

Issue

Brief

ISSUE NO. 747
OCTOBER 2024

The Case for a Quad Mineral Security Partnership

Abhishek Sharma

Critical minerals have emerged as a vital resource for a state's national security and strategic calculations. Consequently, like-minded states have attempted to establish alliances for mineral security to mitigate their vulnerability arising from overreliance on a single country, notably China. In the Indo-Pacific, the Quad has taken the initiative to work together on critical minerals. The Quad's strategy aims to combine available resources to achieve mineral security and help build a more robust supply chain. This brief assesses the strategies of the Quad on mineral security, as well as those of its members. It analyses the obstacles and recommends steps to improve coordination and collaboration for mineral security.

Critical minerals^a are considered to be the ‘new oil’, with the potential to drive the high-technology industrial revolution.¹ However, the concentration of critical mineral supply chains along the downstream, middle, and upstream segments^b in specific states, such as China, has created security challenges for other countries; this is true for the Quad members.^c Consequently, countries are developing policies and strategies to create a resilient supply chain. The European Union (EU)² and countries such as Canada,³ India,⁴ Australia,⁵ and South Korea⁶ have acknowledged the importance of critical minerals and have released either a strategy or a list of critical minerals.

Currently, the global critical mineral supply chain is concentrated among a few key players along the upstream segment, including China, Australia, and the United States (US), and regions like Latin America and Central Asia.⁷ China controls the midstream and downstream segments.⁸ Much of the competition is concentrated in the Indo-Pacific region. In this context, the Quad members’ push to secure the critical mineral supply chain is driven by economic growth targets and the pursuit of development and regional influence.

a Critical minerals are minerals that play vital roles in the economic development and national security of a country, such that any lack of availability of these minerals can lead to serious supply-chain issues. Some critical minerals are lithium, cobalt, gallium, and rare earths like neodymium. See: <https://mines.gov.in/admin/storage/app/uploads/649d4212cceb01688027666.pdf>

b The upstream segment of the supply chain focuses on mining ores and extraction, the midstream looks after the separation and processing of minerals, and the downstream segment is related to the manufacturing of advanced materials and the end product.

c The Quad is a strategic grouping of four countries in the Indo-Pacific region: the United States, India, Japan, and Australia.

China's Domination of the Critical Mineral Supply Chain

China currently dominates the supply chain for critical minerals, including rare-earth elements (REEs) such as neodymium and dysprosium, capturing 60 percent of global REE production and almost 90 percent of worldwide processing and refining capacity (Figure 1).⁹ China's domination of the critical minerals supply chain presents risks for adversaries. In 2010, Beijing began weaponising the critical minerals supply chain by halting the export of REEs to Japan.^d In 2023, Beijing began using trade weaponisation as a foreign policy tool,¹⁰ restricting the global export of critical minerals such as germanium and gallium.¹¹ Recognising the risk associated with the high dependence on China for strategic minerals, a number of countries began de-risking from China after the pandemic.¹² However, the extent of de-risking differed across countries, depending on their requirements and relations with Beijing.^e

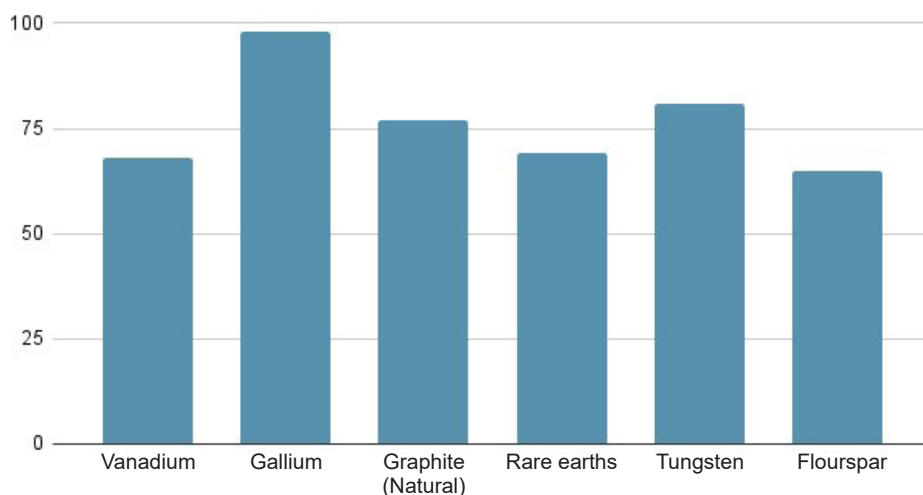
As the great-power rivalry intensifies, states are becoming more anxious about their dependence on China, particularly countries from groups like the Quad and AUKUS—i.e., India, Australia, Japan, the United Kingdom (UK), and the US—which have adversarial relations with Beijing. The dependence on China is expected to increase if proper steps are not taken at the appropriate speed and scale. Existing initiatives are uneconomical and unsustainable.¹³ Current projections indicate that the demand for lithium and REEs will experience a sharp increase between 2030 and 2050 (see Figures 2 and 3). This demand is expected to be fulfilled by China for the next decade. The current supply of lithium is estimated to be able to meet only 50 percent of the demand by 2035.¹⁴ Similarly, the demand of REEs is estimated to increase by three to seven times by 2040 per current levels,¹⁵ with China continuing to dominate 55 percent in mining and 78 percent in refining, respectively.¹⁶ This projection highlights severe challenges for Quad members in the long term, especially as geopolitical competition with China escalates in all domains.

d In September 2010, after a Chinese fishing boat collided with Japanese coast guard vessels and the subsequent arrest of a Chinese fishing trawler captain, China retaliated by blocking the exports of rare-earth elements to Japan. See: <https://www.nytimes.com/2010/09/23/business/global/23rare.html>; <https://www.thehindu.com/opinion/op-ed/chinas-warning-shots-with-minerals-that-run-the-world/article68682895.ece>

e For instance, the US has taken a strong stand against China, barring the import of critical minerals and restricting the transfer of high technology. Meanwhile, India has taken a calculated de-risking approach, with an emphasis on diversifying its import sources by investing in resource-rich states and liberalising its mining sector. In response to the US's measures, China in 2023 implemented export controls over germanium, gallium, graphite, and rare-earth processing technology for magnets. See: <https://www.reuters.com/world/china/china-export-curbs-choke-off-shipments-gallium-germanium-second-month-2023-10-20/>; <https://www.globaltimes.cn/page/202311/1302813.shtml>; <https://www.reuters.com/markets/commodities/china-bans-export-rare-earths-processing-technologies-2023-12-21/>

China's Domination of the Critical Mineral Supply Chain

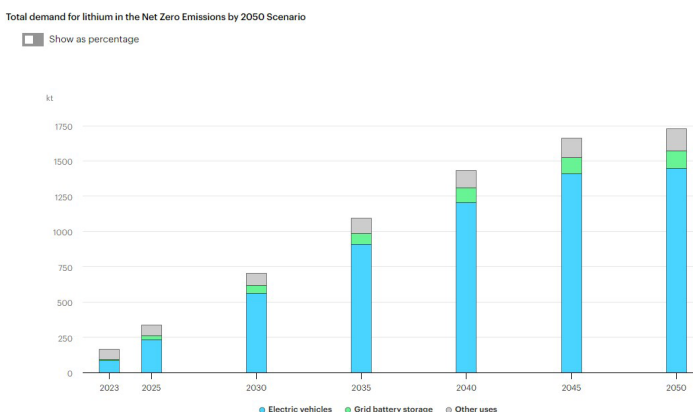
Figure 1: China's Production of Strategic Critical Minerals



Source: Mineral Commodity Summaries 2024¹⁷

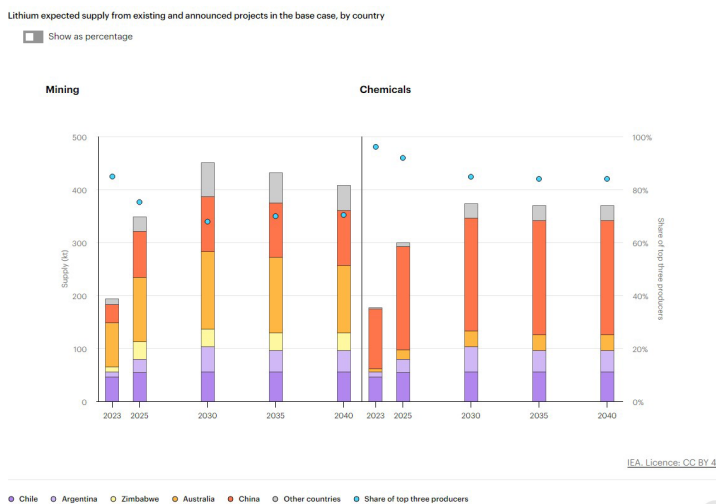
Figures 2a and 2b: Demand-and-Supply Graph for Lithium

2a. Demand



China's Domination of the Critical Mineral Supply Chain

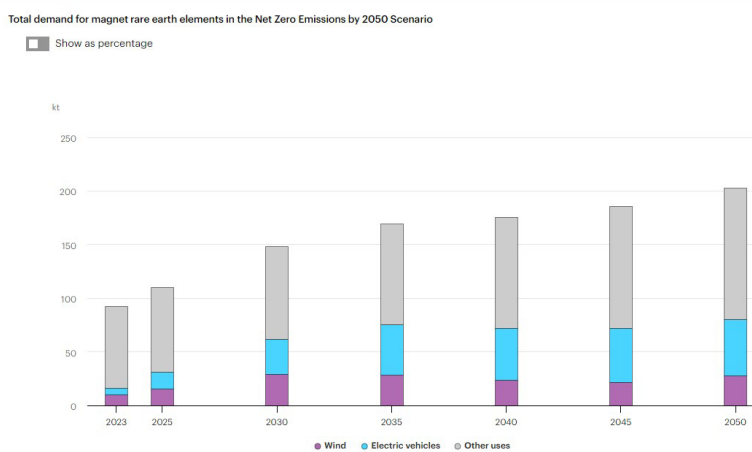
2b. Supply



Source: IEA's Critical Minerals Data Explorer¹⁸

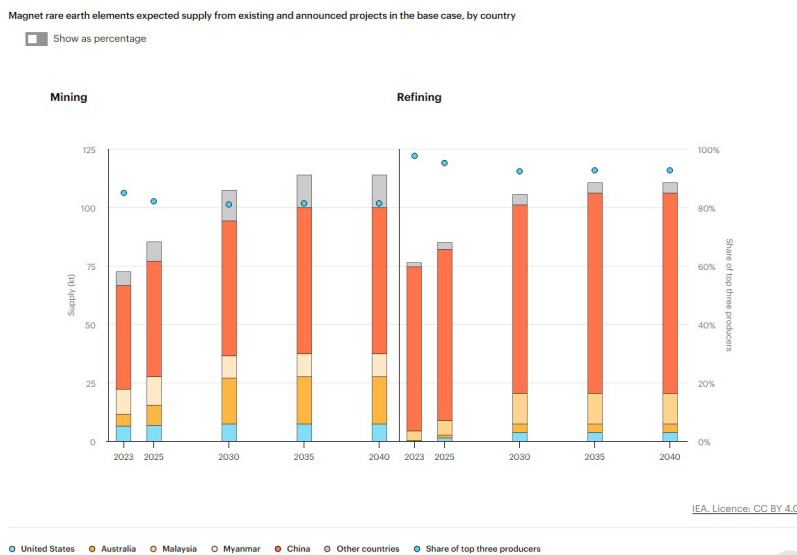
Figures 3a and 3b: Demand and Supply for Rare-Earth Elements

3a. Demand



China's Domination of the Critical Mineral Supply Chain

3b. Supply



Source: IEA's Critical Minerals Data Explorer¹⁹

The Quad and Critical Minerals

The Quad members have their respective strengths in critical minerals: Australia is a resource-rich state with critical minerals reserves; the US has the technological capability for mining; Japan has the capital and extensive experience in extracting and processing; and India has rich reserves of unexploited minerals and a growing consumer market. These capabilities, if combined, can produce positive results for the countries themselves as well as for the Indo-Pacific region.

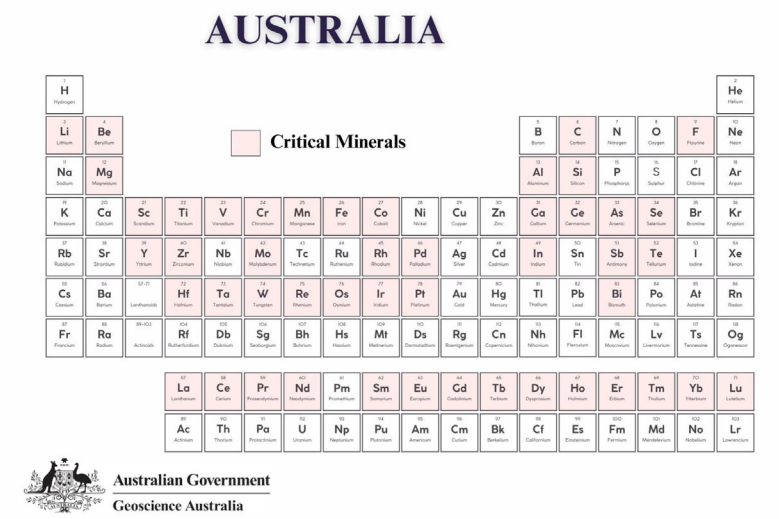
Australia: A Resource Reserve State

Australia aims to position itself as the source of raw minerals for the world.²⁰ Exports from the mining sector can help extract economic benefits and assist in achieving global net-zero targets. It also aims to attract more private funding for green energy industries such as electric vehicles (EVs), solar energy, and wind energy. To enable these goals, the government is providing more assistance and incentives under its 2024 *Future Made in Australia* strategy.²¹

In 2023, Australia released its *Critical Minerals Strategy 2023-2030*, which highlights its political, economic, and strategic priorities to attract more sustainable financial investments into the critical minerals sectors. The strategy lists two types of critical and strategic minerals (Figure 4).²² The 2023 strategy is an updated version of the 2019 strategy.²³ Compared to the 2019 strategy, the 2030 strategy has a more comprehensive vision aimed at having Australia become a “significant producer of raw and processed critical minerals”.²⁴

Australia aims to become a vital player in the upstream and downstream segments of the supply chain, including in mining and processing, leveraging its second position only to China in “exploration investment, reserves, and capital expenditure”.²⁵ To fulfil this objective, Australia has established relations with 26 countries globally, including seven—the US, EU, UK, Japan, South Korea, Canada, and India—who are also considered supply chain partners.²⁶

Figure 4: Australia’s Critical Minerals List



Source: Department of Industry, Science and Resources²⁷

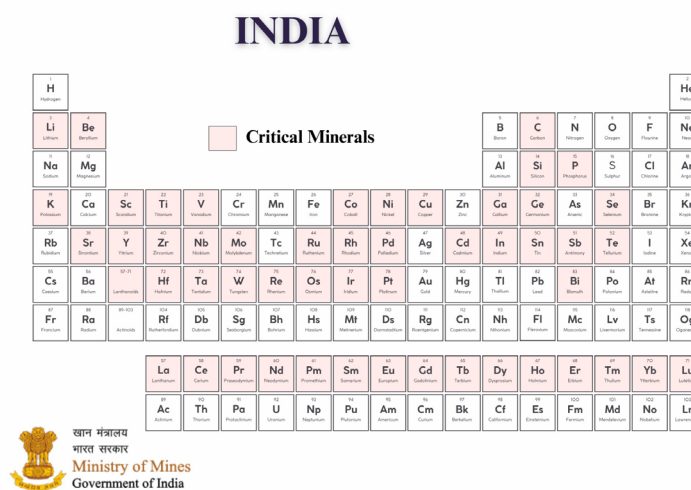
India: Manufacturing Hub

Critical minerals are essential for India’s national security and development. However, this emphasis became noticeable in 2019. India did not participate in global discussions regarding the dependence on China for critical minerals,^f following Beijing retaliating against Japan in 2010. New Delhi’s quest to secure its critical mineral supply chain began after the COVID-19 pandemic and has since accelerated.²⁸ This was acknowledged by Prahlad Joshi, Former Indian Minister of Coal and Mines, who emphasised that “this is the first time our country has identified the comprehensive list of critical minerals taking into account the needs of sectors like defence, agriculture, energy, pharmaceutical, telecom etc.”²⁹ This was the result of disruptions in the raw material supply chain and its increased dependence on other countries, including China, for minerals such as lithium and lithium-ion imports.³⁰ However, the India-China border conflict was one of the crucial factors in reaffirming India’s strategic

^f While India’s Mineral Policy focused on securing critical minerals for economic development needs, this was not part of diplomatic conversation and initiatives, either bilaterally with like-minded countries such as Australia, US, and Japan or as part of initiatives such as the Mineral Security Partnership and Sustainable Critical Mineral Alliance. See: <https://asia.nikkei.com/Opinion/Quad-should-lead-region-forward-in-securing-mineral-supply-chains>

concerns regarding China, including its dependence for critical minerals. Recently, Indian Defence Minister Rajnath Singh, while addressing a strategic community gathering, emphasised India’s critical mineral vulnerability without naming China, saying, “While scramble for resources for economic reasons has had a long history, their weaponisation by some nations for strategic reasons is a comparatively new phenomenon. These tendencies are not conducive for the global good.”³¹

Figure 5: India’s Critical Minerals List



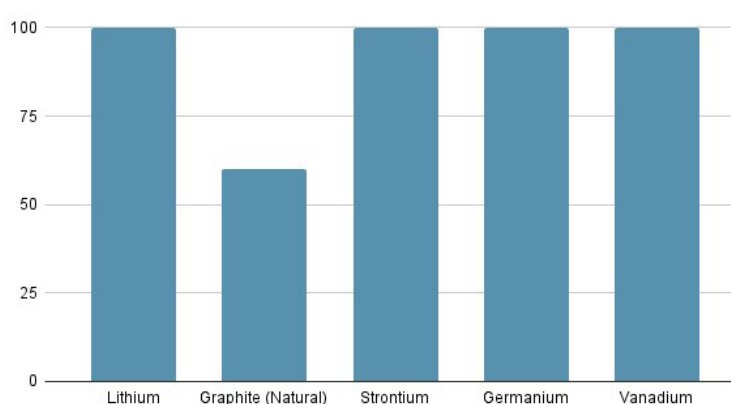
Source: Ministry of Mines³²

In 2023, the country released its first list, which comprised 30 critical minerals (see Figure 5).³³ For New Delhi, critical minerals are vital to achieve sustainable development and accomplish its *Atmanirbhar Bharat* vision.³⁴ To fulfil the new vision, India began focusing on unexploited minerals domestically, based on two pillars: making the mining process for critical minerals easy and business-friendly³⁵ and fostering international cooperation with resource-rich countries.³⁶ To facilitate the first pillar, in 2023, India introduced the Mines and Minerals (Development and Regulations) Amendment (MMDR) bill to liberalise the mining sector and passed the bill through parliament.³⁷ For instance, the government delisted six minerals^g from the atomic list, facilitating mining by

^g Comprising lithium, titanium, beryllium, zirconium, niobium, and tantalum.

private players and allowing the government to auction.³⁸ Subsequently, the government announced the royalty rates for 24 critical minerals, as mentioned in Part D of the first schedule of the MMDR Act.³⁹

Figure 6: India's Import Dependence on Third Countries for Critical Minerals



Source: Ministry of Mines⁴⁰

India has now adopted a whole-system approach to securing critical minerals supply chains, focusing on coordinating with stakeholders from industry, academia, think tanks, and public and private sectors⁴¹ to bring together and leverage the capacities of different ministries and private companies to promote critical mineral mining, extraction, and processing. This vision was first partially stated in National Mineral Policy (NMP) 2019, which stressed a more effective, meaningful, and implementable policy that brings transparency, better regulation and enforcement, balanced social and economic growth, and sustainable mining practices.⁴² India has also joined global initiatives on critical minerals, such as the Indo-Pacific Economic Framework and the Mineral Security Partnership, to further the vision in line with the NMP 2019, which states that “particular attention will be given to the prospecting and exploration of minerals in which the country has a poor resource-cum-reserve base despite having the geological potential for large resources.”⁴³ The progress achieved till

date is evident in the increased exploration projects approved in India since 2019 (see Table 1). However, responses following three tranches of auctions among private players has been lacklustre.⁴⁴

Table 1: Exploration Projects by the Geological Survey of India (2020-24)

| Field Season | 2020-21 | 2021-22 | 2022-23 | 2023-24 |
|--|---------|---------|---------|---------|
| Total Projects on Critical Minerals | 59 | 118 | 123 | 122 |

Source: Ministry of Mines⁴⁵

For international collaborations on critical minerals, the Indian government created a public-sector enterprise called Khanjij Bidesh Private Ltd. (KABIL) in 2019, which aims to identify and acquire overseas mineral resources such as lithium, cobalt, and other minerals.⁴⁶ So far, KABIL has finalised agreements with Australia and Argentina and is finalising a deal with Chile.⁴⁷ Additionally, India is reported to be in talks with Sri Lanka for acquiring graphite mines in the island state.⁴⁸

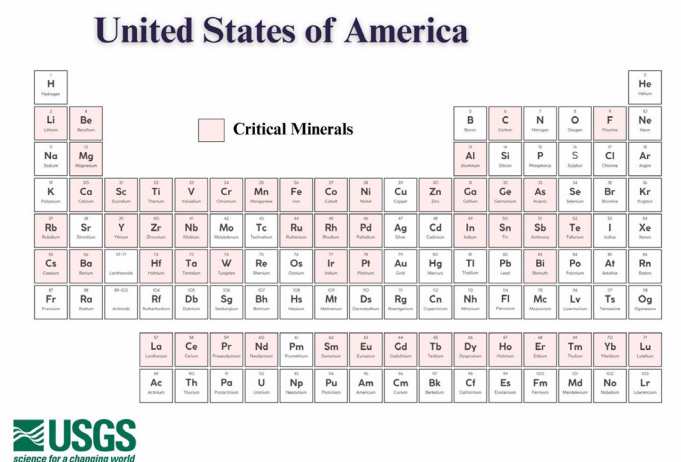
United States: Technology Leader

Critical minerals form an essential part of the US Grand Strategy, which aims to maintain its supremacy in the digital era, where it faces strict competition from China. Mineral resources can also help the US secure its future through green energy transition and advanced defence manufacturing, which will scale according to the increasing demand for critical minerals. Therefore, unlike other countries that look at the critical mineral supply chain issue from the perspective of economic opportunities, the US seeks to eliminate existing strategic impediments that may threaten its position as the global technological leader, which necessitates its control over the supply chain. Accordingly, the US strategy is based on four pillars: “Diversifying supplies of critical minerals and materials; Developing alternatives to critical minerals and materials; Improving materials and manufacturing efficiency; and Investing in circular-economy approaches.”⁴⁹

The Quad and Critical Minerals

In 2022, the United States Geological Survey (USGS) released a list of 50 minerals categorised as critical (see Figure 7). The Department of Energy also released their critical mineral lists in 2023.⁵⁰ Currently, the US is entirely dependent on third countries (including China) for 12 critical minerals and 50 percent reliant for another 29 critical minerals (see Figure 8).⁵¹ With targets such as reducing greenhouse gases by 2030,⁵² achieving net zero by 2050, and carbon-pollution-free electricity by 2035,⁵³ the US is under increasing pressure to fast-track all its initiatives to meet domestic needs and manufacturing objectives. To manage its domestic priorities and international commitments and maintain its position as the technology leader, Washington has introduced initiatives such as the Inflation Reduction Act (IRA) and other methods such as tariffs, aimed at attracting domestic investment in critical minerals supply chains across all segments and simultaneously limiting Chinese access to the US market.

Figure 7: The US’s Critical Minerals List

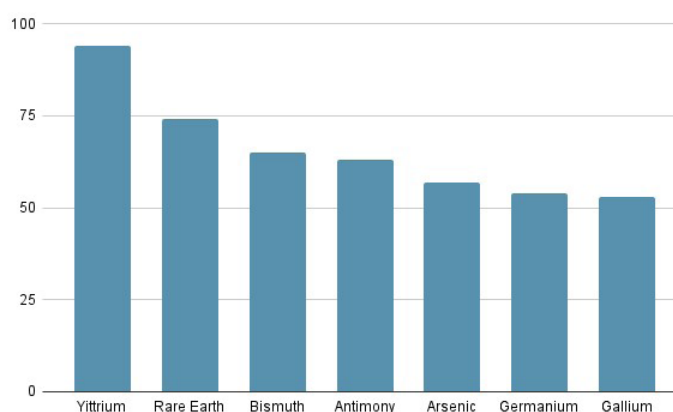


Source: USGS⁵⁴

Among the Quad member states, the US is the only country that has adopted a strong stance regarding critical minerals. The tariffs implemented under US President Joe Biden on critical mineral imports is an example of the extent to which the administration is willing to push against Chinese control over the

supply chain. The US has introduced new, increased tariffs, from 0-25 percent on some critical minerals and 25 percent on graphite and permanent magnets.⁵⁵ The tariffs target the whole supply chain of critical minerals, from mining to processing upstream, midstream, and downstream. Tariffs have also been introduced for EVs, battery parts, lithium-ion EVs, and non-EV batteries.⁵⁶ These steps are part of larger efforts that began in the Biden administration’s second year through the IRA, which restricted EV imports from a “foreign entity of concern”, mainly aimed at stopping the inflow of China-made EVs and providing incentives to promote domestic EV production.

Figure 8: US Reliance on China for Critical Minerals



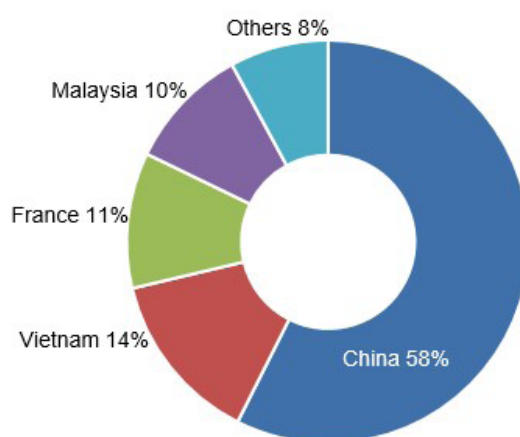
Source: Annual Report to Congress 2023⁵⁷

Japan: Capital Provider and Facilitator

As a resource-scarce country and export-dependent economy, Japan does not hold any major strategic reserves of minerals and depends on third countries, including China, for its critical mineral consumption; for instance, 60 percent of its rare-earth imports come from China (see Figure 9). The consequences of critical mineral supply chain vulnerability were first felt in Japan, when China stopped the export of rare earth elements to the country in 2010.⁵⁸ Since then, Japan has made a consistent effort to de-risk its critical mineral supply chain by focusing on five main pillars.⁵⁹ In 2020, Japan released its International

Resource Strategy to secure a stable supply of mineral resources; the strategy focused on stockpiling strategic minerals, including REEs (see Figure 10), at 30 days for some metals, 60 days for sensitive metals, and 180 days for highly geopolitically risky metals.^h

Figure 9: Japan’s Dependence on Other Countries for REEs

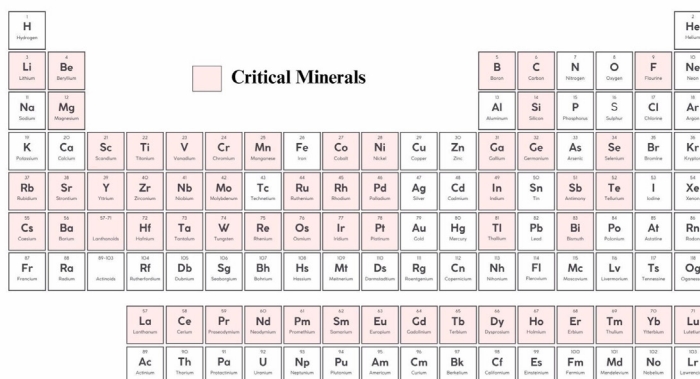


Source: METI⁶⁰

The National Security Strategy, released in 2022, states that, to relieve itself from dependence on any country, Japan “will curb excessive dependence on specific countries, carry forward next-generation semiconductor development and manufacturing bases, secure stable supply for critical goods including rare earth, and promote capital reinforcement of private enterprises with critical goods and technologies, and strengthen the function of policy-based finance, in pursuit of protecting and nurturing critical goods.”⁶¹ In the same year, Japan passed the Economic Security Promotion Act (ESPA), under which the Japanese government designated critical minerals as specified critical products affecting economic security.

^h The Japan Organization for Metal and Energy Security (JOGMEC), established in 2004, is the nodal agency under the Ministry of Economic, Trade, and Industry (METI) that manages Japan’s National Rare Metal Stockpiling Project. The organisation is also responsible for providing funds in the form of equity, support, and loans to Japanese companies working towards energy transition and strengthening relationships with resource-producing countries as part of its resource diplomacy. See: https://www.jogmec.go.jp/english/stockpiling/metal_10_000003.html and <https://www.jogmec.go.jp/content/300374576.pdf>

Figure 10: Rare Metals Mentioned in the JOGMEC Stockpiling System JAPAN



As per JOGMEC Stockpiling system

Source: JOGMEC⁶²

Japan has also undertaken multiple steps as part of its resource diplomacy in the international arena, including the appointment of a special assistant for natural resources in 60 diplomatic missions in 53 countries, cooperating with international financial institutions like the World Bank and international energy⁶³ and mineral resources organisations like the International Energy Agency (IEA), International Renewable Energy Agency (IRENA), G20, G7, and Mineral Security Partnership (MSP) to induce stability in the supply chain.⁶⁴

Convergences and Divergences in Quad States' Critical Minerals Strategies

There are a few differences and similarities in the approaches and definitions of critical minerals for each Quad member (see Tables 3 and 4). The definitions of critical minerals highlight the different vantage points for all members. Members like the US and Australia have a greater focus on structural factors compared to India and emphasise domestic priorities such as poverty alleviation and development. Similarly, the Quad members have adopted distinct strategies. India, Japan, and Australia prefer a de-risking policy, whereas the US has adopted a decoupling approach. The former prioritises diversifying dependence to reduce strategic vulnerabilities focused on the upstream supply chain; the latter focuses on establishing mineral security and considers the importance of the entire supply chain. Other differences among the countries are shaped by their respective national priorities and different economic statuses, such as their stance on Environmental, Social, and Governance (ESG) and their targeted segment of the critical mineral supply chain. Therefore, while the China factor remains vital in shaping the policies of some members, for others, the policy is dictated by economic priorities and reducing strategic vulnerabilities emanating from overdependence on one country.

Table 2: Definition of Critical Minerals

| Country | Definition |
|---------------|---|
| India | Minerals essential for economic development and national security; the lack of availability of these minerals or even concentration of existence, extraction or processing of these minerals in few geographical locations may lead to supply chain vulnerability and disruption. ⁶⁵ |
| United States | Any non-fuel mineral, element, substance, or material that the Secretary of Energy determines: (i) has a high risk of supply chain disruption; and (ii) serves an essential function in one or more energy technologies, including technologies that produce, transmit, store, and conserve energy. ⁶⁶ |

Convergences and Divergences in Quad States' Critical Minerals Strategies

| Country | Definition |
|-----------|---|
| Australia | Metallic or non-metallic materials essential to modern technologies, economies, and national security and whose supply chains are vulnerable to disruption. Risks of disruption to critical mineral supply chains are heightened when mineral production or processing is concentrated in particular locations, facilities, or companies. ⁶⁷ |
| Japan | Not available. |

Source: Author's own, using various open sources.

Quad Members' Mineral Security Approaches

- **Australia:** The critical mineral strategy aims to take a “concerted, targeted and proportionate approach” to develop its critical mineral sector, contributing to its broader security.⁶⁸
- **India:** The critical mineral strategy is shaped majorly by its national security and economic needs, in alignment with the *Aatmanirbhar Bharat* vision, i.e., to “harness the potential of critical minerals to fuel the country’s growth, competitiveness, and sustainable development.”⁶⁹
- **Japan:** The critical mineral strategy is based on three sub-strategies: investing in offshore mining projects, mainly mining and extraction; developing strategic resource partnerships with third countries; and capacity building through human resource developments, mining skills, and industrial promotion. The three-layered approach aims to de-risk Japan from the current structural impediments, safeguarding its national security.⁷⁰
- **US:** Unlike its Quad partners’ de-risking approaches, the US’s critical mineral strategy aims for decoupling to establish an alternative, resilient, sustainable, and liberal critical mineral supply chain, safeguarding its economic, mineral, and national security.⁷¹

The Quad and Critical Minerals: Potential and Opportunities

Since 2021, the Quad has taken steps towards fostering strong cooperation on critical minerals. The private sector-led Quad Investors Network (QUIN) was launched⁷² during the second Quad Leaders’ Summit in 2022 and has since worked towards identifying areas of cooperation on the critical mineral supply chain.⁷³ The aim is to facilitate closer collaboration with the private sector in 10 critical and emerging technologies, including clean energy and critical minerals.⁷⁴ The US has also adopted some initiatives to ensure that the Quad’s capabilities can be leveraged to reduce dependence on China. For instance, in April 2022, the Quad Critical Minerals Partnership Act bill was introduced in the US Senate to “develop a more reliable and secure supply chain of critical minerals.”⁷⁵ However, the bill failed to make progress. In 2024, the *Critical Minerals Security Act of 2024* bill was also introduced to formulate a “strategy for the development of advanced mining, refining, separation, and processing technologies” and direct the US administration to develop “a method for sharing the intellectual property” with allies and partner “to license such technologies and mine, refine, separate, and process the resources of such countries.”⁷⁶ However, no progress has been achieved on this front.

Developments are also taking place at the bilateral and multilateral levels. Currently, a few Quad members have exclusive critical mineral agreements with each other or are negotiating separate agreements with other members (Table 5). In 2023, the US signed an agreement with Japan on critical minerals.⁷⁷ In the same year, the US and Australia established a task force focused on “identified areas in which the U.S. and Australian governments can take joint action to increase investment in critical minerals mining and processing projects.”⁷⁸ India has a critical mineral agreement with only Australia and none with the other Quad members.

Table 3: Critical Mineral Agreements Between Quad Members

| | Australia | India | Japan | United States |
|-----------|---|-------|--|---------------|
| Australia | | | Partnership on Critical Minerals ⁷⁹ | |
| India | Critical Mineral Investment Partnership ⁸⁰ | | | |

The Quad and Critical Minerals: Potential and Opportunities

| | Australia | India | Japan | United States |
|---------------|--|-------|-------|--|
| Japan | | | | Agreement on Strengthening Critical Mineral Supply Chain ⁸¹ |
| United States | Partnership on Critical Minerals ⁸² | | | |

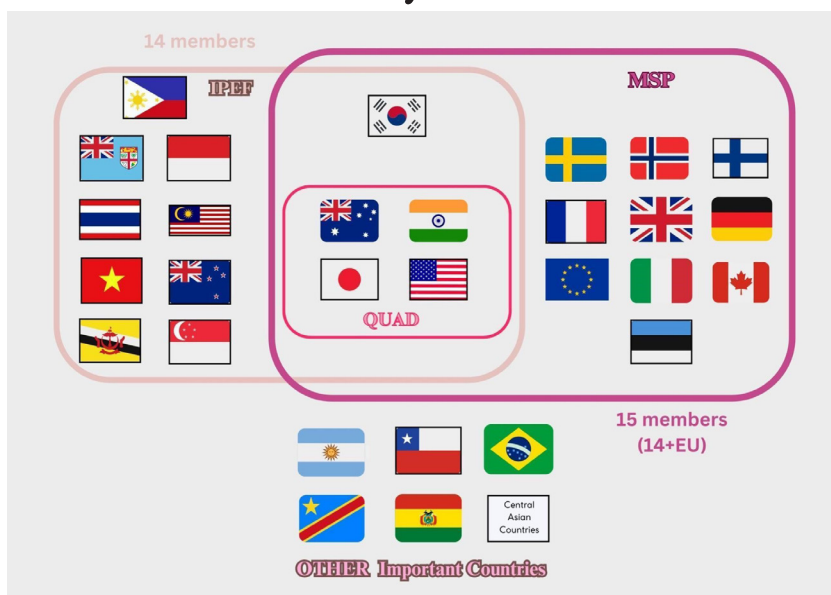
Source: Author's own

The Quad has the political will and strategic vision to invest in developing a resilient and secure critical mineral supply chain. Currently, however, the Quad needs an overarching framework on critical minerals. Although there exists a Principles on Clean Energy Supply Chains in the Indo-Pacific agreement between the Quad members, it overlooks the importance of the upstream segment of the critical minerals supply chain.⁸³ Under the leadership of the US, the Quad can bring together Indo-Pacific multilateral initiatives operating in the domain, including the Indo-Pacific Economic Framework (IPEF) and other multilaterals, most of which are being led by the US (see Figure 11). As the demand for green technologies increases, more countries are exploring options to invest in renewable energy sources, which are highly dependent on critical minerals. For instance, India lacks the technological expertise and skills to benefit from its critical mineral reserves.

The Quad's mineral security is linked with its economic security and thus needs to build a resilient multilateral critical mineral supply chain that addresses all segments. This can be made possible by pooling resources, sharing information and knowledge, building expertise, and developing the capacities of its members. Such an approach will distribute risk exposure and help achieve better supply chain planning for Quad members.

The Quad and Critical Minerals: Potential and Opportunities

Figure 11: Existing Groupings Focused on Mineral Security



Source: Author's own

Australia has rich sources of critical minerals, including lithium, uranium,⁸⁴ and heavy REEs like dysprosium,⁸⁵ which can satisfy the growing demand for critical minerals in the Indo-Pacific region.⁸⁶ For its part, India has rich resources of light REEs, such as neodymium and praseodymium, as well as other minerals like iron ore and manganese.⁸⁷ To forge a strong mineral security partnership, Quad members like Japan and the US can support Australia's and India's upstream projects by providing strategic funding, knowledge sharing, and plan coordination.ⁱ For the midstream segment, which includes battery cell, module, and pack manufacturing, Australia and Japan can coordinate to establish a diverse supply chain, and the US and India can work together on the downstream segment, which focuses on EVs. Developing capacities in downstream segments would require a holistic strategic plan aimed at creating a resilient upstream and midstream supply chain, which would not be possible without the cooperation and collaboration of member states.^j

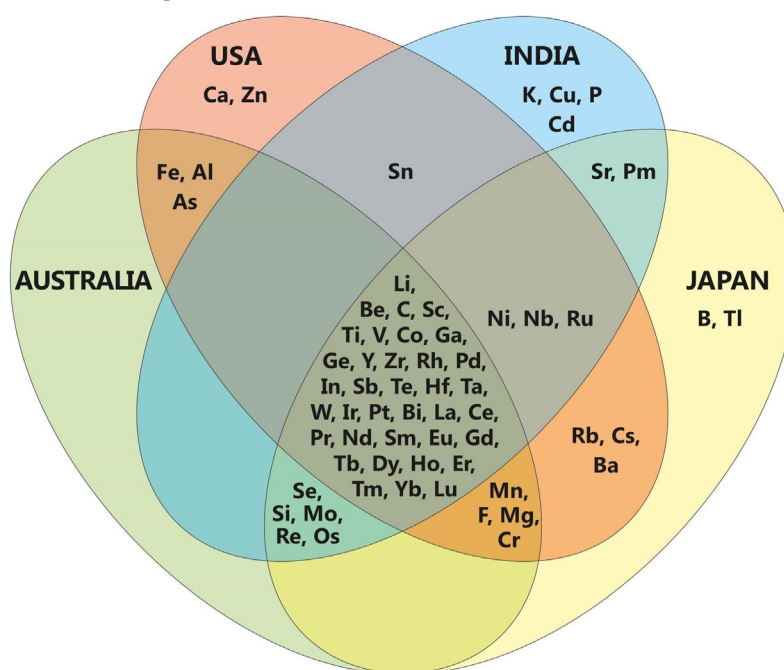
i Successful examples of cooperation between Quad members include India and Japan partnering to refine rare-earth oxides through Japanese company Toyotsu Rare Earth India Limited. See: <https://www.pib.gov.in/PressReleasePage.aspx?PRID=1914305>

j China dominates the downstream segment of the critical mineral supply chain. For example, in categories like lithium-ion battery production, China's 2023 capacity was almost equal to the global demand of 960 gigawatt-hours. This is expected to increase. See: <https://www.bloomberg.com/news/newsletters/2024-04-12/china-already-makes-as-many-batteries-as-the-entire-world-wants>

The Quad and Critical Minerals: Potential and Opportunities

The Quad’s rationale for collaboration should be twofold: first, to create a resilient supply chain to protecting its interests and offer alternatives to the region, and second, to ensure that the supply chain is not concentrated in one country. The latter is necessary as the domination of one player enables market manipulation or economic coercion, further dampening investor interests, affecting government policies, and requiring regular executive intervention. The Quad must ensure that global markets are not manipulated and can handle supply chain vulnerabilities without external interventions. The grouping needs to align its critical mineral initiatives with the broader Indo-Pacific region to address these issues through unilateral and multilateral efforts such as the IPEF and MSP.⁸⁸ For example, the Quad can identify common minerals for all countries (Figure 12) and work on a collaborative mechanism to secure the supply chains for those minerals. Its role should be to diversify the supply chain of critical minerals to provide financial stability to like-minded countries in the region.

Figure 12: Common Critical Minerals Between Quad Members



Source: Author’s own

The Quad and Critical Minerals: Potential and Opportunities

Each member plays a crucial role in these efforts. Australia, along with the US, can provide mineral security to Quad members and like-minded states in the Indo-Pacific region. India can offer a lucrative manufacturing ecosystem to global manufacturers and provide low-priced end products like EV batteries and solar cells, supported by US and Japanese funding.^k By leveraging and building on each other's capacities and capabilities across the supply chain, the Quad can build a resilient, trusted, and financially sustainable supply chain.

^k The opening of the US-based First Solar plant in India, with US\$500 million in funding support from the US government, is an example of successful friendshoring aimed at strengthening the downstream segment of the supply chain. See: <https://energy.economictimes.indiatimes.com/news/renewable/first-solar-launches-3-3-gw-manufacturing-facility-in-india/106730708>

Although the Quad members have taken steps to strengthen cooperation in critical minerals, challenges remain. Attempts by Quad members like Australia and the US to restrict domestic Chinese funding in mining have backfired,^l requiring many projects to be revised.⁸⁹ At the same time, other projects like BHP Group's Nickel business⁹⁰ have become economically unviable.^m The flood of Chinese minerals into the market has made businesses unviable.⁹¹ It is thus difficult to pursue efforts at the individual level, necessitating a collaborative approach. The following paragraphs outline the factors that have contributed to the Quad members' weakening position vis-a-vis China:

Lack of economic realism

Quad members' attempts to emerge as alternatives to China have not succeeded due to ill-informed expectations. For example, despite Australia's efforts to diversify its consumers,⁹² China remains the largest market for Australian and Australia-produced critical minerals, including rare-earths, amounting to US\$100 billion.⁹³ The failure of an independent approach can be highlighted through the fluctuating prices of minerals, which have dissuaded investors. For example, nickel prices crashed from US\$45,000 in March 2022 to US\$15,900 in 2023, forcing Western companies like BHP Australia to cease operations.⁹⁴ This was a consequence of Indonesia ramping up production of nickel,⁹⁵ with 95 percent of the ferronickel that was produced being exported to China.⁹⁶

Lack of understanding of critical mineral supply chain and industry demand

There is a lack of expertise in next-generation technology, production costs, and transitional material development in the downstream segment of the supply chain, such as in advanced battery materials research and development. Therefore, most of the strategic investments in critical minerals and rare-earths remain removed from reality, which further jeopardises mining investments.

^l A viable and sustainable source of US investment in the Australian mining sector has not succeeded in totally replacing Chinese investment, though Chinese investment decreased from AU\$1.8 billion in 2022 to AU\$34 million in 2023. See: <https://www.rusi.org/explore-our-research/publications/commentary/australias-critical-minerals-strategy-amid-us-china-geopolitical-rivalry>; <https://www.argusmedia.com/en/news-and-insights/latest-market-news/2496197-western-mining-firms-see-china-as-a-key-partner-rival>; <https://www.sydney.edu.au/news-opinion/news/2024/04/08/chinese-investment-in-australia-falls-to-second-lowest-level-sin.html>

^m For instance, attempts by the US to undertake a decoupling approach with China have failed, as indicated by its recent decision to extend the deadline of diverting the supply chain of certain critical minerals from 2025 to 2027. See: <https://www.wsj.com/business/autos/ev-makers-get-two-year-relieve-on-tax-credit-restrictions-38927c81>

Research on new battery technologies for replacing minerals like lithium and cobalt are not considered in investment decisions,⁹⁷ which poses risks for capital investments in the sector. Meanwhile, China has invested billions in new technologies such as semi-solid-state, solid-state, and sodium-ion batteries and is working on sodium-ion cells⁹⁸ that have the potential to lower production costs.⁹⁹

Policy uncertainty

This remains a challenge for all Quad partners. Unlike the centralised political system in China, Quad democracies have decentralised decision-making at the federal and provincial levels. For instance, markets and companies cannot be forced to invest in projects that undermine geopolitical and economic rationales. One example is ESG. The Quad's prospects in critical mineral mining have not fructified due to its strict emphasis on ESG compliance and lack of intra-grouping agreement. For instance, India's approach towards ESG remains underdeveloped, and there is a lack of clarity and convergence with the Western approach towards ESG, even in specific sectors like critical minerals mining.¹⁰⁰

Risk of a zero-sum game

Establishing an alternative, resilient, and secure supply chain will have its disadvantages. Beijing views joint efforts such as these to be targeted towards diminishing Chinese hegemony and is reciprocating with critical minerals restrictions and curbs.¹⁰¹ These actions risk starting a zero-sum game involving the Quad members, paving the way for a further fragmentation of the supply chain.

Recommendations for the Quad's Cooperation on Critical Minerals

The Quad members need to work closely together with each other to achieve mineral security. Multilateral efforts need to be improved to overcome structural and economic challenges in critical mineral supply chains. As more countries adopt an economic nationalistic stance, banning exports of ores and focusing on value-added manufacturing, it becomes critical to have an Indo-Pacific collaborative approach led by the Quad. Despite an inward turn and increasing contestations, Quad can present an alternative model. The following are aspects on which Quad members could collaborate:

- Quad members must have a bilateral and a specific agreement with common overarching principles on critical mineral cooperation. Not all members have bilateral agreements or an agreed framework that connects them. An overarching agreement between the Quad members can align along the lines of the G7's five-point consensus on critical minerals security.¹⁰²
- Quad members must have a standard definition of critical minerals to coordinate their strategic, economic, and security interests and link initiatives. Steps like these can also help form better collaborative mechanisms based on relevant parameters.
- There needs to be a trading system and agreement between the Quad countries focused on critical mineral supply chains across the upstream, midstream, and downstream segments. A common critical minerals agreement would ease trade agreements. At present, the US has a Free Trade Agreement (FTA) only with Australia, which creates issues in market access.¹⁰³
- The Quad needs to establish an early warning system that coordinates information among members on likely disruptions in the supply chain of critical minerals. The Quad can pilot a project identifying some minerals, such as lithium, nickel, and graphite, which are critical for electric batteries and EVs. The mechanism becomes more important as India's membership to the IEA would further strengthen its partnership under the IEA's Voluntary Critical Mineral Security Programme,ⁿ which will help India tap experience and information, including the option for stockpiling, creating a more transparent and resilient supply chain.

ⁿ IEA's Voluntary Critical Mineral Security Programme is aimed at securing the supply of critical minerals for energy security. See: <https://www.reuters.com/business/energy/iea-launch-security-program-minerals-critical-energy-sector-2024-02-13/>

Recommendations for the Quad's Cooperation on Critical Minerals

- There is need to establish a regular annual ministerial meeting of the Quad members to better coordinate their critical minerals initiatives and identify areas for further collaboration and cooperation.
- Quad members can identify projects in third countries through joint projects and co-investments, where their interests converge, and provide financial support for supply-chain projects. To facilitate joint projects in third countries, Quad members can leverage their bilateral partnerships and multilateral groupings such as the MSP.¹⁰⁴

Conclusion

Emerging technologies like EVs, semiconductor chips, batteries, and green technologies will drive the next industrial revolution. States that have control over the building blocks of these technologies, i.e., critical minerals and their supply chain, will control supply, set standards, and influence prices. At present, China controls the entire supply chain of minerals, from extracting and processing to value addition.

In the case of third countries, the supply chain becomes intertwined with geopolitics and industrial policy, which poses a threat to states dependent on China for their mineral needs. Therefore, it is essential for like-minded countries, particularly groups like the Quad, to mobilise resources, capital, and expertise to support an alternative supply chain that is robust, resilient, and trustworthy towards achieving mineral security. [ORF](#)

Abhishek Sharma is a Research Assistant with ORF's Strategic Studies Programme.

The author would like to thank **Vaishali Jaipal** and **Kritvi Gupta** for their research assistance.

- 1 “Energy Transition and Geopolitics: Are Critical Minerals the New Oil?,” World Economic Forum, April 2024, <https://www.weforum.org/publications/energy-transition-and-geopolitics-are-critical-minerals-the-new-oil/>
- 2 “European Critical Raw Materials Act,” European Commission, https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/green-deal-industrial-plan/european-critical-raw-materials-act_en
- 3 Government of Canada, “The Canadian Critical Minerals Strategy,” <https://www.canada.ca/en/campaign/critical-minerals-in-canada/canadian-critical-minerals-strategy.html>
- 4 Ministry of Mines, Government of India, *Critical Minerals for India: Report of the Committee on Identification of Critical Minerals*, June 2023, <https://mines.gov.in/admin/storage/app/uploads/649d4212cceb01688027666.pdf>
- 5 Australian Government, *Critical Minerals Strategy 2023-2030*, July 7, 2023, <https://www.industry.gov.au/publications/critical-minerals-strategy-2023-2030>
- 6 Abhishek Sharma, “The Challenges Ahead for South Korea’s Critical Minerals Strategy,” *South Korea Pro*, May 11, 2023, <https://koreapro.org/2023/05/the-challenges-ahead-for-south-koreas-critical-minerals-strategy/>
- 7 Cyn-Young Park and Anna Cassandra Melendez, “Building Resilient and Responsible Critical Minerals Supply Chains for the Clean Energy Transition,” ADB Brief, May 2024, <https://www.adb.org/sites/default/files/publication/966351/adb-brief-298-critical-minerals-supply-chains.pdf>
- 8 Park and Melendez, “Building Resilient and Responsible Critical Minerals Supply Chains for the Clean Energy Transition”
- 9 IEA, “Energy Technology Perspectives 2023,” <https://iea.blob.core.windows.net/assets/a86b480e-2b03-4e25-bae1-da1395e0b620/EnergyTechnologyPerspectives2023.pdf>
- 10 Christina Lu, “China Tightens Its Grip on Yet Another Critical Minerals,” *Foreign Policy*, August 23, 2024, <https://foreignpolicy.com/2024/08/23/china-antimony-us-critical-mineral-defense-gallium-germanium/>
- 11 “China Export Curbs Choke Off Shipment of Gallium and Germanium for Second Month,” *Reuters*, October 20, 2023, <https://www.google.co.in/url?sa=t&source=web&rct=j&opi=89978449&url=https://www.reuters.com/world/china/china-export-curbs-choke-off-shipments-gallium-germanium-second-month-2023-10-20/&ved=2ahUKEwjQj8i7oMKIAXXOe2wGHWTkF3kQFnoECCUQAQ&usq=AOvVaw3eCc0UdF6qI3zBWtgMCvy->
- 12 Tatsuya Terazawa, “How Japan Solved its Rare Earth Minerals Dependency Issue,” World Economic Forum, October 13, 2023, <https://www.weforum.org/agenda/2023/10/japan-rare-earth-minerals/>
- 13 Cheng Ting-Fang, “China’s Rare Earth Rule to Speed Supply Chain Shifts: Solvay CEO,” *Nikkei Asia*, July 24, 2024, <https://asia.nikkei.com/Spotlight/Supply-Chain/China-s-rare-earth-rule-to-speed-supply-chain-shifts-Solvay-CEO#>

- 14 Joseph Hoppe, “Green Transition Set to Face Critical Minerals Shortfall, IEA Says,” *Wall Street Journal*, May 17, 2023, <https://www.wsj.com/articles/green-transition-set-to-face-critical-minerals-shortfall-iea-says-cc89acf0>
- 15 IEA, “The Role of Critical Minerals in Clean Energy Transitions,” <https://iea.blob.core.windows.net/assets/ffd2a83b-8c30-4e9d-980a-52b6d9a86fdc/TheRoleofCriticalMineralsinCleanEnergyTransitions.pdf>
- 16 International Energy Agency, Critical Minerals Data Explorer, <https://www.iea.org/data-and-statistics/data-tools/critical-minerals-data-explorer>
- 17 U.S. Geological Survey, “Mineral Commodity Summaries 2024,” <https://pubs.usgs.gov/publication/mcs2024>
- 18 International Energy Agency, Critical Minerals Data Explorer
- 19 International Energy Agency, Critical Minerals Data Explorer
- 20 “Critical Minerals Strategy 2023-2030”
- 21 Ministry for the Department of Industry, Science and Resources, “Securing Australia’s Critical Minerals, Exploration and Processing Industries,” May 14, 2024, <https://www.minister.industry.gov.au/ministers/king/media-releases/securing-australias-critical-minerals-exploration-and-processing-industries>
- 22 “Shifting Sands: Updates to Australia’s Critical Minerals List,” *Micromine*, December 20, 2023, <https://www.micromine.com/shifting-sands-updates-australias-critical-minerals-list/>
- 23 Analysis & Policy Observatory, “Australia’s Critical Minerals Strategy,” March 28, 2019, https://apo.org.au/sites/default/files/resource-files/2019-03/apo-nid227646_1.pdf
- 24 “Critical Minerals Strategy 2023-2030”
- 25 James Laureceson, “Australia’s Critical Minerals Strategy Needs More Economic Reality and Less Geopolitical Wishful Thinking,” *Australia-China Relations Institute*, April 28, 2024, <https://www.australiachinarelations.org/content/australia%E2%80%99s-critical-minerals-strategy-needs-more-economic-reality-and-less-geopolitical>
- 26 Ian Satchwell, “Australia’s Leadership Imperatives in Critical Minerals,” *ASPI*, April 17, 2023, <https://www.aspistrategist.org.au/australias-leadership-imperatives-in-critical-minerals/>
- 27 Australian Government, “Australia Critical Mineral List and Strategic Mineral List,” February 20, 2024, <https://www.industry.gov.au/publications/australias-critical-minerals-list-and-strategic-materials-list>
- 28 “Critical Minerals for India: Report of the Committee on Identification of Critical Minerals”
- 29 “Critical Minerals for India: Report of the Committee on Identification of Critical Minerals”

- 30 Ministry of Mines, Government of India, <https://pib.gov.in/Pressreleaseshare.aspx?PRID=1807681>
- 31 “Attempts Being Made to Monopolise Critical Resources: Defence Minister,” *Hindustan Times*, October 5, 2024, <https://www.hindustantimes.com/india-news/attempts-being-made-to-monopolise-critical-resources-defence-minister-101728067391341.html>
- 32 “Critical Minerals for India: Report of the Committee on Identification of Critical Minerals”
- 33 “Critical Minerals for India: Report of the Committee on Identification of Critical Minerals”
- 34 “Critical Minerals for India: Report of the Committee on Identification of Critical Minerals”
- 35 Subhash Narayan, “Centre Sets Stage for Mining Reforms,” *Mint*, July 16, 2023, <https://www.livemint.com/news/india/government-plans-to-ease-mining-clearances-and-relax-rules-for-captive-mining-in-india-11689527405651.html>
- 36 Ministry of Coal, Government of India, <https://pib.gov.in/PressReleaseIframePage.aspx?PRID=2039606>
- 37 Ministry of Mines, Government of India, <https://pib.gov.in/PressReleasePage.aspx?PRID=1945102>
- 38 Ministry of Mines, Government of India, <https://pib.gov.in/PressReleasePage.aspx?PRID=1945102>
- 39 “Cabinet Approves Royalty Rates for Mining of 12 Critical and Strategic Minerals –Beryllium, Cadmium, Cobalt, Gallium, Indium, Rhenium, Selenium, Tantalum, Tellurium, Tungsten, and Vanadium,” PM India February 29, 2024, https://www.pmindia.gov.in/en/news_updates/cabinet-approves-royalty-rates-for-mining-of-12-critical-and-strategic-minerals-beryllium-cadmium-cobalt-gallium-indium-rhenium-selenium-tantalum-tellurium-titanium-tungsten-and-vanadium/#:~:text=The%20Union%20Cabinet%20chaired%20by,%2C%20Cobalt%2C%20Gallium%2C%20Indium%2C
- 40 “Critical Minerals for India: Report of the Committee on Identification of Critical Minerals”
- 41 Ministry of Mines (@MinesMinIndia), “Shri V.L. Kantha Rao, Secretary chaired the second meeting of the Inter-Ministerial Group on Critical Minerals,” Twitter, April 25, 2024, <https://x.com/MinesMinIndia/status/1783522140995907956>; Ministry of Mines (@MinesMinIndia), “@MinesMinIndia held an Industry interaction on various multilateral cooperation initiatives,” Twitter, April 24, 2024, <https://x.com/MinesMinIndia/status/1783093714987925868>
- 42 Cabinet, Government of India, <https://pib.gov.in/Pressreleaseshare.aspx?PRID=1566733>
- 43 Cabinet, Government of India, <https://pib.gov.in/Pressreleaseshare.aspx?PRID=1566733>

- 44 Sumant Banerji, “No White Gold Rush: Why Interest in Kashmir’s Lithium Reserves is Lukewarm,” *Mint*, June 10, 2024, <https://www.livemint.com/industry/energy/no-white-gold-rush-why-interest-in-kashmir-s-lithium-reserves-is-lukewarm-11718099808250.html>
- 45 Ministry of Mines, Government of India, <https://pib.gov.in/PressReleasePage.aspx?PRID=1942027>
- 46 John Reed, Ciara Nugent, and Harry Dempsey, “India Seeks to Secure Critical Minerals Resources in Race for Lithium,” *Financial Times*, April 23, 2024, <https://www.ft.com/content/ac31e55d-17ee-408f-8a38-bea7a4ffd440>
- 47 Ministry of Coal, Government of India, <https://pib.gov.in/PressReleaseIframePage.aspx?PRID=2039606>
- 48 “India in Talks with Sri Lanka to Acquire Graphite Mines,” *The Economic Times*, May 23, 2024, <https://energy.economictimes.indiatimes.com/news/coal/india-in-talks-with-sri-lanka-to-acquire-graphite-mines/110347939>
- 49 Department of Energy, “Critical Minerals and Materials,” <https://www.energy.gov/eere/ammto/critical-minerals-and-materials>
- 50 Rapheal Deberdt, “The United States’ Strategy for Securing Critical Minerals Supplies: Can it Meet the Needs of the IRA?,” Institut français des relations internationales, April 9, 2024, https://www.ifri.org/sites/default/files/atoms/files/ifri_deberdt_us_minerals_supplies_2024.pdf
- 51 Minerals Commodity Summaries 2024, https://tableau.usgs.gov/views/MCSDashboardWorkbook_2024-01-30/MCSDashboard?%3Aembed=y&%3AisGuestRedirectFromVizportal=y#7
- 52 The White House, “President Biden Sets 2030 Greenhouse Gas Pollution Reduction Target Aimed at Creating Good-Paying Union Jobs and Securing U.S. Leadership on Clean Energy Technologies,” April 22, 2021, <https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/22/fact-sheet-president-biden-sets-2030-greenhouse-gas-pollution-reduction-target-aimed-at-creating-good-paying-union-jobs-and-securing-u-s-leadership-on-clean-energy-technologies/>
- 53 “Net-Zero Emissions Operations by 2050 Including a 65% Reduction by 2030,” Office of the Federal Chief Sustainability Officer, <https://www.sustainability.gov/federalsustainabilityplan/emissions.html>
- 54 Department of Energy, “Critical Minerals & Materials Program,” <https://www.energy.gov/cmm/what-are-critical-materials-and-critical-minerals>
- 55 The White House, “President Biden Takes Action to Protect American Workers and Businesses from China’s Unfair Trade Practices,” May 14, 2024, <https://www.whitehouse.gov/briefing-room/statements-releases/2024/05/14/fact-sheet-president-biden-takes-action-to-protect-american-workers-and-businesses-from-chinas-unfair-trade-practices/>

- 56 The White House, “President Biden Takes Action to Protect American Workers and Businesses from China’s Unfair Trade Practices”
- 57 *2023 Report to Congress of the U.S.-China Economic and Security Review Commission*, United States-China Economic and Security Review Commission, November 2023, https://www.uscc.gov/sites/default/files/2023-11/2023_Annual_Report_to_Congress.pdf
- 58 Keith Bradsher, “Amid Tension, China Blocks Vital Exports to Japan,” *The New York Times*, September 22, 2010, <https://nytimes.com/2010/09/23/business/global/23rare.html>
- 59 Terazawa, “How Japan Solved its Rare Earth Minerals Dependency Issue”
- 60 “Japan’s New International Resource Strategy to Secure Rare Metals,” Ministry of Economic, Trade and Industry, July 31, 2020, https://www.enecho.meti.go.jp/en/category/special/article/detail_158.html
- 61 Ministry of Foreign Affairs, *National Security Strategy 2022*, <https://www.cas.go.jp/jp/siryou/221216anzenhoshou/nss-e.pdf>
- 62 Japan Oil, Gas and Metals National Corporation, “Business Tool List: An Introduction of Support Tools of the Metals Departments,” <https://www.jogmec.go.jp/content/300196027.pdf>
- 63 “World Bank and Japan Sign Administration Arrangement on RISE to Boost Investments in Supply Chains of Clean Energy,” World Bank, February 23, 2024, <https://www.worldbank.org/en/news/press-release/2024/02/23/world-bank-and-japan-sign-administration-arrangement-on-rise-to-boost-investments-in-supply-chains-of-clean-energy>
- 64 Ministry of Foreign Affairs, Japan, *Diplomatic Bluebook 2023*, <https://www.ec.emb-japan.go.jp/files/100406514.pdf>
- 65 “Critical Minerals for India: Report of the Committee on Identification of Critical Minerals”
- 66 Department of Energy, “Critical Minerals & Materials Program,” <https://www.energy.gov/cmm/what-are-critical-materials-and-critical-minerals>
- 67 “Critical Minerals Strategy 2023-2030”
- 68 Australian Government, “Critical Minerals Strategy 2023-2030: Our Approach,” <https://www.industry.gov.au/publications/critical-minerals-strategy-2023-2030/our-approach>
- 69 “Critical Minerals for India: Report of the Committee on Identification of Critical Minerals”
- 70 “Japan’s New International Resource Strategy to Secure Rare Metals,” METI, July 31, 2020, https://www.enecho.meti.go.jp/en/category/special/article/detail_158.html
- 71 *2021 DOE Critical Minerals Strategy*, US Department of Energy, https://www.energy.gov/sites/prod/files/2021/01/f82/DOE%20Critical%20Minerals%20and%20Materials%20Strategy_0.pdf

- 72 The White House, “Quad Leaders’ Tokyo Summit 2022,” May 23, 2022, <https://www.whitehouse.gov/briefing-room/statements-releases/2022/05/23/fact-sheet-quad-leaders-tokyo-summit-2022/>
- 73 The White House, “Quad Leaders’ Joint Statement,” May 20, 2022, <https://www.whitehouse.gov/briefing-room/statements-releases/2023/05/20/quad-leaders-joint-statement/>
- 74 Quad Investors Network, “Vision,” <https://quadinvestorsnetwork.org/vision>
- 75 Business Standard, “Bill in US Senate to Curb US’ Dependence on China for Critical Minerals,” April 1, 2022, https://www.business-standard.com/article/international/bill-in-us-senate-to-curb-us-dependence-on-china-for-critical-minerals-122040100142_1.html
- 76 Business Standard, “Bill in US Senate to Curb US’ Dependence on China for Critical Minerals”
- 77 Office of the United States Trade Representative, “United States and Japan Sign Critical Minerals Agreement,” March 28, 2023, <https://ustr.gov/sites/default/files/2023-03/US%20Japan%20Critical%20Minerals%20Agreement%202023%2003%2028.pdf>
- 78 The White House, “Delivering on the Next Generation of Innovation and Partnership with Australia,” October 25, 2023, <https://www.whitehouse.gov/briefing-room/statements-releases/2023/10/25/fact-sheet-delivering-on-the-next-generation-of-innovation-and-partnership-with-australia/>
- 79 Minister for Resources and Minister for Northern Australia, <https://www.minister.industry.gov.au/ministers/king/media-releases/australia-japan-strengthen-critical-minerals-cooperation>
- 80 Australian Government, “Benefits for the Australian Critical Minerals and Resources Sectors,” <https://www.dfat.gov.au/sites/default/files/aiecta-benefits-for-australian-critical-mineral-and-resources.pdf>
- 81 Office of the United States Trade Representative, “United States and Japan Sign Critical Minerals Agreement”
- 82 U.S. Department of the Interior, “The United States and Australia Formalize Partnership on Critical Minerals,” November 18, 2019, <https://www.doi.gov/pressreleases/united-states-and-australia-formalize-partnership-critical-minerals>
- 83 Ministry of External Affairs, “Quad Statement of Principles on Clean Energy Supply Chains in the Indo-Pacific,” May 20, 2023, https://www.mea.gov.in/bilateral-documents.htm?dtl/36572/Quad_Statement_of_Principles_on_Clean_Energy_Supply_Chains_in_the_IndoPacific#:~:text=Supporting%20future%20clean%20energy%20workforce,and%20accessibility%20in%20the%20clean
- 84 “Australia’s Energy Commodity Resources 2024: Uranium and Thorium,” Australian Government, July 15, 2024, <https://www.ga.gov.au/aecr2024/uranium-and-thorium>

- 85 *Global Critical Mineral Outlook 2024*, IEA, <https://iea.blob.core.windows.net/assets/ee01701d-1d5c-4ba8-9df6-abecac9de99a/GlobalCriticalMineralsOutlook2024.pdf>
- 86 Hannah Ritchie and Pablo Rosado, “Which Countries Have the Critical Minerals Needed for the Energy Transition?,” *Our World in Data*, September 16, 2024, <https://ourworldindata.org/countries-critical-minerals-needed-energy-transition>
- 87 Ritchie and Rosado, “Which Countries Have the Critical Minerals Needed for the Energy Transition?”
- 88 Abhishek Sharma, “Quad Should Lead Region Forward in Securing Mineral Supply Chain,” *Nikkei Asia*, December 11, 2023, <https://asia.nikkei.com/Opinion/Quad-should-lead-region-forward-in-securing-mineral-supply-chains>
- 89 David Claughton, “Chinese Investment is Crucial to Australia’s Energy Transition. How Will it Happen?,” *ABC News*, November 6, 2023, <https://www.abc.net.au/news/rural/2023-11-06/chinese-mining-investment-australia/103047580>
- 90 Paul-Alain Hunt, Thomas Biesheuvel, and Mark Burton, “BHP to Shut Australia Nickel Business as Glut Upends Market,” *Bloomberg*, July 11, 2024, <https://www.bloomberg.com/news/articles/2024-07-11/bhp-to-cut-nickel-supplies-as-global-glut-forces-mine-suspension>
- 91 Jon Emont, “China is Winning the Minerals War,” *The Wall Street Journal*, May 21, 2024, <https://www.wsj.com/finance/commodities-futures/china-dominant-mineral-mining-global-supply-chain-e2b7840e>
- 92 Laurenceson, “Australia’s Critical Minerals Strategy Needs More Economic Reality and Less Geopolitical Wishful Thinking”
- 93 Michael E. Miller, “How Chinese Investors Tried to Take Over an Australian Mining Company,” *The Washington Post*, August 20, 2024 <https://www.washingtonpost.com/world/2024/08/20/australia-china-rare-earths-mining-northern-minerals/>
- 94 Rhiannon Hoyle, “BHP to Suspend Australian Nickel Operations Amid Glut of EV Metal,” *The Wall Street Journal*, July 11, 2024, <https://www.wsj.com/business/bhp-to-suspend-australian-nickel-operations-amid-market-slump-75593d6f>
- 95 James Guild, “Australia Gets Nickel-and-Dimed by Indonesian Downstreaming,” *East Asia Forum*, June 11, 2024, <https://eastasiaforum.org/2024/06/11/australia-gets-nickel-and-dimed-by-indonesian-downstreaming/>
- 96 Guild, “Australia Gets Nickel-and-Dimed by Indonesian Downstreaming”
- 97 Daan Walter et al., “The Battery Mineral Loop: The Path from Extraction to Circularity,” *RMI*, July 2024, https://rmi.org/wp-content/uploads/dlm_uploads/2024/07/the_battery_mineral_loop_report_July.pdf
- 98 You Xiaoying, “China’s Position in the Global Race for Alternative EV Batteries,” *Dialogue Earth*, June 18, 2024, <https://dialogue.earth/en/business/chinas-position-in-the-global-race-for-alternative-ev-batteries/>

Endnotes

- 99 Dannie Peng, “China Scientists’ Low-Cost Solid-State Battery Could be EV Industry Breakthrough,” *SCMP*, July 8, 2024, <https://www.scmp.com/news/china/science/article/3269565/china-scientists-low-cost-solid-state-battery-could-be-ev-industry-breakthrough>
- 100 Jyotindra Dubey, “India to Take Lead in Defining Global Rating Standards for ESG: Sanyal,” *The Economic Times*, October 2, 2023, <https://economictimes.indiatimes.com/news/economy/policy/india-to-take-lead-in-defining-global-rating-standards-for-esg-sanyal/articleshow/104105577.cms?from=mdr>
- 101 Lu, “China Tightens Its Grip on Yet Another Critical Mineral”
- 102 “Five-Point Plan for Critical Minerals Security,” G7 2023 Hiroshima Summit, May 2023, <https://www.meti.go.jp/information/g7hirosima/energy/pdf/Annex005.pdf>
- 103 Gregory Wischer, “The US Must Close an Inflation Reduction Act Loophole That May Benefit Indonesian Nickel,” *The Northern Miner*, May 22, 2024, <https://www.northernminer.com/regulatory-issues/the-us-must-close-an-inflation-reduction-act-loophole-that-could-benefit-indonesian-nickel/1003867672/>
- 104 U.S. Department of State, “United States Welcomes New Deal in Graphite Production Between POSCO and Black Rock Mining,” September 6, 2024, <https://www.state.gov/united-states-welcomes-new-deal-in-graphite-production-between-posco-and-black-rock-mining/>



Ideas . Forums . Leadership . Impact

20, Rouse Avenue Institutional Area,
New Delhi - 110 002, INDIA
Ph. : +91-11-35332000. Fax : +91-11-35332005
E-mail: contactus@orfonline.org
Website: www.orfonline.org