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# Europe's narrow path towards Critical Raw Materials

Note — April 2026

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## 1. The Vulnerability of European Industries to Critical Raw Material Supply Chains

Most key European industries – energy, chemicals, pharmaceuticals, automotive, defence, semiconductors - share a common challenge, which is their existential need to be supplied in socalled Critical Raw Materials (CRM). Each industry, and even each player according to their own technological and strategic decisions, have their own A-list of CRM, but there is converging interest towards an actually relatively small number of materials: lithium, graphite, antimony, copper, cobalt, nickel and of course the famous Rare Earth Elements (REE, some Heavy, some Light). And as Europe returns to a nuclear generation ambition – better late than never… – one must add uranium to the list (more on this in chapter 11 below).

As the world's attention is suddenly fixated on the Ormuz' Straight and the disturbance occurring in the global oil and gas markets, it becomes necessary to recall that the world economy depends much more today on the CRM supply than the oil flowing (or not) through this Straight.

Maybe the obsession with Gulf oil and gas is a cultural legacy of famous past conflicts – the 1956 nationalisation of the Suez Canal and the price shocks of 1973 and 1979-1980 – but what happens there is literally dwarfed by the dependency to CRM, which sit at the end of the world's most fragile supply chains.

Unlike oil, natural gas or agricultural commodities, CRM — the metals and minerals that underpin everything from electric vehicles to wind turbines, from semiconductors to military hardware — are not traded on deep, liquid, centralised marketplaces with dozens of competing suppliers. There is no Brent benchmark equivalent for lithium hydroxide, rare earth oxides, battery-grade graphite.

This structural characteristic makes European key industries acutely vulnerable. The European Union (EU) and its neighbour economies (EEA, UK, Switzerland) are among the world's largest consumers of CRM. Yet they produce almost none domestically.

In battery value chains, which are central to the automotive and energy storage sectors, China covered 81.9% of EU import needs between 2021 and 2023, rising to 86% in 2023 alone. For uranium, the EU imports virtually all of its requirements — over 99% — with supply concentrated among a small number of origin countries. In defence-relevant dual-use technologies, Europe produces only roughly 1% of required CRM, while China supplies approximately 40%. And the list goes on.

Beyond exposing the amplitude of this dependency, which is a tangible reality for years already but remains nevertheless understated, the ambition of this paper is to assess which practical solutions European industries can reasonably implement to mitigate it, and when.

It would not be realistic to enter into a comprehensive survey of all CRM supply, so let's 'just' focus here on those CRM that are indispensable to the energy transition and digital transformation: copper, lithium, cobalt, nickel, manganese, graphite, REE, and the nuclear fuel cycle materials. Because, as a matter of fact, the challenges – and solutions – their supply presents is common to other CRM for other industry sectors.

## *2. The Materials That Matter Most: Copper, Lithium, Graphite and the Energy Transition*

Consider the scale of demand that Europe is heading into. Global battery demand is projected to reach 3.7 TWh per year by 2030 under the International Energy Agency's 2°C scenario, with passenger cars accounting for 78 to 85% of that demand. In stationary storage, EU new installations of battery energy storage system installations reached 16 GWh in 2023, representing 12% of the global market — a market that is expected to reach 750 GWh by 2030.

Simply put: the world's demand is structurally up, and Europe will have to compete to be supplied.

Each TWh of battery capacity requires enormous quantities of processed materials. Think: a single NMC811 battery cell, typically used for an electric vehicle (EV), demands 100g of lithium, 750g of nickel, 90g of cobalt and 870g of graphite per KWh.

These are not marginal quantities. When multiplied across the terawatt-hour-scale deployments that European policy mandates, they translate into tens of thousands of tonnes of processed, battery-grade materials that must be sourced, refined and delivered — annually — to European manufacturing facilities.

Lithium is emblematic of the challenge. As of 2023, there was no lithium mine supplying batterygrade lithium within Europe, and there were no lithium processing plants operational in Europe. The entire European battery value chain, where tens of billions of euros are invested — gigafactories for cells, cathode facilities, electrolyte plants — depends on imported processed lithium. The same applies, in varying degrees, to cobalt, nickel, manganese and above all graphite, where China dominates the production of

refined, battery-grade material, accounting for 90% of the global supply in 2023.

REE present a parallel challenge. Neodymium-iron-boron (NdFeB) magnets, which are essential for EV motors, wind turbines and a wide range of defence applications, rely on materials which supply is controlled more than 90% by China. The EU has virtually no independent supply chain for these components.

## *3. The Domino Effect: China's Export Controls and the Price Shock Mechanism (2023–2025)*

This structural vulnerability is nothing theoretical. It was concretely and brutally exposed between 2023 and 2025. In a sequence of escalating measures, China imposed export controls on a series of CRM, demonstrating precisely the mechanism by which supply chain concentration translates into industrial disruption:

- On 3 July 2023, China announced export controls on gallium and germanium, effective 1 August 2023, requiring exporters to obtain licences.
- On 20 October 2023, graphite controls were announced, effective 1 December 2023, with battery-grade graphite subject to export licences requiring renewal every six months.
- On 3 December 2024, a complete export ban was imposed on gallium, germanium and antimony destined for the U.S., accompanied by a transhipment ban.
- Finally, on 4 April 2025, controls were extended to seven REE, including REE magnets and finished products.

Market impacts were immediate and severe. European spot prices jumped 289% (for dysprosium, a REE), 365% (for unwrought gallium), 400% (for wrought germanium), etc.

Simple maths indeed: when a uber-dominant supplier — in this case, China controlling 90% or more of refining capacity for several of these materials — restricts exports, European industries face both immediate supply disruption and massive cost inflation. With, needless to say, an extraordinary windfall in the form of a scarcity rent for any non-Chinese supplier with available capacity.

The antimony case (a key flame-retardant component for defence applications and semiconductors) offers a complementary and particularly instructive angle, this time upstream on the raw

material itself. On 15 August 2024, China announced antimony controls, effective 15 September 2024, under a dual-use export licence regime. This pushed antimony metal prices from 14 000 $ per tonne in July 2024 to 38 000 $ per tonne by December 2024 — a 171% increase in five months. The interesting fact is that here, while the EU is a net importer of antimony ore with negligible domestic metal production, it is actually a net exporter of processed material (antimony oxides). That comparative strength in oxide production thus depends on the continued availability (and price) of imported metal feedstock, which is itself subject to export controls...

This is not a market failure in the traditional sense. It is a structural feature of concentrated supply chains operating under geopolitical tension, due to the lack of anticipation and of supplier diversification on the end user side of the market.

In a way, European industries' vulnerability today vis-à-vis CRM reminds of how stunned the Europeans allowed themselves to be by the Arab members of OPEP during the 1973 oil shock. An additional similarity being that the U.S. were, at that time also, a lot less exposed: just as today the

U.S. have turned away from decarbonating their economy, de facto decoupling from China CRM supply in those areas.

After 1973 it took more than a decade and huge efforts (not least of which wage austerity measures as many businesses' margins were hit hard) to reduce the grip of oil supply concentration over European economies.

France's nuclear generation, still today one of its key elements of economic resilience, is a legacy of this emergency response of the 1970s. So a long-term positive response is possible. But which one?

## *4. The EU Critical Raw Materials Act: a (small) Step in the Right Direction*

The EU has not been entirely oblivious to the problem. The Critical Raw Materials Act (CRMA), adopted in 2024, represents the most significant EU-level policy response to date. It establishes quantitative benchmarks for domestic capacity by 2030: 10% annual consumption to come from domestic extraction, 40% from domestic processing, and 25% from domestic recycling along with a diversification cap of no more than 65% of any strategic raw material sourced from a single third country at any step of the supply chain.

The Act also introduces an accelerated permitting framework for "Strategic Projects" with stated maximum durations of 24 to 27 months for extraction and 12 to 15 months for processing and recycling. It gives strategic projects "public interest" status and provides for shortened public consultation periods.

These are laudable objectives of course. The problem is that, as is often the case with major EU decisions, the CRMA is rich in directions, but poor in execution, and all wrapped in a typical Brussels compromise.

It's not so much that the benchmarks are legally non-binding, explicitly framed as aspirational targets rather than enforceable obligations (which is why discussing the percentages set in the CRMA is an exercise of intellectual interest at best). Overall, the aspiration is sound.

But its achievement is seriously flawed on two accounts at least: firstly because permitting is only one segment of a much larger timeline, and besides the administrative phase (which average duration varies widely between EU Member States, from a year to 7 years) one should account for everything which precedes permit application, such as geological exploration, feasibility studies and project development. Secondly — and this is the most critical deficiency — the CRMA does not create a new European financing instrument for strategic projects. The EU here passes the ball over to national budgets and private investors. While 12 out of 27 EU countries run an excessive budget deficit, which makes them unlikely candidates to massively invest into CRM supply, it is therefore up to private capital to underwrite projects with long lead times and uncertain regulatory outcomes.

As we will see further in this paper, the solution might be to address each segment of the supply chain specifically.

## *5. The Anatomy of the Supply Chain: Where the Real Vulnerability Lies*

Let's look at the CRM supply chain in detail rather than as a single, undifferentiated pipeline from mine to factory.

The value chain for any CRM follows a broadly similar sequence:

- extraction (mining or, in the case of uranium, milling),
- followed by processing, separation, refining or tolling — the "midstream" stages,

- then component manufacturing
- and finally assembly into finished products.

The key insight, which is insufficiently appreciated in most public debate, is that Europe's greatest vulnerability does not lie at the mine mouth. It lies in the midstream.

This diagnosis applies more or less for each CRM supply chain: e.g. processing battery-grade lithium, battery-grade graphite, etc; happens overwhelmingly outside Europe. No sites producing precursor cathode active materials (pCAMs) — the critical intermediate between raw chemicals and cathode — are currently in Europe. China dominates this part of the supply chain in an almost ubiquitous way.

Why? Looking at REE, which refining is controlled 91% by China, one can see REE processing and separation are, by their nature, complex, toxic, and capital-intensive operations that require specialised technical expertise. It requires big investments, expertise and a wholehearted support from regulators.

This explains in part why supply is so difficult to diversify. When China imposed its first REE export restrictions in 2010, the resulting supply shock demonstrated how slowly alternative processing capacity could be brought online: alternate processing operations in South-East Asia and the U.S. took close to a decade to produce.

The pattern across all these value chains is consistent: the further downstream one moves from raw ore extraction, the higher the concentration, the greater the technical specificity, and the more acute Europe's exposure. This is not an accident of geology. It is the result of decades of industrial policy in China — deliberate, sustained investment in processing and refining capacity as part of a strategy to capture value from raw materials and create leverage over downstream industries worldwide.

## *6. Bridging the Midstream Gap: A Challenge Within Reach*

If the midstream is where the vulnerability is greatest, the midstream is also the only place where the opportunity for rapid remediation is maybe realistic. This is the crucial asymmetry that European policy should exploit.

The construction and commissioning timelines for processing facilities are fundamentally different from those for mining projects.

Lithium processing facilities can be operational in 5 years, maybe less (by Chinese standards). The differential reflects regulatory, planning and labour-market factors rather than any inherent technical impossibility. For battery-grade graphite processing, recycling upgrades and cathode precursor manufacturing, the timelines are similarly within the 2024–2030 window — provided that financing is secured, permitting is not delayed by litigation, and offtake agreements provide the revenue certainty needed to underwrite investment.

Plus, Europe does not start from scratch in many areas, it has partial infrastructure to build on, and the downstream manufacturing base creates demand pull for midstream processing. European cell and component manufacturers need battery-grade lithium hydroxide, battery-grade graphite anode materials, cathode active materials, and electrolyte salts. If European midstream processing can supply these materials competitively, it has its own domestic market. If it cannot, European cell manufacturers will remain dependent on Chinese-processed intermediates — even if the cells themselves are assembled in European gigafactories. This would be the worst of both worlds: heavy investment in downstream manufacturing without security of supply for the critical inputs.

The commercial logic is therefore compelling. European governments and development finance institutions should prioritise midstream processing investments with the shortest build times, targeting the specific bottlenecks identified in the supply chain: lithium chemical processing, graphite anode material production, cathode precursor (pCAM) manufacturing, and hydrometallurgical recycling upgrades. These are projects that can realistically be commissioned before 2030, that address verified supply gaps, and that have identifiable European offtakers.

## *7. The Pipe Dream of Domestic European Extraction*

If midstream processing is the realistic priority, one must be equally clear-eyed about what is not realistic: a meaningful expansion of primary CRM extraction on European soil on any timeline relevant to the current supply security challenge.

Starting with the basics: Europe doesn't have the right CRM reserves. Most are simply not present in commercially viable quantities in European territory — or where they are, the deposits are small, deep, low-grade, or otherwise uneconomic relative to competing jurisdictions in Africa, Latin America, Australia or Central Asia.

Then the arithmetic becomes properly unforgiving. One most not only account for the risk inherent to any mining exploration project, from early exploration to 'shovel-ready', but for the other 'European risks'.

First risk factor: the European regulatory environment is extraordinarily complex and stringent. Europe has the most demanding environmental regulations in the world — for good reason. But the cumulative effect of environmental impact assessment requirements, biodiversity protections, water management obligations, noise and emissions permits, waste facility permits, and construction permits creates a multi-authority, multi-year approval process that is fundamentally hostile to the rapid development timeline that supply security demands. In Austria for instance, a single mining project may require construction permits, water permits, environmental and forestimpact related permits, chemicals/noise/emission protection permits, plus mining permits and waste facility permits — each from a different authority, each with its own timeline, appeal process and litigation risk.

Second risk factor: the social licence challenge is formidable. Europe is one of the most densely populated and highly developed regions in the world. Mining projects are intrinsically disruptive — they involve large-scale earthmoving, water use, dust, noise and visual impact — and they inevitably encounter organised opposition from local communities, environmental NGOs and political actors. The case of Rio Tinto's Jadar lithium project in Serbia is instructive: the mining licence was suspended and subsequently retracted because of local opposition, despite the project's strategic significance for European lithium supply. And seeing Imerys pushing back to 2030 the production start of its central France lithium site, one can wonder how long the saga on this project will actually be. And so on.

Final risk factor, Europe's political context has never been as volatile. European politics, at both the national and EU level, are characterised by increasing fragmentation and short-termism. The political commitment required to sustain a 15-year mining development project through multiple electoral cycles, in the face of organised local opposition and shifting environmental priorities, is in practice very difficult to maintain.

As a result, provided that the right ore is there to be mined, any extraction project of meaningful scale for European industries would take 15 years, maybe more, with many risks along the way. This is not only unappealing to investors. It's also totally out of the timescale applicable to the midstream and downstream segments of the supply chain.

## 8. Recycling: Necessary but Insufficient

A similar realism must be applied to recycling, which is often invoked as a partial solution to Europe's CRM dependency. The EU has indeed built significant recycling capacity: lithium-ion battery recycling capacity exceeded 300 000 tonnes per year by December 2024 and is expected to reach 400 000 tonnes per year by end-2025. These are impressive numbers. But they mask a fundamental quality problem.

Most commercial-scale recyclers in Europe offer only mechanical or pyrometallurgical recycling routes. These processes produce what is known as "black mass" — a mixed intermediate containing valuable metals but not in a form that is directly usable by battery manufacturers. Black mass requires additional hydro metallurgical processing to be converted into battery-grade secondary raw materials. And this hydro metallurgical step is precisely what most European recyclers do not do. The result is perverse: black mass is commonly bought to be processed at lower cost outside the EU, mainly… in China. European recycling capacity thus generates a secondary raw material that is exported for value-added processing elsewhere — reproducing the same midstream dependency that exists in primary materials.

There is also a temporal constraint. Batteries must reach end-of-life before they can be recycled, and lithium-ion batteries are designed to last 12 to 14 years. The current generation of EV batteries, deployed in significant volumes only from the mid-2010s onward, will not become widely available for recycling until after 2030. In the critical 2024–2030 window, the feedstock for recycling is limited primarily to manufacturing scrap and early-failure units, not the mass volumes of end-oflife batteries that would be needed to make a material contribution to supply.

In sum, European recycling capacity is growing rapidly in nominal terms, but it does not produce battery-grade secondary raw materials at scale, its effective contribution within the 2024–2030 window is constrained by battery lifetimes. Recycling is a necessary component of a long-term circular economy strategy, but it cannot meaningfully close the CRM supply gap in the period that matters most.

## 9. Trade Partnerships and Friendshoring: The Low-Hanging Fruit

If domestic extraction is a decade away and recycling cannot close the gap, the logical alternative is to secure supply from outside Europe — but from jurisdictions that are politically aligned, commercially accessible and institutionally stable. This is the essence of 'friendshoring' and it is, comparatively, a low-hanging fruit.

Latin America and the countries of the Southern African Development Community (SADC) represent the most significant opportunities. Chile, Argentina and Bolivia hold roughly 60% of the world's identified lithium resources in the 'lithium triangle'. The DRC holds roughly 70% of global cobalt reserves. Namibia, South Africa and Mozambique have significant deposits of graphite, REE and more. These are jurisdictions where the EU has usually built excellent diplomatic relationships, where European companies have historical operational experience, and where infrastructure investment can create mutual benefit — the EU secures long-term supply, the partner countries develop their own 'champions', something which has been contemplated so often but fell short of capital, mostly (more on this below).

The EU has in fact already reached out to resource-rich regions. Soft agreements (MoUs) on CRM have been signed with Canada (2021), Namibia (2022), Argentina (2023), Chile (2023) and the Democratic Republic of Congo (2023). They are linked to the EU's Global Gateway initiative, launched in 2021, which seeks to mobilise public and private investment in infrastructure — ports, railways, roads — in mineral-rich economies. And then of course come in the trade agreements, like the one between the EU and Chile, with a dedicated chapter covering European access to Chilean lithium. However these agreements can only go so far, ensuring non-discriminatory access and bringing EU tariffs down – but they are already pretty low.

Once again, with the EU there is no shortage of strategic talk, buzzwords like "strategic partnerships", a "CRM club" of "like-minded countries", the G7's "Minerals Security Partnership", etc.

But one can only think of the famous Jerry Maguire scene: "Show me the money !"

## 10. The Paradox of Junior Mining Finance

Because, indeed, lies a striking paradox at the heart of the friendshoring opportunity. At precisely the moment when global appetite for CRM supply has never been greater — when European, American, Japanese and Korean industries are all seeking to reduce their dependency from China and secure long-term access to lithium, cobalt, rare earths and other strategic materials — the financing of junior mining companies in friendshoring jurisdictions is actually decreasing.

This paradox has structural roots. Junior mining companies — the small, exploration-stage firms that discover and develop new mineral deposits — are inherently high-risk ventures. They operate at the earliest, most uncertain stage of the mining value chain: geological exploration. They are typically listed on junior stock exchanges (TSX Venture in Canada, ASX in Australia, AIM in London) and funded through equity raises from specialist mining investors. Since 2021, a combination of rising interest rates, risk aversion among institutional investors, the underperformance of commodity equities relative to technology stocks, and ESG-driven screening that often excludes mining companies has compressed the pool of capital available to junior explorers.

The result is a financing gap at the precise point in the value chain where European strategic interests are most engaged. Europe needs new CRM deposits to be discovered, delineated and developed in partner jurisdictions — but the companies that do this work are struggling to raise capital. Meanwhile, Chinese state-backed entities and Chinese private mining companies, operating with a longer time horizon, cheaper capital (often subsidised through policy banks) and a strategic mandate from Beijing, continue to invest aggressively in exploration and early-stage development across Africa, Latin America and Southeast Asia.

The risk is that by the time European industrial offtakers are ready to sign supply agreements, the most attractive assets in friendshoring jurisdictions will already be locked up by Chinese or Chinese-adjacent interests. Not to mention of course global and vertically integrated trading behemoths — such as Glencore, Cargill and Trafigura — which operate across the entire value chain and are unlikely to prioritise European interests over higher-margin opportunities in China or the U.S.

This financing paradox has a direct implication for European industrial strategy: if European companies want to secure supply from friendshoring jurisdictions, they cannot simply wait for

mines to reach production and then negotiate offtake deals. They must engage earlier in the value chain — at the exploration and development stage — using financial instruments and deal structures that de-risk private investment while aligning the interests of European offtakers, mining developers, host-country governments and project finance providers.

Interestingly, this is a key part of Japan's JOGMEC[1] model, providing equity investments, loans and liability guarantees to help Japanese industries access overseas mining projects and secure offtake — including financial support of exploration costs.

## *11. The Nuclear Dimension: A Strategic Mistake Compounded by Dependency*

A particular mention must be made of the nuclear generation sector, which adds an entirely distinct — and in some respects more acute — dimension to Europe's CRM vulnerability.

After roughly 15 years during which many European countries cancelled new-build plans and even terminated existing capacity — Germany shut down its last 3 reactors in April 2023, Belgium planned a full phase-out before partially reversing course, Italy officially abandoned nuclear after a 2011 referendum, and even French President Macron bizarrely sacrificed two reactors in 2020 — there has been a remarkable reversal of direction. France has now committed to building 6 new EPR2 reactors with an option for 8 more. The United Kingdom is constructing Hinkley Point C and has committed to Sizewell C. Poland has launched its first nuclear programme. The Czech Republic is tendering for new units at Dukovany. Even Sweden, which had long planned a phaseout, has signalled openness to new nuclear construction. The European Commission's president Ms. von der Leyen, ironically a former affiliate to the greatest opponent the nuclear industry ever had in Europe (German Chancellor Merkel), has herself acknowledged that the turn away from nuclear was "a strategic mistake."

This reversal creates an enormous — and largely unacknowledged — demand for nuclear fuel cycle services and materials that Europe is overwhelmingly unable to supply domestically.

The EU imports virtually all of its uranium, and overall approximately 14 000 tonnes of nuclear materials and products from a handful of countries: Kazakhstan, Niger, Canada and – of course – Russia.

1 Japan's Organisation for Metals and Energy Security

But uranium ore is merely the beginning of the fuel cycle. The critical dependencies lie further downstream — in conversion and enrichment, where technical complexity, capital intensity and qualification requirements create formidable barriers to entry and switching.

At conversion — the process of transforming uranium oxide ("yellowcake") into uranium hexafluoride for enrichment — the global market is served by only 4 companies: Orano (France), Cameco (Canada), CNNC (China) and Rosatom (Russia), and Orano's conversion plant is already used at close to maximum capacity. From a European perspective, we therefore definitely look at a conversion services shortfall without further investment. This is a structural bottleneck that constrains the entire European nuclear fuel supply chain.

At enrichment, the concentration is even more extreme and geopolitically charged. In 2023, 55% of enrichment services were supplied by EU-based providers (principally Urenco), but 38% originated from Russia — only slightly less than before the Russian invasion of Ukraine… Meanwhile, enrichment prices more than doubled in recent years, reflecting the pass-through of geopolitical and capacity constraints into market prices.

The Russia dependency in nuclear fuel is not merely a commercial inconvenience. It is a strategic vulnerability that runs directly counter to Europe's declared objective of reducing dependence on Russian energy inputs following the invasion of Ukraine. It is, for instance, an obstacle to the deployment of small modular reactor (SMR) designs that Europe is actively pursuing.

The irony is acute: while Europe has largely weaned itself off Russian gas and oil — at enormous cost — it remains deeply dependent on Russian nuclear fuel services, particularly enrichment.

The extent of this dependency was illustrated in stark operational terms when, on 1 March 2022, a Russian transport plane was granted special permission to land in Slovakia despite an EU ban on Russian aircraft, to deliver fuel rods to Slovakia's nuclear power plants. The symbolism was unmistakable: even at the height of the confrontation with Russia over Ukraine, European nuclear operators could not do without Russian fuel. A dependency only accrued of course when certain European countries (essentially in Central and Eastern Europe) operate reactors of Russian design.

To sum it up, the nuclear sector exhibits the same structural pattern as batteries and rare earths — midstream concentration, technical switching costs, long qualification timelines — but with the additional complication of Russia-origin dependency and reactor-design specificity.

Looking at the 'big picture', it is quite striking that two of the most eminent energy policy objectives Europe has set for its strategic autonomy – electric mobility and storage, and for more than half of European countries maintaining and expanding their nuclear generation capacity – depends overwhelmingly on China for the first one, and on Russia for the second one.

## 12. Conclusion: The Narrow Path

The analysis presented in this paper converges on a narrow but actionable conclusion. European industries face a CRM supply security challenge that is structural, not cyclical. It cannot be solved by market mechanisms alone, because the markets in question are not competitive. It cannot be solved by domestic extraction alone, because the timelines are incompatible with the urgency. It cannot be solved by recycling alone, because the capacity is insufficient and the quality is deficient. And the EU CRMA, while directionally correct, does not resource the strategy it articulates.

The only realistic course of action for European industries is therefore a two-pronged approach, pursued simultaneously and with urgency:

- Firstly, invest domestically in midstream processing projects with the shortest build times, to reduce dependence on Chinese-controlled intermediates at the specific bottleneck points where concentration is highest and price-shock risk is most acute.

- Secondly, invest upstream outside Europe in friendly jurisdictions to conclude long-term CRM supply arrangements, which will require financially de-risking mining exploration, early production and associated infrastructure in partner jurisdictions.

Across both, the common element is government guarantees — public risk-sharing instruments that enable private capital to flow into investments that the market, left to itself, will not adequately finance within the required timeframe. This is not a call for state intervention in the sense of subsidising uneconomic projects. It is a recognition that supply security is a public good that generates

externalities — reduced disruption risk, price stability, strategic autonomy — which private investors cannot fully capture and will therefore systematically underinvest in. The role of government is to correct this market failure by sharing the risks that the market prices too highly and by providing the demand certainty (through offtake frameworks and procurement mandates) that makes private investment bankable.

The path is narrow, but it would be ill-advised for Europe to wait much longer before taking it: others do not.