



Reclaiming leadership

Australia and the global critical minerals race

IAN SATCHWELL

APRIL 2024

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**NORTHERN AUSTRALIA
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Executive summary

Climate policy, geopolitics and market forces are coalescing to deliver Australia a global leadership opportunity in critical minerals. To grasp that opportunity, Australia needs to utilise its mineral endowment and its mining knowledge and technology and leverage the global footprint of Australian companies to build a global supply chain network. Australia has committed in multiple agreements to work with like-minded nations to achieve this.

How Australia responds will not only determine economic benefits to the nation but will also affect the world's ability to achieve minerals security and the sustainability required for the global energy transition and inclusive economic growth. Will Australia take up a leadership mantle beyond simply being a large producer of critical minerals and apply its expertise, technology, environmental, social and governance credentials and global corporate reach to help other nations contribute to secure and sustainable critical minerals supply chains? Will Australia extend support for its companies to explore for and develop critical minerals deposits wherever they operate, at home and abroad?

The global energy transition and other high-technology applications have increased demand for critical minerals, particularly in countries that have strong complex manufacturing industries. At the same time, the concentration of production of many critical minerals, the dominance of China in supply chains and its actions to restrict supply and influence markets, are disrupting both minerals production and availability.

In response, developed nations have formulated critical minerals strategies and entered into bilateral and multilateral agreements, involving supplier nations and customer nations, to build alternative supply chains that are more diverse, secure and sustainable. Current critical minerals lists and strategies are inconsistent between nations, however, and need to be harmonised. For example, there are only 13 minerals in common identified as critical by Australia and its seven strategic supply chain partners, out of a total of more than 50 that one or more nations have so classified. While all strategies emphasise the security and sustainability of supply chains, there are no common standards for these.

Australia is endowed with rich economic geology, and is an acknowledged leader in mineral production, in minerals governance, and in garnering broad economic benefits from its large mining and processing sector. Consequently, Australia has become a major source of many of the world's critical minerals and a destination for global investment in exploration, mining and processing. Australia's domestic critical minerals sector, measured by exploration investment, reserves and capital expenditure, is the largest of any nation outside China. Canada is a close second.

Australian minerals companies, as well as mining equipment, technology and services (METS) companies, also have a large presence outside Australia, conducting exploration, mining and METS activities in all inhabited continents. They also apply deep knowledge, technology and high standards to their global operations. The operations of those companies form vital components of critical minerals supply chains. Given the huge scale of Australia's domestic minerals industry, the fact that outbound direct investment in mining has reached 53% of the level of inbound investment¹ is impressive testament to the global success of Australian companies.

The world's future demand for critical minerals exceeds the ability of currently dominant producer nations, such as Australia, Canada and China, to supply securely and sustainably. Therefore, many of the strategies and agreements that Australia has entered into go to expanding mine and processing production from other countries, including developing nations, while also assisting them to build governance capacity to better assure supply chains.

Australia has signed 25 agreements with other nations to work with them to develop a network of secure and sustainable critical minerals supply chains. However, the Australian Government has yet to announce how it will contribute to capacity building of mineral-rich developing nations to help them contribute to and benefit from those supply chains. Its current critical minerals strategy sells Australia and its allies short by focusing only on domestic production and outbound supply chains.

In addition to being a dominant and growing supplier, Australia must also address how it contributes to building supply chains from other nations. This is in the interests of its strategic supply chain partners, in the interests of Australian companies, and in Australia's own economic and strategic interests. Australia needs to broaden its critical minerals strategies and activities, implementing what it has committed to, by taking global action. Australia has a strong record in mining governance leadership, assisting other nations to build their minerals sectors and reap the benefits. It can draw on that experience to take the opportunities and meet its obligations.

This report is intended to provide the government with a road map to 'step up' to (re)activate Australia's mineral leadership. It explains why critical minerals are important and outlines Australia's role in critical minerals supply chains. It also outlines key global international agreements and initiatives that Australia has entered into, including bilateral, multilateral and minilateral agreements.

In the next section, the report sets out seven policy recommendations for governments.

Recommendations

1. Harmonise critical minerals criteria, lists and strategies

The critical minerals lists and strategies of Australia's strategic supply chain partners have much in common, but also have significant differences (which at a minimum is confusing for other participants to navigate), have some key inconsistencies, and lead to the fragmentation of efforts to build new, more secure and sustainable supply chains.

***Recommendation:** Strategic supply chain partners should seek to harmonise critical minerals criteria, lists and strategies to create more effective cooperation frameworks and underpin collaboration to develop all stages of supply chains.*

2. Strategic supply chain partners need to enhance collaboration to better integrate supply chains

While critical minerals strategic supply chain partners and supplier nations are well on the way to increasing mining output of many critical minerals, processing capacity remains geographically concentrated in too few nations, notably China, leading to market dominance and heightened risks of supply chain disruption.

***Recommendation:** Strategic supply chain partners should collaborate to facilitate private sector construction and operation of additional processing capacity in their nations and integrate that capacity into supply chains between partners.*

3. Strategic supply chain partners need to develop common sustainability and security standards

Australia's strategic partners share a common objective to build a matrix of more secure and sustainable supply chains for critical minerals, but they have yet to define comprehensive standards against which to assess progress, to implement certification and verification protocols, or to establish market mechanisms that reward private sector supply chain participants for meeting or exceeding benchmarks.

***Recommendation:** Strategic supply chain partners should develop common sustainability and security standards,*

establish auditable certification for partner nations and corporate suppliers based on those standards, building on existing guidelines and standards adopted by nations and the minerals industry, and facilitated by expanded guidelines, technical support and governance capacity-building.

4. The Australian Government should conduct a stocktake of the role of Australian minerals companies' operations overseas to better understand their activities

Leading practice domestic policies and regulations have led to high levels of private sector investment within Australia, which, together with the success of Australian companies overseas, has positioned Australia as the leading nation in global critical minerals exploration, reserves, investment and production, with Canada as a close second. Unlike the Canadian Government, however, the Australian Government has a poor understanding of the reach and activities of Australian minerals companies abroad. Understanding that reach is important because it can be used to better inform how Australia should contribute globally to critical minerals supply chains.

***Recommendation:** While Australia and its subnational jurisdictions must continue to enhance domestic regulation, cost and infrastructure environments to further facilitate critical minerals investment domestically, the Australian Government should also ensure that it has a clear picture of the activities of Australian minerals and METS companies' operations overseas and their factors of success, and formulate strategies to encourage their investment in other nations and contribute to supply chains.*

5. Revise Australia's Critical Minerals Strategy to better incorporate international engagement

In contrast to the strategies of its strategic supply chain partners, Australia's current Critical Minerals Strategy focuses exclusively on domestic production and outbound supply chains, despite Australia agreeing to work globally to build diverse, secure and sustainable supply chains and notwithstanding the global reach of its minerals and METS companies.

Recommendation: *Australia's Critical Minerals Strategy should be revised to reflect the commitments it has made in agreements with other nations, recognise the strategic and commercial rationale for international engagement in capacity building, encourage overseas investment by its companies, and set out strategies and actions for achieving global supply chain objectives.*

6. Australia should add uranium to its Strategic Materials List or Critical Minerals List

Uranium has been identified by the International Energy Agency as essential to the energy transition, alongside critical minerals. Japan, Australia's largest customer for energy materials, and Canada, a major uranium producer, have included uranium in their lists of critical minerals, and the US Department of Energy has assessed it as meeting 'critical' criteria. Australia, which hosts the largest uranium resources of any nation, hasn't given the mineral any special status, despite future demand projected to more than double.

Recommendation: *The Australian Government should add uranium to at least its Strategic Materials List.*

7. Australia should develop a code of conduct and accredit minerals companies that supply the US defence industry

The US has based its assessment of minerals criticality in part on an assumption about the security of supply from Australia under the United States – Australia Reciprocal Security of Supply Arrangement signed in 2011 but not yet implemented by Australia.

Recommendation: *Australia should develop the code of conduct provided for under the US–Australia Security of Supply Arrangement and seek to accredit minerals companies that supply the US defence industry.*

Critical minerals in context

What are critical minerals, critical materials and strategic materials?

Different nations and the European Union (EU) use a mix of related terms to describe minerals and materials that are vital to energy and other technologies, and national security, and for which there's a risk of supply chain disruption. The general criterion for differentiating between 'critical' and 'strategic' is one of supply-chain risk: strategic materials have lower risk. The common definition of critical minerals and materials is neatly summarised by Geoscience Australia:²

A critical mineral is a metallic or non-metallic element that has two characteristics:

1. It is essential for the functioning of our modern technologies, economies or national security.
2. There is a risk that its supply chains could be disrupted.

'Critical minerals' are referred to using that term by the governments of the UK, Canada, Japan, India and Australia, and as 'critical raw materials' by the EU, which also has a list of 'strategic raw materials'. The International Energy Agency (IEA) also uses the term 'critical minerals'. The US Government uses the term 'critical materials' and, as subsets of that, 'critical materials for energy' and 'critical minerals'. Australia's definition of critical minerals, revised in December 2023, introduces a separate category of 'strategic materials', for which supply chains aren't currently vulnerable enough to meet the critical-minerals criteria fully.

Definitions and their application are very similar among nations. Some differences can be seen between those of net supplier and net consumer jurisdictions; for example, Canada and Australia add criteria of domestic production and prospectivity to their definitions.³ Australia's inclusion of nickel in its Critical Minerals List in February 2024 signalled an additional criterion: the need for temporary production support due to global market perturbations threatening the viability of Australian mining and processing and reducing supply chain diversity. Other such market interventions by strategic supply chain partners⁴

may be needed to overcome distortions and the potential for further undesirable supply chain concentration and control.

There's no practical difference between critical minerals and critical materials. Fuel minerals such as uranium, coal and petroleum have generally been excluded from the definitions. Japan recently included uranium in its list, however, and the US Department of Energy has assessed uranium as meeting the 'critical' criteria, but it isn't on the list of critical materials for energy due to legislation proscribing its inclusion. Canada, a major uranium supplier, has included it in its critical minerals list, while the IEA has assessed uranium as key to the global energy transition.

There are some temporal differences in assessments of what materials are critical. For example, the US Government's assessments of criticality⁵ are in the short and medium terms; the UK Government takes a short-term approach,⁶ but potential shortages in the medium term trigger inclusion on a 'watchlist'.

For producer nations such as Canada and Australia, adding the additional criteria (the availability or likely availability of domestic resources of a mineral) is a pragmatic approach. From a producer's perspective, there's little point in classifying a mineral as critical if it's unlikely to be produced in commercial quantities domestically. However, doing so can add to mismatches with consumer nations' classifications of critical minerals.

In the future, some current critical minerals could be removed from this classification, where discoveries are made, forward supply meets demand, other minerals are substituted, demand projections are less than previously thought, source regions are sufficiently diverse and/or risks of supply chain disruption are reduced.

How can supply chains be disrupted?

Supply chains can be disrupted in multiple ways: through natural or human-caused events interrupting production or transport; civil strife or governance upheavals in major producer nations; economic or military coercion; lengthy industrial disputes halting production or transport; major

technical mishaps shutting down production; market manipulation, including deliberate flooding of a market to drive out competitors; and withholding of supply by a producer jurisdiction.

Overconcentration of supply sources can exacerbate risks arising from such occurrences. The IEA has identified supply chain risks arising from production concentration of nickel from Indonesia, cobalt production being dominated by the Democratic Republic of the Congo, and the high proportion of lithium being mined in Australia, for which China dominates processing capacity.⁷

The disruptive impact of a rapid increase in Indonesia's nickel output, enabled by investment from China, combined with production costs well below those of other nations, has resulted in mine closures and possible shutdowns of smelters and refineries in Australia and elsewhere, further concentrating global supply. High local environmental and social impacts in Indonesia, however, raise questions about supply-chain sustainability and future supply-security risks. This could be replicated for other minerals from other mining and/or processing sources.

Import-dependent jurisdictions such as the US and Japan have implemented domestic and international policy responses to reduce the risks and impacts of critical minerals supply disruption. Those responses include enhanced stockpiling to provide supply to manufacturers during short-term disruptions and incentives for companies to diversify supply and re-shore manufacturing away from higher risk locations. Agreements between net producer nations and net consumer nations also seek to reduce disruption risks through enhanced cooperation in supply chains bilaterally and through joint support to resource-rich developing nations to participate in secure and sustainable supply chains. Given current market uncertainties and the high potential for further disruptions, partner nations (producers, processors and consumers) need to do more to strengthen supply chains and build their sustainability.

Current and suggested policy responses of key consumer and producer jurisdictions are discussed in more detail later in this report.

The global web of critical minerals lists

There's some commonality between nations' and groupings' current lists of critical minerals, although they do vary markedly, as Figure 1 illustrates. There are only 13 minerals identified as critical by Australia and all of its seven strategic supply chain partners, out of a total of more than 50 that one or more nations have so classified. Nations and groupings that have strong manufacturing sectors but less local supply (such as the US, Japan and the EU) are net importers of critical minerals, while nations with diverse and rich economic geology and strong mining sectors (such as Australia and South Africa) are net exporters. Canada is both a major producer and a consumer in manufacturing.

In the US, there are two intersecting lists: critical materials for energy, maintained by the Department of Energy (DOE)⁸, and critical minerals, generated by the US Geological Survey (USGS)⁹. Together, they make up a superset of the DOE Critical Materials List comprising 54 materials; rare-earth elements (REEs) and platinum group elements (PGEs) classified as critical are individually identified.

The UK has two lists: critical minerals, comprising 18 minerals and groups, and a watchlist of minerals that are 'deemed to be increasing in criticality' (five minerals).¹⁰

Japan's list under its Economic Security Promotion Act¹¹ includes 34 critical minerals and mineral groups, including uranium.¹²

The Republic of Korea has a list of 33 critical minerals, which overlaps with a list of 10 'strategic critical minerals'.¹³ Critical minerals are required to ensure economic security, while strategic critical minerals are under more intensive management to ensure stable supply chains for high-technology industries.

The EU published its fifth list of 34 'critical raw materials' in 2023.¹⁴ While copper and nickel don't meet the critical raw materials thresholds, they're included as two of nine 'strategic raw materials', along with materials such as manganese and, uniquely, coking coal.

The IEA has issued a list of 37 critical minerals needed for clean energy transitions,¹⁵ and in 2023 published its inaugural *Critical Minerals Market Review*,¹⁶ which contains

detailed analysis of demand and supply for six of them (copper, lithium, nickel, cobalt, graphite and REEs). Other energy-transition minerals assessed in the market review were aluminium, manganese and platinum group minerals. Demand and supply prospects for uranium were also briefly examined. The review examined production from both mining and processing operations.

Canada has 31 minerals on its critical minerals list,¹⁷ including the five minerals on the Australian Strategic Materials List. Potash and uranium, which aren't in either of Australia's lists, are included in Canada's list. Canada prioritises the development of six of its critical minerals based on demand and impact on economic growth.

A new Critical Minerals List was issued by Australia in December 2023,¹⁸ along with the new Strategic Materials List. The 2023 Critical Minerals List has been modestly expanded by five minerals to 30, with one deletion (of helium). Nickel was shifted from the Strategic Materials List to the Critical Minerals List in February 2024 in response to a price slump,¹⁹ driven by low-cost Indonesian supply, which has led to a reduction of Australian mining and processing capacity, threatening supply chain diversity. Australia's lists now align better with those of its supply chain partners, but there remain 16 minerals listed by various supply chain partners that aren't on either of Australia's lists (see Figure 1).

There's a need for greater alignment of critical minerals lists between nations to reduce complexity, improve consistency and provide a basis for the harmonisation of critical minerals strategies.

Uranium is also 'critical'

Uranium has been identified alongside critical minerals as essential to the global energy transition. At the 2023 COP28 climate change conference, 22 nations pledged to triple nuclear capacity by 2033.²⁰ The IEA included an assessment of uranium demand and supply in its *Critical Minerals Market Review 2023*, which is an indication of uranium's criticality to future energy supply. The US DOE assessed uranium for criticality in 2023 and found that it met the threshold for inclusion on the list of critical materials for energy.²¹ The DOE didn't designate uranium as a critical material 'at this time', however, as the Energy Act of 2020 restricts listing to 'non-fuel' materials.

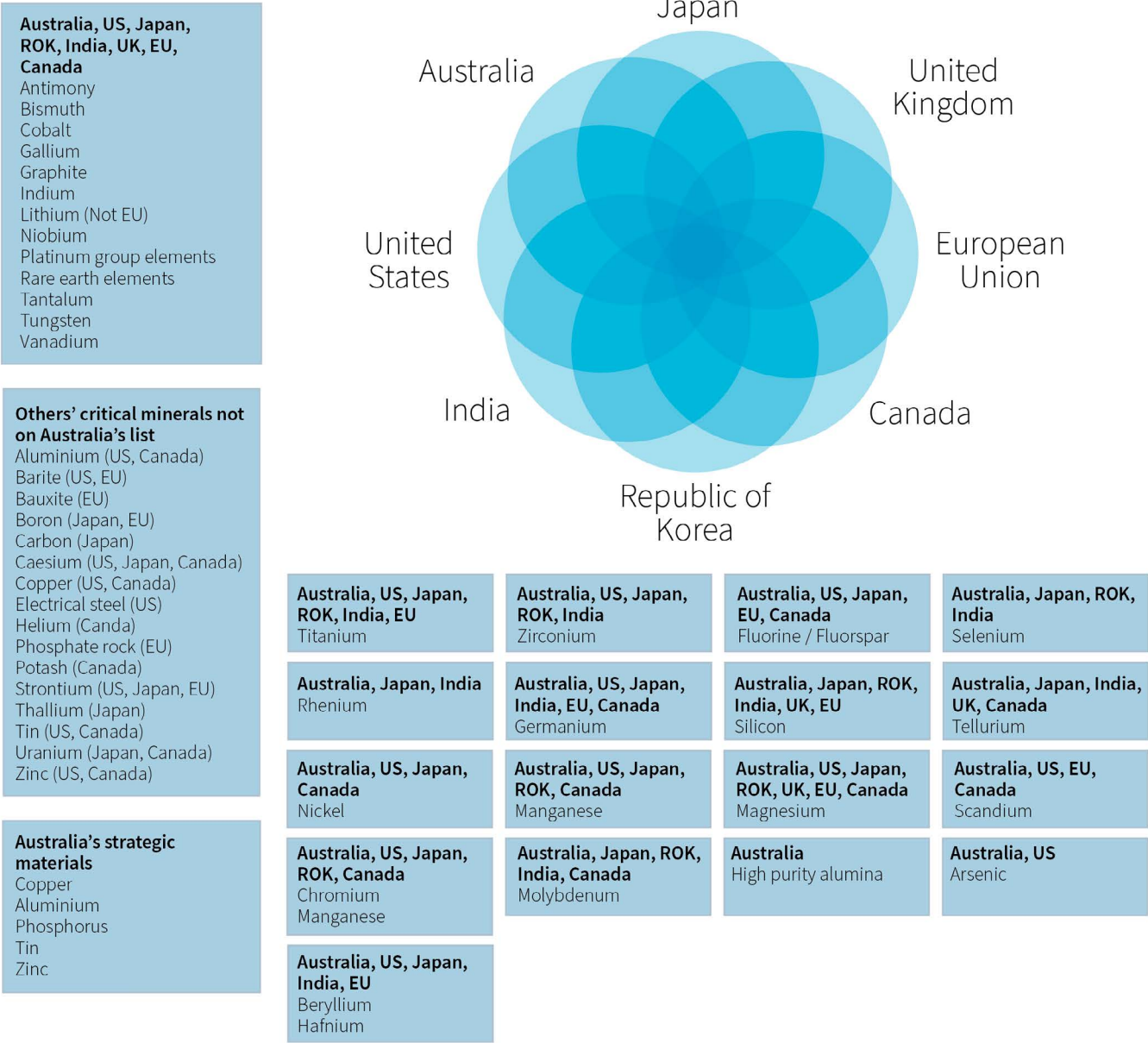
That position may change as looming US restrictions on imports from Russia are implemented.

Japan included uranium on its list of 'important minerals' in January 2024²² in response to projected increased demand from restarting nuclear power stations and concerns about supply, particularly from Russia.

Canada, as a major uranium producer and the largest supplier to the US, has included uranium in its critical minerals list.

Accordingly, Australia, as a large uranium supplier with high potential for expanded production, should consider adding uranium at least to its Strategic Materials List, particularly as the volume of Australia's uranium exports to the US more than doubled during 2023; total export value to all customers is forecast to double in the five years to 2028–29.²³

Figure 1: Critical minerals/materials of Australia’s current and pending supply chain partners



Note: Agreement with EU under discussion.
Source: National and European Commission critical-minerals lists, accessed in March 2024.

Critical minerals strategies

Major consumer nations and producer nations each have critical minerals strategies, as do the EU and the IEA. The strategies have much in common, but some significant differences. For net consumer nations, including those within the EU, strategies aim to assure supply through comprehensive policies and actions, within and between jurisdictions and along supply chains. Table 1 summarises and compares the key components of strategies of Australia²⁴ and its main partners in supply chains, Canada²⁵, the US²⁶, Japan²⁷, the Republic of Korea²⁸, the UK²⁹, the EU³⁰ and the International Energy Agency³¹.

These strategies generally seek to:

- grow and strengthen internal critical minerals supply chains through exploration and resources development by the private sector, and by building downstream processing and manufacturing capabilities of industry
- diversify sources of critical minerals through international investment, trade and cooperation with like-minded nations
- improve understanding of and access to critical minerals resources through supply chain risk mitigation, improved collection of geological data, greater recycling and the use of unconventional resources, such as historical mine tailings
- ensure high levels of supply chain sustainability, with sound environmental, social, economic outcomes, particularly in developing economies.

Strategies of net producer nations such as Canada and Australia focus more on policies and actions to expand and secure supply chains to other nations, maximise national

and local economic benefits, grow critical minerals workforces, and engage, share benefits and advance reconciliation with indigenous peoples.³² Canada's strategy also includes strengthening its global leadership in sustainable mining through extensive cooperation with others on collective action to support the global energy transition. Australia, however, has a domestically focused strategy: international engagement is targeted at securing offtake of mineral products by customers and attracting investment, and sustainability actions are listed under 'promoting Australia as a world leader in ESG (environmental, social and governance) performance'.

With the exception of Australia's, all strategies examined include objectives to develop *networks* of secure and sustainable supply chains from producer nations, including emerging producers, to customer nations, sometimes via processor nations. Australia's strategy, while including an objective to 'create diverse, resilient and sustainable supply chains through strong and secure international partnerships'³³, frames it in the context of outbound supply from Australia to customers.

Strong engagement with the private sector is necessary for the success of strategies in assuring the supply of critical minerals to manufacturers and in achieving greater investment in exploration, mining and processing. Strategies vary in their focus on industry engagement, however. In Japan, Korea and the US, the links between those nations' governments and industries are longstanding, strong and key to their global success in manufacturing. Their strategies are driven primarily by the imperative to maintain the supply of critical minerals for

Table 1: Summary comparison of key elements of critical minerals strategies

Country/grouping	Growing domestic supply	Diversified international supply chain network	Recycling	Supply chain sustainability	Industry engagement internationally
Australia	Yes	From Australia only	Yes	Yes – domestic only	Domestic only
Canada	Yes	Yes	Yes	Yes	Yes
US	Yes	Yes	Yes	Yes	Yes
Japan	Yes (+ stockpiles)	Yes	Yes	No	Yes
Korea	Yes	Yes	Yes	No	Yes
UK	Yes	Yes	Yes	Yes	Yes
European Union	Yes	Yes	Yes	Yes	Yes
International Energy Agency	NA	Yes	Yes	Yes	Yes

their domestic industries. Linkages with industry in the UK and EU appear less intimate, but the imperative for secure supply remains the key focus of their strategies.

The US gives effect to its strategy through incentives enabled by its Inflation Reduction Act.³⁴ The Act authorises a US\$40 billion loan facility ‘for innovative clean energy technologies, including renewable energy systems, carbon capture, nuclear energy, and critical minerals processing, manufacturing, and recycling’. This facility and associated financing support supply chain elements both in the US and abroad for US-bound critical minerals.³⁵

Canada, as a large and leading mining nation, has sought to strengthen its strategies to boost domestic exploration and mining investment, driven in part by effective competition from Australia in recent years. Closer engagement of companies is inherent to these strategies. Canada has also long recognised its role as a global mining investor nation and in its minerals action plan and critical minerals strategy has sought to strengthen its leadership, in partnership with Canada-based companies and the Canadian mining industry. Canada maintains an up-to-date database of activities of Canadian companies both at home and abroad to facilitate that engagement.³⁶

The IEA has focused on providing information and guidance to government and industry through its *Critical Minerals Policy Tracker*,³⁷ which covers more than 35 countries and 450 policies, and its December 2023 report, *Sustainable and responsible critical mineral supply chains: guidance for policy makers*.³⁸ The report builds on the IEA positions that ‘critical mineral supply chains cannot be truly secure, reliable and resilient unless they are also sustainable and responsible’ and that addressing ESG risks in the minerals supply chain both protects people, communities and the environment and reinforces security of supply. It emphasises that governments and companies both have a role in driving improvements in performance and outcomes.

Strategic supply chain partners, however, have yet to adopt common standards for security and sustainability and a process for certification and compliance.

The Australian Government’s current approach is domestic in focus. It lacks a contemporary and comprehensive strategy for global supply chain development, while the industry engagement components of its 2023 Critical

Minerals Strategy focus on the development of individual projects in Australia, improved project approval processes and infrastructure, and loan and grant funding support for local projects. The expanded A\$4 billion Critical Minerals Facility,³⁹ administered by Export Finance Australia, has so far been applied only to projects within Australia, although Australian minerals investors in Southeast Asia may be able to access the new \$2 billion Southeast Asia investment financing facility,⁴⁰ which is designed to facilitate investment in the region by Australian companies.

The Australian approach fails to acknowledge, much less leverage, the global investment footprint of Australian companies and their crucial role in critical minerals supply chains. It’s also at odds with Australia’s commitments under multiple critical minerals agreements, which are highlighted in later discussion.

Critical minerals demand and supply

The USGS has been warning for some years about the import reliance of the US for the supply of key minerals.⁴¹ It found that, in 2023, the US was reliant on imports for more than one-half of non-fuel minerals consumption, and 100% import reliant for 12 of the 50 critical minerals that the USGS has listed. That doesn’t necessarily mean that US geology is bereft of certain minerals, but that in many cases market signals have been inadequate to attract private-sector investment in exploration for and the development of new-critical mineral resources and the construction of processing capacity.

The IEA first projected demand in 2021 in a special report titled *The role of critical minerals in clean energy transitions*.⁴² It found that supply needed to increase markedly, and that supply chains should be more diverse to reduce risks of disruption. It concluded that reaching the Paris Agreement climate-stabilisation target would generate a quadrupling of mineral requirements for clean energy technologies.⁴³ A faster transition to meet global net-zero by 2025 would lift demand by six times.

In December 2023, the IEA updated its projections in its *Critical minerals market review*.⁴⁴ The report found that:

- demand for key energy-transition minerals has doubled over five years, and demand for some minerals has increased more

- investment in critical minerals development increased by 30% in 2022, following a 20% increase in 2021
- exploration spending for critical minerals rose by 20% in 2022, led by exploration in Canada and Australia.

Despite strong investment in new supply, the IEA noted growing recognition that policy interventions are needed to ensure adequate and sustainable supplies of critical minerals. This means that, left on their own, and without price signals and incentives, minerals markets might not respond to the need for more diverse and secure supplies from new mines and processing plants. Market volatility, in some cases caused by actions of dominant suppliers, might further dampen investor interest, again requiring intervention by governments in the form of incentives and other measures.

Building secure and sustainable supply chains

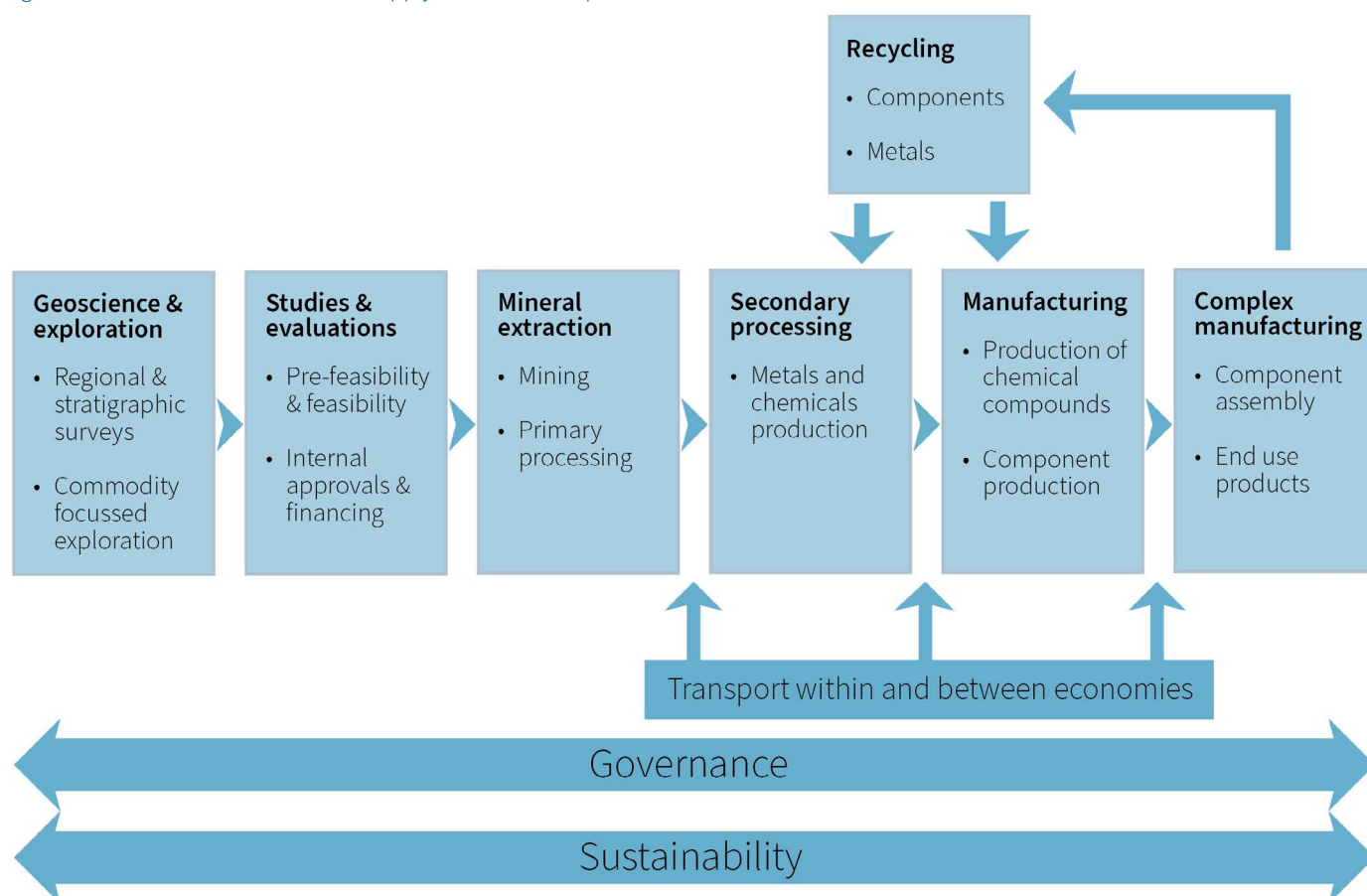
The supply chain for critical minerals is illustrated in Figure 2. It commences with strong public geoscience, such as government-sponsored regional mapping, geochemical

and geophysical surveys, assessments of historical drill cores and packaging of information by governments to provide to exploration companies. Commodity-focused exploration is generally conducted by expert teams from large, medium-sized and small companies using a range of survey techniques to identify potential mineral targets and culminates in drilling. If a resource is identified, then prefeasibility and feasibility assessments are conducted to confirm commercial reserves, followed by detailed mine planning and applications to government(s) for mining licences, environmental approvals and in some cases export permits.

The time from the discovery of a mineral deposit to the opening of a mine can be 10 to 20 years or longer; the average in Australia is 15 years,⁴⁵ although some smaller deposits may be developed more rapidly.

The mining process can occur underground, in open-cut pits, or in some cases by *in situ* leaching of target minerals. Primary processing of ore is generally done on site to minimise transport costs and enable the placement of waste rock and tailings in secure landforms. Secondary

Figure 2: Illustrative critical-minerals supply chain and components



Source: Adapted from Canadian Critical Minerals Strategy.

processing, generally resulting in the production of metal or an intermediate product, is often undertaken in a specialised plant away from the mine site and may use output from several mines. Sometimes, this is a two-stage process conducted in two different processing plants, such as with aluminium and sulphide nickel.

The resulting metal or chemical product is then transported to a manufacturing plant where it's turned into components or refined chemicals for use in complex manufacturing, such as the production of batteries or vehicles.

Recycling of waste from mineral processing and manufactured goods at the end of their economic lives reduces input costs and waste streams for disposal. In some cases, tailings (finely ground waste following primary processing) from historical mining may be reprocessed to extract new in-demand minerals.

Transport between steps is an integral part of the supply chain and usually involves international shipment at one or more stages.

Leading practice and secure and sustainable supply chains are underpinned by sound governance and strong sustainability frameworks encompassing economic, social and environmental outcomes.

There are obvious advantages in having vertically integrated supply chains and industry clusters in one country or adjacent nations. It reduces supply chain risks, particularly those stemming from geopolitical interventions, enhances self-sufficiency and potentially reduces supply chain costs. In nations with domestic resource potential for critical minerals, such as the US, and in Europe, developing own-source supply chains from mining to processing to end-use is a priority. The critical minerals strategies of the US and EU therefore focus first on domestic sourcing of minerals for use in local manufacturing. They also emphasise the building of processing and technical capacity to reduce reliance on others. Where minerals can't be sourced in adequate quantities, the strategies seek to develop secure and sustainable supply chains with allied nations.

For critical minerals, well-functioning supply chains are particularly important to mitigate risks of disruption. Consumer nations therefore first seek supply from nations such as Canada and Australia, where minerals production

is well governed. Supply chains that are subject to poor governance or poor outcomes for the environment, communities, regions and nations are inherently more at risk. That's why the critical minerals strategies of several consumer nations and the EU include capacity building for developing nations that are existing suppliers or have high potential to supply. Many of the multilateral and bilateral critical minerals agreements to which Australia is a party also include capacity-building components that seek to transfer good governance, technology and ESG practices to developing nations and to promote their participation in supply chains.

Australia's role in critical minerals supply chains

Australian-based companies are major investors in exploration, mining and processing of critical minerals around the world. Figure 3 shows the location and stage of all critical minerals exploration properties and production facilities in Australia, operated by companies based either in Australia or overseas. Figure 4 shows the location of critical minerals exploration properties and mining and processing projects operated by Australian companies globally.

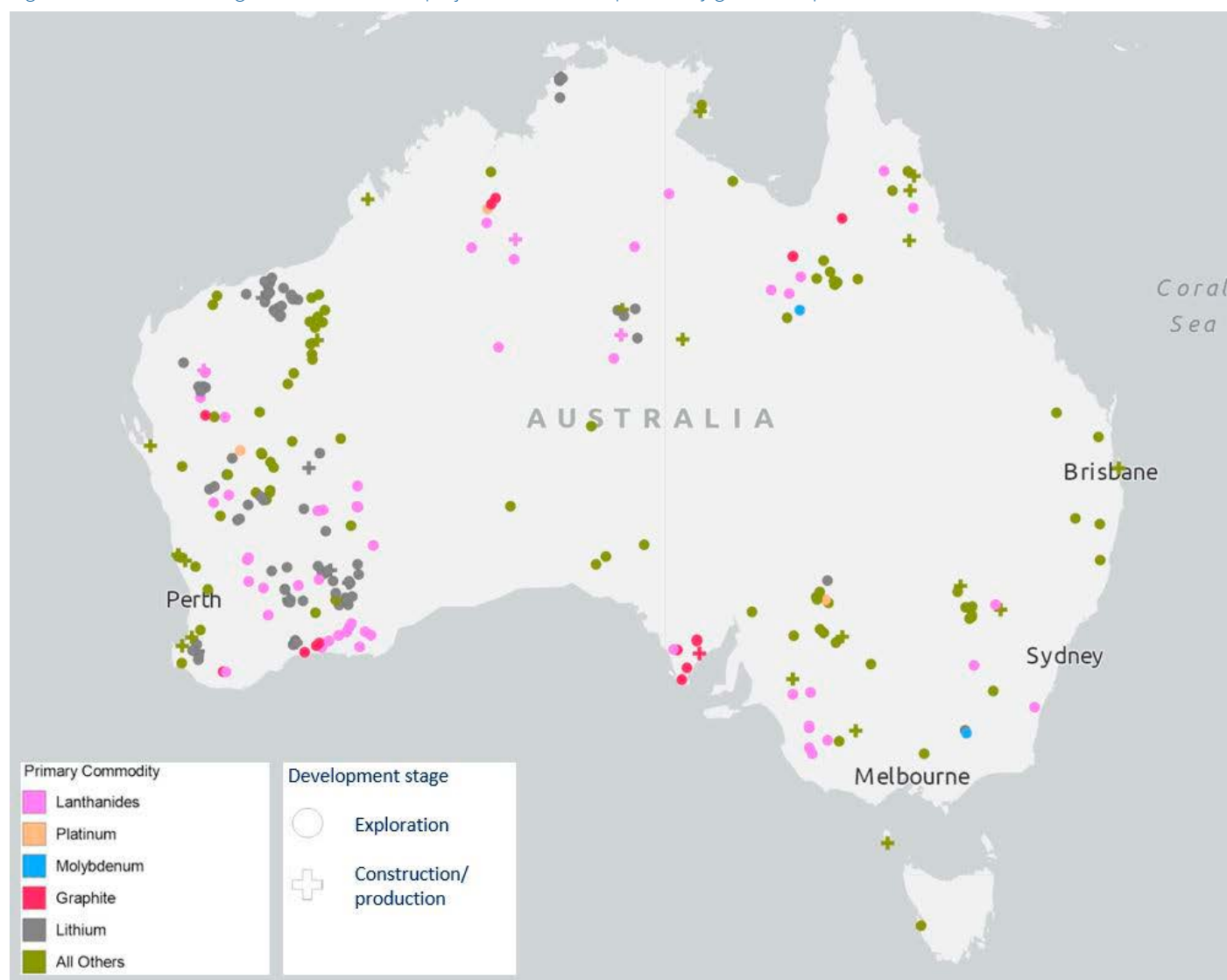
A large critical minerals producer

Australia's diverse geology, experience, skills and capital markets have combined to make it one of the world's largest destinations for minerals investment⁴⁶ and a

major producer and exporter of critical minerals. Australia has a large, well-developed exploration and mining industry, limited secondary minerals processing and a small complex manufacturing industry. As an advanced economy, however, Australia consumes large amounts of critical minerals in defence equipment, manufactured goods and agricultural inputs.

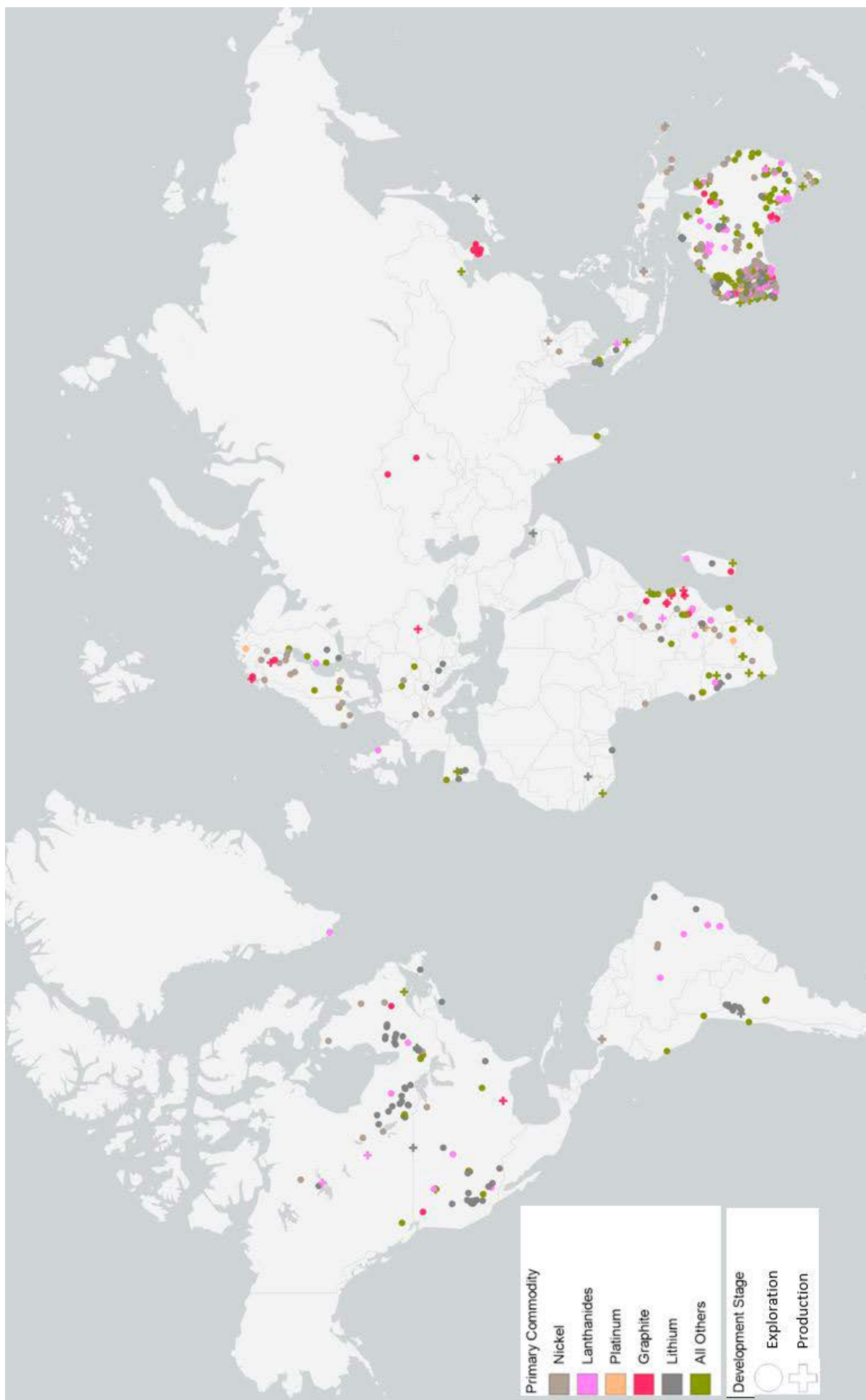
Australia's domestic critical minerals sector, measured by exploration investment, reserves and capital expenditure, is the largest of any nation other than China.⁴⁷ Canada is a close second. Analysis of data drawn from the S&P Global Market Intelligence database,⁴⁸ accessed through The University of Queensland, shows that mining companies in Australia⁴⁹ producing critical minerals⁵⁰ as primary outputs

Figure 3: Location and stage of critical minerals projects in Australia operated by global companies



Source: S&P Global Market Intelligence / The University of Queensland.

Figure 4: Location and stage of global critical minerals projects operated by Australian companies



Source: S&P Global Market Intelligence / The University of Queensland.

operate 54 mines and processing plants. An additional 28 operations produce critical minerals as secondary products. There are currently 457 exploration projects in Australia targeting critical minerals, and exploration investment in 2023 totalled US\$342 million or 18% of global exploration budgets for critical minerals. However, that’s only 30% of the global critical minerals exploration spend of Australian companies.

Australia’s exports of the key critical minerals spodumene (lithium) and nickel in 2022–23 were valued at A\$26 billion, although those exports are projected by the Department of Industry, Science and Resources to be as much as 50% less in 2028–29 due to falling market prices resulting from a combination of lower-than-expected demand and higher global production.⁵¹

A major global investor

Exploration, mining and processing

As well as Australia being a leading nation in critical minerals exploration, investment and output, Australian companies collectively are also among the world’s largest investors in minerals exploration and production globally.⁵² Companies from Australia, together with

companies from Canada, dominate global exploration, both for critical minerals and for all other minerals.

Table 2 provides indicative relative metrics of the Australian and Canadian global footprints for all minerals and coal, and for critical minerals. While Canada leads Australia in the size of its companies’ overall international mining footprint, Australia heads Canada in critical minerals activity.

Table 3 provides a comparison of the domestic and international profiles of Australian companies in critical minerals; overseas exploration expenditure in 2023 was more than twice that in Australia.

Mining equipment, technology and services

Both Australia and Canada also host large METS sectors, which have developed to service the domestic mining industry and are now also major exporters and overseas investors. The Australian METS sector is a vital enabler of critical minerals exploration, mining and processing at home and abroad. It also generates additional value for Australia through its domestic and export earnings, including from operations supporting critical minerals activities.

Table 2: Exploration and mining leaders: comparison of global footprints of Australian, Canadian and rest-of-world companies

	All minerals and coal			Critical minerals		
	Australian companies	Canadian companies	Rest-of-world companies	Australian companies	Canadian companies	Rest-of-world companies
Exploration properties (number)	2,407	3,986	2,458	595	552	362
Global exploration investment 2023 (US\$)	\$3,547 m	\$4,850 m	\$4367 m	\$1,081 m	\$431 m	\$395 m
Global mining and processing projects (number)	549	525	5,612	112	42	597
Capital investment to end 2023 (US\$)	\$566 b	\$803 b	\$1,477 b	\$107 b	\$107 b	\$145 b
Reserves value (US\$)	\$6,691 b	\$5,892 b	\$50,815 b	\$895 b	\$590 b	\$6,856 b

Note: Critical minerals exploration data is for cobalt, lithium, nickel, platinum group metals and rare earth elements.
Source: S&P Global Market Intelligence / The University of Queensland.

Table 3: Comparing domestic and overseas critical minerals interests of Australian companies

	In Australia	Overseas	Total
Exploration properties (number)	371	226	597
Exploration budgets 2023 (US\$)	\$342 m	\$739 m	\$1,081 m
Mining and processing projects (number)	56	53	109
Capital investment to end 2023 (US\$)	\$65 b	\$42 b	\$107 b
Reserves value (US\$)	\$597 b	\$298 b	\$895 b

Note: Critical minerals exploration data is for cobalt, lithium, nickel, platinum group metals and rare earth elements.
Source: S&P Global Market Intelligence / The University of Queensland.

The annual global revenue of Australian-based METS providers from the minerals sector was about A\$65 million in 2020, according to an industry survey by its association, Austmine.⁵³ The proportion of Australian METS firms supplying goods and services to the global critical minerals sector increased from 34% in 2015 to 47% in 2020. Some 65% of METS companies exported goods and services, while 50% of METS companies had invested in overseas operations.

A leader in mining governance

Australia has long been acknowledged as a global leader in mining governance. The Australian mining industry led the world in issuing the first *Code for Environmental Management* in 1997, which was mandated for all members of the Minerals Council of Australia (MCA) wherever they operated. Core elements of that code were incorporated into *Enduring Value—the Australian minerals industry framework for sustainable development* in 2005. The MCA has since adopted the international *Towards Sustainable Mining* ESG accountability framework for companies,⁵⁴ originally developed by the Mining Association of Canada.⁵⁵

Major Australian (and Canadian) mining companies have also endorsed the 10 *Mining Principles* of the International Council on Mining and Metals, which cover ethical business, decision-making, human rights, risk management, health and safety, environmental performance, conservation of biodiversity, responsible production, social performance, and stakeholder engagement. The Mining Principles, launched in 2003, were most recently updated in 2022.

In a combined government–industry–university effort, the Australian Government published an extensive series of *Leading practice handbooks for sustainable mining*⁵⁶ between the late 1990s and early 2000s. They remain the world’s most comprehensive public guidelines for the sustainable management of the environmental and social impacts of mining.

In 2011, the Australian Government launched the *Mining for Development* initiative⁵⁷ in response to requests from resource-rich developing nations for advice and assistance in building governance capacity to host mining well and do well from mining. This Australian aid program was the largest mining governance capacity-building project

of any nation at the time. While mining-focused official development assistance is now much contracted along with the overall Australian aid program, some activities remain in the Pacific, Asia and Africa.⁵⁸

Canada’s current minerals-governance capacity-building programs are led by the 84-nation Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development (IGF),⁵⁹ which is co-sponsored by the Netherlands. Australia isn’t a member of the IGF.

In 2013, the McKinsey Global Institute assessed Australia as ranking highly across six elements of the resources value chain, which it identified as institutions and governance; infrastructure; fiscal policy and competitiveness; local content development; spending the windfall; and economic development.⁶⁰

The Fraser Institute Annual Survey of Mining Companies consistently ranks several (if not all) of Australia’s states and the Northern Territory as being near the top for investment attractiveness globally, based on assessments by exploration and mining companies of geological prospectivity and ‘policy potential’.⁶¹

Australia’s performance in conducting mining competitively and responsibly, reaping the economic benefits of resources development over decades, and continually improving regulatory, commercial and ESG settings has not only provided a leading example for other nations to follow, but has also helped to lift the status of Australian exploration and mining companies around the world.

The ESG performance of the Australian mining industry is a key reason why nations and groupings have sought to conclude critical minerals agreements with Australia. Not only are they seeking access to its domestic mineral resources and production, but they also wish to leverage the ESG performance of Australian companies and tap the minerals-governance capacity-building experience of government and institutions. Many of the agreements include commitments to cooperate on building minerals governance in resource-rich developing nations.

Global critical minerals markets have yet to price in high ESG performance of supply chains originating in or passing through Australia (and other nations, such as Canada), despite net customer nations such as the US and EU nations committing to fostering sustainable as

well as secure supply chains and despite their objectives to diversify supply sources. It remains to be seen whether agreements to develop ‘secure and sustainable supply chains’ and representations by the Australian Government will result in any preference for Australian-produced critical minerals that allows for higher prices, rather than from producers with lower ESG performance.

Nickel production from Indonesia potentially driving down Australian production is a case in point. The combination of investment and technology from China, the Indonesian Government’s raw materials export ban and lower costs than other producer nations have driven a rapid expansion of nickel mining and processing in Indonesia, with associated economic gains, but also with serious environmental impacts and community disruption.

Success factors for Australia

Australia’s endowment of rich and diverse economic geology, including large deposits of many critical minerals, have delivered it huge *comparative* advantages. Turning those into *competitive* advantages, however, has taken sustained and largely cooperative effort and innovation by governments, industry, service providers and workforces.

Australia’s 60 years of modern mining has been strongly supported by governments and international investors. The Australian mining industry has developed world-leading skills, knowledge and technology that enable mineral discovery, mine and processing plant development, efficient mining and processing operations, sustainable economic, environmental and social impacts, and continuous improvement of all aspects of performance. The flow of financial and economic benefits has helped to build broad community understanding and support for mining.

Other factors in Australia’s success in minerals development at home include:⁶²

- the generation of world-leading public geoscience data by governments to attract private-sector investment, the provision of targeted incentives such as financial support for stratigraphic drilling to understand deep geology, and infrastructure to enable development in remote regions
- governments continually seeking to improve regulation and approval processes, with a particular focus on

coordination between the federal and subnational governments

- governments and industry applying sophisticated exploration technologies to understand geology and discover minerals in a variety of settings, including deposits buried under overlying cover
- the mining industry’s ability to operate successfully in remote, frontier environments and on deposits that are highly complex in terms of geologies, infrastructure, policies and regulations, environments, and cultural and social settings
- overall high standards of environmental management and community engagement, despite some serious mishaps that have led to changes to industry standards and government regulation
- an ecosystem of small, mid-tier and large exploration and mining companies, service providers and associated financial institutions with differentiated but synergistic skill sets and risk appetites and the ability both to be nimble to take advantage of changing market opportunities for minerals and to be patient in development to meet market windows
- industry clusters in several cities that bring together all the required skills to discover and develop mineral resources, including skills in geology, metallurgy, mining engineering, environmental and social management, government relations, law and finance
- a strong, diverse and innovative METS sector that provides the goods and services to enable industry operations and performance.

Those capabilities have led to great success in attracting exploration and mining investment to Australia. They’ve also equipped Australian companies to expand their geographical reach and grow their investments to be among the leaders in exploration and development across all inhabited continents. Increasingly, those companies are applying their capabilities to exploring for and developing critical minerals in Australia and overseas, in both new minerals provinces and non-traditional geological terranes.

The 2022 stock of inbound foreign direct investment (FDI) in mining⁶³ in Australia was the largest of any industry sector at A\$359.3 billion or 32% of all inbound FDI.⁶⁴ The fact that *outbound* FDI in mining, at A\$191 billion, has reached 53% of the level of inbound mining FDI is

testament to the success of Australian mining companies around the world. Australian companies play a key role in the development of resources, the economies of host nations, and the production of mineral and energy resources demanded by global markets.

Benefits to Australia and supply chain partners

Value for Australia

The leading role of Australian companies in mining and processing critical minerals at home and abroad delivers strong flows of benefits to Australia, host nations for Australian investment, and customer nations and regions.

As a fast-growing subsector of the highly successful Australian minerals industry, expanded critical minerals production and processing will enhance returns to host states and the Northern Territory through royalties, taxes, employment and other economic engagement. National benefits include additional corporate and personal taxes, goods and services tax generated by additional economic activity, and the impact of exports on the balance of trade.

There are also strong returns from further positioning Australia as a strategically critical partner for customer nations, including its allies.

While estimated returns to Australia generated by critical minerals activities on their own aren't available, returns from the wider mining industry provide some impressive benchmarks. The MCA reports that, in the decade to 2022, the industry paid \$252 billion in mining wages, \$143 billion in company taxes and \$112 billion in royalties, contributed \$270 billion in average annual exports (69% of national export revenue) and generated 10% of GDP and 21% of the economy's growth.⁶⁵

Overseas mining activities by Australian companies are also important to the Australian economy in multiple ways. Other locations provide alternative and additional destinations to crowded Australian exploration tenement areas for Australian companies to deploy their expertise, technology and capital. Activities of Australian explorers, miners and processors abroad provide important vectors for the METS sector to export and to establish business operations overseas. Mining around the world returns dividends to Australian shareholders; for example

\$1.7 billion from minerals and energy companies' overseas affiliates in 2018–19 (according to the latest available data).⁶⁶

Production by Australian companies from mines both in Australia and overseas provides opportunities for processing in Australia, adding value to companies and the Australian economy, and supply chain assurance for customers. One example is a graphite processing project in Western Australia that's been financially supported by the Australian Government. It will source its raw material from a mine operated by the same company in Tanzania. The Australian Government isn't providing direct financial support to the Tanzanian mining operation, however, and so far hasn't restarted a program to assist the Tanzanian Government, or governments of other resource-rich African nations, with capacity building in minerals governance.

It's in Australia's interests to support resources-rich nations, particularly developing countries, in critical minerals development and consequent accelerated economic growth. Neither Australia on its own, nor Australia plus Canada, can supply the full range or volumes of critical minerals needed by strategic supply chain partners. The resources of other nations are needed as well, and many of them are less developed than Australia and Canada; even some developed European nations require greater technical capacity, having lost expertise in exploration and mining over recent decades.

The global footprint of Australian companies, their performance and reputation, together with Australia's reputation as a leader in sustainable mining, provide Australia with leverage to contribute to high standards of governance and industry performance along supply chains. They also provide Australia-linked companies with opportunities to gain preferred investor or supplier status and be acknowledged by supply chain partners as leading contributors to building a global network of secure and sustainable supply chains.

In turn, that will help to reinforce Australia's primacy in critical minerals supply chains, its role as a strategic partner, and the value it derives.

Value to producer nations

Resource-endowed nations hosting capable mining and METS companies are able to develop new and

fast-to-market sources of economic activity and revenue. Responsible minerals development, underpinned by sound governance, provides one of the fastest and highest impact pathways to revenue and economic growth, particularly for less developed countries. Demand for critical minerals adds to the potential.

As noted, Australia's reputation for high standards of governance leading to value capture means that other nations look to Australia for leadership in all aspects of the minerals value chain.

Customer nations and their companies—and the customers for their manufactured goods—demand high standards of governance from their suppliers and sustainability from governments and the private sector throughout supply chains. Furthermore, customers want, indeed need, to be assured that supply chains are secure so that supplies of critical minerals and intermediate and final products are reliable and timely.

Supplier and potential supplier nations of critical minerals therefore have both the opportunity and the imperative to build their governance capability to attract investment in critical minerals exploration, production and processing and to deliver into secure and sustainable supply chains. They need assistance, however, and Australia and its strategic partners have committed to provide such support.

Value to customer nations

Australia is an essential participant in global critical minerals supply chains, as, without its production, the world will experience shortfalls in the supply of several minerals. The supply chain agreements concluded with Australia by customer nations and groupings provide confirmation of its role.

As the IEA has pointed out, however, additional supply sources are needed to both bolster production and underpin more diverse and robust supply chains.

Several of the multiple agreements to which Australia and its partners have committed provide for support for the development of a network of secure, sustainable, multi-node supply chains involving developed and developing producing countries, potential intermediate processing in other nations and use in manufacturing by net consumer nations.

Developing-country producer nations may be at different stages in mining governance and sustainability, so support arrangements need to be tailored to their circumstances. Australia's world-leading mining performance at home, plus the global footprint of its minerals companies and its record in international capacity-building in minerals governance, means that Australia can deliver value to customer nations and groupings by taking a leadership role to support minerals-rich developing nations to contribute to supply chains.

International agreements and initiatives

Australia's engagement in critical minerals processes

The Australian Government and associated institutions are party to 25 international agreements and initiatives on critical minerals and related cooperation, comprising 13 bilateral engagements (including five with the US) and 12 processes involving multiple nations. The Australian Government is negotiating a 26th agreement, with the European Union. The number of Australia's international engagements on critical minerals is by far the highest of any nation.⁶⁷

Lists of the agreements and initiatives are set out below. Figure 5 maps the agreements and their linkages.

Most agreements are aimed at diversifying critical minerals supply chains and enhancing their security and sustainability. Some agreements and initiatives are multilateral, involving large numbers of countries, some are so-called 'minilateral', involving small groups of countries, and some are bilateral. While many of the agreements and processes aren't legally binding, Australia's accession to them signifies commitment to prescribed actions.

Twelve of the agreements explicitly provide for cooperation to build diverse networks of supply chains involving both signatory and non-signatory countries. They each envision signatory countries working between themselves and with other nations, both developed and developing. Other Australian commitments go to cooperation with other nations to secure bilateral supply chains and collaborate on research and development (R&D) and technology exchange. The undertakings by Australia form vital parts of its global role in critical minerals supply chains and are highly complementary to the footprint of Australian companies involved in those chains.

Bilateral agreements

1. Australia – United States Climate, Critical Minerals and Clean Energy Transformation Compact and Statement of Intent
2. United States – Australia Reciprocal Security of Supply Arrangement
3. Australia – United States Strategic Commercial Dialogue
4. Australia – United States Net Zero Technology Acceleration Partnership
5. Australia – United States Energy Security Dialogue
6. Australia and United Kingdom Critical Minerals Statement of Intent
7. India – Australia Critical Minerals Investment Partnership
8. Australia – Republic of Korea Memorandum of Understanding on Cooperation in Critical Mineral Supply Chains
9. Japan – Australia Critical Minerals Partnership
10. Australia – France Strategic Dialogue on Critical Minerals
11. Australia – Germany Joint Declaration of Intent
12. Indonesia – Australia cooperation on critical minerals supply chains
13. Joint Statement by Canada and Australia on Cooperation on Critical Minerals.

The Critical Minerals Office has indicated that Australia is working closely with the EU to establish a bilateral Strategic Critical Minerals Partnership.

Multilateral and minilateral agreements and processes

1. Minerals Security Partnership (US-led)
2. Sustainable Critical Minerals Alliance (Canada-led)
3. IEA Critical Minerals and Clean Energy Initiatives
4. Quadrilateral Security Dialogue (Quad) Clean Energy Supply Chains pillar
5. Conference on Critical Materials and Minerals (Japan, US, EU, Australia, Canada)
6. Strategic Advisory Group on Critical Minerals in the International Organization for Standardization (ISO)
7. Energy Resource Governance Initiative (Australia, Botswana, Canada, Peru and the US)
8. Indo-Pacific Economic Framework Critical Minerals Dialogue

9. Organisation for Economic Co-operation and Development (OECD) resources governance programs
10. Critical Minerals Mapping Initiative (Geoscience Australia, the US Geological Survey and the Geological Survey of Canada)
11. APEC Ministers Responsible for Mining, and Mining Task Force
12. European Raw Materials Alliance.

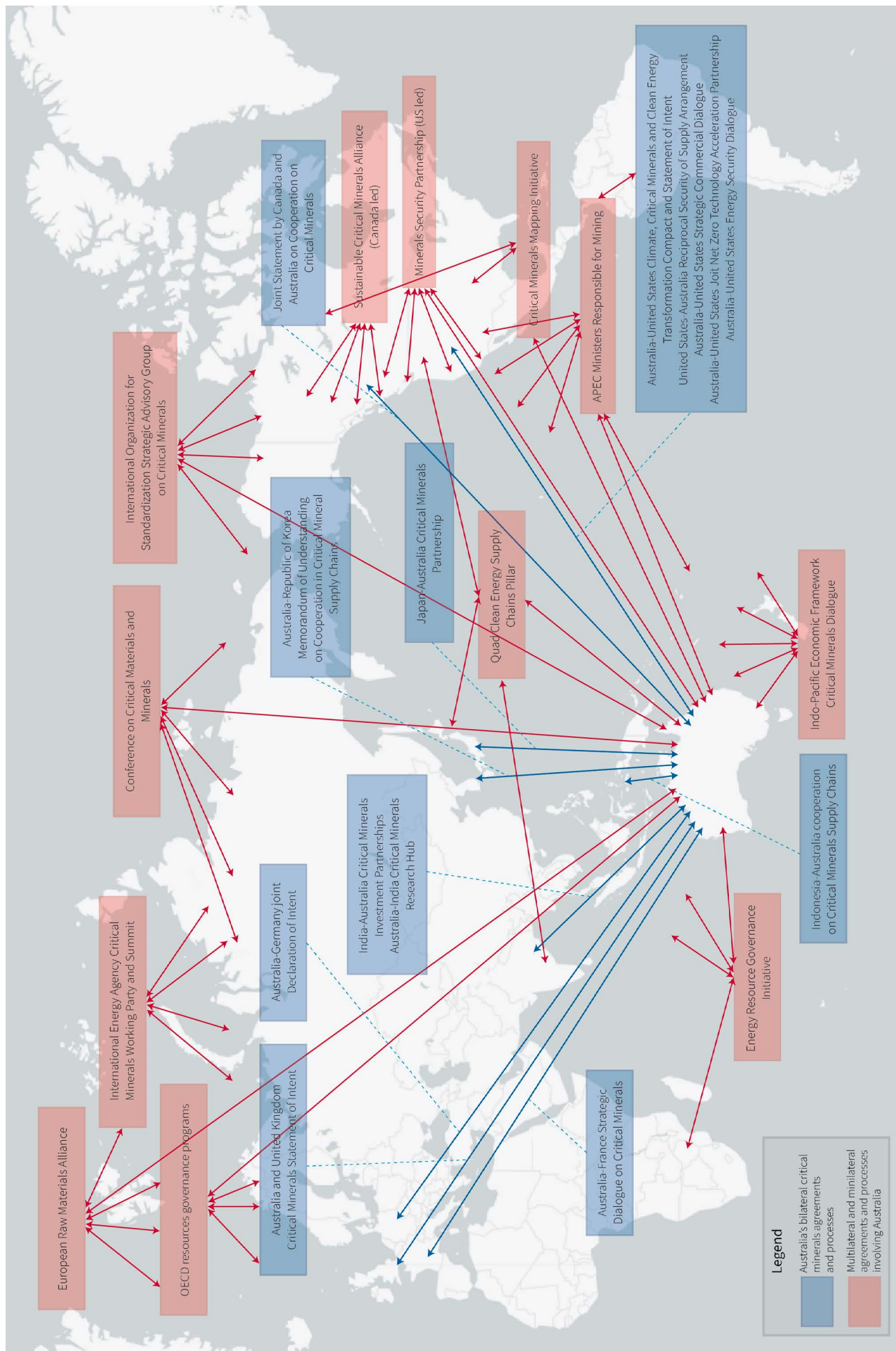
For a full and detailed explanation of the above bilateral, multilateral and minilateral agreements, see the Appendix to this report.

Australia's lacklustre response to agreements

Despite Australia's commitment to multiple agreements and processes that are explicitly aimed at diversifying and securing global supply chains involving multiple supplier countries, among other objectives, it's concerning that its Critical Minerals Strategy doesn't mention such actions. Instead, the strategy focuses exclusively on Australian domestic production and processing to feed into international supply chains, save for a November 2023 memorandum of understanding with Indonesia establishing an electric-vehicle collaboration mechanism.

This position seems to ignore the critical aspects of what Australia has agreed to do. It neglects Australia's large and growing global investment position in critical minerals exploration and production, discounts Australia's established minerals leadership position around the world, and misses the geostrategic and economic opportunities that will come from support for end-to-end supply chains and greater engagement in capacity-building in minerals governance. If Australia doesn't step up, its agreement partners will be at least nonplussed at its noncompliance with agreements, particularly given Australia's current leadership in critical minerals exploration and production and its recent leadership in governance capacity-building in resource-rich developing countries around the world.

Figure 5: Australia's critical minerals agreements, mapped



Base map source: S&P Global Market Intelligence.

(Re)activating Australia's minerals leadership

This report sets out data that demonstrates Australia's undisputed global strength in critical minerals production and supply chains, alongside Canada. As discussed, however, Australia's leadership in critical minerals must go beyond feeding domestically produced minerals into global supply chains.

In their mineral industry plans and critical minerals strategies, most of Australia's supply chain partners include provisions for:

- the diversification of supply chains to increase the availability of critical minerals and reduce risks of disruption
- building a network of supply chains that are more secure and sustainable
- working with current and potential supplier nations to lift standards of governance and sustainability for mineral exploration, extraction, processing and shipment.

Australia's approach to critical minerals should also include those activities, both boosting its contribution to supply chains from domestic critical minerals outputs and assisting developing nations to lift theirs and so improve global supply security and sustainability. Australia needs to build on its deep domestic and international experience in minerals production and governance to do more to meet its commitments to its strategic supply chain partners and its global leadership responsibilities. Suggested mechanisms are discussed in the recommendations, which are placed early in this report on page 6.

Appendix: Australia's international critical minerals agreements

Bilateral agreements and initiatives

Australia – United States Climate, Critical Minerals and Clean Energy Transformation Compact and Statement of Intent

The compact

In May 2023, the leaders of Australia and the US signed the Australia – United States Climate, Critical Minerals and Clean Energy Transformation Compact.⁶⁸ It establishes climate and clean energy and a shared energy industrial base as the third pillar of the Australia–US alliance, alongside defence and economic cooperation. The compact sets up a framework to coordinate policies and investments to support the expansion and diversification of clean-energy and critical minerals supply chains and to develop a shared energy industrial base.

Implementation of the compact is led by Australia's Department of Climate Change, Energy, the Environment and Water (DCCEEW) and the US National Security Council.

The compact is a mechanism to coordinate supply chains and accelerate market development and investment to support the clean-energy economy, including through:

- accelerating the expansion and diversification of end-to-end clean-energy supply chains
- promoting the responsible, sustainable and stable supply of critical minerals
- driving the development of emerging battery technologies.

The actions will be implemented by:

- engaging critical minerals and clean-energy industries in each nation
- collaborating on projects under domestic policy agendas and on standards for products
- promoting robust emissions-accounting methodologies
- assessing workforce requirements and establishing the Jobs and Skills Partnership for Clean Energy Technologies to support workforce development for the critical minerals and critical-technologies sectors.

The compact indicates that actions should build on existing work in other agreements and forums involving the US and Australia.

Statement of intent

The Australia – United States Climate, Critical Minerals and Clean Energy Transformation Statement of Intent is an instrument signed by the US President and the Australian Prime Minister, also in May 2023, that commits to cooperation through the compact. It sets out the respective interests of each nation:

The United States supports Australia's actions towards becoming a renewable energy powerhouse globally and in the Indo-Pacific, supplying essential materials and products fundamental to meeting global climate goals. Similarly, Australia welcomes the United States' actions to transform its domestic energy and industrial base to lead to the establishment of a global clean energy economy, leveraging its technological innovation to global benefit.⁶⁹

The statement of intent cites the US Inflation Reduction Act and Australia's *Powering Australia Plan* as the enablers for them to accelerate global climate action to meet the Paris Agreement goals. It also commits to supporting energy transformation and the diversification of supply chains in the Indo-Pacific.

A fact sheet issued by the White House in October 2023, on the occasion of the visit of Prime Minister Albanese to Washington DC, provides a useful summary of joint and complementary actions to build clean-energy supply chains, including for critical minerals.⁷⁰

Actions 'promoting responsible, sustainable and stable supply of critical minerals' include:

- collaborating to map complementary production capacities
- working towards mutual recognition of common and aligned ESG standards for the sector
- increasing information sharing to help each country shape local priorities and support industry investment

- enhancing collaboration on traceability practices for verifying the provenance of critical minerals and commodities
- developing options to improve market dynamics and address non-market practices for critical minerals.

Actions to give effect to the objective of ‘investing in high-quality mines and diversifying supply chains’ include:

- collaboration on export finance instructions to promote the growth of reliable and secure critical minerals supply chains
- financial support to critical minerals mining and processing projects in the US, Australia and other countries
- promoting investment in critical minerals projects of Australian and US companies.

There appears to be a difference of interpretation between the US and Australia on the reach of actions. The fact sheet notes a commitment to ‘continuing work through the Minerals Security Partnership to promote investment in strategic critical minerals projects across four continents involving Australian and US companies’. The joint leaders’ statement published on the Prime Minister’s website, however, refers only to ‘joint action to increase investment in critical minerals mining and processing projects *in our respective countries*’ (emphasis added).⁷¹

United States – Australia Clean Energy Dialogue

The ministerial-level United States – Australia Clean Energy Dialogue is convened between the US DOE and the Australian DCECEW. At its Washington DC meeting in October 2023, the dialogue agreed to collaborate on clean-energy supply chains, starting with battery supply chains, and seeking to deepen R&D and manufacturing capabilities. It announced its intention to establish the Australia–US Clean Energy Industry Council to advise governments on industry development and cooperation in both nations. No further information on the industry council was available at the time of writing.

Australia – United States Taskforce on Critical Minerals

The compact also establishes a taskforce led by representatives of the US National Security Council, in partnership with the US Department of Commerce, and the Australian Department of Industry, Science and

Resources to promote the responsible, sustainable and stable supply of critical minerals. The remit of the taskforce is to:

... work with industry leaders to develop and expand reliable, responsible and secure global access to critical minerals, strengthening global supply of critical minerals through the development of a shared energy industrial base⁷².

Meeting for the first time in October 2023 in Washington DC, the taskforce agreed to a wide range of actions, including joint action to increase investment in critical minerals mining and processing projects in each country and to enhance market transparency in that sector. It also agreed to support and collaborate on R&D of technologies and practices for sustainable mining, enhanced minerals recovery from unconventional sources and new mineral-processing methods.

Other Australia – United States cooperation on clean energy and critical minerals

At the October 2023 meetings under the compact, several other initiatives were agreed and/or progress under existing initiatives was noted. They included:

- investing in ‘high-quality’ mines and diversifying supply chains through:
 - collaboration between the Export-Import Bank of the US and Export Finance Australia to promote the growth of reliable and secure critical minerals supply chains involving Australian or US companies
 - financial support for mining and processing projects through loans to Australian and US companies with investments in Australia, the US and other nations
 - work through the Minerals Security Partnership (see below) to promote investment in strategic critical minerals projects across four continents involving Australian and US companies
- expanding R&D collaboration in minerals, including the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Geoscience Australia and USGS seeking to increase critical minerals production and processing capabilities to support energy, manufacturing and defence supply chains.

United States – Australia Reciprocal Security of Supply Arrangement

The methodology for assessment of the US critical minerals lists by USGS references ‘security of supply’ agreements with a number of countries, including Australia. The agreements are factored into a ‘willingness to supply’ index that takes into account trade and ideological and defence ties that a producing country has with the US and how they affect the likelihood of deliberate disruption of supply to US manufacturers.

The United States – Australia Reciprocal Security of Supply Arrangement, signed in 2011 between the US and Australian defence departments, provides for cooperation, coordination and priority support for requests for ‘industrial resources’.⁷³ That’s to be enabled by a system based on a code of conduct to be signed by accredited Australian companies. Thirteen years on from the agreement date, however, no code of conduct has been developed, and no companies have been accredited.

Given that the US has based its assessment of criticality in part on an assumption about security of supply from Australia under this agreement, it seems urgent that it be fully implemented. Seven other nations that have similar agreements with the US have done so.

Australia – United States Strategic Commercial Dialogue

The Australia – United States Strategic Commercial Dialogue was first held in March 2022 and again in May 2023.⁷⁴ It included a focus on critical minerals and supply chain resilience. Discussions examined enhanced cooperation and working with like-minded partners to build more secure and resilient supply chains across the US, Australia and the Indo-Pacific. The dialogue also identified the importance of developing shared approaches to ESG and traceability standards for critical minerals supply chains and agreed to examine how financing mechanisms could be better coordinated and leveraged to support private-sector investment. It’s unclear how those outcomes are being actioned.

Australia – United States Net Zero Technology Acceleration Partnership

The Australia – United States Net Zero Technology Acceleration Partnership, agreed in July 2022, aims to accelerate the development and deployment of

zero-emissions technology solutions and advance collaboration on critical minerals supply chains to support energy security, economic growth and decarbonisation goals across the US and Australian economies.⁷⁵

The partnership recognises the crucial role that more diversified sources of critical minerals and materials will play in the energy transition and in other key technologies. It says that Australia and the US also intend to collaborate on ensuring resilient, diversified, responsible and sustainable critical-material supply chains encompassing production, processing and manufacturing capacity.

The partnership establishes a framework for practical cooperation in four initial areas, including two that are particularly relevant to critical minerals demand and supply: long-duration energy storage and digital electricity grids and technology for the integration of variable renewable energy.

Australia – United States Energy Security Dialogue

The officials-level Australia – United States Energy Security Dialogue has been held annually since 2018.⁷⁶ Implementation of the Net Zero Technology Acceleration Partnership is reported through the dialogue, which is held between the US Department of State’s Bureau of Energy Resources in collaboration with the US DOE and the Australian DCCEEW in conjunction with the Australian Department of Foreign Affairs and Trade.

In 2023, the dialogue reaffirmed commitments to cooperate on clean-energy supply chains, critical minerals, energy security and clean-energy technologies. The next dialogue will be held in Australia in 2024.

Australia and United Kingdom Critical Minerals Statement of Intent

Signed in April 2023, the Australia–UK Critical Minerals Joint Statement of Intent sets out how Australia and the UK will seek to work together to:⁷⁷

- increase and diversify the global supply of critical minerals, including by boosting global investment and connecting buyers, sellers, suppliers and investors across both nations
- support both nations to build their sovereign capabilities in downstream processing and manufacturing

- build new critical minerals industries within both nations.

The statement sets out a range of collaboration opportunities, including:

- identifying opportunities to encourage investment in supply chains
- seeking to collaborate in critical minerals R&D
- promoting higher ESG performance in critical minerals production, including support for the adoption of the highest ESG standards by global industry.

Implementation of the statement is overseen by the Australia – United Kingdom Joint Working Group on Critical Minerals. No update on implementation was available at the time of writing.

India – Australia Critical Minerals Investment Partnership

India and Australia signed a memorandum of understanding in March 2022 to identify critical minerals projects in Australia for potential investment by Indian companies. The partnership is between a joint venture company formed by the Indian Ministry of Mines and Australia’s Critical Minerals Office.

In March 2023, the governments announced that five target projects (two lithium and three cobalt) had been identified for due diligence to be conducted.⁷⁸ Presumably, assessment of those projects is continuing.

Australia – Republic of Korea Memorandum of Understanding on Cooperation in Critical Mineral Supply Chains

Under a December 2021 memorandum of understanding, the Korea–Australia Critical Minerals Working Group leads collaboration across joint initiatives, including supply chain mapping, R&D and trade and investment in critical minerals.⁷⁹ As with the India–Australia partnership, the working group will seek to connect private-sector organisations to investment and trade opportunities within supply chains.

The Australia – Republic of Korea Comprehensive Strategic Partnership, signed by first ministers also in December 2021, has a clause on committing to ‘increase cooperative efforts to ensure supply chain resilience for critical minerals and associated products’ to increase

certainty of supply for renewable energy and advanced manufacturing.⁸⁰ The clause then references action under the memorandum of understanding.

Japan – Australia Critical Minerals Partnership

Australia and Japan signed their critical minerals partnership in October 2022.⁸¹ It set up a framework to build critical minerals supply chains between the two nations and to contribute to diversifying global critical minerals supply chains. It seeks to facilitate information sharing and research collaboration and to encourage Japanese investment and partnerships with Australia-based firms.

Specifically, the partnership includes:

- exploring partnership opportunities in critical minerals
- sharing information, knowledge and experiences to support critical minerals supply chains and recycling
- exploring co-financing critical minerals projects and catalysing private-sector investment
- cooperating on ESG standards, including coordination in international forums.

A working group oversees implementation.

Australia – France Strategic Dialogue on Critical Minerals

The bilateral Australia – France Strategic Dialogue on Critical Minerals, which was established in 2021, aims at ‘building secure, reliable and sustainable supply chains for critical minerals’.

In September 2023, Australia and France signed the Bilateral Dialogue on Critical Minerals agreement.⁸² This includes cooperation on a joint study into bilateral critical minerals supply chains and identifying the needs of both countries in batteries and rare-earth magnets. The dialogue facilitates exchanges of information on policy and market developments in each country and provides a collaboration mechanism for such activities as:

- joint government-supported projects on critical minerals value-chain opportunity mapping between Australian and French companies and R&D activities of domestic science agencies
- facilitating investments and offtake agreements for investors in the mining and manufacturing sectors

- fostering common positions in international forums on critical minerals, including about ESG frameworks to promote sustainable mining standards.

Cooperation on critical minerals is a key component of the *Australia–France Roadmap: a new agenda for bilateral cooperation*, released in December 2023.⁸³

Australia – Germany Joint Declaration of Intent

In April 2023, Australia and Germany signed a joint declaration of intent for a study on critical minerals value-chain feasibility.⁸⁴ The study covers:

- Critical minerals products most crucial to the industrial needs of Germany
- the most significant or commercially prospective geological resources and projects within Australia that can contribute to meeting those needs
- the most significant and commercially promising mining, refining and recycling projects and operations in Australia for Australia–Germany value chains
- sustainable approaches to those projects and the application of high ESG standards
- barriers or obstacles to establishing and growing supply chains and potential actions by governments and industry to help overcome them.

Indonesia – Australia cooperation on critical minerals

In November 2023, Indonesia and Australia executed a memorandum of understanding to cooperate on battery manufacturing, critical minerals processing and other aspects of electric-vehicle supply chains.⁸⁵ The two nations have agreed to conduct mapping of supply chains and scientific and research studies, as well as fostering new business-to-business links.

Separately, the Western Australian Government signed a plan of action with Indonesia’s Chamber of Commerce and Industry (KADIN) in July 2023 to implement a memorandum of understanding to build supply chains of critical minerals and promote bilateral investment and collaboration to develop value-adding critical minerals and battery industries.⁸⁶ The plan has three pillars of cooperation: develop resilient and sustainable supply chains; support strong ESG outcomes; and grow skilled workforces.

Joint Statement by Canada and Australia on Cooperation on Critical Minerals

Canada and Australia reaffirmed and strengthened cooperation in global critical minerals extraction, processing and refining in a joint statement agreed by the two nations’ resources ministers in March 2024.⁸⁷ The joint statement is in recognition that each nation is a large investor in critical minerals and METS in the other, and that both nations are jointly the world’s largest minerals investors.

The statement sets out joint actions to promote shared priorities, including:

- driving robust ESG efforts to improve the security and sustainability of supply chains
- driving the development of critical minerals supply chain transparency and traceability ‘to monetise the value proposition for responsibly sourced minerals’
- ensuring that Canada’s and Australia’s common values are accurately reflected through multilateral forums on critical minerals
- supporting bilateral mining and service sector trade and investment
- committing to continued improvement of engagement with indigenous peoples.

Multilateral and minilateral agreements and processes

Minerals Security Partnership

The US-led Minerals Security Partnership (MSP) was established in June 2022 to build diverse, secure and sustainable supply chains for critical minerals, focusing on clean-energy technologies.⁸⁸ MSP partners have agreed to strive to elevate ESG standards across the global minerals sector both within and beyond their borders.

Further, the MSP aims to ensure that minerals are produced, processed and recycled in a way that helps producing countries realise the full economic benefits of their resources. The MSP Framework says that:

The MSP identifies and addresses four major critical minerals challenges:

1. Diversifying and stabilizing global supply chains;
2. Investment in those supply chains;

3. Promoting high environmental, social, and governance standards in the mining, processing, and recycling sectors; and
4. Increasing recycling of critical minerals.

It will do this by assessing and supporting projects around the world, both in established and emerging clean energy economies both within MSP partners and beyond.

MSP partner governments are Australia, Canada, Finland, France, Germany, India, Italy, Japan, Norway, the Republic of Korea, Sweden, the UK, the US and the EU. MSP partner governments may provide financial, diplomatic or other forms of support.

The MSP is very much a north–south initiative that aims to have developing countries lift their standards of mineral production. Initial engagements have been with African countries Angola, Botswana, the Democratic Republic of the Congo, South Africa, Tanzania, Uganda and Zambia, and with Argentina. Australia-linked minerals companies are active in all those locations.

MSP Principles for Responsible Critical Mineral Supply Chains

In 2023, MSP partner countries issued a statement of principles for developing ‘responsible’ critical minerals supply chains that adhere end-to-end to high ESG standards.⁸⁹ The principles make clear that responsible supply chains are also more secure supply chains, as those without high ESG standards risk their social licence to operate and are less resilient, and therefore more prone to disruptions.

Sustainable Critical Minerals Alliance

Australia joined the Sustainable Critical Minerals Alliance in 2022.⁹⁰ The alliance is an initiative led by Canada to promote sustainable, environmentally and socially responsible mining practices for the critical minerals sector. Other signatories include the UK, France, Germany and the US.

Members of the alliance have agreed to work together through existing multilateral forums to:

... drive the global uptake of environmentally sustainable and socially inclusive and responsible mining, processing and recycling practices and responsible critical minerals supply chains.

Members of the alliance have also agreed to welcome and encourage actions taken domestically and globally to advance its objectives.

IEA Critical Minerals and Clean Energy initiatives

Australia is party to IEA processes on the supply of critical minerals, which, as noted, the IEA has identified as fundamental to the global energy transition.

Critical minerals supply chains were a focus of the Sydney Energy Forum in July 2022, co-hosted by the IEA and the Australian Government in partnership with the Business Council of Australia. The IEA published a report for the forum, titled *Securing clean energy technology supply chains*.⁹¹ The report identifies five strategies to build secure, resilient and sustainable supply chains: Diversify, Accelerate, Innovate, Collaborate and Invest.

The IEA Critical Minerals and Clean Energy Summit in September 2023, attended by Australia among 50 countries, agreed that demand growth for critical minerals can’t be solved by any one country or company.⁹² Australia chairs the officials-level IEA Critical Minerals Working Party.

The summit endorsed six actions, led by diversifying supply chains, on which it agreed:

Accelerate progress towards diversified minerals supplies: To support countries’ climate and clean energy ambitions, it will be necessary to significantly increase supplies of many minerals and metals. Progress on diversifying supply sources has also been limited in recent years. Delegates agreed on the need to accelerate progress towards diversified and sustainable supplies of critical minerals⁹³.

Other actions include tapping technology and recycling to alleviate strains on supply; promoting transparency in markets and supply chain risks; enabling public data sharing on critical minerals; creating incentives for sustainable practices; and fostering international collaboration between all participants.

The IEA’s December 2023 report *Sustainable and responsible critical mineral supply chains: guidance for policy makers*⁹⁴ and its *Critical Minerals Policy Tracker*⁹⁵ provide valuable advice and direction to both governments and companies on ESG and other policies and practices that

will protect people, communities and the environment and at the same time bolster supply chain security.

The guidance report makes five recommendations for policymakers:

1. Ensure robust legal and regulatory protections for the environment, workers and communities.
2. Channel public spending to encourage development of better practices and to reward good actors.
3. Strengthen collection and reporting of granular and standardised data to enable benchmarking and progress tracking across the industry and throughout the supply chain.
4. Encourage or require companies to improve transparency throughout the supply chain, including by undertaking due diligence and reporting publicly on risks and mitigation actions.
5. Support development of credible voluntary sustainability standards and encourage harmonised approaches consistent with international standards.

The IEA was scheduled to meet again on critical minerals in February 2024 to assess progress on those actions and agree on next steps. At the time of writing, no report on that meeting had been published.

Quad Clean Energy Supply Chains Pillar

The Quadrilateral Security Dialogue (Quad) aims to intensify cooperation between partner countries Australia, India, Japan and the US. The May 2023 Quad Leaders' Summit adopted the *Statement of Principles on Clean Energy Supply Chains in the Indo-Pacific*, giving effect to the Clean Energy Supply Chains pillar of the initiative.⁹⁶ The principles include:

- diversifying clean-energy supply chains in the Indo-Pacific, including for critical minerals
- supporting clean-energy workforce needs
- exploring interoperability in technical standards, policies and measures
- promoting enhanced cooperation in ESG practices
- encouraging public and private investment in R&D
- encouraging and incentivising companies to proliferate decarbonisation solutions.

Conference on Critical Materials and Minerals

The Conference on Critical Materials and Minerals is a periodic forum involving Japan, the US, the EU, Australia and Canada.⁹⁷ Technical and policy experts exchange information on policies governing critical materials, R&D, future challenges and other issues. A focus is on advancing collaborative efforts towards securing a stable supply of critical materials. At conference sessions, participating economies emphasise the importance of making supply chains for critical materials more resilient.

ISO Strategic Advisory Group on Critical Minerals

The International Organization for Standardization (ISO), of which Australia is a member along with 167 other countries, established the Strategic Advisory Group on Critical Minerals in March 2021. The advisory group's mandate includes:⁹⁸

- providing strategic advice on the organisation of the ISO's work on critical minerals, including the development of overarching guidance for common chemical analysis techniques
- investigating the market need for standards on sustainability issues related to critical minerals
- investigating the development of overarching standards guidance for participants in critical minerals supply chains.

Energy Resource Governance Initiative

The governments of Australia, Botswana, Canada, Peru and the US founded the Energy Resource Governance Initiative (ERGI) to source and disseminate 'best practices' across the international mining sector under the banner of *Mineral Sector Governance for a Responsible Energy Transformation*.⁹⁹ The partner countries have robust mining economies that reflect the implementation of best practices in mining governance and development. ERGI engages countries to advance governance principles, share best practices and encourage a level playing field. ERGI also promotes resilient and secure energy-mineral supply chains.

ERGI focuses on three strategic objectives:

- Engage resource-rich countries on responsible energy minerals governance
- Support resilient supply chains

- Meet the expected demand for clean energy technologies.

ERGI has published a toolkit to provide guidance for mining industry development in countries that may benefit from adapting best practice approaches and case studies to their local circumstances.

Indo-Pacific Economic Framework for Prosperity

Australia and 13 other nations across the Indo-Pacific launched the Indo-Pacific Economic Framework for Prosperity (IPEF) in May 2022.¹⁰⁰ IPEF has four pillars of work (trade; supply chains; clean energy, decarbonisation and infrastructure; and tax and anticorruption), all of which are relevant to critical minerals supply chain security and sustainability. The IPEF Supply Chain Agreement establishes structures to build resilient and competitive supply chains across the Indo-Pacific region.

In November 2023, member nations established the IPEF Critical Minerals Dialogue to foster closer collaboration between members in order to strengthen competitiveness and the diversification of critical minerals supply chains and boost regional economic competitiveness.

Developing economy members of IPEF have access to technical assistance and capacity building.

The IPEF partners are Australia, Brunei, Fiji, India, Indonesia, Japan, the Republic of Korea, Malaysia, New Zealand, the Philippines, Singapore, Thailand, the US and Vietnam.

OECD resources governance programs

The OECD, of which Australia is an active member, has several programs that aim to improve resources governance, mining practices and outcomes for nations, including for critical minerals. The programs include:

- Policy Dialogue on Natural Resource-based Development¹⁰¹
- Forum on Responsible Mineral Supply Chains¹⁰²
- Mining Regions and their Cities.¹⁰³

In May 2023, the OECD published a report for G7 finance ministers titled *Strengthening clean energy supply chains for decarbonisation and economic security*.¹⁰⁴ Its key findings and recommendations include the following:

- Substantial geographical and market concentration in clean energy supply chains may generate choke-point

risks where natural disasters or policy decisions in a specific region/country negatively affect supply.

- Policymakers face a policy trilemma in their efforts to avoid such choke-points where it's difficult to develop policies that simultaneously support secure supply chains, promote clean energy adoption and maintain competitive neutrality, while avoiding conflict.
- Strategic co-operation between countries can go far in reducing choke-point risks and securing supply chains without necessarily impeding competitive neutrality.

Critical Minerals Mapping Initiative

The Critical Minerals Mapping Initiative (CMMI) is a geoscientific collaboration between government agencies Geoscience Australia, the USGS and the Geological Survey of Canada.¹⁰⁵ The CMMI Portal merges and delivers mineral-resource information of the three organisations and covers critical-mineral resources around the world.

CMMI seeks to provide data to build a diversified critical minerals industry across Australia, Canada and the US by developing better understanding of the world's known critical minerals resources, understanding the geology of critical minerals distribution, identifying new sources of supply through mapping and quantitative assessments of critical minerals potential and quantitative mineral assessments, and promoting critical-mineral discovery by the private sector.

APEC Ministers Responsible for Mining and Mining Task Force

Recognising that about 70% of global mining output is produced and consumed in Asia-Pacific Economic Cooperation (APEC) member economies, APEC established annual meetings of ministers responsible for mining and set up the APEC Mining Task Force in 2007 to guide technical cooperation between APEC economies.¹⁰⁶

At the ministers' 2018 meeting, they noted the growth of critical minerals output and the importance of critical minerals, saying:¹⁰⁷

The APEC region continues to be an engine of global economic growth as well as a significant producer and consumer of minerals, metals and related products and with the emergence and growing importance of new commodities such as lithium, graphite, cobalt and nickel, we acknowledge that the mining sector

continues to hold significant potential in contributing to global trade.

The ministers seek closer cooperation in mining within APEC to promote investment, innovation, growth and inclusive, sustainable development.

European Raw Materials Alliance

The Australian Government isn't a party to the European Raw Materials Alliance (ERMA),¹⁰⁸ but the Australian Trade Commission, the Western Australian government and several Australian companies and universities are alliance partners. The objective of ERMA is to secure access to critical and strategic raw materials and advanced materials and processing know-how for EU industrial ecosystems.

ERMA was established in September 2020 as part of the EU Action Plan on Critical Raw Materials. The action plan assesses challenges for the supply of critical raw materials. It proposes actions to reduce Europe's dependency on third countries, including diversifying supply and improving resource efficiency and circularity, while promoting responsible sourcing worldwide.

Notes

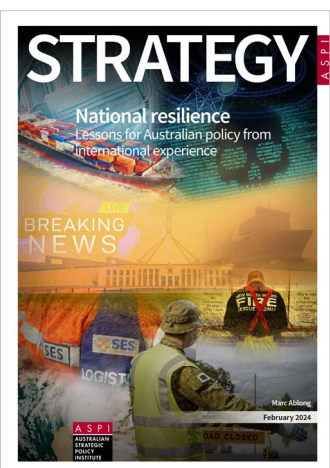
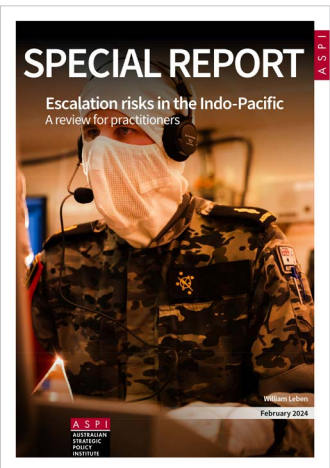
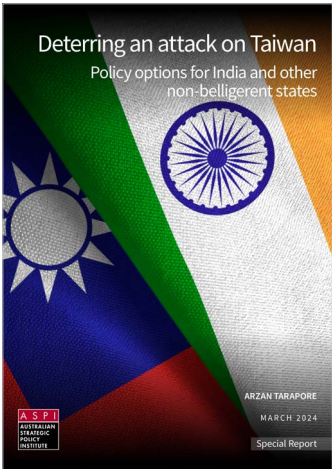
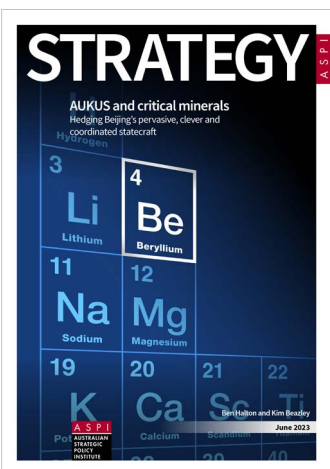
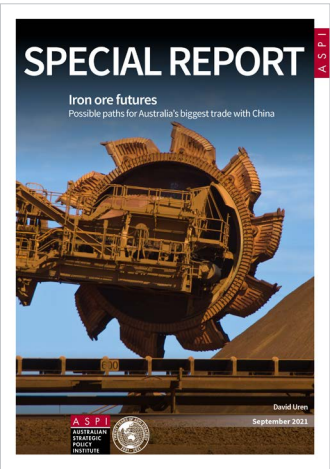
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Acronyms and abbreviations

APEC	Asia–Pacific Economic Cooperation
CMMI	Critical Minerals Mapping Initiative
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DOE	Department of Energy (US)
ERGI	Energy Resource Governance Initiative
ESG	environmental, social and governance
EU	European Union
FDI	foreign direct investment
GDP	gross domestic product
IEA	International Energy Agency
IGF	Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development
IPEF	Indo-Pacific Economic Framework for Prosperity
ISO	International Organization for Standardization
MCA	Minerals Council of Australia
METS	mining equipment, technology and services
MSP	Minerals Security Partnership
OECD	Organisation for Economic Co-operation and Development
PGEs	platinum group elements
Quad	Quadrilateral Security Dialogue
R&D	research and development
REEs	rare-earth elements
USGS	United States Geological Survey

Some recent ASPI publications



WHAT'S YOUR STRATEGY?

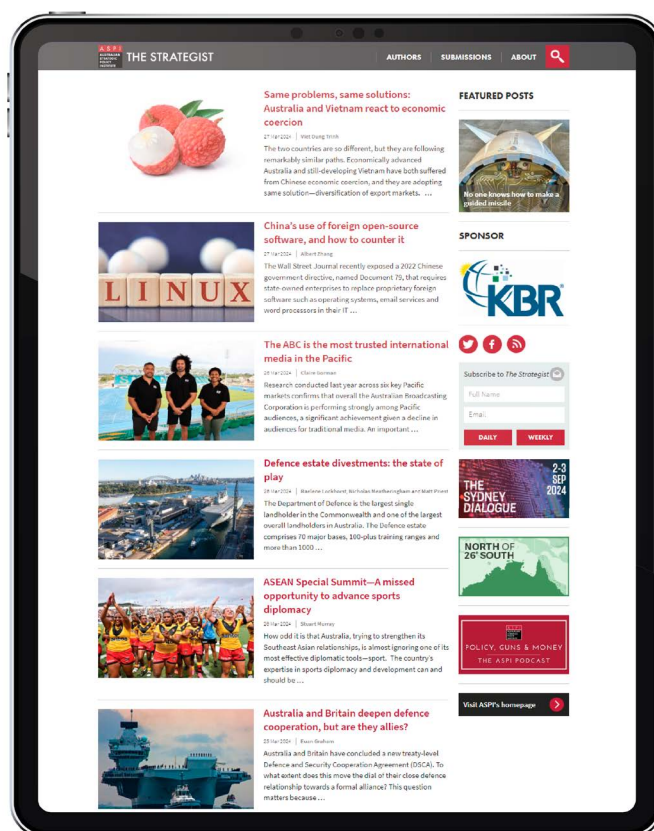


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