Australia's resource and energy export strategy for the decarbonized era

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Summary

1. Australian resource and energy export trends are an important factor for global supply chain restructuring centered on decarbonization and reducing dependence on China. Reasons that can be given for this are that 1) Australia has abundant resources used in products necessary for decarbonization, such as EVs (electric vehicles) and solar and wind power generation equipment, and 2) many of the resources currently exported from Australia are supplied to other countries through China, where refining and processing costs are low. The Australian government's direction for resource and energy exports has the two following aims:

2. The first is to increase the added value of the resource and energy industry by making it more environmentally friendly. The Australian government is seeking to enhance the competitiveness of the mining and manufacturing industries by encouraging the development of resource extraction, refining, and processing businesses that employ less environmentally burdensome methods. To this end, it has been coming up with one new restructuring-oriented measure after another, such as the "Critical Minerals Strategy" and "Future Made in Australia" initiative, which provide for subsidies in areas that are expected to increase in importance in the future, and the "National Hydrogen Strategy," which is aimed at expanding the production of hydrogen derived from renewable energy.

3. The second is to diversify its export destinations. At present, Australia's exports are heavily focused on East Asia, mainly China, but the government is stepping up diplomatic efforts to diversify its export destinations. As key themes for its economic diplomacy, the government is working to strengthen relations with developed countries that have high technological development capabilities and are expected to see early diffusion of environmentally friendly products, and to liberalize trade and investment with ASEAN countries and India, where demand for resources and energy is projected to rise in the medium to long term.

4. The challenges that Australia faces in restructuring its resource and energy industry include the high cost of refining and processing domestically and the lack of potential for ASEAN countries and India to replace Chinese demand. It is necessary to note that the success or failure of Australia's efforts to transform its resource and energy export structure will also be affected by external factors. One such factor is whether appropriate regulations are put in place in each country to curtail the refining and processing of resources using environmentally burdensome methods and the use of products containing those refined/processed resources. Another is the extent to which the manufacturing industry shifts from China to ASEAN countries and India.

Introduction

As supply chain restructuring centered on decarbonization and reducing dependence on China progresses, Australia's economic growth model, which has been driven by coal and iron ore exports to East Asia, is reaching its limits.

First, regarding the environment surrounding coal, at the end of April 2024, the G7 climate, energy, and environment ministers agreed to phase out coal-fired power plants that do not take measures to reduce CO₂ emissions. To placate Japan and Germany, where coal-fired power plants generate around 30% of electricity, the joint statement offered two alternatives for the timing of the completion of the phase-out: "during the first half of the 2030s" and "a timeline ... in line with countries' net-zero pathways." Nevertheless, there is no doubt that calls from the international community for Japan and Germany to accelerate their transition away from coal-fired power generation will intensify. Similar positions are expected to spread to countries/territories beyond the G7 through international conferences and other channels. If Japan, South Korea, and Taiwan, which together buy about 60% of Australia's coal exports, move away from coal-fired power generation, a significant decline in Australia's coal exports is inevitable. On the investment side, the effects of the phasing out of coal-fired power generation have already become apparent, and major resource companies and Japanese general trading companies with interests in Australia are withdrawing from the coal business in anticipation of a future decline in demand⁽¹⁾.

As for the environment surrounding iron ore, which is Australia's largest export, there is an increasingly widespread view that the country's exports will remain sluggish for a long time due to the economic stagnation in China, the primary export destination, which is occurring against the backdrop of worsening U.S.-China relations and the problems with China's real-estate sector, as well as China's expansion of domestic production of iron ore and diversification of import supplying countries amid tensions between Australia and China.

Although the impact of global decarbonization on the demand for iron ore is currently limited compared to that on the demand for coal because the technological development necessary for the proliferation of the use of materials to replace steel products is still in progress, the use of materials other than iron, such as aluminum, titanium, magnesium, copper, and fiber-reinforced plastics, is expected to expand as issues with strength and price are resolved with advances in technology. In addition, with the improvement of impurity removal technology in electric arc furnaces, it is predicted that there will be a shift from steelmaking using blast furnaces, which mainly use iron ore and coal as raw materials, to steel-recycling with electric arc furnaces, which use scrap steel as the raw material. In light of these developments, it is unlikely that Australia's iron ore exports will continue to increase at the same pace as in the $past^{(2)}$.

Against this backdrop, the Australian government is trying to develop resource and energy businesses that are projected to see an increase in demand in the decarbonized era. Examples are critical minerals such as lithium and nickel that are used in storage batteries for electric vehicles (EVs) and ICT devices⁽³⁾, copper and zinc, which are used in solar and wind power generation equipment, and green hydrogen derived from renewable energy. At the same time, with an eye to diversifying export destinations, it is working to strengthen relations with developed countries that are expected to see early diffusion of environmentally friendly products, and deepen relationships with ASEAN countries and India, where demand for resources and energy is predicted to rise in the medium to long term against a backdrop of economic growth.

Australia has the abundant resources needed for the decarbonized era and is an important partner for Japan, as it shares fundamental values such as freedom, democracy, and the rule of law. Therefore, for Japan to achieve decarbonization domestically and also play a leading role in ensuring stable supplies of resources and energy in other countries/territories through frameworks such as the QUAD (Quadrilateral Security Dialogue), the Indo-Pacific Economic Framework for Prosperity (IPEF), and the Asia Zero Emission Community (AZEC), the country will need to consider the direction of future policies related to Australia's resource and energy exports. Japan will also need to recognize, with accuracy, the challenges that stand in the way of achieving the aforementioned goals.

With the above issues in mind, and with Australia's resource and energy exports as my starting point, in this paper I will examine Australia's response to the advent of a decarbonized society and the outlook for its economic relations with Asian countries. Note that in this paper, "resources" refers to mineral resources in general, and "energy" refers to energy obtained from mineral fuels, hydrogen, sunlight, etc.⁽⁴⁾.

1. Australia's importance in supply chain restructuring centered on decarbonization and reducing dependence on China

First, I will affirm the importance of focusing on Australia's resource and energy exports as a foundation for analyzing supply chain restructuring trends centered on decarbonization and reducing dependence on China. In doing so, I will point out that Australia will continue to play an important role as a resource and energy supplier even if global demand for fossil fuels shrinks in the future, and whether other countries can reduce their dependence on China for imports of materials will be greatly affected by whether the supply chains of resources mined in Australia will change.

(1) Abundant resources and potential for next-generation environmental technologies

One of the reasons for the growing interest in Australia among countries is the country's abundant resources, which include not only iron ore and fossil fuels such as coal and natural gas but also resources for which demand will increase in the decarbonized era. Another is that the country has great potential to introduce next-generation environmental technologies.

First, looking at the impact on resource demand of changes in industrial structure in conjunction with decarbonization, demand for copper, nickel, manganese, graphite, zinc, lithium, and other minerals will increase with the shift from gasolinepowered vehicles to EVs (electric vehicles) and from thermal power generation to solar and wind power generation⁽⁵⁾ (Fig. 1). In addition, widespread moves to replace steel products, for which large amounts of CO₂ are generated during the production process, with other materials will also boost demand for aluminum, magnesium, titanium, and other metals. Australia has a wealth of resources for which demand is expected to increase in the decarbonized era, and produces 50% of the world's lithium and 20% of its bauxite, the raw material for aluminum (Fig. 2). With lithium, in particular, Australia is likely to play an important role as a supplier, as it is expected that lithium will continue to be used as the main raw material for EV storage batteries, regardless of what materials are used for the cathodes, anodes, and electrolvtes⁽⁶⁾.

In addition, the country has great potential as an exporter of green hydrogen, which is derived from renewable energy, and synthetic fuels⁽⁷⁾ (e-fuels), which are produced from green hydrogen and CO₂ captured from industrial gases or the atmosphere. There are a number of factors in the background to this, including 1) the availability of natural gas production and transportation infrastructure that can be diverted to the hydrogen business, 2) the existence of the legislation needed to expand the hydrogen business⁽⁸⁾, and 3) the ability to introduce solar and wind power generation with high power generation efficiency⁽⁹⁾. Australia also scores well in the Hydrogen Investability Index, which rates the potential of the hydrogen business in different countries from multiple perspectives, with its score lower only than Germany, Spain, and the U.S. (Fig. 3). Geographical proximity to



Fig. 1 Resource usage by type of automobile and power generation equipment

Source: Prepared by JRI based on IEA [2021]





Notes: figures for coal, crude oil, and natural gas are for 2022. Those for others are for 2023. Source: Prepared by JRI based on USGS, "Mineral Commodity Summaries 2024" and Energy Institute, "Statistical Review of World Energy"

Fig. 3 Hydrogen Investability Index by country (2021)



Asia is another reason that Australia's potential to become a hydrogen production and export hub for Asia is attracting attention.

Australia is also garnering attention as a suitable location for $CCS/CCU/CCUS^{(10)}$ (CO₂ separation, capture, utilization, and storage technology), which will be indispensable for achieving carbon neutrality. The reasons for this include 1) the existence in various parts of the country of geological formations that have been exhausted of oil and natural gas and are thus suitable for CO_2 storage, 2) the low risk of large-scale earthquakes, 3) availability of geological data necessary for CCS development, and 4) progress with the enactment of legislation related to $CCS^{(11)}$. And as with hydrogen, geographical proximity to Asian countries is also one of Australia's strengths (Fig. 4), and it is attracting attention as a base for receiving CO_2 from countries where large-scale CCS would be difficult. Among Japanese companies, Nippon Steel, Mitsubishi Corporation, JERA (jointly owned by TEPCO and Chubu Electric Power), Tokyo Gas, Osaka Gas, and others are participating in a CCS development project in Australia with a view to transporting CO_2 emitted in Japan by sea to Australia and storing it there.

(2) Heavy dependence on China for resource refining and processing

As the U.S.-China confrontation intensifies, moves have emerged, mainly in Western countries, to reduce dependence on China for imports of products that are important for economic security, such as semiconductors, storage batteries, and pharmaceuticals. In addition, against the backdrop of rising labor costs and sluggish domestic demand in China, as well as the improvement of business environments and resilient economic growth in emerging Asian countries other than China, global companies are relocating the manufacturing of products with limited economic security risks from China to Southeast Asia and South Asia.

On the other hand, the refining and processing of resources is not being transferred or dispersed to countries/territories other than China due to China's low costs resulting from economies of scale. Most of the resources produced in Australia are also exported to China in their raw form (Fig. 5).

As a specific example, let us look at lithium, which is indispensable for the production of storage batteries used in EVs and ICT devices. Currently, Australia accounts for about 50% of the world's lithium production, but 99% of the coun-



Fig. 4 CCS Readiness Index by country (2021)

Notes: Each country's CCS readiness is given a score from zero to 100 points based on 1) moves to prepare multiple large storage sites, 2) status of enactment of legislation related to CCS, 3) moves to formulate policies related to CO₂ emission reduction and CCS development, and 4) importance of CCS introduction (degree of dependence on fossil fuels).
 Source: Prepared by JRI based on data from the Global CCS Institute

Fig. 5 Share of exports to China in Australian exports of minerals and metals (2023)



Notes: The figures in parentheses on the vertical axis are four-digit HS codes. Spodumene ore is included in "Other mineral substances."

Source: Prepared by JRI based on data from the United Nations

try's spodumene ore⁽¹²⁾, which contains lithium, is exported to China, where it is processed into lithium carbonate and lithium hydroxide and supplied to other countries. For this reason, South Korea and Japan, which along with China are major producers of lithium-ion batteries, depend on China for about 60% of their lithium imports⁽¹³⁾. In the U.S. and Europe, the import value of lithium is small and China's share of those imports is low, but the import value of lithium-ion batteries is large and the proportion coming from Japan, China, and South Korea is high, at around 50-80%, so China still plays an important role in Western supply chains.

Countries aiming to reduce their dependence on China for lithium imports are diversifying their sources of lithium, but little progress has been made with supply chain restructuring for reasons such as these: 1) In Chile and Argentina, which alongside Australia are currently major producers, lithium is produced by drying salt lake brine in the sun, making it difficult to rapidly increase the supply in the short term⁽¹⁴⁾. 2) The development of new lithium mines in African countries would require a considerable amount of time, and there is a risk of supply disruption due to political instability. 3) The development of technologies necessary for the recovery and reuse of lithium from used storage batteries is still in progress⁽¹⁵⁾.

In addition, as they do with lithium, China and Australia play important roles in the global supply of steel products, which are used in various industries, including manufacturing equipment, factories, transportation machinery, and logistics infrastructure, and iron ore, which is the main raw material for steel. Australia accounts for about 40% of the world's iron ore production, but less than 0.01% of the world's crude steel production. More than 80% of the iron ore produced in Australia is exported to China, which produces about 50% of the world's crude steel, where it is processed into steel products and other products made from them before being exported to other countries. Highly price-competitive steel products made in China play a key role in the economic activities of emerging countries in Africa and Asia, where income levels are low (Fig. 6).

Fig. 6 China's share of imports of iron and steel (SITC 67) by region



Source: Prepared by JRI based on data from United Nations, UN Comtrade

These factors suggest that in order for each country to create a decarbonized society while at the same time avoiding excessive dependence on imports from China, it will be necessary to develop the capacity for resources produced in Australia to be refined and processed in countries/territories other than China. Restructuring supply chains is important not only for resource-importing countries, but also for Australia, as it seeks to diversify its export destinations.

2. Direction of Australia's resource and energy export strategy for the decarbonized era

In Australia, it is an established principle to leave economic activities related to resources and energy to the private sector as much as possible. Partly because of this, the government did not actively take measures to support the development of specific resources until around the mid-2010s⁽¹⁶⁾. And due to concerns about the negative impact of a rapid transition away from fossil fuels on the country's economy, it was also cautious about efforts to promote the use of EVs and the introduction of renewable energy. However, against a backdrop of growing awareness of economic security risks and the increasing need to change production methods to achieve decarbonization, which entails business risks that the private sector cannot shoulder alone, the government has been getting more actively involved in areas related to resources and energy in recent years⁽¹⁷⁾.

Since Anthony Albanese took over as prime minister in 2022, the government has launched a series of measures to accelerate efforts for the restructuring of resource- and energy-related industries, and the two major directions are 1) to increase the added value of the resource and energy industry by making it more environmentally friendly, and 2) to diversify export destinations by expanding exports to countries other than China. Below I will examine each of them in turn.

(1) Direction 1): High added value through environmental measures

The first direction is to increase the added value of the resource and energy industry by making it more environmentally friendly (Fig. 7 and Table 1).

First, a look at the resources and energy that the Australian government will focus on for the decarbonized era reveals that it has designated 31 resources as critical minerals in its latest Critical Minerals Strategy⁽¹⁸⁾ (Table 2) and announced a policy of multifaceted support for the development of these resources at each stage, namely exploration, extraction, refining, and process-

Fig. 7 Environmental measures in Australia's resource and energy industry and relationship with related policies and initiatives



Notes: Refining and purification for the purpose of extracting substances contained in ore is classified as manufacturing. Source: Prepared by JRI

Table 1 Australia's environmental measures and efforts to increase the added value of the resource and energy industry

Government	Date	Policies and initiatives that attracted attention	
Liberal Party Turnbull government (Sep. 2015 – Aug. 2018)	Jul. 2016	Established the "NAIF, Northern Australia Infrastructure Facility" to provide funding for the infrastructure development necessary for Australia's economic growth	
Liberal Party Morrison government (Aug. 2018 - May 2022)	Mar. 2019	Announced "Australia's Critical Minerals Strategy 2019" to support the development, exploration, extraction, production, and processing of critical minerals	
	Nov. 2019	Announced the "National Hydrogen Strategy" with the aim of becoming a leading hydrogen exporter	
	Oct. 2020	Announced the "Modern Manufacturing Strategy" to develop the manufacturing industry, prioritizing the following sectors: 1) resources technology and critical minerals processing, 2) food and beverage, 3) medical products, 4) recycling and clean energy, 5) defense, and 6) space	
	Sep. 2021	Established the "Critical Minerals Facility" financing scheme to support the development of industries related to critical minerals	
	Dec. 2021	The Labor Party (then in opposition) announced the decarbonization policy "Powering Australia" ahead of the 2022 general election	
	Mar. 2022	Announced the "2022 Critical Minerals Strategy," adding silicon and high-purity alumina to the minerals covered by the 2019 strategy	
Labor Party Albanese government (May 2022 - present)	Sep. 2022	Enacted the Climate Change Act with the aim of reducing greenhouse gases by 43% by 2030 compared to 2005 levels (previous target was a 26-28% reduction by 2030)	
	Oct. 2022	Established the "National Reconstruction Fund" to support the diversification and advancement of the Australian economy, prioritizing seven sectors: 1) resources, 2) transport, 3) medical science, 4) defense capability, 5) renewables and low emission technologies, 6) agriculture, forestry, and fisheries, and 7) enabling technologies (engineering, data science, and software development)	•
	Apr. 2023	Announced the first "National EV Strategy" to promote the adoption of EVs and the introduction of new fuel efficiency standards for new cars	
	Jul. 2023	Announced the "Critical Minerals Strategy 2023-2030" with the aims of developing critical mineral resources, diversifying supply chains, and expanding domestic refining operations	◄┘
	Nov. 2023	The Western Australia state government submitted the "CCS Bill" to the state parliament to establish a business environment for CCS (passed in May 2024)	
	Apr. 2024	Announced the legislative initiative "Future Made in Australia" to support the development of new industries such as green metals, green hydrogen, and storage batteries	
	May 2024	Announced the "Critical Minerals Production Tax Incentive," a tax incentive providing a 10% rebate on refining and smelting costs for downstream critical mineral projects (part of the Future Made in Australia initiative, with a budget of AUD 22.7 billion from 2027 to 2039)	
	Sep. 2024	Announced the "2024 National Hydrogen Strategy," intending to export hydrogen and also utilize it domestically	◀

Source: Prepared by JRI based on various media reports

ing. Among these, 16 minerals offer particularly strong mining potential: high-purity alumina, cobalt, gallium, germanium, lithium, magnesium, manganese, nickel, rare earths, scandium, silicon, tantalum, titanium, tungsten, vanadium, and zirconium. They are used in electronic products and transportation machinery⁽¹⁹⁾. Through the development of these resources, the government is trying to change the country's export mix, which is heavily skewed to iron ore and coal (Fig. 8).

To encourage private companies to develop these resources, the government is making geological data obtained through the geological survey project "Exploring for the Future," conducted by the Geoscience Australia, available to companies and providing subsidies through the "Critical Minerals Development Program"⁽²⁰⁾. In the energy field, particular emphasis is being placed on the green hydrogen industry, which plays an important role in each stage of resource development, and in 2019 the government formulated a "National Hydrogen Strategy" focused on exports, and in 2024 announced a new strategy aimed at expanding domestic use alongside exports⁽²¹⁾.

Next, looking at the main environmental measures related to resource extraction, 1) develop-

Critical minerals designated by Australia				signatior (O: Des	by othe	r countri ×: Undes	es/territo ignated)	rritories ted)			
Name of mineral	Example uses	Mining potential	U.S.	EU	U.K.	India	Japan	South Korea			
High-purity alumina	Electronic products	High	×	×	×	×	×	×			
Cobalt	Storage batteries	High	0	0	0	0	0	0			
Gallium	Semiconductors, low melting point alloys	High	0	0	0	0	0	0			
Germanium	Semiconductors, medical devices	High	0	0	×	0	0	×			
Lithium	Storage batteries	High	0	0	0	0	0	0			
Magnesium	Automobiles, electronic products	High	0	0	0	×	0	0			
Manganese	Storage batteries, special alloys	High	0	0	×	×	0	0			
Nickel	Storage batteries	High	0	0	×	0	0	0			
Rare earths	Automobiles, electronic products	High	0	0	0	0	0	0			
Scandium	Aerospace products	High	0	0	×	×	×	×			
Silicon	Semiconductors, solar power generation equipment	High	×	0	0	0	0	0			
Tantalum	Automobiles, electronic products	High	0	0	0	0	0	0			
Titanium	Aircraft	High	0	0	×	0	0	0			
Tungsten	Alloy materials, cutting tools	High	0	0	0	0	0	0			
Vanadium	Steel additives	High	0	0	0	0	0	0			
Zirconium	Exhaust gas purification catalysts	High	0	×	×	0	0	0			
Antimony	Plastic and textile products	Medium	0	0	0	0	0	0			
Arsenic	Pharmaceuticals, pesticides, semiconductors	Medium	0	0	×	×	×	×			
Beryllium	Alloy hardeners	Medium	0	0	×	0	0	×			
Bismuth	Low melting point alloys	Medium	0	0	0	0	0	0			
Chromium	Special steels	Medium	0	×	×	×	0	0			
Fluorine	Automobiles, semiconductors	Medium	0	0	×	×	0	×			
Graphite	Automobiles, electronic products	Medium	0	0	0	0	0	0			
Hafnium	Special alloys, nuclear reactors	Medium	0	0	×	0	0	×			
Indium	LCD TVs, solar cells	Medium	0	×	0	0	0	0			
Molybdenum	Steel additives	Medium	×	×	×	0	0	0			
Platinum group metals	Exhaust gas purification catalysts	Medium	0	0	0	0	0	0			
Niobium	Heat resistant alloys	Unknown	0	0	0	0	0	0			
Rhenium	Super heat resistant alloys	Unknown	×	×	×	0	0	×			
Selenium	Paints, pigments, photovoltaic cells	Unknown	×	×	×	0	0	0			
Tellurium	Special steel additives	Unknown	0	×	0	0	0	×			

Table 2 Australia's critical minerals

Source: Prepared by JRI based on information from Geoscience Australia

ing laws and investment rules to achieve both environmental conservation and rapid resource development, 2) improving the energy efficiency of and electrifying mining-related machinery, and 3) increasing the proportion of renewable energy in power generation are among the initiatives that are attracting a lot of attention⁽²²⁾.

With regard to 1) developing laws and investment rules, the government aims to achieve both environmental conservation and smooth resource development through initiatives such as the revision of the Environment Protection and Biodiversity Conservation Act⁽²³⁾, the streamlining of processes for obtaining permission and approval from state governments, and the use of ESG criteria when deciding whether to grant subsidies for projects⁽²⁴⁾.

As for 2) improving the energy efficiency of and electrifying mining-related machinery, the private sector is leading the charge in most areas, developing and field-testing essential technologies for the electrification of rock-cutting machines,



Fig. 8 Australian exports by product

digit HS codes. Source: Prepared by JRI based on data from the United Nations

large excavators, beneficiation machinery⁽²⁵⁾, cargo trucks, etc.⁽²⁶⁾. The government's efforts are centered on measures to support peripheral areas, such as the formulation of the "National EV Strategy"⁽²⁷⁾, which includes the development of the charging infrastructure necessary for the proliferation of EV trucks, and the formulation of the NVES⁽²⁸⁾, which promotes the use of fuel-efficient gasoline trucks. Looking ahead, eyes are on what measures will be taken in response to calls for tax incentives for companies that are pursuing the electrification of mining-related machinery⁽²⁹⁾.

Regarding 3) increasing the proportion of renewable energy in power generation, various initiatives are underway based on the Labor Party's 2022 election promise of "Powering Australia"⁽³⁰⁾. Specific examples include subsidies for renewable energy generation and storage infrastructure through the "Capacity Investment Scheme" and renewal of grid infrastructure in line with "Rewiring the Nation." There is also the "Powering the Regions Fund," which provides support for CCS projects, as these play an important role in addressing CO₂ emissions that cannot be reduced solely by expanding the use of renewable energy.

Next, with regard to initiatives at the resource refining and processing stages, the government is



Fig. 9 Share of GDP of Australia's

Source: Prepared by JRI based on data from the Australian Bureau of Statistics

trying to put a stop to the decline in manufacturing that has occurred in tandem with the expansion of resource exports (Fig. 9). Specifically, it is endeavoring to increase the added value of manufacturing by refining and processing critical minerals and iron ore, which had hitherto been exported unprocessed due to high domestic refining and processing costs, using environmentally friendly methods. To this end, in April 2024 the government announced its intention to legislate "Future Made in Australia," a framework to support the production of aluminum, steel, storage batteries, green hydrogen, etc. It also announced the "Critical Minerals Production Tax Incentive," a scheme that refunds 10% of the cost of refining critical minerals, and the "Hydrogen Production Tax Incentive," a tax incentive for the production of green hydrogen to replace coal as a reduction agent for iron ore⁽³¹⁾. In these areas, major steelmakers, general trading companies, and resource companies from Japan and South Korea have already decided to invest or are considering investing in Australia (Table 3), but thanks to the expansion of Australian government support measures, other companies are also becoming more interested.

As the above has shown, the Albanese govern-

Date of announcement or media report	Company	Business domain	Recent developments with investment in Australia
	POSCO	Green steel manufacturing	Announced an investment of \$40 billion in green hydrogen manufacturing plants and hydrogen-based steel production facilities in Australia by 2040
Mar. 2023	Nippon Steel	Green steel manufacturing	Began considering investments in steel production projects using hydrogen, with potential locations including Australia, Brazil, and the Middle East
Jul. 2023	SunCable	Manufacturing of hydrogen-derived synthetic fuels	Singaporean renewable energy company SunCable proposed a project to manufacture synthetic fuels for aircraft during a meeting on the advancement of Australian manufacturing
Feb. 2024	ltochu, JFE Steel, Mitsui O.S.K. Lines, HIF Global	Manufacturing of hydrogen-derived synthetic fuels	Announced that Itochu, JFE Steel, Mitsui O.S.K. Lines, and a subsidiary of the American synthetic fuel manufacturing company HIF Global will collaborate to begin a study on the manufacturing and export of hydrogen- derived synthetic fuels
	Rio Tinto, BHP Group, BlueScope Steel	Green steel manufacturing	Announced that major Anglo-Australian resource company Rio Tinto, Australian resource company BHP Group, and Australia's largest steel producer BlueScope Steel will pursue a "green iron" project aimed at reducing emissions from steel manufacturers reliant on Australian iron ore. The project will include research toward the construction of Australia's first experimental electric arc furnace, with the aim of putting it into operation in 2027

Table 3 Participation in Australia's next-generation manufacturing sectors

Source: Prepared by JRI based on various media reports

ment's policies generally represent an acceleration of the policies of the previous government, but the new government is more reluctant than the previous one to support CCS. One of the reasons for this is that the only domestic CCS project so far, which was implemented from 2019 by the U.S. oil giant Chevron⁽³²⁾, suffered a series of problems and failed to achieve the expected results. In addition, with the Labor Party holding less than a majority of seats in the Senate, the government cannot pass various bills without the cooperation of the Greens party, which has pledged to freeze new fossil fuel development projects. This is a factor preventing the development of CCS, which is sometimes criticized by renewable energy radicals as throwing a lifeline to fossil fuels.

While there have been moves at the state level to improve the business environment, such as the passage of the CCS Bill by Western Australia in 2024, action at the federal level has been limited to the opening of storage sites, and no new subsidy scheme specifically targeting the expansion of CCS projects has been formulated. In addition, the formulation of a national-level CCS strategy, which the previous government had been moving forward with, has stalled.

(2) Direction 2): Diversification of export destinations

The second direction is to diversify export destinations. At present, Australia's exports are heavily focused on East Asia, mainly China (Fig. 10), but against the backdrop of uncertainty about China's politics and economy and the deterioration in Australia-China relations since the 2010s, the Australian government is stepping up diplomatic efforts to diversify its export destinations⁽³³⁾ (Table 4).

First, in the area of international cooperation via multilateral frameworks centered on developed countries, in July 2022 Australia joined the "Minerals Security Partnership (MSP)," which is led by the U.S. and aimed at diversifying supply chains for critical minerals. The MSP comprises 15 countries, including the G7, and is promoting cooperation among member states in four areas: 1) information sharing, 2) formation of investor networks, 3) raising ESG standards, and 4) promoting recycling and reuse. Raising ESG standards has been positioned as a key theme because to diversify refining and processing operations to countries other than China, it is essential to raise



Fig. 10 Value of Australian exports by country

Source: Prepared by JRI based on data from the United Nations

awareness among companies and investors of the importance of environmental conservation. Five meetings have been held so far, and the "Principles for Responsible Critical Mineral Supply Chains" have been formulated to raise ESG standards.

A similar effort is underway in the U.S.-led Indo-Pacific Economic Framework for Prosperity (IPEF), and in November 2023, IPEF member states announced the launch of the "IPEF Critical Minerals Dialogue" to strengthen action to restructure critical mineral supply chains.

Furthermore, in May 2023, the QUAD (Quadrilateral Security Dialogue), led by Japan and the U.S., announced the launch of the "Quad Investors Network (QUIN)" to encourage investment in strategic technologies related to clean energy and critical minerals.

To complement and strengthen international cooperation within these multilateral frameworks, the Australian government has also established bilateral partnerships with other countries/territories to expand trade and investment in critical minerals and clean energy. When Japan's then-Prime Minister Fumio Kishida visited Australia in October 2022, he signed a deal to establish the "Japan-Australia Critical Minerals Partnership." Through such international partnerships, Australia aims to attract investment from developed-country companies with strong technological capabilities and abundant financial resources, as well as to expand exports to developed countries of resources and energy extracted, refined, and processed using methods that have a low environmental impact.

Australia is also actively working to expand economic relations with India and ASEAN countries, where demand for resources and energy is expected to continue to increase over the medium to long term against a backdrop of economic growth.

With regard to relations with India, after upgrading their bilateral relationship to a "Comprehensive Strategic Partnership (CSP)" in 2020, the two countries concluded the "India-Australia Critical Minerals Investment Partnership" in 2022. And in the same year, the "Economic Cooperation and Trade Agreement (ECTA)," which eliminates tariffs on 85% of products imported by India, including resources and agricultural products, came into effect⁽³⁴⁾. The Indian government believes that ECTA has the potential to double the value of trade between Australia and India over the next five years⁽³⁵⁾. Going forward, the aim is to develop the ECTA into a CECA (Comprehensive Economic Cooperation Agreement).

In 2021, Australia also upgraded its trade deal with ASEAN to a CSP, and the two sides have been working to deepen cooperation by, for example, drawing up a plan of action for cooperation in various fields, including human resource development and technology development in the area of resources and energy⁽³⁶⁾. In addition, within the framework of the Asia Zero Emission Community (AZEC), proposed by Japan in 2022, Australia has declared a commitment to support ASEAN's decarbonization. Furthermore, at the ASEAN-Australia Special Summit in 2024, the two sides announced a framework for investment and financing to support clean energy in ASEAN countries, and during a bilateral meeting with Indonesia that took place on the sidelines, Australia indicated its intention to cooperate with Indonesia on the production of EV batteries and the development of the resources used in them. In addition, negotiations are underway to facilitate use of and enhance liberalization within the ASEAN-Austra-

Table 4 Developments with international cooperation toward the diversification of export destinations for Australia's resource and energy exports

Government	Date	Partner country/ territory	Policies and initiatives that attracted attention		
	Oct. 2019	U.S.	Agreed with the U.S. to formulate the "US-Australia Action Plan for Minerals Cooperation"		
	Jun. 2020	India	Announced a "Comprehensive Strategic Partnership (CSP)" to stree relations between Australia and India		
Liberal Party	Oct. 2021	ASEAN	Announced a "Comprehensive Strategic Partnership (CSP)" to strengthen relations between Australia and ASEAN		
Morrison government (Aug. 2018 - May 2022)	Dec. 2021	South Korea	Held a summit with South Korea and signed a memorandum of understanding on establishing a Comprehensive Strategic Partnership (CSP) and cooperating on critical mineral supply chains		
	Mar. 2022	India	Established the "India-Australia Critical Minerals Investment Partnership"		
	Apr. 2022	Germany	The German and Australian chambers of industry and commerce established the "German-Australian Critical Minerals Alliance"		
		India	Signed the "Economic Cooperation and Trade Agreement (ECTA)" with India (effective from the end of December of the same year)		
	May 2022	IPEF member states	Established the "Indo-Pacific Economic Framework for Prosperity (IPEF)" (members comprise Japan, the U.S., Australia, India, South Korea, New Zealand, Fiji, and seven ASEAN countries excluding Cambodia, Laos, and Myanmar)		
	Jul. 2022	MSP member states	Joined the U.Sled "Minerals Security Partnership (MSP)" (members comprise the G7, Australia, Finland, Norway, Sweden, Estonia, India, South Korea, and the EU)		
	Oct. 2022	Japan	Announced the "Japan-Australia Critical Minerals Partnership" at the Japan-Australia summit		
	Dec. 2022	SCMA member states	Joined the Canada-led "Sustainable Critical Minerals Alliance (SCMA)" (members comprise Japan, the U.S., Australia, France, Germany, Canada, and the U.K.)		
	Jan. 2023	France	Held the France-Australia Foreign and Defense Ministerial Consultations and announced the start of discussions to strengthen cooperation on critical mineral supply chains		
	Apr. 2023	U.K.	Issued a joint statement with the U.K. on cooperation in critical minerals		
	May 2023	U.S.	Signed the "Australia-U.S. Climate, Critical Minerals and Clean Energy Transformation Compact"		
Labor Party Albanese government (May 2022 - present)		Japan, U.S., and India	Announced the establishment of the "Quad Investors Network (QUIN)" at the QUAD summit (Japan, the U.S., Australia, India) to encourage investment in strategic technologies related to clean energy and critical minerals		
	Aug. 2023	ASEAN and New Zealand	Signed a protocol to upgrade the ASEAN-Australia-New Zealand FTA (aiming for revision within 2024)		
	Sep. 2023	Philippines	Upgraded relations with the Philippines to a "Strategic Partnership" and agreed to hold annual defense ministerial meetings		
	Nov. 2023	IPEF member states	Announced the launch of the "IPEF Critical Minerals Dialogue" to strengthen measures for restructuring critical mineral supply chains at the IPEF summit		
	Dec. 2023	AZEC member states	Announced the strengthening of cooperation on critical minerals and clean energy among member states at the first Asia Zero Emission Community (AZEC) summit (11 members: Japan, Australia, and ASEAN countries excluding Myanmar)		
	Mar. 2024	ASEAN	Announced an investment and financing framework to support the transition to clean energy for ASEAN countries at the ASEAN-Australia Special Summit		
		Vietnam	Upgraded relations with Vietnam to a "Comprehensive Strategic Partnership" and announced the start of ministerial meetings on critical minerals		
		Indonesia	Held a summit with Indonesia during the ASEAN-Australia Special Summit and signed a memorandum of understanding on cooperation in EVs		
	Jun. 2024	EU	Signed a memorandum of understanding with the EU on the establishment of supply chains for critical minerals and strategic materials		

Source: Prepared by JRI based on various media reports

lia-New Zealand FTA (Free Trade Area), which came into effect in $2010^{(37)}$.

3. Challenges for Australia's resource and energy export strategy

In view of the situation surrounding Australia, the policy direction aimed at increasing the added value of the resource and energy industry through environmental measures and diversifying export destinations through international cooperation can be said to be appropriate. However, whether these goals can be achieved is a separate matter entirely. Whether Australia can successfully restructure the industry hinges on whether it can overcome the following two challenges:

Fig. 11 Share of employees' income (personnel expenses) in production value (sales) in resource-related industries in Australia (FY2021)



Flow Table) in FY2021 I/O tables Source: Prepared by JRI based on data from the Australian Bureau of Statistics

(1) High cost of refining and processing domestically

The first challenge that Australia faces in restructuring its resource and energy industry is the high cost of refining and processing. For mining, resource availability is the main determinant of which businesses will be pursued, but in the case of refining and processing, labor costs are also a key deciding factor. Given that the ratio of personnel expenses to sales tends to increase as one moves downstream to the processing stage (Fig. 11) and that Australia's nominal GDP per capita, a proxy variable for labor costs, is second only to the U.S. among major developed countries (Fig. 12), there is little incentive to refine and process resources in Australia. In addition, given that Western nations also have plenty of potential for introducing CCS and hydrogen, companies in these countries/territories will prefer to set up refining and processing facilities using nextgeneration technologies in their own countries or in neighboring countries that are geographically close to them and have low labor costs. The Australian government is trying to reduce production costs through the Critical Minerals Production

Fig. 12 Nominal GDP per capita (2023)



Source: Prepared by JRI based on IMF, "World Economic Outlook 2024 April" Tax Incentive, which reimburses 10% of the cost of refining, but it is unlikely that such subsidies will sufficiently reduce the gap in price competitiveness compared to other countries. If the government raises the subsidy rate further to attract investment, it could encounter new problems, such as fiscal deficits and accusations of violating WTO rules⁽³⁸⁾.

Furthermore, given the rise in production costs and selling prices associated with the shift to production methods with less environmental impact, it will be difficult for Australia to maintain its export competitiveness unless appropriate regulations are put in place in each country to curtail the refining and processing of resources using conventional methods and the use of products containing those refined/processed resources. In particular, emerging countries that place more emphasis on economic growth than environmental conservation will continue to import cheaper products from China even if they have a higher environmental impact than refined and processed resources from Australia, which have a lower environmental impact but are more expensive. In addition, China is also decarbonizing its mining and manufacturing industries using hydrogen and CCUS, and the possibility that the advantages of producing in Australia will be lost if the environmental impact of resource refining and processing in China is reduced cannot be ignored.

Given such factors, whether Australia's current efforts will be successful will depend on 1) whether it can achieve environmental friendliness through the introduction of next-generation technologies ahead of other countries, 2) whether it can reduce unit labor costs through automation and labor-saving in resource refining and processing, and 3) whether importing countries take measures, such as regulations and incentives, to expand the use of resources and energy extracted, refined, and processed using methods that have a low environmental impact.

(2) Lack of potential for ASEAN countries and India to replace Chinese demand

The second challenge is the fact that ASEAN countries and India are not yet big enough markets to replace Chinese demand. Although these countries are attracting attention as alternatives to China as destinations for resource and energy exports from Australia, given the overwhelming size of China's current demand for resources and energy, it will take a long time for Australia to diversify its resource export destinations.

Taking iron ore, Australia's largest export, as an example, China accounts for about 50% of the world's crude steel production, while the combined output of ASEAN countries and India is less than one-fifth of China's (Fig. 13). While crude steel production in China has seen an ongoing decline in recent years against the backdrop of factors such as worsening problems in the country's real-estate sector, output in Southeast Asia and South Asia has been increasing at an annual rate of about 6%, with India the main driver. But even if crude steel production in Southeast and South Asia continues to rise at the pace of recent





Source: Prepared by JRI based on data from the World Steel Association



Fig. 14 Crude steel production volume in China and Southeast/South Asia

Notes: Estimates based on average rates of increase/decrease in 2021-2023. Source: Prepared by JRI based on data from the World Steel Association

years, it will take a quarter of a century to catch up with China's output (Fig. 14). Furthermore, India, which is the driving force behind crude steel production in Southeast and South Asia, currently procures close to 100% of its iron ore domestically⁽³⁹⁾ (Fig. 15), making it unlikely that Australian exports of iron ore to India will expand in response to higher crude steel production in India.

In addition, the slow adoption of EVs, solar and wind power generation, etc. in ASEAN and India compared to China, and ASEAN's and India's continued dependence on China for imports of materials will also constrain Australia's diversification of export destinations. Looking at EVs, which drive demand for minerals such as lithium. cobalt, and nickel, the combined sales of BEVs and PHVs in China exceeded nine million units in 2023, and China possesses 50% of the world's EVs (Fig. 16). In contrast, annual sales of EVs in ASEAN countries and India are still only about 200,000 units. Although these countries have set targets to promote the rapid diffusion of EVs, the pace of sales growth has slowed recently, partly because subsidies designed to make EVs more affordable have been reduced in India and Thai-

Fig. 15 Indian resource self-sufficiency rates



Source: Prepared by JRI based on Ministry of Mines [2023] [2024]

Fig. 16 Share of EV stock by country/ territory (2023)



Notes: No breakdown of "Other" is given in IEA [2024b]. Source: Prepared by JRI based on IEA [2024b]

land⁽⁴⁰⁾. Against the backdrop of low sales compared to China, the business of producing storage batteries in ASEAN countries and India is centered on the assembly process, and most of the materials used in the storage batteries are imported from China.

Meanwhile, the installation of solar and wind power generation equipment, which affects demand for minerals such as copper, silicon, and zinc, has been limited in ASEAN countries and India compared to China, and most of the equipment still needs to be imported from China.

Therefore, even if demand for EVs and solar and wind power generation equipment increases in these countries/territories, Australia's exports of resources to China, which is engaged in refining and processing, will expand. ASEAN countries and India are moving to impose regulations aimed at expanding their own refining and processing capacity. For example, Indonesia has banned exports of raw nickel and bauxite, and India is considering making it mandatory to procure solar cells from domestic manufacturers in the future⁽⁴¹⁾. However, it is not clear whether such protectionist moves will succeed⁽⁴²⁾.

Conclusion

Australia's next federal general election is scheduled for May 2025, and there is growing interest what changes will be made in resource and energy policy following the election.

However, regardless of whether there is a change of government, it should be noted that the major direction of Australian government policy, i.e., 1) promoting the development of resources and energy that will see higher demand in a decarbonized society using environmentally friendly methods and 2) diversifying trade and investment partners to avoid excessive dependence on China, will not change.

As shifts in production away from China are expected to accelerate further following Mr. Trump's victory in the U.S. presidential election, it would be desirable for Japan and Australia to strengthen their ties while also looking at cooperation with third countries, with the aim of promoting both economic growth and environmental conservation in Southeast and South Asia.

End Notes

- 1. For information about the Australian coal industry's response to the situation with coal-fired power generation in developed countries, see Kumagai [2024].
- 4. Namikawa [2013] points out that in Japan, the distinction between "resources" and "energy" is vague, but that in Australia the two terms are used differently, being based on the supply-demand relationship rather than material properties.

2. Although technology for removing impurities from scrap steel in electric arc furnaces is improving, the production of the highest quality steel still depends on blast furnace steelmaking using iron ore as a raw material. In addition, since the supply of scrap steel depends on the service life of buildings, industrial machinery, automobiles, etc., production in blast furnaces using iron ore as a raw material is expected to continue to play an important role even as the proportion of steel produced in electric arc furnaces rises (see Kumagai [2021]).

3. There is no universal definition of "critical minerals" or "critical raw materials" because priorities in resource procurement differ from country to country, as they depend on the industrial structure of the country concerned. Although iron is expected to continue to be an important material in the future, the Australian government has not designated iron ore as a critical mineral due to the abundance of global reserves and the fact that it can be mined in many countries around the world. 5. See IEA [2021], [2024a], [2024b]. Zinc is used in wind power generation equipment because such equipment employs large amounts of galvanized copper wire, which offers high tensile strength and fatigue strength as well as corrosion resistance.

6. There are various types of lithium-ion batteries, such as cobalt-based, manganese-based, and nickel-based, with the type used differing depending on the application. Which type will become mainstream in the future will be affected by trends in technological development.

7. Since synthetic fuels can be used in a similar way to fossil fuels, their potential for use in transportation machinery that is difficult to electrify, such as aircraft, ships, and large cargo vehicles, is attracting attention.

- The National Gas Law is being revised to integrate hydrogen blends and biomethane into the regulatory framework for domestic gas (see Japan External Trade Organization [2023]).
- 13. The world's leading manufacturers of lithium-ion batteries include CATL and BYD in China, LG Energy Solution and Samsung SDI in South Korea, and Panasonic and Murata Manufacturing in Japan, all of which are East Asian companies.
- 9. While Australia has a land area 20 times that of Japan, it has a small population of about 26 million, so there are numerous candidate sites suitable for the installation of renewable energy power generation equipment. The southern part of the country is attracting attention as a suitable location for wind power generation, while the central and northern regions are attracting attention as suitable locations for solar power generation.

10. The term CCS or CCU is used when focusing on technologies for either the storage or utilization of captured CO_2 , and the term CCUS is used when both are included.

 For a discussion of the potential of CCS in Australia and the involvement of Japanese companies, see Aoshima [2024] and ANZ [2024].

12. Spodumene ore is classified under HS code 2530 "Other mineral substances."

 In addition, environmental issues such as water shortages and water and soil contamination may constrain the expansion of lithium production in the medium to long term.

 For a discussion of issues in lithium production, see Kumagai [2022] and Katayama [2023a].

16. In Japan, a number of strategies aimed at expanding exports in specific sectors, such as the "Action Plan for Facilitating the Export of Agricultural, Forestry and Fishery Products and Food" and the "Infrastructure System Export Strategy," have been formulated, but in Australia, there have been no strategies aimed at expanding exports of specific resources such as iron ore and coal, nor have medium- to long-term resource development policies been established. Namikawa [2013] notes several reasons for this, including: 1) the Australian government has emphasized the efficient allocation of resources through free competition, 2) resource development is mainly carried out by multinational corporations with abundant financial and technological capabilities, and there is little need for economic and technical support from the government, and 3) there is little risk of depletion of key minerals.

17. For a discussion of changes in Australia's foreign policy, see Takeda and Nagano [2023].

 The Critical Minerals Strategy was first formulated in 2019 and subsequently revised in 2022 and 2023 (see Katayama [2023b] and Department of Industry, Science and Resources (Australia) [2023]).

19. The reason that iron ore, which is currently the largest export item and expected to continue to play an important role in the future, was not included in the list of critical minerals is that development by the private sector is on track and there is little need for government support. 22. Besides these, regarding environmental measures related to mining around the world, the mining of geological formations relatively close to the surface is attracting attention as a means of reducing energy consumption and protecting ecosystems.

- 23. In Australia, until around the 1960s, environmental measures were mainly implemented by state governments, but beginning in the 1970s, the federal government embarked on the enactment of environmental legislation to deal with environmental problems that transcend states (see Council of Local Authorities for International Relations [2000]). Later, in 2000, the federal government initiated the enactment of the Environment Protection and Biodiversity Conservation Act, but it has been pointed out that to facilitate approval procedures related to resource development, the law will need to be revised to eliminate overlaps of authority between the federal and state governments and establish "national environmental standards."
- 20. A program to support early- to mid-stage resource development. The Morrison government implemented a similar subsidy policy called the "Critical Minerals Accelerator Initiative."
- 24. Currently, the government uses criteria such as the Equator Principles and the OECD Common Approach on Environment to determine whether it is making environmentally friendly investments, but it is considering the application of ESG criteria to attract foreign investment and expand exports.
- 21. See Department of Climate Change, Energy, the Environment and Water (Australia) [2019][2024].
- 25. Machines that extract only useful minerals from mined minerals.

26. For specific examples, see Mining Technology, May 8, 2024, "Australian miners power ahead with equipment electrification."

- 27. See Department of Climate Change, Energy, the Environment and Water (Australia) [2023]. Due to such reasons as the short cruising range of EV trucks, it is likely that the Australian government's immediate focus in EV adoption is passenger cars.
- 30. Regarding the Albanese government's electric power policy, it is often cited that the goal is to increase the proportion of renewable energy in power generation to 82% by 2030, but policy documents, including "Powering Australia," do not include any numerical targets for the share of renewables. The figure of 82% was suggested as an achievable value, provided improvements to the power grid progressed smoothly, by energy consulting company RepuTex when it analyzed the energy mix at the request of the Labor Party when it was in opposition (see Rhys [2023]). Therefore, the figure of 82% should be viewed not as a strict government target, but rather as the outcome if plans such as "Rewiring the Nation" are successfully implemented.

- 28. The English name is "New Vehicle Efficiency Standards." Australia was one of the few developed countries that did not have fuel efficiency standards for automobiles, but from now on, there are vehicle categoryspecific CO_2 emission caps, which will be gradually lowered in phases.
- 31. For an overview of "Future Made in Australia," see Treasury (Australia) [2024] and Shinkawa [2024]. Indonesia has banned the export of raw nickel and bauxite with the aim of developing its resource refining and processing industry, but Australia has not imposed any such export curbs as part of its drive to increase added value.

- 29. See International Mining, September 30, 2024, "Tax incentives needed to drive electrification of Australia's mining fleet: EMC report."
- 32. A second CCS project by Beach Energy started operations in 2024.

33. Although there are signs of improvement in Australia-China relations, such as the resumption of the Australia-China Strategic Economic Dialogue in September 2024 after a seven-year gap, there have been no significant moves toward expanding trade and investment.

- 34. The Australian side decided to take measures to expand the acceptance of Indian immigrants, such as granting work visas to Indian international students after graduation and to Indian yoga instructors, chefs, etc.
- 39. A surge in India's iron ore imports in FY2023 has attracted some attention, but imports are equivalent to less than 2% of India's domestic production.

- 35. Press Information Bureau, January 16, 2023, "ECTA has the potential to double bilateral trade between India and Australia to \$50 billion in the next 5 years."
- 40. In September 2024, India's Cabinet approved "PM E-Drive," the successor policy to the FAME (Faster Adoption and Manufacturing of Electric Vehicles) initiative, but passenger cars will no longer be eligible for subsidies, and the budget for motorcycles has been drastically reduced. In Thailand, the sales incentive for EVs was reduced from a maximum of 150,000 baht to 100,000 baht per vehicle in 2024.
- See ASEAN Secretariat [2024] and Department of Foreign Affairs and Trade (Australia) [2022].

- 37. See Ishikawa [2024] for a discussion of the revision of the ASEAN-Australia-New Zealand FTA.
- 41. It is considering introducing an "ALMM (Approved List of Models and Manufacturers)," a compulsory registration order for approved models and manufacturers of solar photovoltaic modules in 2026.

- 38. The Productivity Commission, which was set up as an external body of Australia's Department of Finance, has argued that it is necessary to rigorously examine whether it is appropriate to spend taxpayers' money in this way.
- 42. Matsumoto [2023] believes that Indonesia has achieved some success with nickel, for which resources are concentrated there, but regards it as unclear whether it will succeed with bauxite and copper.

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