

Darwin Dialogue 2024

Triumph from teamwork



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ASPI
AUSTRALIAN
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Special Report

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Strategic competition is a fact of life.

Nations are drawing an explicit link between economic security and national security. The so-called 'Washington consensus' has fractured—and Washington itself is pursuing a new direction. The United States has implemented the Inflation Reduction Act and CHIPS Acts and pursued what they call a 'small yard, high fence' approach to critical industries.

The European Union has introduced its European Economic Security Strategy. Japan has the Economic Security Promotion Act. The Republic of Korea is re-framing its economic policy around a National Security Strategy. And Canada has brought in new rules to tighten foreign direct investment in their significant critical mineral reserves.

All these countries are investing in their industrial base, their manufacturing capability and their economic sovereignty.

This is not old-fashioned protectionism or isolationism—it is the new competition.

—Prime Minister Anthony Albanese, 11 April 2024

Executive summary

Critical minerals are ever more important to the clean-energy transition, defence equipment and other technological sectors, and their supply chains continue to face extensive challenges. Since ASPI first held its inaugural Darwin Dialogue in 2023, Australian and foreign governments have accelerated the introduction of industrial policies to support the growth of the critical minerals and downstream industries. For Australia, this is the Albanese government's Critical Minerals Strategy,¹ backed by its 'Future Made in Australia' manufacturing policy and close collaboration with state governments.

But industrial policies are a double-edged sword, protecting and promoting industry while also picking winners and potentially further fracturing the international trade order. Despite the costs, Australia's industrial policies are crucial to navigating our current geopolitical environment—but we must work with international allies and partners to coordinate and where possible harmonise policies, making them mutually reinforcing.

In many respects these policies are a response to China's dominance over supply chains for critical minerals, including rare-earth elements (REEs). For decades, Chinese-owned companies have controlled the global supply of REEs and several other critical minerals, using that near-monopoly to exert substantial influence over international markets. Under President Xi Jinping, the alignment of China's private sector with government interests has further solidified that control, allowing Beijing to leverage its critical minerals dominance against countries such as the US and Japan.

Investment from China, in Australia at least, is essential to critical minerals development and production. It can include equity, operator status, offtake agreements and loans, plus technology provision for processing. The challenge is how to further diversify investment and how to avoid a greater concentration of supply chains.

Despite efforts to develop alternative supply chains, significant challenges persist in creating resilient and competitive systems that have high standards of environmental, social and governance (ESG) performance. The geopolitical pressures against creating more

diverse supply, notably economic coercion and market manipulation, only reinforce the inherent problem of over-reliance on a single geopolitical and market actor and the need for diversification and long-term supply security.

ASPI's Darwin Dialogue 2024, held from 17 to 19 April 2024 and supported by the Northern Territory Government, convened high-level representatives from Australia, the US, Japan and the Republic of Korea (ROK), senior observers from the Netherlands and Taiwan, and senior figures from industry, academia and think tanks for a focused Track 1.5 discussion on critical minerals. Over two days of in-depth discussions under the Chatham House rule, the dialogue provided a comprehensive assessment of the critical minerals supply-chain landscape, strategic challenges, and the need for international cooperation. This report's observation and analysis sections present an analysis of the dialogue. Based on that analysis, I have extracted their key observations.

The dialogue's findings—both the in-person discussions and this outcomes report—emphasise the urgency of addressing market distortions driven by state practices and the need for sound global market practices. This report, which makes 11 recommendations for governments, further highlights the critical role of government intervention to counteract those distortions and promote market stability. Minilateral cooperation among Japan, the ROK, Australia and the US, plus the EU, the UK and Canada, is identified as a key strategy to establish secure and sustainable supply chains while advocating for international standards on responsible sourcing and sustainable supply chains.

Practical, proactive measures are needed to resolve current challenges and create stable and secure international markets that place a premium on high standards of ESG performance. By addressing market distortions, fostering strategic international collaboration, implementing common standards, stabilising prices and achieving prices that recognise responsible sourcing, nations can work towards more resilient and sustainable global supply chains for critical minerals.

Summary of policy recommendations

To tackle the challenges posed by China's manipulation of global critical minerals markets, it's essential that Japan, the ROK, the US, Australia and other like-minded countries recognise and communicate the risks associated with Beijing's state-driven practices. Those practices create uncertainty for producers and end users, undermining competition and transparency in the market.

By raising awareness among stakeholders, we can foster a collective response that promotes responsible sourcing and transparent market practices. Both governments and industry leaders must also acknowledge the need for strategic interventions to build diverse and secure supply chains that mitigate those distortions.

At the same time, multilateral cooperation among nations such as Japan, the ROK, the US, the UK and Australia and the EU presents a unique opportunity to enhance supply-chain resilience and sustainability. By collaborating on critical minerals, they can leverage their complementary strengths to foster innovation and develop responsible market standards.

Establishing national and shared stockpiles can stabilise supply and prices, while trustworthiness criteria will ensure ethical practices throughout the supply chain. Improved communication and education initiatives by Australian governments (state and federal) will further support the growth of a skilled workforce, enabling Australia and its partners to lead in sustainable critical minerals production and processing on the global stage.

Background: A global critical minerals challenge

Establishing resilient critical minerals supply chains poses several significant challenges for Australia, Japan, the ROK and the US, encompassing geopolitical, economic, logistical and environmental dimensions.

One of the foremost challenges is the geopolitical risk associated with China's current dominance in the global supply of many critical minerals. China's near monopoly of many of those resources introduces vulnerabilities for Western and allied nations, creating potential disruptions in supply due to geopolitical tensions. That dependency underscores the need for those countries to diversify their sources and reduce reliance on any single nation to safeguard against such risks. Furthermore, international trade policies and diplomatic relations add another layer of complexity, as trade disputes, tariffs and export controls can disrupt the flow of critical minerals and affect market stability.

Economic and market volatility also present considerable obstacles. While most minerals are subject to demand and price fluctuations, the prices of some critical minerals can be highly volatile, influenced by market manipulation, fluctuations in demand, supply interruptions and geopolitical factors. That volatility can affect investment

decisions and threaten the overall reliability of supply chains. Additionally, the substantial investment required for developing and maintaining critical minerals infrastructure for mining, processing and transportation can be challenging to secure, particularly amid economic uncertainties and shifting market conditions.

The complexity of supply chains themselves introduces logistical challenges. Managing the intricate process of extraction, processing, transport and final use requires effective coordination among various stakeholders, including governments, mining companies and logistics providers. Existing infrastructure may also have gaps that need addressing, and the development and upgrading of facilities can be costly and time-consuming.

ESG performance along supply chains is another critical aspect. Ensuring that critical minerals activities are sustainable and adhering to high environmental and social standards are vital to maintaining long-term security of supply. This involves managing environmental impacts, fostering positive community relations and adhering to ethical labour practices. Navigating the regulatory landscape, which varies across jurisdictions, further complicates that effort. Underpinning supply-chain

sustainability are high standards of governance by companies, governments and NGOs that interact with mineral production.

Finally, the sector must find pathways to overcome technological and efficiency challenges. Advancing technologies for more efficient and sustainable extraction and processing requires significant research and development (R&D) efforts, plus innovation. Integrating changes into existing supply chains presents its own set of challenges, necessitating coordination across various stages and adaptation to evolving industry standards.

No nation can address those challenges alone, even with the most generous subsidies. Addressing such multifaceted challenges requires like-minded nations to adopt a collaborative approach. By leveraging their complementary and collective strengths, those nations can work towards developing resilient, competitive and sustainable critical minerals supply chains.

Industry, along with governments, has responsibilities. New industry thinking is needed to diversify and strengthen supply chains and enhance sustainability.

With its substantial domestic production and reserves of critical minerals, Australia has begun to address those challenges through its updated Critical Minerals Strategy and the dedicated Critical Minerals Office within the Department of Industry, Science and Resources (DISR).

Policy progress and domestic industry since the Darwin Dialogue 2023

Australia's critical minerals policy has significantly advanced since the inaugural Darwin Dialogue in April 2023. Policy efforts are attracting direct foreign investment and a renewed focus on international collaboration. More is needed for Australia to develop competitive domestic mineral processing and resilient critical minerals supply chains, but our policy settings are progressing in the right direction.

Federal government initiatives

The most significant policy changes include:

- the July 2023 update to the federal Critical Minerals Strategy

However, to effectively build more diverse and secure supply chains, enhanced collaboration between Australia and international partners is needed. While Australia has signed on to multiple multilateral and bilateral agreements to enhance supply chains, there's been little evidence of activation of close coordination or collaboration between Australia and its partners. The establishment of the Minerals Security Partnership Finance Network, announced in September, is a positive step towards financial collaboration and the activation of international networks.² Other critical minerals partners and networks should consider ways to more directly integrate financial institutions or industry.

Given the expanding global footprint of Australian companies in critical minerals exploration and production, and Australia's multiple commitments to work with others to build supply chains involving multiple producer nations, Australia needs to do much more, both at home and abroad, to meet its responsibilities.

The complexity and urgency of the issues were underscored during Darwin Dialogue 2024, which emphasised the need for a coordinated and collaborative international effort to build a more resilient and diversified critical minerals supply chains.

- the introduction of a Strategic Materials List in December 2023
- updates to the Critical Minerals List and Strategic Materials List in February 2024
- the 'Future Made in Australia' industrial policy announced in April 2024.

Australia's updated Critical Minerals List now includes 31 minerals and mineral groups and, importantly, better aligns Australia's lists with those of international partners—adding fluorine, molybdenum, arsenic, selenium, and tellurium and de-listing helium. In February 2024, nickel was also listed in response to its price collapse and ongoing market vulnerabilities.

The Strategic Materials List includes important materials that are below the ‘critical’ threshold. Those included in the strategic list fit the following criteria:

- i) The material is important to the energy transition and broader strategic applications.
- ii) Australia has geological potential for resources.
- iii) It is in demand from our strategic partners.
- iv) The material’s supply chain is not vulnerable enough to qualify as a ‘critical’ mineral.³

The Strategic Materials list currently includes aluminium, copper, phosphorus, tin and zinc. Government support is available for those materials, and the government will continuously monitor their market developments.⁴

While the two lists are comprehensive, there are some notable materials of strategic value that meet the strategic materials criteria but aren’t currently on the list, such as uranium. The government’s willingness to update and adjust the lists is a positive for effective policy, and the government should continue to evaluate the need to add or remove materials from either list in future.

In April 2024, the Australian Government launched the new Future Made in Australia (FMIA) policy. Backed by \$22.7 billion over the next decade, FMIA is our domestic

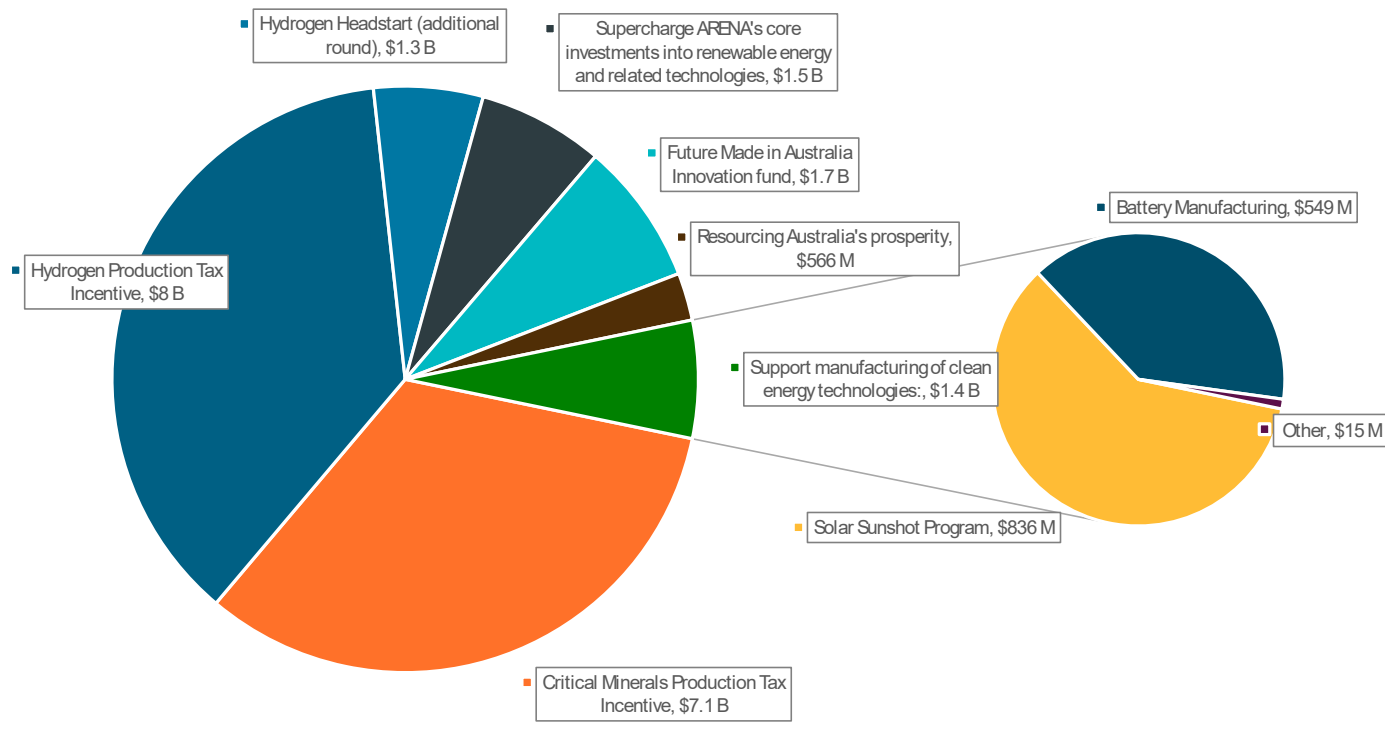
response to the rising tide of international industrial policies. It ambitiously seeks to support the development of both upstream and downstream domestic clean-energy industries and secure Australia’s economic role in the clean-energy transition.

For critical minerals, the crucial policy is the Critical Minerals Production Tax Incentive slated to begin in 2027. The incentive promises a 10% tax offset on downstream critical minerals processing and refining in Australia and is projected to cost approximately \$7.1 billion over its lifetime.

The government is also establishing a comparable Hydrogen Production Tax Incentive for domestic production of renewable hydrogen. If successful, hydrogen supply may lower domestic energy costs, reduce carbon emissions and improve conditions for domestic critical minerals refining and processing.

FMIA is further investing into critical minerals production projects, an innovation fund and downstream demand-side industries (such as solar panels and batteries), as well as other policy measures (Figure 1).

Figure 1: Budget 2024–25, ‘Future Made in Australia’ investments



Source: Data from the Department of Treasury, Budget 2024-25, Budget Paper No.2, [online](#).

Several other policy measures developed since the Darwin Dialogue 2023 will also be important to optimising Australia's role in critical minerals supply chains.

Underpinning the FMIA industrial policy is a national interest framework to 'guide the identification of priority industries and prudent investments in the national interest'.⁵ The national interest framework is structured around two streams:

- the *net zero transformation stream*, wherein it's in the national interest to invest public funds to make a significant emissions reduction at reasonable cost
- the *economic resilience and security stream*, wherein the domestic capability is necessary for economic resilience and national security but outside of private-sector investment.⁶

The framework is intended to impose rigour on the government's FMIA investment decision-making and promotes broadly positive community outcomes.⁷ The proposed Future Made in Australia Bill 2024 also introduces limits on ministerial direction.

Rigour is undoubtedly important, but so too is overarching strategy. The key questions are whether these investments are well coordinated (do they 'fit together') and whether they'll build a sustainable ecosystem of domestic clean-energy industries. Australia's updated Critical Minerals Strategy predates the FMIA and is light on specific future strategic planning. While a national interest framework will add rigour and add guiding principles for public investment, it's ultimately process oriented. Effective strategy needs to be results oriented.

The FMIA Bill introduces a process for the responsible minister to initiate robust sector assessments to determine areas of sustained competitive advantage, or areas where government investment is needed to achieve economic resilience or security outcomes.⁸ Once complete, it's vital that those sector assessments both inform and are publicly reflected within Australia's broader critical minerals strategy.

The 'Resourcing Australia's Prosperity' (RAP) exploration policy⁹ is a significant investment in Australia's minerals future. It commits \$566.1 million over 10 years to Geoscience Australia to fund the exploration and mapping of Australia's geological potential in close collaboration with state and territory geological surveys, which undertake the bulk of geological data gathering in each jurisdiction.

Over 35 years, the RAP will produce high-quality exploration datasets and present new project opportunities, incentivising investment and uncovering greater supply needed to meet future demand, with a total spend of approximately \$3.4 billion.¹⁰ It expands upon Geoscience Australia's previous 'Exploring for the Future' program from 2016 to 2024. The RAP should reveal new deposits and reinforce the extent of Australia's mineral wealth, attracting future investment and strengthening international understanding of Australia's role in the critical minerals economy. An additional \$448.7 million over 11 years will also be spent on continued collaboration with the US Geological Survey's satellite exploration,¹¹ which closely aligns with the US–Australia–Canada Critical Minerals Mapping Initiative.¹²

State and territory government initiatives

Over the past 18 months, Australian states and territories have made significant strides in developing critical minerals initiatives:

- The Western Australian Government launched its Battery and Critical Minerals Strategy 2024–2030 in May 2024.¹³ The strategy aims to attract investment across the supply chain and streamline the state's exploration and mining approval processes. It emphasises the state's lithium and REE sectors, bolstering R&D efforts to advance processing technologies.
- Queensland unveiled its Queensland Critical Minerals Strategy in June 2023, with a focus on diversifying supply chains and enhancing local processing capabilities. The strategy promotes partnerships with industry stakeholders to accelerate the development of critical minerals projects and includes funding for sustainable mining practices.
- New South Wales established the Critical Minerals and High-Tech Metals Strategy 2024–2035¹⁴ to promote investment in its potential REE sector. This initiative highlights the importance of environmental sustainability and aims to create a supportive regulatory framework for exploration and development.
- South Australia has taken a proactive approach with its Critical Minerals Action Plan, which seeks to harness the state's rich deposits of REE and lithium. By enhancing regulatory frameworks and attracting

investment, South Australia aims to foster industry growth and innovation.

- In the Northern Territory, efforts are focused on leveraging substantial mineral resources to attract investment in REE projects, further contributing to Australia's critical minerals landscape. The Northern Territory Geological Survey also released a revised edition of the Critical Minerals in the Northern Territory 2024 prospectus in October 2024.

Those initiatives collectively represent a robust commitment by Australian states and territories to enhance their roles in the critical minerals market, addressing both domestic resource needs and global supply challenges. Through strategic investments and collaborative efforts, Australia is poised to play a pivotal role in shaping the future of critical minerals.

Industry outlook

Despite policy development and increased government focus, 2024 has been a difficult year for Australia's critical minerals industry. Falling commodity prices presented a near-existential challenge to nickel and lithium production and resulted in the suspension of, or delays to, mining or

processing operations (see Appendix 2, pg26). In response, crisis talks were held in early 2024 by the Australian Minister for Resources and Northern Australia, Madeleine King, with leading industry representatives to discuss viable policy options.¹⁵ However, a long-term policy solution is yet to be found.

Parts of the Australian critical minerals industry are particularly threatened by oversupply relative to demand, domestic construction and operational costs and uncompetitive prices, in part driven by China's market influence. The problem is that global lithium production (led by Australia) has expanded to meet demand projections, but actual demand hasn't grown as fast as forecasted. In lithium, long-term deliberate investment patterns for diversified supply chains by China have reinforced low ESG-compliant lithium and nickel production.

Those challenges further evidence the need for a critical minerals policy underpinned by greater collaboration between governments and industry, and between like-minded nations.

Observations and analysis

Urgency, engagement and consensus

The inaugural Darwin Dialogue in 2023 focused, as expected, on critical minerals supply-chain concentration in China and, more specifically, on how China is dominating and manipulating critical minerals markets. With global demand for these resources projected to significantly increase, the dialogue was dominated by discussions on the urgent need to expand Australia's mining and processing capacities.

Participants posited that the concentration of supply from single sources creates the need for greater diversification and resilience in global supply chains. That need is particularly important as a result of China's coercive economic practices in the critical minerals and other sectors, but also because of risks of supply-chain disruption due to other causes. There was also some consensus on

the need for a collaborative policy approach involving Australia, allied governments and the private sector. The consensus was that the focus should be on increasing supply-chain resilience and securing alternative sources rather than abandoning globalisation, balancing economic openness with strategic risk management.

In the year that's passed, the number of critical minerals conferences, summits, bilateral meetings, agreements and compacts has rapidly increased. Understandably, Darwin Dialogue 2024's discussions focused far more on what needs to be done at the sector, national and multilateral levels. Discussions indicated fierce agreement across the private sector, governments, think tanks and academia that more diverse, secure and sustainable critical minerals supply chains are needed. However, market forces alone can't achieve that.

Despite the proliferation in conferences and critical minerals summits in the past year, more consensus and

synchronisation of efforts is needed. Discussion at the Darwin Dialogue 2024 practically illustrated that there’s often incongruence between private-sector perspectives and public-sector policy and investment, especially in Australia. Additionally, the considerable bureaucratic work that government is pursuing in developing formal diplomatic agreements isn’t yet translating into collaborative international supply-chain initiatives.

Furthermore, what is being done has yet to have much impact on supply chains. That’s understandable, given the long lead times associated with mining and processing critical minerals.

The Darwin Dialogue 2024 highlighted that, while conferences and the like are always an important element of public policy discourse, there was an equal or perhaps even greater need for more informal dialogue that brings together government, business, NGOs and academia for open discussion under the Chatham House rule.

Track 1.5 dialogues are crucial in addressing complex economic and policy challenges, such as critical minerals, by facilitating informal yet impactful discussions between government officials, industry experts and academics. The dialogues bridge the gap between official policymaking and practical implementation, allowing innovative solutions and collaborative strategies. Track 1.5 dialogues are instrumental in crafting practical, multifaceted

approaches to global supply-chain issues and policy development by fostering a comprehensive understanding of diverse perspectives and trust among stakeholders.

Government intervention

The private sector often resists government regulatory interventions in the minerals sector due to concerns about increased burdens and potential disruptions to established market dynamics. Companies fear that such interventions could lead to higher operational costs, reduced profitability and uncertainties that complicate long-term planning and investment. Additionally, there’s apprehension that government actions could inadvertently distort market competition and hinder innovation by imposing restrictive or misaligned policies.

Despite the reservations of free marketeers, the Darwin Dialogue 2024 revealed an acceptance among stakeholders, and the nations represented, that, for critical minerals, government interventions were needed to build more diverse, secure and sustainable supply chains. In short, there was a general sentiment that national and transnational government interventions are currently an unavoidable feature of the critical minerals sector. Governments globally (including Australia, the US, Canada and the EU) are increasingly willing to intervene in their domestic economies, and hundreds of new policies have been introduced in recent years (Table 1).¹⁶

Table 1: New industrial policies, by region

	Domestic subsidy	Export barrier	Export subsidy	FDI	Import barrier	Localisation	Procurement
Sub-Saharan Africa	6	2	1	0	3	1	0
South Asia	37	26	6	1	73	29	1
North America	209	20	26	4	21	55	22
Middle East and North Africa	7	0	1	0	3	0	0
Latin America and the Caribbean	84	7	11	3	104	13	0
Europe and Central Asia	427	47	53	14	68	5	13
Asia-Pacific	148	40	55	6	278	15	2
Totals	918	142	153	28	550	118	38

Source: Simon Evenett, Adam Jakubik, Fernando Martin, Michele Ruta, ‘The return of industrial policy in data’, IMF working papers, January 2024, [online](#), 18.

Critical minerals and downstream industries (including low-emissions technologies such as solar panels, wind turbines, advanced batteries and electric vehicles) are increasingly a focal point of such policies as nations seek to secure supply for manufacturing and carve out an industrial role in the clean-energy transition. Amid that competition, policymakers must identify the most effective—and least effective—interventionist policies.

Participants pointed out that interventionist policies must be transparent and up front about their direct and indirect costs, duration and desired impact. Such transparency gives each sector the information it needs to develop strategies for future self-sufficiency. Moreover, it sustains public trust and support in the strategy, which is critical when committing public funds and attempting to shape Australia’s future economic composition.

Managing political price risks

Investment requires a level of risk tolerance. Investors are generally prepared to assume, protect against and/or mitigate various types of risks, such as construction and price risks, as part of their investment strategy. However, political risk presents a unique challenge: it's very difficult to hedge against and is outside the remit of traditional risk-management strategies.

Unlike many other risks, political risk stems from government actors outside of the market who regulate or oversee it, and whose decisions affect both markets and market participants and the broader society in which they operate. As a rule of thumb, the rule of law diminishes political risk but arbitrary or dictatorial decision-makers increase it.

Geopolitical interests in critical minerals supply chains and markets, and the direct impact of incidents and various international policies, translates political risk into price risk for various minerals. That is especially so where a single political entity can unilaterally influence and dictate market prices. A heavily imbalanced market creates a precarious investment environment outside of the dominant player. Price stability is compromised by the unpredictable actions of the dominant entity and causes investors to reconsider investing in long-term projects.

Political risks are currently pervasive throughout the critical minerals sector. The risks predominantly manifest as price volatility, driven by state actors that can significantly influence market stability.¹⁷ China, particularly, plays a central role in that volatility. It exerts dominance over critical minerals supply chains through monopolistic control of production and is the primary purchaser of many of those minerals.

Price volatility largely results from China's state-supported subsidies, below-market financing and national stockpiles, which artificially inflate demand signals and lead to overproduction. Those practices result in sharp declines in commodity prices, which threaten international industry players (as illustrated in Appendix 2, pg26). Due to long development timelines, substantial capital requirements and a singular product (such as the minerals mined and refined at a mine site), mining operations are especially vulnerable to commodity price fluctuations, and their profitability is heavily dependent on current prices. Politically driven price risks can therefore be perilous.

China's political risks have been notable for decades, but both market actors and governments haven't consistently acted accordingly. Consider the following advice from the *Harvard Business Review* in 2006:

R&D, production, and supply chains should not be concentrated in any one Chinese province or region—or in China generally.¹⁸

Overall, that and similar advice was not heeded. China's supply-chain dominance, aggressive industrial policies and national mineral stockpiles are at the root of many current mineral price-risk issues. The country leads globally in implementing industrial policies: in 2019, China spent conservatively 1.73% of its GDP (US\$248 billion) implementing such policies.¹⁹ That expenditure slightly exceeded its official defence spending for the same year.

Additionally, while details of China's national mineral stockpiles, which is managed by its National Food and Strategic Reserve Administration, are closely guarded, they appear to be extensive. For example, tracking of its open market transactions, which are partially used for stockpiling purposes and also to send price signals to the market,²⁰ reveals significant recent purchases of cobalt, and it's possible that by 2025 China will own or operate 60% of global cobalt supply.²¹

Political price risks are also evident downstream. Emerging end-user industries, such as the electric vehicle (EV) sector, face similar challenges, including price fluctuations and overproduction risks (see Appendix 1, pg25).²² Substantial investments made by China, such as the US\$47.5 billion²³ allocated to its semiconductor industry in May 2024, signal potential future competition across various high-tech sectors that are reliant on critical minerals.

In response to those distortions—and recognising that China's market interventions are unlikely to cease—other governments must increase their market involvement. Protecting domestic industries from adverse policies and ensuring a level playing field are essential. As Prime Minister Anthony Albanese noted, 'This is the new competition.'²⁴ That awareness and the impacts of recent economic shocks drive the Australian Government's push for a 'future made in Australia', and, while it's a significant departure from Australia's previous economic approaches, it does align with its traditional political emphasis on national-security and economic-management narratives.²⁵

Slow capital investment in the sector

Mines are relatively high-risk and capital-intensive projects, particularly in the early phases of development. Mining is a long-term endeavour, and mines are long-term projects with high upfront costs, yet they're also vulnerable to fluctuating commodity prices throughout their lifetimes.

At the Darwin Dialogue 2024, there was a widespread view that the current Australian state and national regulatory frameworks are cumbersome and adding to investor uncertainty and should be streamlined.

In Australia, it takes an average of 15 years of lead time for a mine to progress from discovery to production.²⁶ Much of that time is spent in transitioning from discovery, exploration and feasibility studies,²⁷ and a common hurdle is a lack of investor confidence and capital availability.²⁸ While 15 years of lead time is too long, it's also worth noting that this is better than the global average (15.9 years) and better than other significant jurisdictions: Brazil (21.8), Indonesia (18.8), Russia (18.7), Canada (17.9) and Chile (16.8).²⁹

Incentivising critical minerals investment, and doing so quickly enough to meet projected critical minerals demand and facilitate the energy transition, is a unique policy challenge. While Australia, the US, Japan, the ROK

and others have significant capital, their investment in critical minerals remains limited.

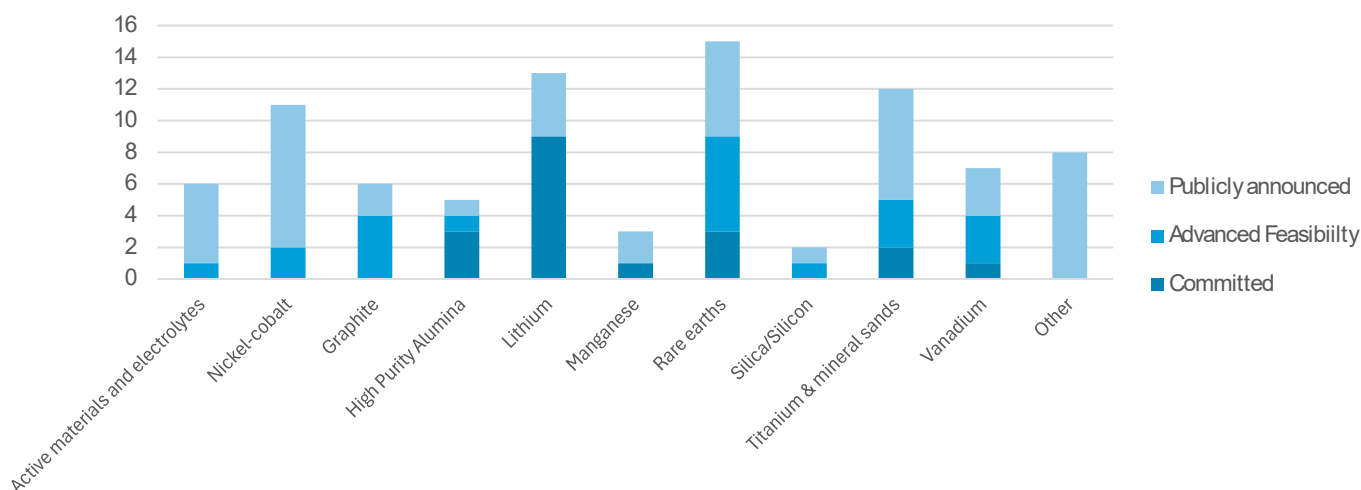
Capital flow into Australian projects is trending upwards. There's an estimated \$24 billion in proposed investment for projects, including \$11.8 billion in committed investments—an increase of 75% compared to 2022.³⁰ That was despite a significant decline in investment from China.³¹ But investment is also concentrated into certain minerals, and only a handful of minerals have projects in the advanced feasibility or committed stages (see Figure 2).

Unlocking foreign direct investment into Australian critical minerals

Australia must unlock non-Chinese foreign investment into its domestic critical minerals sector and work with partners to build diverse supply chains. Australia has historically relied upon and benefited from international investment, tending to have more attractive investment opportunities than available domestic capital.³² Australia's mining industry also continues to gather the largest proportion of total business investment in industry.

Currently, the Australian Foreign Investment Review Board has advised the Australian Treasurer to reject some Chinese investment in critical minerals. Such scrutiny isn't unique to Australia; the US and Canada block similar investments.³³

Figure 2: Australia's major critical minerals projects at various project stages



Source: DISR, *Resources and energy major projects: 2023*, 'Resources and Energy Major Projects 2023 Report', December 2023, [online](#).

While restrictions are necessary for national security and designed to protect the national interest,³⁴ new sources of investment are needed to fill the gap. And the gap is vast: in 2023, new Chinese investment in Australian mining essentially collapsed, from \$1.8 billion in 2022 to \$34 million through 2023.³⁵

Ultimately, new government policies are needed to unlock capital investment.

Appendix 3, (pg 27) describes US Government interventions into the uranium market during the Cold War. Similar policy interventions may prove necessary for critical minerals. Current approaches centred on subsidies aren't sufficient on their own. Many critical minerals can be produced as by-products of larger operations but critical minerals with low market demand are often left unprocessed. Ultimately, without a market to sell into, industry can't invest in processing them. Subsidies can make processing cheaper, but they don't replace a customer.

Balancing industrial policy and international cooperation

International collaboration remains a vital mechanism through which like-minded partner nations, such as Australia, the US, Japan and the ROK, can achieve shared and individual critical minerals policy outcomes. However, the rise of various internally focused industrial policies and export bans threatens key outcomes, including the development of diverse and resilient supply chains.

Market interventions, including government project financing, must prioritise collaboration to achieve effectiveness. It's crucial for governments to work alongside their domestic industries without imposing excessive interference that could undermine international competitors. That approach is essential not only for ensuring fairness but also because no single nation has sufficient critical minerals reserves to meet the rising global demand. However, in an era of industrial policy and market intervention, collaboration and competition have new dimensions that must be addressed. Governments must work with their domestic industries to achieve policy success and maximise economic gain. However, that must be balanced with international partnerships to ensure diverse supply chains and market competition.

International efforts to collaborate in critical minerals need to be more robust. Numerous bilateral compacts and multilateral forums have been established—Australia alone has 27 individual agreements: 14 bilateral and 13 multilateral.³⁶

Those agreements result from significant diplomatic efforts and come with substantial overheads. It's also increasingly difficult to argue that any have yet delivered significant value for the sector. That observation strongly indicates that this approach needs to evolve and that countries that do so successfully will gain a competitive advantage.

A meaningful change to the agreements and their implementation would be a focus on:

- directing and supporting foreign investment
- delineating supply-chain opportunities and challenges
- harmonising industrial policies.

Regarding industrial policies, as of 2023, approximately 28.1% of new industrial policies introduced globally were due to 'climate-related concerns'; 19.7% for 'geopolitical concerns or national security'; and 15.2% for 'supply chain resilience'.³⁷ Government action on those issues is important, and it's at least a positive trend that there's growing international consensus on the need to act in those policy areas.

But policy must be more effectively leveraged to develop the best ways to work together. It's important to note that the industry doesn't sit back and wait for government lists or policies. Instead, it responds to the market, which will dictate who to sell to—often companies within China, or the state itself.

An international critical minerals marketplace among like-minded nations is fundamental to successfully diversifying supply and building dependable supply chains. Australia and like-minded nations can't seek to produce supply or consumption monopolies without cannibalising partner nations' industries (see Appendix 2, pg26). The advantage instead lies with a networked approach taking advantage of multiple nations' complementarities (see Appendix 4, pg27). That cooperative approach must also reflect the fact that partners will continue to compete where they must.

Subnational governments

Subnational governments, such as state and territory administrations in Australia, are pivotal in shaping regional economic landscapes and driving local development. In Australia, state and territory governments have primary responsibility for the facilitation and oversight of minerals exploration and production.

Subnational governments globally can unlock significant financial benefits by tailoring policies to regional needs, including by stimulating local industries and employment, enhancing infrastructure and attracting investment. Their ability to implement targeted initiatives can lead to increased local opportunities and improved economic resilience at the community and regional levels. In Australia, subnational governments are crucial in leveraging their unique geographical and financial advantages to foster growth and innovation across diverse sectors, often underpinned by resources production.

Critical minerals challenges and opportunities are often considered at the national level, spurred on by the proliferation of national critical minerals strategies and lists and by international agreements, but that assumption must be tested.

Critical mineral reserves in Australia and other nations—such as Canada and the US—are distributed over particular regions. Similarly to Australia’s rich iron-ore regions, such as the Pilbara in Western Australia, specific critical minerals are predominantly concentrated in commercially viable deposits in particular locations and jurisdictions. Those regional concentrations of critical minerals highlight the importance of localised expertise and resource management in optimising their economic potential. Capitalised on effectively, that provides a policy advantage.

In Australia, the supply of many critical minerals is highly concentrated in particular subnational jurisdictions. For example, Western Australia possesses 90% of the nation’s economically demonstrated reserves (EDR) of nickel, 99% of Australia’s lithium and 70% of the nation’s cobalt; South Australia has 68% of the nation’s copper and 67% of its graphite; Queensland has 57% of bauxite EDR; and Victoria has 59% of Australia’s rutile.³⁸

As exploration and the total number of economic deposits increases, those figures are likely to change. For example, the Northern Territory has significant mineral resources, including 20% of Australia’s lead (not an Australian critical mineral), 24% of its zinc (an Australian strategic material), 20% of REEs, and 30% of manganese EDR.³⁹ As with other regions, the territory is underexplored, and opportunities remain underdeveloped. It’s likely that further commercially viable deposits of a diverse range of critical minerals remain to be found.

High concentrations in particular jurisdictions are an asset to Australia. Australian state and territory governments can pursue minerals without intra-domestic competition, and local industries can cluster and specialise in the proximate commodities, although such arrangements will require agreement.

The proliferation of national critical minerals strategies has somewhat overshadowed the role of subnational governments at the city, state, territory or province level in achieving critical minerals policy outcomes. In federated systems such as Australia or the US, subnational governments are vital to realising policy aims and have strong incentives to achieve economic outcomes quickly.⁴⁰

Subnational governments are highly influential on minerals investment climates. For example, Western Australia, South Australia and the Northern Territory are ranked by the minerals industry as among the most attractive locations for mineral investment worldwide.⁴¹ Subnational governments—due to their economic focus, mineral policy responsibilities and ability to be nimble—have a large role to play in developing Australia’s critical minerals at speed and scale (see Appendix 5, pg28). Subnational governments are therefore crucial to solving the underlying critical minerals pacing challenge: supply must increase rapidly to meet international objectives and diversify the market.

Project pipeline, capital flow, risk tolerance and developing new markets

The critical minerals sector in Australia is already large and holds significant promise for growth due to the nation’s vast geological endowment. Yet it faces complex challenges that must be navigated to fully realise its

potential. Key areas of concern include managing the project pipeline, ensuring efficient capital flow, balancing risk tolerance and developing new markets. Each of those facets presents unique challenges that require strategic approaches and robust solutions.

The project pipeline for Australian critical minerals is extensive, encompassing a range of exploration, development, production and processing investments and proposals. Effectively managing the pipeline is crucial for meeting growing global demand and maximising the economic benefits of Australia's mineral resources. One primary challenge is the length and complexity of project development timelines. Mining projects often span several years from initial exploration to full-scale production, involving extensive feasibility studies, environmental assessments and regulatory approvals. Delays in those stages can disrupt the project pipeline, leading to increased costs and missed opportunities.

Moreover, the pipeline is subject to fluctuations in commodity prices and changes in global demand, which can affect project viability. Ensuring a steady flow of projects requires efficient management and the ability to adapt to evolving market conditions and technological advances. Investment in project development must be carefully calibrated to balance long-term goals with short-term market realities.

Capital flow is a critical component for the growth and sustainability of Australia's critical minerals sector, yet access to capital continues to be a hurdle. The industry requires substantial investment to finance exploration, development and operational activities. Securing that capital can be challenging due both to the inherent risks associated with mining projects, such as price volatility, regulatory changes and environmental concerns, and competition for capital between projects, which can be operated by a common company.

Investors typically seek returns that meet hurdle rates and justify risks, which means that fluctuations in commodity prices or unexpected regulatory hurdles can affect capital availability. For instance, if prices for a critical mineral experience significant and sustained declines, that can deter investment, affecting the project pipeline. Additionally, high capital requirements can inhibit the participation of smaller players in the industry, concentrating investment among investors with

deep pockets and high tolerance for risk (for example, state-owned and state-directed companies from China), plus larger entities with the financial capacity to invest and weather market fluctuations.

Currently, in Australia, there are multiple critical minerals projects, for the products of which there's demonstrable demand, but that are struggling to reach a final investment decision or financial close.

To mitigate those challenges, it's essential to cultivate a diverse investor base and explore alternative financing mechanisms for certain commodities and projects. Public-private partnerships, government-backed funding initiatives and innovative financial instruments can be crucial in bridging capital gaps and supporting project development.

Given that supply chains are global and multi-nodal, involving multiple supplier and end-user jurisdictions and mining, processing and manufacturing companies from multiple nations, those financing mechanisms also need to take a supply-chain approach. Australia's bilateral and multilateral critical minerals agreements have, up until now, focused on attracting foreign investment, and Australian financial support has been applied only to projects in Australia. In comparison, partner nations are investing across international jurisdictions. Will Australia start supporting Australian-operated projects in other jurisdictions in support of its companies, wherever they operate, and in support of its international partners?

Risk tolerance is a significant factor in the critical minerals sector, in which geopolitical, environmental and market risks intersect. Investors and project developers must navigate a complex landscape of uncertainties, including fluctuations in mineral prices, changes in government policies, and environmental regulations. Political instability or trade restrictions can also pose risks, particularly for markets heavily dependent on international supply chains.

Managing those risks requires a nuanced approach incorporating risk assessment, mitigation strategies and contingency planning. Projects must have robust risk-management frameworks that address potential disruptions and uncertainties. That involves conducting thorough due diligence, implementing flexible operational strategies and maintaining strong relationships

with stakeholders, including local communities and regulatory bodies.

In Australia, governments play a pivotal role in shaping the risk environment through policy and regulatory measures. Ensuring that policies are clear, consistent and supportive of industry growth is crucial for managing risk and fostering confidence among investors and developers. Enhancing resilience against the impacts of natural disasters, for example through enhanced infrastructure, is also a key role for governments. Additionally, enhancing resilience through diversified supply chains and strategic partnerships can help mitigate geopolitical and market fluctuation risks.

Australian firms must invest in market research, build strategic partnerships and leverage trade agreements to penetrate new markets successfully. Engaging with international stakeholders, participating in global trade forums and establishing global sustainability standards (developed by industry and endorsed by governments) can also enhance market access and acceptance. Furthermore, promoting the unique value propositions of Australian critical minerals, such as their ethical sourcing and high quality, can differentiate them in the global marketplace.

By tapping into Australia's substantial pool of superannuation funds, the nation could access a significant source of domestic capital that reduces reliance on external investors. Complemented with government support, that approach would be likely to foster greater financial stability within the critical minerals sector. It ensures that capital remains within the Australian economy, supporting local industry growth and innovation. Superannuation funds use a long-term investment horizon, making them well suited for funding the large-scale, capital-intensive projects typical of the critical minerals industry. The funds are hesitant to invest in specific mineral projects and niche companies due to the volatility of returns, which poses a significant risk. By directing the funds towards critical minerals, Australia can enhance its resource base, reduce the volatility associated with foreign investment and strengthen its position in the global market. That strategy would also align financial interests with national priorities, ensuring that Australia's mineral resources contribute directly to economic development and technological advancement.

The US should officially designate Australia as a domestic source across all relevant policies, including those from the departments of Defense, Energy, and Commerce, similarly to the designation granted to Canada. That integration would open new avenues for collaboration and investment, particularly in critical minerals essential for defence technologies. By aligning with US procurement standards, Australia can ensure that its mineral resources are recognised as integral components in defence supply chains, potentially leading to increased orders and investment opportunities. That alignment would boost Australia's position in the defence sector and strengthen bilateral ties with the US, leading to mutual benefits in technology exchange and strategic collaboration. Such a move would underscore Australia's commitment to supporting global security and highlight its critical role in providing essential materials for advanced defence systems.

Tax credits for investment in R&D within the critical minerals sector would serve as a powerful incentive for innovation and technological advancement. By offering tax benefits to domestic and foreign investors, Australia can stimulate significant investment in new mining and processing technologies, driving efficiency, sustainability and resource extraction improvements. Tax credits would encourage research institutions and industry players to develop cutting-edge solutions that enhance Australia's competitive edge in the global market. Additionally, fostering a culture of innovation through targeted financial incentives would help Australia maintain its position as a leader in critical minerals, supporting long-term growth and technological leadership. Such measures would also attract international investment, further integrating Australia into the global critical minerals supply and technology advancement network.

Supply shortages and project timelines

Global critical mineral demand is expected to increase drastically in the coming decades, primarily driven by clean-technology industries and the energy transition. However, there's the near existential challenge of projected demand far outstripping available supply. Critical minerals projects must progress more quickly to resolve future shortages, decreasing from the 15-year average from

mineral discovery to production.⁴² Failure to diversify supply quickly, and to maintain effective governance while expanding the sector, would be likely to incentivise fragile or autocratic state actors, or even organised crime, to engage in the industry and extract significant profits.

Australia and like-minded supplier nations must significantly reduce project lag time to mitigate the risk of any future supply shortages. Doing so will assist in de-risking projects and ‘unlocking’ investment capital. Nations or jurisdictions able to do so quickly are likely to gain a competitive advantage over slower competitors.

Notably, not all mineral-production growth is equivalent. The growth that increases the concentration of supply, exacerbates negative environmental and social impacts, or both, at the expense of growth elsewhere that improves supply-chain security and sustainability will only exacerbate existing supply-chain risks and the market’s exposure to political risks.

Projected demand far outstrips the existing and projected supply of lithium and graphite—minerals of which Australia has significant natural reserves. The International Energy Agency has identified both as having high supply growth risk (meaning that the necessary supply growth to meet projected future demand is significantly more than each mineral’s historical growth rate).⁴³ Lithium and copper are also assessed to have high risk for long-term market balance; their availability is expected to fall ‘significantly short of primary supply requirements’.⁴⁴

Certain considerations mitigate this problem. For example, lithium supply is increasing from a shallow historical base. Other factors compound it: China currently controls nearly 100% of graphite supply chains. Australia is the largest mine producer of lithium (via spodumene ore), while China is the largest lithium processor. China is also an investor in Australian mining and processing.⁴⁵

Yet Australian and international critical minerals projects are stuck in the pipeline. Or, worse, they are actively threatened or suspended by current mineral oversupply and crashing prices.⁴⁶

Sustainable development

Sustainably developing and expanding the critical minerals sector was a focal point of discussion at the Darwin Dialogue 2024, and for good reason. The clean-energy

transition is a core motivator behind the development of critical minerals production, as international governments are committed to climate targets and seeking economic advantages by ‘greening’ their economies and innovating in the green tech space.

Sustainable development is often considered through the ESG prism. While detractors dismiss ESGs as mere ‘buzzwords’ or ‘left-wing activism’, the term is more practical.

Originating in the 2004 UN report *Who cares wins*, a joint initiative with 20 major financial firms, ESGs are a way for companies to manage risks to value creation. The report argued that companies can mitigate risk and achieve long-term growth by adhering to good environmental, social and governance practices.⁴⁷ It also argued that the integration of ESG factors would lead to more resilient financial markets. As opposed to some contemporary commentary, ESGs aren’t token ‘corporate responsibilities’ but critical factors to consider when building sustainable and resilient business models.

Australian mineral commodities comply with high ESG standards, meaning that Australian mines and processors operate with minimal environmental and social impacts and with well-established governance structures, corporate oversight and a lack of organised crime or other malign actors. Our high ESG standards are especially true relative to mining operations in underdeveloped, dictatorial or politically fragile nations. Australia’s high ESG standards differentiate our product and give our sector a competitive advantage: Australian minerals have lower environmental and social impacts than those of international competitors, and as a result our mining companies’ business models should be lower risk, more sustainable, and dependable in the long term.

Government currently recognises elements of this and promotes the ‘green premium’, but the messaging can be improved.

The flip side of the ‘green premium’ is the underdiscussed ‘black price’. The black price is the hidden costs of low-ESG-compliant products that aren’t included in the dollar amount, such as damage to the environment, damage to communities, emissions, and corporate damage via inefficiency or corruption. Rhetorical focus on the green premium is a necessary differentiator for high-ESG

products and partly reflects why they have a higher price tag, but a focus on the black price also informs others that there are real, if non-monetary, costs for cheap commodities—and those costs are often paid by the environment, highly vulnerable groups, or both.

Examples of the green premium and black price can be seen in costing comparisons of lithium hydroxide plant in China and Australia. A plant capable of producing 50 kilotons per year of lithium hydroxide would cost approximately \$650 million in Australia, or \$230 million in China.⁴⁸ Factors explaining that differential include lower construction and labour costs (and reduced regulation) in China, lower energy costs in China due to cheap but high-emissions coal (>50% of all lithium refining plants in China rely on coal), and minimal regulation of hazardous waste management, leading to high environmental or social impacts on surrounding areas and communities.⁴⁹ Operations in other jurisdictions, such as Chilean lithium mining operations, similarly result in poor social and/or environmental outcomes.⁵⁰

Cobalt provides a further example. Global cobalt production centres in the Democratic Republic of the Congo (DRC), where it's broadly an environmentally and socially destructive force. Impacts include hazardous and poorly regulated artisanal mining,⁵¹ illegal child labour, environmental damage and forced mass evictions. Nevertheless, cobalt is a crucial battery mineral (a typical EV battery contains approximately 14 kilograms of it).⁵² Cobalt supplies outside of the DRC face far higher operating costs and the threat of fluctuating prices.

It's critical that the supply chain be diversified and that governments, corporations and the public appreciate the true costs associated with 'cheap' cobalt. Governance practices should integrate the black price into costs to do that—recognising the economic and social damages caused. The black price also comes with significant political risks, including where it stems from hostile state actors, underdeveloped or highly corrupt states and politically fragile states.

An immediate effect of black-price considerations for companies serious about risk management should be their recognition of the costs of an insecure and undiversified cobalt supply chain. Insecure supply chains carry material risks. Governments are recognising that and investing in diverse critical minerals and REE supply chains. Private

enterprise and industry must also follow. Integrating the black price into government, industry and public analysis will better inform all stakeholders of the inherent risks of current low-ESG supplies—and demonstrate that the 'green premium' is also a downpayment for supply-chain security.

Many major markets currently have a policymaker or consumer preference for high-ESG-compliant minerals. However, enacting those policies requires more commitment and 'follow-through'.⁵³ Markets instead continue to prioritise the cheapest possible product, irrespective of supply-chain vulnerabilities and the product's non-alignment with climate, environmental or national-security objectives.

While the practice is not yet widespread, investors are increasingly considering ESGs within their portfolios, and critical minerals—due to their strong upside and alignment with clean energy—are attractive in this space:

'We're building out investments in that space for the next five years-plus,' the fund manager said. 'The energy transition is absolutely a great thematic to invest in.'⁵⁴

Government and industry, and even consumers, will need to work together to continue to incentivise investment into high-ESG critical minerals mining and processing, and to disincentivise low-ESG products.

First Nations economic determination

Critical minerals offer First Nations communities significant economic determination opportunity, which is often overlooked in the current discourse. Although the Australian Government recognises that opportunity within the Critical Minerals Strategy 2023–2030,⁵⁵ it remains underexplored. International investors might also misinterpret or fail to understand Australia's land rights and heritage protection systems, increasing perceived risk and unnecessarily dissuading investment to the detriment of all parties.

Australia's distant and recent history has systematically excluded many First Nations people and groups from wealth creation. Land rights are a significant asset for First Nations communities and offer significant opportunity for economic participation, as approximately 79% of critical minerals projects are in areas where Indigenous

Australians have legal rights to negotiate, native title, or both.⁵⁶

As Australia invests in critical minerals for its future, it's an exciting prospect that access to explore for and develop many mineral deposits will require collaborative work with Indigenous communities. Each community will approach minerals development independently, but there are already signs of many communities being interested in facilitating projects on country.

Unfortunately, lack of engagement with and awareness of Australia's land ownership and First Nations' role is creating international uncertainty.⁵⁷ That uncertainty reduces investment in viable projects, damaging the economic interests of all—including First Nations communities.

Better management of relations between industry and First Nations communities, integrating them within core stakeholder considerations, and better communication of industry best practices are vital to achieving mutually productive outcomes.

Similarly, some activist groups can also improve their participation in this space. Alarming incidences of 'hijacking' incidents by *'agenda-ed allies'* can threaten projects and, far worse, speak over the top of Indigenous communities. Executed correctly, critical minerals projects offer long-term economic opportunity in terms of both mining benefits and potential careers for working-age Indigenous adults. Available jobs can include construction and mining jobs, support services jobs as well as jobs for rangers facilitating exploration, monitoring environmental impacts over the lifetime of the mine and supporting land rehabilitation after mine closure.

Building resilient supply chains

Much of the discourse about critical minerals has traditionally centred on augmenting supply—enhancing domestic production capabilities, fortifying supply chains and reducing dependence on external sources. While those efforts are crucial, addressing demand dynamics is equally imperative to building a robust and resilient critical minerals supply chain. The intersection of supply and demand, particularly amid shifting global markets and technological advancements, is pivotal in ensuring stability and sustainability within the sector.

While policy measures often emphasise increasing supply, the demand side of the equation is fundamental to creating a resilient supply chain. A significant portion of the global demand for critical minerals remains concentrated in China. That concentration poses substantial risks, subjecting the international market to fluctuations and uncertainties driven by a single dominant player. Western markets, although growing, need to scale their demand for critical minerals, partly due to the complex and gradual adoption of new technologies and infrastructure. The mismatch between supply and demand can create vulnerabilities, especially if demand outstrips supply capacity or overproduction leads to market distortions.

Strong demand signals, and then actual demand, from Western markets are essential for incentivising investment in mining and production. By creating a robust and predictable demand trajectory, those markets can drive the development of new mining projects and encourage investment in infrastructure, technology and innovation. Without such demand signals, the sector might struggle to align production capacities with future needs, leading to potential mismatches and vulnerabilities.

The concentration of demand within China is a significant challenge for building resilient supply chains. China's dominance in producing and consuming critical minerals creates a scenario in which a single country's policies and market behaviours heavily influence global supply chains. This situation poses risks to supply stability and affects global pricing and availability. Reliance on Chinese markets for critical minerals has led to concerns about overproduction and market manipulation, destabilising global supply chains and creating economic uncertainty for other countries.

Western industries and governments must address this issue by diversifying their sources of demand from consumer nations and reducing reliance on any single market. Encouraging growth and development in Western markets can help to mitigate the risks associated with overdependence on China. That involves scaling domestic demand and fostering international collaborations and trade agreements to create a more balanced and resilient global supply network.

Projections indicate that the supply of critical minerals will face significant challenges, particularly as demand escalates. Current forecasts suggest steep drop-offs in

supply capacity relative to the expected surge in demand, which is expected to intensify in the coming decades. One of the first major spikes in demand is projected as early as 2030, driven mainly by advances in electrical grid infrastructure and the growing adoption of EVs.

The expected increase in demand for critical minerals, driven by technological advances and infrastructure development, underscores the urgent need to scale up production and improve supply-chain resilience. Failure to address those supply challenges could lead to severe shortages, increasing commodity prices and delays to critical-infrastructure projects. Such delays could have

cascading effects, stymying industry growth, hindering the energy transition and affecting broader economic and environmental goals.

To mitigate those risks, it's essential to proactively invest in expanding supply capacities, developing new mining and processing technologies and enhancing supply-chain resilience. That includes investing in R&D to improve extraction and processing technologies, expanding exploration efforts to identify new mineral reserves, and strengthening international collaborations to ensure a stable and diversified supply network.

Policy recommendations

1. Japan, the US, the ROK and Australia should enhance their minilateral cooperation by establishing an annual Quad + partners ministers meeting on critical minerals.

A minilateral approach to critical minerals, grounded in shared interests and complementary strengths, can deliver substantial economic, social, environmental and geopolitical benefits. It will enhance supply-chain diversity, resilience and sustainability, reduce geopolitical risks and foster technological advances. Joint ventures can expand exploration, extraction and processing, ensuring high ESG standards and enabling technological innovation. This partnership could drive R&D in sustainable mining practices, recycling technologies and alternative materials, positioning the coalition as a global leader in the green economy. Collectively, the four nations can implement international standards and policies that promote responsible sourcing.

2. Japan, the US, the ROK and Australia should continue to research, publicly recognise and communicate about how China manipulates global critical minerals markets and supply chains.

Currently, global markets for critical minerals are significantly distorted by state-driven practices, particularly those employed by China, which exert substantial influence over supply chains and pricing. China's control over key supply chains and its strategic manipulation of market dynamics creates considerable risk and uncertainty for producers and end users. This situation

undermines competition and hinders the ability of other nations and industries to operate within a predictable and transparent market environment. Publicly recognising and communicating about those market manipulations and associated economic coercion is vital. Doing so raises awareness among global stakeholders about the challenges and risks posed by such distortions, fostering a more informed and unified response. Such transparency is crucial for mobilising collective action and advocating for transparent market practices internationally. Moreover, governments and industry leaders must also acknowledge that some government intervention is now necessary to counteract those distortions and build more diverse, secure and sustainable supply chains.

3. Japan, the US, the ROK and Australian governments should collaborate to introduce green premiums for sustainably produced critical minerals.

New market mechanisms such as price premiums or floor prices are needed to support and encourage responsible supply-chain operators and high standards of mining governance in host jurisdictions. Currently, global market prices for minerals and metals reflect only their quality standards and demand–supply balance. There's no market differentiation of the way in which the minerals are produced, processed and supplied, including for the application of sustainable practices to supply chains.

4. Japan, the US, the ROK and Australian governments should collaborate to introduce floor prices for selected critical minerals.

Downward plunges in market prices for certain critical minerals can profoundly affect the viability of Australia's domestic production and international supply chains. An agreed floor price for selected critical minerals, combined with offtake to market or stockpiles, would create a more predictable revenue stream for producers, allowing them to invest more confidently in exploration, development, mining and processing, applying high ESG standards. Price stability would foster long-term investments in the sector, ensuring a steady supply of these vital resources to meet growing global demand. Moreover, a floor price would contribute to the stabilisation of international markets. By setting a minimum price, the Australian Government and its partners can mitigate the risks associated with volatile price swings that undermine the viability of critical minerals projects and disrupt supply chains.

5. Japan, the US, the ROK and Australian governments should collaborate on establishing national and minilateral critical minerals stockpiles.

Ensuring a reliable and stable supply is imperative as critical minerals become more integral to technological advancement and the energy transition. By establishing national and minilateral stockpiles of selected minerals, Japan, the ROK, the US and Australia could collectively address market challenges and foster a more stable and predictable environment for critical minerals producers. National stockpiles would allow each country to build strategic reserves, mitigating the impact of supply disruptions and price volatility. That approach would enhance individual countries' national security and provide a buffer against market fluctuations. Simultaneously, minilateral stockpiles—shared among the partner nations—would facilitate market creation and stability through coordinated resource management and supply-sharing agreements. That collaborative model would reduce the risk of market manipulation through sudden price increases and falls and ensure a more balanced market, benefiting industries and consumers alike. Creating the stockpiles would also stimulate market development by fostering a more reliable supply chain, encouraging investment in mineral-extraction and processing technologies and promoting R&D in resource

efficiency. Furthermore, the collaborative nature of the minilateral stockpiles would help to align market practices and standards across the participating countries, contributing to a more integrated and transparent global market.

6. Japan, the US, the ROK and Australian governments should collaborate to mitigate the unintended impacts of nationalist critical minerals policies on partner nations.

Nationalist policies in the critical minerals sector, often aimed at securing domestic resource needs and enhancing national industries, can inadvertently disrupt global supply chains and economic stability. Those disruptions can manifest as market distortions, trade barriers or increased costs for partner nations that rely on essential minerals for their technological and industrial needs. Governments must appreciate that, while industrial policies are designed to bolster domestic industries, they also have far-reaching implications for international trade and economic relationships. To address those concerns, it's essential to harmonise policies wherever possible, particularly among nations with existing free trade agreements. Instead of nations implementing those policies with a purely domestic focus, they should increasingly consider effects across an integrated network of like-minded mini-lateral partners. That approach helps to align national interests with broader global objectives, foster a cooperative environment that balances competition with collaboration and ultimately improve effectiveness. Alignment would enhance mutual benefits, reduce trade friction and support the creation of sustainable supply chains. Coordinated policy frameworks can ensure that pursuing national goals doesn't come at the expense of global economic stability or partner nations' interests.

7. The Department of Industry, Science and Resources should continue to work to improve Australian Government communications with state and territory governments and the critical minerals sector.

Effective communication among agencies, between governments and between governments and industry stakeholders is vital for addressing critical minerals challenges. It must occur before and during crises. Improved interagency communication facilitates the seamless sharing of information and coordination of policies across different departments and with subnational

governments. That integration helps to ensure that data collected from various sources is accurate and comprehensive, reducing the risk of inconsistencies and errors. Accurate data is fundamental for making informed decisions regarding resource management, regulatory frameworks and strategic investments. Enhanced data accuracy directly benefits the quality of government policies and industry regulations, ultimately benefiting the sector and the broader economy. Streamlined communication channels between governments and the critical minerals sector can significantly expedite decision-making. By fostering a collaborative environment in which industry feedback is promptly incorporated into policy development, governments can respond more swiftly to emerging trends and challenges.

8. Australian governments need to boost the number of graduates in critical minerals mining and processing.

Increasing the number of university and technical graduates in critical minerals mining and processing is crucial to meeting the sector's growing demand for expertise. Targeted educational programs, enhanced industry-academic partnerships and the promotion of career pathways in critical minerals are essential to achieve that outcome. By investing in education and training, the Australian Government and state and territory governments can help to develop a highly skilled workforce equipped to tackle the complex challenges and technological advances in mining and processing. Furthermore, addressing barriers to higher education in these fields is imperative. Such barriers may include limited access to relevant programs, insufficient industry engagement and students' financial constraints. To overcome those challenges, the government should consider increasing scholarship funding, supporting the development of specialised academic programs, promoting critical minerals' alignment with Australia's clean-energy future, reducing the costs of study and fostering stronger collaborations between universities and the mining industry, including employment pathways for recent graduates.

9. Increase funding for Australia's critical minerals exploration, mining and processing.

- Expanding Australia's critical minerals operations and meeting this economic security challenge will require

significant capital. Australia's superannuation funds are a substantial domestic resource, and their investment in the sector would reduce dependence on external investors and foster greater financial stability within the sector. Superannuation funds are hesitant to invest in some critical minerals projects due to the volatility of returns, which poses a significant risk. Additionally, mounting pressure from ESG activists is causing the funds to view mining investments with increasing scepticism as they seek more sustainable options. To tackle this issue, both industry and government can collaborate to establish comprehensive ESG frameworks and incentives that promote responsible mining practices while ensuring financial stability for investors.

- The US should designate Australia as a domestic source under all US policies (departments of Defense, Energy, and Commerce), as it has done for Canada. Such a designation would open new avenues for collaboration and investment. That alignment would boost Australia's role in global defence supply chains and attract investment in critical minerals essential for defence technologies.
- Tax credits for R&D investment in the critical minerals sector would incentivise innovation and technological advancement. The credits would encourage domestic and foreign investors to contribute to developing new mining and processing technologies, further enhancing Australia's competitive edge.

10. Introduce 'trustworthiness criteria' for critical minerals and downstream clean-energy technology applications.

Establishing trustworthiness criteria would help to address ESG concerns by setting standards that ensure responsible practices throughout the supply chain. Implementing the criteria would promote transparency and accountability, mitigating risks associated with unethical practices and environmental degradation. It would also foster greater confidence among consumers, investors and governments in the sustainability and ethical sourcing of critical minerals and clean-energy technologies. Nations with high ESG standards, such as Australia, should actively support and advocate for adopting those measures in multilateral forums. Australia's commitment to stringent environmental and social governance standards positions it as a leader

in promoting responsible resource management. By endorsing trustworthiness criteria, Australia can help to shape global standards that align with its values and contribute to the sustainable development of the critical minerals sector. Supporting those measures aligns with Australia's strategic interests in enhancing market stability and ensuring fair competition. Trustworthiness criteria would also facilitate greater international cooperation and trade in critical minerals, strengthening global supply chains and reducing dependency on single sources of supply.

Conclusion

The future development of global critical minerals supply chains is shaped by a multifaceted interplay of geopolitical strategies, technological advance and market dynamics, particularly in response to the strategic dominance of China in this sector. As the global economy increasingly relies on critical minerals—which are essential for technologies ranging from EVs to renewable-energy systems—mitigating China's control over those supply chains will be a central focus of international efforts. So, too, will strengthening security in all components of supply chains, particularly those emanating from emerging mineral-producer nations. Supply-chain sustainability is critical to security.

As the world grapples with the strategic implications of China's critical minerals market dominance, countries and corporations are likely to prioritise diversification and resilience within their supply chains. To counterbalance China's market influence, there will be a concerted effort to develop and expand alternative sources of critical minerals. That will involve intensifying exploration and mining activities in regions outside China, such as in Australia, Canada, the US, Africa, Latin America, Asia and Europe, parts of which are rich in critical minerals deposits. Additionally, strategic investments in those regions will be crucial to enhance their production capacities and establish more stable and secure supply chains.

In parallel with those efforts, there will be a marked push towards enhancing the value chain within other nations. Countries will be likely to focus on building their processing

11. Improve communication about Australia's assessment, approval and regulatory regimes to international investors.

Global investors must comprehensively understand Australia's assessment, approval and regulatory regimes (especially land rights laws and the associated regulatory framework) to ensure that critical minerals investments are managed responsibly. Improving communication regarding those regimes will give investors a clearer understanding of their obligations and the legal requirements for land access and environmental stewardship.

facilities to reduce dependency on Chinese processing capabilities. By investing in refining technologies and infrastructure, nations can add significant value to their raw materials before export, securing a greater share of the economic benefits from critical minerals resources. That shift towards local processing is expected to stimulate economic growth and technological innovation within those regions, contributing to a more balanced global supply chain.

Technological innovation will also be critical in mitigating China's market control. Advances in mineral extraction and processing technologies, including more efficient and environmentally friendly methods, will reduce reliance on traditional supply chains. Furthermore, developing alternative materials and recycling technologies will provide viable substitutes and reduce the demand for specific critical minerals. Enhanced recycling practices, particularly for high-demand minerals such as lithium and cobalt, will contribute to a more sustainable and less China-dependent supply chain.

Geopolitical strategies will further influence the trajectory of global critical minerals supply chains. Countries are expected to forge strategic partnerships and trade agreements to secure alternative sources of critical minerals and reduce their vulnerability to market fluctuations driven by China. Collaborative initiatives, such as establishing international mineral supply chains and joint ventures, will enhance global resource security and ensure a more equitable distribution of critical minerals.

ESG considerations will also drive future developments. As global sustainability priorities intensify, there will be increased pressure on all players, including China, to adhere to stricter sustainability standards. That

pressure will prompt China and other nations to invest in greener technologies and practices that align with global sustainability goals and potentially lead to more ethical and transparent supply chains.

Appendix 1: Electric vehicles case study

EVs, including both plug-in hybrid and battery electric vehicles, are a major source of critical minerals demand. They particularly drive demand for the ‘battery minerals’, which include lithium, nickel, cobalt, graphite, manganese and silicon. EV motors also require small amounts of REEs.⁵⁸

New battery chemistries may adjust the composition and requirements of electric batteries, but alternatives aren’t yet well developed.

EVs constitute an estimated 18% of the global car market, and sales are expanding rapidly. Sales in 2023 were up 35% from 2022 and six times higher than 2018.⁵⁹ Competition is significant throughout this market, in which Chinese and US EV manufacturers are the dominant players, although China has a clear lead in battery research and production. Data from ASPI’s *Critical Technology Tracker* shows that China has led the US and other nations in highly cited publications in this field since 2014, producing 76% of highly cited papers in 2023.⁶⁰ China similarly leads in battery-production capacity (77% in 2022 and a projected 69% by 2027 despite increased international competition)⁶¹ and investment; Chinese companies Contemporary Amperex Technology Co. Limited (CATL) and BYD Auto alone accounted for 53% of battery investments in 2023 (81% for Chinese companies cumulatively).⁶²

Both EV demand and battery demand are increasing rapidly. Nearly 14 million new EVs were registered globally in 2023 (bringing total registered EVs to 40 million)⁶³, and battery demand grew by 35% in China, 40% in the US and approximately 70% elsewhere.⁶⁴

China’s domestic battery market is approximately four times larger than the US market (415 GWh compared to 100 GWh) and more than double the EU market (185 GWh),⁶⁵ but its domestic investment into EV production is producing ‘massive overcapacity’ and a supply glut affecting the global EV battery sector.⁶⁶

It’s likely that the strategy behind that overproduction is long term, aiming to meet far higher demand projections from 2030 onwards. In the meantime, it’s uncompetitive practice that boxes out battery investments elsewhere.

Chinese EVs are cheaper than alternative US or EU products, directly benefiting China’s control of battery supply chains and significant upstream subsidies on domestic mineral processing.⁶⁷ European Commission President Ursula von der Leyen has publicly argued that the ‘artificially low’ price of Chinese EVs, resulting from ‘huge state subsidies’, is disrupting the market.⁶⁸

In 2023, EU imports of Chinese EVs rose from US\$1.6 billion to US\$11.5 billion.⁶⁹ In Europe, Chinese brands sell at a premium price far higher than in the domestic market but still well below the prices of European auto manufacturers. Recently introduced EU tariffs on Chinese EVs—ranging from 19% to 48%⁷⁰ faced backlash from European automakers afraid of retaliatory tariffs in China.⁷¹

Notably, the oversupply leading to massive Chinese EV import growth isn’t unique to Europe. It can also be seen in Canada (a 25-fold increase in 2023)⁷² and Australia.⁷³ By contrast, the US has avoided the influx through tariffs. The US introduced a 25% tariff on Chinese EV imports in mid-2018 under President Trump. In May 2024, President Biden increased tariffs on various imports from China, including quadrupling the tariff on EVs manufactured in China (which may affect some Teslas manufactured in China) to 100% and increasing the tariff on lithium-ion EV batteries from 7.5% to 25%.⁷⁴ The tariffs have successfully reduced China’s products’ access to the US domestic market.⁷⁵ The US Internal Revenue Service (IRS) further discourages domestic EV manufacturers from collaborating with China, excluding companies whose battery supply chains are overly integrated with China from IRS subsidies. In August 2024, Canada similarly imposed a 100% tariff on Chinese EVs.⁷⁶

Appendix 2: Nickel case study

Nickel overproduction, primarily driven by a rise in Indonesian nickel production, crashed the commodity's value to below \$16,000/t in late 2023 and early 2024—a two-year low from a peak of \$100,000/t in March 2022 and a sustained \$50,000/t.⁷⁷

Many nickel producers applying high ESG standards in Australia and elsewhere are unable to continue nickel production at that low price.⁷⁸ That's despite Australian nickel being led by major mining companies operating at significant scale, including BHP, Glencore and First Quantum Minerals.

Indonesia's overproduction and its associated price slump are primarily the result of protectionist domestic policies and large-scale investments from China-based companies. Chinese capital has flowed into Indonesia's nickel value chain after the nation's nickel ore export ban, introduced in 2014 and finalised in 2020 (a challenge in the World Trade Organization was successful in November 2022,⁷⁹ although it's currently under appeal and the ban remains in effect). This reflects the broader Chinese critical minerals investment trend through the retooled Belt and Road Initiative (BRI).

Critical minerals were over-represented in BRI investments in 2023, when minerals and metals investments surged to US\$19.4 billion (+158% compared to 2022).⁸⁰ Accompanying this is significant investment into related sectors, such as grid-scale and EV batteries (Table 2); overall, Indonesia is the single largest beneficiary of those investments.

Table 2: Critical minerals and related firms among the top 10 BRI investors in 2023 (parent companies)

Ranking ^a	Company name	% of total
#1	Contemporary Amperex Tech	15.2
#2	Zijin Mining	10.8
#3	Southern Power Grid	9.3
#4	Zhejiang Huayou Cobalt	8.8
#5	China Molybdenum	5.4
#6	Minmetals	5.1
#9	Baosteel	3.4
#10	GEM	3.3

a = The ranking of the eight companies listed reflects their investment rank within the overall BRI for 2023. Companies without significant investment in critical minerals have been excluded from this table.

Source: Christoph Nedopil, *China Belt and Road Initiative (BRI) investment report 2023*, Griffith University, February 2024, [online](#).

Due to recent Chinese investment, Indonesian nickel and steel production has soared. Indonesian nickel production has increased from 200,000 tonnes in 2016 to an estimated 1.8 million tonnes in 2023.⁸¹ The value of Indonesian stainless-steel production (stainless steel is an alloy containing nickel) increased to US\$30 billion in 2022, or 10 times its value in 2013.⁸² Notably, the vast majority of both commodities is exported directly to China.

Put simply, Indonesia's nickel and steel are cheap and dirty. Its deposits are predominantly low-grade ore, mined after mass land clearing of forest and farmland. Much of it is processed as nickel pig iron, which combines coal, aggregate and nickel ore in a rotary kiln. Emissions to land, air and water are large and lasting. While employment is welcomed by local communities, they also suffer disruption to traditional economic pursuits and livability.⁸³

As a result of nickel overproduction relative to current demand and the associated price collapse, Australian and other international nickel ventures are effectively under siege. The Australian Government held crisis talks with the industry in early 2024. Production from mines and processing plants is being scaled back or ceased, and major players such as BHP are reconsidering participation in the nickel market.⁸⁴

It's also worth noting that there are considerable flow-on effects of diminished domestic nickel production across the domestic critical minerals ecosystem. Halted nickel production will affect sulphuric acid production (a by-product of sulphide nickel smelting) used in processing REEs and other critical minerals. It may also affect Australia's future cobalt production, as cobalt is often found, mined and processed in combination with nickel.

Appendix 3: Uranium production in the US during the Cold War

During World War II, the US built a domestic uranium supply chain to fuel the Manhattan Project. It continued to develop the sector through the years of the Cold War. That included the development of uranium reserves in Moab, Utah. Through a suite of policies, the US Government effectively created a market and a resilient uranium supply chain.

Throughout the Cold War, expanding the nuclear missile program was a critical national-security policy, as the principles of ‘mutually assured destruction’ and ‘massive retaliation’ underpinned the US’s nuclear strategy in the 1950s. Enabling that critical military build-up was the largest government-backed ‘minerals rush’ in history.⁸⁵

Key policies were critical to its success, including 10-year floor prices for uranium to reduce risk, alongside critical infrastructure, roads to support mineral exploration and uranium mills to process the ore.⁸⁶ Government support was critical to de-risking the project and incentivising industry investment.

After the 10-year uranium floor price period that helped establish Moab, the US Government became the major uranium customer as its nuclear stockpile expanded. For critical minerals, governments may be able to replicate this through national mineral stockpiles—with sunset clauses—while demand rapidly scales up in the next few years.

Appendix 4: ‘Friendshoring’—the EU, Hastings Technology and EIS

European industry is exposed to political risks to supply of some minerals from China and Russia, as well as projected overall supply shortfalls in the face of increased demand, principally driven by its energy transition. Projections estimate that the bloc will need 18 times more lithium and five times more cobalt in 2030 than in 2020.⁸⁷ To meet its 2040 clean-energy targets, the EU must invest significantly in new mines, refineries and recycling plants both in Europe and elsewhere.

In May 2024, the EU passed the European Critical Raw Materials Act, which sets targets for raw material reliance by 2030: 10% of the EU’s annual critical minerals sourced from domestic extraction; 40% of the EU’s annual processing to occur within the EU; and 15% of the EU’s annual consumption to come from recycling.⁸⁸

It also sets the explicit goal of reducing supply-chain reliance on a single source to below 65%,⁸⁹ implicitly aiming to reduce reliance on China and politically fragile states such as the DRC. That stipulation sets the scene for ‘friendshoring’ and collaboration, as the EU needs to source from trusted partners and create opportunities for collaboration on projects within Europe.

Australia’s advanced mining sector and expertise, extensive natural reserves, global mining investment footprint (including many operations in the EU) and relationship with the EU should make it a partner of choice. Hastings Technology Metals (an Australian company) and the Estonian Government, via the EIS investment agency, are already exploring the development of a downstream rare-earths processing facility in Estonia. The facility would process REEs mined at Hastings’ Yangibana project in Western Australia and align with the EU’s objectives.⁹⁰ The project would combine Australian expertise with EU economic opportunity and policy objectives. Friendshoring of mine production such as this remains an excellent collaborative opportunity to build resilient, diverse critical minerals supply chains and an integrated international market.

Appendix 5: International investment—ROK, POSCO, KOMIR

Investments by the ROK through KOMIR and Korean steel manufacturer POSCO indicate the significant opportunities that international investment in Australian critical minerals presents. Importantly, it demonstrates the interplay between federal governments (ROK and Australia), subnational governments and industry.

POSCO's Gwangyang lithium hydroxide plant—partially funded by A\$693.4 million in loans from the ROK Government⁹¹—will process spodumene ore mined in Western Australia. The POSCO chemical plant is part of a future battery cathode mega-cluster projected to supply cathode materials needed for 1 million EVs annually.⁹² Secured via offtake agreements, the deal cements demand for the Pilbara Minerals lithium and aims to create a reliable

lithium and battery-materials supply chain for Korean automakers and industry.

The ROK's Korea Mine Rehabilitation and Mineral Resources Corporation (KOMIR) similarly also recently invested A\$4.5 million into lithium exploration in Western Australia.⁹³ There's also an option within the agreement for battery manufacturer LG Energy Solution to purchase KOMIR's 30% stake in the project and up to 70% of produced lithium—potentially guaranteeing demand from the mining operations. KOMIR also signed a memorandum of understanding with the Northern Territory Government in April 2024, signalling their intent to further cooperate on critical minerals trade and investment.

Notes

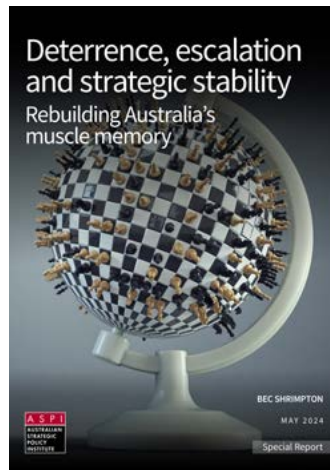
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Acronyms and abbreviations

BRI	Belt and Road Initiative
DISR	Department of Industry, Science and Resources
DRC	Democratic Republic of the Congo
EDR	economically demonstrated reserves
ESG	environmental, social and governance
EU	European Union
EV	electric vehicle
FMIA	Future Made in Australia
GDP	gross domestic product
GWh	gigawatt hour
NGO	non-government organisation
R&D	research and development
RAP	Resourcing Australia's Prosperity
REE	rare earth element
ROK	Republic of Korea
UN	United Nations

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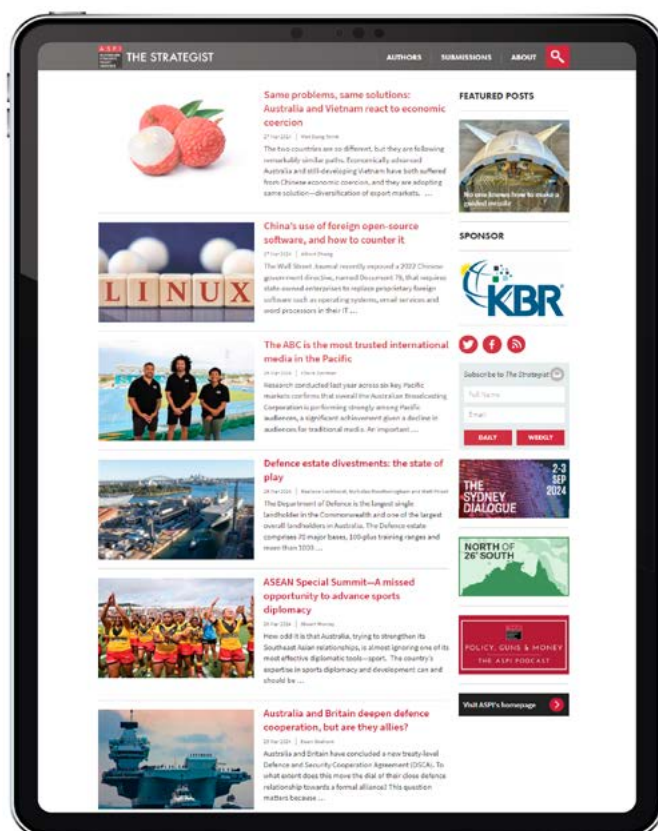


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