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# Financial Tools for Boosting Resilience of CRM Value Chains and Strategic Stockpiling

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# Executive summary

Critical Raw Material (CRM) value chains are more vulnerable than ever and entire vital industries in Europe are now at risk if supplies are not secured through strategic and urgent actions, given mounting geopolitical confrontation, resource nationalism, growing demand and limited supply increase. Resilient CRM products will be more expensive than China dominated markets or products hence building resilient CRM supply chains comes at a cost. A key question is who pays for the extra costs, governments or industry and consumers. Governments must reduce the extra costs and facilitate investment, yet consuming industries must bear costs too.

The mobilization by the United States (US) to build resilient CRM supply chains is unprecedented, with a total of over USD 40 billion (bn) of public money now mobilized in various forms, including direct equity, debt, guarantees and fixed offtake prices *via* five public institutions mainly. The US has *de facto* established a quasi-sovereign fund to take equity into key companies inside the US and is extremely active also abroad, not least in Latin America, Africa, and Australia. The difference between the EU's (European Union) and the US's financial mobilization is around 1 to 10, and much of EU's financial commitment is actually not spent, or very long to be mobilized. Moreover, the European Investment Bank (EIB) cannot take equity, which is powerful for derisking projects, and the public-private funds put in place by France, Italy or Germany are no match to the US.

Current policy efforts in Europe are still not enough. A major additional effort to align supply and demand support mechanisms is needed on the one hand, alongside additional and larger and more dedicated financial support tools aimed at fast-tracking support conducive to Final investment decisions (FIDs), not least in the recycling and processing segments. The EU needs to step up mechanisms for providing competitive financing and derisking projects, alongside predictable regulation and long-term offtake schemes. FIDs on dozens of industrial projects must be taken and facilitated. An effective framework for strategic stockpiling to mitigate short-term disruptions is also needed.

The stronger the coordination between industries and governments, the lower the costs and the more effective the policies will be. The EU needs to take the full value chain view when conceiving funding mechanisms in the CRM field, making sure that the midstream capacities do not become a *de facto* bottleneck for true industrial resilience. The processing segment is the most sensitive and challenging to deploy in terms of business case and technology. In this sense, securing the commitment of downstream consumers to diversify their supplies and commit to buying from resilient

sources is essential, as underlined in the renewed EU Economic Security Strategy. This should be incentivized *via* priority access to EU support for those companies with domestic supply sources, applied more broadly than only the next 2026 Innovation Fund call on clean tech manufacturing and CRM supply (which is nevertheless a good start).

The EU and its instruments need to take stock of the fact that securing CRMs requires new approaches and new tools based on strategic geopolitical and geoeconomic planning and acting, rather than normal, market-based, competitive, risk-averse behavior. The EU needs instruments that can take risks, accept lower rates of returns and take long-term positions, as CRM projects require long-term approaches.

The EU CRM Center needs a strong dedicated budget post 2027 of about EUR 15 bn from the EU Competitiveness Fund of the next Multiannual Financial Framework (MFF), to be used for strengthening resilience over the full value chains in critical technologies. In the meantime, the CRM Funding Center, as a single point of contact for all funding requests, should be readily available and have the capacity to direct rapidly the most appropriate funding to the best projects in priority segments.

The CRM Center should have the know-how and resources to use different mechanisms to support a variety of metals and types of projects and judge what is the best mechanism to use, depending on the type of market, company and metal, as well as short-term and long-term interests and pressures. There is no "one mechanism fits them all". Specific segments need specific support tools:

- The exploration stage is critical yet extremely risky, and funding is both insufficient and stagnating. The EU is largely behind as a player. Effective mechanisms are tax credits and grants convertible into equity.
- For niche companion/small markets metals (ex. gallium, rare earths), which furthermore imply high costs of mastering the processing technology, floor prices and equity investments, giving offtake rights can be a good tool. For base metals/larger metal markets (ex. copper, nickel, cobalt, etc.), concessional loans (giving offtake rights, or linked to offtake commitments by the EU or EU companies) and loan guarantees could reduce the cost of funding for companies and improve diversification of supplies (even in the shorter term in the case of an extension of production capacity). Border tariffs are another option.
- The midstream and downstream stages are critical for securing the offtake of diversified CRM (be it Made in Europe or in partner countries). As such, Environmental, Social and Governance (ESG)/resilience criteria as proposed in the Net-Zero Industry Act (NZIA), conditioning public support schemes (ex. for electric

vehicles, EVs) to obligations for companies to have minimum two suppliers for inputs they use across the value chain (or at a minimum respect the 65% maximum threshold of dependency on a single supplier), foreseeing Made in Europe criteria as a condition of EU funding etc., are among the relevant mechanisms.

- The recycling stage is essential and this nascent sector needs visibility over competitive electricity, stable and secure inputs (for instance, making sure European black mass is not leaving Europe), as well as long-term offtake agreements which usually implies having the confidence that midstream demand for recycled products is available and sufficient (ex. precursor cathode active materials [pCAM] and cathode active materials [CAM] producers in the battery value chain). In many cases, these require B2B matchmaking, transparency of resources and scrap flows, identification and standardization of products and material categories to build up standardized resources and knowledge of demand (localization, volumes, evolution over time) to build up business cases. This supply and demand aggregation work is essential and could be performed by the CRM Center.

What can be done in an emergency includes:

- Spending the money already allocated: several existing funds notably take too much time to allocate money for projects. Profit assumptions, risk appetite and ESG have to be adjusted to a degraded environment. Providing long-term preferential credit lines with leading and niche trading houses in order to secure supplies of CRMs in the medium to long term, and let these specialists operate to secure markets and optimize logistics. Putting together additional resources in a hurry before the next MFF.
- Building up in a confidential manner stocks of niche metals that are key for defense industries, still reasonably priced, potentially subject to future export restrictions, and organizing and planning for the eventual release of stocks. Such stocks cannot be fully ESG compliant and need to be located in Europe. Also, mobilizing the private sector, small and large, for conducting resilient business behavior and subscribing to a strategic stockpiling mechanism that can similarly benefit large and small consumers/buyers.
- Requiring governments to determine demand-side management plans should there be larger supply shortages, enabling to reduce and prioritize demand and possibly cut off designated consumers.
- Fast-tracking the development of a European mining culture with robust license to operate, in order to build understanding and confidence in European mining operations.

- Prioritizing recycling investments and shutting down the exports of metal waste and black mass outside Europe, such as in buying up the European battery scrap (black mass), and prioritizing setting up EU recycling industries, in parallel with mandatory product incorporation requirements, in order to ensure the market ramp-up and business case.
- Developing and funding powerful public-private funds, modelled on the US ones, that support projects in Europe and abroad in taking equity in return for supply commitments with destination requirements.

# Résumé

Les chaînes de valeur des matières premières critiques (CRMs) sont plus vulnérables que jamais. Des industries vitales entières en Europe sont désormais en danger si leurs approvisionnements ne sont pas sécurisés par des actions stratégiques et urgentes face à la montée des confrontations géopolitiques, au nationalisme des ressources, à la demande croissante et à l'augmentation limitée de l'offre. Les produits CRM résilients seront plus coûteux que les marchés ou produits dominés par la Chine, mais les industries consommatrices doivent supporter ces coûts tandis que les gouvernements doivent chercher à faciliter les projets et à réduire les coûts et incertitudes. L'Europe doit renforcer les mécanismes pour fournir un financement concurrentiel et des instruments de réduction du risque, parallèlement à une régulation prévisible et des dispositifs de contractualisation à long terme. Les décisions finales d'investissement sur des dizaines de projets industriels doivent être prises et facilitées. Un cadre efficace pour le stockage stratégique de métaux critiques est également nécessaire. Plus la coordination entre les industries et les gouvernements sera forte, plus les coûts additionnels seront bas et plus ces politiques seront efficaces.

La mobilisation américaine pour construire des chaînes d'approvisionnement résilientes est sans précédent, avec un total de plus de 40 milliards de dollars d'argent public désormais mobilisés sous diverses formes, notamment en capitaux propres directs, en dette, en garanties et en prix plancher *via* principalement cinq institutions publiques. Les États-Unis ont *de facto* créé un quasi-fonds souverain pour transférer des actions dans des entreprises clés aux États-Unis et sont aussi extrêmement actifs à l'étranger, notamment en Amérique latine, en Afrique et en Australie. La différence entre la mobilisation financière de l'Union européenne (UE) et celle des États-Unis est d'environ 1 à 10, et une grande partie de l'engagement financier de l'UE n'est en réalité pas dépensée. De plus, la Banque européenne d'investissement ne peut pas investir des capitaux propres, ce qui est pourtant un levier puissant pour réduire les risques. Les fonds public-privé mis en place par la France, l'Italie ou l'Allemagne ne font pas le poids face à ce que les États-Unis mettent en œuvre.

Les efforts politiques actuels en Europe ne suffisent toujours pas et une mobilisation supplémentaire est désormais indispensable et urgente.

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# Introduction

Over the past three years, the EU has been progressing in building a European industrial and economic security policy, with the resilience of value chains and open strategic autonomy being at the core of EU's efforts in a world marked by the weaponization of dependencies, geoeconomic confrontation and by China's unprecedented implementation of export restrictions of all kinds for CRMs[1].

The Critical Raw Materials Act (CRM Act) represents a step change in the EU's approach to CRM, in the sense of clarifying targets, thresholds for diversification, encouraging domestic mining, processing and recycling, monitoring of market developments, fostering stress tests at corporate levels as well as promoting intergovernmental and B2B partnerships or designating and promoting strategic projects. The European Commission (EC) put together a network of fifteen bilateral partnerships on CRM, is involved in major international initiatives, with the Mineral Security Partnership and its Finance Network[2] relabeled Forum on Resource Geostrategic Engagement[3], the G7 or the United Nations, aimed at building a market framework with common standards and non-restrictive barriers, and has contributed to the emergence of strategic mining, processing and recycling projects in Europe and beyond[4]. It is now largely admitted that the EU's main vulnerability lies in the processing and refining segment, where China has a stronghold. While there are industrial capabilities in Europe, they need to be ramped up fast, which proves very challenging.

The EC, with the support of several Member States, is also now determined to progress on strategic stockpiling and to explore ways to ensure a more effective scale-up. All G7 countries face serious challenges as far as the processing of CRMs is concerned, notably heavy rare earths, a segment dominated by Chinese companies and where re-localization and industrial scale-up will be very long and financially and technologically challenging.

However, challenges and risks have been building up fast and in such a magnitude that policy action has failed to follow suit.

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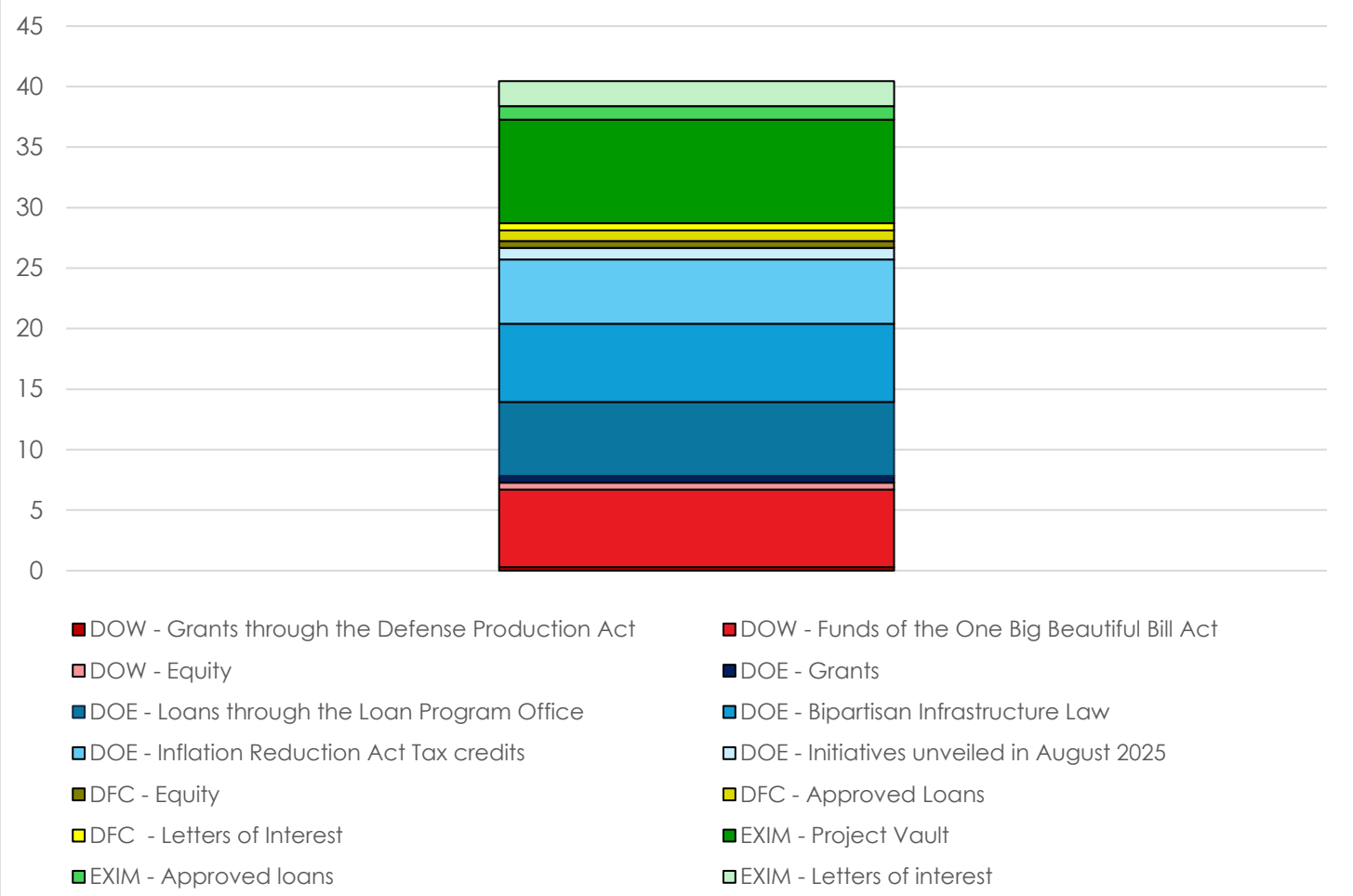
1. M.-A. Eyl-Mazzega, D. Paula Gherasim and T. Michel, "Placing the EU on a Warfare Footing: Energy and Raw Materials Priorities for 2026", *Ifri Papers*, Ifri, January 2026, available at: www.ifri.org.
2. "Joint Statement of the Minerals Security Partnership Principals' Meeting 2024", U.S. Department of State, September 27, 2024, available at: https://2021-2025.state.gov.
3. "2026 Critical Minerals Ministerial, Fact Sheet", U.S. Department of State, February 4, 2026, available at: www.state.gov.
4. D. -P. Gherasim, "The Troubled Reorganization of Critical Raw Materials Value Chains: An Assessment of European De-risking Policies", *Ifri Papers*, Ifri, September 2024, available at: www.ifri.org.

Financing remains an unresolved yet essential condition for truly building the EU's resilience in the field of CRM. South Korea's Supply Chain Stabilization Fund and its overall framework are mobilizing about EUR 30 bn, with EUR 1.5 bn specifically dedicated to CRMs in an update decided in October 2025. Australia's Critical Minerals Facility of around EUR 700 million (mn) from the Australian government will include a strategic reserve to trigger processing investment[5]. Canada's USD 3 bn commitment *via* the Critical Minerals Infrastructure Fund and the Strategic Innovation Fund comes at a significant scale. Japan is largely considered as the model for resilient planning and acting not least through the Japan Organization for Metals and Energy Security (JOGMEC).

Yet the EU's total mobilization of about EUR 5 bn so far, mostly unspent, is largely underperforming versus the US mobilization, which appears to be of another magnitude with a total of over USD 40 bn of public money mobilized in various forms, including direct equity, debt, guarantees and fixed offtake prices *via* the Department of War (DoW), the Department of Energy (DOE), the Department of Commerce (DoC), the International Development Finance Corporation (DFC), and the US Export-Import Bank (EXIM). The US has *de facto* established a quasi-sovereign fund to take equity into key companies in the US and is extremely active also abroad, not least in Latin America, the Democratic Republic of Congo (DRC) and Australia. The difference between the EU's and the US's financial mobilization is around 1 to 10[6].

5. The Australian government has so far announced AUD 185 million for stockpiling and for offtake agreements.
6. M.-A. Eyl-Mazzega, D.-P. Gherasim and T. Michel, "Placing the EU on a Warfare Footing: Energy and Raw Materials Priorities for 2026", op. cit.

**Figure 1. Estimated public support for CRMs in the United States for the period 2021-February 2026, in EUR billion**




*Source: Ifri, based on public announcements.*
*DOW refers to the Department of War, DOE to the Department of Energy, DFC to the Development Finance Corporation, and EXIM to the Export-Import Bank of the United States.*
*Regarding the Inflation Reduction Act provisions, for the 48C and 45X tax credits, which do not cover only critical minerals projects, the assumptions adopted are approximatively 10% of the funds allocated to this type of project.*
*Currency conversion is based on January 1st, 2026, exchange rate (i.e., 1 EUR = 1.173 USD).*

Adding to the challenge, European public-private funds are often not spent and European industrial buyers do not have the buy-resilience reflex, as it can add to supply costs. Last but not least, while the total capital investment "expected" in the 47 EU strategic projects adopted in 2025 (not counting the 13 outside the EU) totals EUR 22.5 bn, most of them are very far from taking a FID.

There is now a sense of urgency to move up a gear for Europe's mobilization. Building resilient CRM value chains requires addressing and mitigating market distortions of all kinds, which make it almost impossible to take FIDs in European markets for key value chain segments –notably for example processing industries currently dominated by Chinese companies which have gained, thanks to huge subsidies allowing huge seize, efficiency and technological advance, extremely robust productivity, and almost unmatchable competitiveness. Competitive financing must be available,

projects need to be derisked, demand needs to be lined up with premium and predictable prices, and offtakers need to accept bearing sometimes higher procurement costs in order to build resilience.

This note focuses on two main dimensions, financial and organizational, related to deploying resilient CRM value chains and strategic stockpiling: how can the EU better mobilize financing to maximize impact and build resilience in the short, medium and long term in the mining, processing and recycling of CRMs? Which financing mechanisms are most likely to attract private investors and give confidence to banks that projects are viable? How best to structure the necessary strategic stockpiling mechanisms that can provide short-term buffers in case of supply disruptions and emergencies? What can the EU learn from stockpiling mechanisms such as JOGMEC? How should a European CRM strategic stock look like, i.e., governance, means, implementation, etc.?

# Long-term resilience mechanisms across the CRM value chain

## RESourceEU is another step that is not enough

With the RESourceEU Action Plan presented on December 3, 2025[7] and the upcoming creation of a European Critical Raw Materials Center (CRM Center), the EU has created an opportunity to streamline and strengthen funding towards the CRM value chains.

The first step is to consist in the creation of a one-stop shop for all CRM projects seeking EU-level funding: different funds (Innovation Fund, Just Transition Fund, Horizon Europe etc.) can already be mobilized today, but project promoters do not always have the capacity to identify the right one or to pursue several opportunities, and tapping into the Innovation Fund is a complex and uncertain endeavor. These are not dedicated, strategic tools, even if some projects have benefited from them (such as Mecaware/Just Transition Fund).

Second, the European Investment Bank (EIB) has committed at the end of 2025 to spend EUR 2 bn/y on CRM value chains, complementing national CRM funds in France, Germany, Italy and the Netherlands. That money is to be predominantly spent within the EU.

Third, the EC has committed to direct EUR 2 bn from the Innovation fund for CRM value chain projects. Yet these are lengthy and uncertain administrative procedures not adapted to the need to rapidly solve the "chicken and egg" problems in the value chain alignment.

Overall, there is a general need for public investment institutions in Europe to accept more risks in CRM projects (EIB is wary of its top rating, hence is inclined to seek low-risk, high-ESG-performance projects, leaving out of its scope the vast majority of projects that would need such institutional financing to actually improve their bankability). Otherwise, they risk displacing private investors willing to invest in lower-risk projects, instead of creating additionality by supporting more risky projects. There is

7. "RESourceEU Action Plan, Accelerating our critical raw materials strategy to adapt to a new reality", Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, December 2025, available at: https://single-market-economy.ec.europa.eu.

also a need for efficient teams to be in place and be able to coordinate with private commercial banks, in order to efficiently process the many projects and files. The EIB cannot take equity, which is powerful for derisking, and the public-private funds put in place by France, Italy or Germany do not play any role similar to that of the US DoW or DoC, which are taking equity or committing to long-term price or offtake guarantees.

In addition, instruments must be available for providing financial support for projects outside the EU beyond the EIB and the European Bank for Reconstruction and Development, as these institutions will necessarily have some very strict compliance rules which are likely to rule out key projects. This is where investment funds like TechMet or Orion CMC, which are supported by the US administration (US DFC is a shareholder), are much more agile and active. Identifying, supporting or creating such flexible and effective vehicles will be crucial.

The new CRM Center should have its own budget for being able to perform correctly its responsibilities (i.e. joint purchasing, matchmaking, stockpiling, derisking etc.). Hence, the next MFF would need to dedicate a specific amount of the budget (ideally at least EUR 15 bn to be leveraged to attract private investment) towards the CRM sector and the resilience of value chains. Indeed, representatives from the financial sector dealing with CRM estimate that for the EU to achieve resilience across the battery value chain would need about EUR 50 bn, hence a EUR 15 bn EU level contribution to complement the EIB and national CRM funds commitments would produce a step-change in EU's ability to secure and diversify CRM flows, if leveraged efficiently (i.e. an average 3.5 leveraging factor, as observed in Global Gateway projects[8] managed by the EIB), to attract private level funding.

## Supporting exploration activities

CRM exploration projects have a very elevated failure rate (up to 90%) and global exploration expenditure stagnated in 2024 (namely due to low minerals prices and still higher interest rates), with Europe being a negligible player in this segment while China dedicates USD 14 bn per year since 2022 to geological exploration[9]. Beyond dedicated funding, actors that are particularly strong in this segment, like Canada, Australia and the US, also have a regulatory framework that is more favorable to exploration by facilitating access to land for companies, streamlining permitting procedures and making geological data available. Private sector representatives rightly point to the importance of providing cheaper finance to support risky and expensive exploration activities from junior mining companies with a view to opening several new mines in the medium to long-term. The CRM Act has

8. D.-P. Gherasim, "Global Gateway: Towards a European External Climate Security Strategy?", *Ifri Memos*, Ifri, April 11, 2024, available at: www.ifri.org.
9. "Global Critical Minerals Outlook 2025", International Energy Agency, 2025, available at: www.iea.org.

also made the mapping of resources in Member States mandatory and could be followed by exploration support mechanisms to turn resources into reserves within these boundaries.

**Tax credits** are one way to incentivize exploration and to increase private investment flows towards it. For instance, Canada has put in place a diversified system of tax credits[10] for exploration, starting with 100% tax deduction for exploration costs ("Canadian exploration expenses"), which include determining the existence, location, extent and quality of the mineral. Among them, there is also the mechanism of "flow-through shares" by which junior mining companies can allocate to their investors (purchasers of shares issued by the company) certain exploration expenses, which investors can afterwards deduct against their income and hence reduce their overall tax liability (100% tax reduction for amount invested in share and a 15% or 30% tax credit for an eligible expense) and maximize the eventual returns. Such a tool is particularly useful for incentivizing broader involvement of the private sector.

**Grant funding convertible to equity** is another interesting option *via* which the EU would not only incentivize exploration but also enhance its direct ownership of CRM projects. The Industrial Development Corporation[11] of South Africa, owned by the South African government, has put in place such a scheme through which grant funding is convertible to equity (limited to 49%) if the project is viable. Grants can go from EUR 500,000 to EUR 2.5 mn (with total available funding under the Junior Mining Exploration Fund of almost EUR 23 mn) and certain conditions must be fulfilled (ex. 51% direct or/and indirect ownership by black people). This is a particularly interesting approach for CRM where the EU wishes to have strategic ownership (ex. rare earth elements).

## Boosting mining and processing activities

Support options for mining operations differ depending on the type of metal (base metals like iron, aluminum, copper etc. vs specialty metals, like battery metals[12]), the size of the market (annual quantities put on the market varying from several million tons like iron, to a few tons like scandium), the size of the company (major mining companies, trading companies, junior companies…). In some cases, several types of support (ex. equity and price floors, loans and offtake agreements, etc.) may need to be combined to strengthen the viability of the project.

Equity investments giving offtake rights is a suitable tool, namely in the case where developers are small companies lacking cash but also a business

10. See: https://natural-resources.canada.ca.
11. "Junior Mining Exploration Fund", Industrial Development Corporation, available at: www.idc.co.za.
12. To be fully accurate, nickel is part of battery metals but generally considered as a base metal.

track record to enhance their credibility with investors. Small equity investments by governments can crowd in private investments, while at the same time giving respective governments the option to require priority access to production (*via* offtake rights). As an example, the Alcoa-Sojitz Gallium Recovery Project, in Australia, will receive concessional equity finance from the governments of Australia, the US and Japan, with a right of offtake for those countries. Equity investments are hence interesting for the EU in the case of small-scale mining projects developed by new/small – medium companies, but also in CRM processing/refining or trading projects where capex is lower and investments give a right of overview over the strategic direction of the project. For instance, US DFC signaled its intention to take a stake in the joint venture between Mercuria and Gecamines (DRC), which would give US end users preferential access to minerals produced and traded (namely copper and cobalt) and the right of first refusal, hence supporting US diversification ambitions and DRC's strategic interest to reduce price volatility[13]. This implies a readiness to take risks and hence possibly lose money. It also requires the ability to effectively process due diligence and files, as speed in making decisions is of the essence. A possible way of structuring such operations is that the EIB lends money at zero interest rates to specialized private funds, like InfraVia, Demeter, the KfW fund or the National Strategic Fund of Italy, and to established trading houses that have a track record of making deals, so that they can expand their operations and build on their expertise. None of these funds has proven very effective so far.

Concessional loans linked to long-term offtake agreements are an interesting tool involving an active public-private partnership. This is a particularly suitable option in the case of base metals (ex. copper, bauxite, nickel, zinc, etc.) issuing from new mines lacking a production track record, which have difficulties finding both large-scale lenders and securing credible offtakes. Several possibilities exist in practice. The public sector can provide the concessional loans conditional on the project developer securing a private offtake (ex. Export Finance Australia signed a USD 200 mn loan agreement with Australian Strategic Metals to develop their Dubbo mine, conditional on signing offtake agreements). A second option is when the government can provide both the concessional loan and engage in a long-term offtake agreement (connected to a stockpiling mechanism or to consumption obligations put on domestic downstream users to re-buy the metals), covering partially or totally the output of the mine or offer volume guarantees[14] (in which case, the government commits to buy the output at an agreed price if there is no market demand), which can also work in

13. "DFC Strengthens Strategic Partnerships with the Democratic Republic of the Congo and Rwanda to Bolster Supply Chain Security and Economic Growth", U.S. International Development Finance Corporation, December 5, 2025, available at: www.dfc.gov.
14. E. Righetti, V. Rizos and D. Tekin, "Making the Green Premium Work. Policy Pathways for Critical Raw Materials", Centre for European Policy Studies, November 18, 2025, available at: www.ceps.eu.

connection with a stockpiling mechanism. A third way, particularly interesting for Europe's diversification efforts abroad, would be the model put forward by the US EXIM Supply Chain Resilience Initiative, through which US EXIM Bank finances a share of CAPEX in a project depending on the share of offtake that goes to US-based firms, which must use the secured CRM in order to manufacture products in the US. To be eligible, mineral producers have to be China-free: not controlled/physically based/owned or relying on China (nor Chinese technology).

Government guarantees can also be used to attract private investors, by adding a layer of protection which boosts confidence and can help project developers obtain better market financing terms. For instance, Germany offered in 2022 EUR 800 mn loan guarantees to Trafigura in return for a 5-year non-ferrous metal supply. This is a very efficient way to secure volumes in the short to medium term, as trading houses have unique logistics, resource and trading portfolios but less so processing assets (with exceptions, such as Trafigura/Nyrstar). Their future revenue commitments are typically not in the long run, hence they need to keep their access to finance as large and cheap as possible. Credit guarantees imply a commitment on the part of the government to take on the debt-service payments on behalf of the borrower in case of default. The EIB has extensive experience in this field and plays a very important role in not only improving the credit quality (*via* increased protection) but also enhancing the credibility and visibility of the project in the eyes of private investors. Although guarantees can be widely used, they make particularly sense in the case of big mining projects developed by major mining companies that are not short in equity and that need guarantees mostly as a way to mitigate risks out of their control (ex. geopolitical) and to improve the credit rate at which they obtain their loans.

Floor prices have risen in popularity in recent months, mostly as a solution to market prices manipulation by China or other distortions. By enabling a predictable revenue stream, they can help take FID and secure funding for projects that could be undermined by price fluctuations. This mechanism is most appropriate in rather small markets like the rare earth elements (REE), with opaque price formation, high processing complexity and high capital requirements, where diversification is particularly difficult due to domination by a single player or because these are companion metals whose production is not sensitive to price signals. A floor price mechanism establishes a guaranteed minimum price for the respective metal and it can be implemented in different ways: ex. the government can engage to buy the production when the metal's price fall below the floor price (similar to a one-sided Contract for Difference) and potentially connect it to a stockpiling mechanism, or could opt for a more complex scheme (similar to a two-sided Contract for Difference) where the government compensates the company during downturns, but the producer shares with the government the benefits from selling the product above the floor price on the market (ex. the mechanism put in place by the Canadian government to support Rio Tinto's

scandium oxide production and Nouveau Monde's graphite refining project, but also the US DoW agreement with MP Materials). This type of mechanism would be particularly interesting to be deployed at the EU level or even G7 or OECD level for REE, graphite and lithium (where processing is dominated by China and prices tend to be below costs), in order to establish minimum prices across a larger region to achieve economies of scale and counter more efficiently market manipulation. The challenge though is that these floors can distort competition or be costly for governments if they are set too high and in a rigid manner. Therefore, they should be considered only for niche products in specific cases, while other mechanisms are to be privileged. Such prices should also be correlated with the actual production costs of downstream industries, which can be monitored and estimated.

Trade measures, such as bans on imports of certain types of metals and products or country-related (such as the US Foreign entities of concerns for public procurements), import quotas or flexible import tariffs, can also be considered to prop up domestic mining industries for example, or within a like-minded club of countries. This is what has been proposed by the Trump administration during the 2026 Critical Mineral Ministerial, with proposals to set up a resilient pricing area for CRMs based on fair reference supply costs[15]. Such mechanisms in most cases lead to higher prices for consuming industries or costs for governments, but these are decisive to build resilience and typically insignificant compared to costs related to a supply disruption. However, it can well be that CRMs are consumed in such small level that price increases have an insignificant impact on end prices. The key is to find the right balance and be able to adjust mechanisms over time.

Last but not least, these industries are electricity-intensive, hence access to low-carbon, competitive electricity is paramount. Mechanisms need to be in place for that.

Matchmaking mechanisms involving public-private risk sharing and funding, like the German H2 Global platform, could also be a suitable tool to link European (or strategic partners') production to EU consumption, thereby helping producers to secure financing thanks to visibility over the offtake and giving buyers visibility over the long-term prices of the products. First, the EU (or national governments) would run competitive auctions (involving a set of criteria that could be related to diversification, sustainability, local content, etc.) to buy the best products at the lowest price. Then they organize a second auction to sell the acquired products to the highest EU bidder. To enhance its effectiveness, the EU should also establish obligations on midstream and downstream users in terms of supply diversification and sustainability, to boost market demand.

15. "Critical Minerals Pricing Mechanisms", *Issue Brief*, SAFE, December 2025, available at: https://safe2020.wpenginepowered.com.

More broadly, national governments have a key role to play too. They should have a public debate conducive to mining investment when appropriate, put in place fast-tracked permitting procedures, ensure that land is available, alongside electricity and infrastructure connections, and national tax incentives. France is a good example, with its *Crédit d'impôt industries vertes* and a streamlined administrative procedure for strategic projects[16].

## Midstream and downstream products (such as pCAM, CAM)

The EU must conceive resilience through the lenses of a full value chain approach, hence should not ignore the importance of developing midstream and downstream industrial capacities as offtakers of CRM. These should actually become a top priority because there is a huge industrial and capacity gap in Europe. This is a very challenging value chain segment because its development requires securing resources, contracts for offtakes and permits for these very sensitive facilities in terms of environment and safety, keeping operational costs, such as electricity, as low as possible, and having the know-how, technologies and required skills.

The battery sector perfectly illustrates this issue, as processed battery minerals (nickel, cobalt, manganese, lithium) must be transformed into precursors of cathode active materials (pCAM), which afterwards are further transformed into cathode active materials (CAM) that can be used for the production of battery cells. Umicore currently has the only operating pCAM facility in Europe (Kokkola site), while BASF's pCAM project in Finland, planned to start by the end of 2024, has been delayed by appeals in court and awaits the final investment decision. Eramet announced the suspension of its recycling project in France and Stellantis withdrew from the MoU with Orano on battery recycling and pCam. Hence, insufficient pCAM and CAM facilities based in Europe means a lack of offtakers for mined or recycled minerals. One of the key reasons for insufficient pCAM/CAM capacities is the lack of offtake for their own products. Further down the value chain, the EU must secure the willingness of automotive companies to support a European-based value chain, while also maintaining the stability of the regulatory framework (ex. $CO_2$ standards regulation) and providing support mechanisms for EVs.

There are several ways in which the EU can incentivize downstream users to put a price on resilience instead of letting themselves make purely price-driven supply choices. On one hand, ESG standards applied to the EU market and at the EU borders would allow for rebalancing the level playing field between EU producers of refined CRM and intermediate products vs.

16. "Industrie verte : les dispositifs pour favoriser l'implantation industrielle", Direction générale des entreprises, March 20, 2024, available at: www.entreprises.gouv.fr.

imports. While the important simplification of the Corporate Sustainability Reporting and Corporate Sustainability Due Diligence regulations weakens the EU's ability to get a thorough understanding of companies' value chains and ESG compliance, instruments such as the Battery Passport (establishing carbon footprint obligations, performance classes, etc.) can work in the sense of creating an advantage for EU and partner countries-based production. In addition, support schemes for final products like EVs can and should also be implemented in a manner that accounts for the resilience of the full value chain (with both diversification and sustainability provisions, such as a maximum percent of single-supplier based content in the batteries at each stage of the value chain, a maximum $CO_2$ life-cycle assessment threshold, etc.). On the other hand, the EU could adopt a much more directive approach and request for a share of Made in Europe (to be progressively phased in over time, taking into account risks of bottlenecks in the short term for certain steps of the value chain), as envisaged in the upcoming Industrial Accelerator Act. This could be either an overall obligation for products placed on the EU market, or a requirement for accessing EU funds (ex. as envisaged for the next Innovation Fund Call according to the RESourceEU Plan) or as a criterion in public procurement or, more generally, state aid. To give credibility and operationalize EU's strategic partnerships on CRM with third countries, the EU could broaden its "Made in EU" definition to include any CRM-related products that are supplied to Europe as a consequence of these partnerships, meaning CRM issued from mines/processing/recycling facilities which receive direct financial backing from the EU or feature the involvement of European private sector (ex. investments, equipment, offtake agreements etc.).

Finally, if the EU is serious about the benchmarks set in the CRM Act, it should take all the necessary measures to ensure that it has secured on its territory the 10% of mining, 40% of processing and 25% of recycling capacities needed compared to its overall consumption. As a result, it should not shy away from direct equity investments in midstream facilities (or other forms of suitable support, including guarantees or tripartite contracts where it covers a part of the risks for midstream producers). National governments can also help by offering export and trade guarantees.

## Recycling, notably of black mass

Our previous research has provided a detailed analysis of issues related to black mass recycling and proposed measures to strengthen the business case for recycling in Europe. The volumes of black mass leaving Europe for Asia, although difficult to estimate, remain relatively low but are projected to grow significantly in the coming years, which is a major threat to scaling up European recycling industries[17]. The EU should first of all maximize efforts

17. D.-P. Gherasim and T. Michel, "Europe's Black Mass Evasion: From Black Box to Strategic Recycling", *Ifri Studies,* Ifri, December 2024, available at: www.ifri.org.

to keep black mass in Europe and avoid the export of black mass outside its borders. As such, the EU should seek to deploy a proactive protective shield for the nascent battery recycling, which should at least take the form of an obligation for black mass producers to give priority to European recycling facilities, while supporting the structuring of pCAM and CAM production in Europe. Overall, it needs to strengthen the business model for black mass recycling in Europe through a combined set of actions: including a fee for recycling the price of the EV battery; ensuring the possibility for recycling to have diversified streams for their outputs to increase their resilience in the short term; creating a European CRM Trading Scheme for recycled metals at a basic level of refining (i.e. not battery-grade, but mixed hydroxide precipitate for instance) to create transparency on volumes available and prices and to ensure European off-take for the metals recycled in Europe; bonus/malus scheme; facilitating black mass flows among EU Member States to favor economies of scale; putting in place rules on batteries' and EVs design that favor disassembly and recyclability.

Rare earth recycling and reprocessing into permanent magnets, for example, is decisive but requires investment from partners capable of taking a long-term approach and also long-term, credible offtake agreements, as well as a secure sourcing of scrap material. Several projects are underway, not least Carester in France. Japan Organization for Metals and Energy Security (JOGMEC) and Iwatani have announced the creation of a joint venture with Carester (for up to EUR 110 mn in equity and shareholder debt) around the Caremag rare-earth refining project, also supported by France *via* France Relance. This agreement guarantees Japan a share of rare earth oxide production, particularly dysprosium and terbium. For its part, the French government is contributing EUR 106 mn[18]. Yet other projects may not take the expected shape because gaps in the business ecosystem block financing. Made in Europe criteria can help here, alongside tools to limit scrap exports.

To note is that for all these segments, the EU has a tool in place, EIT RawMaterials, which can invest little equity in projects to support their development and scale-up. This tool is important and efficient, but does not have the firepower of the US DFC, for example.

18. "Caremag, filiale de Carester, a sécurisé 216 millions d'euros de financement et lance la construction de son usine de recyclage et raffinage de terres rares sur le site IndusLacq (64)", Carester, March 17, 2025, available at: www.carester.fr.

# The challenge of stockpiling

## Stockpiling raw materials is very different from oil and comes with many dilemmas

Since at least the 1973 oil shock, oil stockpiling has been a major energy security tool for net-importing countries. Oil can be easily stored, is a global liquid commodity with little chemical variations and there are IEA Treaty obligations for signatory net importing countries to hold at least 90 days' equivalent of net imports in storage. One could at first sight think this system can be replicated for CRMs. Yet there is no single market for each metal; rather, there are several markets for each. These differences relate to chemical form (salts, oxides, pure metal, ferroalloys), purity, physical form (ingots, sponges, cathodes, etc.) or origin.

Downstream of the metal supply chain, there are countless specific alloys used by a wide range of industries, as well as chemical solutions, which further increase the number of possible forms (references).

Based on this observation, the question of CRM storage and which references to store arises: a trade-off must be made between the versatility of the metals stored (upstream of the supply chain) and the immediate substitutability of these metals (downstream of the supply chain).

Another issue also comes into play, namely the prioritization of stored volume or the speed of mobilization and use of stock: is it preferable to optimize the cost/volume ratio of stored metals or to optimize the cost/responsiveness ratio for manufacturers? Another trade-off relates to the question of the capacity in-country to transform the stockpiled material into various usable forms for the market –storing lithium when there is no processing capacity makes little sense.

This trade-off determines the importance assigned to recycling and urban deposits: should a stock consist solely of pure metals or, conversely, be composed of metals at different stages of the transformation process? Metals in their most upstream forms –concentrates, waste, tailings– offer the advantage of low cost per unit of metal and maximum versatility of use, while pure metals or certain alloys can, downstream, allow for greater responsiveness in the mobilization of stocks to meet the needs of manufacturers.

A question arises concerning the function of securing strategic stock: should it only secure the availability of a material for national economic

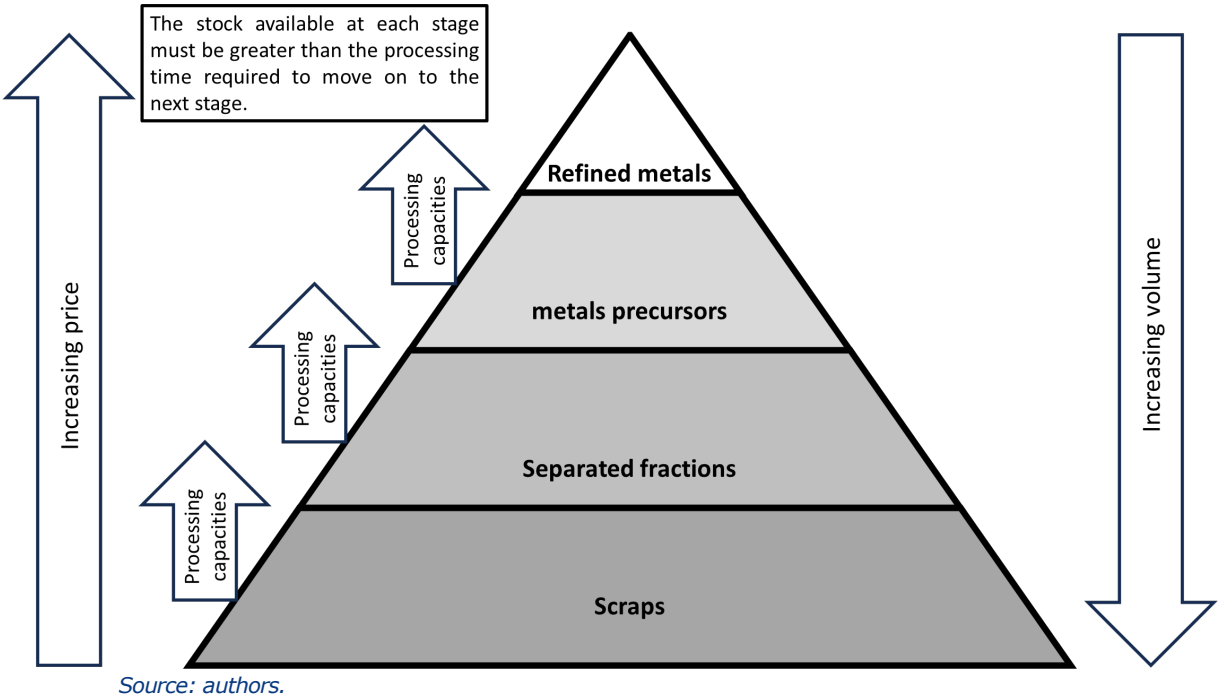
actors, without affecting the price of that material, or should it guarantee not only availability for consumers but also an affordable price? The specifications must therefore be clearly stated in order to obtain a result that corresponds to the needs initially expressed.

In the case of a stockpile focused solely on availability, logic would dictate that metals be sold to manufacturers at the current market price (and therefore at the price at which the stockpile is replenished), which means that the purchase price of metals would likely be very high in the context of a supply crisis.

The addition of commodity price hedging to the specifications requires a redesigned structure and different financing arrangements. In this case, an economic actor must agree to assume the financial risk associated with metal price volatility, and a mechanism for compensating for this risk must be developed.

In any case, strategic stockpiling cannot cover all CRMs, comes with huge logistical and cost challenges, and will never be able to offset lasting supply disruptions, as volumes in storage will necessarily be limited and cannot cover all possible CRMs that can be disrupted.

**Figure 2. Strategic metal stockpiling logics**




*Source: authors.*

**The stability of stored elements must also be taken into account**: some highly reactive elements (such as rare earths in metallic form) are difficult to store for long periods (a maximum of three months for magnesium, 10 to 15 years for rhenium stored in argon, etc.) or are simply dangerous due to their reactivity (lithium). This means that stocks must be thought of as working capital for metals that must be renewed. This cannot

be done without the active support of manufacturers, who must therefore change their purchasing practices and those of their suppliers.

In addition, manufacturers' needs are changing, both in terms of the volumes of metals consumed and the types of metals –the automotive industry consumes much more rare earths, copper, aluminum, and cobalt than in the past, but less steel and, indirectly, less tungsten (which was used in cutting steels for machining engines and gearboxes in particular)–, as well as in terms of purity. As metallurgical applications are being replaced by more technologically advanced ones, metals must achieve increasingly high levels of purity. It is therefore essential that strategic stocks evolve over time to continually adapt to the changing needs of the industry.

Finally, standards, regulations, and traceability requirements can also introduce complexity. In the context of incorporation rate obligations, could a manufacturer, in the event of a crisis, replace recycled metal with primary metal from stock? Could a metal that does not meet the same criteria (ESG, $CO_2$, traceability) be used by a manufacturer in the event of a supply crisis? In other words, will Europe agree to link the use of metals from stockpiles to lower regulatory requirements? In the event of a crisis, does the end justify the means? On this point, it seems necessary to maintain a certain degree of flexibility and crisis mechanisms to respond to such situations, with a threshold to be defined in advance, even if it must necessarily retain some flexibility.

Similarly, the question of metal qualification arises. Significant work needs to be done on prequalification or adaptation to the specific needs of manufacturers, otherwise the metals stored could prove useless, hence the need for manufacturers to be heavily involved in the creation of such stocks. Rationalization efforts are also necessary, attempting to minimize the number of different products used for the same purpose. Consumption cannot be standardized across the board, but it is essential to conduct this work to facilitate the transfer between stock and consumption. This rationalization should also enable a more precise definition of the volumes of metals to be stored. Without knowledge of value chains, stocks could prove useless or be depleted in an emergency.

There is also the question of mobilizing strategic stocks. Who would be responsible for this? The states, the EC, industrial sectors, financiers? According to what terms and conditions, and what trigger? Media coverage, feedback from manufacturers, a level of volatility/price increase, official commodity market monitoring and intelligence agencies (such as the French structure OFREMI), approved experts (traders, etc.)? In a scenario where Europe had stocks of refined rare earths in 2025, how would these have been allocated or not to manufacturers, with what degree of priority, etc.?

It is therefore necessary to define the criteria for allocating stocks, according to their uses, and to establish scenarios based on the crises that may arise. The question of financing such a structure remains central, in the

sense that this financing will confer legitimacy on the use of these stocks and thus support those involved in their governance.

## JOGMEC lessons for Europe

When it comes to securing metal supplies, Japan regularly sets an example, particularly with the JOGMEC. Founded in 2004, through the merger of the Japan National Oil Corporation and the Metal Agency of Japan, JOGMEC is responsible for securing Japan's supplies of both hydrocarbons and the 34 metals[19] that Japan considers critical.

JOGMEC is attached to the Ministry of Economy, Trade and Industry (METI) and operates under its authority. Its mission to secure supplies includes, in particular, the creation of strategic stocks that have existed since 1963 and, since 1983, stocks of critical metals. JOGMEC's activities, including the purchase of critical metal stocks, are mainly financed through the mobilization of public funds, as part of the funds allocated by the government to METI. For fiscal year 2024, JOGMEC had a budget of 2,377 billion yen, or approximately EUR 14.5 bn[20], with around 1,100 employees.

The stocks managed by JOGMEC must be sufficient to meet at least 60 days of demand, in addition to the stocks available to private actors. This target remains flexible: for materials considered to pose a high geopolitical risk, the target is 180 days, while it may be lower for materials under less pressure[21]. JOGMEC's stockpiling plan includes detailed instructions and information on the selection of substances, the quantities stored and targeted for each CRM, and the procedures for purchasing and using these stocks as needed. This plan, like the storage sites, is classified and confidential. Little is therefore known about the value chain stages prioritized for storage by JOGMEC, the conditions that enable the storage of materials requiring specific atmospheres, or the stock rotation model. Leaking information from this stockpiling plan is punishable by penalties of up to one year's imprisonment[22]. Overall, JOGMEC is actively involved in trading and manages its stocks dynamically.

The rules for using stocks are strict: manufacturers must exhaust their own stocks before drawing on JOGMEC's stocks. These stocks can be

19. The list includes antimony; barium; beryllium; bismuth; boron; carbon; cesium; chromium; cobalt; fluorine; gallium; germanium; hafnium; lithium; magnesium; manganese; molybdenum; nickel; niobium; platinum group metals; rare earth elements; rhenium; rindium; rubidium; selenium; silicon; strontium; tantalum; tellurium; thallium; titanium; tungsten; vanadium; zirconium, see www.iea.org.
20. This budget is dedicated to the whole of JOGMEC's activities, and not only to critical minerals. The conversion in euro is based on the exchange rate of December 31st, 2024 (i.e. EUR 1.00 = JPY 164.06). "Overview", Japan Organization for Metals and Energy Security, see: www.jogmec.go.jp.
21. "The 2024 Annual Single Market and Competitiveness Report", Commission Staff Working Document, European Commission, February 14, 2024, p. 67, available at: https://eur-lex.europa.eu.
22. C. Powers, "Japanese Lesson: Facing Mineral Squeeze, Europe Looks to Tokyo's Secret Stockpiles", *Euractiv*, December 1, 2025, available at: www.euractiv.com.

released when metal prices reach predetermined crisis levels, and METI's head decides when to release them.

But JOGMEC's activities are not limited to storage. Its remit also includes financing upstream, midstream, and downstream projects worldwide based on a network of regional offices and expertise, with the aim of securing supplies. For example, JOGMEC has a long-standing partnership with the Australian company Lynas, which guarantees it privileged access to Lynas's rare-earth products. In most cases, a joint venture is established between the institution and a local partner for a specific project, such as the one formed with several partners for the Waterberg platinum group metals production project in South Africa, in which JOGMEC holds a 22% stake[23]. JOGMEC also provides technical expertise for upstream mining projects.

These financing activities are not limited to developing countries and JOGMEC is increasingly investing in regions such as North America, as evidenced by the announcement of a deal with REalloys Inc. that covers the entire rare earth value chain, including the development of upstream and midstream capabilities in Canada and a magnet production plant in Ohio.

The Japanese government intends to continue expanding JOGMEC's scope of activities, with three main actions:

- Increase JOGMEC's lending and investment capacity by raising the maximum level of project support from 50% to 75%.
- Enable JOGMEC to support projects on Japanese soil (currently, it can only support projects located overseas).
- Strengthen JOGMEC's support for projects involving Japanese companies overseas[24].

The JOGMEC model is a source of inspiration for Western players seeking to secure their value chains, whether American[25] or European. Maroš Šefčovič, Commissioner for Trade and Economic Security, visited JOGMEC in May 2025, and Stéphane Séjourné, Executive Vice-President for Prosperity and Industrial Strategy, did the same in September 2025[26]. The EU undoubtedly has many relevant lessons to learn from JOGMEC but it must also consider tools that are adapted to its own logic, as it is not Japan. Regarding strategic stocks, should each Member State maintain its own stock? Would Member States be prepared to accept that metals essential to their strategic industries (e.g., fighter jet components) be stored in another Member State, even with a guarantee of supply in the event of a crisis?

23. "Waterberg Project", Platinum Group Metals, September 16, 2024, available at: www.platinumgroupmetals.net.
24 "The 2024 Annual Single Market and Competitiveness Report", European Commission, op. cit.
25. T. Moerenhout, "Five Key Decisions to Revitalize US Critical Mineral Stockpiles", Center on Global Energy Policy at Columbia, July 2025, p. 45, available at: www.hcss.nl.
26. C. Powers, "Japanese Lesson: Facing Mineral Squeeze, Europe Looks to Tokyo's Secret Stockpiles", op. cit.

The question of the budget allocated to a "European JOGMEC" also arises. JOGMEC's funding relies mainly on the mobilization of public money, but would the tight budgetary margins of Member States allow them to do the same? Some suggest that the initiatives announced so far, such as the CRM Act or RESourceEU –whose objectives are similar to those of JOGMEC– could be funded by existing funds, such as the European Defense Industry Program (EUR 1.5 bn)[27].

The main lesson to be learned from JOGMEC is probably its flexibility, agility and its very discrete operations. Far from being dogmatic, this institution employs a range of tools to secure its value chains and invests globally. In line with a doctrine prevalent in Japan, JOGMEC focuses on "indispensability" by promoting its technological know-how, expertise, or its financing capacity.

JOGMEC's approach also does not consider it possible for Japan to secure its value chains on its own. The joint venture model it employs enables it to position itself across multiple production areas, without always holding the majority stake, and sometimes in cooperation with other countries. For example, JOGMEC and other Japanese companies have been investing in niobium production in Brazil since 2011, in collaboration with Korean players[28].

## EU CRM strategic stockpiling – key design elements

Strategic stockpiling is a key and relevant tool in a strategy for securing metal supplies. However, such a strategy cannot be limited to stockpiling alone, which is complex to implement and cannot address all the issues raised by the weaponization of dependencies. For example, JOGMEC's stocks theoretically provide Japanese manufacturers with six months' worth of reserves in the best-case scenario, which is a significant advantage but not a permanent one.

An effective policy for securing value chains must therefore necessarily involve strategic investments in downstream industrial refining and production capacities, as well as upstream extraction partnerships. An agile and responsive investment model appears to be at least as important as an effective stockpiling system.

27. Ibid.
28. "JFE Steel, Nippon Steel, Sojitz, JOGMEC, POSCO and NPS Form Japan-Korea Partnership Group to Invest in Brazilian Producer of Niobium, Critical Alloying Element for High-Grade Steel Products", Japan Organization for Metals and Energy Security, March 4, 2011, available at: www.jogmec.go.jp.

## Joint purchasing must come with a strong framework that ensures trust

One of the main limitations is confidentiality: companies are reluctant to share data related to their needs, let alone make it public. A trusted organization must therefore act as an intermediary, serving as a black box and ensuring the confidentiality of each industrial player's needs. Trust between public authorities and industrial players is essential.

## Need to focus on niche metals

Certain niche metals require specific approaches. For example, experts consider that demand for certain metals –such as indium, gallium, and germanium– is too low (around a thousand tons worldwide) to justify the CAPEX required for local production. To overcome this problem, a joint purchasing entity could make group purchases, centralizing and consolidating the low demand from multiple industrial players. This demand aggregation system would thus provide the necessary guarantees for financing refining projects for these niche metals.

## The US approach

The US now has two options on the table: the National Defense Stockpile managed by the Defense Logistics Agency, and the EXIM Bank financed USD 10 bn Project Vault, which is also planned to include additional private capital investment. The main difference between the two is that the defense stockpile is for emergency situations based on taxpayers' money, while the Vault stockpile is a commercial one, based on EXIM credits, mainly that will need to be reimbursed, and on fees and contributions from companies. The EU could also provide a EUR 10-15 bn credit from the next MFF, for example, to a Strategic Stocks Agency that could be the CRM Center, with an oversight and mandate to operate on markets and build up given volumes of stocks. That would not properly work if operations are too public and if non-professional traders without strong experience in logistics are involved.

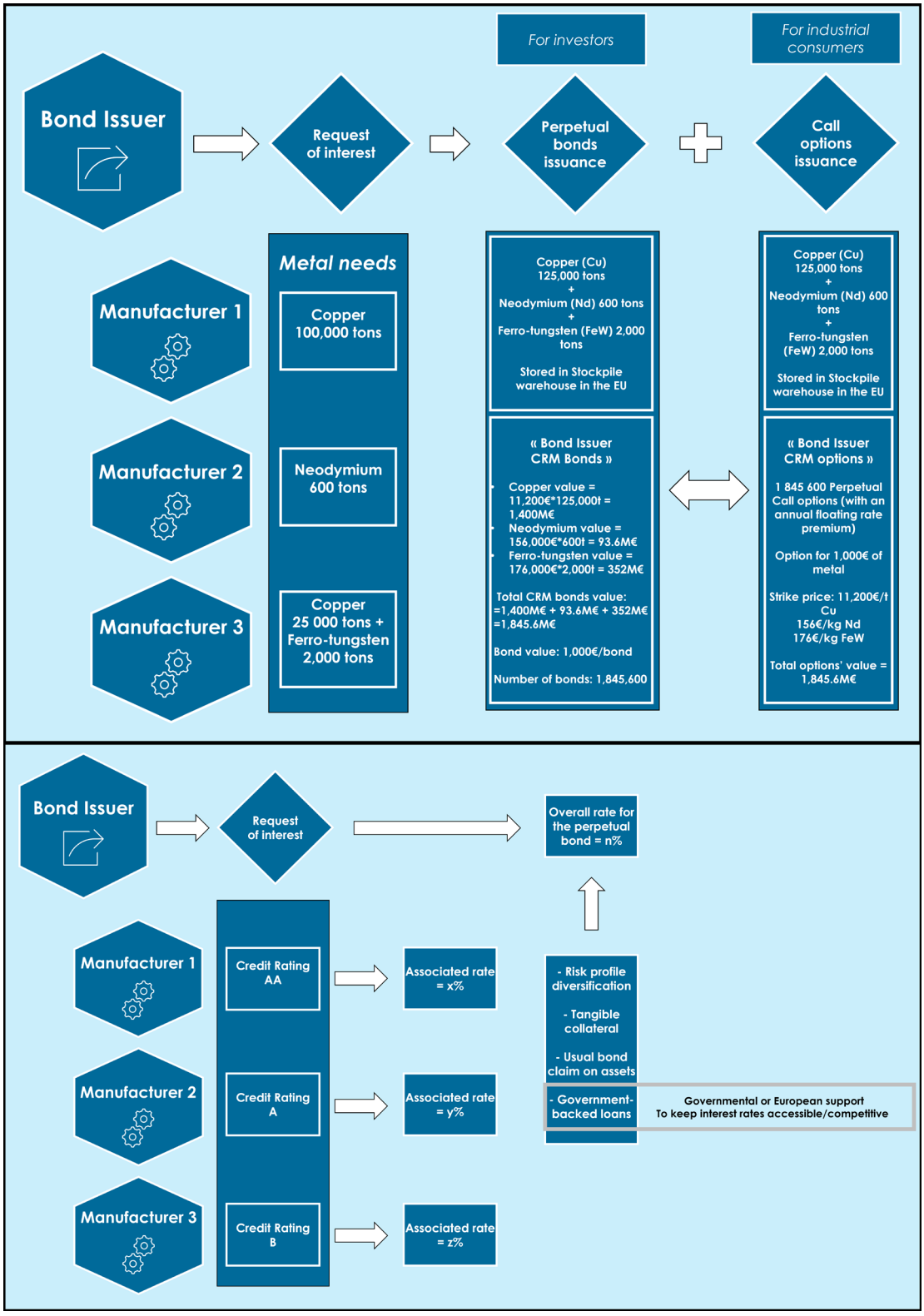
## Innovative mechanisms and options for longer-term resilience: perpetual bonds

During Raw Materials Week 2024, a proposal to establish Critical Raw Materials Bonds (CRMBs) was presented. CRMBs are designed to meet the following specifications:

- Be accessible to all European industrial players, from SMEs/mid-cap companies to multinationals.
- Enable the availability and price of CRMs to be secured.
- Obtain competitive purchase prices through joint purchasing.

CRMBs would be created during a roundtable discussion in which manufacturers would share their full requirements for a given material (e.g., metal, form) to be covered.

**Figure 3. Round table discussion, bond issuance, and credit profiles in the CRM Bonds model**




*Source: authors.*

At the end of this period, a financial assessment of the amount is carried out and calls for tenders are issued to metal producers.

Upon receipt of the producers' bids, contracts are finalized between the bond issuer and the manufacturers for American-style call options. These options are based on the payment of an annual variable-rate coupon by manufacturing consumers, which gives them the option to purchase a specified quantity of a material at their discretion, at a price set in advance based on the initial acquisition costs of the metals. The quantities of CRMs linked to the options are standardized and correspond to divisible lots of material. Through regular payments, manufacturers thus ensure that they have access to a supply of metal at a given price.

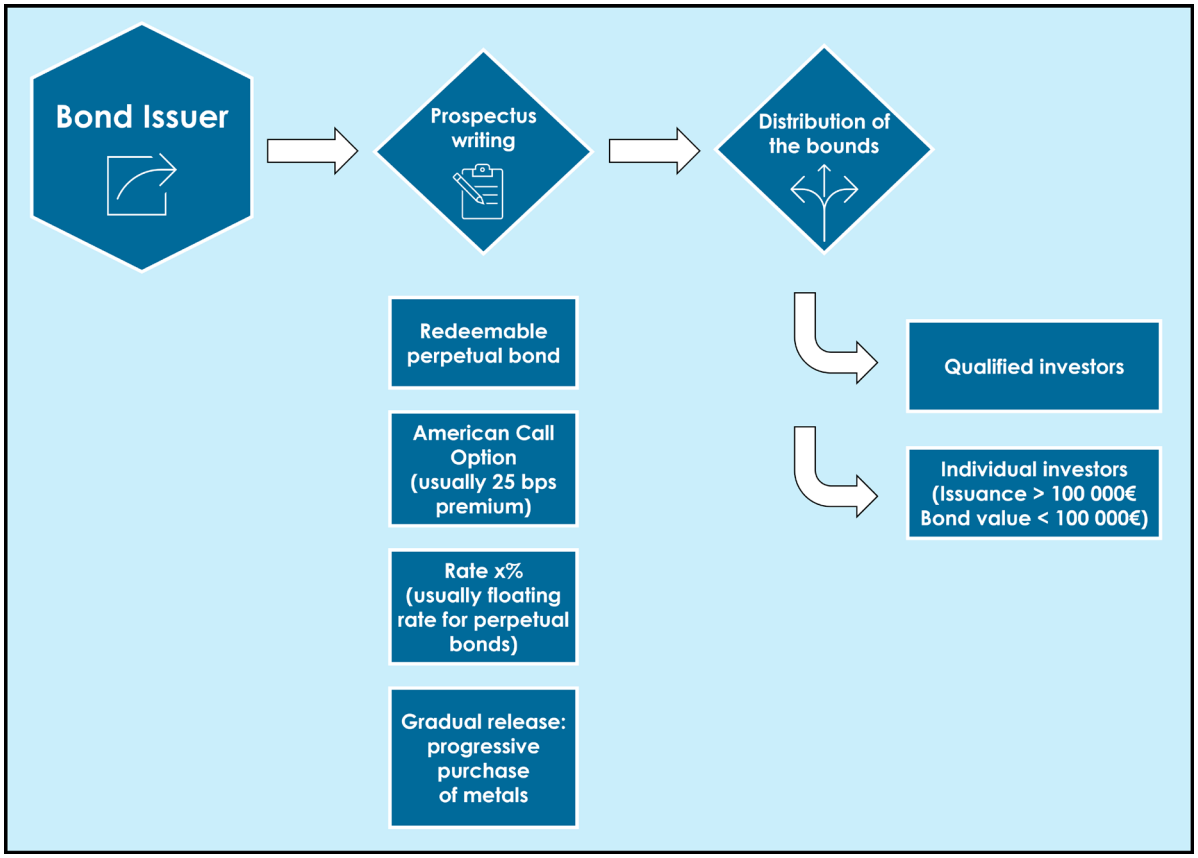
The annual coupon amount for these options is calculated to cover:

- The remuneration of investors who have purchased the bonds (CRMBs), the "coupon".
- The cost of storing and insuring the metals, paid by the bond issuer.
- The bond issuer's margin.

The bond issuer obtains the funds needed to purchase the CRMs by issuing bonds. Investors purchase these bonds and are remunerated by the annual coupon payment made by metal consumers as part of their purchase option. The bonds purchased by investors:

- are redeemable perpetual bonds, meaning they are issued without a maturity date;
- are floating rate bonds: the interest paid to bondholders is indexed to interest rate;
- are issued gradually based on the volumes of metals supplied by producers;
- are issued in amounts corresponding to the value of these volumes of metals.

**Figure 4. Bonds characteristics and issuance in the CRM Bonds model**

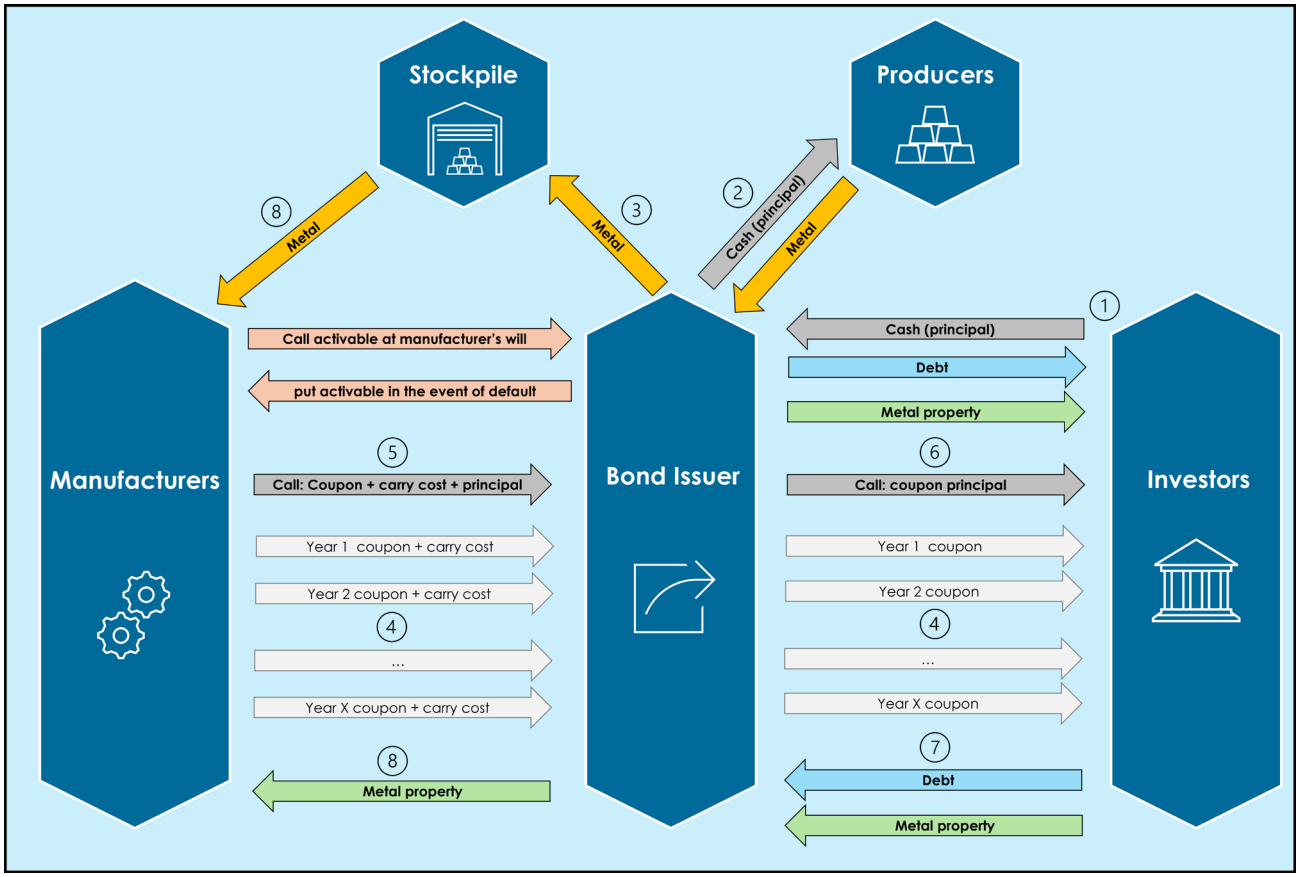



*Source: authors.*

When an industrial consumer wishes to purchase metal, he can exercise the options that he holds and that he wishes to use, depending on the volume he needs. He then pays for the metal of his choice (for which he has previously made a commitment) at the contractual repurchase price defined by the option and the coupon for the current year.

At the same time, the bond issuer repurchases the corresponding number of bonds from investors holding them. The corresponding quantity of metals can then be delivered to the manufacturer.

**Figure 5. Call activation by manufacturers within the CRM Bonds model**




*Source: authors.*

The advantage of this mechanism is that it allows industrial consumers to ensure the availability of a certain volume of metal at a price set in advance. In addition, it delegates storage and insurance costs to the bond issuer.

It can also include a wide variety of different metals and raw materials, and even components. The only constraint is that these materials must be divisible into lots, their financial value must be standardizable, and they must not be perishable or become obsolete too quickly (to fit with the perpetual bond they are linked to).

The system is also reassuring for investors, as the credit risk is low. This is because the bond is based on a tangible asset (metals), which retains its value even if the manufacturer fails to pay the coupon. However, there is a risk for investors that the value of metals may fall, resulting in a market price lower than the price set in advance and therefore a loss in the value of the asset.

This is where public support can be useful: when a bond is issued to finance the purchase of a volume of metal, this volume will usually be consumed by several manufacturers, who will remunerate the bond purchasers through the payment of their annual coupon. However, these

manufacturers may have very different risk profiles, and the more difficult financial situation of one may increase the risk level of the bond, thereby causing its price to rise.

Public support, for example in the form of a guarantee, can thus be provided to reduce the risk perceived by investors and thereby facilitate the launch of the process.

Such a system is not a model designed to respond to emergency situations. It can be effective and protective for manufacturers, in a proactive approach, if metals are purchased when prices are low. If metals are purchased when prices are high, before a period of drop in prices, it then becomes less attractive for manufacturers to pay their annual coupon or to use their option, and this can pose a risk to their competitiveness.

This system requires anticipation of future risks and needs: what trend can be expected in the price of a metal? Does the strategic nature of the uses of certain metals justify building up stocks even when their prices are high? It is therefore necessary for the bond issuer to have an excellent understanding of the logic underlying the metals markets and to be able to act as an advisor to manufacturers.

The implementation of such a system should be accompanied by extensive discussions between public authorities and private actors (both manufacturers and investors), in order to fine-tune the details of a model that remains flexible. The EU could, for example, assume part of the credit risk and act as an investor to finance the issuance of bonds and the creation of stocks for certain metals.

# Recommendations

First, the EU needs to take the full value chain view when conceiving funding mechanisms in the CRM field, making sure that the midstream capacities do not become a *de facto* bottleneck for true industrial resilience. The processing segment is the most sensitive and challenging to deploy in terms of business case and technology. In this sense, securing the commitment of downstream consumers to diversify their supplies and commit to buying European is essential, as underlined in the renewed EU Economic Security Strategy. This should be incentivized *via* priority access to EU support for those companies with domestic supply sources, applied more broadly than only the next 2026 Innovation Fund call on clean tech manufacturing and CRM supply (which is nevertheless a good start).

Second, the EU and its instruments need to take stock of the fact that securing CRMs requires new approaches and new tools based on strategic geopolitical and geoeconomic planning and acting rather than normal, market-based, competitive, risk-averse behavior. The EU needs instruments that can take risks, have a lower rate of returns and take long-term views, as CRM projects require long-term approaches.

Third, the EU CRM Center needs a strong dedicated budget post 2027 of about EUR 15 bn from the EU Competitiveness Fund of the next MFF, to be used for strengthening resilience over the full value chains in critical technologies. In the meantime, the CRM Funding Center, as a single point of contact for all funding requests, should be readily available and have the capacity to direct the most appropriate funding rapidly to the best projects in priority segments.

The CRM Center should have the know-how and resources to use different mechanisms to support a variety of metals and project types, and to judge which mechanism is best, depending on the market, company, and metal, as well as short- and long-term interests and pressures. There is no "one mechanism fits them all" to facilitate the EU's action in securing CRM supplies, but some broad appreciations based on other players' action and results on the ground can be useful to keep in mind:

- The exploration stage is critical yet extremely risky, and funding is both insufficient and stagnating. The EU is largely behind as a player. Here, some of the best mechanisms to act are tax credits and grants convertible into equity.
- The mining and processing stages imply different realities depending on the type of metal (niche vs. base metal) and type of company (small/new players vs. established majors/trading

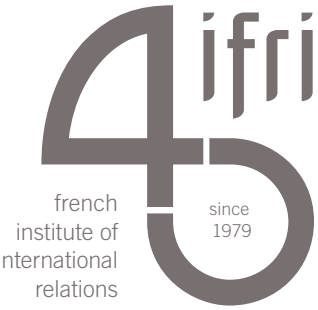
companies), hence it's difficult to generalize what type of support is best. However, for niche/small markets metals (ex. gallium, rare earths), which furthermore imply high costs of mastering the processing technology, floor prices and equity investments, giving offtake rights can be good tools. For base metals/larger metal markets (ex. copper, nickel, cobalt etc.), concessional loans (giving offtake rights, or linked to offtake commitments by the EU or EU companies) and loan guarantees could reduce the cost of funding for companies and improve diversification of supplies (even in the shorter term, in the case of an extension of production capacity).

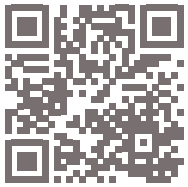
- The midstream and downstream stages are critical for securing the offtake of diversified CRM (be it Made in Europe or in partner countries). Here, the biggest challenge is moving away from a simple price optimization equation to a resilience-enhancing decision-making by purchasing authorities, in both public and private sectors. As such, ESG/resilience criteria as proposed in the NZIA, conditioning public support schemes (ex. for EVs) to obligations for companies to have minimum two suppliers for inputs they use across the value chain (or at a minimum respect the 65% maximum threshold of dependency on a single supplier), foreseeing Made in Europe criteria as a condition of access to EU funding, etc. are among the mechanisms that could lead private companies to paying the price of resilience, which is no longer a choice but a necessity.
- The recycling stage will increasingly become essential for reducing EU's external dependencies on CRM supplies and improving its environmental footprint and resilience. This nascent sector needs visibility over long term targets (on renewables, electrification, etc.), stable and secure inputs (for instance, making sure European black mass is not leaving Europe), as well as long-term offtake agreements which usually implies having the confidence that midstream demand for recycled products is available and sufficient (ex. pCAM and CAM producers in the battery value chain). In many cases, these require B2B matchmaking, transparency of resources and scrap flows, identification and standardization of products and material categories to build up standardized resources, and knowledge of demand (localization, volumes, evolution over time) to build up business cases. This supply-and-demand aggregation work is essential and could be performed by the CRM Center.

There is also a challenge related to timing. The urgency is growing to act yet industrial projects, let alone mining projects, take several years at best to be developed. In a central scenario where the weaponization of critical raw materials continues and where the US continues its bazooka-type all-out

proactive actions, the EU is at risk of being squeezed and facing supply shortages. What can be done in an emergency includes:

- Spending the money already allocated: several existing funds notably take too much time to allocate money for projects. Profit assumptions, risk appetite and ESG have to be adjusted to a degraded environment. Providing long-term preferential credit lines with leading and niche trading houses, in order to secure supplies of CRMs in the medium to long term and let these specialists operate to secure markets and optimize logistics. Putting together additional resources in a hurry before the next MFF.
- Building up in a confidential manner stocks of niche metals that are key for defense industries, still reasonably priced, potentially subject to future export restrictions, and organizing and planning for the eventual release of stocks. Such stocks cannot be fully ESG compliant and need to be located in Europe. Also, mobilizing the private sector, small and large, to conduct resilient business behavior and subscribe to a strategic stockpiling mechanism that can similarly benefit large and small consumers/buyers.
- Requiring governments to determine demand-side management plans should there be larger supply shortages, enabling to reduce and prioritize demand and possibly cut off designated consumers.
- Fast-tracking the development of a European mining culture with robust licence to operate, in order to build understanding and confidence in European mining operations.
- Prioritizing recycling investments and shutting down the exports of metal waste and black mass outside Europe, such as in buying up the European battery scrap (black mass), and prioritizing setting up EU recycling industries, in parallel with mandatory product incorporation requirements, in order to ensure the market ramp-up and business case.
- Developing and funding powerful public-private funds, modelled on the US ones, that support projects in Europe and abroad in taking equity in return for supply commitments with destination requirements.



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