWORK AND REMAINING POLICY GAPS

– Strategic Projects are a good step forward, provided that the selection process is conducted in a swift, efficient way, and as fair and transparent as possible

The CRMA is a good step to strengthen domestic mining value chains. With the status of Strategic Projects, it sends a strong political signal that the EU will be putting a high priority on CRM projects.

The first Strategic Projects could be announced in the Fall of 2024. This would solidify the political momentum in favour of domestic supply chains for CRMs and allow prioritization of EU efforts. Applications will be submitted to the Commission through an open call with at least 4 cut-off dates per year. The first cut-off date should be around June 2024[60]. The Commission must then complete the full evaluation process within 4 months.

The selection process of EU Strategic Projects will need to combine speed with efficiency and legitimacy. Discussion of project applications will take place within the CRM Board. It will be highly strategic and require the involvement of the right expertise. Member States will have the possibility to send their experts to the Board to discuss project applications. Additionally, Members of the European Parliament will be invited as observers.

To facilitate the next steps for Strategic Projects, it will be important to ensure that selection and discussion within the Board will be based on a fair and transparent

60 no later than 3 months after the entry into force of the CRMA

process, as mandated by the CRMA. To that end, making full use of the possibility to invite as observers a balanced mix of representatives of industry, SMEs, civil society, academia, trade unions and sub-national authorities (especially the ones concerned by the potential Strategic Projects) could go a long way in strengthening social acceptability and legitimacy of the selected Strategic Projects.

In addition the Raw Material Supply Group is an opportunity for stakeholders to provide inputs to facilitate the achievements of EU ambitions. It is set up by the Commission's DG GROW to assist other departments of the Commission with the implementation of raw materials policies.[61] However, this group so far remains dominated by trade and business associations, with few NGOs and research institutes, and no representative of local communities. Yet inclusive stakeholder and public participation is critical for planning and decision-making. They have been found to support better implementation of regulations and policies, facilitate reconciliation of varied interests and objectives, and improve the acceptability of the projects[62]. Avenues to strengthen existing dialogue and stakeholder participation structures at the EU level should be explored to facilitate the implementation of the CRMA.

– Speeding up permitting while upholding high environmental and social standards calls for specific implementation efforts

Meeting CRMA's permitting deadline for Strategic Projects will depend on a national single point of contact's sufficient human, financial, technical, and technological resources. Some countries, such as Sweden and Finland, already have a well-developed regulatory framework supporting high environmental safeguards, public participation, and strong social acceptability of mines. In other Member States, such as Spain, mining activities are still very much in their infancy.

The Board will provide a space to exchange best practices between Member States and discuss the implementation of Strategic Projects. A more structured knowledge centre to support a national single point of contact would be beneficial. It would also potentially provide specific technical assistance as well as capacity building. Since new CRM mining projects may be limited to a few projects per Member State in the near future, there is a need to support the mutualisation of project knowledge, and best practices to limit the replication of "first-of-a-kind" projects with limited knowledge spillovers.

Knowledge sharing and best practices on environmental and social aspects will be key for social acceptability. The respect of EU environmental regulations for Strategic Projects recognition, such as the Habitat Directive, has been preserved in the CRMA. Yet inadequate and incomplete environmental impact assessments, or lack thereof, emerge as a key concern for local communities, alongside health and water considerations[63]. In the absence of good practices regarding the implementation of high environmental and social standards, local communities' opposition is likely to slow down or derail the potential projects. For example, the Jadar lithium project in Serbia has been stalled due to massive environmental protests. The Caceres lithium project in Spain is heavily contested. The EU lacks a comprehensive database on mining activities and projects, making an EU-wide assessment of

61 European Commission, Register of Commission Expert Groups and Other Similar Entities. Raw Materials Supply Group. Last updated in December 2022, retrieved on 05/04/2024.

62 Pölönen, O. Allard, C., Raitio, K. 2021. Finnish and Swedish law on mining in light of collaborative governance. In Mononen, T., Kivinen, S., Kotilainen, M.J., Leino, J. 2022. Social and environmental impacts of mining activities in the EU. Study requested by the PETI Committee. European Parliament.

63 Ibid.

environmental and social impacts as well as best practices very difficult[64]. Despite positive steps towards greater transparency, the CRMA does not solve this specific issue.

Beyond the CRMA, the EU should encourage and support the roll-out of targeted public relations and information campaigns across Europe, with special considerations for small project promoters who usually lack the time and resources to conduct these. The EU could formalize normative processes with independent third parties' mediation, the establishment of a scientific board, and the inclusion of opponents in the discussion, as suggested by ERMA[65].

The possible recognition by the EC of sustainable CRM certification schemes could be a great way to enhance trust in sustainable value chains, both in and outside the EU. It is an opportunity to promote equal and shared co-governance models for comprehensive and rigorous standards and audit methodology, providing an equal voice to businesses, workers, and communities. The Initiative for Responsible Mining Assurance (IRMA) Standard for Responsible Mining was developed through such a model[66]. Businesses are increasingly supporting[67] it, as it appears as a credible standard for responsible mining that can be relied upon by downstream purchasers and public authorities.

– Financing - the ongoing challenge of crowding in private investments

CRM projects are considered high-risk investments due to high capital costs, uncertainty regarding permitting, and environmental and social risks. Therefore, the need to secure what is refered to as a "Social Licence to Operate", in other words, building good relationships with local communities, is very important for projects promoters, but adds to project complexity. The economic viability of EU domestic projects, especially regarding extraction and recycling, is an additional challenge to increased EU production compared to relying on imports.

The CRMA, if fully implemented, should strengthen the business case of CRM projects. Shorter permitting times for Strategic Projects should support investments in CRM activities.

However, the CRM does not come along with clearly dedicated funding tools, which is a major weakness of the current policy framework. Cleantech venture investment in CRM exploration, mining, and processing, as well as battery recycling, is significantly lower in Europe than in North America, according to Cleantech for Europe.[68] The recent US Inflation Reduction Act (IRA) and the Bipartisan Infrastructure Law allocated over $8,5 billion for CRM projects and $600 million for domestic CRM recycling, innovation, material efficiency, and substitution[69]. China's state-backed companies benefit from billions in credit available from Chinese banks[70]. According to the IEA, anticipated investments in processing capacities of most cri-

64 Ibid.
65 European Raw Materials Alliance, 2024. Materials for Energy Storage and Conversion. A European Call for Action. A report by the Materials for Energy Storage and Conversion Cluster of the ERMA.
66 T&E, 2023. Open letter "Concern over industry-led mining sector standards".
67 University of Cambridge Institute for Sustainability Leadership (CISL) and the Wupperthal Institute, 2023. Embracing circularity: a pathway for strengthening the Critical Raw Materials Act.
68 Davis, R. 2024. Doing more with less: A European Critical Raw Materials Strategy for Cleantech Competitiveness. Cleantech for Europe.
69 Ibid.
70 Majkut, J., Nakano, J., Krol-Sinclair, M., Hale, T., Coste, S. 2023. Building larger and more diverse supply chains for energy minerals. Center for Strategic and International Studies.

tical raw materials indicate a strengthening of China's leadership. Its share of global CRM output is set to rise by 2030[71].

In contrast, dedicated EU financing instruments are very much in their infancy, small scale, and fragmented. The EU only relies on national state aid to achieve EU-wide CRM ambitions.

Yet, accelerating R&D as well as deployment in CRM processing and recycling to achieve high environmental standards, and improve resource efficiency and productivity remains critical and urgent[72]. Developing and scaling-up technologies and designs with lower carbon and environmental footprint would go a long way to strengthen EU green industrial sovereignty. This requires specific actions, including additional financing efforts and instruments.

There is a lack of synergies among EU funds that could support the deployment and scale-up of innovative solutions that would reduce the environmental impact of extraction and processing, as well as support demand moderation through a circular economy. Horizon Europe finances many innovative projects related to CRM substitution, more sustainable mining, and greater circularity. For example, the recent Horizon call "Resilient value chains 2024" targeted projects aiming at increasing recovery rates of valuable raw materials, increasing the economic performance of sustainable mineral processing, reducing waste and emissions from the whole life cycle, improving responsible supply of CRM extracting and processing in Europe. However, for more mature technologies closer to commercial deployment, the usual EU financial institutional actors, are not sufficiently active in CRMs, especially mining projects, which involve high risks and specific expertise.

The new Strategic Technologies for Europe Platform (STEP), which was supposed to be the EU's answer to the need to accelerate investments in critical technologies and their supply chains, falls short of the challenge. The initial proposal was already insufficient, with no fresh funding, a narrow scale (€10 billion)[73] and an insufficient focus on CRMs for clean energy. The final agreement is even more disapointing, with only €1.5 billion additional funding earmarked for the European Defence Fund. For example, investments in the extraction, processing and recycling of critical raw materials related to net zero technologies was made eligible for European Investment Bank (EIB) finance in July 2023[74]. To make this a reality, Executive Vice President Šefčovič called on the EIB to establish a dedicated "Sustainable Critical Raw Materials Task Force" focusing exclusively on facilitating projects along the entire CRM value chain. He also called on the EIB to develop the right tools, which should allow the EIB to take higher risks than a normal bank[75]. According to him, "given the strategic importance of critical raw materials for the economic security of Europe, policy considerations must sometimes take precedence over profit." This declaration highlights the increasing strategic ambitions of the European Commission.

In December 2023, the European Commission announced a new financial support scheme for EU battery manufacturers under the Innovation Fund, for an amount

71 IEA, 2022. Energy Technology Perspectives 2023.
72 European Raw Materials Alliance, 2024. Materials for Energy Storage and Conversion. A European Call for Action. A report by the Materials for Energy Storage and Conversion Cluster of the ERMA.
73 European Parliamentary Research Service, 2023. Strategic technologies for Europe Platform (STEP)
74 EIB, 2023. EIB to support Green Deal Industrial Plan with €45 billion in additional financing. Press release.
75 European Commission, 2024. Keynote speech by Executive Vice-President Šefčovič at the European Investment Bank Group Forum. Press corner.

of € 3 billion for three years.[76] It could take the form of a fixed premium and should support the most sustainable batteries creating positive spillovers, including in the upstream stages of the supply chain. However, modalities of implementation are still under discussion. Creating explicit links between the Innovation Fund support to battery manufacturers and sustainable EU sourcing of critical raw materials would strengthen the business case of domestic CRM projects.

In January 2024, EIT InnoEnergy,[77] together with Demeter, a European private equity and venture capital company, launched a new fund dedicated to the development of resilient raw materials supply chains for EU batteries.[78] At least 70% of investments should be dedicated to EU domestic production of CRMs (mining, processing, refining, recycling). The EBA Strategic Battery Materials Fund is now looking for financers to achieve a target size of € 500 million. Having EU financial institutions join the fund would give it more strength and send a powerful market signal. However, this can only be part of a greater portfolio of financing instruments.

At the national level, Germany announced early 2024 a new raw materials fund, to be allocated primarily under the form of guarantees, and which seems to be mostly oriented towards international partnerships[79]. France announced its own national CRM investment fund in May 2023. Operated by the private equity firm Infravia, it should get € 500 million from public budget and is fundraising to achieve a target size of € 2 billion. **There is at least a need for EU coordination of these national funds deployment. This also raises the issue of how to achieve collective EU-wide security when Member States do not have the same financial firepower.**

The environmental delegated act of the Taxonomy[80] published in June 2023 covers the recycling of critical raw materials. However, **mining and refining are not included in the EU taxonomy**. This is a missed opportunity to channel private investments into CRM activities with high environmental standards. Criteria for the inclusion of these activities still need to be developed.

EU financial tools for CRMs are fragmented, small-scale, emerging, and potentially involving complex[81] application processes. Because of this, it will be difficult to achieve the speed and scale required for resilience, competitiveness, and clean tech leadership. This stands in stark contrast with the US and China who are not shy of putting billions on the table.[82] With the CRMA, the Commission is now tasked to take actions to support private investment crowd-in. The potential is there, with over 50 investment cases identified by ERMA for energy CRMs. However, the window of opportunity to fulfill this potential lies within the next few years. **The next EU political cycle can make or break the CRMA's ambitions depending on the kind of financing tools the Commission will be able to develop to that end this topic will be further addressed in the recommendation section.**

76 European Commission, 2023. EU-UK relations. Press corner.
77 EIT InnoEnergy is an organisation dedicated to innovative sustainable energy solutions supported by the European Institute of Innovation & Technology, a body of the European Union.
78 InnoEnergy, 2024. EIT InnoEnergy and Demeter launch € 500M European battery raw materials fund.
79 Müller, M. 2024. The Great Extraction. Internationale Politik Quarterly.
80 European Commission, 2023. Delegated regulation, EU Taxonomy 2023/2486.
81 For example to access Innovation Fund, for more details about the shortcomings of the application process see Humphreys, C. 2023. The sharpest tool in the toolbox: how to strengthen the EU Innovation Fund for climate, competitiveness and security. I4CE. Report.
82 As an example, the US DOE recently announced a $ 2.26 billion loan to finance a lithium processing plant in Nevada, contributing to clean transportation objectives. DOE, 2024. LOP Announces conditional commitment to lithium Americas corp. to help finance the construction of a lithium processing plant in Nevada.

– Circularity, resource efficiency, substitution, and sufficiency

Different policies can also help reduce demand and therefore the need for new mines and refining capacities. For example, the strengthened provisions on the recovery of CRMs from extractive waste are a positive step forward.

Additionally, recycling can help to significantly reduce energy and water use related to CRM production, according to a JRC 2018 report.[83] However, recycling CRM is a complex process involving high-temperature techniques and refining processes to produce high-performing secondary materials. Recycling is not yet well developed, except for a few CRMs, such as cobalt.[84] The waste electrical and electronic equipment recycling industry only has a small number of refiners (less than 10), more operators in the dismantling and pre-processing phases (hundreds or thousands), and larger numbers in the collection phase.[85] There are high losses during collection, pre-processing, and recycling phases, and limited profitability for some materials (such as lithium). Competitive sorting and recycling technologies are lacking. The CRMA puts the priority on CRMs in permanent magnets, which makes a lot of sense given that these include REE, for which EU dependency on China is close to 100%.

To facilitate the implementation of the CRM recycling benchmark, the availability and adequacy of EU and national financial support should be assessed. Beyond Horizon funding in coordination with national Research and Innovation programmes, more efforts need to be made to enable the easy removal of CRMs in components both in terms of design and information. The CRM will address this issue for permanent magnets, but other products and waste regulations should be updated accordingly.

The CRM is part of recent momentum in favour of more circularity through EU regulations. The 2023 Battery Regulation is a true blueprint for product regulation covering the whole product lifecycle, which should drive increased battery collection and recycling. By 2030, around 16% of the global volume of lithium-ion batteries will be available for recycling in the EU. The new Regulation introduces a digital battery passport, and sets minimum recycled content targets for some metals (including cobalt and lithium). It also includes mandatory carbon footprint calculations for batteries. Additionally, the proposed End-of-Life vehicles regulation (July 2023) would introduce measures to enable the reuse and recycling of components containing CRMs such as permanent magnets, including a target for vehicles to be designed so that they are 85% reusable or recoverable.[86]

Other products and waste legislation should be updated to best support the implementation of the CRMA with such provisions related to the identification, labeling, recovery, and recycling targets of CRMs. The European Commission should also develop dedicated waste codes for electric lithium-ion batteries and intermediate waste streams ("black mass") to classify it as hazardous waste and restrict export outside the EU. This would allow to building up valuable EU recycling feedstock.[87] Additionally, objectives for the use of recycled materials in clean tech could also contribute to strengthening the business case of recycling projects.

83 EC, 2018. Report on critical raw materials and the circular economy
84 EC, 2018. Report on critical raw materials and the circular economy
85 EEA, 2022. Investigating Europe's secondary raw material market.
86 Watkins, E., Bergeling, E., Blot, E., 2023. Circularity and the European Critcial Raw Materials Act. IEEP.
87 Euractiv, 2023. EU urged to restrict export of 'black mass' from used electric vehicles.

The CRMA focuses mostly on recycling. However, circularity has a much broader meaning. The waste management hierarchy introduced in the 2008 Waste Framework Directive is as follows: prevention, reuse, recycling, recovery, disposal.

Avoiding waste through prevention and reuse has so far overlooked by policy efforts in the EU. As the CRMA, the current Waste Framework Directive and Waste Electrical and Electronic Equipment (WEEE) Directive focus on achieving certain collection and recycling rates, but fail to provide incentives to businesses to adopt more holistic circular practices (reuse, repair, extend lifetime, waste prevention).[88] The new Ecodesign for Sustainable Products Regulation (EPSR) under finalization will provide a framework to enhance the covered products' design for circularity, but setting these requirements will require the development of delegated or implementing acts. These acts should include CRM circularity and recovery provisions.[89]

The CRMA lacks tools to support the demand moderation objective, which corresponds to avoiding some of the needs for CRMs through a shift in technology, infrastructure, or organisation. Material substitution and new resource-efficient technologies would be an important lever to foster resilience and strategic sovereignty.[90] Additional efforts will be undertaken under the new SET Plan task force to explore circularity by design and advanced materials for energy technologies. This field has a lot of room for innovation and improvement.

Some measures that go beyond the materials industry could significantly reduce the need for new materials. A scenario analysis from the Transport & Environment NGO shows that smaller batteries, fewer private car km, and innovative chemistry (sodium-ion) could reduce battery metals needs by a third compared to business as usual, and up to half in the most ambitious scenario.[91] Smaller batteries are the largest driving factor, representing a quarter reduction. A WWF France study involving among others the think thank IMT-IDDRI, and the French national geological service BRGM, made similar conclusions.[92] Europe's growing demand for lithium could be moderated with policies encouraging a limited use of vehicles (and therefore electric vehicles). These include organizational sufficiency to moderate travel needs (teleworking, better land-use planning), dimensional sufficiency to limit the size and weight of cars (and of their batteries), the sufficiency of use to reduce electricity use (speed limitation, car sharing), and collaborative sufficiency to develop pooling equipment (public transport)[93].

– General assessment of the CRMA

- The CRMA is a landmark legislation that clearly sets CRM as a key security and resilience priority for the EU.

- Implementation calls for ambitious public relations and information campaigns, and the establishment of inclusive and transparent consultation processes at the local, national, and EU levels, in order to foster understanding and social accepta-

88 University of Cambridge Institute for Sustainability Leadership (CISL) and the Wupperthal Institute, 2023. Embracing circularity: a pathway for strengthening the Critical Raw Materials Act.
89 EU Raw Materials Coalition, 2024. Limiting environmental damage, human rights abuses and Indigenous People's rights violations: civil society guidelines for the implementation of the EU Critical Raw Materials Regulation.
90 EC, 2024. Advanced materials for substitution in the clean energy sector. Science for policy brief. JRC
91 T&E, 2023. Clean and lean: battery metals demand from electrifying cars, vans and buses. Report.
92 WWF, 2023. Métaux critiques : l'impasse des SUV. Quel scénario pour réussir la transition de nos mobilités ? Report.
93 "Lithium: towards a necessary sufficiency", *Briefing Note*, négaWatt, February 2023

bility of the future Strategic Projects. Strong environmental and social standards will play a key role in that matter.

- Setting and monitoring the implementation of these standards will call for adequate expertise at all government levels, especially within the single national contact points which may need additional support from the EU through technical assistance, capacity building, and best practices exchanges.

- CRMs will not be earmarked to clean energy technologies only, which will compete with other fields such as defence. To contribute to a more resilient green economy, earmarking part of the production towards clean tech manufacturers could be part of the solution, for example through off-take agreements that could also support projects' viability.

- EU CRM funding tools are falling short of the scale and speed required to truly catch up with other major blocks on CRM supply chains. An additional financial effort is urgently needed in R&D and deployment of projects related to the extraction, processing, recycling (techniques to reduce the use of harmful chemicals, reduce water use, and improve productivity) and material substitution as well as resource efficient designs and circular by design products and component. Scaling-up and deployment will also need policy efforts and public investment to crowd in private investments and strengthen the business case in a highly competitive global environment. The window of opportunity lies in the next few years. This should be a priority for the next mandate.

- To make use of the recycling potential, products, and waste related legislations, such as the Waste Electrical and Electronic Equipment Directive, delegated or implementing acts under the new Ecodesign for Sustainable Products Regulation, or waste codes for electric batteries, should be updated or developed.

- Developing a more holistic approach to demand moderation through technological efficiency, product circularity, and design, as well as sufficiency policies would also support the achievements of the benchmarks which as expressed as a share of the EU demand.

III • Conclusion and policy recommendations

This paper focused on domestic opportunities and challenges associated with secure EU CRM supply chains for the green transition and sustainable competitiveness.

Accelerating EU policy efforts towards a more resilient and sustainable supply of CRMs is urgently needed in the face of growing geopolitical and geoeconomic threats which could further endanger EU industrial competitiveness. New European supply chains must be developed as a key complement to external efforts to secure access to CRMs in reliable third countries. This is an opportunity to enforce high EU environmental and social standards.

The potential is substantial. With over 50 investment cases identified on CRM for energy in Europe, the EU could potentially cover 40% of its demand in lithium, cobalt, and rare earth elements by 2030. Yet Europe is lagging behind its main competitors in developing and scaling cutting-edge CRM technologies. **The next EU political cycle is the opportunity to leverage on the EU Single Market through common instruments that would allow an efficient, effective and ambitious implementation of the EU CRMA, leading to a stronger EU green industrial and energy sovereignty.**

The CRMA is a landmark legislation that clearly sets CRMs as a key security and resilience priority for the EU. However, **it can only be the first step** towards a more comprehensive policy mix composed of appropriate financing tools, strengthened governance, and updated products and waste-related regulations and associated policies. The following recommendations should be fully integrated to a new European energy security strategy.

I FUNDING AND FINANCIAL INCENTIVES – COMBINING SPEED AND SCALE TO TRULY COMPETE WITH OTHER MAJOR BLOCKS

Current funding instruments (Horizon, STEP, raw materials for battery supply chains funds from EIT Innoenergy, national CRM funds, potential Innovation Fund Battery manufacturing window if linked to some EU domestic CRM sourcing conditionality) **will fall short of the speed and scale needed to create EU leadership, resilience and sovereignty in CRMs**. The potential for domestic supply chains is there, but the window of opportunity lies in the next few years. Providing enough EU funding (subsidies, blended finance, public guarantees, ect) to crowd in private investments and support innovations for sustainable extraction and refining processes, CRM substitution and circularity should be a priority for the next mandate. It should include the following actions.

- **Increase R&D**: Horizon Europe and national programmes should:
  - Improve recycling and refining technologies to maximize recovery and cost-competitiveness, as well as reduce the environmental (carbon emission, water use, ect) footprint of extraction, recycling and refining activities
  - Develop new product designs,[94] such as new battery chemistries and wind turbine blades, with lower CRM requirements or greater recyclability of alloys

- **Support scale-up**: Making a strong business case for Strategic Projects with high environmental standards
  - The Commission should introduce the use of EU-sourced CRMs when they are available (be it from mining, processing, or recycling) as a condition to accessing the announced Innovation Fund support for EU battery manufacturers, favour CRM substitution designs
  - Member States should mobilize **green public procurement** to favour products using EU-sourced CRMs (with reasonable targets taking into account the progressive rise of the domestic ecosystem), reward CRM substitution and resource efficiency
  - The EIB and InvestEU implementing partners should support the new EBA Strategic Battery Raw Materials Fund and work with the Commission to cover more product supply chains. They should develop a European Green Guarantee that should contribute, among others, to support banks lending to CRM projects.
  - The EIB should deliver on the "Sustainable CRM Task Force" suggested by Executive Vice President Šefčovič to facilitate projcts all along the value chain.
  - The Commission should propose to establish a European Critical Raw Materials Fund to further support the crowding-in of private investment. The Fund could be partly financed by revenues of ETS1
  - EU and national funding should favor projects with the highest environmental standards[95]

94 Davis, R. 2024. Doing more with less: A European Critical Raw Materials Strategy for Cleantech Competitiveness. Cleantech for Europe.
95 Davis, R. 2024. Doing more with less: A European Critical Raw Materials Strategy for Cleantech Competitiveness. Cleantech for Europe.

— The Commission should work with the Platform on Sustainable Finance to develop **criteria to include sustainable CRM extraction and processing in the Taxonomy**

GOVERNANCE FOR STRONG SOCIAL ACCEPTABILITY, HIGH ENVIRONMENTAL STANDARDS, AND EFFECTIVE IMPLEMENTATION

EU CRM Strategic Projects should respect the highest environmental, social, and public participation standards. This will be a key element of the social and political acceptability of the projects. Additionally, the successful implementation of the CRMA calls for capacity building, skills, technical assistance, and knowledge sharing.

- **The European Commission together with Member States should improve transparency on critical raw materials.** Data such as the different mining projects, the consultation taking place, the private and public stakeholders involved, the investment, the expected production, and clients (sector) should be made easily available on an online platform, for example, an EU CRM Observatory (cf below).

- Member states, local governments, and mining companies, with support from the European Commission, should adopt a **whole-of-society approach** when it comes to mining, by ensuring that broad and inclusive consultations are conducted before launching new mining projects and that local populations are included in decision processes at the different levels. The European Commission should make use of the possibility of inviting stakeholders as observers to the CRM Board.

- **Local populations should also receive some substantial benefits from the mining activities, including high environmental standards guarantees.** The EU could provide support to formalize public participation best practices and processes, involving third-party mediation and the creation of a scientific board to oversee the environmental and social impacts of potential projects.

- **The EU should develop active skills and capacity-building policies in the private and public sectors.** The Commission should develop a skills partnership on CRMs under the EU Pact for skills and propose to establish a Raw Materials Academy as part of the Net Zero Academics, as mentioned in the CRM 2023 Communication. Member States should support this effort and mobilise available EU funds (ESF+, ERDF, Just Transition Mechanism) to upskill their workforce on CRM value chains. They should also make use of the possibility to use the Technical Support Instrument of the Commission to upskill their administrative staff to have efficient single contact points with teams sufficiently trained and resourced to handle permitting applications of future Strategic Projects.

- **To support the above tasks, an EU CRM Observatory should be created**, in order to 1) serve as a database of mining and exploration information, 2) assess ESG criteria of different projects, 3) contribute to international and multilateral dialogues on CRMs, to promote EU's best practices in terms of ESG in the mining industry, secure international trade of CRMs and maintain exchanges with the main producing countries by representing the EU in different international fora, for instance the proposed UN Critical Energy Transition Minerals, 4) serve as a knowledge centre for best practices on public participation, environmental standards, permitting processes, and centralize information on the different funding tools, capacity building, and technical assistance opportunities.

- **The Commission should recognize certification schemes with equal governance models**, such as the IRMA Standard for Responsible Mining, and favor the applications of Strategic Projects that have such certification.

RESOURCE MANAGEMENT: EFFICIENCY, CIRCULARITY, SUFFICIENCY

The high supply risk associated with external sourcing of CRMs, the long development time of new CRM projects, the high investment costs together with the potential environmental and social impacts of extraction and refining call for the **acceleration of resource management policies**. Moderation of the demand for primary CRMs can be achieved by setting up greater circularity in CRM supply chains. Resource-efficient and substitution designs also have a lot of potential to lower the demand for CRMs. Lastly, sufficiency approaches such as smaller batteries for electric cars, and shifting mobility habits thanks to improved soft transportation infrastructures (cycle lanes, public transport, car sharing) can be very good complements to the above-mentioned solutions. Coherent policies on resource use increasingly appear as a major element for the social acceptability of new CRM projects, as exemplified in the French debates around the new lithium project in Allier.

- **"Whole-of-supply-chain approach"[96], circularity and sustainability of CRMs should become part of a new vision of EU industrial and security strategy**. This vision could set the prioritization of strategic clean tech manufacturers off-takers, and favour resource allocation to meet energy transition needs. It should also increase the coordination of national industrial policies to better integrate clean tech manufacturing, clean tech deployment, and use, with CRM policies. For example, Member States should develop collection, end-of-life treatment, and recycling facilities for products containing CRMs in a coordinated fashion.

- **The Commission should propose to extend the requirement on labeling and information on composition beyond permanent magnets and batteries**, harmonize waste management rules for waste streams containing CRMs, and update waste codes to keep black mass in Europe.

- **More broadly, policies should favor products and life-cyles that use fewer CRMs through circularity, resource efficiency, and substitution.** The EU should enhance CRMA provisions through additional measures promoting resource efficiency and demand moderation through Ecodesign and Sustainable Products Regulation, to support recyclability, minimum lifetimes and warranties, reusability, and repairability of products containing CRMs. Raising awareness about the risks associated with CRM supply could also contribute to further industrial efforts.

- **Reducing the size of electric vehicles can significantly contribute to moderating the demand for some CRMs.** To support this :

  – The European Commission should propose to the Council and the European Parliament to include a resource efficiency element in the definition of zero-emission vehicles, to support the deployment of efficient and smaller electric cars.

  – EU and national funding should support the industrial manufacturing of small, affordable electric cars using fewer CRMs – besides contributing to green resilience in the EU, this is a matter of business competition with China who is currently dominating this market segment, at the expense of EU car makers[97].

96 European Initiative for Energy Security, 2023. Empowering Europe. Developing a roadmap to strategic autonomy and a competitive energy transition.

97 Forbes, 2024. Europe needs truly affordable EVs, and China has the inside track.

- **It should also explore the idea of an EU resource law** to foster greater material use efficient designs and a circular economy. Austria, the Netherlands, Finland, and Flanders already set targets for material footprint moderation or reduction. Belgium, Denmark, Estonia, Finland, France, Lithuania, Poland, Slovakia, and Spain signed a non-paper[98] in 2021 calling for an EU approach in this respect, and Flanders more recently developed a paper on that aspect.[99]

- **The Commission should encourage national and local governments to adopt sufficiency policies** in order to reduce the demand and/or usage of products using critical materials, and therefore reducing their demand.

98 Joint Non-Paper on the upcoming Sustainable Product Initiative. July 2021. Belgium, Denmark, Estonia, Finland, France, Lithuania, Poland, Slovakia, Spain. Quoted in NGOs' coalition paper Sustainable Resource Management in the EU. White paper for an EU within planetary boundaries. 2024.

99 Watkins, E., van der Ven, C., Bondi, A. 2024. The missing piece of the EU Green Deal. The case for an EU resources law. OVAM (Flemish Public Waste Agency).

Annex

Material	Cobalt
Clean technoloogies in high needs for the material	EV and batteries storage
Price Average (2023)	USD 16 - 17/pound
Price evolution from 2022 to 2023 (rounded)	-45%
Projected growth in demand, 2040 relative to 2020 (2020 =1)	21
Mine Production: country, tons (countries in bold are part of the EU or have a strategic partnership on CRM with the EU)	World total (rounded): 230,000 DR Congo: 170,000 Indonesia: 17,000 Russia: 8,800 Australia: 4,600 Madagascar: 4,000 Philippines: 3,800 Cuba: 3,200 **New Caledonia (Oversea territory of France): 3,000** Papua New Guinea: 2,900 Turkey: 2,800 Canada: 2,100 USA: 500 Other countries: 6,600
Reserves: country, tons (countries in bold are part of the EU or have a strategic partnership on CRM with the EU)	World total (rounded): 11,000,000 **DR Congo: 6,000,000** Australia: 1,700,000 Indonesia: 500,000 Cuba: 500,000 Philippines. 260,000 Russia: 250,000 **Canada: 230,000** Madagascar: 100,000 Turkey: 91,000 USA: 69,000 Papua New Guinea: 49,000 **New Caledonia (Oversea territory of France): NA** Other countries: 780,000
China's share in terms of processing (%)	70%

Material	Copper
Clean technoloogies in high needs for the material	Solar PV Wind Bioenergy Electricity Networks EVs and battery storage
Price Average (2023)	USD 3.90 to 4/pound
Price evolution from 2022 to 2023 (rounded)	-3%
Projected growth in demand, 2040 relative to 2020 (2020 =1)	2
Mine Production: country, tons (countries in bold are part of the EU or have a strategic partnership on CRM with the EU)	World total (rounded): 22,000 **Chile: 5,000** Peru: 2,600 **DR Congo: 2,500** China: 1,700 USA: 1,100 Russia: 910 Indonesia: 840 Australia: 810 **Zambia: 760** Mexico: 750 **Kazakhstan: 600** **Canada: 480** Poland: 400 Other countries: 3,100
Reserves: country, tons (countries in bold are part of the EU or have a strategic partnership on CRM with the EU)	World total (rounded): 1,000,000 **Chile: 190,000** Peru: 120,000 Australia: 100,000 **DR Congo: 80,000** Russia: 62.000 Mexico: 53,000 China: 41,000 USA: 50,000 Poland: 34,000 Indonesia: 24,000 **Zambia: 21,000** **Kazakhstan: 20,000** **Canada: 7,600** Other countries:180,000
China's share in terms of processing (%)	42.3%

Material	Lithium
Clean technoloogies in high needs for the material	Batteries
Price Average (2023)	USD 46,000/metric ton (annual average-nominal, battery-grade lithium carbonate)
Price evolution from 2022 to 2023 (rounded)	-33%
Projected growth in demand, 2040 relative to 2020 (2020 =1)	42
Mine Production: country, tons (countries in bold are part of the EU or have a strategic partnership on CRM with the EU)	World total (rounded): 180,000 Australia: 86,000 **Chile: 44,000** China: 33,000 **Argentina: 9,600** Brazil: 4,900 **Canada: 3,400** Zimbabwe: 3,400 Portugal: 380 USA: NA Other countries: NA
Reserves: country, tons (countries in bold are part of the EU or have a strategic partnership on CRM with the EU)	World total (rounded): 28,000,000 **Chile: 9,300,000** Australia: 6,200,000 **Argentina: 3,600,000** China: 3,000,000 USA: 1,100,000 Canada: 930,000 Brazil: 390,000 Zimbabwe: 310,000 **Portugal: 60,000** Other countries: 2,800,000
China's share in terms of processing (%)	58%

Material	Nickel
Clean technoloogies in high needs for the material	EV and battery storage Geothermal Hydrogen
Price Average (2023)	USD 22,000/metric ton
Price evolution from 2022 to 2023 (rounded)	-15%
Projected growth in demand, 2040 relative to 2020 (2020 =1)	19
Mine Production: country, tons (countries in bold are part of the EU or have a strategic partnership on CRM with the EU)	World total (rounded): 3,600,000 Indonesia: 1,800,000 Philippines: 400,000 **New Caledonia (Oversea territory of France): 230,000** Russia: 200,000 **Canada: 180,000** Australia: 160,000 China: 110,000 Brazil: 89,000 USA: 17,000 Other countries: 380,000
Reserves: country, tons (countries in bold are part of the EU or have a strategic partnership on CRM with the EU)	World total (rounded): >130,000,000 Indonesia: 55,000,000 Australia: 24,000,000 Brazil: 16,000,000 Russia: 8,300,000 **New Caledonia (Oversea territory of France): 7,100,000** Philippines: 4,800,000 **Canada: 2,200,000** USA: 340,000 Other Countries: >9,100,000
China's share in terms of processing (%)	40%

Material		Clean technoloogies in high needs for the material	Price Average (2023)	Price evolution from 2022 to 2023 (rounded)	Projected growth in demand, 2040 relative to 2020 (2020 =1)	Mine Production: country, tons (countries in bold are part of the EU or have a strategic partnership on CRM with the EU)	Reserves: country, tons (countries in bold are part of the EU or have a strategic partnership on CRM with the EU)	China's share in terms of processing (%)
Rare Earth Elements	Neodymium	Wind	USD 80/ kg	-40%	3	World total (rounded): 350,000 China: 240,000 USA: 43,000 Burma: 38,000 Australia: 18,000 Thailand: 7,100 India: 2,900 Russia: 2,600 Madagascar: 960 Viet Nam: 600 Brazil: 80 Malaysia: 80 **Canada: NA** **Greenland: NA** South Africa: NA Tanzania: NA	World total (rounded): 110,000,000 China: 44,000,000 Viet-Nam: 22,000,000 Brazil: 21,000,000 Russia: 10,000,000 India: 6,900,000 Australia: 5,700,000 USA: 1,800,000 **Greenland: 1,500,000** Tanzania: 890,000 **Canada: 830,000** South Africa: 790,000 Thailand: 4,500 Burma: NA Madagascar: NA Malaysia: NA	>80%
	Praseodymium	EVs and battery storage Wind	???					
	Dysprosium	Wind	USD 323/ kg	-15%				
	Terbium	Wind	USD 1,300/kg	-37%				

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