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# Trilemma for Supply Chain Restructuring in the Clean Energy Sector

## — Achieving both de-carbonization and de-risking from China is difficult, and strategic initiatives are needed —

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〈Summary〉

◆ In recent years, China has been rapidly expanding its share of the global market for clean-energy devices. Due to China's sluggish domestic consumption, Chinese companies have been redirecting their products from domestic sale to export, and this so-called "deflation exports" is eroding markets in many countries and causing negative effects such as depressing production in related industries in these nations. The impact on Germany has been especially striking, with the country's auto sector taking a serious blow.

◆ Yet such developments are not limited to Germany, and may spread to various other countries in the future. The nations of the G7 countries have adopted a united front of curbing China's actions, and the EU and Canada have been ramping up protectionist measures, hiking tariffs on Chinese-made EVs, for example. Japan, however, has not been making any noticeable moves, partly due to country-specific factors such as the unpopularity of Chinese-made EVs and low EV penetration, though discussions about taking similar steps are likely to intensify going forward. Over in the U.S., the Trump administration is also doubling down on its protectionist stance, while at the same time de-prioritizing environmental protection, and though not the intention, this has eased concerns about potential reliance on China in the clean-energy field.

◆ Many developed countries have been confronted with the need to restructure their supply chains, such as by nurturing their own industries, to prevent dependence on China's clean-energy sector, and are thus being forced to take protectionist measures such as sanctions and tariffs. However, these responses lack economic rationality, and there is no guarantee that

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they will help accelerate supply chain restructuring in the clean-energy field. At present, China is supplying environment-related devices and components/materials that contain critical minerals at low prices, which is reducing the economic burden of the worldwide transition to clean-energy. The underlying goals of supply chain restructuring are to reduce dependence on China, achieve de-carbonization, and deliver economic stability. However, given that the world is reliant on China for the sources of the clean-energy transition, it is practically impossible to advance all three objectives simultaneously.

- In restructuring their supply chains in the clean-energy field, governments are faced with a trilemma. Put simply, they can only choose from three combinations: (A) reducing dependence on China and achieving de-carbonization (but abandoning economic stability), (B) reducing dependence on China and delivering economic stability (but abandoning de-carbonization), or (C) achieving de-carbonization and delivering economic stability (but abandoning de-risking from China). So whichever of the three combinations they opt for, they must abandon one of the three objectives. If developed countries aggressively reorganize their supply chains for critical minerals based on the current prioritization by many of them of reducing dependence on China and achieving de-carbonization, inflation will accelerate and public finances will deteriorate, and their economies will be destabilized as a result.

- They therefore need to recognize the problem that, in restructuring their supply chains in the clean-energy field, they are faced with a trilemma. And it is necessary for them to respond to this problem by adopting a strategy of balancing each objective (de-risking from China, de-carbonization, and economic stability) through 1) acceptance of fiscal risk (expansion of industrial subsidies: focus on high value-added fields with economic rationality), 2) acceptance of China risk (cooperation with China to the extent possible and acceleration of the "China Plus One" strategy), and 3) acceptance of de-carbonization delay risk (development of rules based on high standards for the manufacture of clean-energy products). It will probably also be important for Japan to pursue similar strategic initiatives if it is to accelerate the restructuring of its supply chains in the clean-energy field.

- **This is a English version of “新エネルギー分野サプライチェーン再編のトリレンマ -脱炭素/脱中国依存の両立は難しく、戦略的な取り組みが必要 -” in JRI Review(The original version is available at https://www.jri.co.jp/MediaLibrary/file/report/jrireview/pdf/15640.pdf)**

## 1. Introduction

China is increasing its influence in the area of clean-energy-related products, such as by rapidly expanding exports. Developed countries have slammed this as market-distorting "dumping," and are taking countermeasures, but such moves can also be said to be indicative of the sense of crisis felt by advanced nations concerning China's overwhelming advantage in the supply chain for electric vehicles (EVs) and other clean-energy products. As long as the de-carbonization trend continues, the clean-energy field will become more and more important in the future, and another reason that countermeasures against China are supported by so many countries is that they serve to avert the threat of China intensifying its so-called "economic statecraft."

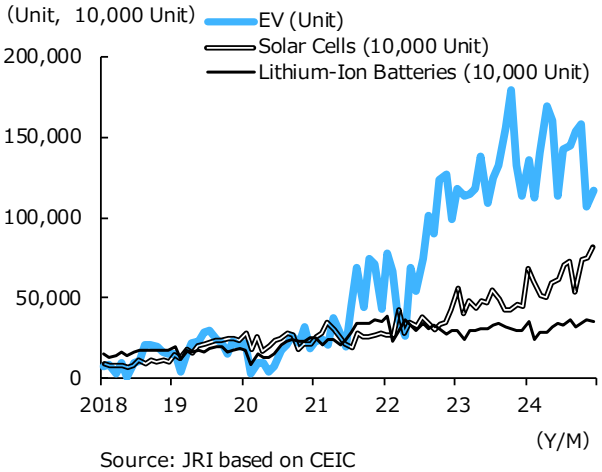
On the other hand, these protectionist policies lack economic rationality, and even if they cause some damage to China, they will be insufficient to significantly alter the supply chains. In addition, there is a risk of economic deterioration through inflation and fiscal risks, leading to supply shortages in countries pursuing such policies. It will not be easy to achieve success with manufacturing supply chain restructuring in the clean-energy field, and developed countries must recognize the difficulty of balancing de-carbonization with de-risking from China as they move forward with supply chain restructuring.

Regarding the structure of this paper, first, section 2 will examine what countermeasures developed countries are taking against China's expanding influence in manufacturing in the clean-energy field, and then, section 3 will examine how difficult it is to balance de-carbonization with de-risking from China. Finally, section 4 will discuss how Japan should balance de-carbonization with de-risking from China and what kind of policies it should aim to pursue.

## 2. Struggles of developed countries with manufacturing in the clean-energy field

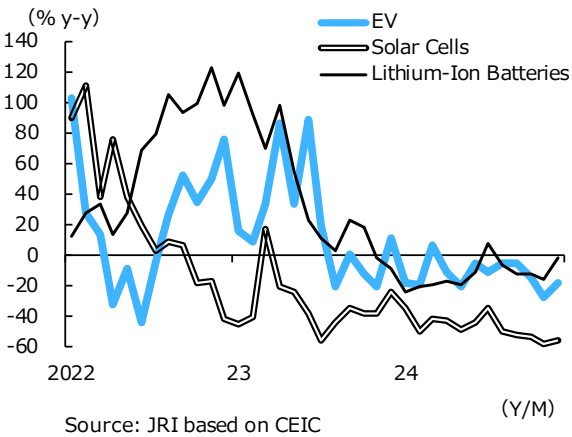
In recent years, China has been rapidly expanding its share of the global market for clean-energy devices. Exports of EVs and solar cells have been growing especially quickly, with exports of EVs soaring by 590% from 2019 to 1.65 million units in 2024, those of solar cells jumping by 217% over the same period to 7.79 billion units, and those of lithium-ion batteries climbing by 88% over the same period to 3.91 billion units

**Figure 1. Export Volumes of Clean Energy Related Goods**




Source: JRI based on CEIC

**Figure 2. Export Unit Values of Clean Energy Related Goods**



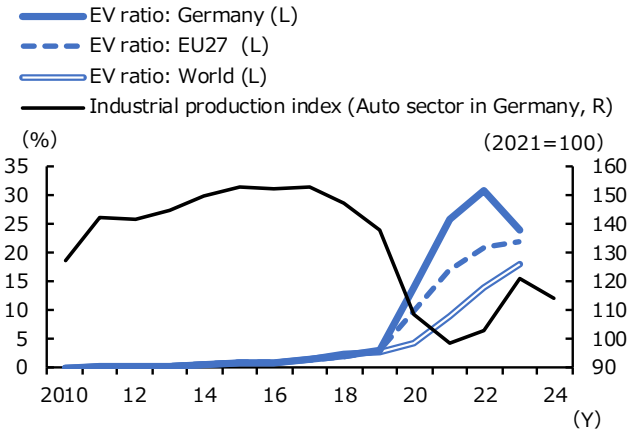

Source: JRI based on CEIC

(Figure 1). As a result of mass production by Chinese companies, the prices of China's clean-energy products have been falling, dragging companies in the sector from many countries into fierce price competition (Figure 2). Due to China's sluggish domestic consumption, Chinese firms have been redirecting their products from domestic sale to export, and this so-called "deflation exports" is eroding markets in many countries. With clean-energy products, in particular, China's share of the market in these nations has been expanding, resulting in such effects as depressing domestic production.

### (1) Miscalculation of the EV shift toward de-carbonization: German auto sector loses steam

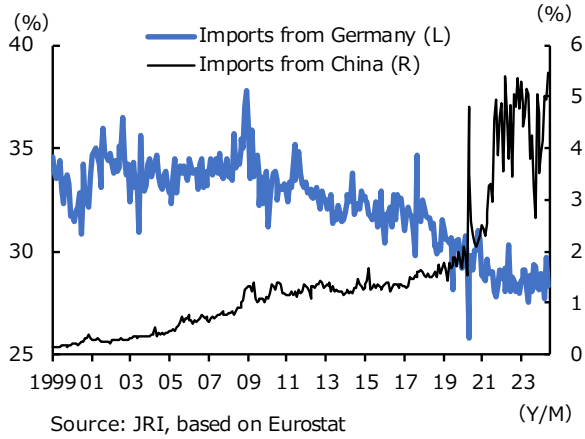
The impact of China's "deflation exports" on Germany has been especially striking. For instance, on September 4, 2024, German automaker Volkswagen announced that it was considering closing some of its domestic factories because of the need to reduce costs[1]. Volkswagen has serious woes, but it is not only the company in trouble, with the entire German auto sector seemingly in a state of torpor. What is behind this is the rapid EV shift. Since 2018, the penetration rate of EVs has risen rapidly since 2018, while the number of automobiles produced in Germany has declined sharply (Figure 3). The German auto sector has been unable to boost its competitiveness in EV production, causing it to fall behind in the battle with Chinese manufacturers. Even so, it has failed to halt its strategy of shifting from conventional vehicles, which run on fossil fuels such as gasoline, to EVs as part of the march toward de-carbonization, and the German auto sector has become increasingly reliant on China for production and sales. And now, these miscalculations have come back to bite.

**Figure. 3 EV Sales Share and Auto Production in Germany**




Source: JRI, based on IEA and CEIC Note: Industrial production index for 2024 is the average for Jan-Nov.

**Figure 4. Share of Auto Imports in EU (SA)**




Source: JRI, based on Eurostat

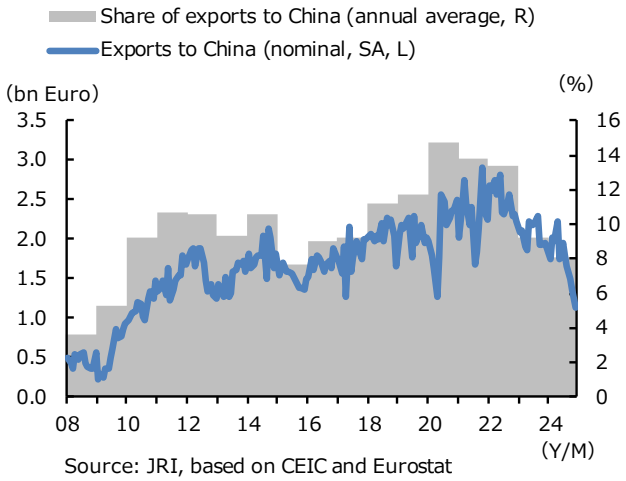
The situation for the German auto sector is deteriorating against the backdrop of 1) weak competitiveness against Chinese products in the EU market and 2) increased reliance on China during the COVID-19 pandemic and a subsequent decline in exports due to the downturn in the Chinese economy.

[1] On December 20, 2024, negotiations with labor unions culminated in an agreement to scrap the plans for domestic factory closures. However, it was also agreed that at least 35,000 domestic jobs would be cut by 2030.

First, there has been a sharp decline in Germany's share of automobile imports in Europe (Figure 4). In the past, German-made cars were highly competitive, and they accounted for as much as 30-35% of automobile imports by EU member states. In 2019, however, this share fell below 30%, and it currently stands at around 28%. These imports have been replaced by vehicles from China, which have seen their share soar. Besides the rise of Chinese EV manufacturers, another reason has been that European automakers, including German ones, had been shifting production to China due to its cost advantages, causing a sharp increase in their reliance on China for automobile manufacture.

Second, there has been a steep drop in Germany's exports of automobiles and components to China (Figure 5). During the COVID pandemic, the German auto sector struggled in the EU market, yet significantly expanded its exports to China. German-made cars already enjoyed a hefty share of the Chinese market, and by increasing exports of vehicles and their components, German automakers benefited from the growing demand in China. Also during the pandemic, the Chinese government provided support to consumers, such as subsidies when purchasing EVs. This led to a sharp rise in EV diffusion, so German automakers, who were pursuing a shift to EVs, also expanded local production in China. However, triggered by a strict lockdown in Shanghai in 2022, Chinese household consumption plummeted, and even since 2023, when the lifting of the zero-COVID policy produced only a tepid recovery, German automakers have significantly cut back on selling vehicles in China.

**Figure 5. German Exports of Automobile and Auto Parts to China**




Source: JRI, based on CEIC and Eurostat

So even though German automakers attempted a rapid EV shift, they struggled to compete with Chinese manufacturers, and though they tried to bounce back by increasing their dependence on China in terms of both production and sales, the slump in Chinese demand has dealt them a heavy blow. As a result, the threat posed by China's economic statecraft in the EV market has increased, and Germany's experience has come to serve as an example highlighting the problems of relying on China in the clean-energy sector.

## (2) Accelerating protectionist moves in developed countries

Yet such developments are not limited to Germany, and may spread to various other countries in the future. To counter this, developed countries have been ramping up protectionist measures, hiking tariffs, for example. In the communiques from the Meeting of the G7 Finance Ministers and Central Bank Governors (May 23-25, 2024) and the G7 Summit (June 13-14, 2024) in Italy, concerns were raised that China’s non-market policies and practices have led to excessive output of EVs and many other products by Chinese manufacturers, undermining G7 countries' workers, industries, and economic resilience. The G7 nations presented a united

front on keeping China in check, stating that they "will consider taking steps to ensure a level playing field" (Figure 6).

**Figure 6. Developed countries' countermeasures against Chinese overproduction/overcapacity**

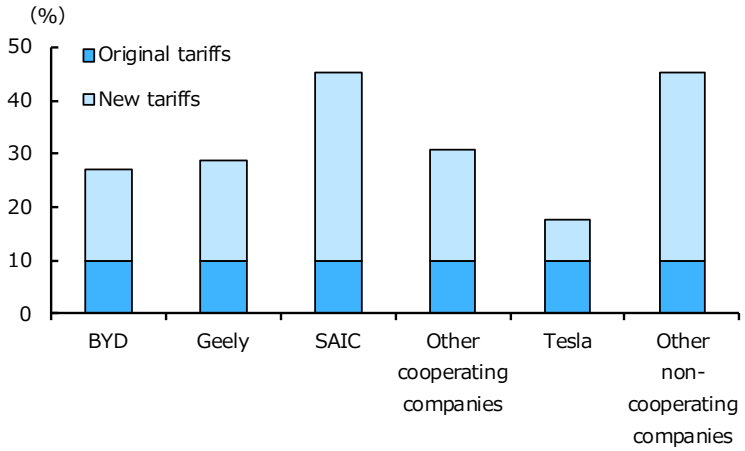
| | | |
|---|---|---|
| G7 | | |
| | May-24 | G7 expressed concerns about China's industrial policies that have flooded global markets with overproduced products.<br>"We will continue to monitor the potential negative impacts of overcapacity and will consider taking steps to ensure a level playing field." |
| US | | |
| | May-24 | The US Government announced increases in tariffs on Chinese imports, particularly on new energy products.<br>EVs: 25% to 100% (from August 2024), lithium-ion batteries (for EVs): 7.5% to 25% (from August 2024), etc. |
| EU | | |
| | October-23 | The European Commission has launched an anti-subsidy investigation into EVs imported into the EU from China, with a view to imposing countervailing duties. |
| | April-24 | The Commission has launched an investigation into the subsidies to two Chinese photovoltaic companies. |
| | April-24 | The Commission launched an investigation into the subsidies to a Chinese company supplying wind turbines. |
| | June-24 | The Commission announced provisional tariffs of up to 37.6% on Chinese EV imports (from July 2024). |
| | October-24 | The Commission formally approved tariffs on Chinese EV imports (from October 2024). |
| Canada | | |
| | August-24 | Canada said would impose 100% import tariffs on China-made electric vehicles. |

Source: JRI, based on various media

Regarding Europe, in October 2023, the European Commission launched a probe into Chinese-made EVs, suspecting that Chinese government subsidies were undermining fair competition. And in April 2024, it initiated a similar investigation of Chinese-made solar panels and wind turbines. For Chinese-made EVs, the application of a provisional offset tariff of up to 37.6% in addition to the 10% already imposed, began on July 4, 2024. Finally, on October 4 of the same year, a proposal to impose an additional tariff of up to 35.3% was approved by member states in a vote, and the levy was formally introduced for a five-year period on October 30 (Figure 7).

Ten countries, including France, voted in favor, five countries, including Germany, voted against, and 12 countries, including Spain, abstained. The purpose of the tariff hike was to address the problem that Chinese-made EVs distort market competition with unfairly low prices, and it targeted not only EVs from Chinese manufacturers, but also ones produced in China by European automakers. Struggling in the EU market, German

**Figure 7. Tariffs on Chinese-made EVs by the EU (as of 30 October 2024)**




Source: JRI, based on the European Commission and JETRO

automakers had sought a lifeline in the Chinese market, and stepped up local production there, so they will be hit hard by the higher import duties. Volkswagen seems to have lost the ability to compete in the EU EV market, and on September 4, 2024, announced that it was considering closing some of its domestic factories. The German Association of the Automotive Industry has called on the European Commission to withdraw the tariff. In addition, Tesla (U.S.) and BMW (Germany), objecting to the increased levy, have filed a case against the European Commission with the Court of Justice of the European Union.

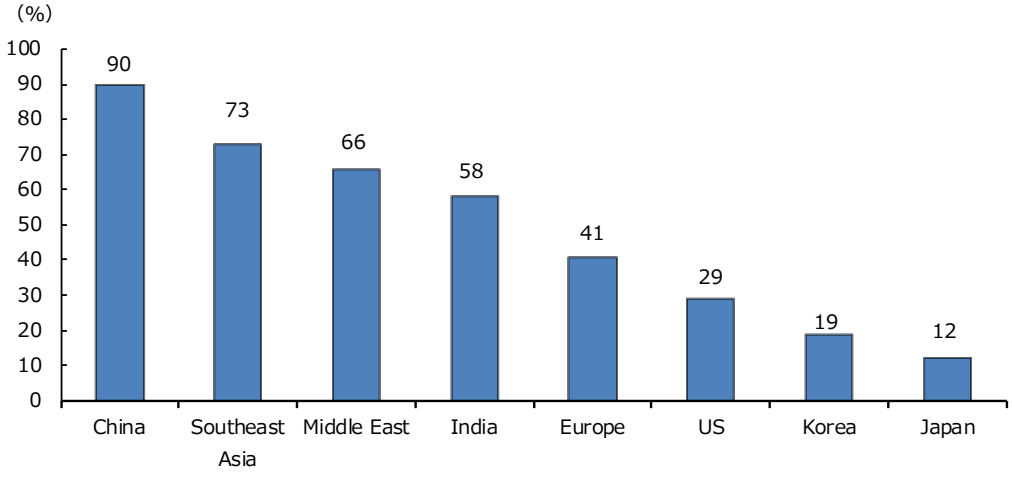
Canada has been moving in the same direction, announcing on August 26, 2024, that it would impose a 100% tariff on Chinese-made EVs from October 1 of the same year. The duty applies to EVs and some hybrid passenger cars, trucks, buses, and vans.

### (3) Signs of increasing protectionism in Japan

Even in Japan, there is growing concern about the rapidly expanding share of Chinese clean-energy products such as solar panels, making it possible that Japan will follow the paths taken by Europe and other countries. The Japanese government has so far been cautious about raising tariffs on Chinese products. It believes that the impact of the influx of Chinese products on the domestic economy is limited, and has not aped the protectionism that has intensified in the West. However, the Japanese EV market is in an unusual situation. In 2022, domestic EV sales accounted for only 1.71% of domestic passenger car sales, with the diffusion of EVs lagging behind other countries. In addition, Chinese cars are unpopular despite their low prices (Figure 8). Even though the Japanese government has not adopted exclusionary policies toward Chinese products, sales of Chinese EVs remain low, as Japanese consumers have a fairly low opinion of Chinese cars and a lack of interest in EVs. For this reason, discussions about tariffs on Chinese products have not really emerged.

Meanwhile, solar power generation in Japan has been expanding steadily. Japan ranks third in the world for solar power after China and the U.S. In this field, dependence on China is high, with almost all the solar cell panels used in Japan being imported from China. However, according to the Nikkei newspaper (August 18, 2024), there are problems such as the hijacking of solar power generation equipment and malicious use of

**Figure 8. Interest in purchasing a Chinese EV in selected markets**




Source: Arthur D.Little https://www.adlittle.com/nl-en/insights/report/chinese-electric-vehicles-drag-or-driver-global-markets

systems. At present, there is no discussion in Japan about imposing tariffs on Chinese-made solar panels, but there is a growing sense of alarm about China's expanding market share. However, if import duties are hiked, the continued diffusion of solar power, which has hitherto relied on Chinese panels, may be hindered.

A report entitled "The future of European competitiveness" (commonly known as the "Draghi report"), released in Europe on September 9, 2024, rejects excessive exclusion of China, but points out that tariffs on Chinese goods "will help level the playing field while accommodating genuine productivity gains in China." Until now, WTO rules have tended to make it difficult for governments to push through tariff hikes aimed at protecting their domestic industries, but as a means of averting the threat posed by China's economic statecraft, it has become easier for countries around the world to garner support for levies designed to prevent Chinese products from flooding their markets. Note that the Japanese government's list of "strategically important goods" includes storage batteries and critical minerals, and policy support in the form of subsidies is already being provided to the clean-energy field, with the focus on these two categories (Figure 9).

**Figure 9. Strategically Important Products under the Economic Security Promotion Act: Eleven Categories Designated by the Japanese Government**

| | Strategically important products | Competent authorities |
|---|---|---|
| 1 | Antibacterial products | Ministry of Health, Labour and Welfare |
| 2 | Fertilizers | Ministry of Agriculture, Forestry and Fisheries |
| 3 | Permanent magnets | Ministry of Economy, Trade and Industry |
| 4 | Machine tools and industrial robots | |
| 5 | Aircraft parts | |
| 6 | Semiconductors | |
| 7 | Storage batteries | |
| 8 | Cloud program | |
| 9 | Natural gas | |
| 10 | Critical Minerals | |
| 11 | Ship-related equipment | Ministry of Land, Infrastructure, Transport and Tourism |

Source: JRI, based on Cabinet Office, Japan

### (4) De-prioritization of the clean-energy field by the new Trump administration even with bolder protectionist policies

Like other developed countries, the U.S. is moving in the direction of more aggressive protectionism, but the situation there is somewhat complicated, being affected by political power changes and other factors.

In August 2022, under the Biden administration, the Inflation Reduction Act (IRA) was passed. The IRA had the potential to alter the structure of supply chains in the clean-energy field, as it offered, for example, tax credits worth $369 billion in the clean-energy space. Notably, the EV-related subsidies are large-scale, and at the final-demand stage, tax breaks are given when EVs are purchased. However, reflecting concern about China, a caveat

was added, namely that these perks are only available if the EV batteries and the critical minerals used in them are not made by "foreign entities of concern."

Furthermore, on May 14, 2024, then-President Joe Biden announced massive increases in duties on imports from China, especially in the clean-energy field, which includes goods such as EVs and solar cells (Nogimori and Sano [2024]). He said, "The fact is that American workers can outwork and outcompete anyone, as long as the competition is fair. But for too long, it hasn't been fair." (Reuters, May 14). After this announcement there followed a period of consultation with U.S. industry leaders, after which the decision to raise tariffs from September 27 was finalized.

Coming into 2025, however, Mr. Trump was inaugurated for his second term as president in January, and he immediately declared his country's withdrawal from the Paris climate agreement, indicating that a major policy shift on the environmental front had occurred. In terms of policies related to the clean-energy field, while the higher tariffs will stay in place, substantial reductions in subsidies seem unavoidable. As evidence of this, on January 20 President Trump signed an executive order scrapping measures to promote EVs.

The Trump administration is certainly doubling down on its protectionist stance, and at the same time it is downgrading the importance of environmental protection in its list of policy priorities. Unlike in other developed countries, industrial development in the clean-energy field will recede significantly, but as a result, concerns about dependence on China have faded. However, the clean-energy field is expected to become increasingly important, making it hard to view President Trump's moves as positive from a long-range perspective.

## 3. The challenges of supply chain restructuring in the clean-energy field and the difficulty in balancing de-carbonization with de-risking from China

As the above has shown, many developed countries are stepping up protectionist measures such as sanctions and tariffs as they try to nurture their own industries in ways that avoid dependence on China's clean-energy sector and reinforce/restructure their supply chains. However, these responses lack economic rationality, and there is no guarantee that they will help accelerate supply chain restructuring in the clean-energy field.

Above all, China is incredibly competitive in the clean-energy field in terms of manufacturing costs, and attention must be paid to the threat that this represents to the clean-energy sectors of other countries. As mentioned above, the U.S. has pushed de-carbonization way down the list of its priorities, and has also lost enthusiasm for industrial development in the clean-energy field. The gap in terms of competitiveness is huge, so ironically, indifference toward the popularization of clean-energy is currently the most effective means of countering China.

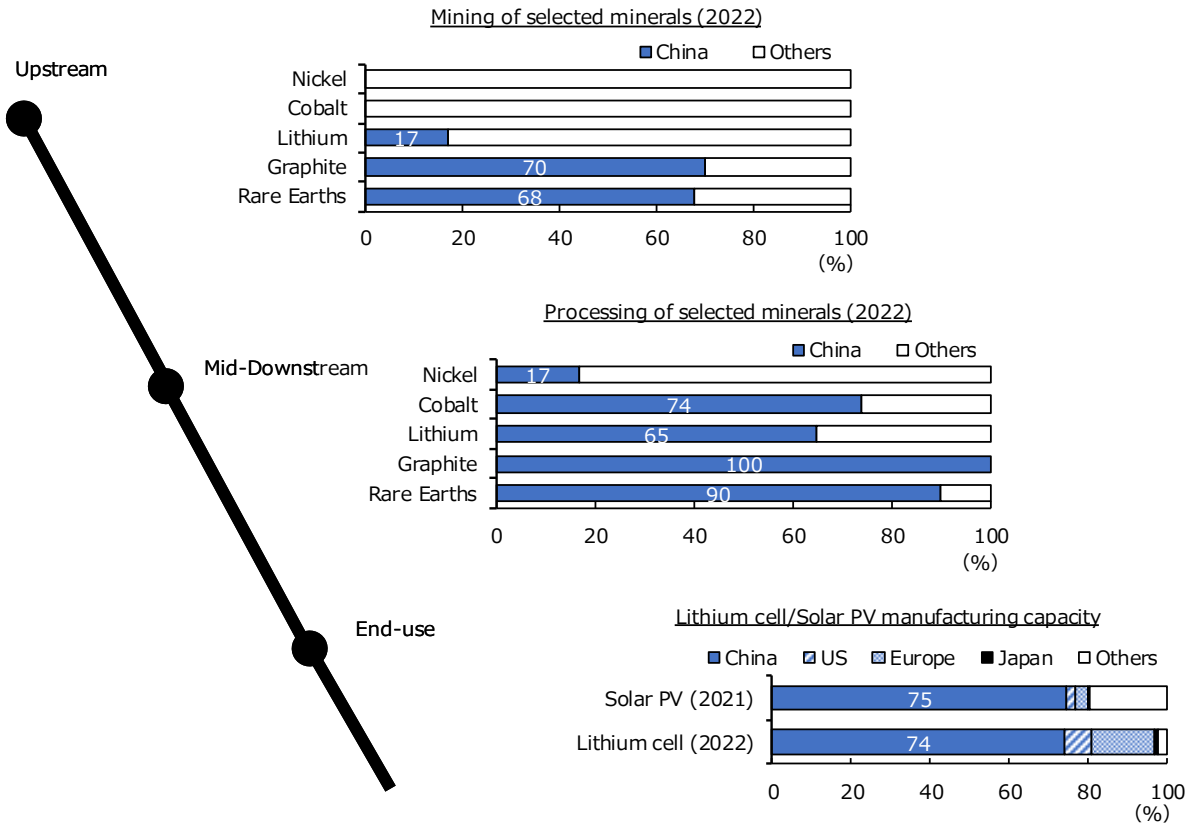
### (1) Supply chain dominance is the source of China's competitiveness

A frequently cited reason for China's superiority in clean-energy products is Chinese government subsidies and other measures to support the industry (Appendix 1). Despite this, while many developed countries are already pursuing similar subsidy policies, the restructuring of supply chains in the clean-energy field has been slow. Although the scale of subsidies varies, like China, many of them are providing subsidies and other forms

of support in clean-energy fields such as EVs, storage batteries, and critical minerals. But China's dominance in clean-energy products cannot be explained by subsidies alone.

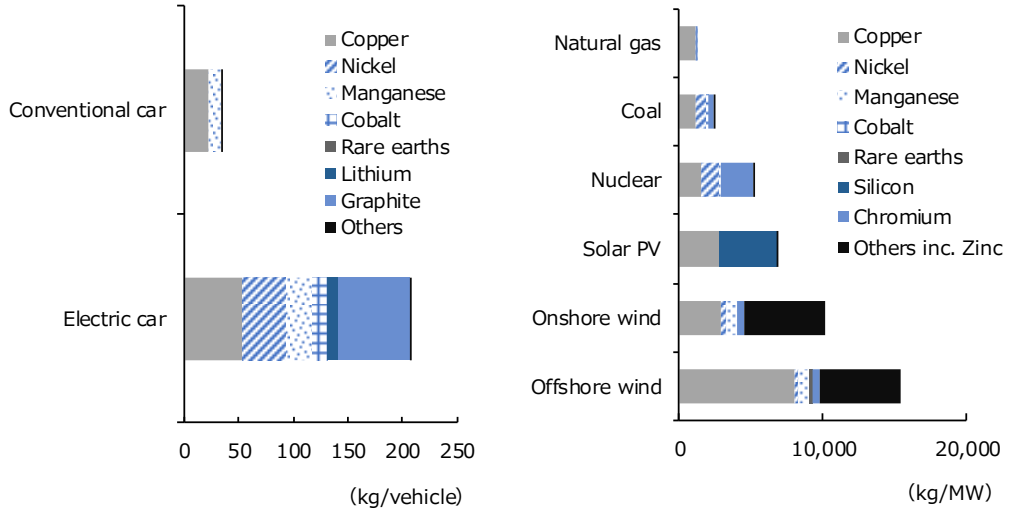
As the backdrop for China's gaining of competitive superiority in clean-energy products, the country has an overwhelming global share of production capacity not only in the final goods, but also in intermediate goods and in the critical minerals that are used as raw materials (Figure 10). China's critical minerals sector enjoys particularly strong advantages such as 1) provision of large subsidies to companies, 2) labor costs that remain low compared to developed countries, 3) companies with expertise in the fields of refining and processing critical minerals and possession of more advanced technological capabilities than developed countries, and 4) lax environmental regulations. According to data published by the IEA, the volume of critical minerals used in EVs (compared to in conventional vehicles) and in clean-energy technologies (average in offshore power generation, onshore power generation, and solar cells compared to coal and natural gas) is more than six times higher than in conventional vehicles and energies (Figure 11). Although critical minerals are a vital resource in the clean-energy field, it is not easy for developed countries to change the structure of their supply chains and compete with China (Nogimori [2024]).

**Figure 10. Clean Energy Supply Chain: Up-Mid-Downstream of critical minerals and End-use products**




Source: JRI based on IEA, BloombergNEF, Agency for Natural Resources and Energy in Japan

**Figure 11. Critical Minerals used in Car and Clean Energy Generation**




Source: JRI based on IEA

Of these, 4) lax environmental regulations constitute a particularly big advantage for China. When impurities are removed from the ores containing critical minerals, the release of harmful substances results in water and soil pollution, and such environmental destruction is regarded as a problem (Nayar [2021]). Since the government and companies in China have been becoming more conscious of the importance of environmental protection in recent years, it is not the case that no environmental measures have been taken whatsoever. But in contrast to developed countries, Chinese companies are viewed as being able to manufacture without incurring substantial environmental-protection costs. This is also a major factor in the almost complete absence of cooperation between Japan and resource-producing countries such as Australia to reduce dependence on China for critical minerals (Appendix 3). Japan, as a support measure for improving its access to critical minerals, has set aside 105.8 billion yen to subsidize projects related to mineral resources under the Economic Security Promotion Act, yet only four projects have actually been awarded subsidies, and the amounts are only 1.1 to 13.2 billion yen (as of January 2025).

This means that as the world strives to transition to clean energy, China is reducing the burden on other countries by, in effect, doing the dirty work. Efforts to achieve the ambitious de-carbonization targets that so many countries have declared will inevitably invite negative impacts such as green inflation. Eliminating relatively low-priced Chinese products in favor of dearer domestic ones requires a willingness to accept adverse effects such as inflation. To reduce dependence on China, it is necessary to face up squarely to the negative aspects of de-carbonization.

In addition, the woes of the German auto sector, which is currently struggling with deteriorating performance, were triggered by it increasing its dependence on China for EV production. Given the cost advantages described above, the increase in reliance on China for German automobile production can be seen as having been to some extent rational from an economic point of view. However, the rapid deterioration of the Chinese economy and the growing protectionist tendencies of late, such as tariff policies, mean that the German auto sector made a serious miscalculation. And as a result, Chinese-made EVs have grabbed a sizable share of the European market,

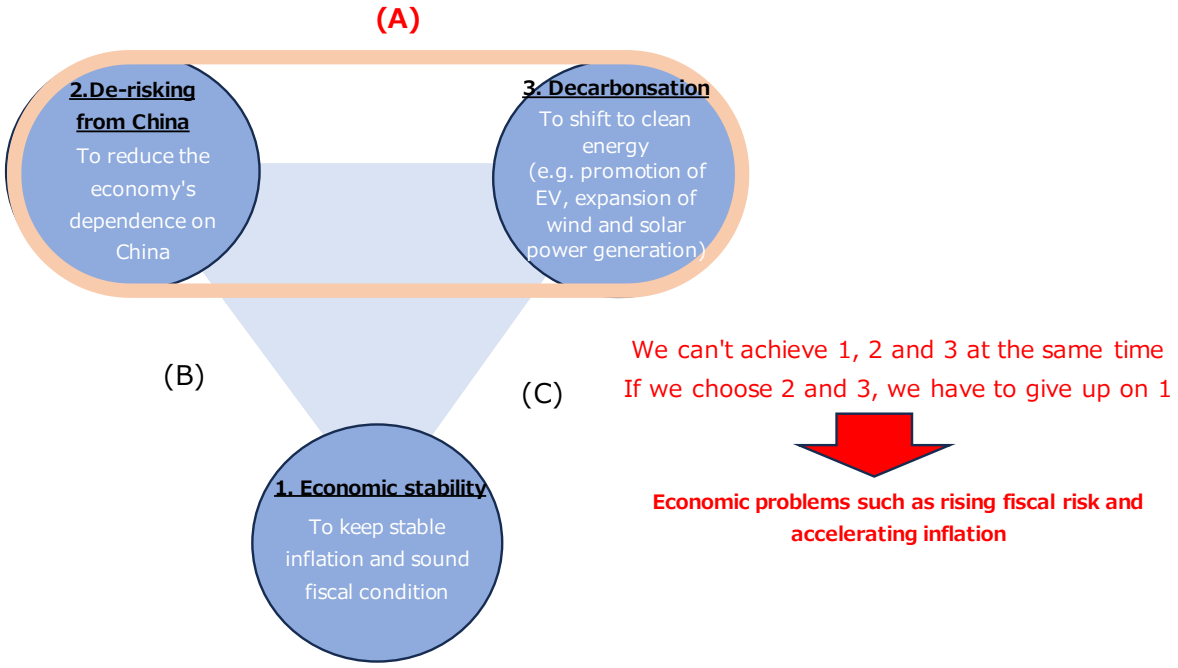
and China's use of economic statecraft to increase its influence through economic means has increased the likelihood of a heightening of geopolitical threats. Although many countries are transitioning to clean-energy, there is a need for vigilance concerning the risks posed by reliance on China, i.e., the possibility that other countries, including Japan, could experience the same headaches Germany has.

### (2) The "trilemma" that it is impossible to simultaneously deliver economic stability, reduce dependence on China, and achieve de-carbonization

As the above has shown, China, which holds the key to the transition to clean-energy, is an immense presence. The underlying primary aims of restructuring manufacturing supply chains are to "deliver economic stability" through stable supply and "reduce dependence on China" in order to weaken China's influence. In the clean-energy field, just as in other fields, "economic stability" and "de-risking from China" are major objectives, but in the clean-energy field there is an additional goal: "de-carbonization." The clean-energy field is somewhat unique in that it will be more important in the future than it is now, so the issues that will need to be tackled in restructuring supply chains in this field are more complex.

In the clean-energy field, it is practically impossible to successfully restructure supply chains while simultaneously delivering economic stability, reducing dependence on China, and achieving de-carbonization. A "trilemma" arises, as one of the following has to be chosen: (A) reducing dependence on China and achieving de-carbonization (but abandoning economic stability), (B) reducing dependence on China and delivering economic stability (but abandoning de-carbonization), or (C) achieving de-carbonization and delivering economic stability (but abandoning de-risking from China) (Figure 12).

**Figure 12: The Trilemma Facing the Reorganisation of the Supply Chain of Clean Energy**




Source: JRI

Selecting option (B) means accepting a delay in de-carbonization. If de-carbonization is delayed, it becomes possible to take measures such as switching to domestic production in fields related to sensitive technologies, such as technologies for high-tech equipment that could have military applications. It also becomes possible to avoid a situation where, despite economic interdependence, excessive isolation of specific countries or reshoring of production increases risks to the world economy. For example, if de-carbonization that requires dependence on China were abandoned, the need for aggressive supply chain restructuring would also be reduced. The current Trump administration, with its "de-decarbonization/anti-climate action" moves, can be said to be choosing this option.

Selecting option (C) means strengthening cooperation with China. It would be undesirable for the promotion of green transformation (GX), which emphasizes both de-carbonization and the economy, to impose an excessive economic burden in the form of higher costs. By utilizing China, which can produce environment-related equipment at low cost, a decarbonized society becomes feasible, so the aim would be to strengthen the resilience of critical mineral supply chains by including China in them. On a cautionary note, however, it is necessary to be aware of the risk that increasing dependence on China in the way that Germany did amplifies the threat of economic statecraft.

At present, the option being chosen by many developed countries, including Japan, is (A), i.e., reducing dependence on China and achieving de-carbonization. Taking this path means aggressively pursuing a transition to clean-energy without China. But to make serious progress, large-scale policy support will be essential, which raises concerns about elevated fiscal risks, especially in developed countries. And even if progress is made with restructuring supply chains for critical minerals, the economy may become prone to inflation due to being forced to accept high-cost products. This would mean abandoning "economic stability," and accepting that the economic burden for households and businesses would increase.

## 4. Path for Japan in restructuring supply chains in the clean-energy field: risks need to be faced

In Japan, although moves to restructure supply chains are progressing, many areas are facing problems. This is especially true of the clean-energy field, which is expected to grow rapidly in importance in the future. Here, the difficulty in balancing "de-risking from China" and "de-carbonization" is hindering supply chain restructuring. Japan is already a little behind the West in its de-carbonization efforts, and moving forward with reducing dependence on China could cause Japan to fall even further behind.

As already mentioned, the problem of the trilemma in the clean-energy field needs to be recognized. And as will be discussed below, finding ways to mitigate the problem by balancing the objectives of "de-risking from China", "de-carbonization," and "economic stabilization" will be important for supply chain restructuring in the clean-energy field.

### (1) Acceptance of economic risk: provision of industrial subsidies to high value-added fields

So far, the Japanese government has avoided the blatant protectionism seen in the West, having refrained from introducing protective tariffs, for example. It should continue to steer clear of excessive protectionism and stick to a policy of building supply chains based on economic rationality.

However, it will still need to take measures to counter China's provision of massive policy support to expand its share of the clean-energy field and the increasing threat of economic statecraft. This will be difficult for the private sector to accomplish alone, so government policies to support the industries will almost certainly be needed. In particular, measures to support reshoring, especially in high value-added industries, can be expected to deliver economic benefits and facilitate a smooth restructuring of supply chains. Indiscriminate reshoring of industry to Japan could cause a great deal of harm, such as reducing productivity, so it is recommended that the government's industrial support measures aim for the optimal allocation of economic resources and emphasize cooperation with developing countries for the production of low value-added products.

At present, supply chain restructuring in Japan's semiconductor industry is being supported by policies specifically targeting high value-added sectors (Appendix 2). Japan's approach to semiconductor support, which is based on the payment of subsidies to companies regardless of nationality, has attracted numerous foreign firms that possess advanced technology. So this can be considered an area where industrial policy has proved fruitful without any overt focus on protectionism.

### (2) Acceptance of China risk: cooperation with China to the extent possible and acceleration of China Plus One

Japan is lagging behind in the clean-energy industry, and there are areas where cooperation with China needs to be strengthened. As the situation with numerous products, such as home appliances, attests, heavy dependence on China is not a new phenomenon. So in the case of products that are less technologically important, Japan should avoid going overboard in trying to shut China out of the clean-energy supply chain.

In the case of products that are technologically important, however, Japan must aim to further reduce supply chain dependence on China in order to avert the threat of economic statecraft. In this latter case, the Japanese government can promote supply chain restructuring in the clean-energy field while avoiding excessive protectionism and the reshoring of low value-added industries by supporting corporate "China Plus One" moves. China Plus One is a business strategy that involves diversifying investments into countries/territories other than China, has become mainstream, and ASEAN states and India, which offer cost advantages, are viewed as strong candidates as investment destinations. Such moves have intensified since the 2010s, but the government will need to be proactive in providing support to further encourage companies to expand overseas. In recent years, against the backdrop of growing U.S.-China animosity, global companies have been accelerating the transfer of production to Vietnam and other countries, but many emerging countries, particularly ASEAN member states, are not supportive of the excessive exclusion of China being pursued by Western countries, and some of them are actually becoming more proactive in accepting investment from China (Nogimori [2023]). Therefore, while it needs to be noted that there are some areas that will not see decreased dependence on China, cooperation with emerging countries is vital for making it possible to compete with China on cost.

### (3) Acceptance of de-carbonization delay risk: development of rules based on high standards for the manufacture of clean-energy products

As mentioned above, one of China's strengths in clean-energy products is that its environmental standards for the refining and processing of critical minerals are lax. Even if EVs are an environmentally friendly good, if there is an adverse environmental impact during the production process, they cannot necessarily be said to be contributing overall to environmental protection efforts. Progress is also being made in calculating "carbon footprints," an approach that visualizes greenhouse gas emissions throughout the life cycle of products and services, and it will be important to expand such initiatives if market penetration of clean-energy products that meet high standards is to be achieved. Europe's Carbon Border Adjustment Mechanism (CBAM) will also be important in building high-standard supply chains. The CBAM imposes charges on imports if reductions in the generation of greenhouse gas (GHG) emissions in their production have been insufficient. It aims to avert declines in the competitiveness of EU-made products burdened by mandatory participation in carbon pricing schemes and action for de-carbonization, and prevent "carbon leakage" through the offshoring of production to escape carbon pricing. With the launch of CBAM, from January 2026, direct emissions generated in the manufacture of listed products imported into the EU and indirect emissions corresponding to the electricity consumed in connection with the production of cement, power, and fertilizers will be subject to surcharges. Australia has indicated that it intends to promote "green nickel" that satisfies strict environmental standards in the production process (Appendix 3).

In addition, if standards are established that deem products that meet ESG criteria, which cover not only environmental factors but also factors such as treatment of workers, to be high value-added products, China will need to withdraw low-standard products from the market and switch to high-standard production processes. This should lead to the formation of a fair market that includes both developed countries and China. This will be unavoidable as the de-carbonization of societies is contingent on the establishment of fair and efficient markets for clean-energy products.

It should be recognized that clean-energy products are currently making inroads in Japan at low prices, and that these low prices are partly the consequence of lower costs thanks to China's lax environmental regulations. So there ought to be concern that if this situation continues, the fundamental issues relating to environmental protection will remain even if progress with de-carbonization is made. To transform global supply chains for clean-energy products such that the products become high value-added products that comply with ESG standards, which include not only environmental standards but also labor standards, the Japanese government will need to work with the governments of other countries to create a framework for ensuring adherence to high standards. The experience of Japan, which has played a leading role in the creation of frameworks for regional economic partnership agreements such as the Trans-Pacific Partnership (TPP), should prove very useful in this regard.

## 5. Conclusion

Developed countries, feeling a sense of crisis over the rapid diffusion of clean-energy-related products from China, have embarked on countermeasures such as tariff hikes. However, these protectionist policies lack economic rationality, and even if they cause some damage to China, they are unlikely to be insufficient to significantly alter manufacturing supply chains in the clean-energy field. It will not be easy to achieve success with manufacturing supply chain restructuring, and developed countries must recognize the difficulty of balancing de-carbonization with de-risking from China as they move forward with supply chain restructuring.

In the U.S., unlike in other developed countries, industrial development in the clean-energy field will recede significantly under the Trump administration. This abandonment of de-carbonization that requires dependence on China also reduces the need for aggressive supply chain restructuring. So while it can serve as a countermeasure, it will be impossible to keep ignoring the climate change issue over the long term, so it would be reasonable to assume that the Trump administration's "de-decarbonization/anti-climate action" moves will be subject to a rethink at some point, and that the U.S. government will be forced to change course. There are risks associated with climate change, heightened dependence on China, and economic stability, and decisions about which to choose and which to abandon are not easy to make. Managing this trilemma over the long term and finding ways to mitigate risks constitutes a key economic and strategic policy challenge for developed countries.

Japan also should not try to force through de-carbonization and de-risking from China simultaneously. Instead, by striking a balance, it will be important for Japan to execute strategic policies to solve problems. To that end, it would probably be effective to implement such policies as expanding industrial subsidies with a focus on high value-added fields with economic rationality, cooperating with China to the extent possible and accelerating the China Plus One strategy, and developing rules based on high standards for the manufacture of clean-energy products. In particular, the Japanese government could be expected to play a leading role in the creation of a framework by developing rules based on high standards.

## Appendix 1. Subsidies and other measures by the Chinese government to support industry

In China, industrial support measures such as subsidies are being aggressively implemented, and lithium-ion batteries, EVs, and solar cells, known as "new three," have become the main targets for development in recent years. Although the rapid expansion of exports is a recent phenomenon, the Chinese government's generous support for these industries has been accelerating since around 2010. After the implementation of the massive four-trillion-yuan economic stimulus package at the time of the global financial crisis in 2008, China began providing full-scale support for the clean-energy industry with the intention of further stimulating the economy. In October 2010, the government announced the "Decision on Accelerating the Cultivation and Development of Strategic Emerging Industries," which identified seven industries, including clean-energy vehicles, as strategic emerging industries, and presented promotion measures, policies, and targets. Furthermore, the "Made

in China 2025" plan unveiled in May 2015 declared that promotion of industry, including the clean-energy sector, would be strengthened through subsidies, tax incentives, and financing from sovereign wealth funds.

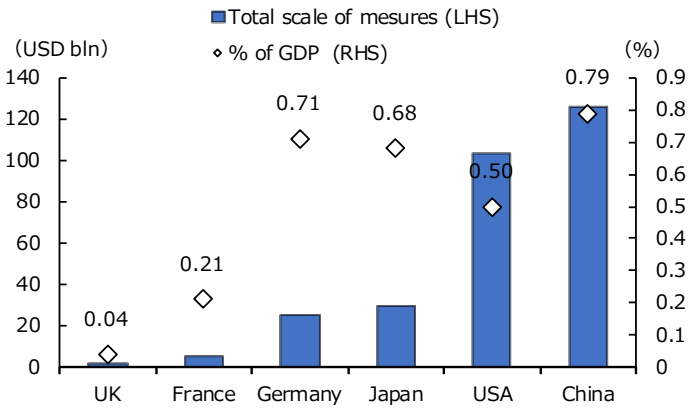
The timing of the major shift in EV policy is said to have been 2020, when the "New Energy Vehicle Industry Development Plan (2021-2035)" was announced. This plan followed the "Energy Conservation and New Energy Vehicle Industry Development Plan (2012-2020)" which had been announced in June 2012. So with the new plan, the words "energy conservation" were removed from the name, and the plan called for the targeted development of "new-energy vehicles." Specific targets were also included, such as increasing the share of new-energy vehicles sold to about 20% of the total by 2025. In 2022, the 14th Five-Year Plan on Renewable Energy Development called for relevant industries to be boosted further, and targeted a doubling of wind power and solar power.

As a result of such policies, the EV industry has stood out for a level of business expansion that could even be described as reckless. In 2019, real-estate firm Evergrande Group entered the EV business as it moved to diversify its operations, while smartphone giant Xiaomi, which announced its entry into the sector in 2021, started selling new cars in China in 2024, though it is currently selling them at a loss. These companies are believed to be seeking to take advantage of China's cost-superior supply chain to capture demand not only in China but, ultimately, all around the world.

## Appendix 2. Japan's vigorous investment in the semiconductor sector: background and current status

Moves to restructure supply chains are currently gaining momentum around the world globally. Semiconductors are at the center of such developments, with support for that sector being stepped up in recent years. When the CHIPS-Plus Act (budget: $52.7 billion) was passed in the U.S. in August 2022, there were high hopes for reshoring there. Subsequently, though, countries other than the U.S. also moved aggressively to introduce support measures, with Japan, in particular, accelerating action to boost its semiconductor production capacity (Figures 13 and 14). The Japanese semiconductor industry has seen massive investments being made by major non-Japanese manufacturers such as TSMC (Figure 15).

**Figure 13. Scale of Semiconductor Support Measures (as of April 2024)**




Source: METI "'Semiconductor and Digital Industry Strategy" (May 31, 2024)

**Figure 14. METI's policies related to supply chain restructuring after 2020**

JPY bn

| Policy measures in supplementary budgets and reserve funds□ | | FY20 | FY21 | FY22 | FY23 | FY24 |
|---|---|---|---|---|---|---|
| Related to reshoring | Subsidy for projects to promote domestic investment for supply chain measures | 517 | | 11 | | |
| | Securing domestic production bases for advanced semiconductors | | 617 | 450 | 632 | 471 |
| | Business restructuring promotion projects for small and medium-sized enterprises | | | 580 | 100 | |
| Related to friendshorin | Support for the Diversification of Overseas Supply Chains | 35 | | | | |
| | Project for strengthening supply chains in the Indo-Pacific region | | 1 | | | |
| | Project for promoting overseas market development and building supply chains in friendly countries | | | 19 | | |
| Other supply chain- | Decarbonisation and renewal of production facilities for semiconductors, which are highly indispensable in the supply chain | | 47 | | | |
| | Economic security key technology development programme | | 125 | | | |
| | Project to support the strengthening of supply chains for important products in response to changes in the economic environment | | | 958 | 915 | 16 |
| | (of which semiconductors) | | | *216* | *438* | |
| | (of which storage batteries) | | | *332* | *266* | |
| | (of which mineral resources) | | | *106* | | |
| | (Others) | | | *305* | *211* | *16* |
| | Investment project by JOGMEC to secure stable supply of mineral resources | | | 110 | | |

Semiconductor-related budget

Clean energy- related budget

Source: JRI based on METI

The goals of restructuring and strengthening the semiconductor supply chain are extremely simple, so Japan's semiconductor sector has been invigorated. These goals are to 1) "deliver economic stability" through stable supply, and 2) "avoid reliance on China" in the face of such developments as tougher restrictions on the export of semiconductors to China amid the growing U.S.-China rivalry. To achieve these goals, the "small yard, high fence" strategy has been adopted for the semiconductor field, with the range of technologies covered being narrow and limited. This makes it easy to move forward with supply chain restructuring.

Furthermore, in the case of Japan, an improved economic environment is also providing tailwind. Although policies surrounding subsidies to TSMC and others have been attracting attention, the acceleration of semiconductor investment has been largely due to 1) the rise in demand for advanced semiconductors in conjunction with the AI investment boom, and 2) the perception that investing in Japan is relatively low cost.

The first factor, the AI boom, is driving demand for advanced semiconductors. The increase in the profitability of semiconductor companies owes more to this boom than government subsidies, which only affect initial investments.

The second factor, low investment costs, has lured major semiconductor manufacturers. In Japan, labor costs remain extremely low compared to other developed countries due to reluctance to raise pay, the weakness of the yen, and so on (Figure 16). Compared to developing countries, labor costs are still relatively high, but among

**Figure 15. Enterprises Subsidised by the Japanese Government (Advanced Semiconductor Industry)**

| | tsmc jasm | KIOXIA Western Digital | Micron | Micron | KIOXIA Western Digital | tsmc jasm |
|---|---|---|---|---|---|---|
| Approval Date | Jun-22 | Jul-22 | Sep-22 | Oct-23 | Feb-24 | Feb-24 |
| Subsidy (Maximum, JPY bln) | 476.0 | 92.9 | 46.5 | 167.0 | 150.0 | 732.0 |
| Place | Kumamoto | Mie | Hiroshima | Hiroshima | Mie | Kumamoto |
| Main Products | Logic semiconductors (22/28nm and 12/16nm) | 3D flash memory (6th generation products) | DRAM (1β) | DRAM (1γ) *Produced with EUV | 3D flash memory (8th/9th generation products) | Logic semiconductors (6nm, 12nm, 40nm) *40nm not eligible for support |
| Production capacity | 55,000 wafers/month | 105,000 wafers/month | 40,000 wafers/month | 40,000 wafers/month | 85,000 wafers/month | 48,000 wafers/month *63,000 wafers/month if 40 nm is included |
| Timing of first shipment | Dec-24 | Feb-23 | Mar - May 2024 | Dec 2025 - Feb 2026 | Sep-25 | Oct - Dec 2027 |
| Customers and industries to whom products are delivered | Mainly Japanese customers | Memory cards, SSDs for smartphones, tablets, PCs/servers, as well as data centres, medical, automotive, etc. | Automotive, medical equipment, infrastructure, data centres, 5G, security, etc. | Automobiles, medical equipment, infrastructure, data centres, 5G, security, etc.* Also used for generation AI. | Memory cards, SSDs for smartphones, tablets and PCs/servers, as well as data centres, medical, automotive, etc. | Mainly Japanese customers |
| Capital Investment | Approx. 8.6 billion dollars | Approx. 278.8 billion yen | Approx. 139.4 billion yen | Approx. 500 billion yen | Approx. 450 billion yen | Approx. 13.9 billion *About 12.2 billion for the portion eligible for support, excluding 40nm. |

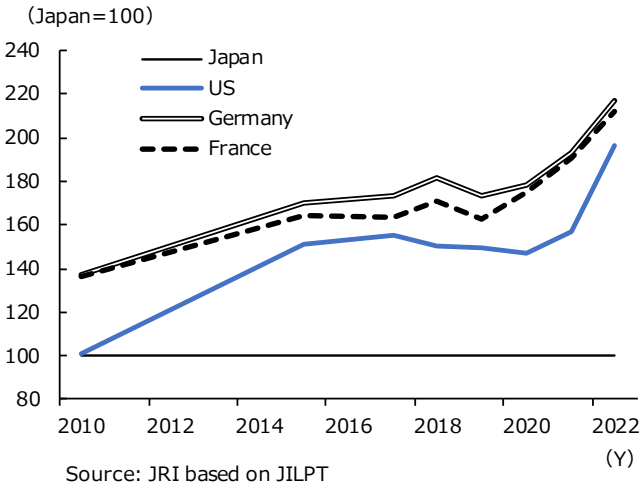
Source: JRI based on METI

developed countries, they are fairly low. The wages of manufacturing engineers, in particular, remain curtailed in Japan. Being able to manufacture at relatively low cost yet with a more highly skilled workforce than in developing countries has enticed numerous competitive foreign companies to Japan, promoting inward direct investment.

This swift restructuring of the semiconductor supply chain in Japan can be attributed to concentration on the cutting-edge areas of the sectors. But could this trend spread to encompass legacy semiconductors? China is currently in the process of rapidly expanding its production of legacy semiconductors, and the U.S. has voiced

concern about this [2]. However, extending supply chain restructuring to encompass legacy semiconductors, which do not stand to benefit much from the AI boom, would be unlikely to generate sufficient profits. And unlike with advanced semiconductors, production in Japan would pose problems in terms of cost competitiveness. It would therefore probably be difficult to build a supply chain of legacy semiconductors in Japan.

**Figure 16. Labour costs, manufacturing**



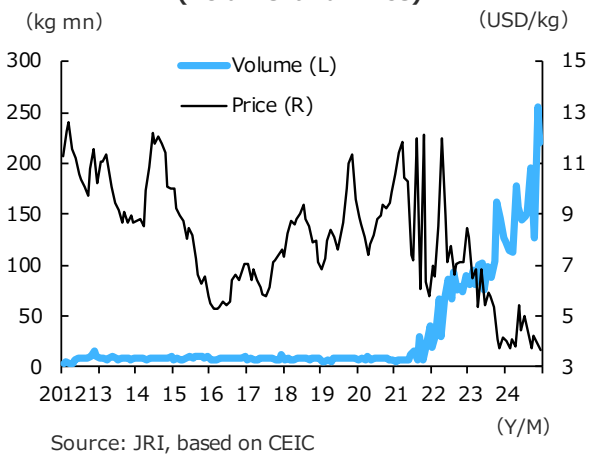

Source: JRI based on JILPT

## Appendix 3. Problems highlighted by the clash between Indonesia and Australia in the nickel industry

In the area of critical minerals, domestic investment in Australia is expected to expand further, and many in Japan are calling for efforts to be made to seize this opportunity. However, while Japan is seeing the gradual emergence of Australian investment projects amid the provision of various forms of government support, the number looks unlikely to increase significantly, especially in the field of mineral refining and processing, an area where Japan has hardly any experience.

Moreover, since the end of 2023, Indonesia's nickel production has increased rapidly as a result of support from Chinese companies, which has caused prices to plummet and put many Australian nickel firms in dire straits (Figure 17). This experience has given Australia a lesson on the difficulty of competing with Chinese companies in the critical mineral space. According to reports, some Australian firms are ditching their original plans to strengthen their nickel processing operations and instead turning their attention to businesses such as gas extraction[3]. It is worth noting, though, that in Indonesia's nickel industry, serious environmental damage has become a problem. Since China hardly discloses any information on the actual situation with critical mineral production by Chinese companies in China, it has been hard to know what is going on in terms of issues such as environmental destruction, but as soon as the Chinese firms moved

**Figure 17. Exports of Nickel in Indonesia (Volume and Price)**




Source: JRI, based on CEIC

[2] "U.S. nervous about 'flood' of older-generation chips from China," *Nikkei Asia*, January 9, 2024.
[3] "Australian battery metal company shifts to gas amid nickel slump," *Nikkei Asia*, April 24, 2024.

into Indonesia, the problem of environmental damage came to light. This suggests that low environmental costs have been a contributing factor to the enhanced competitiveness of Chinese companies.

The Australian government is also providing subsidies to support companies engaged in nickel mining and processing, but it is not positioning this as a fundamental solution. “Australian nickel resources are produced to high environmental, social and governance (ESG) standards, meaning Australia offers more sustainable and ethical critical minerals than many of our competitors,” the Australian government explains. It has set out a policy of gaining acceptance for prices of the country's nickel to include a "green premium," i.e., getting it recognized as a high value-added product[4]. It is asking its trading partners to add on this premium, but as yet no countries have agreed to do so. Penetration of a system like this that emphasizes high standards will likely take some time, as there will need to be discussions about who will bear the costs. Eliminating minerals that are offered at low prices because environmental damage is being ignored, and implementing a system where minerals that meet high standards are traded at appropriate prices, should lead to the construction of supply chains that enable developed countries such as Australia to remain competitive. In addition, if China and Indonesia, whose environmental regulation of production processes is regarded as insufficient, are also required to comply with high standards, it will be possible to establish fair and efficient markets at the global level in the clean-energy field.

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