

EU ACCELERATES THE TRANSITION TO RENEWABLE ENERGY AND LOOKS TO REDUCE DEPENDENCE ON CHINA

— THE CRITICAL RAW MATERIALS ACT AND THE NET ZERO INDUSTRY ACT —

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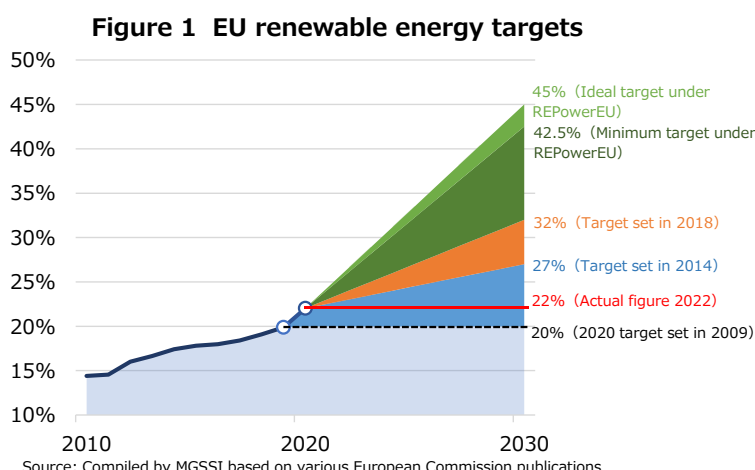
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SUMMARY

- The EU is accelerating the deployment of renewable energy in the wake of Russia's invasion of Ukraine in 2022, but there are mounting concerns over the EU's heavy reliance on China for solar and wind power supply chains.
- In March 2023, the European Commission proposed the Critical Raw Materials Act and the Net Zero Industry Act. These acts aim to reduce the EU's dependence on China by diversifying the supply chains, including raw materials supplies, and by strengthening industries within the EU.
- There are high hurdles to overcome to achieve these goals. Decarbonization is a global trend, and competition for critical materials is expected to intensify. Expanding extraction, processing and manufacturing capacity in the EU will not be easy either. Companies will also be required to conduct supply chain audits, including where the raw materials are sourced. That said, there will be business opportunities for alternatives to mineral resources and recycling technologies as demands for those grow.

1. INTRODUCTION

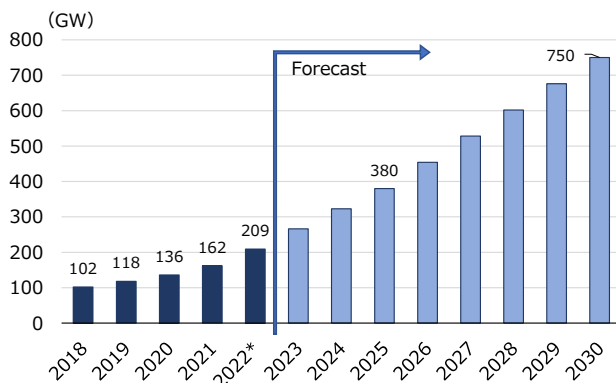
The EU is accelerating the deployment of renewable energy to decarbonize its energy system. In December 2019, the European Commission announced the European Green Deal, a growth strategy to achieve climate neutrality by 2050. As part of this strategy, the commission launched the "Fit for 55" in July 2021, a comprehensive policy package that aims to reduce greenhouse gas emissions by 55% from 1990 levels by 2030, and proposed to raise the target for the share of renewable energy in the EU's final energy consumption in 2030 to 40% from the previous 32% goal set in 2018. Furthermore, the REPowerEU plan announced in May 2022, a strategy to phase-out EU's reliance on Russian fossil fuels and to ensure the EU's energy security in response to Russia's invasion of Ukraine in February of that year, has put the acceleration of the transition to clean energy as one of the core measures. In March 2023, the European Commission, the European Parliament, and the Council of the European



Union, agreed to raise the minimum target for the share of renewable energy by 2030 to 42.5%, with aspiration to achieve 45% (Figure 1)¹.

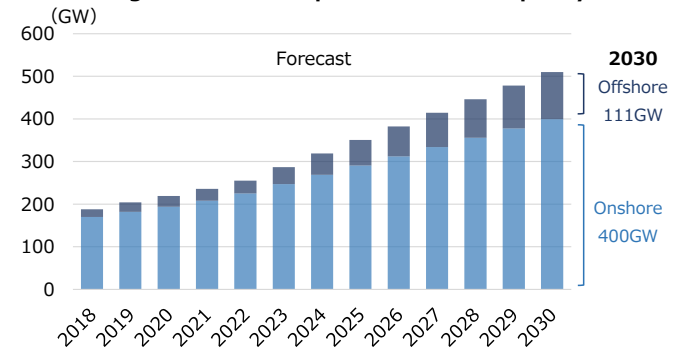
The centre piece for the acceleration of the deployment of renewable energy is the expansion of solar and wind power generation. The EU Solar Energy Strategy, announced alongside the REPowerEU plan, calls for increasing installed capacity from 162 GW in 2021 to 380 GW in 2025 and 750 GW in 2030 (Figure 2). The goal for wind power is to increase the combined onshore and offshore installed capacity to 510 GW by 2030. In January 2023, EU member countries agreed to a 2030 installed capacity target of 111 GW for offshore wind power² (Figure 3).

Figure 2 EU solar power installed capacity



Note: Based on direct current (DC). To 2021, actual data, for 2022, SolarPower Europe estimate, from 2023 onwards, figures are MGSSI calculation based on SolarPower Europe's forecast for 2025 and 2030, in which European Commission targets values are used.
Source: Created by MGSSI based on SolarPower Europe "EU Market Outlook for Solar Power 2022-2026", published December 2022, last accessed June 19, 2023 (<https://www.solarpowereurope.org/insights/market-outlooks/eu-market-outlook-for-solar-power-2022-2026-2>)

Figure 3 EU wind power installed capacity



Note: To 2022, actual values from WindEurope, from 2023 onwards, calculated based on European Commission target values

Source: Created by MGSSI based on WindEurope "Wind Energy in Europe: 2022 Statistics and the outlook for 2023-2027", published February 2023, last accessed June 19, 2023 (hereinafter the same) (<https://windeurope.org/intelligence-platform/product/wind-energy-in-europe-2022-statistics-and-the-outlook-for-2023-2027/>), European Commission "RePowerEU COMMISSION STAFF WORKING DOCUMENT", published May 18, 2022 (<https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52022SC0230&from=EN>), European Commission press release "Member States agree new ambition for expanding offshore renewable energy", published January 19, 2023 (https://energy.ec.europa.eu/news/member-states-agree-new-ambition-expanding-offshore-renewable-energy-2023-01-19_en)

2. DEPENDENCE ON CHINA IN THE SOLAR AND WIND SUPPLY CHAINS

While the EU is looking to accelerate the adoption of renewable energy as described above, there are challenges to overcome. One such challenge is external dependencies in the supply chain.

The main focus of the EU is China. The supply chain disruption caused by the COVID-19 pandemic, as well as Russia's invasion of Ukraine have intensified the EU's urgency to reduce its over-reliance on certain countries in areas of high importance to the EU economy, such as the green and digital sectors. In the solar and wind power sectors, there is a high degree of dependence on China, mainly for raw materials. There are concerns that the acceleration of renewable energy deployment would deepen the EU's reliance on China and give China an economic advantage. Moreover, this could also result in the EU being affected by the geopolitical risks associated with China. These would damage the European economy as well as its decarbonization effort.

In the solar industry, there is a high dependence on China across all processes, from raw materials to finished products. According to the International Energy Agency (IEA), China accounted for about 75% of global manufacturing capacity for solar modules as of 2021, while Europe accounted for a mere 3% (Figure 4)³. According to the Brussels-based economic thinktank Bruegel, while 41.4 GW of new solar PV capacity was

¹ The EU's Renewable Energy Directive sets targets for the share of final energy consumption from renewable sources. In March 2023, general agreement was reached on a draft of the Renewable Energy Directive, including an increase in the 2030 target to 42.5%. As of July 2023, however, the draft had not been adopted due to disagreements among member states over whether hydrogen derived from nuclear power should be treated the same as hydrogen from renewable energy, and other issues.

² European Commission "Member States agree new ambition for expanding offshore renewable energy" published January 19, 2023, https://energy.ec.europa.eu/news/member-states-agree-new-ambition-expanding-offshore-renewable-energy-2023-01-19_en (accessed July 29, 2023)

³ International Energy Agency "Energy Technology Perspectives 2023" published January 12, 2023, last accessed July 12, 2023, <https://www.iea.org/reports/energy-technology-perspectives-2023>

installed in Europe in 2022, only 9.2 GW worth of solar modules, or about 20%, was produced within Europe, and the rest are imports (Figure 5). According to the European Commission, 75% of imports come from China⁴. In terms of raw materials, there is a high dependence on China for materials such as gallium and germanium (see Figure 9 below for the degree of dependence).

Figure 4 Solar and wind power component production capacity by country/region

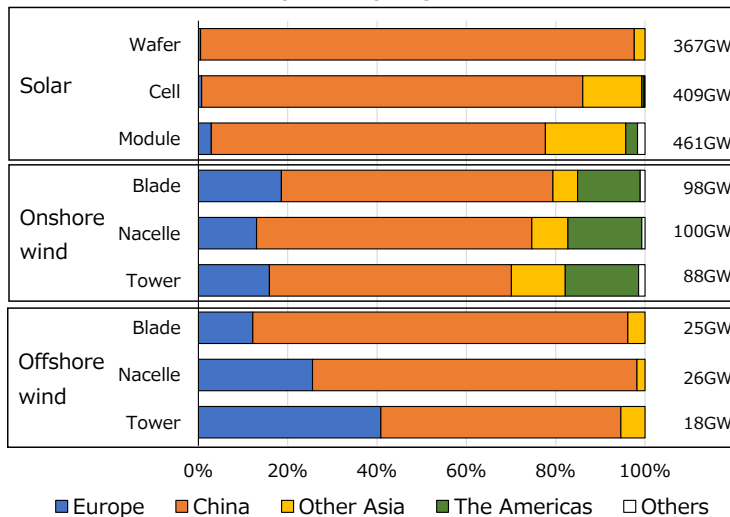


Figure 5 Solar and wind power component production capacity and newly installed capacity in Europe

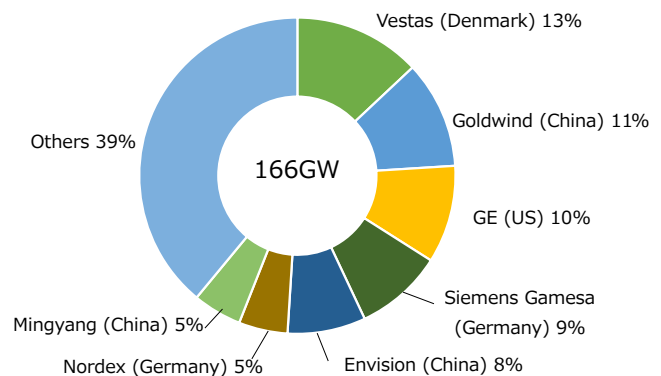
Component	Production capacity (GW)	Newly installed (GW)	Data	
Solar	Wafer	1.7	41.4	2022
	Cell	1.4	41.4	2022
	Module	9.2	41.4	2022
Onshore wind (note)	Blade	17.0	16.7	2021
	Nacelle	11.8	16.7	2021
	Tower	11.8	16.7	2021
Offshore wind (note)	Blade	2.9	2.5	2021
	Nacelle	6.6	2.5	2021
	Tower	7.2	2.5	2021

Note: Wind power values are for the 27 EU member states plus the UK.
 Source: Created by MGSSI based on Bruegel "Cleantech manufacturing: where does Europe really stand?", published May 17, 2023, last accessed June 29, 2023 (<https://www.bruegel.org/analysis/cleantech-manufacturing-where-does-europe-really-stand-0>)

Note: Data for 2021. Figures on the right indicate global production capacity.
 Source: Created by MGSSI based on IEA, "Energy Technology Perspectives 2023", published January 12, 2023, last accessed June 30, 2023 (<https://www.iea.org/reports/energy-technology-perspectives-2023>), Bruegel, "Cleantech manufacturing: where does Europe really stand?", published May 17, 2023, accessed June 30, 2023 (<https://www.bruegel.org/analysis/cleantech-manufacturing-where-does-europe-really-stand-0>)

European companies have a certain degree of presence in wind power. The Danish company Vestas leads the world in wind turbine production, accounting for 13% of global capacity (Figure 6). The EU installed 16.7 GW of new onshore wind capacity in 2021, and European turbine blade production capacity amounts to 17 GW, meaning that they can cover demand within Europe. In addition, the offshore wind power production capacity significantly exceeded the newly installed capacity. When it comes to the raw materials, however, the EU is 100% dependent on imports from China for the rare earths that are essential for wind turbines (heavy rare earths, see Figure 9 below).

Figure 6 Wind turbine production capacity (2022)



Source: Created by MGSSI based on Rystad Energy "The State of the European Wind Energy Supply Chain", published April 2023, accessed July 12, 2023 (<https://www.review-energy.com/fileuploads/user/20230413%20Rystad%20Energy%20-%20Wind%20Supply%20Chain%20Report-PRINT.pdf>)

3. MEASURES TO REDUCE DEPENDENCE ON CHINA - NET ZERO INDUSTRY ACT AND CRITICAL RAW MATERIALS ACT

The EU has begun to take action to reduce external dependencies. The Net Zero Industry Act, proposed by the European Commission in March 2023 to strengthen green industries in the EU (Figure 7), has selected solar, and wind as one of "strategic net zero technologies". The proposed act introduces measures, such as easing permit approval procedures for the establishment of production facilities, to encourage investment to expand

⁴ Import share figure as of 2020. European Commission "In focus: Solar energy – harnessing the power of the sun", published September 13, 2022, last accessed July 12, 2023, https://commission.europa.eu/news/focus-solar-energy-harnessing-power-sun-2022-09-13_en

production of these technologies in the EU. In the selected sectors, the EU also aims to produce 40% of the EU's domestic consumption within the single market by 2030.

Figure 7 Outline of the Net Zero Industry Act

Purpose	To improve the investment environment by simplifying the regulatory framework in areas such as the procedures for permits for construction of production sites, and to support the development of net-zero technologies and expansion of production capacity.
Targets	To meet 40% of annual domestic production targets in "strategic net zero technologies" in by 2030. Strategic net zero technologies <ol style="list-style-type: none"> 1. Solar photovoltaic and solar thermal technologies 2. Onshore and offshore renewable technologies 3. Battery/storage technologies 4. Heat pumps and geothermal energy technologies 5. Electrolysers and fuel cells for hydrogen production 6. Sustainable biogas/Biomethane technologies 7. Carbon Capture and Storage (CCS) technologies 8. Grid technologies (incl. smart/fast charging facilities for EVs)

Source: Created by MGSII based on European Commission "Net-Zero Industry Act: Making the EU the home of clean technologies manufacturing and green jobs", published March 16, 2023, accessed June 30, 2023 (https://ec.europa.eu/commission/presscorner/detail/en/IP_23_1665)

Stable supply of raw materials is essential for expanding domestic production. On the same day that the European Commission presented the Net Zero Industry Act proposal, the Commission also presented its draft for the Critical Raw Materials Act (Figure 8).

Figure 8 Outline of the Critical Raw Materials Act

Purpose	To reduce excessive dependence on specific countries in raw materials supply essential to achieve the European Green Deal and digitalization, and ensure a stable and sustainable supply of critical raw materials.
Specific measures	<ol style="list-style-type: none"> ① Building a critical raw materials value chain in the EU <ol style="list-style-type: none"> 1) List of critical raw materials and strategic raw materials <ul style="list-style-type: none"> • Critical Raw Materials (CRM) (Critical importance for the EU economy and a high supply risk) • Strategic Raw Materials (SRM) (Strategic importance for the EU's green, digital, defense, and space sectors and a future supply risk) 2) Setting 2030 production targets for strategic raw materials <ul style="list-style-type: none"> • 10% of the EU's annual consumption of critical minerals • 40% of the EU's annual consumption of processed critical minerals • 15% of the EU's annual consumption of recycled critical minerals • No more than 65% of annual consumption in any part of the processing process to be dependent on a single third country ② Diversification of supply networks and enhancing of mutually beneficial international partnerships <ol style="list-style-type: none"> 1) Establishment of a Critical Raw Material Club: Countries that consume critical raw materials working together with resource-rich countries to ensure a stable and sustainable supply of critical raw materials 2) Strengthening relations with resource-rich countries through trade and investment agreements, bilateral strategic partnerships, etc. ③ Ensuring sustainable supply of critical raw materials and promote circular economy <ol style="list-style-type: none"> 1) Enhancing sustainability through corporate due diligence regulations (preventing forced labor, armed conflict, and serious human rights violations in supply chains) 2) Enhancing circularity: Recovery and recycling of critical raw materials from motor vehicles, electronic equipment, etc.

Source: Created by MGSII based on European Commission "Critical Raw Materials: ensuring secure and sustainable supply chains for EU's green and digital future", March 16, 2023, accessed June 30, 2023 (https://ec.europa.eu/commission/presscorner/detail/en/ip_23_1661)

With China in mind, the proposed act aims to reduce excessive dependence on specific countries in the supply of critical mineral resources, especially those needed for the green, digital, defence, and space sectors, in order to ensure a stable and sustainable supply. Specifically, it aims to enhance extraction, processing, and recycling of critical materials within the EU to diversify its supply.

The European Commission has selected 34 minerals as Critical Raw Materials (CRM). Seventeen of these, which are deemed to have particular importance and future supply risks, have been designated as Strategic Raw Materials (SRM) (Figure 9). For SRMs, the goal is to achieve, by 2030, an annual self-sufficiency rate of 10% for extraction, 40% for processing, and 15% for recycled products relative to the EU demand. In addition,

imports from a single third country may not exceed 65% of annual consumption in any SRM. Currently, seven out of 17 SRMs exceed this threshold, and five of them are from China, including rare earths and gallium (the former is essential for wind turbines and the latter is for solar PVs).

Figure 9 Critical raw materials list

				Extraction (E) Processing (P)	World		EU					
					Principal source	Share	Import dependence	Principal source	Share	End of life recycling input rate		
Critical Raw Materials (CRM)	Strategic Raw Materials (SRM)	1	Rare earths	Heavy rare earths	P	China	100%	100%	China	100%	4%	
		2		Light rare earths	P	China	85%	100%	China	85%	3%	
		3	Boron/Borate			E	Turkey	48%	100%	Turkey	99%	1%
		4	Magnesium			P	China	91%	100%	China	97%	13%
		5	Lithium			P	China	56%	100%	Chile	79%	0%
		6	Gallium			P	China	94%	98%	China	71%	0%
		7	Bismuth			P	China	70%	71%	China	65%	0%
		8	Germanium			P	China	83%	42%	China	45%	2%
		9	Manganese			E	South Africa	29%	96%	South Africa	41%	9%
		10	Natural graphite			E	China	67%	99%	China	40%	3%
		11	Nickel			E	China	33%	75%	Russia	29%	16%
		12	Titanium			P	China	43%	100%	Kazakhstan	36%	19%
		13	Silicon metal			P	China	76%	60%	Norway	33%	0%
		14	Tungsten			P	China	86%	80%	China	32%	42%
		15	Copper			E	Chile	28%	48%	Poland	19%	55%
		16	Cobalt			E	DRC	63%	81%	-	-	22%
		17	Platinum group	Iridium, platinum, rhodium, ruthenium,		P	South Africa	75%	96%	-	-	10%
		Palladium		P	Russia	40%	-	-	-	-		
	18	Strontium			E	Iran	37%	0%	Spain	99%	0%	
	19	Niobium			E	Brazil	92%	100%	-	-	0%	
	20	Hafnium			P	France	49%	0%	France	76%	0%	
	21	Scandium			P	China	67%	100%	China	67%	0%	
	22	Phosphorus			P	China	79%	100%	Kazakhstan	65%	0%	
	23	Aluminum/Bauxite			E	Australia	28%	89%	Guinea	63%	32%	
	24	Antimony			E	China	56%	100%	Turkey	63%	28%	
	25	Vanadium			E	China	62%	-	China	62%	1%	
	26	Beryllium			E	US	67%	-	US	60%	0%	
	27	Arsenic			P	China	44%	39%	Belgium	59%	0%	
	28	Feldspar			E	Turkey	32%	54%	Turkey	51%	1%	
	29	Barite			E	China	32%	74%	China	45%	0%	
	30	Helium			P	US	56%	94%	Qatar	34%	2%	
	31	Tantalite			E	DRC	35%	99%	DRC	35%	0%	
	32	Flourite			E	China	56%	60%	Mexico	33%	1%	
	33	Phosphate rock			E	China	48%	82%	Morocco	27%	17%	
34	Coaking coal			E	China	53%	66%	Poland	26%	0%		

Note: The recycled input rate is the percentage of overall demand filled by secondary raw materials (recycled materials). The gray shading indicates a dependence on specific countries for 65% or more of the EU's demand. Rare earths are classified into heavy rare earth elements (HREE) and light rare earth elements (LREE).

Source: Created by MGSSI based on European Commission, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, Grohol, M., VeeEuropean Commission, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, Grohol, M., Veeh, C., Study on the critical raw materials for the EU 2023 – Final report, Publications Office of the European Union, 2023, <https://data.europa.eu/doi/10.2873/725585>, accessed June 30, 2023 (https://single-market-economy.ec.europa.eu/publications/study-critical-raw-materials-eu-2023-final-report_en)

To maximize the use of CRMs, the EU promotes research and development for recycling technologies and alternative materials as well as strengthens resource management. The act also proposed to implement inventory control, joint purchasing, and stress tests to evaluate the effects of price hikes, supply shortages and disruptions as well as corporate supply chain audits.

In terms of diversifying supply, the European Commission aims to establish a supply network by strengthening ties between resource-rich and resource-poor countries through various frameworks, including bilateral, regional, and multilateral groupings such as G7. The EU has concluded critical minerals partnerships with countries such as Canada and Kazakhstan, and is looking to strengthen ties with Chile, Argentina, Australia,

and African countries, amongst others. In addition, at the G7 Climate, Energy, and Environment Ministers' Meeting in April 2023, ministers agreed to provide \$13 billion worth of financial support, and promote joint investment in sustainable resources and supply chain development projects. At the G7 Hiroshima Summit in May 2023, leaders agreed to work closely together to reduce dependencies on certain countries for critical minerals. There was a shared recognition of the need to build reliable supply chains and the importance of cooperation with the so-called Global South countries.

The Net Zero Industry Act and the Critical Raw Materials Act proposed by the European Commission are currently under consideration by the Council of the European Union and the European Parliament, the two legislative bodies of the European Union. Once the Council of the EU and the European Parliament have passed the act with amendments if there is any, a trilogue with the European Commission will be held to finalise them and final texts are expected to be adopted by the end of the year at the earliest.

4. FUTURE OUTLOOK

Energy research firm Rystad Energy estimates that Europe's demand for rare earths in the wind sector alone will increase from less than 1,000 tonnes in 2022 to about 6,000 tonnes in 2030⁵. The decarbonization trend is not limited to Europe; it is a global phenomenon. Demand for critical mineral resources will only continue to grow, and so will the competition for resources.

On July 3, 2023, in response to measures taken by the US, Japan, and the Netherlands to restrict exports of semiconductor manufacturing equipment, China announced that it would restrict exports of gallium and germanium, two invaluable elements used in the green and digital sectors. Both are minerals designated as SRMs in the Critical Raw Materials Act, and the risk of China using critical minerals as a tool of economic blackmailing has become evident.

The Critical Raw Materials Act aims to simplify permitting procedures for extraction of mineral resources within the EU. It should be noted, however, that the development of the EU's mineral resources may face some challenges along the way. Swedish state-owned mining and minerals giant LKAB announced in January 2023 that it had discovered rare earth deposits, the largest of its kind in Europe. The company also said, however, that it would take at least 10-15 years to start extracting the deposits and supply raw materials to the market. If residents or other stakeholders raise concerns over the environmental impact of such project, it may well be delayed or even cancelled. Even if extraction were possible, the value chain which is well developed in China, including post-extraction refining and processing of critical raw materials, is not currently fully established in Europe. Securing these facilities domestically or through friend-shoring with like-minded countries would be time-consuming and costly, and there is a risk that they will not be competitive. The hurdle is high to achieve the goal of self-sufficiency.

Businesses should also be prepared for possible mandated stress testing, inventory controls, supply chain audits, and other regulatory procedures related to critical raw materials. In addition, it will be crucial to establish measures to address geopolitical risks, such as the possibility of a Taiwan contingency and the risk of supply network disruptions due to political manoeuvrings.

Meanwhile, the demand for alternatives and recycling technologies is expected to increase, representing potential business opportunities.

⁵ Rystad Energy "The State of the European Wind Energy Supply Chain", published April 2023, last accessed July 12, 2023, <https://www.review-energy.com/fileuploads/user/20230413%20Rystad%20Energy%20-%20Wind%20Supply%20Chain%20Report-PRINT.pdf>