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China and Trade in Critical Raw Materials (CRMs):

Understanding the means of exchange, control, and power amid heightened geopolitical tension

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Key takeaways

- Critical Raw Materials (CRMs) are now a lever of geopolitical power — and a matter of sovereignty for Europe.
- China's dominance of production and processing, once about resource security, is now just as much about industrial strategy and geopolitical leverage. Beijing is increasingly looking to capitalize on and entrench its advantage.
- Diversification for Europe is key, but CRM markets are fundamentally different from classical commodity markets, vastly complicating the effort.
- Strong public-sector engagement is fundamental, but while the state must lead, it cannot succeed alone. Engagement and close coordination with the private sector is essential, as demonstrated in the case of Japan.
- Ultimately, the price of inaction far outweighs the cost of ensuring resilient CRM supply chains.
- The Netherlands, as a logistics, warehousing and trading hub, has an outsized role to play in bolstering European resilience, even without significant domestic mineral deposits or processing capacity of its own.

Executive summary

Critical raw materials (CRMs) — from rare earths to gallium, germanium, tungsten or antimony — have become central instruments of power politics in an era of intensifying great-power competition. As the energy transition, digital transformation and modern defense industries drive demand for an ever-widening range of mineral resources, China's dominant position across mining, processing and trade has turned resource security into a defining question of sovereignty for Europe and its allies. Since 2023, Beijing has progressively deployed export controls and other tools to leverage this dominance, placing the survival of key European industries — automotive, energy, health, aerospace and defense — increasingly at risk. This paper argues that too little policy attention has been paid to the underlying mechanics of CRM markets themselves, a gap that has allowed severe market concentration to take hold and threatens to entrench further dependency. It sets out a framework for understanding how CRM trade functions, examines the sources and levers of Chinese power in this space, draws lessons from Japan's experience of supply chain diversification, and closes with concrete recommendations for the European Union and the Netherlands.

Understanding CRM markets

Before considering China's dominant role, it is essential to understand the structural specificities of CRM markets themselves, since these features — more than Chinese policy alone — explain why supply chains have become so concentrated and why diversification is not straightforward. In short, CRMs do not trade like conventional commodities. They differ from base metals such as iron, aluminum or zinc in two fundamental respects: their availability is exposed to multifactorial risk, and demand for them is set to grow considerably as they underpin high value-added applications in chemicals, electronics and defense. Because substitution is technically very difficult for most specialty metals, demand does not fall naturally even as supply tightens or prices spike — a rigidity that removes one of the normal shock absorbers of a functioning market.

On the supply side, most CRMs are obtained as by-products of base or precious metals, so their production levels are dictated by the market dynamics of an unrelated host metal rather than by their own price signals. When prices for a given CRM rise, producers typically have little ability to ramp up supply in response, since output is tied to decisions made about the host metal. This same dynamic starves the market of information: because most CRM output correlates with capital expenditure in the host metal rather than in the CRM itself, dedicated market intelligence is scarce. The combination of low price elasticity on both the demand and the supply side, together with this chronic information deficit (in addition to China's own market maneuvers), produces significant price volatility — itself a direct symptom of underlying availability risk.

These features also block out the kind of market infrastructure taken for granted in other commodities. Because CRMs are produced in small volumes and trade at prices far below those of precious metals, trading volumes are too thin to support futures markets on exchanges such as the London Metal Exchange; a listing generally requires substantial liquidity, low concentration of supply and demand, and strong standardization of the material, none of which most CRMs offer to a sufficient degree. Matters are further complicated by the fact that each metal exists in multiple purities, chemical forms and countries of origin, effectively fragmenting a single metal into several distinct markets — and prices — at once. As a result, almost all CRMs are traded over the counter (OTC), with price discovery performed not by an exchange but by private Price Reporting Agencies, which compile OTC transactions reported by market participants into regional benchmark prices for the US, Europe and China. In the absence of exchange-listed futures or options, hedging is similarly confined to OTC instruments such as forward contracts.

This OTC structure also shapes how industrial buyers actually secure supply. Except during downturns, large industrial consumers favor forward contracts negotiated directly with producers — extending up to 15 years in sectors such as aerospace, where product cycles are long and visibility into future needs is clear. Spot markets, by contrast, are generally reserved for marginal demand, for small industrial purchasers, or for large buyers running tenders, and this spot segment is itself dominated by intermediary traders rather than direct producer-to-consumer transactions. Because CRM demand — and with it, market volumes — is set to grow substantially in the years ahead, and given ongoing innovation in fintech, new quotation and price-discovery mechanisms tailored to these metals may yet emerge, but for now these structural features leave CRM markets thin, opaque and highly exposed to concentrated control by whichever actor dominates production and processing — a vulnerability that China has been best positioned to exploit.

The sources and levers of China's power

China's dominance is the product of decades of deliberate policy choice rather than geological advantage. Three priorities have shaped this trajectory over time: resource security, industrial competitiveness, and international power politics — and each has left a distinct imprint on how CRM trade functions today. Resource security has dominated the policy mindset in Beijing since the foundations of the People's Republic and China has systematically built the capacity to mine and refine ores — including those imported from overseas — even where it lacks a natural endowment. There is ultimately a distinction in Chinese strategic debates between "advantageous" minerals where the country holds genuine production dominance and "shortage" minerals where it remains structurally dependent, particularly on mine production overseas. The result is striking: China accounts for over half of global production or processing for 19 of the 34 raw materials the EU deems critical, exceeding 90% for magnesium, gallium and heavy rare earths, and it still processes the overwhelming majority of the world's heavy rare earths, 79% of cobalt refining and 95% of manganese chemical production, despite mining only a small fraction of the primary ore itself. Aggressive overseas investment has extended this refining dominance well beyond China's own geology, while state stockpiling has provided a further tool to smooth supply, support upstream investment, and adjust flows to foreign markets at will. At its core, Beijing has thus been driven by a sense of vulnerability that has led it to seek out a degree of self-sufficiency which would develop into market dominance and ultimately strategic strength while mining and processing in Europe, the United States and elsewhere was abandoned to purely cost-maximizing, market logics.

China has moved to translate its position of strength into strategic gains in two areas: industrial competitiveness and, more recently, geopolitical leverage. On industrial competitiveness, cheap and secure upstream inputs have underwritten China's dominance in downstream industries such as batteries, solar panels and electric vehicles — China accounts for roughly three-quarters of global battery production and over 80% of global solar PV manufacturing capacity — with the scale of domestic demand in turn reinforcing upstream leverage over global pricing. Industry estimates suggest the cost advantage afforded to downstream manufacturers is highly significant – even up to ten times greater than the cost of building the upstream overcapacity that enables it – illustrating how tightly the two ends of the value chain reinforce one another. On power politics, President Xi Jinping's 2020 call to "strengthen the dependence of international industrial chains on China" as a deterrent against foreign pressure has been operationalized through a rapidly expanding legal and regulatory toolkit — the 2020 Export Control Law, the Unreliable Entities List, the Anti-Foreign Sanctions Law, and a widening catalogue of export-controlled materials and technologies — all explicitly designed to convert market dominance into a source of deterrence and geopolitical leverage. Regulations adopted by the State Council from April 2026 on supply chain security and countering extraterritoriality are meanwhile positioned to complicate or undermine foreign (including European) efforts to diversify supply chains and reduce dependence on China.

Export controls have been the most significant lever of power at Beijing's disposal. Operationalized since July 2023, a dual-use export licensing regime complemented in some cases by specific product or technology bans have expanded to cover not only raw materials, but chemical intermediates and downstream goods such as rare earth magnets. These controls generate two distinct effects. The chokepoint effect allows Beijing to restrict access to vital materials in pursuit of political and strategic goals, as has been visible in its standoff with Washington, while simultaneously bolstering the relative competitiveness of Chinese downstream firms. The panopticon effect operates through the licensing process itself: exporters seeking authorization must disclose detailed information on end uses, downstream buyers and supply chain structure, effectively requiring foreign firms to hand over sensitive commercial intelligence in exchange for continued access. It essentially provides Beijing with a detailed map of global supply chains. This map allows the Chinese authorities the ability to more surgically target specific sectors, industries or firms to achieve various policy goals, such as undermining foreign technological development or specific competitors, without the diplomatic blowback or destructive economic impact of a general restriction or a blanket ban. Significantly, Beijing has extended these controls extraterritorially — mirroring the US Foreign Direct Product Rule by asserting jurisdiction over any product containing more than 0.1% Chinese-origin rare earth value — and has increasingly applied them punitively and selectively: against Japan over its stance on Taiwan, against American firms central to rebuilding a domestic rare earth industry, and against 14 European entities in July 2026 in response to sanctions tied to Russia's war in Ukraine.

The IEA estimates that full application of rare earth controls announced in October 2025 and suspended until 10 November 2026 could cost OECD economies as much as USD 6.5 trillion annually — a figure that underscores both the scale of exposure and the seriousness of the threat. On the other hand, Beijing has shown that it can just as readily inundate markets to undercut diversification efforts when that better serves its interests, as was the case after 2010.

Lessons from Japan

Because China's dominance rests on policy rather than geology, it is in principle reversible — and Japan offers the most instructive model of partial success to date. Since the 2010 rare earth disruption tied to the Senkaku/Diaoyu dispute, Tokyo has pursued a five-pillar strategy combining substitution, efficiency, recycling, stockpiling and overseas investment, more recently folded into a broader Economic Security Promotion Act. This has cut Japan's reliance on China for rare earths from over 90% to below 60%, though acute vulnerabilities persist, as shown by Beijing's 2026 embargo on dysprosium, terbium, yttrium, gallium and tungsten exports to Japan over Tokyo's stance on Taiwan. The paper highlights an under-appreciated dimension of Japan's success: the close, structured partnership between state agencies — notably JOGMEC, which provides patient, risk-tolerant capital for early-stage projects — and private trading houses (sogo shosha) such as Sojitz, Sumitomo and Mitsui, which bring commercial intelligence, capital and market access that government alone cannot replicate. Landmark investments, from the JOGMEC-Sojitz backing of Lynas Corporation in Australia to the more recent JOGMEC-Iwatani investment in the Carester rare earth refining project in France, illustrate how blended public-private vehicles can sustain diversification efforts through price cycles that would otherwise sink them. The core lesson for Europe is not simply that state support matters, but that it must be structured to complement, rather than substitute for, private-sector market knowledge and risk appetite.

Recommendations for the EU and the Netherlands

The Netherlands, and Rotterdam in particular, occupies a distinctive position in any European response: the port's LME- and MMTA-certified bonded warehouse system, its role as a pricing benchmark, and its base of trade-finance expertise make it a natural logistics and price-discovery hub for CRMs, even though the country lacks significant deposits or industrial offtake of its own comparable to France or Germany, and faces persistently high energy costs that constrain new processing investment. Building on this position, the Dutch government appointed a Special Envoy for critical raw materials in 2024, tasked with mobilizing public and private actors around four exposed sectors — defense, aerospace, digitalization and the energy transition — across short, medium and long-term timelines. The paper's broader recommendations for Europe are organized around a three-pronged strategy: facing up to China, strengthening European resilience, and deepening complementary partnerships.

On facing up to China, the paper calls for stronger diplomatic and legal protection for European firms against coercive information-sharing requirements, more rigorous scrutiny of anti-competitive behavior by Chinese trading firms, and a more deliberate use of access to the EU's common market as leverage — including through the Anti-Coercion Instrument — to push back against both strategic-level export bans and quieter, firm-level restrictions that erode European competitiveness beneath the threshold of political attention.

On strengthening European resilience, CRM security must be embedded as an explicit, decades-long objective across energy, digital and defense policy, rather than treated as a byproduct of environmental or industrial policy. This requires market-shaping tools — price floors, contracts for difference, and physically settled, exchange-listed futures anchored in Rotterdam's warehouse infrastructure — to reduce capital costs and volatility for CRM investment; renewed support for base-metal processing capacity (zinc, copper, aluminum) on which much CRM production depends; a centralized European purchasing agency to improve collective buying power; and urgent rebuilding of strategic stockpiles, an effort in which the Netherlands, given Rotterdam's role as a price benchmarking, trade and logistics hub, should take an active part at the European level alongside other national-level initiatives such as France's COMESTRAN.

On deepening partnerships, the paper urges Europe to move beyond declaratory strategic partnerships toward substantive, mutually beneficial cooperation with resource-rich countries across the Global South, where China and increasingly the United States have been more proactive. It also calls for a standards-based, multilateral market architecture — potentially a buyers' club with Japan, South Korea, Taiwan, Australia, the UK and Canada — to counterbalance China's market weight, and for Europe to engage constructively with a more transactional United States without trading Chinese dependency for a new dependency on Washington.

1. Introduction

The world is rapidly shifting into an era of great power competition wherein economic statecraft is a defining feature. The liberal international order is dissolving, the globalized economy is being increasingly fragmented, and the deepening of strategic competition, particularly over leadership in emerging, transformational technologies, is hardening. In this context, globalized markets and interdependent supply chain networks are being leveraged and weaponized[1] in pursuit of diplomatic, even feudalistic[2] gains and broader strategic objectives. Critical raw materials (CRMs), from rare earths to gallium to lithium to cobalt and beyond, have become central features of this new dynamic of power politics insofar as they are indispensable components for achieving key policy priorities, from the energy transition to the digital transformation to the bolstering of modern, capable militaries. Just as technologies advance, an ever-broader range of mineral resources with specific properties, from magnetism to superconductivity to heat resistance to luminosity, are needed to support them. Amid rising regional and global uncertainty, resource security is back in the spotlight as a key determinant of sovereignty and national security for Europe and its allies and partners. With demand for a broad range of mineral resources set to rise considerably over the next decade,[3] access to critical raw materials, their derivatives and the technologies and processes needed to transform them is being disrupted. China, with dominant positions across many critical mineral supply chains, is a central player. Following decades of consolidating control over critical mineral supply chains, since 2023 Beijing has been progressively rolling out tools to leverage its dominant position in mining and processing to both restrict access to vital inputs and further consolidate its position. For Europe, the very survival of key, even vital industries, from automotive to health to energy to aerospace to defense, is at stake.

Diversifying supply chains and ensuring access to critical minerals beyond China has thus become a priority for Europe, as well as major consuming countries such as the United States and Japan. Since 2023 and the adoption of the Critical Raw Materials Act (CRMA), the EU has been putting in place measures to mine and process more at home, diversify supplies from overseas, and bolster recycling for 34 raw materials and metal groups it considers critical and 9 it qualifies as "strategic".[4] But its efforts so far have failed to measure up to the task at hand.[5] Japan has meanwhile developed a useful model for mitigating risk and diversifying supply chains over the

[1] Farrell, H. and Newman, A. (2019), "Weaponized Interdependence: How Global Economic Networks Shape State Coercion", *International Security*, Vol. 44, No. 1, Summer, https://direct.mit.edu/isec/article/44/1/42/12237/Weaponized-Interdependence-How-Global-Economic

[2] Goddard, S.E. and Newman, A. (2025), "Further Back to the Future: Neo-Royalism, the Trump Administration, and the Emerging International System", *International Organization*, Vol. 79, Supplement 1, pp. S12–S25, December, https://www.cambridge.org/core/journals/international-organization/article/further-back-to-the-future-neoroyalism-the-trump-administration-and-the-emerging-international-system/ABB12906CA345BBCA5049B544363D391

[3] IEA (2025), "Global Critical Minerals Outlook 2025", IEA, Paris, 21 May, https://www.iea.org/reports/global-critical-minerals-outlook-2025/overview-of-outlook-for-key-minerals

[4] European Commission, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, "Critical Raw Materials Act", https://single-market-economy.ec.europa.eu/sectors/raw-materials/areas-specific-interest/critical-raw-materials/critical-raw-materials-act_en ; https://single-market-economy.ec.europa.eu/sectors/raw-materials/areas-specific-interest/critical-raw-materials_en

[5] European Court of Auditors (2026), "Critical Raw Materials for the Energy Transition – Not a Rock-Solid Policy", Special Report 04/2026, 2 February, https://www.eca.europa.eu/en/publications/SR-2026-04

last 15 years that has encountered a degree of success and inspired policy innovations in Europe of late. The United States, for its part, which has shifted from a constructive multilateral approach toward greater unilateralism in Donald Trump's second term, presents an increasing number of challenges for Europe in the raw material space.[6] For Washington today, access to critical minerals is serving as a driver not only of a more transactional approach, but a key motivator in a seemingly new era of American interventionism and territorial conquest. For mineral resource-rich players such as Australia, Canada, Ukraine, Saudi Arabia, Indonesia or the DRC, critical raw materials have become important bargaining chips not only in the pursuit economic development opportunities, but also in the search for security and as tools of geopolitical maneuvering and alignment in a rapidly changing world.

These dynamics are having a profound impact on the way that trade in critical raw materials is organized and how markets for minor, yet vital metals function. While attention to critical minerals has grown exponentially, far too little attention has been paid at the policy level to the mechanics and dynamics that structure the market – a condition that has ultimately led to severe market concentration and may lead to further dependencies in the future. Europe in particular has long been guided by a globalized, free market logic that has for decades ceased to function properly and has eroded its position in critical minerals trade. Raw material markets are not fluid nor transparent and have been skewed by supply-side industrial intervention elsewhere, namely in China. Now, as the need for state intervention has begun to sink in, European governments run the risk of overplaying their hand. Overly top-down policies are unlikely to capture the specificities of niche materials and their industry dynamics. State intervention is key, and the lack of scale of European public-sector (financial) buy-in risks setting European industry back. Still, what is ultimately needed is a balanced public-private partnership in the critical minerals sector that combines greater public sector engagement with industry and market-led perspective that will lead to a more optimal distribution of limited financial capital and expertise.

The goal of this paper is to establish a framework for understanding a number of defining principles that determine how trade in critical mineral markets function. In particular, it will explore China's specific role in the market and how Beijing's most recent export control policies are reorganizing trade for a number of critical raw materials. The analysis will then discuss efforts to develop critical mineral value chains outside of China by focusing in particular on the case of Japan, which will provide important lessons on managing public-private interactions. Lastly, the analysis will turn to lessons for Europe and the Netherlands.

[6] Handley, P. and Michel, T. (2026), "The US's Critical Mineral Offensive Strategy: How Can Europe Step Up?", Ifri Papers, Ifri, March, https://www.ifri.org/en/papers/uss-critical-mineral-offensive-strategy-how-can-europe-step.

2. Understanding critical raw materials and their markets

CRMs, or more specifically critical metals are elements in the Periodic Table that form a group with no clear definition or strict boundaries. They are therefore an aggregate of metals that vary greatly in terms of their origins, properties, abundance, prices, uses, and even risks. Understanding their defining characteristics and variations is important to formulating effective policy to address the very concerns that make these metals "critical" in the first place. The following analysis offers a working definition of criticality and explores the implications for how markets are structured.

Factors of criticality and their market implications

The classification of what is "critical" differs by country depending on industry and societal needs and political goals, but criticality is generally based on three basic criteria: 1) economic (or strategic) importance of a raw material; 2) supply risks associated with the raw material; and 3) the availability of substitutes.

The notion of criticality itself implies that these metals are essential to certain processes and, by extension, to certain supply chains. If these supply chains relate to matters of sovereignty (defense, energy, etc.), raw materials can even be referred to as strategic.[7]

This notion of criticality should therefore conclude that essential metals are, by nature, vital for the economy. The most widely consumed metals would therefore be the most critical: iron, aluminum, chromium, manganese, nickel, zinc, and copper. However, critical metals tacitly share another important characteristic: the risk of supply chain disruption. Supply disruption tends to be more elevated with higher degrees of geographical concentration and/or geological scarcity overlayed with political, geopolitical, social, economic or environmental risk factors that could provoke disruptions.

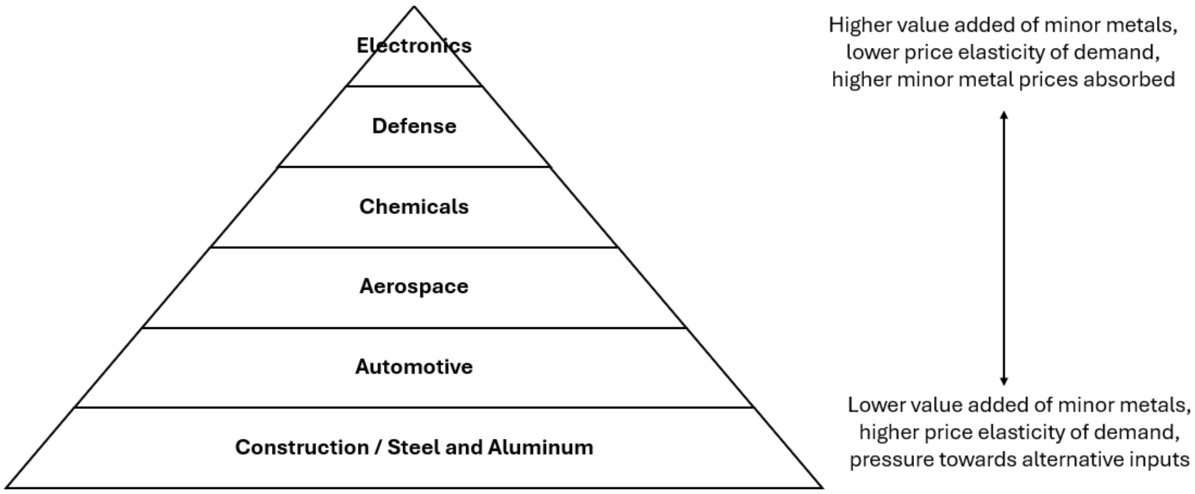
Demand dynamics are also an important feature. The concept of critical metals is part of a dynamic world view: a critical metal is certainly a metal that is necessary, but above all, it is a metal that is likely to become even more so in the future due to an expected increase in demand, either for existing or for emerging technologies. Their high added value for technology, but also the ability for changes in technology to change the demand structure for critical metals over time is therefore an important feature.

Notably, the substitutability of critical metals tends to be low because it is inversely proportional to the level of technological applications they are used for and the increasingly

[7] Haglund, D.G. (1984), "Strategic Minerals: A Conceptual Analysis", *Resources Policy*, Vol. 10, No. 3, pp. 146-152, September, https://www.sciencedirect.com/science/article/abs/pii/0301420784900291 ; Glöser, S., Tercero Espinoza, L., Gandenberger, C. and Faulstich, M. (2015), "Raw Material Criticality in the Context of Classical Risk Assessment", *Resources Policy*, Vol. 44, pp. 35-46, June, https://www.sciencedirect.com/science/article/abs/pii/S0301420715000021.

technical specificity that is sought from a particular metal (for instance heat resistance or magnetism). This leads to very low price elasticity of demand (meaning demand stays high despite rising prices) because manufacturers are often unable to do without these metals for their production. The possibilities for substitution are limited and, in most cases, these substitutions require a long development and qualification period and come at a cost in terms of performance.[8]

Figure 1. Price elasticity and added value of minor metals by industry type



For industries toward the bottom of the pyramid, the added value of minor metals tends to be lower which implies a higher price elasticity of demand. As demand for a minor metal rises, driven by industries higher up on the pyramid, there is greater pressure on tiers below to find alternative solutions by reducing demand. Industries higher up on the pyramid have a proportionally lower price elasticity of demand and will tend to absorb high prices due to their higher value added by metal quantity.
Source: Authors' conception

On the supply side, finally, most critical metals share common characteristics with regard to mine production: on the one hand, they are mainly obtained as by-products of other metals (base metals or precious metals) and, on the other hand, they are produced in smaller quantities (annual global production of less than one million tons).

Extraction of critical metals (for all or part of their production) as a by-product results in low price elasticity of supply (meaning supply has difficulty adjusting upwards or downwards in response to price signals) because their production is based less on standard market forces of supply and demand for the critical metal in question than on the production of the base mineral with which its production is associated. As a result, the impact of intra- and inter-sectoral competition for resources (particularly new uses resulting from technological innovations) can pose a very significant risk of crowding out industrial demand with the lowest added value.[9]

[8] In the case of rare earth-free electric motors, for instance, despite more than 15 years of research, the market share of traction motors that require NdFeB rare earth magnets still exceeds 95%.
[9] This has been the case, for example, in tellurium, which is no longer used in metallurgy due to its high price, whereas the metal's use in solar panels offers much greater value added, allowing panel manufacturers to remain profitable despite paying more for tellurium.

Figure 2: Base and precious metals and their by-products[10]

Principal host metals	Percentage of metals obtained as by-product of host metal production (est. ca. 2008)				
	100%	75%	50%	25% 0%	Unknown
Aluminum (Al)	Ga			V	
Titanium (Ti)	Zr Hf			Ho various REEs	Th Fe
Iron (Fe)		Nd Ce Pr La	Eu V	Tb Mn Gd Dy Sm Y	In Sc
Nickel (Ni)		Pd	Co	Pt Ru Rh Cu Au Os Ir	Se Ag
Copper (Cu)	Se Te		Re Mo Co	Ag Au In Bi U Sn Zn	Ti Fe Hg Ba As Pb
Zinc (Zn)	In Cd	Ge	Ag	Ga Sn Cu Au	Ti Se Ba Pb As Hg
Lead (Pb)		Bi	Sb	Te Cu Zn	Hg As Se Ba In Ti
Tin (Sn)				Nb In W various Sb REEs Bi Ta	As Th Sc Ag
Platinum (Pt)	Os Ru Rh Ir		Pd	Ag Ni Cu Co Cr Au	
Gold (Au)				U Sb Ag Cu Zn	Ba As Hg

Source: Authors' representation derived from data in supplementary materials of Nassar, N.T., Graedel, T.E. and Harper, E.M. (2015), "By-Product Metals Are Technologically Essential but Have Problematic Supply", Science Advances, Vol. 1, No. 3, 3 April, https://www.science.org/doi/10.1126/sciadv.1400180.

As the production volume of these metals is essentially dependent on the market dynamics of the primary metal from which they are derived as by-products, this can lead to periods of significant declines in CRM prices (in the event of high prices and high production

[10] Nassar, N.T., Graedel, T.E. and Harper, E.M. (2015), "By-Product Metals Are Technologically Essential but Have Problematic Supply", *Science Advances*, Vol. 1, No. 3, 3 April, https://www.science.org/doi/10.1126/sciadv.1400180.

volumes of the primary metals from which they are derived).[11] This could give the false signal to consumers of these critical metals that there is no risk of availability for their target material.

This is reinforced by the fact that the information available on extractive raw materials is largely correlated with the CAPEX associated with these materials. As critical metals are mainly or exclusively by-products of base metals or precious metals, there are very few (or even none, depending on the metal) dedicated players (pure players) for these metals. As a result, information on these metals is scarce and often non-existent outside of a few specialized channels such as price reporting agencies or specialized market intelligence providers. Compounding the information problem is the fact that these metals are primarily traded over the counter, making the market opaque and information fragmented.

Indeed, the low level of production of critical metals leads to another specific feature: as the financial volume represented by their market is generally modest, these metals are not listed on metal trading exchanges such as COMEX, LME,[12] or Shanghai, making them very much niche markets. One emerging alternative, ABAXX, a new third-party virtual exchange regulated by financial authorities in Singapore, currently trading in lithium carbonate and nickel sulphate, offers future contracts that has physical settlement in ports as a default, as opposed to pre-settled contracts. In the absence of a clearinghouse, the Minor Metals Trading Association (MMTA) provides a self-regulating and accrediting function through the adoption of standards and certification of storage and trade facilitation for unlisted minor metals.

Ultimately, these various features combined mean that CRM markets are characterized by a low level of available information and by very low price elasticities both in terms of supply and demand. These three elements are significant risk factors that result in high price volatility on the one hand (which weighs on the security of supply chains) and a high risk of availability on the other, specifically for applications with the lowest added value.

Understanding trade in critical metals

As CRMs are traded on over-the-counter markets, there are no publicly available prices that can be executed on commodity exchanges. However, as market participants need price indications, they use price reporting agencies (PRAs). These agencies, which are private companies, reconcile transactions carried out by industry players in order to publish (twice a week for the most traded metals and once a month for the most confidential markets) updated prices that reflect the reality of past transactions. The two best-known PRAs are FastMarkets (formerly Metal Bulletin) and Argus Metals, both based in the United Kingdom.

[11] Bismuth, for instance, which is as geologically rare as gold, sells for 3.9 USD/lb. because of its association with lead. Rhenium, which sold for 5200 USD/lb. in 2008 but fell to 420 USD/lb. in 2021 because volumes obtained in association with copper and molybdenum production exceeded market demand at the time.

[12] LME was acquired by the Hong Kong Exchanges and Clearing in 2012, which has subsequently raised questions over its independence, particularly following the Nickel short squeeze in 2022.

These PRAs publish prices on different markets (generally a European price, a US price, and a Chinese price). The European price is based (with a few rare exceptions) on Delivery Duty Unpaid Rotterdam.[13]

There is not necessarily a single price per metal. There may be different prices depending on the chemical form of the metal (metal, oxide, ferroalloy, concentrate, etc.), its purity (60%, 99%, 99.95%, etc.) or its origin (China vs. Canada for cobalt in particular, for example). This diversity of specifications further fragments markets that are already very small. This fragmentation is reflected in spreads (price differences between bid and ask) that can even reach or exceed 40% for certain metals at certain times (tellurium, for example). In general, spreads, the amplitude of which depends greatly on the size and liquidity of the market for each metal or each form of metal, can very often be around 10% for the rarest CRMs and are relatively low for the most liquid (such as cobalt, ferroalloys).

It should be noted that the prices published by the PRAs are spot (prompt delivery) prices. This spot market represents a relatively small, even negligible, share of the CRM market, but it is the basis for setting prices for futures contracts. In fact, industrial consumers prefer to contract (on an annual or often pluriannual basis) their supplies (with variable or fixed prices), except in special market conditions such as the economic crisis of 2008 or when the CRM markets are trending downward (and expected futures prices are lower than spot prices). In very illiquid markets, the price benchmark is often determined by the price paid or agreed to by the largest buyer, locked-in through an offtake agreement with miners as a way to guarantee an income stream for the producer and a security of supply for the consumer.

Hedging and futures contracts

Another consequence of the absence of CRM listings on commodity exchanges is that it is impossible for industrial consumers to use standardized risk hedging contracts (futures or options) that exist for base metals and precious metals.

Risk management must therefore also be carried out through over-the-counter (OTC) contracts, which must be tailor-made between two industrial players who mutually wish to hedge a symmetrical risk. In this OTC system, there is no clearing house to eliminate the risk in commodity exchanges. In other words, parties using an OTC hedging contract (forward contract) must assume counterparty risk, i.e., the risk of default (voluntary or otherwise) by the other contracting party. Finally, it is not possible to cancel or modify a contract in the event of changing market conditions (as is possible for futures by taking a symmetrical position), unless the other party agrees.

[13] Under Delivery Duty Unpaid, the seller is obliged to deliver to specified location in the buyer's country without paying the import duties, often bonded warehouses.

Specific players

Due to their very unique nature, CRM markets operate in a particular way. Large industrial consumers generally favor forward delivery contracts that can be multi-year (up to 5 years or even more than 15 years in the aerospace industry), where visibility (backlog, technological continuity) on future needs is very important. These forward contracts (signed with producers or traders/brokers) are generally structured with defined quantities of materials that can be called upon over a defined period.[14] Prices may be fixed or variable, with an amount defined by a calculation formula accepted by the contracting parties (which may be based on changes in the spot price of the material or even a precursor of that material during the contract period).

As CRM producers are mainly non-European (mostly Chinese), it is difficult for SMEs and mid-cap companies to buy directly from distant producers for several reasons, including:

- The risk associated with the material and delivery: purchasing material in China without any certainty that it is not counterfeit;
- FOB cash payment and logistics management (with a shipping time of more than 30 days from China, customs clearance, and REACH processes);
- Minimum order sizes;
- Traceability issues.

For all these reasons, manufacturers who consume small quantities of materials generally tend to use traders to source their CRMs. Purchases from traders are almost exclusively spot purchases, i.e., purchases followed by immediate delivery (prompt release/cash against release with metals usually already available in Rotterdam's bonded and LME/ MMTA certified warehouses) or subject to shipping time.

The largest industrial consumers tend to use tenders between different listed suppliers in order to select the best offers for immediate or future delivery. These companies favor forward purchases and only use the spot market to cover marginal (increased needs due to an unexpected increase in production, etc.) or one-off requirements.

Several factors impact the size of spot liquidity in each of the metals markets and determine the interest of commodity exchanges in offering futures contracts on metals. These factors are:

- Liquidity. Market size: the volume and value of annual global production. This depends on three factors:
    - The quantity of metals produced (primary + secondary)
    - The price of these metals
    - Storage levels
- Market players and concentration, both on the supply and the demand side.

[14] CME Group, "Cash Flow in Metals Futures vs Forwards", Lesson 8 of 9 in Introduction to Base Metals, https://www.cmegroup.com/education/courses/introduction-to-base-metals/cash-flow-in-metals-futures-vs-forwards.html

    - Concentration of supply. If supply is highly concentrated, the market cannot function. This is the case for the niobium market, which is almost exclusively controlled by Brazil's CBMM - Companhia Brasileira de Metalurgia e Mineração, which produces more than 80% of the world's niobium metal.
    - Concentration of demand and qualification of metals for supply chains.
- Standardization. Market fragmentation. The more a metal is marketed under a large number of references, the more difficult it will be to offer derivative products based on them. This fragmentation may be due to:
    - Traceability constraints leading to the creation of several parallel markets based on the origin of the metals rather than their purity or chemical form;
    - Different chemical forms, including metals, salts (hydroxides, carbonates, sulfates, etc.), ferroalloys, oxides, etc.;
    - Different purities, for example, standard gallium at 99.99% vs. high-purity, electronic gallium at 99.99999%.

Generally speaking, the more precise and varied the specifications of metals are, the further they move away from being "pure commodities," i.e., interchangeable materials regardless of their origin, and become niche products and even components of supply chains (for instance, high-purity metals for the electronics industry).

Figure 3. Metals and their markets

Metal	Shanghai Futures Exchange Futures	Shanghai Futures Exchange Options	London Metals Exchange Futures	London Metals Exchange Options	Chicago Mercantile Exchange Futures	Chicago Mercantile Exchange Options	Primary production 2024 (tons)*	Approximate Price Feb 2026**(USD/ton)	Approximate Market Value (USD millions)
aluminium	SHFE	SHFE	LME	LME	CME		72.000.000	2.860	205.920
chromium							47.000.000	12.000	564.000
copper	SHFE	SHFE	LME	LME	CME	CME	23.000.000	11.700	269.100
Manganese							20.000.000	2.000	40.000
zinc	SHFE	SHFE	LME	LME	CME		12.000.000	3.200	38.400
lead	SHFE	SHFE	LME	LME	CME		4.300.000	2.000	8.600
nickel	SHFE	SHFE	LME	LME			3.700.000	15.000	55.500
magnesium							900.000	2.450	2.205
tin	SHFE	SHFE	LME	LME			300.000	40.000	12.000
molybdenum			LME		CME (oxide)		260.000	50.000	13.000
cobalt			LME		CME (metal, carbonate, hydroxide)	CME (hydroxide)	290.000	50.000	14.500
antimony							100.000	30.000	3.000
vanadium							100.000	25.000	2.500
lithium			LME (hydroxide)		CME (carbonate, hydroxide, spodumene)	CME (hydroxide)	240.000	11.000	2.640
tungsten							81.000	100.000	8.100
niobium							110.000	90.000	9.900
cerium							121.000	3.500	424
lanthanum							112.000	3.000	336
neodymium							77.000	160.000	12.320
silver	SHFE	SHFE			CME		25.000	1.800.000	45.000
cadmium*							24.000	3.500	84
bismuth							16.000	42.000	672
praseodymium							30.000	160.000	4.800
yttrium							17.000	45.000	765
samarium							15.000	35.000	525
selenium*							3.700	25.000	93
gold	SHFE	SHFE			CME	CME	3.300	134.000.000	442.200
indium							1.080	400.000	432
tellurium*							980	120.000	118
dysprosium							960	290.000	278
gallium							760	500.000	380
palladium			LME		CME	CME	190	46.000.000	8.740
platinum			LME		CME	CME	190	53.000.000	10.070
germanium*							180	2.500.000	450
rhenium							70	4.500.000	315
ruthenium							30	43.400.000	1.302
rhodium							40	341.000.000	13.640
iridium							6	186.000.000	1.116

** sources : USGS, CDMR*

*** Based on consolidated estimates from average forms' prices*

Table Sources: Author calculations based on USGS Commodity Summaries (production volumes), Argus Prices, interviews and own calculations.

Disclaimer: Because metals trade in many different forms, exact or consolidated market values cannot be determined. The table above approximates order-of-magnitude economic value based on market prices and production volumes across these forms; it excludes recycling and multi-year purchase contracts.

In the table above, the listed metals appear in grey. It appears that the minimum market size to justify a listing is roughly USD 5 billion/year, with the following exceptions:

- Chromium: Ferrochromium of different grades (carbon content) used in steelmaking. Many futures contracts and few spot contracts.
- Manganese: Ferro-manganese of different grades used in steelmaking. Lots of futures contracts and few spot contracts.
- Niobium: 80% of global supply is controlled by a single player, Brazil's CBMM.
- Tungsten: The price of tungsten has doubled in the last six months due to a significant deficit. The historical size of the market is closer to USD 4 billion.
- Antimony: The price, which was historically around USD 10,000/ton rose to USD 60,000/ton in May 2025 following Chinese export restrictions. The price has fallen to USD 30,000/ton in late 2025/early 2026. The historical market size is closer to USD 1 billion.
- Lithium: Unlike tungsten and antimony, lithium is a market that has shrunk significantly in size despite increased production due to the collapse of lithium prices in recent years. Market forecasts for lithium (strong growth in demand and supply expected) and expected price increases from 2027 onwards should significantly increase the (financial) size of the market.

3. The sources and levers of China's power in critical metals

China's dominant role in the mining and processing of critical metals is ultimately a core feature of global CRM trade today, in addition to the structural dimensions laid out above. Indeed, China accounts for over half of the production and/or processing for 19 of the 34 raw materials that the European Union has considered "critical" or "strategic". For metals such as magnesium, gallium or heavy rare earths (dysprosium or terbium), that dependence is either total or exceeds 90%. At the same time, as the primary hub of global manufacturing, China also represents the primary market for many critical metals. Key policy goals – including bolstering resource security, facilitating industrial policy and building geopolitical leverage – have fueled investment into mining and processing and led to an increasing consolidation of control over the sector and its activities in recent decades. Beijing's efforts in the last three years to leverage its dominant market position through measures such as export licensing, entity blacklisting or broad-based export bans for materials, processing technologies or derived products ultimately serves to further consolidate its position in service of its broader policy objectives.

Beijing's broad policy priorities structure CRM trade

While China does have a natural endowment for certain mineral resources, its dominant supply chain position is much less the result of geology than of policy.[15] In stark contrast to policies in Europe or the United States, for instance, that sought to constrain domestic mining and favor globalized markets and offshoring notoriously polluting industries, raw material production, procurement and processing have long played and continue to play an important role in China's policy landscape. Three key policy priorities in particular – resource security, industrial competitiveness and international power politics – have been central to creating the conditions for China's dominance in critical metals and capitalizing on and further enhancing that position.

Resource security

In no instance does China hold a natural monopoly on the production of any critical mineral resulting from geological exclusivity. This is not to say that domestic mining has not played an important, even central part in developing critical mineral value chains in China. Indeed, stretching back to the foundations of the People's Republic, Beijing has placed a premium on resource security and prioritized domestic mineral production when possible[16] – a principle that continues to guide the country's natural resource policy.[17] Chinese mining for base metals meant to support heavy industry from as early as the 1950s has ultimately enabled the country to obtain

[15] Seaman, J. (2023), "Critical Minerals: A problematic diversification" (in French: Minerais critiques : une diversification problématique), *Politique étrangère*, vol.4, pp.67-79.
[16] Klinger, J.M. (2017), *Rare Earth Frontiers: From Terrestrial Subsoils to Lunar Landscapes*, Cornell University Press.
[17] Wang G.H. (2023), 推动重要能源和矿产资源增储上产, ["Promoting the increase in reserves and production of important energy and mineral resources"], 经济日报 [Economic Daily], 8 November, https://www.ydkj.ha.cn/?shizhengyaowen/3855.html.

numerous CRMs through co-production or as by-products of base metal smelting (bismuth from lead mines, gallium from bauxite and aluminum production, indium from zinc ore, germanium with zinc ore and coal ash, tellurium and molybdenum from copper, tungsten from tin, rare earths originally from iron ore).

As it became increasingly clear that minor metals were important raw materials for the development of new technologies, ensuring the capacity to take advantage of the resources China has and refine them domestically became a priority.[18] From 2005 to 2020, for instance, China's production capacity for primary gallium expanded more than 20 times, resulting in an estimated surplus of 948 metric tons, or over three times the market size,[19] as state incentives and requirements pressed major aluminum producers – such as the state-owned Aluminum Corporation of China (Chalco) – to integrate gallium recovery into their refining operations.[20] Gallium producers in Germany or Hungary couldn't handle the resulting price volatility and high competitiveness differentials and ultimately exited the market. This has similarly been the case with zinc and the associated production of germanium.

At the same time, China's geology is limited and domestic constraints, including rising environmental pressures, have increased reliance on overseas mining, prompting Chinese experts to distinguish between "advantageous minerals" (优势矿种), where China has a strong natural endowment and production dominance, and "shortage minerals" (短缺矿种), where Chinese dependencies lead to a degree of vulnerability.[21] Even in rare earths, which experts qualify as "advantageous" and where China accounted for over 95% of global mine production in the mid- to late-2000s, environmental constraints placed on the extraction of heavy rare earth-rich ionic clays in southern China have pushed mine production over the border into Myanmar, where civil conflict and domestic tensions have at times resulted in a disruption of supplies.[22] In such a context, an aggressive support for the acquisition of overseas mining assets has and remains a key feature. In 2025, China's overseas investments into mining and metals within the context of its "Belt and Road Initiative" surpassed a previous record set in 2024, reaching an estimated USD 32.6 billion.[23] Whereas China cannot reinvent its geology, it can ensure a degree

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[18] Seaman, J. (2010), "Rare Earths and Clean Energy: Analyzing China's Upper Hand", Note de l'Ifri, September, https://www.ifri.org/en/papers/rare-earths-and-clean-energy-analyzing-chinas-upper-hand.

[19] Jia, H. et al. (2022), "Evolution of the Anthropogenic Gallium Cycle in China from 2005 to 2020", Frontiers in Energy Research, 10 July, https://www.frontiersin.org/journals/energy-research/articles/10.3389/fenrg.2022.944617/full ; SAFE (2025), "Critical Minerals Pricing Mechanisms", Issue Brief, December, https://secureenergy.org/pricingmechanisms-criticalminerals/.

[20] Powers-Riggs A. et al. (2025), "Beyond Rare Earths: China's Growing Threat to Gallium Supply Chains", CSIS Briefs, 17 July, https://www.csis.org/analysis/beyond-rare-earths-chinas-growing-threat-gallium-supply-chains

[21] Li J.W., Li T.J. and Wang A.J. (2023), 中国战略性关键矿产目录厘定 ["Determination of China's Strategic and Critical Minerals List"], 地球学报 Acta Geoscientica Sinica, March, 44:2, p.261-270; Anderson, P. (2020), "Chinese assessments of "critical" and "strategic" raw materials: Concepts, categories, policies and implications", The Extractive Industries and Society, Vol.7, Issue 1, pp.127-137, https://www.sciencedirect.com/science/article/abs/pii/S2214790X19303454.

[22] Global Witness (2024), Fuelling the future, poisoning the present: Myanmar's rare earth boom, 23 May, https://globalwitness.org/en/campaigns/transition-minerals/fuelling-the-future-poisoning-the-present-myanmars-rare-earth-boom/; Ghoshal, D. et al. (2025), "Myanmar rebels disrupt China rare earth trade, sparking regional scramble", Reuters, 17 September, https://www.reuters.com/world/asia-pacific/myanmar-rebels-disrupt-china-rare-earth-trade-sparking-regional-scramble-2025-03-28/.

[23] Nedopil, C. (2026), *China Belt and Road Inititative (BRI) Investment Report 2025*, Griffith Asia Institute, January, https://blogs.griffith.edu.au/asiainsights/china-belt-and-road-initiative-bri-investment-report-2025-2/ ; Lapi, T., Le Bihan, J, Halloy,

of resource security by mastering the technology and developing the scale necessary to process ore concentrates and refine raw materials from overseas in China. Until 2025, China still processed 100% of the world's heavy rare earths. Elsewhere, while it only accounts for 21% of primary lithium production, 68% of the world's lithium chemical processing is done in China. The contrast is even more stark for cobalt and manganese. With less than 2% of primary production occurring in China in 2025, the country accounted for 79% of the world's cobalt refining activity and 95% of global manganese chemical production.[24] Finally, stockpiling of various minor metals has also been a useful tool not only to ensure the availability of supply in time of crisis, but also to support upstream mining and processing efforts as a form of offtake insurance and to adjust upward or downward the supplies to foreign markets as a way to stifle upstream competition.[25]

Figure 4. Strategic mineral and energy resources for China perceived in terms of strength and vulnerability

Advantageous minerals (优势矿种)	Antimony; Bismuth*; Fluorite; Gallium ; Germanium ; Crystalline Graphite; Indium; Rare Earths (REE); Tungsten; Vanadium
Shortage Minerals (短缺矿种)	Aluminum (Bauxite); Beryllium; Cobalt; Chromium; Copper; Iron; Natural gas; Hafnium; Lithium; Manganese; Nickel; Niobium; Petroleum; Potassium Chloride; Rhenium; Tantalum; Uranium; Zirconium
Other (unspecified) strategic minerals	Boron; Coal; Tin; Shale gas; Coalbed methane; Molybdenum; Gold; Phosphorus; Titanium

List of "Strategic Mineral Resources" derived from China's most recent 2021 undisclosed National Mineral Resources Plan 全国矿产资源规划, surmised by Andersson (2026) with strength and vulnerability assessments discussed in Seaman et al. (2024). Bismuth is not included as a strategic mineral in the mineral resources plan but nevertheless qualified as an advantageous mineral for China by Chinese analysts.

Sources: Andersson, P. (2026), "What does China's undisclosed strategic minerals catalogue reveal about its industrial priorities?", Brief No.5, Swedish National China Centre (NKK), 28 April, https://kinacentrum.se/en/publications/what-does-chinas-undisclosed-strategic-minerals-catalogue-reveal-about-its-industrial-priorities/, and Seaman, J., Vidal, F. and Danino-Perraud, R. (2024), "Critical Raw Materials: What Chinese Dependencies, What European Strengths?", in Rühlig, T. (ed.), Reverse Dependency: Making Europe's Digital - Technological Strengths Indispensable to China, Digital Power China, Report No. 3, German Council on Foreign Relations (DGAP), 7 May, https://dgap.org/en/research/publications/reverse-dependency-making-europes-digital-technological-strengths.

J. et al. (2025), "China's foreign investments in the metal sector", Mineral Economics, June, https://link.springer.com/article/10.1007/s13563-025-00525-7

[24] Benchmark Minerals (2025), "The evolution of China's upstream supply chain dominance", *Benchmark Source*, 11 July, https://source.benchmarkminerals.com/article/the-evolution-of-chinas-upstream-supply-chain-dominance

[25] Pinhas, P. (2026), "China's Stockpiling: Domestic Resilience, Global Influence", Explainer, Institut Montaigne, January, https://www.institutmontaigne.org/en/publications/chinas-stockpiling-domestic-resilience-global-influence.

Industrial upgrading and competitiveness

Since the global financial crisis and the subsequent identification of "new strategic industries" in 2010, Beijing has emphasized the transformation of China's economy into a value-added growth model and underscored the importance of high-tech leadership as a strategic imperative.[26] The 2015 publication of the Made in China 2025 strategy and subsequent policies served to further clarify the value-chain approach that Beijing would pursue, starting with the leveraging of advantageous positions in critical metals to move up the value chain in emerging and high tech industries.[27] Now, with the 15th Five Year Plan published in March 2026, China's industrial policy is expanding beyond targeted sectoral interventions focused on strategic emerging industries toward an approach that cuts across mature sectors, foundational supply chain nodes and frontier technologies alike, constituting an "industrial policy of everything" with an increasing emphasis on economic security and self-reliance.[28] Meanwhile, the State Council has enacted a broad regulatory framework aimed at consolidating its tools of economic statecraft, restricting compliance with foreign de-risking and supply chain diversification measures and controlling the outbound flow of capital, technology and knowhow.[29] The global impact ultimately risks an acceleration of China's trade dominance, deeper foreign dependence on Chinese supply chains, and a rapid global expansion of Chinese firms.

Critical metal-related policies have long played a key role in China's industrial policy and shaped the market as a consequence. From 2010, export tariffs and quotas imposed on rare earths, antimony, tungsten or silver, in addition to disruptions in rare earth exports caused by a diplomatic confrontation between China and Japan from September to November of that year, provided a powerful incentive to foreign firms to transfer downstream production to China in order to secure access to raw materials – further solidifying China's position not only as the largest producer but also direct consumer of many CRMs.[30] Ensuring cost advantages for downstream industries has also been a strong motivator in building upstream capacity in mining and processing, ultimately lowering input prices for downstream products produced in China. Industry players estimate that the benefits afforded to downstream manufacturers from lower input costs can exceed by as much as tenfold the cost of building overcapacities in mining and processing.[31]

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[26] Seaman, J. (2021), "Towards a more China-centred global economy? Implications for Chinese power in the age of hybrid threats", *Hybrid COE Paper*, European Centre of Excellence for Countering Hybrid Threats, November, https://www.hybridcoe.fi/publications/hybrid-coe-paper-9-towards-a-more-china-centred-global-economy-implications-for-chinese-power-in-the-age-of-hybrid-threats/.

[27] Seaman, J. (2019), "Rare Earths and China: A Review of Changing Criticality in the New Economy", Note de l'Ifri, January, https://www.ifri.org/en/papers/rare-earths-and-china-review-changing-criticality-new-economy.

[28] Boullenois, C., Black, M., & Caruso, A. (2026), "China's Next-Generation Industrial Policy", Rhodium Group, 11 May, https://rhg.com/research/chinas-next-generation-industrial-policy/.

[29] Paterson, S. (2026), "China's three decrees reshape multinationals engagement", Hinrich Foundation, 28 July, https://www.hinrichfoundation.com/research/article/fdi/china-three-decrees-and-multinational-companies, and Bullenois, C. et al. (2026), op.cit.

[30] Pothen, F., and Fink, K. (2015), "A Political Economy of China's Export Restrictions on Rare Earth Elements", Discussion Paper No.15-025, Centre for European Economic Research (ZEW).

[31] SAFE (2025), "Critical Minerals Pricing Mechanisms", Issue Brief, SAFE, December, https://secureenergy.org/pricingmechanisms-criticalminerals/

Already, clean energy is one area where China's value-chain strategy has been particularly successful. In 2023, China accounted for three quarters of global battery production, including over 80% of cathode and 90% of anode active materials globally,[32] while its dominance in lithium iron phosphate (LFP) batteries in particular extends beyond 98%.[33] Similarly, China accounts for 80% of global manufacturing along the solar PV supply chain, including the production of polysilicon, wafers, cells and modules, where its production is more than double the country's share of global demand.[34] Its firms also hold leading positions in global value chains for wind turbines and electric vehicles. In 2024, China's clean energy sales and investments, notably in solar, electric vehicles and batteries, amounted to USD 1.9 trillion, accounting for 10% of the country's economic growth.[35] While China's dominance of the upstream cannot attribute for all of the success of Chinese firms downstream, which result from a much broader set of policy support tools and industrial competitiveness factors,[36] it has nevertheless played an active role. Crucially, it is the robustness of this downstream demand that backstops China's upstream mineral ecosystem.[37] Dominance in upstream metal production and processing coupled with a vast downstream market to ensure demand domestically ultimately gives China a considerable degree of leverage on price formation and the ability to shape minor metal markets both at home and abroad.

Power politics

Ensuring resource security, bolstering industrial competitiveness and achieving technological leadership all ultimately fit within a much broader framing of structural transformation of the international system and the strategic imperative of China to seize the opportunities afforded by what Xi Jinping has termed since 2019 as "changes unseen in a century".[38] Indeed, a convergence of societal, technological, and geopolitical transformations has presented China with a unique opportunity to challenge and even displace American global leadership and power and reshape the international order to better serve its interests,[39] but requires that Beijing deftly and effectively wield the tools at its disposal.

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[32] IEA (2024), EV Battery Supply Chain Sustainability, IEA, Paris https://www.iea.org/reports/ev-battery-supply-chain-sustainability.
[33] Greitemeier, T., Kampker, A., Tübeke, J., & Lux, L. (2025), "China's hold on the lithium-ion battery supply chain: Prospects for competitive growth and sovereign control", *Journal of Power Sources Advances*, Vol. 32, April, https://doi.org/10.1016/j.powera.2025.100173.
[34] IEA (2025), "Global Critical Minerals Outlook 2025", IEA, Paris, 21 May, https://www.iea.org/reports/global-critical-minerals-outlook-2025.
[35] Myllyvirta, L., Qin, Q., & Qiu, C. (2025), "Analysis: Clean energy contributed a record 10% of China's GDP in 2024", Centre for Research on Energy and Clean Air (CREA), 19 February, https://energyandcleanair.org/analysis-clean-energy-contributed-a-record-10-of-chinas-gdp-in-2024/
[36] See for instance Boullenois, C., et al. (2025), "Far from Normal: An Augmented Assessment of China's State Support", Rhodium Group, 17 March, https://rhg.com/research/far-from-normal-an-augmented-assessment-of-chinas-state-support/; Wang, D. (2025), *Breakneck: China's Quest to Engineer the Future*, Alan Lane.
[37] Baskaran, G. (2026), "Winning the Minerals Race Requires Building Demand, Not Just Supply", Center for Strategic and International Studies (CSIS), 3 April, https://www.csis.org/analysis/winning-minerals-race-requires-building-demand-not-just-supply.
[38] Xi Jinping's reference to "changes unseen in a century" (百年未有之大变局) has been used repeatedly since 2017–2018; see Mattis, P. (2023), "'Changes Unseen in a Century': Seeking American Partnership in US Decline", *China Brief*, The Jamestown Foundation, 21 November, https://jamestown.org/program/changes-unseen-in-a-century-seeking-american-partnership-in-us-decline/.
[39] Doshi, R. (2021), *The Long Game: China's Grand Strategy to Displace American Order*, Oxford University Press.

In October 2020, amidst the global COVID-19 pandemic, deepening strategic competition with the United States, and a broader awakening on the need to re-think dependencies, economic security and global supply chains, Xi published a seminal article in the PCC's leading journal *Qiushi*. In it, he explained that the country must "strengthen the dependence on China of international industrial chains, and form a powerful countermeasure and deterrent capability against deliberate supply disruptions by foreign parties".[40] In the same month in 2020, China would adopt a new Export Control Law, paving the way for the development of Beijing's critical mineral export restrictions. The law would be further complemented by a slew of instruments designed to leverage China's strengths in both deterring foreign pressure and pursuing broader policy goals, including the Unreliable Entities List (2020), Anti-Foreign Sanctions Law (2021), Regulations of Export Controls for Dual-Use Items (2024), successive updates to the Catalogue of Technologies Prohibited or Restricted from Export, as well as the State Council's latest regulations on supply China security (Decree 834) and on countering extraterritoriality (Decree 835) in April 2026.

As further explored below, the application of these tools to critical metals and their value chains has proven to be an effective, strategic lever. In addition to the indispensability of many of the China-controlled critical metals in military technologies to ensure security and defense in an increasingly unstable world, the economic implications of a stoppage of Chinese exports alone should give pause. According to a recent assessment of the International Energy Agency (IEA), if China's export controls of rare earths rolled out in October 2025 were to be applied in full, the direct and indirect cost to OECD economies could reach upward of USD 6.5 trillion per year.[41] China's chokehold over vital raw material supply chains today ultimately gives it the ability to undercut the operation or development of a wide range of vital industries, including defense, energy, medicine and aerospace and more broadly bring the global economy to halt.[42] Beijing recognizes the strategic value of its position and has moved to consolidate, strengthen, and leverage it, including against Europe directly.

China's industry consolidation and control of the value chain

With critical metals playing an important, even central role in the pursuit of China's strategic policy goals, consolidating control over the composite parts of the industry – the flow of raw and processed materials as well as the actors involved – has proven to be a priority as well as a challenge in recent years. Indeed, often with catastrophic environmental impact,[43] informal

[40] XI, J. (2020), " 国家中长期经济社会发展战略若干重大问题" [Several major issues in the national medium- and long-term economic and social development strategy], *Qiushi*, 21 October ; Original quote: 拉紧国际产业链对我国的依存关系，形成对外方人为断供的强有力反制和威慑能力

[41] IEA (2026), Rare Earth Elements: Pathways to secure and diversified supply chains, IEA, April, https://www.iea.org/reports/rare-earth-elements

[42] Teer, J. (2026), "Beijing's Critical Raw Material Weapon – And How to Dismantle It", Chaillot Paper 189, European Union Institute for Security Studies (EUISS), May, https://www.iss.europa.eu/publications/chaillot-papers/beijings-critical-raw-material-weapon-and-how-dismantle-it.

[43] Schröder, P. (2026), "The rare earths race risks environmental disaster", Expert Comment, Chatham House, 3 March, https://www.chathamhouse.org/2026/03/rare-earths-race-risks-environmental-disaster, Standaert, M. (2019), "China Wrestles with the Toxic Aftermath of Rare Earth Mining", YaleEnironment360, 2 July, https://e360.yale.edu/features/china-wrestles-with-the-toxic-aftermath-of-rare-earth-mining

activity, crony capitalism and corruption have long been features of the mining sector and associated mineral processing activities in China,[44] as in many countries including historically in the West. Beijing has rolled out a mix of policy tools to address the problem of control by reducing the number of players involved, seeking to instill a degree of order in the upstream segments of the value chain so as to more closely align industry action in the resource sector with broader policy aims. Formal policy measures include licensing requirements (for mining, processing and export, including of associated technologies) and production quotas, stricter environmental regulations, traceability requirements, crackdowns on illegal mining, industry planning, SOE restructuring and the facilitation of mergers and acquisitions that encourage vertical integration among both private and state-owned actors, and the direction of state purchasing through stockpiling.

Such efforts have been clearly visible in the rare earth industry.[45] Rare earth production in China was once dominated by hundreds of mining, separation and refining companies and informal operators, wherein illegal mining and trade was estimated to account for over one third of market activity as recently as a decade ago.[46] After establishing a system of licenses for mining and processing, as well as production quotas and export licenses, in 2015 Beijing moved to consolidate the industry into the hands of six major, state-owned companies. In 2016, it also created a strategic stockpile of rare earths to better regulate prices. Further industry consolidation came again in 2022, with the creation of two industry giants – China Rare Earth Group (pooling the units of Minmetals, Chinalco and Ganzhou Rare Earths, operating primarily in the southern mining regions), and Northern Rare Earth Group (dominated by Baotou Steel Rare Earth, which operates the world's largest rare earth mine in Inner Mongolia). Through production quotas and a tighter control of producers themselves, China could swing output upward or downward, ultimately influencing prices and market conditions though policy – fluctuations that would undermine efforts to build rare earth value chains overseas.

China has also seen a consolidation of national trading players that manage and often dominate the flow of raw materials, including in foreign markets. Vital Materials (先导科技), for instance, is a private firm that has acquired considerable shares in critical metal trading markets, including indium, gallium, germanium, selenium and bismuth products. Following the collapse of the Fanya Metal Exchange in 2019, when Yunnan police seized an estimated 70,000 tons of 14 different non-ferrous metals as the result of a vast ponzi scheme, Vital succeeded in carving out a dominant market position by purchasing much of Fanya's stocks – for instance 3,629 tons of indium, or the equivalent of 6 years of global consumption.[47] More than in commodities trading of niche metal products, the company has been investing down the supply chain, particularly in semiconductors, seemingly leveraging its upstream market position to bolster downstream

[44] Pei, M.X. (2016), *China's Crony Capitalism : The Dynamics of Regime Decay*, Cambridge, MA: Harvard University Press, pp. 60-65.
[45] Parkinson, J. (2025), "Detailed Timeline: China's Rare Earth Restrictions and Strategic Moves", Rare Earth Exchanges, 16 April, https://forum.rareearthexchanges.com/threads/detailed-timeline-chinas-rare-earth-restrictions-and-strategic-moves.16/
[46] Shen, Y., Moomy, R. and Eggert, R. (2020), "China's public policies toward rare earths, 1975-2018", Mineral Economics, Vol.33, pp.127-151, https://link.springer.com/article/10.1007/s13563-019-00214-2
[47] Fastmarkets (2020), "Exclusive: Vital Materials confirms buying Fanya minor metals stocks", Fastmarkets, 21 January, https://www.fastmarkets.com/insights/exclusive-vital-materials-confirms-buying-fanya-minor-metals-stocks/.

investments. As a measure of its success and ambition, its workforce has grown from 4,000 employees in 2020 to 15,000 operating across 20 countries today.[48] Beyond the company's ambition and that of its founder and CEO, George Shihui Zhu,[49] industry insiders accredit Vital's success to support from the Chinese state, particularly with regard to access to financing, which at times has allowed the company to operate at a loss while still acquiring significant assets.[50] By facilitating the emergence of trading companies and Vital Materials in particular, China is able to further consolidate a dominant position in the trading and logistics of CRMs and gain a better understanding of the flows and vulnerabilities of foreign, including European, industrial players.

Conversely, in cases where China is an importer of materials, it has pursued a strategy of centralizing purchases. For example, it created the China Mineral Resources Group Co. (CMRG) in 2022 to centralize the $130 billion in iron ore purchases for more than half of Chinese steelmakers.[51] Thanks to CMRG's position as the world's largest buyer, after years of effort China has been able to turn its dependence on foreign, primarily Australian ore to its advantage, negotiate terms (including trade denominated in RMB) and influence prices and mitigate the volatility of ore prices.[52] CMRG is also said to have built up stocks of nearly 20 million tons of ore in Chinese ports.[53] In parallel, China has now moved toward greater centralization of overseas investment in the mining sector. In June 2026, it was revealed that the state's economic planning agency, the National Development and Reform Commission (NDRC), would take up a greater role in coordinating such investments and that the Guangyan International Investment Co., a firm created in 2024 and controlled by the state-owned China Minmetals Corp., will proactively co-invest in overseas deals and offer support on compliance, financing and industry-wide coordination.[54] The emerging structure around China's participation in overseas metal markets, which has taken a large number of traders out of play, is not only aimed at limiting volatility and price increases in order to keep inflation under control, but is part of a broader effort to re-tool market architecture that touches on the location of commodity exchanges, the currencies that minerals are traded in, the regulations that govern their trade, and ultimately the role of Western financial institutions.[55]

[48] Vital Materials, company website, https://en.vitalchem.com/fr/contact/
[49] Burton, M. (2023), "The Little Known Metals Giant that Rules a Global Market", *Bloomberg*, 24 July, https://www.bloomberg.com/news/articles/2023-07-25/china-firm-vital-materials-holds-biggest-share-of-metals-needed-for-green-tech
[50] Interviews with industry insiders conducted in November and December 2025.
[51] Gemmel, K. & Cang, A. (2025), "Xi's Iron Ore Trader Is Shaking Up a $130 Billion Market", Bloomberg, 19 June, https://www.bloomberg.com/news/articles/2025-06-19/china-economy-xi-s-giant-iron-ore-trader-is-shaking-up-a-130-billion-market.
[52] Source – Massot, P. (2025), "China moves to regain iron ore market power", East Asia Forum, 12 December, https://eastasiaforum.org/2025/12/12/china-moves-to-regain-iron-ore-market-power/ ; Massot, P. (2024), *China's Vulnerability Paradox: How the World's Largest Consumer Transformed Global Commodity Markets*, Oxford University Press: Economy, E. & Levi, M. (2014), *By All Means Necessary*, Oxford University Press.
[53] Gemmell, K. and Cang, A. (2025), "Xi's giant iron ore trader is shaking up a $130 billion market", Bloomberg (via Mining.com), 19 June, https://www.mining.com/web/xis-giant-iron-ore-trader-is-shaking-up-a-130-billion-market/.
[54] Lee, A. & Xie, H. (2026), "China Picks State Firm to Help Coordinate Mining Deals Abroad", Bloomberg (via Mining.com), 3 June, https://www.mining.com/web/xis-giant-iron-ore-trader-is-shaking-up-a-130-billion-market/.
[55] Massot, P. (2020), "The state of the study of the market in political economy: China's rise shines light on conceptual shortcomings", Competition & Change, Vol. 25, Issue 5, https://doi.org/10.1177/1024529420965523.

Export controls: Leveraging chokepoints and information

Since July 2023, Beijing has taken the significant step of more formally regulating trade flows through export controls that include licenses and formal bans on raw and processed materials as well as on processing technologies and derived components The measures, applied by the Ministry of Commerce (MOFCOM), are officially meant to target “dual use” items, with export toward military end-uses being prohibited as a matter of principle. Yet, the effects of the licenses necessarily extend beyond the military realm to serve Beijing’s geopolitical and industrial policy goals as well.

Starting with value chains for gallium and germanium, MOFCOM’s restrictions would extend to graphite, antimony, tungsten, tellurium, bismuth, indium, molybdenum and seven rare earths, including neodymium, dysprosium, terbium and samarium. By May 2025, China’s “dual use” export licensing requirements would apply to 240 product lines, affecting raw materials, chemical products and downstream intermediate goods such as rare earth magnets.[56] The measures themselves began as a response to increasing pressure from the United States in the trade and technology realm, as Washington sought to undermine China’s rise as a peer competitor. Escalatory moves from the two sides would ultimately reach a pinnacle in October 2025, with Beijing not only adding new materials and product lines to the control list but formally introducing the principle of extraterritoriality, mirroring an American innovation in export controls known as the Foreign Direct Product Rule (FDPR) and the de-minimis principle. Applied to the rare earth value chain, Beijing threatened that if a traded product contained more than 0.1% of value of Chinese rare earths, that trade would be subject to authorization by the Chinese authorities. Donald Trump and Xi Jinping would ultimately negotiate a truce in their trade and technology war, with Beijing delaying its latest measures and some targeted export bans until November 2026, but the ubiquity of China’s chokepoint advantage in critical raw materials has become blatantly clear.

Since the beginning of 2026, China has proceeded with targeted application of export controls on materials and product lines previously identified, starting with export bans toward Japan following Tokyo’s position on the security implications of a conflict over Taiwan. Indeed, since January exports to Japan of key critical metals such as dysprosium, terbium, yttrium, gallium and tungsten have considerably fallen or come to a complete halt.[57] Over the course of the year Beijing has proceeded with targeted bans on firms in the United States, including MP Materials and USA Rare Earths, two firms proving central to the American efforts to rebuild a rare earth supply chain, and as well as in Europe. In particular, on 26 July Beijing targeted 14 European entities in response sanctions placed on Chinese firms for their support of Russia in its war in Ukraine. In these cases, and since October 2025, extraterritoriality has become a regular feature of Chinese export control measures.

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[56] Wübbeke, J. and Catarata, M. (2025), “Chokepoint Politics: China’s Export Controls in the Era of Great Power Rivalry”, Sinolytics, 12 June, https://sinolytics.de/global-business-news/blog/china-policy/chinas-export-controls-in-the-era-of-great-power-rivalry/.
[57] Bloomberg News (2026), “China’s Key Minerals Exports to Japan Stay at Low Levels in May”, Bloomberg (via The Japan Times), 20 June, https://www.japantimes.co.jp/business/2026/06/20/china-japan-mineral-exports-low/.

Figure 5. Timeline of China's critical metal export controls since 2023

Chokepoints, panopticon effects, and the impact on trade networks

The export licensing regime ultimately leverages two important features of complex, interdependent supply chains: chokepoint effects and panopticon effects.[58]

First and foremost, the *chokepoint effect* allows China to limit access to vitally important materials and technology in pursuit of broader political, economic and strategic goals, such as those explored above. Following the 2020 adoption of the Export Control Law, the development of the control regime itself began in response to Washington's export controls on advanced semiconductor technologies meant to stymie China's development of Artificial Intelligence starting in October 2022 and have expanded as tensions around trade and technology with the United States deepened.[59] But the export licenses have also been used to pressure the European Union over the bloc's countervailing duties on EVs and other products from China, as well as European adherence to American export control measures.[60] As Europe looks to invest massively into building out its defense sector to counter immediate threats, particularly from Russia, and imagine the future of its alliance with the United States, China can leverage its supply chain position to exact concessions. It could also be used to limit European support for Taiwan, particularly in the case of armed conflict. Already, export controls targeting 7 European entities from 24 April responded to those firms' supposed interactions with the Taiwanese defense industry,[61] while the 26 July bans toward 14 firms were in response to Chinese involvement in Russia's war effort in Ukraine.

At the same time, the chokepoint effect serves to bolster the relative competitiveness of Chinese downstream products by ensuring that Chinese firms conserve stable supplies of raw materials and intermediate goods relative to foreign competitors. In effect, non-Chinese firms that rely on raw materials, chemicals or intermediate goods from China will face an added supply chain risk relative to their Chinese competitors, ultimately making Chinese downstream products appear a safer choice. Price differentials caused by supply disruptions also weigh in favor of Chinese industries downstream. According to Argus listings, the price in the EU exceeds that in China by 4 times for germanium metal, 12 times for gallium (99.99 purity) and 5 times for terbium oxide.

Furthermore, while supply restrictions to global markets have led to acute shortages and price spikes, Beijing could just as easily reverse course, flood global markets and complicate diversification efforts if it perceives that the threats to its market dominance undercut its broader

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[58] Farrell, H. and Newmann, A. (2019), "Weaponized Interdependence: How Global Economic Networks Shape State Coercion", *International Security,* 44 (1): 42–79, https://doi.org/10.1162/isec_a_00351

[59] Seaman, J. (2023), "China's Weaponization of Gallium and Germanium: The Pitfalls of leveraging Chokepoints", Brifings de l'Ifri, 27 July, https://www.ifri.org/en/memos/chinas-weaponization-gallium-and-germanium-pitfalls-leveraging-chokepoints; Luck, P., and Gray, R. (2025), "The Hidden Risk of Rising U.S.-PRC Tensions: Export Control Symbiosis", Commentary, Center for Strategic and International Studies (CSIS), 14 April, https://www.csis.org/analysis/hidden-risk-rising-us-prc-tensions-export-control-symbiosis

[60] Barkin, N. (2025), "Watching China in Europe – June 2025", Insights, German Marshall Fund of the United States, June, https://www.gmfus.org/news/watching-china-europe-june-2025.

[61] MOFCOM (2026), "MOFCOM Spokesperson's Remarks on Adding Seven EU Entities to the Restricted Namelist", 30 April, https://english.mofcom.gov.cn/News/SpokesmansRemarks/art/2026/art_393371b908b543a690f8ff4ceaba8734.html.

interests. Indeed, China's return to open trade in the rare earth products market following export restrictions beginning in 2010 ultimately undercut efforts to diversify the supply chain, as prices fell, firms opted for China's price advantage, and the sense of urgency fell away from government policy.[62]

Secondly, *panopticon effects* of the licensing regime are generated through requirements by prospective exporters to provide detailed information about value chains and downstream markets. Dual-use export regimes, whether in China, the United States, Europe or elsewhere, are intended to stop the export of goods that can impede upon national security, and thus require exporters to provide detailed information on how exported goods will be used, including product details, as well as subsequent buyers and end users.[63] With regard to magnets and the heavy rare earths needed to produce them, it has been reported that manufacturers are required not only to clearly identify end uses and users, but also provide photos and diagrams of the systems in which these parts will be used in order to obtain a license.[64] Furthermore, these licenses are often granted for much lower volumes than those requested by manufacturers, forcing them to repeat the process several times, while Chinese authorities have also warned against foreign consumers generating commercial or strategic stockpiles from Chinese materials at the risk of licenses being revoked.

Two dimensions are significant with regard to information flows. First, if managed wisely, Chinese authorities will ultimately be able to construct a detailed mapping of downstream value chains using the licensing process. This functional map – which is far more exhaustive and up to date than those that European governments have been going to great pains to draw for themselves over the last 3 years – can then be used to precisely tailor future export restrictions to more effectively achieve its policy goals. With more accurate information about supply chain vulnerabilities of specific firms or use cases, export controls can be targeted towards individual end users either to undercut the development of significant technological advancements or undermine the comparative advantage of a foreign competitor. As exporters need to obtain a license to sell a controlled metal (such as terbium) or downstream product (such as a magnet) to a specific buyer with an identified end use (for instance in the electric motor of a rival EV or wind turbine manufacturer), it would suffice to deny or revoke a license without clear for justification. Such a targeted export control would be less likely to result in high-level diplomatic tensions, allowing Beijing to achieve specific yet significant gains at lower political cost. The July 2026 measures targeting of 14 European entities within 24 hours of Brussels sanctioning Chinese firms

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[62] Baskaran, G. and Schwartz, M. (2026), "Rare Earth Export Restrictions One Year Later", Brief, Center for Stategic and International Studies (CSIS), 27 April, https://www.csis.org/analysis/rare-earth-export-restrictions-one-year-later.
[63] Interesse, G. (2024), "China Issues New Export Control Regulations: What Businesses Need to Know?", China Briefing, 19 November, https://www.china-briefing.com/news/china-issues-new-export-control-regulations/
[64] Leonard, J. (2025), "German Firms Hand Over Secrets That China Could Use for Leverage", Bloomberg, 25 October, https://www.bloomberg.com/news/articles/2025-10-25/german-firms-hand-over-secrets-that-china-could-use-for-leverage?embedded-checkout=true; Björkman, M. (2025), "China pushes German firms to disclose data for mineral access", Mining Metal News, 19 November, https://www.miningmetalnews.com/20251119/3269/china-pushes-german-firms-disclose-data-mineral-access; McMorrow, R., Leahy, J. and Inagaki, K. (2025), "China demands sensitive information for rare earth exports, companies warn", Financial Times, 12 June, https://www.ft.com/content/0fce7177-a713-4c06-ba22-0ae429efe73f

for their role in aiding Russia's war effort in Ukraine suggest that Beijing has already done a fair share of its homework.

Another effect of vendor disclosure requirements is the deconstructing of international trading networks for controlled materials and, implicitly, the end of the spot market for Chinese material. By definition, the buyer and ultimate end user of a product traded on a spot market is unknown at the time of export and the material traded through an intermediary, or trader.

4. Responding to supply chain disruptions: Lessons from Japan

That China's dominant position in critical minerals is built more around policy than geology is ultimately good news for formulating a strategy of supply chain diversification. As policy has played a major role in China's success and the failures of Europe and its partners in this field, it also means that responding to these successes and failures and getting the policy mix right will be an important part of the solution.

As Europe scrambles to find that right policy mix to diversify its sources of critical minerals and reduce dependence on China, Japan provides perhaps the best example so far of effective policies and actions in achieving diversification. Although the country still struggles with severe dependencies in a number of areas, its relative success in reducing reliance on China for rare earths over the last 15 years provides valuable lessons. These lessons not only center around the importance of long-term state support in various forms, which is increasingly well known, but also the importance of synergies and a balancing of roles between state agencies and the private sector, which will be highlighted here.

The starting point for Japan's policy shift was a diplomatic incident in disputed waters off the Senkaku/Diaoyu islands resulting in the disruption of vital rare earth shipments from Chinese ports to Japan between the months of September and November 2010. A debate persists over whether such a disruption was a desired policy on the part of the Chinese central authorities or rather the result of Beijing's inability to control various interest groups and local authorities bursting with nationalist zeal at the time.[65] Nevertheless, Tokyo perceived the events as a targeted, politically driven embargo and the first example of how China's raw material value chain advantages could be leveraged in the pursuit of political or diplomatic gains, one that was couched in a broader transformation of China into a more assertive regional, even global power.

As a result, Japan's diversification efforts for rare earths took on a high degree of political importance. Efforts to build non-Chinese supply chains ultimately succeeded in reducing the country's reliance on China for rare earths from over 90% to below 60%, and Japan today still produces an estimated 7% of the world's rare earth magnets as a result[66]– though until now the country has still relied entirely on China for heavy rare earths such as dysprosium and terbium. The country's initial strategy developed in the height of the 2010 rare earth crisis has been built upon 5 pillars: 1) the development of substitute materials and technologies; 2) efficiency gains on raw material use; 3) recycling of critical minerals in both industrial and consumer waste; 4) strategic and commercial stockpiling; and 5) diversification through investment into the development of mining and processing overseas (the development of seabed resources in

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[65] Klinger, J.M. (2017), *Rare Earth Frontiers: From Terrestrial Subsoils to Lunar Landscapes*, Cornell University Press; Evenett, S.J. and Fritz, J. (2023), *The Scramble for Critical Raw Materials: Time to Take Stock?*, Center for Economic Policy Research, 7 May, https://www.wita.org/atp-research/scramble-critical-raw-materials/;.

[66] Terazawa, T. (2023), "The rare earths embargo of 2010 and its lessons", Chairman's Message, Institute of Energy Economics, Japan, October, https://eneken.ieej.or.jp/en/chairmans-message/chairmans-message_202310.html.

Japan's EEZ would be added in 2021). In 2020, the Japanese government revised its resource strategy, notably specifying strategic stockpiling targets for the 34 (now 35) raw materials deemed as "critical" – 60 days in general, and up to 180 days for materials representing a "high geopolitical risk" (in addition to reserves that firms may hold privately).[67] While not a panacea, such reserves are sure to offer a degree of breathing room in the event of a crisis. Since 2022, the approach has been integrated into a broader economic security strategy – the Economic Security Promotion Act (ESPA)[68] – operationalized by the Ministry of Economy, Trade and Industry (METI). The ESPA integrates critical raw materials into a broader strategic framework which, on one hand, seeks to bolster Japan's resilience and autonomy and, on the other, invest in specific industries and technological niches where the country remains or can develop a degree of strategic indispensability to act as a deterrent to coercion or a source of leverage in its own right.[69] Crucially, the ESPA enables long-term policy support by the Japanese government and improves predictability while establishing a legal basis for cooperation between the state and Japanese firms.[70]

The role that the Japanese state has played in coordinating and financing these activities, particularly in critical mineral mining and processing ventures abroad, has garnered significant attention, particularly as Europe develops its own critical raw materials strategy and seeks to mobilize government agencies and public resources in ways that were previously restricted by European legislation. The Japan Organization of Metals and Energy Security (JOGMEC) in particular, which provides equity investment, loans and debt guarantees, as well as expertise for prospecting and project development and manages the country's strategic stockpiles, has inspired the creation of the European Union's Critical Raw Materials Center, inaugurated in March 2026. What is significant about JOGMEC is that it benefits from a broad political mandate to take risks and invest "patient" or strategic capital in early stages of supply chain projects that otherwise wouldn't attract the commercial capital necessary for their development. While more considerable project financing comes from the Japan Bank of International Cooperation (JBIC) in support of larger scale, more commercially viable projects, JOGMEC's originality is in shouldering the risk burden. An aspect that has not garnered as much attention with regard to Japan, however, is the role that private companies, and in particular trading houses, or *sogo shosha (*including Sojitz, Sumitomo, Mitsui, Mitsubishi, Tsusho…*)*, play in project development and supply chain resilience.

More than traditional commodity traders, Japanese trading houses are crucial investors along the entirety of the supply chain, assisting industry players in linking together often complex production networks. *Sogo shosha* are entirely private enterprises and do not typically own or operate the means of production, whether it's mining raw materials, producing batteries or assembling vehicles, but they are indispensable intermediaries in the Japanese industrial

[67] METI (2020), *Japan's new international resource strategy to secure rare metals*, Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry (METI), 31 July, https://www.enecho.meti.go.jp/en/category/special/article/detail_158.html
[68] Koyu, I., et al. (2023), "Japan's Economic Security Promotion Act: Background and Overview", Asia-Pacific Review, Vol. 29, No. 3, pp.28-55, https://doi.org/10.1080/13439006.2022.2154520.
[69] METI (2026), *Guidelines for Economic Security Management (1st Edition)*, 23 January, https://www.meti.go.jp/press/2025/01/20260123004/20260123004.html.
[70] Interview, Japanese firm, 18 December 2025.

ecosystem and a key pillar in Japan's critical mineral supply chain strategy. As one government official explained, in developing viable critical raw material projects, the *sogo shosha* not only provide significant capital investments, they also bring an invaluable perspective and understanding of the market and commercial networks that government is unable to garner on its own.[71] Indeed, Japan's trading houses have spent decades collecting, monitoring and analyzing technological trends, industry needs, substitution potential, future demand pathways and emerging bottlenecks. One key feature of Japan's overall response therefore isn't just the level of support provided by the government, but the close interaction between the state and private Japanese firms.

In the earlier rare earth value chain example, investments of USD 250 million jointly made by JOGMEC and the Sojitz Corporation as early as March 2011 to develop the Lynas Corporation's rare earth mine at Mount Weld in Australia and processing facilities in Malaysia ensured the sustained development of a non-Chinese supply chain. The deal further secured an offtake agreement equivalent to 30% of Japan's needs.[72] High prices caused by China's disruptions in the market (which included export quotas and taxes) brought a slew of potential rare earth projects to the fore, with some estimating the number at over 400, but when prices fell, the long-term Japanese engagement ensured that Lynas' project would remain afloat and become the only rare earth mining and processing operation outside China. With Sojitz's backing, Lynas is now moving into refining for heavy rare earths from its mine, in hopes of breaking what remains a severe dependence on China.[73] The Sumitomo Corporation, which has been involved in the global rare earth trade since the 1980s, would later provide important support for rare earth (NdPr) oxide production by MP Materials in the United States, signing a distribution agreement in 2023 that would allow the American miner to break its dependence on China for processing ore concentrate from the mine at Mountain Pass in California.[74]

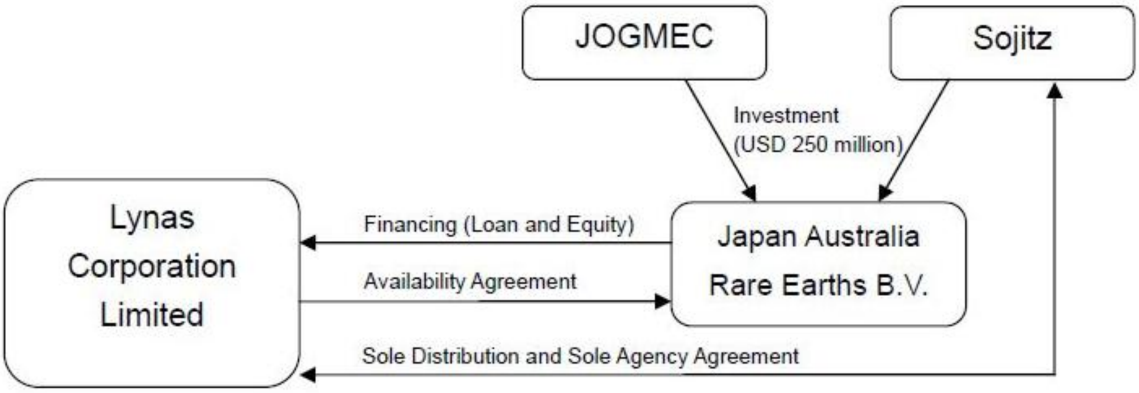
Today, the Japanese government and Japanese firms have become crucial partners in reinforced efforts to develop alternative supply chains. More than replicating Japan's model in Europe, the strengths of Japan's value-added proposition underline the importance of overseas partnership. Following the establishment of a framework agreement on critical minerals with France in 2024, JOGMEC and the Iwatani Corporation signed in March 2025 a long-term supply agreement and injected EUR 110 million into the Caremag rare earth refining and magnet recycling project in southwest France run by the French company Carester, which is slated to

[71] Interview, anonymous JOGMEC official, 17 December 2025.
[72] Gholz, E. and Hughes, L. (2019/2021). "Market structure and economic sanctions: the 2010 rare earth elements episode as a pathway case of market adjustment." Review of International Political Economy, 28(3), pp. 611–634, https://doi.org/10.1080/09692290.2019.1693411.
[73] Oyabashi, Y. (2025), "Japan's Sojitz begins importing heavy rare earths from Australia", Reuters, 30 October, https://www.reuters.com/world/asia-pacific/japans-sojitz-begins-importing-heavy-rare-earths-australia-2025-10-30/
[74] Sumitomo (2023), "Rare Earth Related Businesses For Carbon Neutralization", Sumitomo Corporation, 24 February, https://www.sumitomocorp.com/en/asia-oceania/news/topics/2023/group/20230224_2; Jamasmie, C. (2023), "Only rare earths miner in US to bypass China in supply deal with Sumitomo", The Northern Miner, 22 February, https://www.mining.com/us-only-rare-earths-miner-to-bypass-china-in-supply-deal-with-sumitomo/

become a significant source of refined heavy rare earth oxides (notably dysprosium and terbium) outside of China by the end of 2026, even meeting up to 20% of global demand.[75]

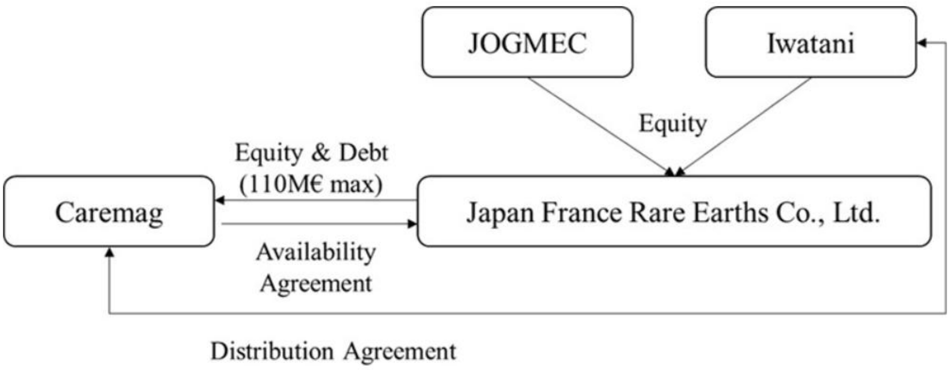
In the case of investments into Lynas as into Carester, JOGMEC established a segregated portfolio company (SPC) jointly with the Japanese commercial partner to pool equity and channel investments, while separate offtake agreements were made between the private players.

Figure 6. Structural arrangement for JOGMEC – Sojitz investment into Lynas in 2011



Source: https://www.jogmec.go.jp/english/news/release/release0069.html

Figure 7. Structural arrangement for JOGMEC – Iwatani investment into Carester in 2025



Source: https://www.jogmec.go.jp/english/news/release/news_08_00035.html

[75] The French government further supplied subsidies and tax credits worth EUR 106 million for the project. https://www.carester.fr/en/caremag-launch/

The Japanese government and firms have furthermore been proactive players in advancing projects through minilateral and multilateral arrangements such as the G7 and the Minerals Security Partnership (MSP). Examples of associated investment include participation by Mitsui in graphite production in Canada and Sumitomo in developing gallium production in Australia.[76] Japan Australia Gallium Associates (JAGA), a joint venture between JOGMEC and Sojitz has also entered into a joint investment agreement with the Australian subsidiary of the Alcoa Corporation, a leading US-headquartered aluminum producer, to extract gallium from alumina refining beginning in 2026.[77] Traditionally, Japan's trading houses have been oriented towards meeting the needs of Japan's domestic market. However, as growth prospects in the domestic market have stagnated, many firms are looking for new growth strategies, including deeper integration into viable foreign markets.[78] This opens opportunities for deepening public-private collaboration between Europe and Japan. The broad takeaway from the Japanese case should therefore not only be the importance of state involvement, but the necessity of creating synergies between public and private action to ensure a balanced approach that responds to the needs of industry. Europe can not only learn from but capitalize directly on this model.

Despite the relative success of Japan's diversification model and a bolstering of efforts over the last three years, the country and its industries nevertheless remain acutely vulnerable to supply chain bottlenecks. Recent tensions with China over Tokyo's expression of views regarding the security risks posed by a Taiwan contingency prompted Beijing in January 2026 to more directly target Japan with an embargo on a broad range of dual-use goods, including rare earths (dysprosium, terbium and yttrium) and other critical minerals including tungsten and gallium, with Japanese firms increasingly sounding the alarm.[79] While stockpiling and demand-side adjustments have helped reduce the short-term impact, Japan remains nevertheless highly vulnerable to Chinese coercion in the critical minerals space and as such a natural partner for Europe in the broader quest for supply chain diversification and resilience.

[76] JOGMEC (2025), "Equity Participation in a Joint Development Study for Gallium Production in Australia - Toward the Establishment of a New Gallium Supply Chain", Japan Organization for Metals and Energy Security (JOGMEC), 4 August, https://www.jogmec.go.jp/english/news/release/news_08_00044.html
[77] Sojitz (2025), "Sojitz Begins Joint Development Study for Gallium Production in Australia", Sojitz Corporation, 4 August, https://www.sojitz.com/en/news/article/20250804.html.
[78] Enomoto, S. (2026), "Japanese Sogo-Shosha & Their New Frontiers", Japan SPOTLIGHT, January/February, pp.19-23, https://www.jef.or.jp/journal/pdf/265th_Cover_Story_02.pdf.
[79] Sugiyama, S. and Suzuki, H. (2026), "Corporate Japan's rare-earth warnings get louder as China keeps the spigot closed", Reuters, 7 July, https://www.reuters.com/world/china/corporate-japans-rare-earth-warnings-get-louder-china-keeps-spigot-closed-2026-07-06/.

5. Recommendations for the EU and the Netherlands

Europe must cut its dependence on China for critical raw materials, but how? This section first identifies the unique role that the Netherlands offers in a European response and some of the strengths it can bring to the table. It then explores key elements of a three-pronged approach to addressing diversification: face up to China, build European capabilities, deepen and strengthen complementary partnerships. A key difficulty for Europe will be addressing the need to maintain short and medium-term supply assurances from Beijing while pursuing a longer-term endeavor of building value chains and a robust market for CRMs outside of China that can resist efforts on the part of Beijing to impede effective diversification.

The unique role of The Netherlands and the port of Rotterdam

The Netherlands has an important role to play in both European and global CRM diversification in that its ports and geographical location act as a crucial trading and logistics gateway. The port of Rotterdam is for example already a location for the Strategic Petroleum Reserves and acts as a global pricing center in energy trade. Likewise in global metals supply chains, the port plays a key role with an extended LME and MMTA certified, bonded warehouse system that allows for storage, breakbulk and re-exports of base metals, scrap metals and CRMs.[80] In terms of investments in processing and recycling assets, the port has some strong cards (land, infrastructure, technical capabilities, storage facilities nearby), but OPEX remains a key bottleneck, driven notably by high energy costs in the Netherlands relative to other locations. Although the Netherlands does not have any significant CRM deposits that could be mined nor any large industrial offtake of CRMs when compared with France and Germany, it still has some processing assets (e.g. Nystar's zinc smelter). Significantly, as the main logistics hub and pricing center, the port of Rotterdam is a strategic asset in the global supply of CRMs to industrial off-takers in the neighboring countries. The Dutch banks also have rich experience in trade commodity finance, including mining and shipping, and have all major trading houses as customers. Moreover, the Netherlands has strategic industries that are exposed to supply risks of CRMs in applications such as the semi-conductor industry and the defense applications industry.

In order to accelerate the Dutch CRM agenda in terms of security of supply, the Dutch government appointed a Special Envoy (SE) in early 2024. The Dutch government has set 3 timelines and identified 4 core industries/ market segments in the context of the EU CRM Act. The mandate of the SE is to mobilize public and private actors and identify the criticality of CRM supply chains, the exposure of Dutch industry and address institutional mechanisms in support of security of supply. The identified core industries/ market segments are defense, aerospace, digitalization and energy transition. The strategic approach follows 3 distinct timelines. In the

[80] Jacobs, W., Amit, A., and N. Kumar (2024), *Security of Supply and Investment in Critical raw Materials. The strategic role of the Port of Rotterdam*. Strategic Roundtable Whitepaper, commissioned by the Port of Rotterdam Authority, Rotterdam: Erasmus Commodity & Trade Centre.

short-term, strategic stockpiling is addressed, while investments in recycling and processing are pursued in the middle long-term and dedicated offtake agreements in origin are addressed in the long term.

In order to coordinate actions at the European level, the Dutch government is active in the EU Critical Raw Materials Board to support the CRMA's implementation.[81] The European CRM Board has a number of thematic subgroups in which a number of member states are present. The Dutch government is for instance represented in the Strategic Stocks Subgroup in which coordinated action takes place with regards possible stockpiling arrangements. In a letter to parliament dated July 7th the government announced their support for a European stockpiling pilot. The pilot is currently being discussed by the European Critical Raw Materials Board.

Given not only its vulnerabilities in key industries, but also its strategic assets in logistics and finance related to port facilities in Rotterdam in particular, the Netherlands has a unique role to play in Europe's efforts to construct CRM resilience in the short, medium and long term. With this goal in mind, we recommend the following courses of action around three main policy areas: responding to the specific challenges that China presents, strengthening Europe's own market, and deepening global partnerships.

Responding to the China challenge

1) **Shield European firms from Chinese coercion.** European firms are under considerable pressure to conform to China's export licensing requirements, which carry significant risk of further undermining European industrial competitiveness. Despite a pause in some measures, particularly extraterritorial application of measures on rare earths announced in October 2025, the licensing regime (with its stringent information requirements) remains. The propagation of targeted, firm-level bans over the course of 2026 that carry extraterritorial provisions only increase the burden of proof for firms that seek to obtain licenses for controlled materials. The European Union and members states must provide more robust legal and diplomatic protection for European firms in this context. In the least, this should include the prohibition of handing over proprietary information and sensitive supply chain data in exchange for access to critical minerals and related components, including rare earth magnets. Left to their own devices, firms will have no leverage. Tools at the disposal of the EU and its member states include, for instance, the use of blocking statutes. Such pressures must also be met with active communication with China and pressure the state level to ensure unfettered access to critical raw materials and associated products for European firms.

2) **Restrict anti-competitive behavior.** Europe must more diligently examine the behavior and strategy of Chinese players in CRM trading, particularly firms such as Vital Materials which have broader industrial ambitions. It must be prepared to respond to unfair

[81] European Commission, European Critical Raw Materials Board, https://single-market-economy.ec.europa.eu/sectors/raw-materials/areas-specific-interest/critical-raw-materials/critical-raw-materials-act/board_en.

competition and anti-competitive behavior such as price gouging and predatory acquisitions through tools such as investment screening and anti-subsidy measures in order to bolster re-nascent CRM value chains in Europe.

3) **Leverage the common market and sources of European strength**. More broadly, the EU must use its greatest source of leverage – access to the common market – as a deterrent to targeted supply chain disruptions and in a broader negotiation to ultimately end China's highly disruptive supply chain polices. Chinese raw material supplies remain vital to the functioning of the European and global economy today. Crippling the global or even European economy is not in China's interest, but the threat of doing so has proven highly effective. Yet, such moves also carry a high cost for Beijing in that they more effectively mobilize high-level resistance. It is the more targeted firm or sector level restrictions that lie below the strategic radar but pick away at European competitiveness and industrial strength or undermine firms that are vital to bolstering European defense which are more difficult to counter. Europe must further define its own sources of leverage[82] and clarify tools and their use cases that would effectively allow Europeans to respond not only to strategic-level threats such as those set to resume on 10 November, but measures that target individual firms or sectors as well. Europe must demonstrate a greater degree of resolve in how it responds to such measures, for instance through the Anti-Coercion Instrument. Access to the European market for Chinese companies should ultimately be made conditional on the end of policies restricting exports of critical metals and those restricting the transfer of technology in critical mineral supply chains.

Strengthening European resilience

4) **Link long-term vision for strategic autonomy with industrial strategy and adapted policy tools for CRM supply chain security**. Europe must first and foremost demonstrate a concerted, long-term policy vision that extends beyond the political cycle and integrates CRM supply chain security into each of its industrial policy components, from energy to digital to defense. Without resilient, diversified supply chains for critical raw materials, any economic security and industrial strategy can only be partial. A long-term vision that results in real investment must reflect the reality that returns on investment in critical infrastructure should be measured in decades, not years or trimesters. It should also make more explicit the goal of security of supply in its own right and adopt policy tools designed specifically for such a purpose. Environmental standards and climate goals, through ESG standards and measures such as the CBAM, while serving their own important objectives, are not sufficient for achieving diversification. Indeed,

[82] For further discussion, see: The Netherlands Scientific Council for Government Policy (2026), Strategic action: policy for a geopolitical economy (in Dutch: "Strategisch handelen. Beleid voor een geopolitieke economie"), Wetenschappelijke Raad voor het Regeringsbeleid (WRR), 27 August, https://www.wrr.nl/documenten/2026/08/25/strategisch-handelen.-beleid-voor-een-geopolitieke-economie ; Gehrke, T. (2026), "Beijing hold'em: European cards against Chinese coercion", Policy Brief, European council on Foreign Relations (ECFR), 31 March, https://ecfr.eu/publication/beijing-holdem-european-cards-against-chinese-coercion/; Garcia-Herrero, A., and Rühlig, T. (2026), "China – A fragile power? How Europe can use its economic leverage over Beijing", Challiot Paper, 188, March, https://www.iss.europa.eu/publications/chaillot-papers/china-fragile-power-how-europe-can-use-its-economic-leverage-over.

environmental constraints in China itself are pressing the evolution of the industry and China is likely to remain competitive even while producing at higher standards.

5) **Act to create market conditions conducive to CRM supply chain investment**. Europe needs to do more to generate market certainty, reduce cost both in capital and operating expenses (CAPEX and OPEX) and support the entire ecosystem of small, medium and intermediate-sized companies involved in specialized CRM supply chains. On the producer side, reducing energy costs is a major impediment that must be addressed. The need for price discovery and stabilization measures such as hedging instruments to counteract market volatility and reduce borrowing costs is now evident. Europe should explore various options, including price floors and contracts of difference that can provide guarantees in times of volatility.[83] For example, in 2025 the US Department of War (DOW) agreed with MP Materials to pay a fixed price for the firm's NdPr rare earth output in the US, with the difference paid relative to the market price in China identified by the market intelligence firm Asian Metal.[84] This index price is shaped by the Chinese market, leaving it exposed to Chinese pricing power. Therefore, what is needed is the introduction of exchange-listed, physically settled futures contracts of certain CRMs. The inclusion of physical settlement in futures contracts (which are essentially financialized future delivery contracts) allows for more accurate price discovery and reduction of price risks. The port of Rotterdam with its vast certified bonded warehouse system is the right location to physically settle, strengthening its price benchmark function.[85] Favoring long-term contracts through incentives such as tax rebates or subsidies, as well as constraints through regulation should be explored further. At the same time, rationalizing the regulatory burden though streamlined permitting processes and a review of procedures such as REACH requirements for pure metals. Furthermore, a balance must be struck between the need for state support and intervention and the bottom-up integration of private sector knowhow and market acumen, eventually taking a page from the complementary relationship that Japanese firms and trading houses in particular play alongside state agencies such as JOGMEC, helping public policy to augment rather than confound the private sector.

6) **Support production of base metals**, including processing of ore concentrates for zinc, copper and aluminum. As many CRMs aren't economically produced on their own and their production is intricately tied to the smelting and refining of various base metals, ensuring CRM production requires support for processing base metals. While Europe has lost much of its capacity in this domain, it still maintains a degree of both infrastructure and know-how that should be capitalized on before it disappears – for example Nyrstar's Budel zinc smelter in the Netherlands. Building on limited but existing capacity is

[83] See discussion of various price mechanisms, including Contract for Difference (CfD), price insurance, forward contracts, advanced market commitments, offtake backstops and the role of tariffs in SAFE's Critical Minerals Pricing Mechanisms Issue Brief (December 2025): https://secureenergy.org/pricingmechanisms-criticalminerals/

[84] Wu, A. (2025), "Unpacking The Department of Defense and MP Materials Critical Minerals Partnership", Federation of American Scientists, 15 July, https://fas.org/publication/unpacking-dod-and-mp-partnership/.

[85] Jacobs, W., and Amit. A. (2026), What is the price we pay? Rotterdam's strategic role in the geopolitics of commodity trade, ECTC Whitepaper, Rotterdam: Erasmus Commodity & Trade Centre.

necessarily easier than rebuilding from nothing at all. Core problems remain to be addressed in high energy costs, technical capabilities (the availability of skilled labor and collective process knowledge), and environmental and safety standards and permitting.

7) **Improve buying power.** Currently being explored within the remit of the CRM Centre, Europe should establish a centralized European purchasing and procurement agency for CRMs, inspired by or modeled on the Chinese Mineral Resources Group (CMRG). This body would provide sufficient visibility to invest in CRM exploration, mining, and recycling (especially if it agrees to guarantee a minimum price). Such a procurement agency would serve two interests in particular: 1) changing the balance of power between supplier and consumer in Europe's favor, and 2) stimulate investment in alternative projects where Europe would have a critical mass to impose standardized conditions.

8) **Urgently rebuild strategic stockpiles**. Stockpiling would have at least two important functions. First, it would enable industrial activity to continue, even in degraded mode, in the event of a crisis. Secondly, stockpile purchases could be used to support nascent mining and processing operations by ensuring a minimum level of demand and offering price support that accounts for the real costs of production. In a letter to parliament dated July 7th the Dutch government announced their support for a European stockpiling pilot. which is currently being discussed by the European Critical Raw Materials Board. The Netherlands' current role as a primary European gateway for the storage and transshipment of CRM with Rotterdam as the main price benchmark justifies an active role by the Dutch government in the European pilot initiative. Any design of a stockpiling framework needs to include the following elements: governance and mandates, CRM selection, materials purchasing and supply arrangements, financing and storage costs including insurance, materials release and rotation mechanism, and how to arrange for offtake. Coordination across the various European member states is required.

Box 1. COMESTRAN: The French initiative for a sovereign operator in CRMs*

France is now developing COMESTRAN, a private initiative aimed at creating a sovereign operator for critical raw materials, including the constitution and management of strategic stockpiles. The project is currently in its formation phase and is led by Equipe du Made In France (EMIF); Alliance des Minerais, Minéraux et Métaux (A3M), the French federation representing the mining, metallurgy, steelmaking and metals recycling industries; Compagnie Des Métaux Rares; and ADIT, Europe's leading strategic intelligence firm.

The French government, through a letter of intent, has confirmed its support for the project, notably including the taking of a golden share announced by the Minister of Industry. COMESTRAN aims to establish a sovereignty operator in the field of CRMs, with 3 business units providing solutions across three different timeframes:

- Strategic stockpiling and trading: short term
- Mining operations: medium term

- Exploration: medium and long term

While the COMESTRAN initiative originated in France, the project favors a bottom-up approach, starting in particular from the real needs of industrial players — material, form, quality, specification, volumes and coverage level — rather than from an administrative list of critical materials. The stockpile must be capable of being managed dynamically so as to continuously match market developments, through trading, and so as to anticipate future supply risks through active management.

The project aims to bring in allied industrial and state actors (European countries and certain non-European countries), with several expressions of interest having been received to that effect.

COMESTRAN also intends to optimize its operational functioning as much as possible using the "best athlete" concept. As such, regarding CRM storage, the project looks to Rotterdam as the main trade and logistics hub, where recognized operators in the field are based.

**Disclaimer: Vincent Donnen, co-author of this paper, is a constituting member of COMESTRAN through la Compagnie Des Métaux Rares*

Deepening partnerships for diversification

9) **Seek supply chain diversification by enhancing complementary partnerships** based on mutual interest, leveraging the comparative advantages of partners in the field of resource endowments, energy costs and infrastructure. Rationalizing strategic partnerships that Europe has pursued in the field[86] and deepening engagement across the Global South will be key. While Europe's engagement has been lagging, China has been long been proactive in engaging in the resource sector in Africa, Latin America and Central and Southeast Asia. The United States is now also more pro-active in facilitating offtake agreements and infrastructure investments. Middle Eastern players (particularly the UAE and Saudi Arabia) as well as India are positioning themselves in Africa, as well. Europe must be more proactive in its approach and ultimately seek to forge a competitive offer for partnership that seeks mutual benefit through a rational assessment of comparative advantage supported by more robust financing and technical cooperation. Europe's market can ensure that it remains an attractive partner, if efforts to bolster European competitiveness can be successful.

10) **Work to establish a standards-based market** built around common rules and a level playing field that mitigates the effects of industrial policy divergences. Matching the advantages of China's own market size in CRMs and countering distortionary trade practices requires a coordinated, multilateral effort. Initiatives in the G7 have been moving in the right direction, but need more concrete action beyond political

[86] European Commission, Raw materials diplomacy, https://single-market-economy.ec.europa.eu/sectors/raw-materials/areas-specific-interest/raw-materials-diplomacy_en

declarations. Europe should further explore the establishment of a buyers' club together with common-interest partners, starting in East Asia (Japan, South Korea, Taiwan, Australia...), as well as the UK and Canada, and explore CRMs as a possible avenue for EU-CPTPP rapprochement. In the least, the EU should continue to explore synergies with these partners individually through joint financing, complementary industrial partnerships and common pricing mechanisms.

11) **Engage the United States from a position of strength in concert with partners**. The EU should look to galvanize US momentum, but mitigate risks associated with Washington's aggressive, unilateral tendencies. There is a real risk that the pull of American initiatives and the push of Washington's aggressive diplomacy could ultimately lead to a detrimental level of co-dependency – on China on the one hand, and the US on the other. Europe must stress resilience through broad diversification and avoid creating new chokepoints and overdependencies.