# AUSTRALIA'S RARE EARTH HIGHWAY: A RACE TO RESILIENCE OR DOMINANCE?

**NEHA MISHRA**

## INTRODUCTION

The anticipated global demand for Rare Earth Elements (REEs) is projected to reach 315,000 tonnes by the year 2030, which can be mostly attributed to the worldwide transition towards clean technology, including electric vehicles, wind power, and solar power. The expanding demand, and the increasing control of China over the REE supply chain have prompted the formation of collaborative resilience initiatives at both bilateral and global levels.

A secure rare earth supply chain requires resilience in three main components: upstream (extraction and separation of rare earth oxide); midstream (processing of rare earth metals and alloys); and downstream (manufacturing of permanent magnets and end-products). It is noteworthy that China dominates in all the components; thus, a robust and dependable network of countries with thriving economies is required to maintain resilience within the Environmental, Social, and Governance (ESG) frameworks. Although the capacities of the upstream and midstream sectors have witnessed expansion in most countries, downstream capacities are still underdeveloped, which makes it imperative to foster collaboration.

Ms **Neha Mishra** served as an Associate Fellow at the Centre for Air Power Studies, New Delhi. She is currently working as an Executive Officer, Policy and International Affairs, Society of Indian Defence Manufactures (SIDM), Confederation of Indian Industry.

**Australia holds the distinction of being the foremost global exporter of minerals that are characterised by their superior quality, while adhering to ethical sourcing practices and employing environmentally sustainable mining techniques.**

Within these resilience initiatives, Australia is well-positioned to fill the gap for advancing downstream capacities outside China, considering its abundant resource endowment, strong mining capacity, and well-established processing infrastructure.

Australia is acknowledged as a prominent resource-rich nation and plays a pivotal role in the global supply of critical minerals, which are being utilised for a wide range of applications, including lithium-ion batteries, smartphones, electric vehicles, solar panels, wind turbines, and space missions. It should be noted that Australia holds the distinction of being the foremost global exporter of minerals that are characterised by their superior quality, while adhering to ethical sourcing practices and employing environmentally sustainable mining techniques. These factors have been enhancing global attention towards Australia as a viable destination for supply chain resilience.

It is worth noting that China has held the prime interest in Australia's resource power and has extended multiple investments and collaborations over the past decade, for instance, in iron ore. However, China's strategic employment of resources in the past years, such as during the trade war (2018), has affected its trade dynamics with Australia. Although Australia has not experienced any immediate consequences from the Russia-Ukraine crisis, the potential impacts on market dynamics raised considerable concerns for Australia's export sector. From the words of Leon Trotsky, a Ukrainian-Russian Marxist revolutionary of the early 20th century, "You may not be interested in war, but war is interested in you", it can be inferred that the Australian economy and its capacity for exporting will inevitably be impacted by the ongoing crisis. Consequently, it becomes crucial for Australia to ensure its position within the supply chain and the global efforts to sustain resilience.

Using the above-explained context, the objective of this article is to determine whether Australia's rare earth highway is a race to resilience or dominance? The article commences by examining the growing global initiatives for supply chain resilience. The subsequent section deals with Australia's rare earth highway and its strategies to achieve defence and clean energy goals. The next section will examine the current rare earth progress in Australia in terms of deposits, processing facilities, exploration and development projects, policy and regulation initiatives, operating framework of the REE industry supporting the advancement of Research and Development (R&D) and infrastructure facilities. The next part explains the position of Australia in the global supply chain resilience framework such as the Quadrilateral Security Dialogue (QUAD), Supply Chain Resilience Initiative (SCRI), Indo-Pacific Economic Framework for Prosperity (IPEF), G20, China+1, and others. The subsequent section explains the resilience collaborations at the bilateral level with high-import dependent countries like the USA, Japan, India, South Korea, and United Kingdom; and with resource rich countries like Malaysia, Vietnam, and Tanzania. The final section examines the dynamics between China and Australia amidst the ongoing global supply chain crisis and the potential of Australia's rare earth highway to be a challenge to China's rare earth dominance or be a significant contributor to the global supply chain resilience.

**The matter of supply chain resilience has gained significant attention in recent times due to several factors challenging the supply chains. These concerns include resource scarcity, disruptions in commodity flow, embargoes, geopolitical tensions, trade disputes, and the recent pandemic crisis.**

## GROWING GLOBAL RESILIENCE INITIATIVE

The matter of supply chain resilience has gained significant attention in recent times due to several factors challenging the supply chains. These concerns include resource scarcity, disruptions in commodity flow,

embargoes, geopolitical tensions, trade disputes, and the recent pandemic crisis. Countries such as the United States, Canada, Japan, Australia, India, and various others are presently engaged in these initiatives with the objective of enhancing resilience within the supply chains.

### *Evolution of Global Supply Chain Risk*

Supply chains have been around for as long as there have been industries. They have always linked the order of all plants to keep the inputs and outputs of industries going. Michael Porter popularised the idea of the "value chain" with the goal of applying the "Ricardian principle of comparative advantage" to the value chains of industries. This meant that industries should focus on what they do best and hire others to do the rest. The global supply chain holds great importance as it pertains to a nation's need to attain and prosper through its manufacturing, commercial endeavours, and participation in the global economic system.

The idea of supply risk within Global Value Chain (GVC) started to emerge in the late 1930s and received increased significance during the oil and cobalt crises in the 1970s. The growth of GVC led to its expansion beyond finished items to encompass components and sub-assemblies. This development proved significant not just for the manufacturing industries, but also for sectors such as energy, food production, Research and Development (R&D), and various others. Consequently, there was an increase in the cross-border exchange of intermediate commodities, specifically parts and components, which led to a shift from 'trade in goods' to 'trade in value added' in the supply chain.

With the development of 'trade in value added', a notable asymmetry known as the hub-and-spoke model evolved, which signified the interdependence between the factory economy (which deals with raw materials) and the headquarters economy (which deals with manufactured goods). As an example, the United States, being a headquarters economy, has minimal reliance on imports from Canada and Mexico. Conversely, Mexico and Canada, functioning as manufacturing or factory economies, have a significant dependence on the United States.

The concept of the global supply chain encompasses a broader scope beyond mere trade, as it encompasses various factors. These factors include: (a) international investments made in production facilities and technology; (b) infrastructure services that aid in the distribution of production and services; (c) cross-border exchange of information and knowledge. This phenomenon is sometimes referred to as the '*Trade-Investment-Services-International Production'* nexus. In order to effectively engage with, and compete within, the global supply chain, nations or emerging economies must possess a robust industrial foundation, which may be characterised as the implementation of the '*Join-Instead-of-Build Development Paradigm*' strategy or be termed as the 'resilience strategy'.

### *Conceptualisation of Supply Chain Risk*

The inclusion of REEs in the global value supply chain, coupled with the increasing supply risk associated with them, has prompted many conceptual assessments, including the examination of supply diversification both domestically and internationally. The initial examination of REEs within the supply chain centred on the evaluation of national strategies for ensuring supply security, the examination of geopolitical factors influencing resource availability, criticality assessments, and the assessment of resource efficiency within the global mineral markets. Additional areas of examination for REEs encompassed their strategic dimensions, implications for national security, resource technology considerations, environmental challenges, and other related aspects. Overall, the aforementioned analyses indicate the utilisation of a systemic approach to examine the various challenges within the REE market related to underlying causes, interconnections, and consequences inside the market system.

Globalisation led to a significant transformation in the focus of supply chains, shifting from a major emphasis on industrial interests to the character of production phases. This movement may be attributed to two key phenomena: fractionalisation and dispersion. Fractionalisation refers to the process of dividing supply networks into smaller stages of production,

whereas dispersion entails the division of supply chain processes based on their geographical distribution. These two phenomena have been defining the global resilience projects, which involve dividing the supply chain into production stages based on the geographic distribution of resources. Australia has emerged as a potential leader in both of these categories. Contrary to nations heavily reliant on imports, Australia, being a significant worldwide exporter and having low domestic use of REEs, acknowledges their significance as a valuable resource with the ability to meet global demand. This has encouraged a significant role of Australia in the major resilience initiatives, at the bilateral level with countries like the USA, Japan, India, and others, as well as at the multilateral level with initiatives like the QUAD, SCRI, Mineral Security Partnership (MSP), and others.

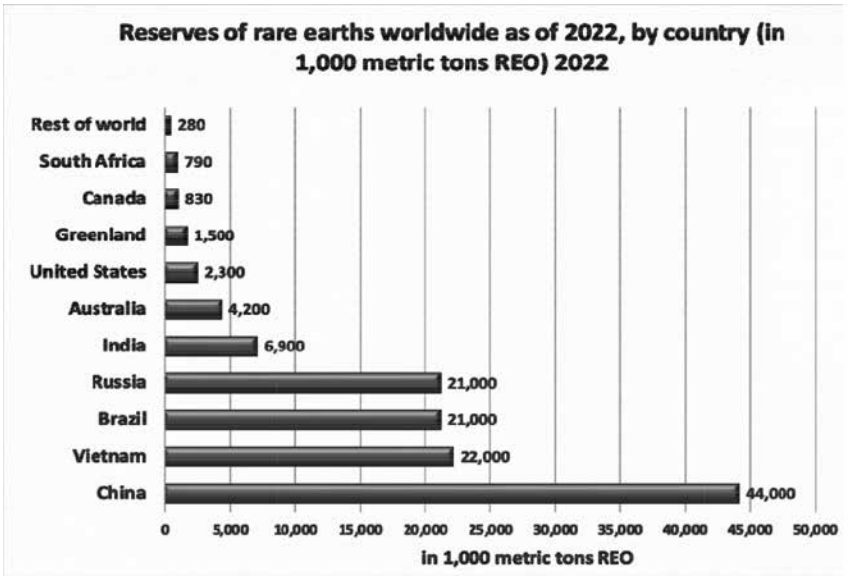
## AUSTRALIA'S RARE EARTH HIGHWAY

As per United States Geological Survey (USGS) data (2022), Australia, with the sixth-largest deposits of 4.2 million tonnes and the being the fourth-largest producer of rare earth elements, with an annual capacity of 22,000 tonnes, has a significant position on the road of REE supply chain resilience (see Fig 1). This output, albeit relatively smaller in magnitude in comparison to China's 168,000 tonnes, exhibits substantial growth from Australia's mere 1,995 tonnes capacity in 2011. Companies like Lynas Rare Earths, Arafura Rare Earths, and Iluka Resources have played a significant role in the advancement of the Australian rare earth industry by contributing to the development of both upstream and midstream segments of the supply chain.

Since 2011, Lynas has experienced growth in neodymium-praseodymium production, whereas Arafura Rare Earths' Nolans project focusses on expanding downstream processing by producing economically significant neodymium iron boron (NdFeB) magnets and permanent magnets. As part of its initiative to reduce dependence on China, the Australian government allocated AUD 30 million towards this endeavour, which is a component of the broader AUD 240 million investment in the rare earth business.

Former Australian Defence Minister Kim Beazley pointed out that without rare earths, it would be impossible to produce the next generation of military systems that countries like Australia will rely on to give them an advantage in deterrence or confrontation. Beazley also explained that a reliable supply of refined rare earths is crucial for producing the cutting-edge capabilities being developed by the Australia-United Kingdom-United States (AUKUS) security collaboration, such as cyber capabilities, artificial intelligence, quantum technologies, hypersonics, standoff strike weapons, and underwater technology. Beazley suggested that Australia will need significant government investment in its processing and manufacturing capabilities to become less reliant on China, which the United States and Japan can work together to accomplish through the resilience initiative, as the US has the availability of reserves and Japan has the necessary infrastructure to refine rare earths.

**Fig 1: Rare Earth Reserves in Australia**

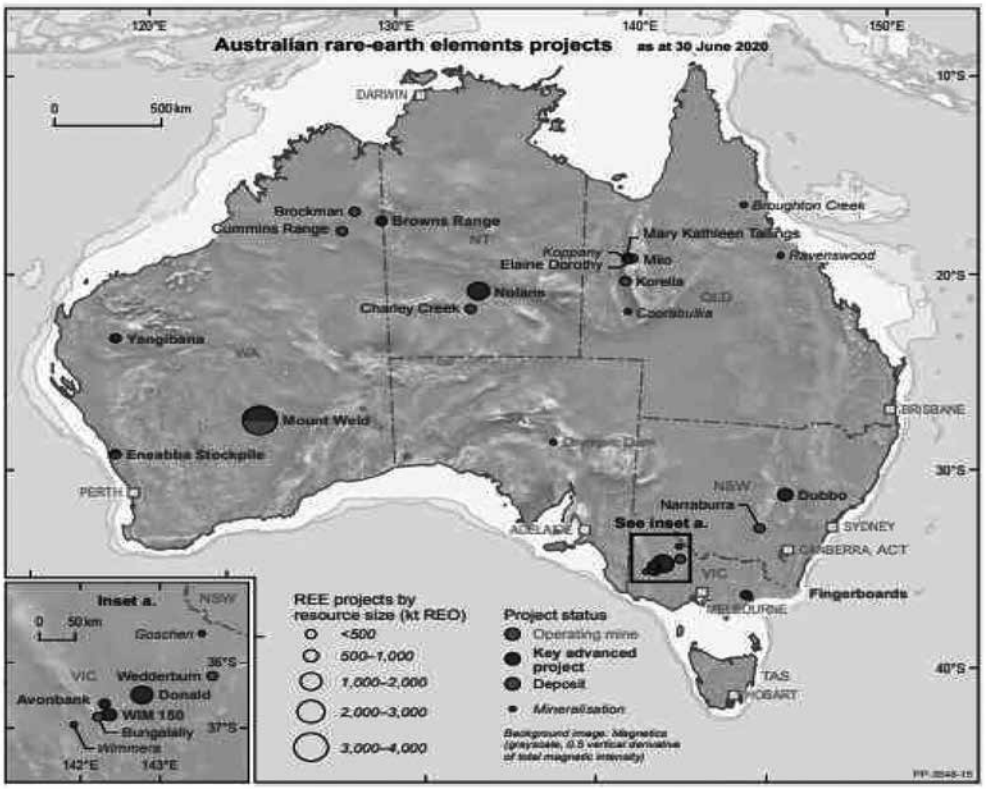



Source: Yogesh Joshi, Kapil Patil, and Kartik Bommakanti, "Resilient Rare Earths: Pathways for the G20", *ORF T20 Policy Brief*, June 14, 2023, https://www.orfonline.org/wp-content/uploads/2023/06/TF1_132_RareEarths.pdf. Accessed on October 2, 2023.

## REE INITIATIVES OF AUSTRALIA

John Coyne, the head of the Australian Strategic Policy Institute's (ASPI's) Northern Australia Strategic Policy Centre, has claimed that the creation of multi-ore mineral-processing centres in Australia holds considerable potential. However, ultimately, it will be futile to establish supply chain resilience for rare earth ores if the miners are still obligated to transport them to China for processing.

**Fig 2: Australia's REE Deposits**




Source: Rare Earth Elements - Reliable, Responsible, Australian: A Critical Minerals Snapshot based on the Australian Prospectus 2020, Commonwealth of Australia, March 2021, https://www.austrade.gov.au/ArticleDocuments/5572/ATIC_critical%20minerals%20snapshot_REE_JUN21_web%20(002).pdf.aspx. Accessed on May 15, 2023.

Securing each stage of the rare earth supply chain is crucial for establishing a sustainable ecosystem. The reliability of upstream mining is essential in ensuring consistent access to raw Rare Earth Oxides (REOs) for subsequent processing into REEs during the midstream stage. Successful processing is imperative for the manufacturing of end products and rare earth magnets. Australia has been working to secure and advance its presence in every stage of the REE supply chain through initiatives such as given below.

**The Lynas Corporation, an Australian firm, holds the distinction of being the largest rare earths mining and processing company outside of China.**

***(a) Projects to Develop Deposits and Processing Facilities***

The 'mine to metals' strategy of major Australian companies like Australian Strategic Materials (ASM), Lynas, Illuka, involves extracting, refining, and manufacturing high-purity metals, and alloys for direct global supply, thus, aiming to develop the capacity of REE deposits all around Australia (see Fig 2). Multiple key projects are in the operating and under-construction stages to increase the output of raw rare earth materials and processed rare earth oxides (see Fig 3). The details of some of these significant projects are as follows:

*(i) Lynas Rare Earths: Mount Weld Concentration Plant*

The Lynas Corporation, an Australian firm, holds the distinction of being the largest rare earths mining and processing company outside of China. This corporation operates two significant facilities, one dedicated to mining and the other to processing. Mount Weld, located in Australia, is home to a processing plant situated in Kuantan, Malaysia. The Lynas Corporation of Australia began to develop its production capacity since 1983, but conducted its first mining campaign in 2008 in the largest deposit of rare earth, the Mount Weld mine. However, the company could not handle the burst out of the market due to the Senakaku Island crisis in 2011.

The Lynas Corporation redeveloped in 2014 by establishing a collaboration with the US and Malaysia. It began investing in the $800 million rare earth processing plant in Malaysia, which would become the world's leading processing facility whenever it becomes fully operational, challenging the monopoly of China. However, the increasing environmental-related concerns of the regions near the east coast pose an obstacle to the planning of Australia. For instance, Nicholas Leadbeater, a chemist at the University of Connecticut has claimed, "As the world's hunger for these elements increases, the waste is going to increase. The more mines there are, the more trouble they are going to be."

Lynas is spending over AUD 1 billion to build a Rare Earths Processing Facility in Kalgoorlie and to develop its Mount Weld mine and concentration plant in the Laverton area. Before being sent to the Lynas advanced materials factory in Malaysia, the concentrate from Mount Weld will be processed at the facility. In addition, Lynas plans to build a processing plant in the United States, possibly on the Texas Gulf coast, and the Kalgoorlie Facility was built with that plant in mind. By 2024, the Mount Weld expansion project will produce enough concentrate feedstock to manufacture 12,000 tonnes per annum (tpa) of praseodymium (NdPr) products.

*(ii) Nolans Project by Arafura Resources*

The Nolans Project is the only fully integrated neodymium and praseodymium (NdPr) project in Australia that is ready to go ahead. It will dig from an open pit and process the ore to oxide. All the necessary permissions from the government are in place for the spot to be used for mining, extracting, and separating rare earths, as well as managing waste.

*(iii) Iluka Resources: Eneabba Rare Earths Refinery*

After making a final investment decision in 2022, Iluka is constructing a fully integrated rare earths refinery at Eneabba in Western Australia. The Critical Minerals Facility of the Australian government has provided Iluka with a loan of AUD 1.25 billion. With initial production expected to begin in 2025, Iluka is poised to become a major source of rare earth oxides for the entire world. Illuka Resources forecast production up to 23 kilo tonnes per annum (ktpa) of rare earth oxides.

**Fig 3: Rare Earth Projects in Australia**

| Project name | Company | Project status | Primary mineral(s) | Tonnage (Mt) | Grade | Units | | Contained (kt) |
|---|---|---|---|---|---|---|---|---|
| Mount Weld | Lynas Corporation Ltd | Operating | REE | 55.4 | 5.40 | % | TREO | 3,000 |
| Eneabba Stockpile | Iluka Resources Ltd | Operating | Zr, REE, Ti | 1.0 | 10.34 | % | TREO | 103 |
| Nolans | Arafura Resources Ltd | Pre-const | REE, P | 56.0 | 2.60 | % | TREO | 1,456 |
| Dubbo | Alkane Resources Ltd | Pre-const | Zr, Nb, Hf, Ta, REE | 75.2 | 0.88 | % | TREO | 662 |
| Yangibana | Hastings Tech. Metals Ltd | Pre-const | REE | 21.3 | 1.12 | % | TREO | 238 |
| Browns Range | Northern Minerals Ltd | Pre-const | REE | 9.3 | 0.67 | % | TREO | 57 |
| Donald | Astron Ltd | FS | Zr, Ti, REE | 2,427.0 | 0.06 | % | TREO | 1,398 |
| WIM 150 | Murray Zircon Pty Ltd | FS | Zr, Ti, REE | 1,650.0 | 0.06 | % | TREO | 908 |
| Fingerboards | Kalbar Resources Ltd | FS | Zr, Ti, REE | 530.0 | 0.09 | % | TREO | 490 |
| Avonbank | WIM Resource Pty Ltd | PFS | Zr, Ti | 490.0 | 0.06 | % | TREO | 308 |

Source: Rare Earth Elements - Reliable, Responsible, Australian: A Critical Minerals Snapshot based on the Australian Prospectus 2020, Commonwealth of Australia, March 2021, https://www.austrade.gov.au/ArticleDocuments/5572/ATIC_critical%20minerals%20snapshot_REE_JUN21_web%20(002).pdf.aspx. Accessed on May 15, 2023.

*(iv) Browns Range – Wolverine Rare Earth Project by Northern Minerals*

The Wolverine Rare Earth Project, which is a component of the Browns Range Total Mineral Resource, is poised to become the initial noteworthy producer of dysprosium and terbium outside China—its feasibility study was completed in 2015. Northern Minerals has partnered with

**ASM signed a conditional agreement with Hyundai Engineering, South Korea, in 2022, for the engineering, construction, and procurement design work for its flagship strategy, the 'Dubbo Project'.**

Iluka Resources to deliver rare earth concentrate from its Browns Range Wolverine Project through which it aims to be the leading supplier and ethical producer of dysprosium and terbium, sourcing from one of Australia's greatest heavy rare earth inventories—Iluka Resources. This supply agreement covers 30,500 tonnes of Total Rare Earth Oxides (TREOs) in concentrate during the first 8+ years of the mine's life.

*(v) Dubbo Project by Australian Strategic Materials (ASM)*

ASM signed a conditional agreement with Hyundai Engineering, South Korea, in 2022, for the engineering, construction, and procurement design work for its flagship strategy, the 'Dubbo Project'. ASM plans to generate metal oxides and mixed chlorides at the Dubbo Project and secured AUD 200 million of debt capital in 2021 with a non-binding letter of support from Export Finance Australia, an Australian government-owned organisation. The projected annual production rate for REEs is at 6,664 tpa, respectively, which is in the under-development stage.

*(vi) Donald Rare Earth and Mineral Sand Project by Astron Corporation Limited*

The Donald Project will employ traditional shallow dry mining techniques to support an on-site processing plant. The processing facility will generate Rare Earth Elements Concentration (REEC) and the availability of over 2.4 billion tonnes of heavy minerals is projected to provide a sustainable supply of zirconium, titanium, neodymium, and praseodymium (rare earth elements) for many years to come.

*(vii) Fingerboards Mineral Sands Project by Kalbar Operations*

The project is projected to generate heavy mineral concentrate that is expected to yield 13.5 ktpa of rare earths, consisting of 5 per cent of

light rare earths (Nd-Pr) and 20 per cent of heavy rare earths (Dy-Tb) in the global supply.

*(viii) Goschen Project by VHM Limited*
Goschen, a global rare earth project, contains 413,107 tonnes of Total Rare Earth Oxides (TREOs) in its mineral resource, thus, aims to produce Rare Earth Mineral Concentrate (REMC), Mixed Rare Earth Carbonate (MREC), and zircontitania Heavy Mineral Concentrate (HMC) for national and international markets.

**In 2019, the Australian government introduced its first critical mineral strategy, which involved the development of the inaugural critical minerals list.**

### *(b) Policy and Regulation Initiatives*

The policy initiatives to develop the rare earth industry began with the plan of Geoscience Australia, along with geological surveys in various states and the Northern Territory, to spearhead the national drilling initiative of the Australian Mineral Exploration Cooperative Research Centre (MinEx CRC). This collaborative effort, valued at AUD 218 million, represents the largest mineral exploration partnership globally, uniting industry, government, and research institutions. There are more than 13 policies, and regulations have been announced in the past three years (see Table 2), all of which show a promising growth for Australia's rare earth industry in the global supply chain resilience.

In 2019, the Australian government introduced its first critical mineral strategy, which involved the development of the inaugural critical minerals list. This decision was motivated by the acknowledgement that Australia's mineral economy is predominantly focussed on the exportation of minerals rather than domestic manufacturing, as explained by the Director of Mineral Resources Advice and Promotion at Geoscience Australia Ms Britt. The initial assemblage of a list of 24 minerals was devised with careful consideration of the strategic needs of Australia's partner nations, specifically the United States, the European Union, Japan, the United

Kingdom, and South Korea. Furthermore, the Australian government established the Critical Minerals Facilitation Office in 2020, with the purpose of providing guidance on critical minerals policy and facilitating connections in 2020 between Australian critical minerals projects and various stakeholders, including investors, regulators, government finance facilities, and strategic partners. In April 2021, the Australian government announced the Modern Manufacturing Initiative (MMI) worth AUD 1.3 billion, with the goal to fund recycling and renewable energy national manufacturing priority roadmap projects.

In May 2021, the Australian government made an announcement regarding the establishment of the 'Office of Supply Chain Resilience' with the aim of implementing COVID-19 responses and other reforms within the public service. In order to ensure rare earth mining within the ESG framework, the Australian government awarded Everledger, a supply chain and asset tracking company, and its partners, an AUD 3 million blockchain pilot grant to investigate how blockchain technology can be used to digitally certify critical minerals and track them through international supply chains at all levels, ranging from mining, downstream processing, cyclical, and end-of-life materials. The project aimed to build supply chain integrity and contribute to the 'Critical Minerals National Ethical Certification Scheme', with optimising ESG data reporting processes to save time and money.

In September 2021, the Australian government founded the 'Critical Minerals Facility' under the management of the Export Finance Australia to support all critical minerals initiatives. The facility has been endowed with AUD 2 billion funding with the goal to supplement private enterprises with commercial finance, in the form of loans, loan guarantees, bonds, and working capital support. This represented a significant step towards developing public-private partnerships in the rare earth industry. In the same year, the "Critical Energy Minerals Roadmap" was developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO), as a strategic initiative to facilitate the development and validation of innovative

technologies to effectively unleash the economic potential of these minerals. The roadmap outlines strategies for harnessing Australia's inherent potential and fostering synergies among the mining, manufacturing, and energy sectors. The 2022 Critical Minerals Strategy (CMS) has outlined a vision for Australia to establish itself as a prominent global player in the critical minerals sector, which builds on the first critical mineral strategy in 2019 (see Table 1).

The CMS prioritises three key areas to maximise Australia's natural resources:

- Reduce project risk by facilitating private investment, providing technical support, and making strategic investments to scale up financing.
- Build strong international alliances with important countries like the US, Japan, Korea, UK, India, and European Union (EU).
- Ensure an enabling environment for Australia's critical mining industry through policies which include maintaining standards and accreditation for a competitive edge; use of common infrastructure and facilities to attract investment; and research and development for sector growth.

**Table 1: Australia's Critical Mineral Strength (Reserves and Production)**

| | **Critical Mineral** | **Australia's Reserve Capacity (in tonnes)** | **Australia's Production Capacity (in tonnes)** | **Global Production Capacity** |
|---|---|---|---|---|
| 1 | High Purity Alumina (Aluminum Oxide) | 16.74 Mt | 0 | - |
| 2 | Antimony | 136.5 kt | 3.4 kt | 109 kt |
| 3 | Beryllium | No data | No data | 260 kt |
| 4 | Bismuth | No data | No data | 19 kt |
| 5 | Chromium | 0 | 0 | 41,400 kt |
| 6 | Cobalt | 1,582 kt | 5.3 kt | 165 kt |
| 7 | Gallium | No data | No data | 430 t |
| 8 | Germanium | No data | No data | 140 t |
| 9 | Graphite | 7,970 kt | No data | 1,000 kt |

| | | | | |
|---|---|---|---|---|
| 10 | Hafnium | 14.5 kt | No data | No data |
| 11 | Helium | No data | 4 $hm^3$ | 160 $hm^3$ |
| 12 | Indium | No data | No data | 920 t |
| 13 | Lithium | 6,700 kt | 55 kt | 105 kt |
| 14 | Magnesium (Magnesite) | 286,000 kt | 894 kt | 30,000 kt |
| 15 | Manganese Ore | 277,000 kt | 4,900 kt | 19,500 kt |
| 16 | Niobium | 216 kt | No data | 75 kt |
| 17 | Platinum | 247.7 t | 0.470 t | 380 t |
| 18 | Rare Earth Elements | 4,260 kt | 23 kt | 240 kt |
| 19 | Rhenium | 157 t | No data | 59 t |
| 20 | Scandium | 36.65 kt | 0 | No data |
| 21 | Silicon | No data | No data | 8 kt |
| 22 | Tantalum | 104.4 kt | 0.1 kt | 2.1 kt |
| 23 | Titanium | Ilmenite: 273,800 kt; Rutile: 33,800 kt | Ilmenite: 600 kt; Rutile: 200 kt | Ilmenite: 14,400 kt; Rutile: 600 kt |
| 24 | Tungsten | 570 kt | <1 kt | 79 kt |
| 25 | Vanadium | 8,110 kt | 0 | 110 kt |
| 26 | Zirconium (Zircon) | 78,600 kt | 500 kt | 1,600 kt |

Source: Geoscience Australia, "Critical Minerals at Geoscience Australia", July 24, 2023, https://www.ga.gov.au/scientific-topics/minerals/critical-minerals. Accessed on September, 18, 2023.

**Table 2: Australia's Rare Earth Related Policy/Initiatives**

| Year | Policy/Initiative | Goal/Focus |
|---|---|---|
| 2018 | Critical Minerals Mapping Initiative | A collaboration among Geoscience Australia (GA), Geological Survey of Canada (GSC), and U.S. Geological Survey (USGS) |
| 2018 | MinEx Cooperative Research Centre (MinEx CRC) | Geological surveys |
| 2020 | Western Australia Statutory Guidelines for Mine Closure Plans | Standards for environment compliance requirements |
| 2021 | Blockchain Pilot Grants: Critical Minerals | Build supply chain integrity and contribute to the Critical Minerals National Ethical Certification Scheme |

| | | |
|---|---|---|
| 2021 | Critical Minerals Facility | Managed by Export Finance Australia and provides financing to critical mineral projects |
| 2021 | Critical Energy Minerals Roadmap | Commonwealth Scientific and Industrial Research Organisation's strategy to unlock the economic potential of Australia's energy minerals |
| 2021 | Modern Manufacturing Initiative (MMI) | Funding of AUD 30 million to Arafura Resources Limited to construct the Nolan's Project Rare Earth Separation Plant in the Northern Territory<br>Funding of AUD 14.8 million to Lynas Rare Earths to commercialise an improved process for producing rare-earth carbonate |
| 2022 | Critical Mineral Strategy | Strategic plans to ensure supply chain resilience |
| 2022 | Geoscience Australia Strategy 2028 | Australia's premier geoscientific research organisation aiming to build Australia's resource wealth |
| 2022 | Critical Mineral List | List of 26 critical minerals based on Australia's geological endowment and potential with partner nations |
| 2022 | Critical Minerals Development Programme (CMDP) | Supports critical mineral projects through funding and pilot testing |
| 2022 | Australian Critical Minerals Research and Development Hub | Combines Commonwealth Scientific and Industrial Research Organisation (CSIRO), Geoscience Australia and the Australian Nuclear Science and Technology Organisation (ANSTO) |

Source: International Energy Agency, "Critical Minerals Policy Tracker", November 10, 2022, https://www.iea.org/data-and-statistics/data-tools/critical-minerals-policy-tracker. Accessed on September 20, 2023.

**Foreign investment and offtake arrangements in critical minerals continue to be facilitated through Austrade, the primary agency for promoting the international trade and investment of the Australian government.**

The Australian government has allocated AUD 50.5 million over three years to build the virtual National Critical Minerals Research and Development Centre as part of the Fiscal Year (FY) 22 Federal Budget. The centre will enhance Australia's world-leading research skills by combining expertise from the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Geoscience Australia, and Australian Nuclear Science and Technology Organisation (ANSTO) to serve the critical minerals industries. The centre is supposed to achieve the following objectives: (a) foster the development of Australian intellectual property in the field of critical minerals; (b) identify and address the specific technological obstacles hindering the efficiency of the strategic supply chain; (c) advancement of collaborative research to reach significant breakthroughs.

***(c) Operating Framework of Australian REE Industry***

- **The Australian Trade and Investment Commission (Austrade):** Foreign investment and offtake arrangements in critical minerals continue to be facilitated through Austrade, the primary agency for promoting the international trade and investment of the Australian government. The agency links Australian project proponents with specific possibilities for investment and offtake agreements through its large offshore network and partnerships with federal, state, and territory governments.
- **Critical Minerals Facilitation Office (CMFO):** This is the federal government's primary coordinating and facilitation body for the expansion of Australia's key minerals industry and elevation of its standing as a reliable and secure provider of these materials on a global scale. The CMFO was set up at the Department of Industry, Science, Energy, and Resources in January 2020.

- **Export Finance Australia:** This assists projects using critical minerals, as well as the infrastructure surrounding them and the businesses that are a part of the export supply chain for these minerals. Export Finance Australia also manages the government's Defence Export Facility, which may provide financing in cases where critical minerals are essential to the defence supply chain.
- **Geoscience Australia:** This provides reliable data on Australia's geology and geography. It offers technical competence, geoscientific knowledge, critical mineral-related innovation, and expert advice. The federal agency collaborates with individual states and territories to implement data collection initiatives on a continental scale and provide mapping, forecasting, and decision-making applications. New exploration methods, increased mineral exploration investment, exciting new discoveries, and the introduction of new, productive critical minerals provinces are the goals of Geoscience Australia's critical minerals operations.

**The US government's friendshoring strategy aims to build partnerships between countries that share similar values, such as the Quadrilateral Security Dialogue (QUAD), Mineral Security Partnership (MSP), and others. These include goals for member countries to become less reliant on China by building their own rare earth mining and processing centres.**

## AUSTRALIA'S POSITION IN THE GLOBAL RESILIENCE INITIATIVE

Australia has become an important partner in many global efforts to become less dependent on a single country. For example, the US government's friendshoring strategy aims to build partnerships between countries that share similar values, such as the Quadrilateral Security Dialogue (QUAD), Mineral Security Partnership (MSP), and others. These include goals for member countries to become less reliant on China by building their own

rare earth mining and processing centres. This can be seen in the "Critical Minerals Mapping Initiative" that Geoscience Australia (GA), Geological Survey of Canada (GSC), and US Geological Survey (USGS) have set up together. The goal is to build a diversified critical minerals industry in Australia, Canada, and the US by finding new sources of supply through critical mineral potential mapping and quantitative mineral assessments. It brings together records from GA, GSC, and USGS to make a world database that can help in understanding important mineral distribution limits and making better mineral resource assessments.

Australia has developed bilateral collaboration with import dependent major countries, and investment partnerships with resource rich countries in the following forms:

***(i) With Major Powers (REE Dependent Countries)***

**(a) With the USA**

As of September 2019, the Australian government identified a total of 15 projects related to rare earth and critical minerals that are intended to be promoted as part of the collaborative endeavours between Australia and the United States, with the aim to diminish dependence on China, most particularly for the defence and high-technology industries. In November 2019, a formal agreement was reached between the United States and Australia to establish a collaborative relationship aimed to develop sources of key minerals, encompassing rare earths, cobalt, and tungsten. The agreement aimed to facilitate reciprocal supply and demand agreements, bridge knowledge disparities, and expedite the process of innovation between the two nations. The agreement, which was entered into by Geoscience Australia and the United States Geological Survey, solidifies a longstanding relationship between the two nations that originated during World War I.

**(b) With Japan**

Australia and Japan maintain strong commercial relations, with a particular emphasis on the energy sector. Japan had a pivotal role in the growth and

advancement of Australia's Liquefied Natural Gas (LNG) industry and continues to be one of its principal purchasers. Additionally, the bilateral association between the two nations encompasses comparable patterns of development and trade in Australia's iron ore, thermal coal, and coking coal industries. In October 2022, an agreement was reached between Australia and Japan regarding the procurement of critical minerals. This pact establishes a commercial framework wherein Australia will provide Japan with rare earths, lithium, and other materials essential for the production of low-emissions energy technologies, including batteries, wind turbines, and solar panels.

In March 2023, Lynas Rare Earths Limited and Japan Australia Rare Earths B.V. (JARE) signed new agreements, under which JARE has proposed funding of AUD 200 million (US$ 132 million) to Lynas. It aims to bolster Lynas' cash sheet and fund capital projects to meet the rising rare earth material demand. JARE was created in 2011 by Sojitz Corporation and Japan Organisation for Metals and Energy Security (JOGMEC), and since then, Lynas and JARE have had a long-term senior credit arrangement. As per the agreement, Lynas will revise its current priority supply rights to align with the sustained expansion of the Japanese rare earths market, so granting Japan more priority in its rare earth shipments. For instance, if Lynas' yearly production of neodymium and praseodymium (NdPr) falls below 9,600 tpa, a preferential allocation of up to 7,200 tpa will be provided to Japan.

**(c) With India**

India, now in the period of exploration, and Australia, the second-largest producer in the REE industry, have initiated collaborative efforts in the field of critical minerals subsequent to the signing of their Memorandum of Understanding (MoU) in 2020. Collaborative efforts, such as the SCRI and QUAD, have materialised across various levels of bilateral, trilateral, and multilateral engagements.

The recent bilateral declaration to collaborate on five specific critical mineral projects, consisting of three cobalt projects and two lithium projects,

also signifies an enhancement of their collaborative efforts in the realm of supply chain management. In the year 2022, the Australian government made revisions to its India Economic Plan, extending it until 2035, with particular emphasis on granting priority status to the Mining Equipment, Technologies, and Services (METS) sector in India. Subsequently, the Australia-India Business Exchange (AIBX) identified mining and resources as one of its five key goals. It has been reported that over 40 Australian businesses had engaged in the Indian mining industry by the year 2022.

**(d) With South Korea**

South Korea, renowned for its substantial presence in the global battery manufacturing sector, seeks to diversify its sources of critical minerals outside China. According to David Woodall, managing director of Australian Strategic Materials, Seoul has been among the early adopters in recognising the global challenges associated with critical minerals. Over the past years, Seoul has actively pursued strategies to mitigate the risks in its supply chain. In this context, Australia's metals industry benefits significantly from its trade relationship with South Korea, which stands as one of its prominent customers. Moreover, South Korea has the position of Australia's fourth-largest trading partner and third-largest export market, with a valuation of about AUD 26 billion. In addition, POSCO, a prominent steel manufacturer based in South Korea, holds the distinction of being Australia's primary purchaser in the steel industry.

Between 2018-20, South Korean corporations committed to invest over AUD 500 million in Australian mining projects. In December 2021, Australian Strategic Materials (ASM) entered into a joint declaration of collaboration with the Korean Resources Corporation (KORES) titled 'Memorandum of Understanding on Cooperation in Critical Mineral Supply Chains', for the purpose of supplying critical minerals and metals from ASM's Dubbo rare earths project in New South Wales to South Korea. South Korean corporations have committed to investing over AUD 500 million in Australian mining projects. This company has already received funding totalling US$ 4.5 million

as part of the South Korean government's US$ 5 billion initiative in 2020, which aimed at advancing the development of a low-emission, high-purity metal refining technology. This technology is intended to be utilised in the refining processes of zirconium, titanium, and rare earths, specifically for the production of permanent magnet alloys.

In 2022, ASM signed a conditional agreement with Hyundai Engineering, South Korea, as part of its 'Dubbo project' for engineering, construction, and procurement design work. As part this project, ASM plans to generate metal oxides and mixed chlorides and develop a rare earth processing facility within Australia.

**(e) With the United Kingdom**

In 2020, the United Kingdom and Australia established a Critical Minerals Joint Working Group to enhance cooperation. In April 2023, the Governments of Australia and the United Kingdom made a joint commitment to collaborate on the development of critical minerals, with the aim of enhancing the global supply chain. This collaboration follows the approval of a free trade agreement by the UK Parliament with Royal Assent.

***With Resource Rich Countries***

**(a) With Malaysia**

Malaysia has been blessed with a significant amount of non-radioactive rare earth deposits. The USGS estimates that approximately 30,000 metric tonnes of rare earth ores can be found in peninsular Malaysia. Although this represents less than one per cent of the global deposits, it is more than enough for the country to become a significant regional player in the rare earths supply chain. The USGS study suggests a higher enrichment of Heavy REEs (HREEs) in the core marine sediments of coastal east Malaysia than Light REEs (LREEs).

Monazite, which contains up to 30 per cent thorium, is the main rare earth mineral extracted in Australia. Australia produced rare earths mostly by processing monazite in heavy mineral sands until 1995. In 2007, mining began

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at Mount Weld, Laverton, Western Australia, the world's richest rare earth deposit in the form of Lanthanide Concentrate (LC). Secondary rare earth phosphates (most likely monazite) are encased in iron oxide crystals in this deposit. Then, the crushed rare earth ore entered the concentration plant in 2011, which required to extend the processing and establish further concentration plants. To double the production of the concentrates, the Lynas Advanced Materials Plant (LAMP) was set up for processing in 2011, and since 2012, these mines have been supplying LC to the LAMP facility. LAMP processes in three steps: Stage I: Cracking and leaching, mixing lanthanum concentrate, from the Mount Weld mine, with concentrated sulphuric acid, then cracking it at a high temperature (350-450ºC); Stage II: REE separation, that involves solvent extraction, combining the rare earth sulphate solution with hydrochloric acid (HCl); Stage III: Production of finished product, in which LREEs like praseodymium/neodymium turn into solid carbonates or oxalates, such as neodymium oxide or cerium carbonate.

However, the LAMP facility is disputed for its rare earth processing effects. Although it got support from the former Malaysian government, the local populations continue to protest against it due to the impact on the environment, health, and livelihoods. Even recently, LAMP received a three-year Malaysian licence extension, but with restrictions. Malaysian Minister of Science, Technology, and Innovation Chang Lih Kang, stated that the Australian rare earths mining corporation must follow the Malaysian government conditions to maintain their mutual agreement. These conditions will prevent Lynas from importing and processing rare earth concentrate in Malaysia after July 1, 2023, unless it imports radioactive waste as well from the Cracking and Leaching (C&L) facilities. Overall, the Malaysian Atomic Energy Licensing Board (AELB) has issued four conditions:

- Create a Permanent radioactive waste Disposal Facility (PDF).

- Submit a PDF construction development plan.
- Establish a C&L facility outside Malaysia by the July deadline.
- Maintain a financial deposit to comply with licence requirements.

**Vietnam contains 22 million tonnes of rare earths, second only to China, whose production capacity showed a high jump to 4,300 tonnes in 2022, from 400 tonnes in 2021.**

These restrictions were imposed to prevent another radioactive waste occurrence like the Bukit Merah radioactive pollution (1982) caused by Misubishi Chemicals. Not meeting these standards will lead to Lynas' licence being revoked and, thus, can be a challenge to the refinery capacity of Australia and the worldwide rare earth supply chain. This has encouraged Australia to develop its processing capacity within the ESG framework to ensure its long-term stability in the rare earth supply chain.

**(b) With Vietnam**

Despite the current underdevelopment of resources, Vietnam possesses the potential to contribute to the disruption of China's monopoly on REEs. According to the USGS, Vietnam contains 22 million tonnes of rare earths, second only to China, whose production capacity showed a high jump to 4,300 tonnes in 2022, from 400 tonnes in 2021. As per its official plan, Vietnam will build three to four additional rare earth mines after 2030 to reach the production capacity of 2.02 million tonnes raw rare earth by 2050. In addition to mining, the country plans to invest in rare earth mining facilities to produce 20,000 to 60,000 tonnes of Rare Earth Oxides (REOs) yearly by 2030, and to 40,000-80,000 tonnes by 2050.

Vietnam's reserve and production capacity enables it to be a potential partner to Australia's resilience strategies. The recently signed MoU between the Vietnam Rare Earth Company (VTRE) and two Australian entities, namely Australian Strategic Materials (ASM) Ltd and Blackstone Minerals Ltd is a significant step towards maintaining to the security of the mining and

manufacturing of REEs. As part of the agreement, VTRE can use Blackstone's beneficiation plant at the Ban Phuc Nickel Mine (BPNM) in northern Son La province to improve REE oxide production.

**(c) With Tanzania**

In April 2023, Tanzania entered into agreements valued at AUD 667 million with three Australian companies for the extraction of rare earth minerals and graphite. This initiative aligns with the Tanzania's efforts to expedite negotiations related to mining and energy ventures. Tanzania will have 16 per cent ownership interest in the jointly constituted firms responsible for operating the projects as part of the agreements, including Evolution Energy Minerals Ecograf Ltd, and Peak Rare Earths.

## AUSTRALIA VERSUS CHINA: ROAD TO DOMINANCE?

Since the year 2000, China has been Australia's largest export market, overtaking the United States. Over the course of several decades, Australia remained a primary supplier of iron ore, amounting to around AUD150 billion (US$ 135 billion) in annual sales, which facilitated China's high demand and economic growth. Tensions, however, have been building over the past few years, especially since the US-China trade war in 2018, when Australia banned the participation of Chinese tech giants Huawei and ZTE in its telecommunications infrastructure on the grounds of national security. Furthermore, Australia began to endorse other US initiatives, such as the AUKUS alliance, Indo-Pacific Economic Framework, QUAD and Blue Pacific Initiative, to limit China's influence in the global supply chain. In 2020-21, there was a considerable increase in trade tensions between China and Australia, with China imposing trade restrictions on Australian exports such as coal, wine, seafood, and barley. The tension was reflected in the statement of former Australian Prime Minister Kevin Rudd who said, "Australia has been on the rough end of the pineapple in the relationship with China".

Despite the trade tensions, both countries commemorated the 50th anniversary of their bilateral relations in 2022 on the sidelines of the G20 in Bali and agreed that their economies are 'complementary'. Despite this commitment, bilateral trade between the two nations dropped 3.9 per cent to US$ 220.91 billion in 2022, as reported by the General Administration of Customs (GAC), in which Australia exported US$ 142.09 billion to China, a 13.1 per cent decrease from 2021. The diminishing trade dynamics between China and Australia could be attributed to Australia's increasing recognition of the need to safeguard the supply chain for critical minerals like rare earth elements and lithium, particularly in times of disruptive occurrences, to meet energy transition goals.

Australia's strategic acknowledgement to secure these minerals was reflected in 2023, when the Foreign Investment Review Board (FIRB) announced blocking a Chinese company from investing in Australia's critical minerals sector twice, citing national interest as the reason. The Treasurer of Australia and spokeperson of FIRB, Jim Chalmers stated that Australia holds the position of the leading global supplier of lithium and is a significant producer of rare earths, and intends to adopt a more discerning approach when considering potential investors in its key minerals sector. In February 2023, FIRB allegedly prevented Yuxiao Fund, a prominent Chinese investor and the primary stakeholder of an Australian company engaged in rare earth mining, Northern Minerals, from augmenting its ownership portion.

Currently, China dominates the dysprosium market with control over 94 per cent of the global supply; dysprosium is a primary constituent for the production of electric vehicle magnets. Thus, by preventing the Chinese investor, Northern Minerals expressed its intention to establish itself as the primary global producer of dysprosium outside of China. As was further confirmed by Nick Kurtis, the executive chairman of Northern Minerals, the necessity of these material for the magnet supply chain was likely the primary factor for the obstruction of increased investment by a Chinese investor. Secondly, the Australian government declined a

proposal from Austroid Corporation, a business affiliated with China, to acquire Alita Resources Ltd, a financially challenged lithium mining company in Australia, in July 2023. These events and Australia's rare earth potential within the global supply chain resilience initiatives, establish its position both as a challenge to Chinese dominance and a highway in the global road towards supply chain resilience.

However, Australia still needs to develop the capacity to project itself as a challenge to China's dominance in the following sectors:

- Exploring reserves and increasing production and processing capacity.
- Meeting ESG standards to sustain long-term growth.
- Building resilience to achieve self-sufficiency or *Atmanirbharta,* not to counter the domination.
- Geoeconomic investment in other resource regions to sustain its raw materials supply.

### *Develop Upstream Mining and Downstream Processing Capacity*

Securing each stage of the rare earth supply chain is crucial for establishing a sustainable ecosystem. The reliability of upstream mining is essential in ensuring consistent access to raw rare earth oxides for subsequent processing into REEs during the midstream stage. Successful processing, in turn, guarantees the production of end products and rare earth magnets.

Australia accounts for around 8 percent of the overall world supply of rare earth elements, positioning it behind China (58 per cent) and the United States (15 per cent) in terms of its position within the global supply chain. However, the prospectivity of a resource depends on the grade, processing cost, contaminants, and concentration of the most in-demand REEs as these are environmentally and economically difficult to mine. According to a 2018 assessment by Professor Dudley J. Kingsnorth of the Western Australian School of Mines, six state-owned enterprises in China have maintained an advanced ecosystem of the rare earth industry that allows it to mine, produce, and process all the elements in one place, thus, giving the Chinese state government an advanced control over the supply

chain of 17 REEs through keeping prices artificially low and making international initiatives unprofitable. The initiatives in Australia to improve the downstream processing capacity shows a promising growth, but the major objective should be to develop a sustainable ecosystem that can ensure the advancement of upstream mining; improve exploration of untapped reserves; and develop the processing of REEs to deliver end-products as well.

### *Meeting the ESG Standard to Sustain Long-Term Growth*

The effects of mining projects on the Environmental, Social, and Governance (ESG) frameworks also come with big risks. Some of these risks are tense political situations, armed conflict, violations of human rights, bribery and corruption, pollution, water shortages, and loss of wildlife. Such effects can make people less likely to support mining projects, and they will be looked at more closely by investors, downstream businesses, and civil society. This could cause short-term production problems and strong opposition to mining investments in the area and around the world. This could then make it harder to get minerals and metals that are needed for clean energy changes. If governments and companies do not properly manage these risks, they could also face regulatory, ethical, and reputational problems linked to ESG.

Professor Kingsnorth adds that all rare earths contain uranium and thorium, thus, Australian environmentalists may oppose their processing. It should be noted that China does not enforce environmental rules as strictly, while Australia is rising as the most ethically mining country. REEs are termed as the 'industry vitamin' but carry considerable negative consequences on the environment in the processes of mining, smelting, and separation, which cause ecological damage, water pollution, and soil erosion. According to the BBC (2015), China's dominance in the rare earth market may be due to its willingness to take environmental risks that other nations may not. China, with its less environmental and legislative supervision, has been producing more efficiently and cheaply without government-specific controls. In pursuit of

**Australia should aim to match the ESG standards globally to ensure long-term resilience, for instance, the case of public protest against LAMP's activities in Malaysia. Australia's major step towards working on the ESG framework was reflected in its joining the 'Sustainable Critical Minerals Alliance'.**

industrial catch-up, China allowed severe environmental deterioration from the REE industry. To manufacture one tonne of rare earth oxide from ionic-adsorbed clays, 2,000 tonnes of tailings and 1,000 tonnes of waste water with heavy metals are produced. It is estimated that one tonne of ionic REs produced in southern China generates 60,000 cubic metres of waste gas containing hydrofluoric acid, 200 cubic metres of acid-laden sewage, and 1 to 1.4 tonnes of radioactive waste. To resolve the challenge, the Chinese government has made many environmental policies for REs now to encourage green growth and prevent the decline of its RE industry.[1]

Thus, it is suggested that unlike China, Australia should aim to match the ESG standards globally to ensure long-term resilience, for instance, the case of public protest against LAMP's activities in Malaysia. Australia's major step towards working on the ESG framework was reflected in its joining the 'Sustainable Critical Minerals Alliance' that was announced by Canada on the sidelines of the UN Biodiversity Conference (COP15) in December 2022. It is an effort to promote mining practices that are safe for people, the environment, and the critical minerals industry. Other signatories to this group, are the United States, Canada, the United Kingdom, France, and Germany. The group aims to ensure:

- Use of a nature forward approach within the industry to minimise biodiversity loss, safeguard endangered species, and support nature protection, including net-positive environmental benefits.
- Encourage safe working conditions, responsible labour standards, diverse and inclusive workforces, and respect for local and indigenous rights.

1. Song Chai, Zhicong Zhang, and Jianping Ge, "Evolution of Environmental Policy for China's Rare Earths: Comparing Central and Local Government Policies", *Resource Policy*, vol 68, October 2020, 101786, https://doi.org/10.1016/j.resourpol.2020.101786.

- Promote net-zero mining to reduce greenhouse gas emissions by 2050.
- Dismantling and restoration of mine sites to their natural state, imposing reclamation, and holding guilty parties liable for environmental harm.
- Accelerate reuse and recycling to create a circular economy and eliminate the demand for new mines.

**The proportion of global rare earth reserves held by China has declined from 70 per cent in the 1990s to 38 per cent now, primarily attributable to the consequences of excessive mining.**

Australia should prioritise achieving these ESG targets both at home and abroad. To complement the rare earth sector ecosystem, it should also build local ESG norms.

***Building Atmanirbharta or Self-Sufficiency, not Counter-Dominance***

The primary objective of enhancing the resilience of the global supply chain is to achieve self-sufficiency by fostering interconnection and reducing reliance on any single nation. The pursuit of self-sufficiency has served as a driving force for nations such as the United States, which has implemented strategies promoting the "Made in America" initiative, and India, which has established the objective of *Atmanirbharta* in manufacturing.

Australia should also prioritise attainment of self-sufficiency through collaboration with like-minded governments, rather than focussing on the development of counter-dominance capabilities. Australia undoubtedly possesses the potential to emerge as a dominant force in the rare earth supply chain industry. However, it is crucial to acknowledge the adverse consequences associated with excessive mining, such as the depletion of reserves and the subsequent emergence of supply chain insecurity. For instance, the proportion of global rare earth reserves held by China has declined from 70 per cent in the 1990s to 38 per cent now, primarily attributable to the consequences of excessive mining. Australia is already working with the USA on improving self-sufficiency in the downstream

processing of rare earth elements, outside China. If Australia were granted access to India's undeveloped reserves and could make use of its low labour costs, it would likely have the potential to build a sustainable environment and provide reliable supplies to rare earth oxides. This will enable Australia to effectively strategise its long-term rare earth initiatives and ensure the sustainability of its supply chain.