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Out of the Dependency Trap

Why Germany's and Europe's Critical Raw Materials Policy Falls Short and How to Fix It

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Executive Summary

Germany and the European Union (EU) rely heavily on imports of critical raw materials (CRMs), which are indispensable for defense systems, core industries, the green transition, as well as digital technologies and the AI revolution. Their dependency on China is particularly pronounced; Chinese companies dominate the global processing industry, as well as key downstream segments such as magnets and batteries. Recent instances of China tightening its export controls of CRMs have underscored the scale and immediacy of the vulnerability this economic dependency poses. The risk of supply disruptions exposes Berlin and Brussels to economic and political blackmail. What was long considered a technical supply chain issue has now evolved into a systemic strategic challenge.

Concerns over CRM dependencies are not new and have resulted in several past attempts to foster resilience in the face of such dependency. Given this legacy, it is striking that Germany and Europe find themselves in such a tight spot today. Where did these past efforts fall short? And do Berlin and Brussels's most recent measures finally address these key shortcomings? We seek to answer these questions, also building on learnings from other countries such as Japan and the US.

We find that Germany and Europe's policy approaches are still too strongly based on the false assumption that improving framework conditions for private-sector projects in Europe and elsewhere in the world will suffice to drive supply diversification. This assumption is misaligned with the reality of China's state-backed, vertically integrated dominance that allows Beijing to shape prices and supply conditions. As a result, policies focused primarily on stimulating supply through permitting reform, financial derisking and project support in partner countries are insufficient. Other players such as Japan and the United States (US) have responded with greater resolve, deploying tools such as coordinated offtake agreements and price-support mechanisms to actively shape market dynamics. Europe's failure to take similar steps reflects persistent misconceptions about global CRM markets, alongside fragmented and insufficient capacity in public institutions and a weak CRM ecosystem.

Past efforts along four policy levers – (1) stockpiling, (2) expansion of primary supply, (3) expansion of recycling, and (4) demand reduction – exhibit a range of shortcomings, among which one stands out: the absence of stable, long-term demand at price levels that make investment in diversified supply chains in Europe and partner countries commercially viable. Without addressing this demand-side gap, even well-designed supply-side measures will fail to unlock the investment required.

Germany and Europe must therefore pursue a more determined, market-shaping strategy.

Three strands of action are key:

1. **Adopt targeted demand and price interventions along each critical value chain**: Berlin and Brussels should deploy policy packages along CRM value chains, calibrated to material characteristics, market structure and strategic relevance. While demand aggregation can play a supporting role, these packages should also include direct interventions in demand and price dynamics such as revenue guarantees in low-volume markets and sourcing rules, especially for large buyers. These instruments are essential to make investment in mining, processing, recycling, and substitution projects more 'bankable.' Their costs are moderate in relation to state budgets and total product costs, let alone compared to the economic damage threatened by disruptions and the political damage associated with a vulnerability to blackmail and coercion.

2. **Pursue coordinated stockpiling in cooperation with the private sector**: Rather than treating stockpiles as a measure of last resort, Germany and the EU should use them as a baseline protection against immediate disruptions. A public-private scheme in which the government sets minimum stock requirements and, where necessary, financially supports purchasing and operating costs while private actors manage the stockpiles offers one of the fastest deployable tools to

strengthen resilience. Given Beijing's efforts to restrict the build-up of foreign inventories, Berlin and Brussels should push back against these measures, which clearly serve no other purpose than to keep dependencies as acute as possible.

3. **Put more emphasis on CRM recycling, substitution and efficiency**: The potential of recycling, substitution and efficiency has long been recognized from a sustainability perspective, but they remain underutilized as tools to strengthen resilience. Beyond fostering stronger demand for secondary materials, accelerating progress requires additional measures: specific collection and recovery obligations to keep materials in dedicated value chains, incentives for product design for recyclability, tighter control of scrap exports alongside better functioning intra-EU waste flows, and targeted support for technologies that can most effectively reduce dependencies.

Delivering on this ambitious agenda will require significant changes in governance and implementation:

1. **Lead by example in driving EU action**: As a key EU member state, Germany should support a strong mandate for the proposed EU CRM Centre and decision-making processes that grant the European Commission sufficient leeway to drive implementation. It should also lead an initiative to pool national CRM-related funds to enable joint demand and price interventions at the European level. At the same time, Berlin should bring together flexible member state coalitions to build momentum and demonstrate feasibility, as well as move ahead with determination on initiatives that can be realized at the national level.

2. **Actively pursue and shape plurilateral CRM cooperation**: Germany and Europe need to deepen cooperation with like-minded partners to help reshape global market dynamics and break the dependence on China. Just reacting to US-led initiatives is not enough. Berlin and Brussels need to actively drive plurilateral action toward market-shaping interventions, stockpiling and financing, while ensuring a fair allocation of costs and benefits and secure access to the resulting supply.

3. **Strengthen implementation capacity and Europe's CRM ecosystem**: Effective CRM policy requires not only financial resources but also an upgrade and better pooling of fragmented technical expertise, a much-improved knowledge base on supply chains, as well as better political coordination across member states. At the same time, Germany and Europe must address structural gaps in their industrial base, combining short-term measures leveraging international partnerships with longer-term investments in the domestic talent pool.

Europe's CRM challenge is not primarily one of geological scarcity, but rather marked by captured market structures. Overcoming it will require a shift toward an integrated strategy that actively shapes markets – particularly by creating stable demand and viable price signals for non-China supply – and aligns public and private actors. The costs of such an approach are significant, but they pale in comparison to the economic and political costs of continued dependence on China. This urgent and overdue investment in European resilience will pay outsized dividends.

Zusammenfassung

Deutschland und die Europäische Union (EU) sind in hohem Maße von Importen kritischer Rohstoffe abhängig, die für Verteidigungssysteme, Schlüsselindustrien, die grüne Transformation sowie digitale Technologien und die KI-Revolution unverzichtbar sind. Dramatisch ist die Abhängigkeit von China; chinesische Unternehmen dominieren die globale Verarbeitungsindustrie mit Marktanteilen von über 90 Prozent bei vielen Materialien sowie wichtige nachgelagerte Segmente wie Magnete und Batterien. Jüngste Fälle, in denen China seine Exportkontrollen für kritische Rohstoffe verschärft hat, haben das Ausmaß und die Dringlichkeit der Verwundbarkeit unterstrichen, die diese wirtschaftliche Abhängigkeit mit sich bringt. Das Risiko von Lieferunterbrechungen setzt Berlin und Brüssel wirtschaftlicher und politischer Erpressung aus. Was lange Zeit als technisches Lieferkettenproblem galt, hat sich zu einer systemischen strategischen Herausforderung entwickelt.

Bedenken hinsichtlich der Abhängigkeit bei kritischen Rohstoffen sind nicht neu. Sie haben bereits in der Vergangenheit zu mehreren Versuchen geführt, die Resilienz im Kontext solcher Abhängigkeiten zu stärken. Die Fehlschläge dieser Maßnahmen sind bemerkenswert. Woran sind diese früheren Bemühungen größtenteils gescheitert? Und machen es die aktuellen Maßnahmen Berlins und Brüssels besser? Bei der Beantwortung dieser Fragen greifen wir auch auf Lehren aus anderen Ländern wie Japan und den USA zurück.

Wir kommen zu dem Ergebnis, dass die politischen Ansätze Deutschlands und Europas nach wie vor zu stark auf der falschen Annahme beruhen, dass bessere Rahmenbedingungen für privatwirtschaftliche Projekte in Europa und anderen Teilen der Welt ausreichen, um Rohstofflieferketten zu diversifizieren. Diese Annahme verkennt die Realität von Chinas staatlich gestützter, vertikal integrierter Dominanz, die es Peking ermöglicht, Preise und Lieferbedingungen zu maßgeblich zu beeinflussen. Folglich reichen politische Maßnahmen, die sich in erster Linie auf die Ausweitung des Angebots durch Reformen von Genehmigungsverfahren, finanzielle Risikoabsicherung und Projektförderung in Partnerländern konzentrieren, nicht aus. Andere Akteure wie Japan und die USA haben entschlossener reagiert und Instrumente wie koordinierte Abnahmevereinbarungen und Preisstützungsmechanismen eingesetzt, um einen anders funktionierenden Markt zu schaffen. Das Versäumnis Europas, ähnliche Schritte zu unternehmen, spiegelt anhaltende Fehlannahmen über die globalen Märkte für kritische Rohstoffe wider, ebenso wie fragmentierte und unzureichende Kapazitäten in öffentlichen Institutionen sowie einem schwachen Rohstoffökosystem.

Bisherige Bemühungen in vier Bereichen – (1) Lagerhaltung, (2) Ausbau des Primärangebots, (3) Ausbau des Recyclings und (4) Nachfragesenkung – weisen eine Reihe von Mängeln auf, von denen einer besonders hervorsticht: das Fehlen einer stabilen, langfristigen Nachfrage zu Preisniveaus, die Investitionen in diversifizierte Lieferketten in Europa und den Partnerländern wirtschaftlich tragfähig machen. Ohne diese nachfrageseitige Lücke zu schließen, werden auch gut konzipierte Maßnahmen auf der Angebotsseite nicht ausreichen, um die erforderlichen Investitionen zu mobilisieren.

Deutschland und Europa müssen daher eine entschlossenere, marktgestaltende Strategie verfolgen.

Drei Handlungsstränge sind von entscheidender Bedeutung:

1. **Gezielte Nachfrage- und Preisinterventionen entlang jeder kritischen Wertschöpfungskette**: Berlin und Brüssel sollten Maßnahmenpakete entlang der Wertschöpfungsketten kritischer Rohstoffe einsetzen, zugeschnitten auf die jeweiligen Materialeigenschaften, Marktstruktur und strategische Relevanz. Während Nachfrageaggregierung dabei eine unterstützende Rolle spielen kann, sollten diese Maßnahmenpakete auch direkte Eingriffe in die Nachfrage- und Preisdynamik umfassen, etwa Umsatzgarantien in geringvolumigen Märkten und Beschaffungsregeln, insbesondere für Großabnehmer. Diese Instrumente sind unerlässlich, um Investitionen in Bergbau-, Verarbeitungs-, Recycling- und Substitutionsprojekte finanzierbarer zu machen. Ihre Kosten sind im Verhältnis zu Staatshaushalten und Produktkosten moderat, ganz zu

schweigen vom wirtschaftlichen Schaden, der durch Lieferunterbrechungen droht, und dem politischen Schaden durch Erpressbarkeit und Verwundbarkeit gegenüber Zwangsmaßnahmen.

2. **Koordinierte Lagerhaltung in Zusammenarbeit mit dem Privatsektor:** Anstatt Lagerhaltung als letzten Ausweg zu behandeln, sollten Deutschland und die EU sie als Basisschutz gegen unmittelbare Lieferunterbrechungen nutzen. Ein öffentlich-privates Modell, bei dem der Staat Mindestvorratsanforderungen festlegt und, wo nötig, Anschaffungs- und Betriebskosten finanziell unterstützt, während private Akteure die Lagerbestände verwalten, bietet eines der am schnellsten einsetzbaren Instrumente zur Stärkung der Resilienz. Angesichts der Bemühungen Pekings, den Aufbau ausländischer Vorräte zu beschränken, sollten Berlin und Brüssel diesen Maßnahmen entschieden entgegentreten. Sie dienen offenkundig keinem anderen Zweck, als bestehende Abhängigkeiten so akut wie möglich zu halten.

3. **Stärkere Gewichtung von Recycling, Substitution und Effizienz:** Das Potenzial von Recycling, Substitution und Effizienzsteigerungen ist aus Nachhaltigkeitsperspektive seit Langem bekannt, wird jedoch als Instrument zur Stärkung der Resilienz weiterhin zu wenig genutzt. Über die Förderung einer stärkeren Nachfrage nach Sekundärrohstoffen hinaus erfordert dies zusätzliche Maßnahmen: spezifische Sammel- und Rückgewinnungspflichten, um Materialien in gesonderten Wertschöpfungsketten zu halten; Anreize für recyclinggerechtes Produktdesign; strengere Kontrolle von Schrottexporten bei zugleich besser funktionierenden innereuropäischen Abfallströmen; sowie gezielte Unterstützung für Technologien, die Abhängigkeiten am wirksamsten verringern können.

Die Umsetzung dieser ambitionierten Agenda erfordert dringende Anstrengungen:

1. **Mit gutem Beispiel bei der Förderung von EU-Maßnahmen vorangehen**: Als wichtiger EU-Mitgliedstaat sollte sich Deutschland für ein starkes Mandat für das vorgeschlagene EU-Zentrum für kritische Rohstoffe sowie für Entscheidungsprozesse einsetzen, die der Europäischen Kommission ausreichend Spielraum für die Umsetzung einräumen. Zudem sollte Deutschland eine Initiative anstoßen, um nationale rohstoffbezogene Mittel zu bündeln und so gemeinsame Nachfrage- und Preisinterventionen auf europäischer Ebene zu ermöglichen. Gleichzeitig sollte Berlin flexible Koalitionen von Mitgliedstaaten zusammenbringen, um Dynamik aufzubauen und die Machbarkeit entsprechender Maßnahmen zu demonstrieren, und zugleich entschlossen Initiativen vorantreiben, die auf nationaler Ebene umgesetzt werden können.

2. **Plurilaterale Zusammenarbeit bei kritischen Rohstoffen aktiv verfolgen und gestalten**: Deutschland und Europa müssen die Zusammenarbeit mit gleichgesinnten Partnern vertiefen, um globale Marktdynamiken mitzugestalten und die Abhängigkeit von China zu verringern. Es reicht nicht aus, lediglich auf US-geführte Initiativen zu reagieren. Berlin und Brüssel müssen plurilaterales Handeln aktiv in Richtung marktgestaltender Interventionen, Lagerhaltung und Finanzierung vorantreiben und dabei eine gerechte Verteilung von Kosten und Nutzen sowie gesicherten Zugang zu den daraus entstehenden Lieferungen sicherstellen.

3. **Umsetzungskapazitäten und Europas Ökosystem für kritische Rohstoffe stärken**: Wirksame Rohstoffpolitik erfordert nicht nur finanzielle Mittel, sondern auch eine Aufwertung und bessere Bündelung fragmentierter technischer Expertise, eine deutlich verbesserte Wissensbasis zu Lieferketten sowie eine bessere politische Koordinierung zwischen den Mitgliedstaaten. Zugleich müssen Deutschland und Europa strukturelle Lücken in ihrer industriellen Basis schließen, indem sie kurzfristige Maßnahmen über internationale Partnerschaften mit längerfristigen Investitionen in den heimischen Talentpool verbinden.

Die Herausforderung für Europa im Bereich der Rohstoffversorgung ist in erster Linie keine Frage der geologischen Knappheit, sondern ist vielmehr durch von China gekaperte Marktstrukturen gekennzeichnet. Die Antwort liegt in einer integrierten Strategie, die Märkte aktiv gestaltet – insbesondere indem sie stabile Nachfrage und tragfähige Preissignale für Lieferungen aus Ländern außerhalb Chinas

schafft – und das Handeln öffentlicher wie privater Akteure aufeinander abstimmt. Die Kosten eines solchen Ansatzes sind erheblich, verblassen jedoch im Vergleich zu den wirtschaftlichen und politischen Kosten einer anhaltenden Abhängigkeit von China. Diese dringenden und längst überfällige Investitionen in die Widerstandsfähigkeit Europas werden hohe Dividenden abwerfen.

Introduction

According to the European Commission, there are 34 raw materials that are both critically important to Europe's economy and at high risk of supply disruptions. These CRMs are indispensable for modern weapon systems, ranging from fighter jets and naval vessels to missiles and unmanned systems, making them integral to current efforts to improve Europe's defense readiness.[1] CRMs are equally critical to digital and AI technologies (including semiconductors), as well as tech underpinning the post-carbon transition, including wind turbines, electric vehicle motors, batteries, fuel cells, electrolyzers, and solar panels.[2] Demand for many of those materials is set to increase sharply both within Europe and globally over the next few decades.[3]

For a large share of CRMs (unprocessed and processed), both Germany and the EU rely largely on imports, with extremely concentrated dependencies on China for most processed materials and CRM-heavy products such as magnets made from rare earth elements (REEs).[4] Tighter Chinese export controls on REEs and related technologies in 2025, which marked an escalation of earlier export restrictions on a broader set of materials introduced since 2023, demonstrated that supply disruptions can quickly lead to production stoppages in major industries such as the automotive industry.[5] These dependencies expose Germany and Europe to economic and political coercion. Beijing has already signaled that Europe should refrain from enacting further restrictions on high-tech exports to China or closing the European market to Chinese overcapacity if they wish to avoid further disruptions to vital CRM supplies. Further, it has indicated that military end-users (MEU) should not expect licenses for rare earth shipments, threatening to pull the plug on German and European efforts to modernize their militaries. Taken together, these dynamics elevate CRM dependencies on China to an existential challenge.

However, this is not a wholly new set of problems. For decades, policymakers in Berlin and Brussels have fundamentally recognized CRM dependencies as a concern. Yet, the various measures attempted over time have consistently failed to deliver decisive change. While the last few years have seen more concerted and determined action, many current efforts resemble past initiatives. It is therefore imperative to ask why earlier efforts have not had the desired effects, whether today's policies adequately reflect these lessons learned and what additional steps can be taken to finally overcome persistent obstacles.

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[1] Govini, "From Rock to Rocket: Critical Minerals and the Trade War for National Security," 2025, https://cdn.prod.website-files.com/65e61e6392aba0fa1dba723e/67dd81633a035fbcc3cc161c_Govini-Rock_to_Rocket-Critical_Minerals%20(1).pdf; Stefan Steinicke, "Kampf um die Elemente," *Journal für Internationale Politik und Gesellschaft*, November 11, 2025, https://www.ipg-journal.de/rubriken/wirtschaft-und-oekologie/artikel/rohstoffpolitik-ist-sicherheitspolitik-8659/.

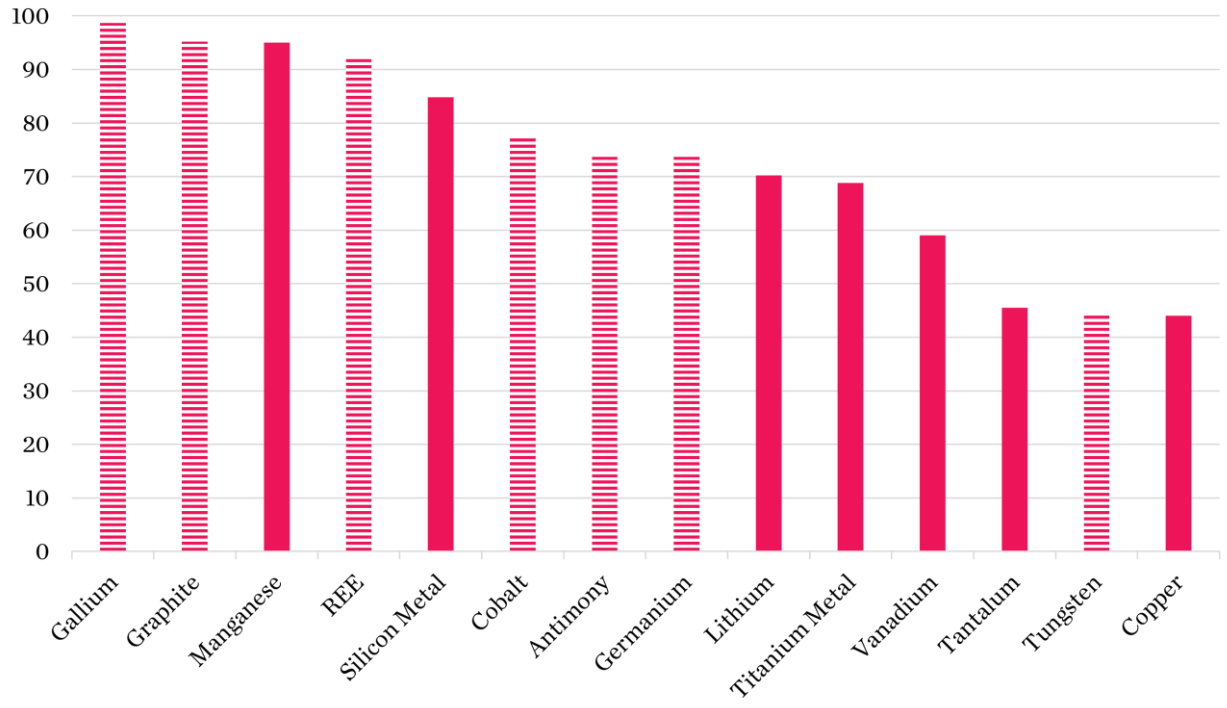
[2] SFA Oxford, "Critical Minerals in Artificial Intelligence," 2026, https://www.sfa-oxford.com/knowledge-and-insights/critical-minerals-in-low-carbon-and-future-technologies/critical-minerals-in-artificial-intelligence/.

[3] Samuel Carrara et al., "Supply Chain Analysis and Material Demand Forecast in Strategic Technologies and Sectors in the EU – A Foresight Study," JRC Publications Repository, 2023, https://doi.org/10.2760/386650.

[4] European Court of Auditors, "Special Report 04/2026: Critical Raw Materials for the Energy Transition," 2026, https://www.eca.europa.eu/ECAPublications/SR-2026-04/SR-2026-04_EN.pdf; Roland Berger, "Wege aus der Abhängigkeit: Wie Deutschland Die Rohstoffe Für Eine Zukunftsfähige Wirtschaft Sichert," 2024, https://content.rolandberger.com/hubfs/07_presse/241108_Roland%20Berger_BDI_Rohstoffstudie.pdf.

[5] These developments must be understood in the context of intensifying US-China technological and economic competition, in which critical raw materials have emerged as a key instrument of statecraft. Starting in 2023, China imposed export restrictions on key semiconductor inputs such as gallium and germanium. As US controls on advanced semiconductor technologies tightened, China expanded its measures to additional materials. In April 2025, Beijing introduced export controls on seven heavy REE in response to the US liberation day tariffs, followed in October 2025 by further restrictions on additional REE as well as related products and technologies. The final set of controls these measures were temporarily eased for a year shortly after being issued.

Figure 1: Share of Global Refined Production of Selected Critical/Strategic Raw Materials by Chinese Companies



Dashed bars represent materials that are or have been subject to export controls to certain or all end users since 2023. Source: IEA[6]

Scoping the Challenge

Securing resilient CRM supply requires engagement with all stages of relevant value chains, from exploration and mining to final products. This is important to stress, as it has become a common talking point that many CRMs, including REEs, are not overly 'rare' in geological terms. As US President Donald Trump noted in his speech at the World Economic Forum in Davos in January 2026, "there is no such thing as rare earths. There is rare processing."[7] Similarly, policy debates in Europe have often focused on Europe's lack of a sufficiently developed separation, metal-making and product manufacturing infrastructure that allows it to process and use minerals.

This captures an important part of the problem but oversimplifies the challenge. While many minerals indeed exist in ample and sufficiently concentrated quantities around the world, this is not true across the board. Consider the subgroup of 11 heavy rare earth elements (HREE), which are among the most strategically important materials due to their role in enhancing thermal resistance, coercivity and magnetic performance in defense, space and other applications.[8] These elements are currently extracted almost exclusively from ion-adsorption clay deposits in only three countries: China, Myanmar and Laos.[9]

[6] International Energy Agency, "Share of Top Refining Country for 20 Energy-Related Minerals," 2025, https://www.iea.org/data-and-statistics/charts/share-of-top-refining-country-for-20-energy-related-minerals; Alessio Scanziani et al., "Designing an Effective Strategic Stockpiling System for Critical Minerals," International Energy Agengy, January 27, 2026, https://www.iea.org/commentaries/designing-an-effective-strategic-stockpiling-system-for-critical-minerals.
[7] Politico, "Full Text: Trump Davos Speech Transcript," April 30, 2026, https://www.politico.com/story/2018/01/26/full-text-trump-davos-speech-transcript-370861.
[8] Deutsche Rohstoffagentur, "DERA Rohstoffinformationen: Seltene Erden," 2025, https://www.deutsche-rohstoffagentur.de/DERA/SharedDocs/Downloads/Rohstoffinformationen/rohstoffinformationen-61.pdf?__blob=publicationFile&v=3.
[9] Jason Bedford, "Rare Earths and Industry: Why Dependence on China Endures," 2025, https://research.nus.edu.sg/eai/wp-content/uploads/2025/09/EAIBB-No.-1843-Rare-earths_China-2.pdf; International Energy Agency, "Global Critical Minerals Outlook 2025," 2025, https://iea.blob.core.windows.net/assets/ef5e9b70-3374-4caa-ba9d-19c72253bfc4/GlobalCriticalMineralsOutlook2025.pdf.

In Brazil, Serra Verde's[10] Pela Ema deposit has also started production in 2023; additional projects are under development.[11] There may be significant depletable clay resources in Madagascar, Vietnam, Uganda, Australia, Malaysia, and Chile, as well as hard-rock deposits in Greenland, the US or Australia that are of substantially higher grade but more difficult to extract.[12] None of these have been exploited at a meaningful scale due to limited confirmed reserves, lack of commercial profitability, local opposition, and the long lead times required.[13] Today, only a few rare earth mining sites are operating at scale, and those that are do so mostly for source light rare earth elements (LREEs), not HREE. Crucially, none of these sites are in Europe. Even the most advanced European projects, such as Kiruna in Sweden, are unlikely to operate at scale for years.[14]

For many other materials, deposits are known (or at least assumed) to be more abundant and geographically diversified. Still, here too, exploration activities and project development have remained far below potential, mostly due to a lack of commercial profitability. Expanding mining capacity should therefore not be dismissed as a trivial issue, particularly given Europe's comparatively limited domestic resource base and high degree of local opposition to mining projects.[15]

Notwithstanding, the International Energy Agency (IEA) rightly notes that the "refining segment of the supply chain outside China is even more nascent than mining" and more technologically demanding.[16] For example, there are only a few industrial-scale separation and refining facilities that process REE into high-purity oxides, metals and magnets outside of China. Those are located in the US and Malaysia (run by Australian company Lynas), or, at a more modest scale, Estonia (run by Canadian firm NeoPerformance Materials) and France (run by Belgian company Solvay).[17] Besides the dependence on a continuous supply of input materials, the mere presence of processing capacity in Europe also fails to ensure supply security if processed materials are then shipped elsewhere for further use. Solvay, for example, signed a deal in late 2025 to ship rare earths processed in France to the US firm Noveon Magnetics to make magnets.[18]

When considering possible ways to promote European extraction and processing capacity and reduce chokepoints in global supply chains, it is helpful to keep in mind three constraints that have shaped the global CRM industry:

- **Environmental and social externalities**: Mining and processing activities have significant and often long-lasting environmental, climate and social impacts.[19] Even as processes are improved, they will continue to require the use of hazardous chemicals, generate toxic waste and contribute to water scarcity, pollution, soil degradation, and greenhouse gas emissions. In addition, CRM

[10] Serra Verde Group has been acquired by USA Rare Earth in April 2026.
[11] Deutsche Rohstoffagentur, "DERA Rohstoffinformationen: Seltene Erden."
[12] Bedford, "Rare Earths and Industry: Why Dependence on China Endures;" Nicolas Charles et al., "Chapter 1 - The Rare Earth Resources of Europe and Greenland - Mining Potential and Challenges," 2023, https://normandie-univ.hal.science/hal-04394758v1/file/Charles%20et%20al%202023%20postprint.pdf; Deutsche Rohstoffagentur, "DERA Rohstoffinformationen: Seltene Erden"; International Energy Agency, "Global Critical Minerals Outlook 2025"; Rare Earth Exchanges, "Heavy Rare Earths: The Unseen Battlefield in the Global Tech War," July 25, 2025, https://rareearthexchanges.com/news/heavy-rare-earths-the-unseen-battlefield-in-the-global-tech-war/; Meredith Schwartz and Gracelin Baskaran, "Greenland, Rare Earths, and Arctic Security," Center for Strategic and International Studies, 2025, https://www.csis.org/analysis/greenland-rare-earths-and-arctic-security.
[13] More recently, Saudi Arabia has claimed significant HREE deposits, but these remain unproven. Hard-rock deposits in Sweden and Norway may also host relevant quantities of HREE.
[14] Lisa O'Carroll, "Freedom from China? The Mine at the Centre of Europe's Push for Rare Earth Metals," *The Guardian*, January 10, 2026, https://www.theguardian.com/environment/2026/jan/10/china-mine-europe-rare-earth-metals-swedish-producer.
[15] The Economist, "Europe Risks a Rare-Earths Crunch between China and America," January 29, 2026, https://www.economist.com/europe/2026/01/29/europe-risks-a-rare-earths-crunch-between-china-and-america.
[16] International Energy Agency, "Global Critical Minerals Outlook 2025."
[17] Additional facilities are to come online through Carester's flagship Caremag project in France, supported with €100 bn each by France and Japan later this year or REEtec's Herøya project in Norway
[18] Liz Alderman, "Europe's Biggest Rare Earths Producer Forges U.S. Deals," *The New York Times*, November 12, 2025, https://www.nytimes.com/2025/11/12/business/europe-rare-earths.html.
[19] Sabine de Haes and Paul Lucas, "Environmental Impacts of Extraction and Processing of Raw Materials for the Energy Transition," 2024, https://www.pbl.nl/system/files/document/2024-02/PBL-2024-Environmental-impacts-of-extraction-and-processing-of-raw-materials-for-the-energy-transition-5364.pdf; Andreas Manhart et al., "The Environmental Criticality of Primary Raw Materials – A New Methodology to Assess Global Environmental Hazard Potentials of Minerals and Metals from Mining," *Mineral Economics* 32, no. 1, 2019: 91–107, https://doi.org/10.1007/s13563-018-0160-0.

mining and processing have often had wide-ranging negative impacts on local communities.[20] Even if the commercial viability of a project is clear, it will typically face considerable obstacles on its way to entering production.

- **High risk, uncertain reward**: Industrial mining and processing activities tend to have long lead times and exposure to various risks that can derail entire projects. They are also often very capital intensive.[21] Obtaining financing for investments and achieving commercially viable operations is challenging and contingent on factors beyond companies' control, such as the timely provision of permits or infrastructure. Moreover, developers require early and consistent demand signals to assess the viability of potential projects. Reacting quickly to unexpected changes in the demand trajectory (for example, due to technological change in the industries using the material in question) is usually difficult.

- **Technical and value chain complexity**: Despite some exceptions, many mining and processing activities require specific expertise and technology that constitute barriers to market entry and contribute to specialization in certain processes and materials. In addition, many CRMs are produced as coproducts and byproducts of other minerals and commodities (for instance, gallium from aluminum refining), making their supply relatively inelastic and subject to fluctuations on broader commodity markets. These factors lead to significant interdependencies along value chains.

The Need for Market-Making

This report examines why past German and European efforts to reduce CRM dependencies have fallen short. It argues that the assumptions these reform efforts were based on were incorrect in a few crucial ways. Even the most recent policies have only just begun to address these misconceptions about global CRM markets and supply chains, institutional capacity gaps and ecosystem weaknesses.

Above all, Berlin and Brussels remain focused on facilitating upfront investment in new mining, processing and recycling projects and on reducing regulatory obstacles, in the hope that this will suffice for supply diversification to advance through market forces. This assumption is misaligned with the reality of China's vertically integrated and state-supported dominance across CRM value chains. In addition to the scale advantages and undeniable technological prowess of China's CRM industry, the monopoly position that it has achieved now enables Beijing to dictate global supply conditions, price dynamics and investment incentives, up to the point of manipulating prices strategically to fend off competitors.

For too long, Germany and Europe have remained too passive in dealing with Chinese market capture, blindly optimizing for short-term cost efficiency and ignoring the vulnerability and political costs associated with seemingly cheap supply. US Trade Representative Jamieson Greer rightly noted that reducing dependencies cannot be achieved for free: "Cost efficiency, this is why we are in the situation we're in. There is a premium we pay, and I call it the national security premium, and we will all pay a national security premium to have a secure supply chain."[22]

If Germany and Europe want to break China's stranglehold and adequately protect themselves against coercion, they can simply not stand by and let market forces run their course. Berlin and Brussels must actively pursue carefully calibrated state intervention in three areas. First, they should adopt targeted

[20] Etienne Berthet et al., "Assessing the Social and Environmental Impacts of Critical Mineral Supply Chains for the Energy Transition in Europe," *Global Environmental Change* 86, May 2024, https://doi.org/10.1016/j.gloenvcha.2024.102841; Sabine de Haes and Hester Brink, "Social Impacts of Mining Critical Raw Materials. Challenges and Entry Points for Governance," 2025, https://www.pbl.nl/system/files/document/2025-06/pbl-2025-social-impacts-of-mining-critical-raw-materials-5740.pdf.
[21] Paul Manalo, "From 6 Years to 18 Years: The Increasing Trend of Mine Lead Times," S&P Global Market Intelligence, April 11, 2025, https://www.spglobal.com/market-intelligence/en/news-insights/research/from-6years-to-18years-the-increasing-trend-of-mine-lead-times.
[22] Aime Williams, "US Trade Chief Urges Allies to Pay More for Critical Minerals," *Financial Times*, April 22, 2026, https://www.ft.com/content/7c5a8936-9726-4892-9532-d63b07831537?syn-25a6b1a6=1.

demand and price interventions along critical value chains to reshape market dynamics. Second, they should establish a coordinated stockpiling program in cooperation with the private sector. This would function as a baseline defense that can be implemented much faster than other instruments, even though it is by no means straightforward. Third, they need to face the reality that expanding primary CRM supply, be it at home or abroad, is a difficult and lengthy process. Given this reality, they should make recycling, substitution and efficiency integral elements of their CRM resilience efforts.

Taken together, these three strands amount to an ambitious agenda – one that can only succeed if policymakers adopt a suitable modus operandi and ensure that certain necessary conditions are in place. As a key member state, Germany should lead by example and drive EU-level progress. Together with Brussels and other member state capitals, Berlin should also intensify its efforts to pursue and shape plurilateral cooperation with partners beyond the EU. Finally, substantial investments in public sector implementation capacity and a stronger CRM ecosystem in Europe are necessary to create a sound foundation for policies that will impose considerable demands on public agencies and industry players.

This report develops these propositions in five steps. First, it provides a brief summary of the overall evolution of German and European CRM policy in a changing political and economic context. Second, it takes a closer look at past and current measures to strengthen resilience along the four main policy levers: (1) stockpiling, (2) expansion of primary supply, (3) recycling, and (4) substitution and demand reduction. Third, it identifies a set of challenges and shortcomings that account for the limited impact of efforts to date, both at an overarching level and more specifically for each policy lever. Fourth, it looks more closely at the central problem of creating stable demand for materials from diversified sources and considers various ways to address this issue. Finally, it advances the policy recommendations outlined above based on this analysis.

Evolution of German and European CRM Policy

Concerns about Germany's and Europe's dependence on imported raw materials and about the reliability of these supply chains are not new. Already in 1975, in the aftermath of the 1973 oil crisis, the then Commission of the European Communities warned of a "real and serious problem" arising from high and growing import dependence for key minerals, including cobalt, manganese, and platinum.[23]

While the degree of political salience of raw materials supply issues has ebbed and flowed over time, China has been a factor in German and European debates since the early 1980s. In 1980, the then West German Minister of Economic Affairs Otto Graf Lambsdorff visited Beijing. The German news magazine DER SPIEGEL ran the headline: "China's officials hope for cheap credit lines from Germany. And lure with long-term contracts on raw materials."[24] At the time, Chinese Minister of Metallurgical Industry Tang Ke stressed that China could provide what Germany did not have: raw materials like tungsten, antimony or titanium. Ultimately, German and Chinese officials forged a series of deals where German companies provided know-how for Chinese CRM production. They then would sell the resulting outputs jointly.

Other countries such as the US and Japan made similar deals with China, investing in building up the Chinese raw materials industry. In general, states were often all too happy for China to take over this dirty, low-margin business. In 1995, for example, the US allowed General Motor's Magnequench division – a leader in REE magnet technology critical to the defense industry – to be sold to Chinese investors. In 2004, it moved its production facilities fully to China. "We're handing over to the Chinese both our defense technology and our jobs in the midst of a deep recession," US Representative Peter Visclosky, a lawmaker from northern Indiana, said at the time. "By controlling access to the magnets and the raw materials they are composed of, US industry can be held hostage to Chinese blackmail and extortion," a Pentagon advisor argued in 2005.[25] But these concerns did not gain political traction during the heyday of engagement with China in the late 1990s and early 2000s.

As a consequence, at the turn of the millennium, China had established a dominant position in the mining, separation and refining of REE and other raw materials.[26] Coinciding with rising global demand for raw materials (which was in part driven by the rapidly growing Chinese economy), Beijing enacted a number of policies that effectively reduced its REE exports in the early 2000s.[27] This reignited European concerns about raw materials supply security. German industry was particularly worried about supply security and began to call more forcefully for government involvement to secure access to international raw materials markets. At the first Raw Materials Congress launched by the German Federation of Industries (*Bundesverband der Deutschen Industrie*, BDI) in 2005, the then-President of the German Steel Association (*Wirtschaftsvereinigung Stahl*, WV Stahl) warned that Germany could only "remain the world's leading exporter if companies were granted free and fair access to international raw materials markets."[28] This marked the beginning of a more coordinated effort by industry to shape German raw materials policy.

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[23] Commission of the European Communities, "The Community's Supply of Raw Materials," 1975, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:51975DC0050.
[24] Der Spiegel, "Groß, aber arm," August 17, 1980, https://www.spiegel.de/wirtschaft/gross-aber-arm-a-6f6081a3-0002-0001-0000-000014322276.
[25] Jeffrey St. Clair, "The Saga of Magnequench," Counterpunch, April 7, 2006, https://www.counterpunch.org/2006/04/07/the-saga-of-magnequench/.
[26] Politico, "Full Text: Trump Davos Speech Transcript,"
[27] Yuzhou Shen et al., "China's Public Policies toward Rare Earths, 1975–2018," *Mineral Economics* 33, no. 1, 2020: 127–51, https://doi.org/10.1007/s13563-019-00214-2.
[28] Peter Fuchs and Michael Reckordt, "Rohstoffsicherung in Deutschland und zivilgesellschaftliche Antworten," *PERIPHERIE*, 2013, https://budrich-journals.de/index.php/peripherie/article/view/22726.

The German government issued its first dedicated Raw Materials Strategy at the third BDI Raw Materials Congress in October 2010.[29] The strategy focused primarily on external supply risks for German industry and promised action to challenge export restrictions through the World Trade Organization (WTO) dispute settlement mechanism, expand raw materials partnerships and promote free trade agreements, alongside incentives for firms to diversify their supplies. It also announced the establishment of the German Raw Materials Agency (*Deutsche Rohstoffagentur*, DERA), primarily designed as an advisory body to support companies with information, risk assessments and market intelligence. At the same time, the strategy made clear that the federal government largely regarded raw materials supply security as a task for industry itself, with the state playing a supportive role. This industry-centered approach was reflected in the creation of the so-called *Rohstoffallianz* ("Raw Material Alliance") in 2011, when 12 major German companies joined forces to organize direct participation in raw materials projects abroad.

In parallel, the European Commission released a Raw Materials Initiative in 2008.[30] This initiative was structured around three pillars: (1) securing European access to raw materials by reducing trade barriers, (2) developing domestic supply and (3) reducing demand for primary supply. In practice, the first pillar once again clearly dominated, while the other two pillars remained comparatively less developed. Following the launch of the Raw Materials Initiative, the European Commission began to formalize the identification and prioritization of critical materials. In 2009, it tasked an expert working group with developing a methodology to define a list of critical non-energy, non-agricultural raw materials at EU level.[31] Out of an initial set of 41 minerals, 14 were classified as 'critical,' based on their economic importance, supply risk and 'environmental country risk.'[32] Since the publication of this first list in 2011, both the methodology and the scope of assessment have been regularly updated, which has led to a gradual expansion of the number of materials classified as critical.

These steps were taken against a backdrop of greater political salience of raw materials supply risks compared to earlier decades. Over the course of the 2000s, Beijing had tightened export restrictions on REE and other materials.[33] In 2009, the EU, the US and Mexico launched a first WTO complaint against Chinese export restrictions on a range of raw materials.[34] Still, Beijing proceeded to sharply reduce its export quotas by around 40 percent in 2010. Japan also suffered a severe disruption of Chinese REE exports following a collision between a Chinese fishing trawler and the Japanese coast guard around the disputed Senkaku Islands. Widely reported, this episode alerted international observers to the urgency of their own supply vulnerabilities and possible Chinese weaponization of dependencies, even as the empirical evidence for a targeted and centrally coordinated export ban remains contested.[35] The EU, together with the US and Japan, launched a second complaint in 2012 targeting China's restrictions on REE and other materials, with the WTO again ruling in its favor.

This spike in political attention proved difficult to sustain throughout the 2010s. An extended period of seemingly abundant supply and low prices reduced immediate pressure on supply security. In this environment, private-sector initiatives like the German *Rohstoffallianz* collapsed as there was no market for

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[29] Bundesministerium für Wirtschaft und Technologie, "Rohstoffstrategie Der Bundesregierung: Sicherung einer Nachhaltigen Rohstoffversorgung Deutschlands mit Nicht-Energetischen Mineralischen Rohstoffen," 2010, https://www.medico.de/fileadmin/_migrated_/document_media/1/rohstoffstrategie-der-bundesregierung.pdf.

[30] European Commission, "The Raw Materials Initiative — Meeting Our Critical Needs for Growth and Jobs in Europe," 2008, https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0699:FIN:en:PDF.

[31] European Commission, "Critical Raw Materials for the EU: Report of the Ad-Hoc Working Group on Defining Critical Raw Materials," 2010, https://ec.europa.eu/docsroom/documents/5662/attachments/1/translations.

[32] Environmental country risk being defined as the risk of measures taken by countries to protect the environment that could endanger raw materials supply

[33] Brigid Gavin, "China's Growing Conflict with the WTO: The Case of Export Restrictions on Rare Earth Resources," 2013, https://www.intereconomics.eu/contents/year/2013/number/4/article/chinas-growing-conflict-with-the-wto-the-case-of-export-restrictions-on-rare-earth-resources.html.

[34] The WTO ruled against China in its 2011 judgement and confirmed the judgement in 2012, following an appeal by China

[35] Simon Evenett and Johannes Fritz, "Revisiting the China–Japan Rare Earths Dispute of 2010," CEPR, July 19, 2023, https://cepr.org/voxeu/columns/revisiting-china-japan-rare-earths-dispute-2010; Eugene Gholz and Llewelyn Hughes, "Market Structure and Economic Sanctions: The 2010 Rare Earth Elements Episode as a Pathway Case of Market Adjustment," *Review of International Political Economy* 28, no. 3, 2021: 611–34, https://doi.org/10.1080/09692290.2019.1693411; Amy King and Shiro Armstrong, "Did China Really Ban Rare Earth Metals Exports to Japan?," *East Asia Forum*, August 18, 2013, https://eastasiaforum.org/2013/08/18/did-china-really-ban-rare-earth-metals-exports-to-japan/; Jeffrey D. Wilson, "Whatever Happened to the Rare Earths Weapon? Critical Materials and International Security in Asia," *Asian Security* 14, no. 3, 2018: 358–73, https://doi.org/10.1080/14799855.2017.1397977.

costly and risky upstream raw materials investments. Meanwhile, civil society activism also contributed to a gradual shift of the policy debate, placing greater emphasis on environmental, social and governance (ESG) issues in extraction countries, as well as on resource efficiency and recycling.

In the late 2010s and early 2020s, supply chain security re-emerged as a priority due to accelerating demand for CRMs linked to the green and digital transitions, experiences of supply chain disruptions due to the COVID-19 pandemic and intensifying US-China competition. Key signals of this shift included the publication of the 2020 EU Action Plan on Critical Raw Materials and Germany's updated 2020 Raw Materials Strategy.[36] While declaring ambitious aims, these strategies failed to provide integrated plans to achieve specific resilience objectives. These strategies also steered clear from more transformative approaches that aimed to reduce overall material demand or to rethink consumption patterns, despite the continuing salience of such thinking in environmental or development policy contexts.

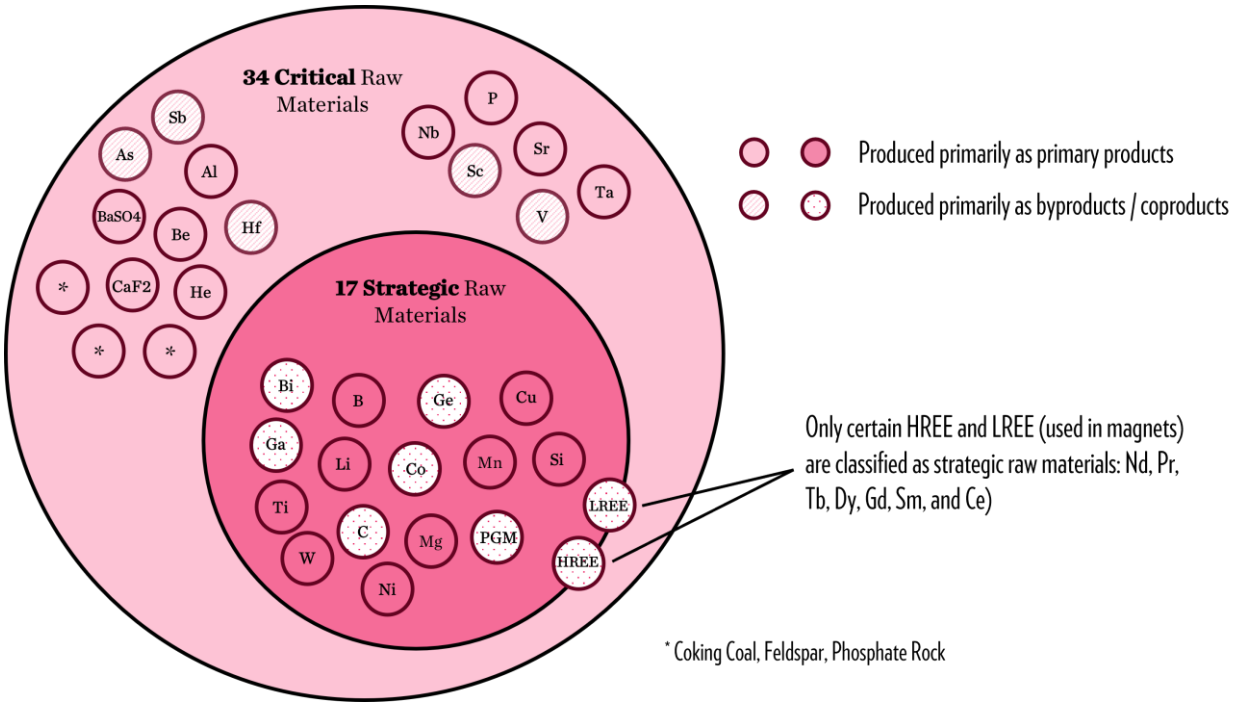
Against this backdrop, the Critical Raw Materials Act (CRMA), in force since May 2024, marks a qualitative shift in European raw materials policy. The CRMA establishes a first comprehensive framework that translates earlier strategic objectives into quantified EU-level benchmarks; it also introduces new governance and coordination mechanisms, including the designation of and support for Strategic Projects across the value chain. Importantly, the CRMA redefines the relationship between EU-level action and national policies. It recognizes that fragmented national approaches alone are insufficient to address structural vulnerabilities. Rather than replacing member state initiatives altogether, the CRMA seeks to align them and further build on them. Member states are required to implement key elements of the framework, but retain a central role in project development and financing. Rather than centralizing authority at the EU level, the CRMA coordinates member state action.

As part of the original CRMA proposal of 2023, the European Commission also published the most recent CRM list of 34 materials.[37] This updated list introduced a distinct category of strategic raw materials (SRMs), comprising 17 materials considered to be of particular strategic importance given their current and future relevance for technologies underpinning the green and digital transitions, as well as those with defense or aerospace applications.

[36] Bundesregierung, "Rohstoffstrategie der Bundesregierung: Sicherung einer Nachhaltigen Rohstoffversorgung Deutschlands mit Nichtenergetischen Mineralischen Rohstoffen," 2020, https://www.bundeswirtschaftsministerium.de/Redaktion/DE/Publikationen/Industrie/rohstoffstrategie-der-bundesregierung.pdf?__blob=publicationFile&v=1; European Commission, "Critical Raw Materials Resilience: Charting a Path towards Greater Security and Sustainability," 2020, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0474.

[37] European Commission, "Annexes to the Proposal for a Regulation of the European Parliament and of the Council Establishing a Framework for Ensuring a Secure and Sustainable Supply of Critical Raw Materials and Amending Regulations (EU) 168/2013, (EU) 2018/858, 2018/1724 and (EU) 2019/1020," 2023, https://eur-lex.europa.eu/resource.html?uri=cellar:903d35cc-c4a2-11ed-a05c-01aa75ed71a1.0001.02/DOC_2&format=PDF. The EU CRM list shows substantial overlap with other major economies, particularly on core inputs such as rare earths, lithium, cobalt, and platinum group metals. Compared to the US, Japan, and the UK, the EU list is relatively comprehensive and includes all minerals commonly identified across these economies, while also covering a small number of additional materials (e.g. bauxite, feldspar) but excluding some bulk metals (e.g. iron or zinc) that others classify as critical.

Figure 2: EU Critical/Strategic Raw Materials by Predominant Production Form



Sources: Critical Raw Materials Act Annex I,[38] US Geological Survey,[39] SFA Oxford[40]

The CRMA sets the following 2030 targets:

- Meet at least 10 percent of the EU's annual aggregate-level SRM consumption through EU-based extraction;
- Meet at least 40 percent of the EU's annual aggregate-level SRM consumption through EU-based processing;
- Meet at least 25 percent of the EU's annual aggregate-level SRM consumption through EU-based recycling;[41]
- Ensure that any single state does not account for more than 65 percent of the EU's supply of any SRM at any relevant stage of processing.

In addition, the CRMA aims to moderate demand growth through resource efficiency, substitution and technological innovation. As such, it requires EU member states to (1) establish national exploration programs, (2) streamline permitting processes and support strategic projects, including through single points of contact and faster procedures, (3) develop circular economy measures, including recycling and waste recovery, and (4) strengthen supply risk monitoring and preparedness, including data reporting and stress testing.[42]

[38] European Commission, "Annexes to the Proposal for a Regulation of the European Parliament and of the Council Establishing a Framework for Ensuring a Secure and Sustainable Supply of Critical Raw Materials and Amending Regulations (EU) 168/2013, (EU) 2018/858, 2018/1724 and (EU) 2019/1020,"
[39] US Geological Survey, "Periodic Table Showing Critical Minerals Produced as Byproducts / Coproducts," December 19, 2025, https://www.usgs.gov/media/images/periodic-table-showing-critical-minerals-produced-byproducts-coproducts.
[40] SFA Oxford, "Helium," 2026, https://www.sfa-oxford.com/rare-earths-and-minor-metals/gaseous-elements-and-noble-gases/electronic-gases/helium-he-2/; SFA Oxford, "Scandium," 2026, https://www.sfa-oxford.com/rare-earths-and-minor-metals/rare-earths-elements/scandium-market-and-scandium-price-drivers/.
[41] More granular, material-specific recycling targets based on waste streams are to be defined via delegated acts by 2027
[42] Lyushui Zuo et al., "Global and Regional Gallium Recycling Potential and Opportunities: Based on Historical Material Flow Analysis," *Sustainability* 18, no. 1, 2025, https://doi.org/10.3390/su18010255.

The RESourceEU Action Plan, adopted by the European Commission in December 2025, is aimed at accelerating and amplifying the efforts outlined in the CRMA and seeks to reduce single-supplier dependencies in REE permanent magnets, battery raw materials and defense-related raw materials value chains by 30 to 50 percent by 2029.[43]

In Germany, the Federal Ministry for Economic Affairs and Energy (*Bundesministerium für Wirtschaft und Energie*, BMWE) leads the national implementation of both the CRMA and RESourceEU Action Plan. While Germany has not formally updated its national raw materials strategy to align with the CRMA, implementation effectively takes places within the EU framework, with national policy increasingly shaped by EU-level objectives and instruments.[44]

The CRMA targets set a sensible general direction and are not examined in detail in the following analysis. However, it is worth noting that they are of limited use as a framework to assess progress toward supply security and resilience. Criticisms include the lack of transparency on how they were derived, reliance on incomplete and partly outdated data, missing links to broader policy objectives such as the energy transition, and their non-binding nature.[45] Most importantly, they do not meaningfully capture system-level resilience. Even in a situation where the CRMA targets are fully met, it remains unclear how long key industries would be able to maintain production in the event of a sudden cutoff from a relevant external supplier, and what levels of production loss, price spikes or downstream economic damage such a scenario would cause. The CRMA does foresee the development of more granular benchmarks for supply security, specifically by tasking the European Commission to propose and incentivize action toward safe levels of stock for each SRM, expressed in days of average daily net imports. As of April 2026, however, these benchmarks have not yet been defined.

[43] Carole Maczkovics et al., "RESourceEU Action Plan – Strengthening the EU's Access to Critical Raw Materials," Global Policy Watch, December 16, 2025, https://www.globalpolicywatch.com/2025/12/resourceeu-action-plan-strengthening-the-eus-access-to-critical-raw-materials/.
[44] Deutscher Bundestag, "Wirkung der Rohstoffstrategie 2020 auf Importabhängigkeiten bei Seltenen Erden," 2025, https://dserver.bundestag.de/btd/21/016/2101615.pdf?utm_source=chatgpt.com.
[45] European Court of Auditors, "Special Report 04/2026: Critical Raw Materials for the Energy Transition"; Think Tank Industrielle Ressourcenstrategien, "Critical Raw Materials Act - Chancen Und Risiken für die Deutsche Wirtschaft," 2024, https://www.thinktank-irs.de/wp-content/uploads/2024/06/RZ_THINKTANK_CRMA_A4_DE_web.pdf.

Past and Current Efforts Along Key Policy Levers

Germany and Europe can improve their CRM resilience in several different ways. Four basic levers cover the key dimensions of the policy space, each following a distinct impact logic: (1) stockpiling materials, (2) expanding their primary supply, (3) expanding recycling efforts ("secondary supply"), and (4) reducing demand for CRMs through greater industrial efficiency or substitution with more easily available alternatives.

Successful CRM policy requires the coordinated use of multiple policy levers rather than a reliance on any single instrument. The effectiveness of different levers depends not only on their individual design, but also on how they are combined into a coherent policy framework. Assembling the right policy mix involves navigating trade-offs, aligning incentives across actors and governance levels and tailored strategies across materials and value chains.

1. Stockpiling

Efforts to date

Stockpiling is the practice of accumulating a reserve supply of a certain commodity. Despite longstanding experience stockpiling other commodities like oil, it has only recently emerged as a serious option within the realm of German and European CRM policy. Conceptually, it is helpful to distinguish two forms of stockpiling. First, decentralized stockpiling by private-sector actors, including major stockpiles managed by private metal trading companies from which downstream consumers may purchase in case of need. Second, centralized strategic stockpiling, where a government purchases, owns and manages the stockpiled minerals directly or through a public agency.[46]

Germany's 2010 Raw Materials Strategy explicitly rejected public stockpiling and firmly located responsibility for supply security with firms. The strategy failed to engage in a deeper conversation on the adequacy of private-sector efforts, let alone on how governments might support these efforts.[47] The 2020 update of the Raw Materials Strategy went a step further, acknowledging the growing political risks and opening the door to considering additional state measures (at least, in principle). But it still failed to endorse or develop stockpiling as a policy instrument and did not mention public reserves or mandatory stockpiling requirements.[48]

As of early 2026, Germany has not established a national strategic CRM stockpile, nor any state-funded support scheme for firm-led stockpiling.[49] This stands in contrast to recurring political signals in favor of a more active state role from senior members of successive governments. The 2021-2025 coalition government had promised greater support for German companies to ensure their supply of raw materials and to examine the use of strategic stockpiling of raw materials critical for security and defense.[50] More

[46] Scanziani et al., "Designing an Effective Strategic Stockpiling System for Critical Minerals."
[47] Bundesministerium für Wirtschaft und Technologie, "Rohstoffstrategie der Bundesregierung: Sicherung einer Nachhaltigen Rohstoffversorgung Deutschlands mit Nicht-Energetischen Mineralischen Rohstoffen."
[48] Bundesregierung, "Rohstoffstrategie der Bundesregierung: Sicherung einer Nachhaltigen Rohstoffversorgung Deutschlands mit Nichtenergetischen Mineralischen Rohstoffen."
[49] Deutscher Bundestag, "Rohstoffversorgung sichern, Exportkontrollen begegnen, Rohstofffonds Aktivieren," 2025, https://dserver.bundestag.de/btd/21/011/2101149.pdf.
[50] BMWK, "Eckpunktepapier des Bundesministeriums für Wirtschaft und Klimaschutz (BMWK): Wege zu einer Nachhaltigen und Resilienten Rohstoffversorgung," 2023, https://www.bundeswirtschaftsministerium.de/Redaktion/DE/Downloads/E/eckpunktepapier-nachhaltige-und-resiliente-rohstoffversorgung.pdf?__blob=publicationFile&v=4; Bundesregierung, "Nationale Sicherheits- und Verteidigungsindustriestrategie," 2024, https://www.bmvg.de/resource/blob/5865332/d4d0d9ab55edde72a11cee2a3ca59d3b/nationale-sicherheits-und-verteidigungsindustriestrategie-data.pdf; Deutscher Bundestag, "Planungs- und Umsetzungsstand der Deutschen Rohstoffpolitik," 2023, https://dserver.bundestag.de/btd/20/090/2009096.pdf.

recently, current Finance Minister and Vice-Chancellor Lars Klingbeil publicly called for the establishment of a European CRM emergency stockpile and expressed support for a stronger role of the state as a strategic investor.[51] Despite these signals, the current government's formal policy remains limited, with a commitment only to "facilitate the stockpiling of important materials."[52] An investigation into which materials could be stockpiled, by whom and under which framework is apparently still ongoing. In parallel, the newly established National Security Council announced a CRM action plan in its first session.[53] However, as this plan is not intended for publication, its content and implementation status remain unclear. At the same time, the government has opted against more intrusive measures, rejecting a central register or additional reporting requirements for highly dependent firms beyond existing EU-level obligations.[54]

The BDI and the metalworkers' union IG Metall have signaled cautious approval of publicly supported private-sector stockpiling. At the same time, they warn against strategic stockpiling moves beyond security and defense and "volatility-increasing state intervention."[55] The Association of German Chambers of Industry and Commerce (*Deutsche Industrie- und Handelskammer*, DIHK) has strongly pushed back against any public stockpiling, citing concerns about market distortions.[56]

Firm-led, private-sector stockpiling does occur in large German defense companies.[57] According to a 2025 Germany Trade and Invest (GTAI) survey, about 60 percent of small and medium-sized enterprises (SMEs) across various industries have also invested in increased stockpiling, though the extent of their efforts and the respective baselines remain unclear.[58] Reports about imminent production stops following Chinese restrictions and anecdotal evidence by specialized traders such as Tradium, which store selected CRMs in secure facilities within Germany for private-sector clients, demonstrate that few firms have increased their stockpiles to levels at which they are genuinely resilient against shocks.[59] In light of this, the German government is now considering additional incentives for stockpiling at the private level.[60] Possible measures include adjustments to tax law or access to state aid.

At the European level, there is currently also no structural mechanism to manage stockpiling and release, even though the topic has gained renewed political momentum. In summer 2025, the European Commission adopted an EU Stockpiling Strategy aimed at strengthening coordination between European member states, improving risk assessments and exploring the development of EU-level reserves for essential

[51] Federal Ministry of Finance, "'Reforms for a Strong Germany': Speech by Lars Klingbeil at the Bertelsmann Foundation," 2026, https://www.bundesfinanzministerium.de/Content/EN/Reden/2026-03-25-reforms-for-a-strong-germany.html; Sophie Garbe and Andreas Niesmann, "Vizekanzler Klingbeil über die USA: Trump hält Europa den Spiegel vor," *Der Spiegel*, January 22, 2026, https://www.spiegel.de/politik/deutschland/lars-klingbeil-ueber-die-usa-donald-trump-haelt-europa-den-spiegel-vor-a-308c0950-7b8a-4950-b34c-83c6fe806137.

[52] Bundesregierung, "Koalitionsvertrag zwischen CDU, CSU Und SPD," 2025, https://www.koalitionsvertrag2025.de/sites/www.koalitionsvertrag2025.de/files/koav_2025.pdf; Deutscher Bundestag, "Rohstoffversorgung Sichern, Exportkontrollen Begegnen, Rohstofffonds Aktivieren."

[53] Bundesregierung, "Erste Sitzung des Nationalen Sicherheitsrats," November 6, 2025, https://www.bundesregierung.de/breg-de/aktuelles/start-nationaler-sicherheitsrat-2392476.

[54] Deutscher Bundestag, "Rohstoffversorgung Sichern, Exportkontrollen Begegnen, Rohstofffonds Aktivieren."

[55] Bündnis Zukunft der Industrie, "Wirtschaftssicherheit und Resilienz als Fundament einer Zukunftsfähigen Industrie," 2025, https://buendnis-zukunft-der-industrie.de/wp-content/uploads/2025/11/Rohstoffpolitik_Wirtschaftssicherheit-und-Resilienz.pdf.

[56] DIHK, "Für eine Sichere, Bezahlbare und Nachhaltige Rohstoffversorgung," 2025, https://www.dihk.de/resource/blob/159526/77ff79bd6ee1247b29cc5048d7bc0d3f/umwelt-dihk-positionspapier-rohstoffe-2025-data.pdf.

[57] Marketscreener, "Rheinmetall Confident in Critical Raw Material Supplies," September 1, 2025, https://www.marketscreener.com/news/rheinmetall-confident-in-critical-raw-material-supplies-ce7c50d2d18dff21.

[58] GTAI, "Mittelstand bereit für höhere Rohstoffkosten," 2025, https://www.gtai.de/de/trade/deutschland/specials/gtai-umfrage-rohstoffsicherheit-1938812.

[59] Markus Becker, "Seltene Erden: Bänder in Deutschland stehen still, wenn China es will," *Der Spiegel*, July 3, 2025, https://www.spiegel.de/wirtschaft/seltene-erden-deutsche-betriebe-stoppen-offenbar-produktion-wegen-rohstoff-knappheit-a-43177e8a-fbff-46b6-b675-5bfa14f10872; Rare Earth Exchanges, "Germany's Rare Earth Bunker: The Vault That Could Keep Europe Running," December 15, 2025, https://rareearthexchanges.com/news/germanys-rare-earth-bunker-the-vault-that-could-keep-europe-running/; Tradium, "2025 steht im Zeichen der strategischen Lagerhaltung," 2025, https://tradium.de/markteinblick/2025-steht-im-zeichen-der-strategischen-lagerhaltung/.

[60] Sonja Álvarez, "Kritische Rohstoffe: Warum die Regierung eine Lockerung der Schuldenbremse prüft," February 17, 2026, https://www.wiwo.de/politik/deutschland/kritische-rohstoffe-warum-die-regierung-eine-lockerung-der-schuldenbremse-prueft/100200665.html.

goods, including CRMs.[61] However, the strategy mainly establishes a governance and coordination framework, rather than defining concrete operational arrangements.

Alongside France and Italy, Germany now participates in a European Commission-led pilot initiative on coordinated EU stockpiling that was originally announced in the 2025 RESourceEU Action Plan.[62] In this informal coalition, Germany reportedly contributes to sourcing efforts, France to financing and Italy to storage logistics.[63] The pilot is expected to focus on a limited number of materials, most likely through a special purpose vehicle. Details about who would stockpile and how the initiative would be financed, especially beyond the pilot stage, remain unclear. A planned EU CRM Centre would eventually coordinate these activities or carry out stockpiling on its own, but is unlikely to become operational before 2028.

Overall, Germany's stockpiling agenda is moving forward primarily through European coordination; implementation remains at an exploratory stage. Renewed interest in public stockpiles is mostly met with private sector skepticism, which had already contributed to a softened, monitoring-based approach in the CRMA.[64] The current EU-level initiatives are a renewed attempt to move beyond purely advisory or monitoring frameworks toward more operational coordination. This overall picture of German stockpiling remains broadly representative of EU countries: while France and the Netherlands have begun moving toward strategic CRM stocks, there is still no evidence of a mature public CRM stockpile regime or binding firm-level CRM stockholding requirements across EU member states.[65]

International experiences and ongoing debates

At first glance, a broader international comparison highlights that most countries have historically relied on private companies to secure raw materials on global markets. The International Energy Agency's (IEA) Critical Minerals Policy Tracker shows that only four states currently have dedicated national stockpiling mechanisms in place: Japan, South Korea, China, and the US.[66] These four, however, are among the world's dominant industrial powers; together they account for more than 50 percent of global industrial value added.[67]

Among these states, Japan stands out: it established a national stockpiling system for rare metals as early as 1983.[68] Since 2004, the public agency Japan Organization for Metals and Energy Security (JOGMEC) has set public stockpile targets depending on each mineral's supply risk and directly procured accordingly.[69] These minerals can then be released to companies in case prices hit pre-determined crisis levels. South Korea operates a comparable system through a dedicated public agency.

In the US, the National Defense Stockpile, managed by the Defense Logistics Agency, is supposed to accumulate materials that supply the military, industrial and essential civilian needs for national defense. While stockpiling requirements for most minerals were drastically reduced after the end of the Cold War,

[61] European Commission, "EU Stockpiling Strategy: Boosting the EU's Material Preparedness for Crises," 2025, https://www.europarl.europa.eu/RegData/docs_autres_institutions/commission_europeenne/com/2025/0528/COM_COM(2025)0528_EN.pdf.
[62] European Commission, "RESourceEU Action Plan: Accelerating Our Critical Raw Materials Strategy to Adapt to a New Reality," 2025, https://single-market-economy.ec.europa.eu/document/download/01c448d6-dc93-40d7-9afe-4c2af448d00c_en.
[63] Pratima Desai and Julia Payne, "Exclusive: Italy, France and Germany to Lead EU Critical Materials Stockpiling Plan, Sources Say," *Reuters*, February 04, 2026, https://www.reuters.com/sustainability/climate-energy/italy-france-germany-lead-eu-critical-materials-stockpiling-plan-sources-say-2026-02-04/.
[64] Mark Burton et al., "Europe Balks at Strategic Stockpile for Critical Green Metals," *Bloomberg*, 2023, https://www.bloomberg.com/news/articles/2023-03-13/europe-balks-at-strategic-stockpile-for-critical-green-metals.
[65] French Senate, "Dépendance de la France aux métaux rares nécessaires aux technologies de défense," 2025, https://www.senat.fr/questions/base/2025/qSEQ251106603.html; Ministry of Economic Affairs and Climate Policy Netherlands, "Weerbare ketens: stappen naar strategische voorraden en verwerking van kritieke grondstoffen," 2025, https://open.overheid.nl/documenten/30ad3617-66fd-410d-bf9c-eed23041dcdc/file.
[66] International Energy Agency, "Critical Minerals Policy Tracker – Data Tools," 2025, https://www.iea.org/data-and-statistics/data-tools/critical-minerals-policy-tracker.
[67] World Bank, "Industry (Including Construction), Value Added (Current US$)," 2026, https://data.worldbank.org/indicator/NV.IND.TOTL.CD?most_recent_value_desc=true.
[68] METI Journal, "Our Mission Is to Ensure a Stable Supply of Important Minerals, Including Rare Earths! JOGMEC's Role and Future Developments, as Told by the Chairman," November 17, 2025, https://journal.meti.go.jp/policy/202510/42544/.
[69] JOGMEC does not disclose actual stockpiles of specific minerals. The most recent public document (2020 International Resource Strategy, not accessible online) determined public stockpile targets with a baseline of 60 days, extending to up to 180 days for high-risk minerals.

recent years have seen dedicated efforts to recapitalize and restore the stockpile of critical minerals, with President Trump earmarking 2 billion USD.[70] In addition, the Trump Administration has decisively pivoted toward large-scale stockpiling in a public-private model. In early 2026, the US government launched Project Vault, a 12 billion USD initiative supported by the Export-Import Bank to establish a critical minerals reserve in partnership with major non-defense industrial firms.[71] The program is set up as a public-private partnership based on public financing and private-sector manufacturers, committed to both procuring specific volumes upfront and paying a fee in exchange for guaranteed access during disruptions.

The recent US efforts have contributed to a broader reinvigoration of debates around stockpiling, as well as to a certain shift of perspective. Traditionally, stockpiles were considered to be instruments of last resort, offering a final buffer to deal with residual risk once other risk-mitigation measures had been exhausted. Their purpose was to help governments and companies keep critical functions running until supply chain disruptions, limited in time or scope, had passed or alternative supplies were secured. In contrast, advocates for stockpiles have increasingly argued that they can also serve as a baseline resilience mechanism, especially in the case of structurally distorted markets. In the short term, stockpiles can function as a buffer against supply disruptions and ensure minimum operational capacity during crises. By reducing the immediate vulnerability of downstream industries to export restrictions or supply shocks, stockpiles can also limit the leverage of dominant suppliers and potentially help deter coercive trade measures in the first place. Finally, at least in certain low-volume markets, stockpiles could also help de-risk new mining or processing projects by providing a certain degree of guaranteed demand and by countering potential price manipulation. In this role as a bridging instrument, strategic stockpiles could buy time while longer-term measures, including price support, recycling or substitution, are realized.

Among those voices that are generally supportive of stockpiling, there is still lively debate about the advantages and drawbacks of different designs. Proponents of private-sector stockpiling believe 'their' model to be more efficient: it builds on existing logistics capabilities and supply-chain expertise of companies with intricate knowledge of the type, qualities and quantities of materials necessary for their production processes. Compared with public stockpiling programs, private inventories can be established more quickly and at lower fiscal cost, all the while helping to establish baseline demand. They also avoid some of the market distortions that may accompany large-scale public purchases.

On the downside, private-sector stockpiling does not overcome the structural incentives that encourage companies to prioritize cost efficiency and short-term profitability over achieving a diversified supply – even if they are, indeed, incentivized through public support. It is also subject to free-rider problems, as some companies may rely on others to maintain inventories while minimizing their own costs. As a result, decentralized stockpiling is unlikely to yield optimal results from a resilience perspective. Moreover, private stockpiles remain governed by firm-level commercial logic rather than public allocation priorities. In the event of a crisis, companies will understandably prioritize maintaining their own production rather than sharing materials with other sectors or firms where shortages may cause greater damage from a societal perspective. Mandatory stockpiling requirements could help overcome many of these constraints, but at the expense of imposing real costs on downstream companies and, by extension, consumers.

State-led stockpiling efforts' basic advantage is that they can be designed directly to best serve public priorities. They also avoid burdening domestic companies. However, poorly designed stockpiling programs can also distort the market. Large purchases may drive up prices or encourage speculative hoarding by

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[70] Gracelin Baskaran and Samantha Dady, "Minerals at War: Strategic Resources and the Foundations of the U.S. Defense Industrial Base," Center for Strategic and International Studies, 2026, https://www.csis.org/analysis/minerals-war-strategic-resources-and-foundations-us-defense-industrial-base; Steff Chávez and Camilla Hodgson, "Pentagon Invests $150mn in US Gallium Company to Secure Strategic Supplies," *Financial Times*, January 12, 2026, https://www.ft.com/content/00b2ba44-9f20-4d41-9b01-3df9dde5dae7; White House, "Building Resilient Supply Chains, Revitalizing American Manufacturing, and Fostering Broad-Based Growth," 2021, https://bidenwhitehouse.archives.gov/wp-content/uploads/2021/06/100-day-supply-chain-review-report.pdf?utm_source=sfmc%E2%80%8B&utm_medium=email%E2%80%8B&utm_campaign=20210610_Global_Manufacturing_Economic_Update_June_Members.

[71] Export-Import Bank of the United States, "Week in Review: Project Vault and the U.S. Strategic Critical Mineral Reserve" February 06, 2026, https://www.exim.gov/news/week-review-project-vault-and-strategic-critical-mineral-reserve.

other market participants, while sudden releases can depress prices and undermine private investment. If countries pursue stockpiling strategies without coordination, such dynamics may reinforce global hoarding cycles. The presence of a public strategic stockpile may also weaken companies' incentives to maintain their own buffers and reinforce free rider behavior, thereby 'socializing' the costs of what is effectively an aspect of corporate risk management. What is more, the public financial resources required for both the initial purchases and the ongoing management and storage of the stockpile should not be underestimated. Although operating costs are typically modest compared to the economic damage of supply disruptions, a significant amount of capital could get tied up in stockpiles which could otherwise be invested in measures that directly expand supply or processing capacity.[72] In the same vein, historical experience suggests that maintaining stockpiles over time can be politically challenging. Once the immediate crisis that motivated their creation subsides, governments often face pressure to reduce or liquidate reserves.[73]

Importantly, the feasibility of stockpiling also differs by mineral and value-chain stages.[74] How fragile, hazardous, chemically reactive, or sensitive to humidity materials are varies significantly, resulting in widely ranging shelf lives and warehouse requirements across materials (even if many warehousing challenges can be addressed through technical or organizational means). The form of the material also matters. For stockpiles to be most useful in the case of a disruption, the stored materials should ideally be directly usable in domestic production processes. As many industries rely on highly specialized alloys or processed materials, this can be difficult to achieve.[75] In addition, stockpiling always carries the risk of creating 'stranded' inventories, which can happen when technological changes or shifts in demand render certain materials obsolete. Finally, if there is a highly dominant supplier of a material, that actor may be able to hinder stockpiling efforts in the first place. In recent years, China has tightened its export licensing for REE and related products. While measures currently in place do not amount to a blanket export ban, they grant authorities broad discretion to restrict shipments, including to military end users. Reportedly, limited approval volumes and tightly controlled delivery schedules make it difficult for foreign buyers to accumulate inventories beyond immediate production needs.

Finally, establishing EU-level stockpiles would undoubtedly raise governance questions about the relations between the EU and member states. The latter may be reluctant to delegate decisions about the allocation and release of strategic materials to supranational institutions. Integrating local content or supply diversification criteria into public procurement could further complicate political negotiations. Overall, it is clear that any public stockpiling mechanism would require clearly defined rules governing acquisition, release, allocation priorities, and coordination with allies.

2. Expanding Primary Supply

Efforts to date

Expanding German and European primary supply means promoting new mining and processing projects, either within Europe or in partner countries. At the most basic level, this can happen in one of two ways: (1) by improving conditions for investments on the supply side and (2) by fostering reliable demand at price levels that make investments into additional capacity attractive. German and European efforts, both domestically and internationally, have overwhelmingly focused on the supply side, while discussions on demand-side interventions remain at an incipient stage.

[72] Scanziani et al., "Designing an Effective Strategic Stockpiling System for Critical Minerals."
[73] Baskaran and Dady, "Minerals at War: Strategic Resources and the Foundations of the U.S. Defense Industrial Base."
[74] Scanziani et al., "Designing an Effective Strategic Stockpiling System for Critical Minerals."
[75] Scanziani et al., "Designing an Effective Strategic Stockpiling System for Critical Minerals."

Domestically, improving regulatory conditions, infrastructure and financial de-risking have long been seen as central to facilitating supply expansion.[76] Regulatory measures may comprise efforts to streamline permitting and other bureaucratic processes to shorten the time between exploration and production, as well as actual rule changes that make it easier to realize an envisaged project. Attempts to streamline permitting in Germany have focused mainly on adjustments to the *Bundesberggesetz*, which is set at the federal level but implemented by state-level mining authorities in the German states (*Bundesländer*).[77] This division has led to significant regional variation in procedures and timelines. Reform efforts became most concrete under the 2021-2025 coalition but did not result in concrete draft bills, let alone in legislative changes. At the same time, permitting outcomes are not determined by mining law alone. Projects are also subject to a broader set of environmental and planning regulations, including water law, nature conservation law and immission control law.

Beyond facilitating permitting and other regulatory conditions, governments also have a clear role to play in providing enabling infrastructure for logistics and energy, as well as in promoting access to affordable energy through relevant policies. A third measure to facilitate supply expansion is financial de-risking; available governmental instruments to address the capital-intensive and high-risk nature of CRM projects include outright grants and loans, as well as guarantees that reduce risks for private lenders.

In Germany, the most prominent financing instrument for CRM projects is the Raw Materials Fund, launched in 2024 and managed by the German development bank *Kreditanstalt für Wiederaufbau* (KfW). The fund makes up to 1 billion euros available for minority equity investments across extraction, processing and recycling projects in Germany, the EU and selected partner countries. To be eligible, projects must have signed offtake agreements with German or EU buyers that last at least five years. Its first (and so far, only) two disbursements were granted in 2025 to a domestic lithium project ("Vulcan Energy") and in 2026 to a REE mining and processing project in Australia.[78] Before the fund became operational, the German government financed individual projects through the *Bundesregelung Transformationstechnologien* under the EU's Temporary Crisis and Transition Framework.[79]

Other instruments in use include untied loan guarantees for financial institutions that fund international raw materials projects, as well as a 2025 national exploration program to improve the identification and evaluation of domestic CRM/SRM potential, as required under the EU CRMA. Most of this limited funding (around 10.6 million euros annually), however, reinforces long-standing projects rather than enabling new domestic mining ventures. Germany had a comparable program in place from 2013 until 2015, when it was discontinued due to a lack of industry buy-in.[80]

Despite these financial initiatives, the German raw materials industry has not yet seen a major reversal of its sustained downturn, with few new local projects successfully scaling their operations. In parallel, fully operational divisions and projects working on a range of different materials struggled to offer internationally competitive prices and regularly had to close down or were sold to foreign companies.[81] Some firms have recently begun to move toward longer-term demand-side commitments to support upstream

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[76] Stefan Steinicke, "Rohstoffe „made in Germany"," *Internationale Politik*, April 24, 2024, https://internationalepolitik.de/de/rohstoffe-made-germany.

[77] EY Germany, "Genehmigungsverfahren zum Rohstoffabbau in Deutschland – Endbericht," 2022, https://www.bundeswirtschaftsministerium.de/Redaktion/DE/Publikationen/Industrie/ey-gutachten-genehmigungsverfahren-zum-rohstoffabbau-in-deutschland.pdf

[78] Bundesministerium für Wirtschaft und Energie, "Startschuss für erstes Projekt des Rohstofffonds: Australien und Deutschland begrüßen Investitionen in Lithium-Projekt von Vulcan Energy in Deutschland," December 03, 2026, https://www.bundeswirtschaftsministerium.de/Redaktion/DE/Pressemitteilungen/2025/12/20251203-startschuss-fuer-erstes-projekt-des-rohstofffonds-australien-und-deutschland-begruessen-investitionen.html.

[79] Bundesministerium für Wirtschaft und Energy, "Der Bund unterstützt gemeinsam mit Rheinland-Pfalz und Hessen zwei strategisch wichtige Investitionsvorhaben zur Lithiumgewinnung in Deutschland," July 22, 2026, https://www.bundeswirtschaftsministerium.de/Redaktion/DE/Pressemitteilungen/2025/07/20250722-bund-unterstuetzt-mit-rheinland-pfalz-und-hessen-zwei-investitionsvorhaben-zur-lithiumgewinnung-in-deutschland.html.

[80] EY Germany, "Staatliche Instrumente Zur Erhöhung Der Versorgungssicherheit von Mineralischen Rostoffen," 2022, https://www.bundeswirtschaftsministerium.de/Redaktion/DE/Publikationen/Industrie/studie-staatliche-instrumente-versorgungssicherheit.pdf?__blob=publicationFile&v=1.

[81] Bart Groothuis et al., "Entschliessungsantrag zu Maßnahmen gegen Chinas Ausfuhrbeschränkungen für kritische Rohstoffe," European Parliament, 2025, https://www.europarl.europa.eu/doceo/document/B-10-2025-0330_DE.html; Frank Heine, "Masan-Gruppe verkauft H.C. Starck an Mitsubishi Materials," *Goslarsche,* May 14, 2024, https://www.goslarsche.de/lokales/Masan-Gruppe-verkauft-HC-Starck-an-Mitsubishi-Materials-412010.html; Godehard Weyerer, "Deutschlands einzige Aluminiumoxid-Fabrik," *Deutsche Welle*, January 10, 2020, https://www.dw.com/de/deutschlands-einzige-fabrik-f%C3%BCr-aluminiumoxid/a-51919971.

investments and projects based in Europe or partner countries. For example, Volkswagen concluded a 10-year offtake agreement with Canadian lithium company Patriot Battery Metals in 2024 to secure lithium supply for battery production in Europe and North America.[82] However, in the absence of coordinated public frameworks, such initiatives continue to fall short of a large-scale and reliable long-term demand signal.

Internationally, Germany has long attempted to build bilateral partnerships with countries across the globe, hoping to help those countries expand their own CRM production and processing capacity while simultaneously securing a certain level of privileged access to the resulting outputs. In this vein, Germany concluded its first bilateral raw materials partnership with Mongolia in 2011, followed by two more with Kazakhstan in 2012 and Peru in 2014.[83] It also signed a Memorandum of Understanding (MoU) with Chile in 2013 and a number of cooperation agreements and additional MoUs in a second wave with Canada, Australia, Brazil, Uzbekistan, Ghana, and India.[84] Germany also established so-called competence centers for mining and raw materials at Chambers of Commerce in Chile, Canada, South Africa (focusing also on Zambia, Zimbabwe and the Democratic Republic of Congo, DRC), Australia, Brazil, Peru, Ghana, and notably, China. Finally, Germany supports an additional 16 raw materials partnerships struck at EU level, again including Canada, Chile, Kazakhstan, Uzbekistan, and Australia.

Many of the instruments relevant to supporting domestic CRM industries have also been central to these international efforts, notably including concessional financing through development bank KfW and state guarantees to support private sector investments. KfW has long supported raw material-related projects, primarily through KfW IPEX-Bank. The outstanding portfolio attributed to the relevant "Basic Industries" category amounted to 8.9-10 billion euros between 2015 and 2019, though this high-level industrial sector grouping extends beyond raw materials projects in a narrow sense.[85] From 2020 onward, the category was narrowed and renamed "Resources and Recycling," amounting to 8.4-9.2 billion euros in portfolio stocks throughout the period until 2023.[86] Examples illustrate that this support extends across extraction, processing and recycling, mostly in projects outside the EU. For example, KfW IPEX-Bank provided 300 million USD for Peru's Mina Justa copper mine, 195 million USD for a silicon smelter in Iceland and more recently, 150 million USD for the expansion of the Centinela copper mine in Chile.[87]

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[82] Volkswagen Group, "Volkswagen and PowerCo Make Strategic Investment in North American Lithium Company Patriot Battery Metals," December 18, 2024, https://www.volkswagen-group.com/en/press-releases/volkswagen-and-powerco-make-strategic-investment-in-north-american-lithium-company-patriot-battery-metals-18910.

[83] Bundesministerium für Wirtschaft und Energie, "Abkommen zwischen der Regierung der Bundesrepublik Deutschland und der Regierung der Mongolei über Zusammenarbeit im Rohstoff-, Industrie- und Technologiebereich," 2011, https://www.bundeswirtschaftsministerium.de/Redaktion/DE/Downloads/A/abkommen-zwischen-brd-und-mongolei-zusammenarbeit-rohstoff-industrie-technologie.pdf; Bundesministerium für Wirtschaft und Energie, „Abkommen zwischen der Regierung der Bundesrepublik Deutschland und der Regierung der Republik Kasachstan über Partnerschaft im Rohstoff-, Industrie- und Technologiebereich," 2012, https://www.bundeswirtschaftsministerium.de/Redaktion/DE/Downloads/A/abkommen-zwischenbrd-und-kasachstan-partnerschaft-rohstoff-industrie-und-technologiebereich.pdf; Auswärtiges Amt, "Rohstoffpartnerschaft mit Peru abgeschlossen," July 14, 2014, https://www.auswaertiges-amt.de/de/newsroom/140714-rohstoffpartnerschaft-peru-263704

[84] Bundesministerium für Wirtschaft und Energie, "Gemeinsame Erklärung der Regierung der Bundesrepublik Deutschland und der Regierung der Republik Chile zur Zusammenarbeit im Bereich Bergbau und mineralische Rohstoffe," 2013, https://www.bundeswirtschaftsministerium.de/Redaktion/DE/Downloads/G/gemeinsame-erklaerung-chile-deutschland.pdf; Bundesministerium für Wirtschaft und Energie, "Gemeinsame Absichtserklärung zwischen der Regierung der Bundesrepublik Deutschland und der Regierung Kanadas zur Zusammenarbeit zu kritischen Rohstoffen," 2025, https://www.bundeswirtschaftsministerium.de/Redaktion/DE/Downloads/G/gemeinsame-absichtserklaerung-zwischen-deutschland-und-kanada-zu-kritischen-rohstoffen.pdf; Deutscher Bundestag, "Aktueller Stand von bilateralen Rohstoffabkommen und Rohstoffpartnerschaften der Bundesrepublik Deutschland mit anderen Staaten und Planungen für weitere derartige Abkommen und Partnerschaften," 2026), https://dserver.bundestag.de/btd/21/040/2104072.pdf; Deutscher Bundestag, "Wirkung der Rohstoffstrategie 2020 auf Importabhängigkeiten bei Seltenen Erden."

[85] Based on annual reports listed under KfW IPEX-Bank, "Annual Report of KfW IPEX-Bank," n.d., https://www.kfw-ipex-bank.de/Presse/Download-center/Annual-report/

[86] These figures do not capture the full spectrum of KfW IPEX-Bank's raw-material-related exposure, since the annual reports separately record loans for own account, contingent liabilities, or irrevocable loan commitments, although lending clearly remains the dominant instrument. From 2024 onward, KfW IPEX-Bank reorganized its sector structure into four broader business sectors and there no longer is a directly comparable standalone raw materials bucket.

[87] KfW IPEX-Bank, "KfW IPEX-Bank Finances Mina Justa Copper Mine in Peru," 2018, https://www.kfw-ipex-bank.de/Presse/News/News-Details_485824-2.html; KfW IPEX-Bank, "Rohstoffe," n.d., https://www.kfw-ipex-bank.de/Geschäftssparten/Industrie-Handel/Grundstoffe-und-Recycling/Rohstoffe/; Martin Sattler, "In Húsavík in Island wird eine der modernsten und nachhaltigsten Siliziumanlagen der Welt gebaut," KfW, https://www.kfw.de/stories/kfw/stories/umwelt/natuerliche-ressourcen/nachhaltige-silizium-anlage-husavik-island/.

Beyond project financing, Germany's raw materials partnerships have sought to leverage instruments from the broader development cooperation toolbox, extending into areas such as capacity building (e.g., geological mapping, regulatory frameworks), technology and knowledge transfer, as well as training and skills development, often with a strong emphasis on supporting local value creation alongside ESG standards.[88]

While it is arguably still too early to assess the contributions of Germany's more recent raw materials agreements, the first wave of partnerships concluded in the 2010s is widely assessed as having delivered limited tangible results at best. A recent review of the partnerships with Mongolia and Kazakhstan observes that Germany's raw materials trade with both countries has remained negligible.[89] While extraction and processing of (at least some) materials has expanded in the partner countries, this has largely occurred without the participation of German investors. Overall, the authors of the review describe these partnerships as marked by "discrepancies between expectations and engagement on both sides," as well as by challenges arising both from uncoordinated activities among EU countries and from domestic political dynamics in partner countries. Other assessments of Germany's early raw materials partnerships reach similar conclusions: these partnerships have produced limited commercial engagement by German companies and contend with a lack of concrete incentives, financing mechanisms and insufficient implementation of projects.[90] Similar challenges are also evident at the EU level, where recent assessments point to limited project pipelines, slow financing and insufficient private-sector engagement.[91] Moreover, Germany and Europe are also ill-prepared for the possibility that their raw materials cooperation efforts abroad will actually bear fruit, given a lack of safeguards to ensure access to materials from projects realized with their support and to prevent non-European actors from acquiring these assets.[92]

At the EU level, recent efforts to expand supply both within member states and internationally have largely been structured around the CRMA and the ReSourceEU Action Plan.[93] A key outcome of the CRMA is the Strategic Projects designation, under which selected projects are meant to benefit from streamlined processes and EU support when finding financial support. As of April 2026, 60 projects have been selected, 47 of which are located within the EU.[94] In practice, however, the impact of this measure has been limited, mainly because the designation does not override national environmental law, resolve local political opposition or come with dedicated EU funding. In a recent analysis, the EU Court of Auditors found that many selected projects will struggle to contribute to a more secure supply for the EU by 2030 (as envisaged in the CRMA), as they are still in an early stage of development and as the process did not enforce strict requirements on financial viability or secured offtake with EU buyers.[95]

Financial support and de-risking have gained prominence but remain characterized by a reliance on repackaged or reconfigured instruments and considerable fragmentation across EU and member state schemes. For example, while the ReSourceEU Action Plan was presented as mobilizing 3 billion euros for new priority projects related to permanent magnets, batteries and defense-critical inputs, critics were

[88] Franziska Korn et al., "*R*ohstoff-Partnerschaften : Spannungsfeld zwischen Menschenrechten, Transformation und wirtschaftlicher Souveränität," 2024, http://collections.fes.de/publikationen/450111.
[89] Jakob Kullik et al., "Das Ende der Rohstoffpartnerschafts-Illusion? Die bilateralen Rohstoffpartnerschaften Deutschlands mit der Mongolei und Kasachstan im Fokus – Bilanz und mögliche Weichenstellungen nach vorne," Konrad-Adenauer-Stiftung, 2026, https://www.kas.de/documents/268650/44961800/Das+Ende+der+Rohstoffpartnerschafts-Illusion.pdf/87eb2fc8-214b-5184-20ec-676f417a9e54.
[90] Bundesrechnungshof, "Rohstoffpartnerschaften: Abschließende Prüfungsmitteilung an das Bundesministerium für Wirtschaft und Klimaschutz," 2021, https://www.bundesrechnungshof.de/SharedDocs/Downloads/DE/Berichte/2022/rohstoffpartnerschaften-volltext.pdf; Lukas Rüttinger et al., "Die deutschen Rohstoffpartnerschaften - Analyse der Umsetzung und Ausblick," Umweltbundesamt, 2017-02-01_rohpolress_ka_6_rohstoffpartnerschaften.pdf.
[91] Meike Schulze, "Strategic Raw Material Cooperation between Africa and Europe. Making EU External Instruments Fit for African Industrial Drive and European Resilience," 2026, https://www.swp-berlin.org/publikation/strategic-raw-material-cooperation-between-africa-and-europe.
[92] Jakob Hensing and Ricardo Soares de Oliveira, "Europe Cannot Afford to Leave Its Critical Raw Materials Projects Unprotected," *Agenda Publica*, April 9, 2026, https://agendapublica.es/noticia/20898/europe-cannot-afford-to-leave-its-critical-raw-materials-projects-unprotected.
[93] Arthur Leichthammer, "The EU's Critical Raw Materials Predicament: ReSourceEU to the Rescue," 2025, https://www.delorscentre.eu/fileadmin/2_Research/1_About_our_research/2_Research_centres/6_Jacques_Delors_Centre/Publications/20251219_Policy_Brief_ReSourceEU_Arthur_Leichthammer.pdf.
[94] European Commission, "Selected Strategic Projects under CRMA," 2026, https://single-market-economy.ec.europa.eu/sectors/raw-materials/areas-specific-interest/critical-raw-materials/strategic-projects-under-crma/selected-projects_en.
[95] European Court of Auditors, "Special Report 04/2026: Critical Raw Materials for the Energy Transition."

quick to note that the underlying funds had largely been announced previously under different instruments, even though the Action Plan provided for a new conditionality that requires supported projects to serve European demand.[96] In terms of outright public participation in projects, the ReSourceEU Action Plan foresees the creation of a CRM Centre with the potential to deploy equity and other financial instruments, but these plans are currently still in an early stage. More concretely, the European Bank for Reconstruction and Development has launched a 100 million euro equity facility for CRM exploration, representing one of the few dedicated European efforts to support upstream investment through direct public participation.[97]

German and European policy measures to date have largely remained focused on improving financing and regulatory conditions on the supply side, despite widespread general recognition that the financial viability of projects both at home and abroad is decisively shaped by demand conditions (this, of course, applies not only to primary supply, but also to recycling and substitution). The tentative steps taken on the demand side so far remain limited to demand aggregation and joint purchasing, with the aim of reducing fragmentation among European buyers and providing clearer demand signals to project developers. In Germany, one measure pointing in this direction has been the relaunch of the German Mining & Resources Network in 2024.[98] The network bundles competence centers for mining and raw materials at Chambers of Commerce, DERA, GTAI, and DIHK, and serves as a central contact point for companies, a provider of market intelligence and a platform for matchmaking and business facilitation.

At the EU level, the RESourcEU Action Plan goes further and proposes to pool demand more proactively as a tool to strengthen the purchasing position of European buyers vis-à-vis ex-China suppliers. To operationalize this approach, the European Commission established a Raw Materials Mechanism under the EU Energy and Raw Materials Platform in November 2025.[99] The mechanism is intended to function primarily as a matchmaking and coordination platform. It connects groups of buyers, particularly smaller firms, with suppliers and, where relevant, storage or stockpiling providers from the EU, the European Economic Area, the European Overseas Countries and Territories (OCTs), and countries participating in strategic raw materials partnerships.[100] The idea is that demand aggregation may enable suppliers to conclude offtake agreements with European buyers that would otherwise be difficult to organize individually. Under this model, the European Commission, however, explicitly refrains from participating in commercial negotiations. The European Commission launched the first call to gather buyers and suppliers on April 13, 2026.[101]

International experiences and ongoing debates

Like Germany and Europe, other states have also used these instruments to promote primary supply. Some, however, have taken significantly more steps toward the active shaping of markets and direct intervention, especially on the demand side. Japan, for example, has long relied on a centralized, governmental operating arm (JOGMEC) that combines financing, risk-sharing and strategic coordination across the value chain. More specifically, JOGMEC de-risks the activities of large trading houses like Sojitz through financial and technical support. These trading houses pool often-dispersed demand by private companies, identify and invest in projects and negotiate and sign offtake agreements. Through this scheme, any public investment is clearly connected to the guaranteed offtake (either in full or partially) by Japanese companies.

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[96] Arthur Leichthammer, "The EU's Critical Raw Materials Predicament: ReSourceEU to the Rescue."
[97] European Commission, "RESourceEU Action Plan: Accelerating Our Critical Raw Materials Strategy to Adapt to a New Reality."
[98] German Mining and Resources Network, "Startseite - Deutsches Bergbau- und Rohstoffnetzwerk," n.d., https://germanmining.net/de/.
[99] "Registration Opens for the Raw Materials Mechanism under the EU Energy and Raw Materials Platform - Internal Market, Industry, Entrepreneurship and SMEs," accessed April 30, 2026, https://single-market-economy.ec.europa.eu/news/registration-opens-raw-materials-mechanism-under-eu-energy-and-raw-materials-platform-2025-11-18_en.
[100] European Commission, "RESourceEU Action Plan: Accelerating Our Critical Raw Materials Strategy to Adapt to a New Reality."
[101] European Commission, "Commission Launches Platform to Aggregate Demand of Raw Materials and Boost Diversification - Internal Market, Industry, Entrepreneurship and SMEs," April 13, 2026, https://single-market-economy.ec.europa.eu/news/commission-launches-platform-aggregate-demand-raw-materials-and-boost-diversification-2026-04-13_en.

The US, in turn, has recently deployed a broad industrial policy toolkit that goes beyond enabling measures to include direct equity participation in companies, long-term offtake agreements and revenue guarantees. Notably, the Trump Administration has introduced project-specific price support mechanisms[102] and is now exploring more systemic market price interventions, including tariff-backed price floors through bilateral and plurilateral frameworks.[103] In addition, the Trump Administration also went ahead with prohibiting defense contractors from using certain Chinese-origin materials by 2027.[104] In Congress, several bipartisan proposals push for a 2.5 billion USD government-owned strategic reserve,[105] further developing demand-side support tools such as contracts for difference (CfDs)[106] or establishing a Critical Minerals Security Alliance with duty-free trade within the alliance and coordinated border tariffs.[107]

In comparison, Europe's approach is both rather cautious and built primarily on indirect incentives. Europe has been slower to advance more interventionist tools, such as procurement-based demand creation, mandatory diversification requirements for private firms or price-support instruments (i.e., revenue guarantees, market price interventions). No dedicated German or EU-wide schemes have yet been implemented. The RESourceEU Action Plan calls for mandatory supply-chain risk assessments for large companies, while seeking the European Commission to incentivize and, in the case of non-action, mandate risk mitigation. In parallel, it is exploring mandatory minimum shares of CRMs recovered from domestic waste to be used in permanent magnets; it is also revising Public Procurement and Defense Procurement Directives to prioritize projects based on non-price criteria, potentially including local-content criteria. Finally, the RESourceEU Action Plan announced the launch of a new EU project financing approach that could potentially include de-risking tools such as CfDs, possibly still in 2026 (see the penultimate chapter of this report for a detailed discussion of these instruments and potential alternatives). The RESourceEU Action Plan also indicates that the European Commission intends to examine whether mechanisms for leveraging a price floor could help unlock investment in European processing and in extraction projects, both in Europe and partner countries. However, all these elements are still subject to further discussion and require additional steps before they can materially make a difference.

Meanwhile, international efforts, especially those undertaken in Japan and the US, have had direct impact on initiatives in Europe, both in material and conceptual terms. Japan's JOGMEC, for example, is contributing approximately 100 million euros to a French REE refining project and has signed a long-term offtake contract to secure half of the project's HREE oxide output. This contract builds on the 2024 Japan-France Declaration on Cooperation in the Field of Critical Minerals.[108] More broadly, recent US initiatives such as the Forum on Resource Geostrategic Engagement (FORGE) and Pax Silica have further invigorated the European debate around market-shaping instruments. FORGE has brought renewed attention to the possibility of coordinated price floors or wider critical minerals club arrangements. Pax Silica, although broader in scope and focused on AI-related supply chains, has likewise reinforced the logic of trusted-sector coalitions that extend to critical minerals.

While the US has sought to advance cooperation also through bilateral arrangements with individual EU member states, the European Commission has managed to pursue a coordinated EU-level approach. While it has not yet broadcast an official position on Pax Silica, the EU and the US have signed an MoU on a strategic partnership on critical minerals and agreed an EU-US Critical Minerals Action Plan in April

[102] The US government has already committed 15 billion USD in letters of interest from its Export Import Bank, 7 billion USD in loans and 2.8 billion USD in equity and debt to mining and refining projects
[103] So far, the US-Mexico Critical Minerals Action Plan is most explicit on the goal of establishing price floors
[104] Metal Powder Technology, "US Bans Chinese-Origin Rare Earths in Defence Contracts by 2027," September 17, 2025, https://www.metal-powder.tech/us-bans-chinese-origin-rare-earths-in-defence-contracts-by-2027/.
[105] US Congress, "S.3659 - SECURE Minerals Act of 2026, January 15, 2026, 2026-01-15, https://www.congress.gov/bill/119th-congress/senate-bill/3659/text.
[106] US Congress, "S.596 - Critical Materials Future Act of 2025," December 3, 2025, https://www.congress.gov/bill/119th-congress/senate-bill/596/text.
[107] US Congress, "S.2839 - Restoring American Mineral Security Act of 2025," September 17, 2025, https://www.congress.gov/bill/119th-congress/senate-bill/2839/text.
[108] Claire Kumar, "Building Sustainable Critical Raw Materials Supply Chains," ODI Europe, 2025, https://media.odi.org/documents/2._Briefing_Paper_CRM-related_joint_ventures_FINAL.pdf.

2026.[109] The partnership explicitly foresees cooperation across the full value chain and the joint exploration of market-shaping instruments, including border-adjusted price floors, coordinated offtake agreements, stockpiling, and rapid response mechanisms to supply disruptions. It also signals an intention to develop plurilateral approaches with other partners, building on fora such as the G7 and FORGE. While the agreement marks a significant step toward a more coordinated transatlantic approach to CRM resilience, its scope and implementation modalities remain to be clarified and the purported "action plan" remains brief and exploratory in character. Ultimately, its impact will depend strongly on the member states' willingness to support the type of market-shaping intervention also foreseen in the RESourcEU Action Plan, which they have so far shied away from.

At the same time, these developments are increasingly reflected not only at the EU level but also in industry-led initiatives. German industry players, particularly from the automotive and defense industries, have recently entered the debate more forcefully with an initiative to strengthen joint purchasing through a state-backed German trading house capable of securing supply and managing price risks.[110]

3. Expanding Recycling

Efforts to date

In the context of CRM, 'recycling' means the recovery of secondary raw materials from production waste, residual materials or end-of-life products.[111] It is often framed as 'urban mining', i.e., the recovery of valuable materials from existing product stocks already embedded in the economy.[112]

Recycling raw materials provides both environmental and supply-side benefits.[113] The technical challenges recycling poses can also stimulate technical innovation, like the refining of advanced material separation processes and upcycling methods. However, the value of recycling strongly depends on the extent to which secondary materials can replace primary materials and the environmental impact of the recycling process itself. High-quality, closed-loop recycling preserves material properties and allows repeated reuse in similar applications, while lower-quality recycling leads to material degradation with only limited substitution potential.[114] What's more, whether recycling can meaningfully contribute to supply security also depends strongly on the characteristics of both the raw materials and the products made from them. Some minerals, such as gallium, occur in low concentrations, are dispersed across complex products or are difficult to separate from the materials they are embedded in, making recycling technically challenging and costly. In contrast, current recycling methods for lithium-ion batteries can already recover up to 95 percent of materials such as cobalt and nickel, while consuming significantly less energy and water than primary extraction.[115] Still, the impact of battery recycling on the lithium supply

[109] European Commission, "EU and US Launch Strategic Partnership on Critical Minerals," April 24, 2026, https://ec.europa.eu/commission/presscorner/detail/en/ip_26_862.
[110] Sebastien Ash et al., "Germany Seeks to Emulate Japan in Shoring up Critical Minerals," *Financial Times*, March 9, 2026, https://www.ft.com/content/78138ee8-975b-47a5-ae2b-357d612e7a3e?syn-25a6b1a6=1.
[111] Brian Baldassarre and Samuel Carrara, "Critical Raw Materials, Circular Economy, Sustainable Development: EU Policy Reflections for Future Research and Innovation," *Resources, Conservation and Recycling* 215, 2025, https://doi.org/10.1016/j.resconrec.2024.108060.
[112] Lúcia Helena Xavier et al., "A Comprehensive Review of Urban Mining and the Value Recovery from E-Waste Materials," *Resources, Conservation and Recycling* 190, 2023, https://doi.org/10.1016/j.resconrec.2022.106840.
[113] Baldassarre and Carrara, "Critical Raw Materials, Circular Economy, Sustainable Development: EU Policy Reflections for Future Research and Innovation."
[114] Martijn Roosen et al., "Operational Framework to Quantify 'Quality of Recycling' across Different Material Types," *Environmental Science & Technology* 57, no. 36, 2023, 13669–80, https://doi.org/10.1021/acs.est.3c03023.
[115] Dan Su et al., "Global Regulations for Sustainable Battery Recycling: Challenges and Opportunities," *Sustainability* 17, no. 7 (2025), https://doi.org/10.3390/su17073045.

will only unfold gradually, with large-scale effects expected only in the mid-to-late 2030s, once the volume available for recycling in Europe has increased.[116]

Rising demand for CRMs (driven by electrification, digitalization and defense applications) is likely to outpace gains made in the secondary supply, even with major improvements in recycling rates and technologies. At the same time, however, recycling arguably offers the most promising lever to decrease supply chain vulnerabilities for certain materials and products where high-value scrap streams exist (e.g., REE permanent magnets).

At the European level, the CRMA and the RESourceEU Action Plan set the guidelines for recycling raw materials. European recycling is also shaped by the EU's wider circular economy frameworks, with the 2026 Circular Economy Act expected to soon reinforce the 2020 Circular Economy Action Plan. It is meant to promote a single market for secondary raw materials, improve the availability of high-quality recycled materials and strengthen demand in the EU.[117] European CRM recycling is further supported by the 2024 Ecodesign for Sustainable Products Regulation (ESPR), which introduced recycling-enabling design for all physical products, and the Digital Product Passport, which aims to improve information sharing on product content, environmental impact and end-of-life options.[118] Other EU frameworks dictate sector-specific targets and measures: the 2023 Batteries Regulation, for example, presents binding targets for the recovery and recycled content of certain materials used in EV batteries, as well as the introduction of a digital battery passport disclosing material composition and lifecycle data.[119] The 2012 Waste Electrical and Electronic Equipment Directive discusses the waste collection and preparation for recycling of household appliances, IT, telecommunication, and photovoltaic panels.[120]

At the national, German level, the 2024 National Circular Economy Strategy (NCES) has served as the overarching framework for implementing EU objectives on recycling, complemented by the 2020 Raw Materials Strategy and sector-specific regulations.[121] These frameworks built on the *Deutsches Ressourceneffizienzprogramm* (also known as ProgRess), first issued in 2012.[122] ProgRess comprised a broad catalogue of measures, spanning the full product lifecycle from design and production to consumption, recycling, combining research and pilot projects, informational tools (e.g., guidelines, labels), and (preparatory) regulatory activities. To a much more limited extent, ProgRess also included funding investment instruments alongside voluntary initiatives and networking platforms. Evaluations of ProgRess have found that, despite strong stakeholder engagement and networking effects, the framework's implementation and impact have remained limited. In assessments of ProgRess II (2016-2020), its impact on resource efficiency were considered mixed or even low; key targets, such as the doubling of raw material productivity, were not achieved.[123] As far as ProgRess III (2020-2024) is concerned, 34 percent of measures showed good progress, while 21 percent showed minor and 15 percent no progress.[124] For 30 percent of the measures, no implementation data was available at all. Some of ProgRess's persistent weaknesses include a lack of concrete and binding targets, unclear responsibilities and limited use of economic or regulatory instruments. As a result, the program functions more as a strategic orientation framework than as an effective implementation tool.

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[116] GLOBSEC GeoTech Center, "The Innovation Imperative: Bridging the Supply-Demand Gap for Critical Raw Materials by 2030," 2025, https://www.globsec.org/sites/default/files/2025-05/GLOBSEC%20Innovations%20In%20Critical%20Materials.pdf.

[117] European Commission, "Circular Economy," March 17, 2026, https://environment.ec.europa.eu/strategy/circular-economy_en.

[118] European Commission, "Ecodesign for Sustainable Products Regulation," February 09, 2026, https://environment.ec.europa.eu/strategy/circular-economy/ecodesign-sustainable-products-regulation_en.

[119] European Commission, "Batteries Regulation," 2023, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32023R1542.

[120] European Parliament and Council of the European Union, "Directive 2012/19/EU of 4 July 2012 on Waste Electrical and Electronic Equipment (WEEE) (Recast)," 2012, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32012L0019.

[121] Bundesministerium für Umwelt, Naturschutz, nukleare Sicherheit und Verbraucherschutz, "Nationale Kreislaufwirtschaftsstrategie (NKWS)," 2024, https://www.bundesumweltministerium.de/download/nationale-kreislaufwirtschaftsstrategie-nkws.

[122] Bundesministerium für Umwelt, Naturschutz, nukleare Sicherheit und Verbraucherschutz, "Überblick zum Deutschen Ressourceneffizienzprogramm (ProgRess)," 2020, https://www.bundesumweltministerium.de/WS1742.

[123] Bettina Bahn-Walkowiak et al., "Evaluation des Deutschen Ressourceneffizienzprogramms ProgRess," Umweltbundesamt, 2019, https://www.umweltbundesamt.de/system/files/medien/1410/publikationen/2019-04-18_texte_43-2019_evaluation_progress.pdf.

[124] Bettina Bahn-Walkowiak et al., Evaluation des Deutschen Ressourceneffizienzprogramms (Progress III) – Ergebnisse und Empfehlungen für die weitere Politikentwicklung," Umweltbundesamt, 2024, https://www.umweltbundesamt.de/system/files/medien/11850/publikationen/88_2024_texte_evaluation_progress_iii.pdf.

Combining the EU and national level, projects can be supported through the strategic project designation[125] and Horizon Europe or instruments such as the Important Projects of Common European Interest (IPCEI) framework on batteries[126] at EU level and the German Raw Materials Fund. The Federal Ministry for the Environment, Climate Action, Nature Conservation and Nuclear Safety (*Bundesministerium für Umwelt, Klimaschutz, Naturschutz und nukleare Sicherheit*, BMUKN), BMWE and the Federal Ministry of Research, Technology and Space (*Bundesministerium für Forschung, Technologie und Raumfahrt*, BMFTR) all support demonstration and pilot projects as well as industrial deployment and scaling through various initiatives.[127] In addition, DERA acts as a platform to foster closer cooperation between public and private actors, while the Federal Agency for Breakthrough Innovation (*Bundesagentur für Sprunginnovationen,* SPRIND) supports eight start-ups with up to 34 million euros through its 2025 Tech Metal Transformation program to develop new recovery processes.[128]

Despite these efforts, the overall picture of recycling in Europe is mixed and highly uneven across materials and value chain stages. Germany's overall circular material use rate remains at 14.8 percent, placing it eighth in the EU.[129] There is an inherent limitation to ramping up the contribution of recycling to overall supply, given growing demand for many materials and long product lifetimes, which delay material availability for recycling. Still, End-of-Life-Recycling Input Rates (EOL-RIR, the total material demand met by recycled material) now exceeds 30 percent for some materials such as copper, aluminum and tungsten.[130] In contrast, however, the EOL-RIR for many strategic raw materials in the EU remains negligible (e.g., HREE and LREE at 1 percent, germanium at 2 percent) or at zero (including lithium and gallium), which is clearly far below potential even if one considers delays linked to market ramp-up and lifecycles, e.g., for EV materials. E-waste collection rates remain limited across the EU and in Germany specifically.[131] Crucially, where waste containing valuable materials is being collected, it is also often more economically attractive to export this scrap material to China than to process it domestically, highlighting the need for a holistic push to reshape Europe's CRM market, also with a view to market incentives in the recycling sector.

International experiences and ongoing debates

Current policy debates in Germany and the EU concentrate on increasing recycling contributions across four main areas: (1) scaling innovation in recycling technologies, (2) increasing available feedstock via improved collection systems (e.g., e-waste, REE magnets) and export restrictions on scrap streams (REE magnets, lithium-ion batteries and black mass, aluminum, copper), (3) improving traceability of materials and facilitating cross-border shipments of waste and secondary materials within the EU, and (4) introducing incentives or mandates for the use of secondary materials, including recycled-content requirements.[132] Current efforts place particular emphasis on REE and battery-related materials.[133]

Internationally, recycling policy is increasingly being treated not only as a circular-economy issue, but also as a strategic industrial and supply-security instrument. Japan has long embedded recycling into its broader CRM strategy, combining domestic regulation, which mandates the collection and recovery of

[125] In the first round, 10 out 60 selected projects are on recycling, with a heavy focus on battery materials and REE
[126] Two IPCEIs on batteries approved in 2019 and 2021 involve 59 companies across 12 Member States and combine up to 6.1 billion euros in public funding with 13.8 billion euros in expected private investment, covering the full value chain including recycling but focusing primarily on research and innovation rather than large-scale deployment.
[127] Deutscher Bundestag, "Rohstoffversorgung Sichern, Exportkontrollen Begegnen, Rohstofffonds Aktivieren."
[128] Bundesagentur Für Sprunginnovationen, "Tech Metal Transformation Challenge," 2025, https://www.sprind.org/en/actions/challenges/tech-metal.
[129] Eurostat, "Circular Material Use Rate," 2025, https://ec.europa.eu/eurostat/databrowser/view/cei_srm030/default/bar?lang=en.
[130] Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, "Study on the Critical Raw Materials for the EU 2023: Final Report," 2023, https://data.europa.eu/doi/10.2873/725585.
[131] European Court of Auditors, "Special Report 04/2026: Critical Raw Materials for the Energy Transition"; Christoph Kehl and Pauline Riousset, "Strategien und Instrumente zur Verbesserung des Rezyklateinsatzes. Mit Fallstudien zu Kunststoffverpackungen, Elektrogeräten sowie Baustoffen. Endbericht zum TA-Projekt," 2024, https://doi.org/10.5445/IR/1000168838.
[132] European Commission, "RESourceEU Action Plan: Accelerating Our Critical Raw Materials Strategy to Adapt to a New Reality."
[133] For instance, the RESourceEU Action Plan expects that EU-based recyclers, including Heraeus Remloy in Germany, could contribute about 20 percent of current demand of REE permanent magnets.

key waste streams, with industrial policy support.[134] Post-2010, Japan systematically expanded its recycling ecosystem through urban mining initiatives, support for battery recycling and investments in advanced material recovery technologies. At the same time, Japanese firms are increasingly pursuing international partnerships to scale recycling capacity, as illustrated by Mitsubishi Materials' 2026 collaboration with the US company ReElement on rare-earth recovery from end-of-life magnets.[135]

The US has likewise expanded its recycling toolkit significantly beyond research support. Recent measures include Department of Energy funding calls for up to 134 million USD to prove the commercial viability of recovering and refining REE from mine tailings, e-waste and other waste materials and a 500 million USD funding opportunity to expand US critical mineral processing and battery recycling.[136]

China remains the central actor in global recycling value chains. The country has long been a major destination for used materials, as it has often been economically more attractive to export scrap to China than to process it domestically. China has leveraged this position to develop formidable processing, recycling and circular-economy capabilities. According to the IEA, China was responsible for 80 percent of global battery pre-treatment and material-recovery capacity in 2023.[137] For Europe, this means that the challenge is not merely to prevent the export of scrap to China, but to compete with a highly scaled and policy-backed Chinese circular economy ecosystem.

For some CRMs, recycling is already an economically viable option. For many other materials, however, recycling costs still exceed those of importing primary materials, especially when used in small quantities.[138] As a result, the expansion of recycling capacity is often constrained – not only by technological and cost barriers, but also by the absence of stable and sufficiently priced demand for secondary materials. More fundamentally, recycling is only one component of a wider circular economy model, which aims to retain the value of materials for as long as possible through longer product lifetimes, reuse, repair and remanufacturing before eventual material recovery. Its effectiveness therefore depends not only on processing technologies, but also on other, more upstream factors such as product design, use patterns and end-of-life collection systems.

4. Reducing Demand

Efforts to date

Another way to lessen European and German dependencies on critical materials is through reducing demand. This can be achieved both through outright reduction and substitution. Improvements in material efficiency aim to reduce the quantity of CRMs required per unit of output without fundamentally altering the underlying technology. Outright reduction can be brought about via incremental design improvements and process innovations, such as optimizing component design or enhancing material properties

[134] Takahiro Kamisuna, "Japan's 'Urban Mining' and Economic Security," IISS, 2025, https://www.iiss.org/online-analysis/online-analysis/2025/08/japans-urban-mining-and-economic-security/; Abhishek Sharma, "The Policy Edge of Japan and South Korea in Securing Critical Minerals," 2026, https://www.orfonline.org/public/uploads/posts/pdf/20260407063151.pdf.
[135] Ministry for Economy, Trade and Industry, "Joint Fact Sheet for Japan-U.S. Critical Minerals Project Cooperation," 2026, https://www.meti.go.jp/press/2025/03/20260320001/20260320001-e.pdf.
[136] US Department of Energy, "Energy Department Announces $134 Million in Funding to Strengthen Rare Earth Element Supply Chains, Advancing American Energy Independence," December 01, 2025, https://www.energy.gov/articles/energy-department-announces-134-million-funding-strengthen-rare-earth-element-supply; US Department of Energy, "Energy Department Announces $500 Million to Strengthen Domestic Critical Materials Processing and Manufacturing," March 13, 2026, https://www.energy.gov/articles/energy-department-announces-500-million-strengthen-domestic-critical-materials-processing.
[137] International Energy Agency, "Recycling of Critical Minerals: Strategies to Scale up Recycling and Urban Mining," 2025, https://iea.blob.core.windows.net/assets/d041f616-2f49-4694-861c-97d489ed1856/RecyclingofCriticalMinerals.pdf.
[138] Simon M. Jowitt et al., "Recycling of the Rare Earth Elements," *Current Opinion in Green and Sustainable Chemistry*, Vol. 13, 2018, 1–7, https://doi.org/10.1016/j.cogsc.2018.02.008.

to achieve higher performance per unit of input. For instance, improvements in battery anodes can reduce the required quantities of graphite while maintaining functionality.[139] Such approaches are often among the most immediately scalable, as they can be integrated into existing production systems.

Substitution involves changes in the material composition or architecture of products and systems, thereby replacing specific CRMs within components with less critical or more abundant alternatives. Such transitions have historically been part of general technological progress, for example when the proliferation of LEDs reduced the need for incandescent light bulbs and contributed to a collapse of tungsten prices. Advances in materials science increasingly enable such targeted substitutions, particularly through the development of advanced materials with tailored properties. For example, catalyst technologies allow for a partial substitution of platinum group metals with alternative materials, while electric vehicle (EV) motors can be designed to reduce or eliminate the use of REE.[140] Lithium iron phosphate (LFP) batteries cut the need for nickel (as compared to conventional lithium nickel cobalt oxide batteries).[141] Sodium-ion batteries also appear to approach market readiness at scale and may significantly reduce the need for lithium.[142]

For over a decade, Germany and Europe have pursued such substitution efforts. At the EU level, relevant steps have been defined under the 2015 and 2020 EU Circular Economy Action Plans. In Germany, substitution and demand reduction for CRMs have similarly been embedded in broader frameworks such as the 2024 NCES (previously ProgRess). Successive ProgRess programs and the NCES have emphasized resource efficiency and substitution as key pillars but they never established quantitative targets for reducing primary raw material consumption or CRM intensity. As reflected in recent assessments of Germany's circular economy performance and consistent with the limited impact of successive ProgRess programs discussed above, improvements in raw material productivity overall have fallen short of national targets, despite some progress in decoupling waste generation from economic growth.[143]

Public support instruments for demand reduction remain fragmented and largely indirect. As with recycling, scientific research initiative Horizon Europe has regularly financially supported relevant projects over the last years. This has included broader initiatives on the development and industrial uptake of sustainable advanced materials, such as the 2024 public-private European Partnership Innovative Advanced Materials, to the tune of 500 million euros.[144] In addition, the European Innovation Council launched two accelerator challenges to boost advanced materials development and upscaling by startups with 50 million euros each in 2025 and 2026. In practice, however, those projects have typically focused on environmental sustainability or process improvements, rather than explicitly targeting reductions in CRM demand.

Existing funding schemes in Germany have concentrated on batteries, eyeing successful scaling of five substitution options by 2026, as put forward in the 2023 BMFTR Research Framework.[145] Only recently has the scope been expanded beyond batteries to focus on advanced materials more broadly. Dedicated

[139] GLOBSEC GeoTech Center, "The Innovation Imperative: Bridging the Supply-Demand Gap for Critical Raw Materials by 2030."
[140] Marcos Ierides et al., "Substitution and Reduction of Critical and Strategic Raw Materials in Clean Energy Technologies: An Overview of Solutions Using Advanced Materials," 2025. https://doi.org/10.2760/5159022.
[141] GLOBSEC GeoTech Center, "The Innovation Imperative: Bridging the Supply-Demand Gap for Critical Raw Materials by 2030."
[142] Philipp Voß et al., "Benchmarking State-of-the-Art Sodium-Ion Battery Cells – Modeling Energy Density and Carbon Footprint at the Gigafactory-Scale," *Energy & Environmental Science* 18, no. 17, 2025, 8104–29, https://doi.org/10.1039/D5EE00415B.
[143] European Environment Agency, "Circular Economy Country Profile 2024 – Germany," 2024, https://www.eea.europa.eu/en/topics/in-depth/circular-economy/country-profiles-on-circular-economy/circular-economy-country-profiles-2024/germany_2024-ce-country-profile_final.pdf/@@download/file.
[144] European Energy Research Alliance, "Top Story of the Week: EU Launches €500 Million Initiative for Advanced Materials in Green Digital Transition," Coordinating Energy Research for a Low Carbon Europe," March 4, 2024, https://www.eera-set.eu/news-resources/4685:top-story-of-the-week-eu-launches-500-million-initiative-for-advanced-materials-in-green-digital-transition.html; IAM-I, "IAM4EU Partnership," n.d., https://www.iam-i.eu/iam4eu-partnership/.
[145] Bundesministerium für Bildung und Forschung, "Dachkonzept Batterieforschung – Souveränität für eine nachhaltige Wertschöpfung von morgen," 2023, https://www.bmftr.bund.de/SharedDocs/Publikationen/DE/5/767118_Dachkonzept_Batterieforschung.pdf?__blob=publicationFile&v=5.

funds, however, remain limited in scale.[146] Efforts to develop roadmaps for priority substitution technologies have not been followed up by concrete implementation measures.[147] The German Raw Materials Fund, meanwhile, does not cover substitution projects at all.

Recent initiatives do suggest increasing convergence of sustainability and CRM resilience perspectives. For example, the planned Advanced Materials Act, to be proposed in the last quarter of 2026, aims to accelerate the development and deployment of CRM substitutes, while the forthcoming Circular Economy Act is expected to further expand provisions on resource efficiency and product design. The CRMA and RESourceEU Action Plan also both recognize resource efficiency and material substitution as relevant levers to moderate demand growth. In practice, however, these approaches clearly remain secondary to the expansion of primary and secondary supply, and are not operationalized through dedicated targets, binding requirements or funding streams aimed at reducing CRM intensity or absolute consumption. Tellingly, while substitution projects were eligible for designation as strategic projects under the CRMA, only two out of the 60 projects selected in the first round fell into this category.

International experiences and ongoing debates

Unlike with the other policy areas discussed in this report, German and European CRM demand reduction does not lag behind its international peers. But it is a field where progress has been limited and uneven across the globe. In part, this is due to the inherent difficulty of the challenge. For some materials, such as HREE, LREE or gallium, which have unique characteristics enabling specific applications, sizeable reductions in demand are unlikely. In many other cases, substitution may shift dependencies to other materials rather than eliminating them altogether. Trade-offs in terms of performance, lifetime, cost, or environmental and social impacts are also often inevitable; substitute materials may deliver lower energy density, reduced durability or higher system complexity than the original material, limiting their applicability in high-performance use cases.

Japan is frequently mentioned as a country where substitution and technology alternatives have helped reduce CRM dependencies. However, Tokyo's pursuit of alternative technology pathways through industrial policy has also come with important drawbacks in some cases. For example, its attempt to promote hydrogen technologies for the automotive industry, partly as a way to reduce exposure to CRM-hungry EVs, ended up reducing Japanese firms' ability to participate in what proved to be a key global technology trend.[148] To the extent that Japanese companies have more eagerly pursued CRM substitution research and development (R&D) than firms elsewhere, this arguably had less to do with specific policy choices than with the heightened political urgency they faced following the country's dispute with China in 2010.

As many CRMs have not been acutely scarce in much of the world over the last decades, industry players have not felt too pressured by market forces to engage in substitution or resource efficiency efforts out of commercial interest. On the contrary, incorporating demand-reducing solutions (even where they are already available) into production processes tends to be more costly than sticking with established production processes with existing material configurations, leading many firms to opt for the latter option.

Academic and other publicly funded research, therefore, plays an important role in this field. Much research has focused on batteries, especially the quest to find alternatives to Lithium-ion battery cells, and

[146] Bundesministerium für Forschung, Technologie und Raumfahrt, "Bekanntmachung:Richtlinie zur Förderung von Projekten im Rahmen der Material-Hub-Initiative „Ressourcensouveränität durch Materialinnovationen"," Bundesministerium für Forschung, Technologie und Raumfahrt - BMFTR, 2025, https://www.bmftr.bund.de/SharedDocs/Bekanntmachungen/DE/2025/11/2025-11-24-bekanntmachung-materialneutral.html; Federal Ministry of Research, Technology and Space, "Material Innovations for -transforming Economy and Society (-Mat2Twin)," 2025, https://www.bmftr.bund.de/SharedDocs/Publikationen/DE/5/767118_Dachkonzept_Batterieforschung.pdf?__blob=publicationFile&v=5.

[147] Matthias Buchert et al., "Substitution als Strategie zur Minderung der Kritikalität von Rohstoffen für Umwelttechnologien – Potentialermittlung für Second-Best-Lösungen," 2017, https://www.umweltbundesamt.de/system/files/medien/1410/publikationen/2019-01-14_texte_03-2019_subskrit_arbeitsbericht-6.pdf.

[148] Ben Bowie, "Japan's Responses to China's Supply Chain Dominance," RUSI, September 05, 2024, https://www.rusi.org/explore-our-research/publications/commentary/japans-responses-chinas-supply-chain-dominance; Gregory Brew and Michael Webber, "Japan's EV Misstep Is a Cautionary Tale for Industrial Policy," *Barron's*, July 20, 2023, https://www.barrons.com/articles/japans-ev-misstep-is-a-cautionary-tale-for-industrial-policy-4f8df3c.

has translated into tangible progress. Other products with substantial CRM inputs, such as magnets, however, have received significantly less attention.[149] While substitution options for some applications are already commercially available, many others remain at early research stages, with uncertain timelines for deployment at scale.

Within the broader context of CRM resilience, a final challenge associated with demand reduction and substitution is that doing so may affect circularity strategies in unintended ways. Substituting or reducing the use of specific materials can alter product compositions and can reduce the concentration or economic value of recoverable materials in existing recycling streams. This may weaken the business case for recycling infrastructure designed around current material configurations. In some cases, this could risk rendering existing investments less effective or even obsolete. This is, of course, not a reason to abandon all substitution efforts, but points to the importance of maintaining a holistic view and a level of flexibility to adjust policies to technological and economic development.

[149] Baldassarre and Carrara, "Critical Raw Materials, Circular Economy, Sustainable Development: EU Policy Reflections for Future Research and Innovation."

Shortcomings of Past Initiatives

Foundational Shortcomings

Conceptual Misalignment

A foundational problem that has plagued German and European efforts toward CRM resilience lies in a misunderstanding of the nature of global CRM supply chains. For a long time, CRMs were treated as neutral commodities rather than as strategic goods that could be weaponized for political purposes.[150] As a result, Europe was fundamentally comfortable with its dependency on China, as materials were available cheaply and seemingly reliably.[151] CRM-related policies served various purposes that overlapped with supply security objectives, but never amounted to a coherent strategy that aligned priorities, institutions and instruments toward that aim with urgency and resolve. Policies also rested on the assumption that the sector was fundamentally shaped by market forces. German and European policymakers thought that creating more favorable conditions and providing targeted CRM support would be sufficient to enable viable business cases on the supply side. Moreover, perspectives regarding threat perceptions and the willingness or ability to support the CRM industry also differed between EU member states, which stood in the way of a unified European approach.

In Germany, such misconceptions were particularly pronounced. Policies have been consistently based on an 'ordoliberal' logic, emphasizing the governmental creation of competitive framework conditions while assuming that markets will deliver efficient outcomes. This logic is reflected in the design of key policy instruments. In areas such as stockpiling, Germany has largely relied on voluntary corporate risk management rather than establishing public reserves or structured public-private systems. Similarly, efforts to expand supply have focused on regulatory facilitation and financial de-risking, without systematically addressing the demand side, using tools such as price guarantees, coordinated offtake or procurement-based demand creation.

In a recent interview, Gabriel Felbermayr, a prominent economist and member of the German government's Council of Economic Advisors, openly talked about the failures of ordoliberal economists to see China's strategy for what it is: "I long dismissed this as a conspiracy theory. I didn't want to accept that there are indeed strategies on China's part to actively manipulate markets, monopolize them and then use those dependencies for political leverage. That doesn't fit into the classical liberal worldview that an economist like me has."[152] Germany has paid a significant price for the long-standing reluctance of ordoliberal economists to accurately assess Beijing's strategy and, in response, conceive of policy responses that match the challenge at hand.

Slowly, the German government seems to be growing more aware of these challenges. Institutional reforms such as the establishment of specific units dedicated to Germany's economic security in central ministries, such as the Federal Foreign Office or the BMWE, signal as much. But policymaking on key areas of economic security still lacks the necessary speed and decisiveness.

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[150] Jakob Kullik and Dennis Bastian, "Angriff auf Chinas Rohstoffmonopol: Wie Europa bei Seltenen Erden & Co. unabhängiger werden kann," Bundesakademie für Sicherheitspolitik Arbeitspapier Sicherheitspolitik, 2026, https://www.baks.bund.de/sites/baks010/files/arbeitspapier_sicherheitspolitik_2026_2.pdf.
[151] Stefan Steinicke, "Unterschätztes Nadelöhr," *Internationale Politik*, February 23, 2026, https://internationalepolitik.de/de/unterschaetztes-nadeloehr.
[152] Alexander Wulfers, "„Die dogmatische Ansage, Freihandel sei immer gesetzt, ist falsch"," *Frankfruter Allgemeine*, April 7, 2026, https://www.faz.net/aktuell/wirtschaft/wifo-chef-gabriel-felbermayr-wie-der-neue-wirtschaftsweise-tickt-accg-200698253.html.

Market design and incentive failures

German and European efforts to address their vulnerabilities in CRM supply chains continue to display a pronounced supply-side bias. Measures such as reducing regulatory barriers, accelerating permitting or de-risking financing through guarantees are undoubtedly necessary for expanding mining and processing capacity, both in Europe and with partners. These supply-side efforts alone, however, are far from sufficient to address the core problem of structurally distorted global markets.

Thanks to a combination of technological prowess, established scale and state backing, Chinese producers and processors have a cost advantage that less-established players struggle to match. Higher energy, labor and transport costs, as well as more stringent environmental and social standards, mean that projects in Europe and with European involvement elsewhere often perform better on environmental, social and governance (ESG) criteria. Beyond certain niches, however, this is not systematically rewarded in global markets. Ultimately, China's presence as a non-market price maker exposes any potential competitor to strategic market interventions and price crashes that cast doubt on their viability and make projects 'unbankable' (too high risk to access standard banking services). Without mechanisms that guarantee stable demand and price levels that incorporate a resilience premium – in other words, genuinely market-shaping instruments – capital-intensive upstream and midstream projects struggle to reach financial close or to scale sustainably, even with political backing or access to public finance.

This bankability problem is not limited to domestic projects but extends to international partnerships. While both Germany and the EU have concluded numerous raw materials agreements, these have rarely been matched by a guaranteed long-term demand by European public or private actors. European actors struggle to offer structured price stabilization and long-term risk-sharing mechanisms. As a result, partnerships often lack credibility in the eyes of partner governments and project developers, reinforcing perceptions that Europe's engagement is politically visible but commercially thin.

The logical corollary of such market-shaping interventions is the creation of credible 'demand-pull' mechanisms beyond government purchasing. As long as downstream firms continue to source from the cheapest available provider in global markets, fostering diversified domestic or international supply options under the conditions described above is an uphill battle. In the absence of diversification requirements and sourcing rules, or even mere coordinated demand aggregation, individual companies face little incentive but significant competitive risk when committing to higher-cost supply chains in the interest of greater resilience. While coordinating with peers or even individually investing in alternative supply chains undoubtedly poses real challenges, especially to smaller firms, it would be misleading to treat firms as mere victims of structural forces. Many firms have systematically underestimated political risks in their own business model, prioritizing margin maximization over resilience, despite repeated warning signals and real-life supply disruptions over the past decade. Exemplifying the classical 'moral hazard problem,' many firms may also have relied on getting government assistance if push came to shove, turning a corporate risk management challenge into a systemic risk.

Institutional and operational capacity gap

Germany and the European Union also face a significant institutional and operational capacity gap. While policy awareness has increased and a growing number of instruments have been proposed, the ability to translate strategic objectives into action remains limited. There is no fully operational system of mechanisms that would help shape markets, coordinate actors and execute complex supply-chain strategies across public and private stakeholders. At the European level, the proposed CRM Centre might take on this role, but it is not yet clear if and when it can fulfill all these functions.

The EU does not (yet) have an institution that is capable of organizing large-scale joint purchasing, acts as a credible counterparty in offtake agreements or intervenes directly to stabilize supply chains. The CRMA established a CRM Board, composed of member state and European Commission representatives, to support coordination and provide advice. Given the Board's lack of executive authority, it primarily

serves as a space to exchange best practices and consult over the selection and implementation of strategic projects. Germany also lacks such an anchoring institution;[153] many of the relevant responsibilities are spread across various ministries and agencies, with federal leadership from the Chancellery being spotty at best. Moreover, the extent to which economic and commodity-specific expertise required to design and implement complex market-shaping instruments is being integrated into decision-making remains unclear.

This institutional fragmentation is also evident in the limited integration of different policy domains. Trade defense instruments, industrial policy tools and economic security mechanisms are not yet systematically interwoven into one, coherent strategic framework. While the EU has started to take steps in this direction, important gaps remain, for example regarding safeguards against non-European actors buying up materials from European facilities or acquiring successful projects outright. This creates vulnerabilities not only vis-à-vis China, but also in relation to countries like the US. In particular, Europe lacks effective mechanisms to ensure that publicly supported projects remain aligned with European supply security objectives, including mechanisms that protect them from foreign acquisition or exclusive offtake arrangements that divert output away from European markets.

Another key limitation concerns persistent data blind spots. Institutions such as Germany's DERA provide valuable analysis and early warning signs on supply risks at the mineral level. However, there is no institutionalized mechanism to systematically collect, aggregate and analyze sensitive company-level data on demand, sourcing structures and vulnerabilities. Firms are often reluctant to share such information, even as they are required to disclose sensitive information on suppliers, technical processes and end-use in Chinese regulatory processes for continued delivery of materials since at least April 2025.[154] As a result, policymakers lack the granular, real-time visibility needed to assess systemic risks and design targeted interventions.

Finally, and perhaps most difficult to address, there is also an engrained temporal mismatch between policy cycles and industrial realities. Mining and midstream processing projects require long investment horizons, often spanning 10 to 15 years from exploration to operation. Yet German and European policy has been characterized by frequent shifts in priorities across electoral cycles. This lack of durable commitment undermines investor confidence and contributes to a persistent credibility gap. Importantly, this problem affects not only supply-side measures but also demand-side instruments: even well-designed tools such as price support or long-term procurement commitments will fail to unlock investment if market participants doubt their stability over time.

Ecosystem deficit

Finally, a structural weakness of Germany and Europe lies in the absence of a vibrant CRM industrial ecosystem. Without stronger linkages between exploration, mining, processing, and advanced materials manufacturing, individual projects remain isolated and struggle to integrate into a broader industrial base capable of sustaining long-term supply security. Like other European countries, Germany has allowed large parts of its historically significant mining sector to erode and currently does not have large mining companies. Unlike countries such as Canada or Australia, it also lacks a dynamic junior and mid-tier sector of mining firms that continuously generate new exploration pipelines and project opportunities worldwide. This limits the ability to originate and scale projects domestically or to act as a credible partner in international resource development.

While certain segments, such as equipment manufacturing and specialized mining services, are comparatively strong, critical bottlenecks persist in midstream activities. Despite the existence of some pro-

[153] Jakob Kullik and Jens Gutzmer, "Transformation: Deutschland braucht ein Rohstoffministerium," *Tagesspiegel*, April 7, 2025, https://background.tagesspiegel.de/energie-und-klima/briefing/deutschland-braucht-ein-rohstoffministerium.
[154] Rebecca Arcesati and Altynay Junusova, "Beijing's Rare-Earths Export Licensing System: Delays by Design?" Mercator Institute for China Studies, 2025, https://merics.org/en/comment/beijings-rare-earths-export-licensing-system-delays-design.

cessing companies with capacity in Europe, such as NeoPerformance Materials, Solvay or Vacuumschmelze for REE and permanent magnets, or Aurubis and Glencore for copper,[155] raw materials extracted in Europe or partner countries often still need to be processed elsewhere, undermining the resilience benefit from upstream investments.

The downturn of the metallurgy industry has also resulted in human capital and know-how constraints.[156] With firms being largely absent as a driver of innovation, specialized university programs have had a hard time attracting interest, resulting in a shortage of skilled engineers and technical specialists. This creates a structural disadvantage vis-à-vis established producers, most notably China, which benefits from decades of accumulated operational experience – partly built with German know-how.

Finally, the European ecosystem has long suffered from insufficient integration between industrial and defense policy. In contrast to countries like the US, Germany and the EU lack the structured use of long-term defense-backed offtake agreements to anchor demand and provide predictable revenue streams for strategically important projects. While such issues have received increased attention in the context of Germany's increasing defense spending post-2022, decisive action is necessary to avoid a major missed opportunity in this regard. As one analyst recently warned: "Without public investment in raw material production, the new Brussels defense mantra 'Buy European!' could end up meaning 'Don't buy anything at all!'."[157]

Lever-Specific Shortcomings

Stockpiling

As discussed above, neither the EU nor Germany currently have well-established strategic stockpiles for CRMs or systematic support schemes for firm-led, decentralized stockpiling.

The main shortcoming is not conceptual, but rather operational: stockpiling remains largely unimplemented as a policy instrument. While coordination efforts at the EU level and exploratory initiatives in Germany have increased, they have not yet translated into concrete mechanisms with defined financing, governance and release structures. A second limitation lies in the overreliance on voluntary, decentralized approaches. By placing responsibility primarily on firms, current policy frameworks assume a level of financial capacity and risk tolerance that is not present across large parts of European industry, particularly among SMEs. This limits the scale and consistency of stockpiling efforts and reduces their effectiveness as a systemic resilience tool.

More fundamentally, there is a strategic mismatch between the potential role of stockpiling and its current policy design. Rather than discussing its potential role as a market-shaping instrument, capable of stabilizing demand, countering price volatility and supporting new supply at least in specific 'thin' markets, stockpiling is still treated primarily as a contingency measure.

Expanding primary supply

The failure to support reliable demand is the key factor explaining why the extensive set of instruments to stimulate primary supply, both in Germany and Europe and elsewhere in the world, has so far only had limited impact. This is not to say that the supply-side interventions in place are already optimal – rather,

[155] International Energy Agency, "Global Critical Minerals Outlook 2025."
[156] Helmholtz, "Seltene Erden – wie wir geostrategischen Abhängigkeiten begegnen können," Helmholtz-Gemeinschaft Deutscher Forschungszentren, September 30, 2025, https://www.helmholtz.de/newsroom/artikel/seltene-erden-wie-wir-geostrategischen-abhaengigkeiten-begegnen-koennen/.
[157] Joris Teer, "European Ministers of Defence - Save Europe, Invest in Mining!," European Union Institute for Security Studies, 2025, https://www.iss.europa.eu/publications/commentary/european-ministers-defence-save-europe-invest-mining.

limitations persist regarding (1) financing, (2) permitting for domestic projects and (3) the interplay with partner governments and industry players in international efforts.

The first set of limitations with regard to the expansion of primary supply relates to persistent financing gaps across the value chain. While the number of relevant instruments has increased, support remains fragmented across member states, development banks and EU-level programs, with limited coordination and no overarching tracking of their impact on supply outcomes. The overall scale of dedicated public funding also remains small relative to investment needs. Estimates by the EU-funded agency European Institute of Innovation and Technology (EIT) RawMaterials suggest that more than 10 billion euros in additional investment would be required to meet the CRMA targets for production and processing within the EU, yet few genuinely new funding streams have been created. The EU's strategic project designation does not provide selected ventures with access to newly mobilized and dedicated funding, but merely with support in navigating the maze of potentially relevant schemes. Even flagship instruments such as the German Raw Materials Fund have been slow to deploy.[158]

In addition, available financial support does not adequately cover the entire project lifecycle, with early-stage exploration continuing to receive only limited attention. Germany's Raw Materials Fund, with its focus on projects with financing needs above 50 million euros, effectively excludes early-stage exploration; it also neglects smaller-scale and brownfield investments. This contributes to a structurally weak pipeline of exploration projects, which is further decimated by the inevitably high failure rate at this early stage of project development. By focusing on projects that are already at an advanced stage, schemes effectively support projects at a stage where they – as long as they are sound and there is stable demand at viable prices once the project enters production – can attract private capital with relative ease. Instead, public support should place greater emphasis on the exploration stage: a high-risk segment of the industry, but nevertheless vital for any successful project to launch in the first place.

A second set of limitations centers on permitting. For projects within Germany and Europe, permitting remains a bottleneck, despite longstanding commitments to regulatory acceleration. While the CRMA introduces measures such as one-stop shops and accelerated timelines for strategic projects, these do not override national legal frameworks and are unlikely to compress timelines decisively. Given legitimate environmental safeguards and persistent local opposition to CRM projects, it is unrealistic that German and European permitting timelines for CRM projects would be shortened to the level of, say, China. Still, any opportunities for streamlining need to be seized with greater resolve than has been the case so far, as illustrated by the lengthy and fruitless discussion around the *Bundesberggesetz* mentioned above. Moreover, increasing transparency around the selection of strategic projects could support greater public acceptance at the local level, hopefully reducing local opposition.

Finally, a third challenge to expanding primary supply is posed by country-level partnerships and projects outside the continent. Berlin and Brussels have limited influence on an array of factors that will determine whether such projects will indeed result in greater primary supply, whether that be the provision of adequate infrastructure or the orchestration of local industry linkages. That said, policymakers have also been slow to make these efforts a serious priority. Financing instruments offered by KfW and other European development banks have sometimes supported successful private sector-led projects, while technical cooperation has contributed to advances in geological mapping and sector governance in partner countries. But too often, the overall picture of country-level engagement has been marked by unclear responsibilities, weak operationalization of broad MoUs into actual joint strategies and projects and concentration on narrow aspects (for example, improving the traceability of minerals), rather than by stringent management of activities toward the clear aim of bringing production or processing capacity online.

That German and European private sector interest in cooperation with partner countries for international raw materials has often failed to materialize should hardly be a surprise given the fundamental de-

[158] Philip Blenkinsop, "EU Must Set aside over 10 Billion Euros for Key Minerals, Says Agency Head," Commodities, *Reuters*, May 14, 2025, https://www.reuters.com/markets/commodities/eu-must-set-aside-over-10-billion-euros-key-minerals-says-agency-head-2025-05-14/.

mand-side issues discussed at length in this report. However, it severely undermines the value of cooperation for partners interested in investment, technology transfer and upgrading of local value chains, and makes it unlikely for such partnerships to achieve tangible impact.

The newer EU partnerships with countries like Canada may generate a different dynamic. In this realm, also, much will hinge on whether demand and price interventions will make investment in mining and processing fundamentally more attractive. Especially in countries with developing economies, Germany and Europe face an increasingly clear choice between either upgrading their mode of engagement significantly, starting with personnel capacities and financial resourcing, or abandoning any pretense that this instrument will make much of contribution to CRM supply security.[159]

Expanding secondary supply

While current policy efforts rightly address other key bottlenecks such as technological barriers, insufficient collection and high processing costs, they should pay more attention to recovery. A major shortcoming of efforts to expand secondary supply is that policy tends to oversee issues of recyclability in upstream product design. In practice, the widespread use of composite materials, complex alloys and the dispersion of CRMs in low concentrations significantly complicate recovery. While some of these conditions are hard to avoid, there *is* considerable scope to improve certain design features, with the objective of minimizing CRM use (e.g., by making smaller or different batteries) and facilitating recovery. Similarly, even as recent EU legislation – most notably the Batteries Regulation through the digital battery passport – significantly strengthens transparency requirements, composition data and dismantling information for certain materials, expanding this to other materials and ensuring that materials can be easily separated remains a key challenge for improving recycling outcomes. While the CRMA introduces magnet-specific provisions requiring labeling and product-level information on magnet type, composition and removability, these provisions have not yet been implemented and will only become applicable several years after the adoption of the necessary implementing acts, limiting their short-term impact on recycling performance.

In addition, Germany and Europe have so far failed to establish collection systems that reliably channel CRM-containing products into recycling processes and ensure sufficient processing capacity and infrastructure. Existing targets are often not material-specific, leaving CRM recovery largely voluntary and weakly incentivized, all as demand for recycled materials remains uncertain. As a result, recycling facilities tend to focus on bulk materials such as copper or aluminum, whereas materials used in small quantities or embedded in complex products are frequently not recovered at scale.

Recent policy discussions have increasingly focused on improving transparency of material flows, restricting exports of critical scrap streams and addressing long-standing regulatory barriers to cross-border waste shipments within the EU. These are important steps, as current fragmentation prevents scrap from reaching the European recycling facilities and limits economies of scale. However, implementation remains slow and incomplete.[160]

Improving framework conditions such as energy costs and financial support would also contribute to making processing less expensive.[161] In particular, Germany and Europe lack funding to bring promising technologies from their pilot stage to commercial deployment. Private investors and banks remain reluctant to finance recycling facilities and advanced separation processes, given high technological risks and uncertain commercialization pathways. As a result, many projects fail to translate into industrial-scale applications.

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[159] Jakob Kullik et al., "Das Ende der Rohstoffpartnerschafts-Illusion? Die bilateralen Rohstoffpartnerschaften Deutschlands mit der Mongolei und Kasachstan im Fokus – Bilanz und mögliche Weichenstellungen nach vorne."
[160] United Nations Economic Commission for Europe, "White Paper: Digital Product Passports and Critical Raw Materials for Batteries: Legal Conflicts and Principles for Cross-Border Cooperation," 2025, https://unece.org/sites/default/files/2025-09/WhitePaper_DPP-CRM4Batteries.pdf.
[161] GLOBSEC GeoTech Center, "The Innovation Imperative: Bridging the Supply-Demand Gap for Critical Raw Materials by 2030."

Finally, even where sufficient feedstock and technical capacity exist, demand-side constraints limit the uptake of recycled materials. Secondary materials produced in Europe are and will remain more expensive than primary imports. In practice, recyclers report difficulties in securing offtake, as downstream industries are unwilling to pay price premia for recycled inputs (e.g., Heraeus Remloy).[162] Once more, this highlights a broader structural gap: current policy frameworks insufficiently address demand creation for recycled materials. Instruments such as price support mechanisms, binding recycled-content requirements and public procurement could help close this gap by ensuring stable and resilience-oriented demand.

Reducing demand

While Germany and Europe increasingly recognize demand reduction as a relevant complement to supply-side measures, policy support and industry deployment remain operationally underdeveloped and only partially translated into coherent implementation frameworks.

A first limitation to reducing demand lies in the lack of strategic prioritization and coordination. While a broad range of technological pathways exists, current policy frameworks do not clearly support the identification or prioritization of those applications where demand reduction would have the greatest impact on supply risks. Recent initiatives point toward a more strategic framing by identifying priority sectors and advancing analytical work on CRM substitution, but they stop short of establishing clear, granular priorities across materials or use cases from a supply-risk perspective. As a result, support remains dispersed across sectors and technologies, without a coherent strategy linking innovation efforts to specific CRM dependencies.

Second, public support for demand-side innovation is fragmented and insufficiently targeted toward deployment. While research and development activities are relatively well funded through instruments like Horizon Europe, there is a persistent gap in support for scaling and commercialization, particularly in the transition from laboratory research to pilot and industrial deployment. This is also reflected in recent EU initiatives, which increasingly emphasize scaling, industrial deployment and ecosystem-building, but still provide limited dedicated instruments to ensure large-scale market uptake of substitution or efficiency solutions. Financing instruments remain limited and private investors are often reluctant to support technologies that involve performance trade-offs, uncertain market uptake or long-time horizons. This results in weak commercialization pathways, with many promising substitution or efficiency-increasing technologies failing to reach market maturity.

Third, existing policy frameworks insufficiently address the economic conditions required for adoption. Many demand-reducing solutions remain more costly than established production processes relying on primary materials, while offering uncertain performance or lifetime characteristics. While the advanced materials agenda highlights the importance of market uptake, it is not yet introducing concrete demand-side instruments. In the absence of such instruments, firms are unlikely to adopt alternative materials or technologies at scale.

[162] Ekaterina Venkina, "Warum Deutschland bisher kaum Seltene Erden recycelt," *Deutsche Welle*, August 20, 2025, https://www.dw.com/de/seltene-erden-recycling-in-deutschland-china-europa-rohstoffe-elektroschrott-v2/a-73615829.

Demand Creation as the Missing Link

From this analysis of past German and European initiatives to reduce CRM dependencies and why they have fallen short, we can draw a key conclusion: the absence of sufficient, stable demand at resilience-internalizing prices constitutes a central bottleneck for building alternative supply chains, no matter if projects are located in Europe or in partner countries. A range of policy instruments can help to establish this demand. The following section discusses these instruments, ordered by increasing degree of market intervention.

No single demand-side instrument constitutes a silver bullet. The different instruments this section discusses, whether they be demand aggregation, regulatory demand-shaping tools or price-support instruments, each address different failures and distribute costs and risks differently. A credible European strategy should therefore combine these instruments in a way that offsets their respective weaknesses. At the same time, no demand-side approach will succeed unless it is embedded in a broader strategy to expand supply, particularly in midstream processing, where Europe remains especially exposed. Each material and value-chain stage will require a different mix of instruments. This differentiation is essential to avoid excessive costs while ensuring that policy interventions are targeted at the most binding constraints in each segment of the value chain.

Demand Aggregation/Joint Purchasing

One low-intervention tool for establishing stable demand is demand aggregation. Demand aggregation can help to address coordination failures among European firms, particularly smaller buyers. By pooling demand, companies can reduce search and transaction costs and engage suppliers more strategically rather than relying on ad hoc spot purchases. In addition, aggregation may also increase buyer leverage in negotiations with suppliers by presenting larger and more predictable demand volumes. Pooled demand also improves transparency in markets that currently suffer from limited visibility regarding quantities, specifications and delivery timelines. This could make European demand less opaque for potential suppliers and thereby improve investment signals for new projects.

Demand aggregation is relatively easy to introduce compared with more interventionist policies. In its current form, the mechanism is merely hoped to reveal demand and to facilitate contacts between buyers and suppliers while the European Commission explicitly refrains from participating in commercial negotiations. As a result, the direct fiscal costs are limited and the platform avoids direct price intervention. However, implementation is not entirely straightforward. Legal and administrative challenges remain, particularly with regard to competition law, the protection of confidential business information and the administrative burden of organizing joint procurement processes across companies and sectors.

The main limitation of demand aggregation lies in the fact that it does not fundamentally change market incentives. An aggregation platform will only be of any use if there is a critical mass of firms that are interested in procuring materials outside established channels; this will only result in an expansion of supply over time if these firms are willing to do so at higher prices than they have historically paid. Companies would also need to share granular and sometimes sensitive information about their demand patterns for the platform to function effectively, which may require setting up trusted institutional channels. Up until now, these have been rather difficult to establish. Moreover, both the diversity of mineral products and specifications needed and the related processing requirements complicate aggregation efforts.

Incentivized Private-Sector Diversification

Governments can also seek to encourage diversification by providing targeted incentives for firms to source from alternative supply chains. Such instruments aim to shift procurement decisions by partially

compensating firms for the additional costs associated with diversification. In practice, this can look like tax incentives, subsidies for long-term offtake agreements with non-dominant suppliers or the public co-financing of contracts in strategically relevant sectors. Similar to incentivized private-sector stockpiling, this approach builds on the existing supply-chain expertise of companies, which are best placed to assess material requirements and technical specifications while already possessing procurement capabilities. Incentive-based instruments can be implemented relatively quickly and at both lower fiscal cost (compared to public price support) and political cost (compared to mandates), while helping to establish baseline demand for alternative supply chains.

At the same time, incentivized approaches remain voluntary and therefore do not overcome the structural incentives that have contributed to existing dependencies. Firms continue to face strong pressures to prioritize cost efficiency and short-term profitability. They will typically diversify only to the extent that it aligns with their individual risk management strategies, rather than broader system-level resilience objectives. For these reasons, incentives alone are unlikely to generate sufficiently strong and durable demand signals to make mining, processing, recycling, or substitution projects bankable.

Mandatory Demand-Side Requirements: Diversification, Sourcing and Content Rules

This group of instruments seeks to create stable demand for non-Chinese-controlled supply by obliging downstream firms to internalize resilience considerations in their sourcing decisions. In practice, this can take different forms: mandatory risk assessment and diversification requirements, local-content requirements (including for locally recycled inputs), for example through quota systems,[163] procurement-linked sourcing rules that privilege EU or trusted-partner supply chains, and standards-based market access conditions such as traceability or sustainability requirements. The common logic is that firms should no longer be free to optimize purely for short-term cost minimization if their behavior reinforces dependencies.

Conceptually, these instruments fit together because they all operate through regulatory demand-pull. They do not directly address prices. Instead, they reshape demand by requiring firms to source from alternative supply chains. As cheaper but non-compliant supply becomes less accessible, these rules can indirectly support higher prices for diversified or trusted-partner supply. They re-allocate part of the resilience burden to private firms by changing the rules under which demand is expressed, with the goal of stimulating demand-side diversification and creating a more reliable market for ex-China supply. This logic also applies to market access rules based on ESG or other standards. By restricting market access to suppliers that meet certain regulatory criteria, these standards can indirectly shift demand toward compliant supply chains and reduce the ability of low-cost producers to undercut diversified producers. Crucially, these instruments could create durable demand rather than only temporary support. If large downstream firms are required to diversify suppliers or incorporate locally recycled content, new upstream and midstream projects can rely on a more predictable customer base.

Compared with certain forms of public price support, these tools can shift more of the resilience premium to the market rather than the public budget, reducing direct fiscal exposure. At the same time, they directly constrain private sourcing and inventory policies, cost structures and procurement choices. If firms are required to source higher-cost materials or hold inventories, costs will rise. That may be justified from a resilience perspective, but it is still a real trade-off, particularly in sectors exposed to international competition.

Standards-based instruments are often viewed as comparatively attractive in this regard. Because they are typically framed in terms of sustainability and transparency, they are easier to justify legally and politically than tariff-based price interventions. They also lend themselves to coordination with like-

[163] France suggested a quota system where companies can import only certain amounts of metals, and an obligation for companies in certain sectors to diversify their supply chains

minded partners, potentially enabling the development of shared certification systems or harmonized sourcing standards that expand markets for compliant supply chains. At the same time, these measures still impose compliance costs on firms and indirectly raise input prices for downstream industries.

Moreover, practical constraints complicate implementation. Diversification obligations would require clear definitions of what counts as 'sufficient' diversification, while effective compliance and traceability would require better cross-border legal alignment and interoperable data infrastructure – none of which is easy to build quickly. In addition, these instruments do not in themselves solve the investment challenge for new mining or processing projects. While they can help shift demand toward compliant supply chains, they may still be insufficient in making high-cost projects bankable in the absence of complementary measures that address price volatility or financing risks. Given that costs would be shifted to downstream firms, one would also need to determine whether it would be enough to only apply those rules to narrowly defined strategic industries or if they would need to span more broadly across the manufacturing base. When it comes to updated procurement rules, cost increases would ultimately be covered by governments. This would be no less politically sensitive, as could be observed in the discussions around the EU's 2026 Industrial Accelerator Act. In fact, their design would require particular caution in order to avoid provoking retaliation and potentially undermining cooperation with partners if interpreted too rigidly.

Public Price Support Instruments

Price-support instruments are a final way to establish demand. One needs to distinguish between revenue guarantees and real market price interventions. The former group of instruments guarantees producer revenues but does not change the market price paid by buyers. Other instruments, such as price floors enforced by tariffs, directly increase the price in any given market.

Revenue guarantees

Revenue guarantee instruments aim to stabilize the revenues of producers without necessarily changing the market price paid by buyers. The most widely discussed instrument in this category are Contracts for Difference (CfDs). Under a CfD, a public authority guarantees a minimum strike price to the producer. If the market price, typically paid for by private buyers, falls below that level, the state pays the difference; if prices rise above an agreed ceiling, the producer returns part of the upside. Such mechanisms are already widely used in electricity markets to support investment in renewable energy.

So-called forward contracts and offtake backstops similarly aim to reduce revenue uncertainty. Forward contracts do so by locking in a future price for a predefined volume of minerals. Governments can support such arrangements indirectly by facilitating platforms for private buyers or can act directly as counterparts. As with CfDs, physical delivery usually takes place between producers and private buyers; the role of the state is primarily to enable or underwrite price certainty rather than to replace the market. If the contract does not require product delivery, it functions like a future CfD. However, where no private counterparties are willing or able to enter into such contracts, offtake backstops can come into effect as a complementary mechanism. These backstops, embedded within CfDs or forward-contracting schemes, position the state as a buyer of last resort, either at prevailing market prices or at a guaranteed minimum price, if producers are unable to secure commercial offtake agreements.

Revenue guarantees can directly address the bankability problem of individual minerals projects, without setting a new, higher price for whole CRM markets that downstream buyers need to pay. By protecting producers from extreme price volatility and downside price risks, they can improve access to private capital and make long-term offtake agreements more credible. In particular, such tools may be effective in thin or opaque mineral markets, where the absence of liquid exchanges and transparent benchmark prices complicates conventional hedging. Carefully targeted revenue guarantees could therefore help unlock investments in projects that would otherwise struggle to reach financial close, especially where a single project could significantly improve supply security.

Compared with more interventionist price-management tools, revenue guarantees are also politically more feasible in the European context. Because they stabilize revenues rather than raise market prices, they avoid directly increasing costs for downstream industries. Moreover, they can be applied selectively to specific projects, minerals or stages of the value chain. This targeted approach allows governments to limit fiscal exposure and avoid creating overly broad market distortions.

Nevertheless, revenue guarantees are not without risk. Most importantly, they address the symptoms of distorted markets, not the underlying structural causes. If used broadly and indefinitely, price-stabilization instruments could lead to prolonged public subsidy commitments or trigger competitive subsidy dynamics between major economies. Determining an appropriate reference price is similarly complex. Unlike electricity markets, many CRM markets, especially those for co- or byproducts, are concentrated and opaque, with prices determined through bilateral contracts or price reporting agencies rather than transparent exchanges. This creates significant information asymmetries between public authorities and market participants. In such settings, firms have incentives to shift to supported materials and overstate the price levels required for commercial viability in order to secure more favorable contract terms, particularly where only a limited number of suppliers exist. Poorly calibrated benchmarks could therefore distort investment signals or lock governments into supporting projects that are not economically viable in the long term or, on the contrary, at much lower prices. Finally, price stabilization tools cannot substitute for underlying demand. They are most effective when combined with credible, long-term offtake agreements for European buyers and a broader industrial strategy that supports downstream processing and manufacturing capacity.

Market price interventions

Another set of instruments seeks to directly influence the market price environment in which SRMs/CRMs are traded. Unlike revenue guarantees, these tools attempt to ensure that prices in any given market do not fall below a certain threshold. One approach discussed in the policy debate involves price floors enforced through tariffs or other border measures. Under such a system, imports priced below a defined reference level would face tariffs sufficient to raise their effective price in the domestic market. In the broader US-driven policy debate, this idea has also been linked to the concept of a 'buyers' club' among allied countries. In such an arrangement, participating states could coordinate sourcing strategies and establish common price benchmarks.

Advocates argue that price-floor mechanisms could help restore a more sustainable price environment for diversified supply chains. By preventing heavily subsidized or strategically underpriced imports from dominating the market, such tools could especially reduce the ability of dominant suppliers to undermine new entrants through temporary price suppression. This could strengthen investment signals and help establish a more level playing field for producers operating outside China.

However, market price interventions are more controversial and difficult to implement than revenue guarantees. Tariff-based price floors raise certain legal considerations, notwithstanding necessary ongoing discussions on required WTO reforms and the need for Germany and Europe to adjust to a world in which key players clearly do not feel bound by agreed frameworks. While WTO rules allow trade remedies such as anti-dumping or countervailing duties in specific circumstances, a generalized tariff designed primarily to uphold a domestic reference price would likely face legal challenges. Such a tariff would need to be carefully designed, linked to existing trade-defense frameworks or justified under specific exceptions (such as national security).

More fundamentally, price floors applying to the entire market for a given set of materials rather than targeting specific entities would, by definition, raise costs for downstream industries. Consequently, they could broadly reduce the competitiveness of sectors such as automotive manufacturing, electronics and machinery production. In addition, due to their very visible and direct character, such measures might be more likely to trigger political tensions or retaliatory trade measures, even though this concern applies to any instrument that effectively advances de-risking.

What is clear is that designing an effective policy on price floors poses a formidable technocratic challenge and requires difficult choices regarding reference prices, product categories, enforcement mechanisms, and coordination among participating countries. It would ideally be embedded in broader international initiatives with like-minded countries to guard against political retaliation and realize economies of scale, including the possibility of deeper market integration on strategically important industries that are already threatened by structurally unequal competition with China and may face additional challenges when forced to incorporate a CRM resilience premium.

Recommendations for German and European Policymakers

Despite progress in recent years, the list of measures required to address all the shortcomings in CRM resilience efforts in Germany and Europe remains long. In this concluding chapter we focus on the three strands where the biggest shifts are still needed, in practical but also in cognitive terms: (1) targeted demand and price interventions along critical value chains to reshape market dynamics, (2) coordinated stockpiling as a baseline protection rather than a last resort and (3) a stronger focus on recycling, substitution and efficiency as integral elements of CRM strategy. In addition, we discuss what it will take for Berlin and Brussels to pursue these steps effectively. We stress the importance of Germany, a key EU member state, leading by example to drive EU-level progress, the need to actively pursue and shape plurilateral cooperation with partners beyond the EU and the imperative to invest in stronger public sector implementation capacity as well as a stronger CRM ecosystem in Europe.

Three Key Strands Toward Greater CRM Resilience

1. Adopt targeted demand and price interventions along each critical value chain

Germany and Europe can only break dangerous dependencies on China if they can draw on independent, scalable and reliable CRM production and processing capacity outside of China. Supply-side measures such as better financing options and faster permitting are undoubtedly important. For permitting, the priority across the EU must be to accelerate timelines and increase predictability, while maintaining essential environmental standards. In Germany, for instance, strategic mining and processing projects could be designated as projects of paramount public interest. Political representatives should not ignore public concerns or opposition to projects but should actively make the case defending the projects' importance and benefits. There is a strong argument for reducing European reliance on production in places with often far weaker environmental safeguards.

The key factor currently missing to achieve the necessary expansion is stable and long-term demand for supply from non-Chinese sources at viable price levels. This applies to investments in primary production and processing at home and abroad just as much as it does to the growing secondary supply through recycling.

As the previous chapter has shown, there is no one-size-fits-all solution, given the major differences between different CRMs. Rather, policymakers need to combine and calibrate instruments for each critical value chain depending on factors such as volume, material characteristics and value chain complexity. Crucially, policy packages must address the entire value chain end-to-end, rather than just promoting capacity at a specific step while dependencies persist elsewhere.

For a limited number of projects, there is a case for unilateral revenue guarantees in which the government assumes the price risk. Germany and the EU should aim this instrument at thin markets (e.g., REE, gallium, germanium), where a few projects can already significantly improve supply security and where EU or even national demand is sufficient to absorb the entire output of a new project. For selected larger-volume battery materials, such as battery-grade lithium, manganese or cobalt, project-level revenue guarantees may also be justified for high-impact ventures. Sourcing requirements (for small-quantity markets at the level of trading houses to channel diffuse end user demand) can complement revenue guarantees by ensuring predictable offtake. A tariff component reducing the price gap to imports adopted jointly at the EU level could work, ideally as part of a plurilateral effort, but it would need to be designed particularly carefully.

To determine reference prices, a pragmatic option is to establish a competitive application process in which project developers indicate the price level they consider necessary for commercial viability. These submissions could then be used to derive a benchmark price based on a range of project-level data points. Safeguards against collusion risks and broader investments in government market intelligence are, of course, indispensable.

For higher-volume materials, policies that require private companies to diversify their supply must play a more central role, shifting the resilience premium to the private sector, with the option of targeted compensation. Policymakers in Berlin and Brussels should implement mandatory diversification or locally-recycled-content obligations targeting especially large firms in defense, green tech and digital value chains that account for enough CRM demand to make new production capacities viable through offtake agreements. The case is particularly obvious in the defense industry, where the state is the key customer and where the very utility of the systems being procured depends on whether the underlying supply chains are also secure.[164]

The question of burden-sharing between the state and industry aside, estimates suggest that the cost of such instruments is manageable.[165] Even for a relative volume commodity such as lithium carbonate, bridging the gap between market prices (13.52 euros/kg in 2024)[166] and estimated break-even costs for European projects (21.15 euros/kg)[167] would cost around 240 million euros per year if EU-based refining expands to 31,900 tons, covering 40 percent of expected demand as envisaged in the CRMA.[168] This would rise to roughly 300 million euros for EU projects to supply 40 percent of the projected 2050 demand. Though substantial, these figures are moderate relative to European state budgets and the overall cost structures of downstream industries, let alone in relation to the economic damage threatened by disruptions and the immeasurable political cost of exposure to blackmail. These costs will also decline as non-Chinese producers scale. More generally, revenue guarantees should be designed as temporary instruments. Once the Chinese stranglehold is broken and there is a substantial ecosystem of non-Chinese suppliers, price formation can increasingly be left to market forces within a framework of adequate diversification requirements and safeguards against unfair competition.

Mere demand aggregation can serve as a low-cost first step but will not be sufficient. The Raw Materials Mechanism that the European Commission has already created as a platform for matchmaking and eventually joint purchasing is an example of a tool that can improve transparency for suppliers, reduce transaction costs and help smaller firms reach the scale needed to conclude longer-term offtake agreements – all without any significant fiscal outlays. Its impact, however, will fundamentally depend on firms' readiness to pursue alternative sources of supply at a higher cost. In the absence of binding requirements or significant incentives, this will likely remain limited.

2. Pursue coordinated stockpiling in cooperation with the private sector

Berlin and Brussels should no longer treat stockpiling of critical materials as an instrument of last resort, but rather as a baseline protection to shield vital industries from time-limited disruptions. This would

[164] Stefan Steinicke, "Kampf um die Elemente."
[165] This illustrative calculation approach draws on methodologies discussed in Gracelin Baskaran and Meredith Schwartz, "Stabilizing Cobalt Markets: A Price Floor for U.S. Minerals Security," Center for Strategic and International Studies, 2025, https://www.csis.org/analysis/stabilizing-cobalt-markets-price-floor-us-minerals-security.
[166] Raw Materials Information System, "Raw Materials Profiles - Lithium," 2026, https://rmis.jrc.ec.europa.eu/rmp/Lithium.
[167] Estimate based on Frances Fitzgerald and Beia Spiller, "Can Emerging Industrial Technologies Compete? Scoping the Market Viability of Direct Lithium Extraction in the United States," 2025, https://media.rff.org/documents/Report_25-16_v2.pdf; Muflih Hidayat, "UK Lithium Project Suspension Signals European Battery Supply Challenges," *Discovery Alert*, February 26, 2026, https://discovery-alert.com.au/uk-lithium-project-suspension-2026-europe-challenges/; London Stock Exchange, "Updated EMH DFS at Cinovec Project," 2025, https://www.londonstockexchange.com/news-article/EMH/updated-emh-dfs-at-cinovec-project/about:blank.
[168] The EU currently projects lithium demand to reach 58,000 tonnes in 2030 , 55 percent of which are to be met by EU-based refining (31,900 tons), see Samuel Carrara et al., "Supply Chain Analysis and Material Demand Forecast in Strategic Technologies and Sectors in the EU – A Foresight Study."

create some breathing space for firms to adjust to future shocks and thereby also reduce exposure to coercion. In certain thin markets, strategic stockpiling can also help create baseline demand and help derisk new projects, though this would not be its main function.

Governments can implement this instrument on a shorter timeline than most other options if they ensure that materials available from non-Chinese sources are used with priority for building stockpiles and if they manage to push back on China's export licensing regime that tries to prevent foreign firms and governments from accumulating materials beyond their short-term needs. Berlin and Brussels should clearly call out these measures, which seem to serve no other purpose than to keep European dependencies as acute as possible, and use available economic statecraft instruments vis-à-vis Beijing to assert their vital interests in this critical space.[169]

Firms should have a self-interest in mitigating CRM supply chain risks. Yet, very few have invested in stockpiles that afford them relevant protection to date. It is structurally hard to avoid free riding. Even if all firms were to manage their individual risk exposure diligently, this would likely fall short of ensuring economy-wide resilience without some degree of coordination. An approach that goes beyond encouraging or incentivizing voluntary corporate stockpiling is therefore clearly in order. At the same time, the design of each specific stockpile will depend on material form, volumes, value, specificity of company-level requirements, and shelf lives. This strongly suggests an approach that is coordinated, but not excessively centralized.

A public-private scheme in which the government sets minimum stock requirements and, where necessary, financially supports purchasing and operating costs while private actors manage the stockpiles offers a sensible solution. A strong role for private firms enables operational efficiencies and lower discount costs, as companies can integrate the stockpiled materials into their regular operations as long as they maintain required levels. It also ensures that companies are closely involved in determining how much of which material form needs to be stocked. At the same time, government involvement reduces financing costs – a greater cost driver in stockpiling for many materials than warehousing or logistics[170] – and ensures that the government has transparency over overall stockpiles and can take corrective action if needed.

For materials with limited company-specific requirements and long shelf lives, the government should work with commodity traders who can store materials and make them available to end users in case of need. This may encompass both low-volume, high-value materials such as germanium, as well as larger-volume, lower-value materials. These constellations require particularly clear rules for how and under what conditions stockpiles are to be released. For those materials and products with a wide variety of specifications (e.g., REE magnets) and shorter shelf lives, end users should manage the stockpiles directly.

As discussed below, the most promising approach that integrates all proposed steps would be coordinated action at the EU level, ideally in concert with like-minded partners. Germany should push for such joint efforts. However, given the urgency of the challenge, it should pursue this path via pragmatic interim steps at the national level or within smaller coalitions. The pilot cooperation with France and Italy under ReSourceEU is a positive first step, but it now needs quick implementation and scaling.

3. Emphasize CRM recycling, substitution and efficiency

For too long, policymakers have looked at recycling, substitution and efficient resource use only through the lens of environmental sustainability, while neglecting their potential role in strengthening CRM resilience. Recycling, in particular, can have a powerful impact within a comparatively short period for several REEs and other critical materials if the right conditions are in place.

[169] Tobias Gehrke and Nina Schmelzer, "Beijing Hold'em: European Cards against Chinese Coercion," European Council on Foreign Relations, 2026, https://ecfr.eu/publication/beijing-holdem-european-cards-against-chinese-coercion/.
[170] Scanziani et al., "Designing an Effective Strategic Stockpiling System for Critical Minerals."

In terms of basic market incentives, sufficient and stable demand at economically viable prices is as vital to recycling projects and substitution efforts as it is to the expansion of primary supply. Therefore, the demand and price interventions discussed above will also have a relevant impact here. In addition, Germany and Europe should address four more specific issues to accelerate progress.

First, they should increase the share of CRMs that remain within dedicated value chains and reduce the amount of material being discarded in ways that make recycling difficult or effectively impossible. To achieve this, policy needs to move beyond generic recycling targets and toward specific collection and recovery obligations for individual products and materials (e.g., REE magnets and batteries), as well as obligations for CRM-intensive industries such as electronics and defense.

Second, Germany and Europe should place greater emphasis on upstream product design, strengthening design-for-recycling incentives and requirements. This may include advantageous treatment of products that minimize material use (e.g., smaller EVs requiring less resource-intensive battery configurations) as well as labeling and data requirements to establish greater transparency regarding products' CRM content. It is important to avoid unnecessary administrative burdens on companies. In practice, however, many firms currently procuring CRMs or related products from China already comply with Beijing's extensive data disclosure requirements. Therefore, this level of administrative burden is justified as it directly contributes to improving CRM traceability and, ultimately, to a more secure and predictable CRM supply.

Third, Germany and Europe should speed up ongoing reforms of cross-border waste shipment rules and should take stronger action against scrap exports. Specifically, policymakers should ensure the timely implementation of the 2024 Waste Shipment Regulation and introduce targeted restrictions on strategically relevant waste streams. Crucially, policymakers should combine such restrictions with a push to strengthen European demand, as a key driver of scrap exports is weak demand for secondary materials at the cost levels of domestic recycling. Without simultaneous steps to change this pattern, restrictions on scrap exports risk undermining the business case for collecting scrap in the first place, rather than bolstering CRM supply security.

Fourth, Germany and Europe should actively identify a set of technologies, applications and materials where recycling, substitution and efficiency gains promise to reduce strategic dependencies particularly effectively without disproportionate performance, lifetime or recyclability losses. Firms and projects directly addressing these priority areas should then receive dedicated support, including in the form of early-to-growth stage public venture capital investments or purchase commitments.

How Germany and Europe Can Get There

Lead by example in driving EU action

To amplify impact and preserve Europe's single market, instruments for CRM resilience should be designed and implemented at the EU level and, wherever possible, in concert with like-minded key industrial countries. This especially applies to demand and price interventions – the most transformative strand outlined above and the one on which the least progress has taken place yet.

The ReSourceEU Action Plan fundamentally points in the right direction, as it explicitly raises demand and price interventions. However, it leaves the design and implementation of measures largely up to further political discussion and lacks any mechanism to back them up with fiscal resources. It is not realistic for the European Commission, member states and the European Parliament to develop various value-chain specific policy packages through piecemeal proposals and negotiations, nor is it likely that resources will be mobilized through a patchwork of various EU instruments and national funds on a case-by-case basis.

Germany should therefore throw its weight behind the EU CRM Centre indicated in the ReSourceEU Action Plan and push for a swift clarification that the Centre's mandate includes concrete demand and price

interventions for each critical value chain. Moreover, it should support decision-making processes that grant the European Commission substantial leeway to implement proposed measures while member states and the European Parliament set broad guardrails and exercise oversight.

Financially, the cleanest way to back up this approach would be proper provision in the new EU Multiannual Financial Framework (MFF) for the 2028-2034 period. In this vein, Germany should support the European Commission's proposal to allocate 130.7 billion euros within the European Competitiveness Fund to resilience, security, defense, and space (a major increase compared to the 25.3 billion euros in the current budget) and help ensure that this funding can also be spent on CRM demand and price interventions.[171]

The clock is ticking; the time for concerted action is now. Germany and Europe cannot wait for the next MFF to be in place by 2028 to make decisive progress on CRM security. Instead, member states should move faster, pooling national CRM-related funds in a dedicated joint instrument and adjusting their rules so that they can be used flexibly and inclusively for both EU-level demand and price interventions. Currently, they are overwhelmingly used only for financing specific projects. Germany should declare its readiness to contribute to such a scheme and try to get political buy-in from other key EU members. It should also push to bring together flexible coalitions if there is substantive agreement among a substantial group of member states. This should be guided by the objective of actively shaping and securing integrated European value chains, as highlighted in the Draghi report on EU competitiveness.

Importantly, EU coordination must not become an excuse for inaction at the national level. The option to leverage the EU as one of the world's largest integrated economic areas is a major advantage, but there is no good reason why Germany itself should not also be able to shape CRM supply chains at least as forcefully as Japan. Obvious steps include better leveraging defense-related procurement, including the use of long-term offtake agreements, the introduction of binding sourcing requirements that mandate a minimum share of CRMs from partner countries (or exclude high-risk suppliers such as China) in defense procurement and the integration of price-support mechanisms into defense-related value chains, in line with EU law like the Net-Zero Industry Act, which embeds resilience criteria into procurement and support schemes. This requires assigning clear responsibility at the highest level within the German government, ensuring that CRM security is treated as a top-level political priority rather than a diffuse cross-ministerial issue.

The German government should also take up the recent industry-led initiative toward a national trading house, including the possibility of a public equity stake, provided there are adequate industry commitments. Moreover, it should pursue sample initiatives to guarantee offtake and prices, especially in thin supply chains. This would build on the concept of the German Raw Materials Fund but employ the wider toolbox discussed above, going beyond financing through loans or equity participation to address the very business cases of the projects in question. Such initiatives should not be seen as hindering or distracting from EU efforts, but as stepping stones that can be scaled and expanded over time.

In this spirit, policymakers must put a premium on speed and provide political cover for an approach in which not every intervention will achieve optimal impact and cost-efficiency immediately. In the case of the Raw Materials Fund, it took months to even determine which accounting firm would conduct extensive due diligence processes for each project. Within the boundaries of responsible public spending, the approach urgently needs to shift to adequately account for the costs and risks associated with delays and inaction.

[171] For comparison to the previous MFF, this is equivalent to 115.7 billion euros in 2025 prices, see Arthur Leichthammer, "The EU's Critical Raw Materials Predicament: ReSourceEU to the Rescue."

Actively pursue and shape plurilateral CRM cooperation

Collaboration with partners beyond the EU makes it considerably easier to reshape global market dynamics; it is indispensable in certain areas where even aggregate EU demand is too small for available policy interventions to create a business case for new projects.

Germany and the EU should therefore drive and shape this cooperation more actively. So far, they have mainly positioned themselves in response to US initiatives such as FORGE. Recent developments, including the EU–US MoU on a strategic partnership and its joint Action Plan, mark a significant step toward a more operational transatlantic approach, but key design choices and implementation modalities remain to be defined. To the extent that US representatives have spelled out what cooperation should look like, their approach seems to rely heavily on tariff-based price floors, which could be a very impactful element but also one that requires careful design and calibration to avoid unintended effects, especially during a transition phase where ex-China supply cannot yet meet demand and dependencies on China persist. Besides the cost burden on industry that it will pass on to consumers, there is an obvious risk of Chinese retaliation targeted against US allies, in a context where the current US administration inspires little confidence that it will stand by its partners. Germany and Europe need to prepare for countering such retaliation.

Tariff-based price floors are just one instrument. In times of ever-tighter budgets across the European Union, they have the advantage of not triggering long-term fiscal commitments. At the same time, Germany and Europe should ensure that the entire demand and pricing policy toolbox is a key element of plurilateral cooperation schemes alongside cooperation on stockpiling and release, as well as financing and other supply-side enablers. Most importantly, a viable plurilateral market-shaping scheme should include agreements that ensure a fair allocation of costs and benefits, including robust safeguards that guarantee an adequate share of materials from new projects will actually flow to Europe (or, for projects located on the continent, stay there). This also requires strengthening Europe's ability to control foreign investment in strategically relevant assets. To do so, Germany should support the European Commission's proposal to include strategic European CRM projects as so-called Projects and Programmes of Union Interest under the updated EU Foreign Direct Investment Regulation in order to ensure that ownership and control structures remain aligned with European security interests.

While any international legal mechanism will have its limits in the current environment, the fact that orchestrated offtake agreements with industry players from participating countries will likely be an important element of such a scheme ensures a high degree of transparency, making attempts to secure disproportionate benefits at the expense of partners somewhat less likely.

CRMs is the one area where the Trump Administration has put a premium on plurilateral agreements. US participation greatly increases the heft of any plurilateral scheme. Germany and Europe should make sure to strongly work with other key like-minded players such as Canada, Japan, Australia, and Brazil. At the same time, they should make it a priority to keep the US on board and refrain from pursuing schemes without its participation, unless the Trump Administration changes course and turns hostile on CRMs. While Berlin and Brussels should pragmatically explore various bilateral and minilateral constellations, the most plausible format to advance an ambitious market-shaping scheme remains the G7, with an open invitation for other countries to join the initiative.

Strengthen implementation capacity and Europe's CRM ecosystem

The instruments outlined above amount to an ambitious agenda. Germany and Europe can only advance such an agenda if they invest substantially in capacity and expertise in the relevant public entities and better orchestrate the way they work together.

Currently, small pockets of excellence are scattered across all levels, from the European Commission and national ministries to institutions such as DERA and local authorities. Pooling European resources in the proposed EU CRM Centre offers the most promising way to build critical mass for complex tasks such as developing demand and price intervention packages along critical value chains. It will also make it easier

to organize the all-important interface to the private sector, starting with more systematic collection of relevant firm-level data through appropriate and secure channels. Alarmingly, the conversation around the CRM Centre in Brussels already has a defeatist flavor, with observers questioning whether member states will be ready to support this model in practice. Others are already predicting lengthy turf wars. Germany has an important role to play in preventing this outcome.

In parallel, Berlin and other member state capitals need to invest in domestic capacities. Given the limited supply of available experts and talent, a certain degree of 'cannibalization' may be unavoidable, but it is at least easier to organize mobility between EU and member state entities (depending on how relevant initiatives advance) than to identify and recruit suitable candidates in the first place. Given the erosion of the European CRM sector over the last decades, exchanges and joint training programs with partner countries boasting stronger domestic CRM industries (Canada and Australia, among others) can accelerate the build-up of expertise beyond hiring established experts.

In terms of political direction, European leaders need to establish structures to closely track the progress of initiatives and quickly escalate roadblocks to a level at which they can be resolved politically. They should strengthen the CRM Board established under the CRMA to convene member state and European Commission representatives and equip it with executive authority. In Berlin, the Chancellor and the Minister of the Economy have key roles to play in sustaining top-level political attention to the issue. Given CRMs' crucial relevance for national security, which is not least due to their centrality to the rearmament effort, the National Security Council should also stay abreast of developments and sustain urgency among all ministries and entities involved.

The overall weakness of Germany's and Europe's CRM industry and ecosystem makes for a difficult starting point for the required effort. Besides the limited number of experienced experts available to design and implement policies, the surge capacity of industry players is also impacted. Even if policy succeeds in creating commercially attractive opportunities, established processing firms will only be able to accommodate a limited number of additional projects and complexity in their portfolios. Within the mining industry, large-scale German players are missing altogether and are scarce across the continent.

In the short term, the most plausible way to remedy this challenge is to actively attract companies and entrepreneurs from countries with larger and more differentiated CRM sectors, as exemplified by the flagship lithium project developed in Germany by Australia's Vulcan Energy. Beyond that, policymakers have limited direct means at their disposal to accelerate the re-emergence of German and European mining and processing companies, but they can improve the conditions for this to happen. An obvious starting point is to bolster support for relevant university faculties and programs, broadening the talent pipeline and facilitating career transitions from adjacent fields.

Getting the flywheel of industrial development in motion is by no means an easy task. But it can be done if Berlin and Brussels build on the progress of the last years, learn from past failures and take decisive action to break up the entrenched global market dynamics that have obstructed their past efforts time and again.

Arthur Leichthammer rightly points to the yawning "gap between the political ambition to secure critical supply chains and the instruments capable of ensuring this" in Europe.[172] Germany has every interest to take the lead in closing it. It is high time for the government and industry to finally get serious about this with the necessary sense of urgency.

[172] Arthur Leichthammer, "The EU's Critical Raw Materials Predicament: ReSourceEU to the Rescue."

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