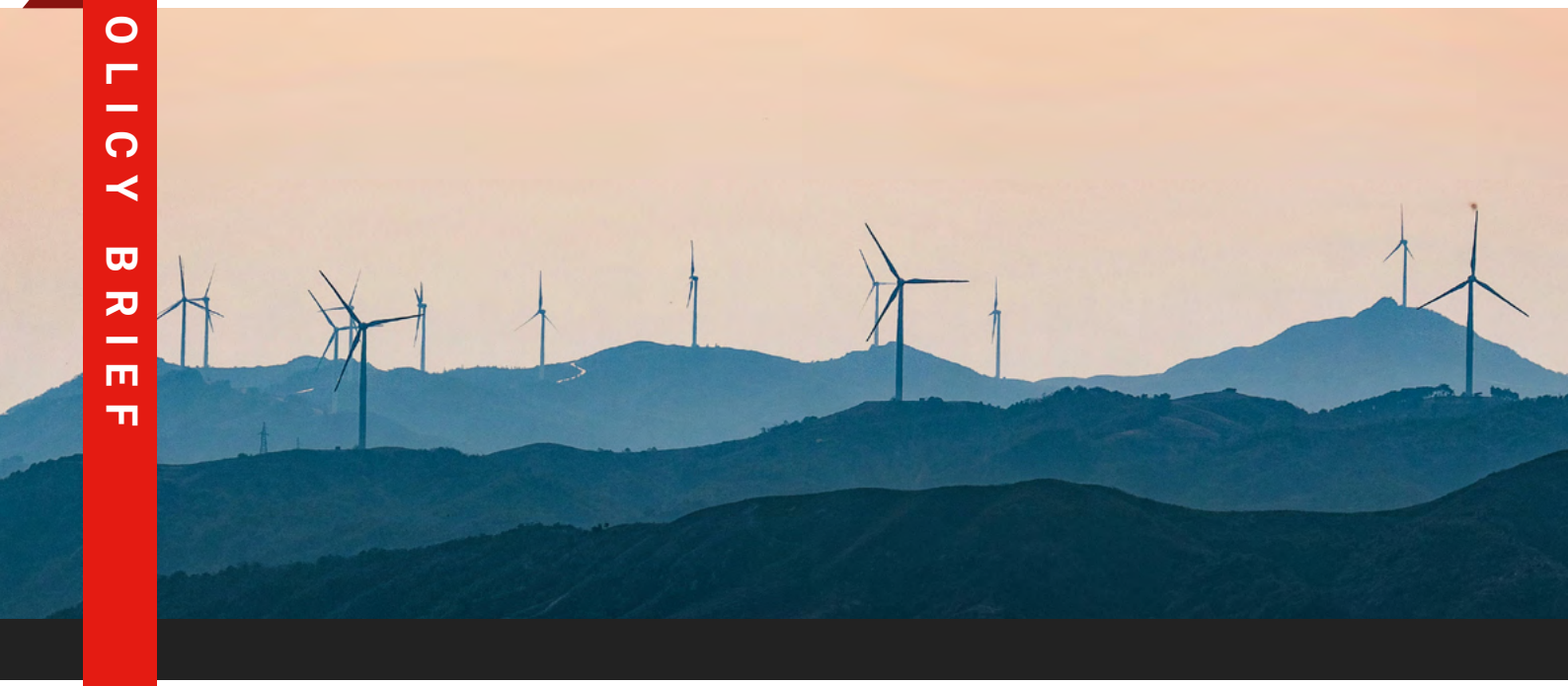
POLICY BRIEF



The international implications of China's roles in the low-carbon energy transition

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August 2025

Understanding the Geopolitics of the
Energy Transition – a new world in the making

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China is the dominant player in the global low-carbon energy transition in two respects: it has deployed the largest fleet of low-carbon electricity generation capacity in the world, and it dominates several international supply chains for clean energy minerals, metals and equipment.

China has installed a massive amount of infrastructure for both solar and wind energy since 2010. The total capacity reached 1,300 GW by the end of 2024, which is more than 45% of the global total. Investment in hydro power and nuclear power also continues. These non-fossil fuels accounted for about 40% of the nation's power generation in 2024. At the same time, the country has built up the world's largest electric vehicle industry and is likely to take the lead in the manufacture and use of green hydrogen.

This success has been built upon several foundations. Most important are the various policies of central and local government that supported investment and innovation along the clean energy supply chains over two decades or more. In the early days, this relied on technology transfer from abroad. More recently, the development of technology and manufacturing clusters have assisted scaling up and innovation, all supported by abundant and skilled human capital (Hove, 2024).

All this adds credibility to Xi Jinping's pledge to peak carbon emissions by 2030 and 'strive for' carbon neutrality by 2060. However, energy and fossil fuel consumption are still rising, as are carbon emissions. Coal is the main culprit as the country has large reserves, and the government sees coal as providing the foundation for energy security. Coal accounted for about 55% of power generation in 2024 and remains an important fuel in some industries.

The continued increase in the use of coal will result in the peak of carbon emissions being significantly higher than might have been projected ten years ago. The good news is that the declining rate of GDP growth combined with the increasing electrification of the economy may result in emissions peaking in the next two-to-three years.

The vast investment in clean energy technologies has not only supported their domestic deployment but has allowed China to gain a prominent and often dominant position in global supply chains for clean energy equipment (Meidan et al., 2023). Three supply chains are particularly important today: those for lithium-ion batteries, wind turbines and solar PV. China dominates in the refining of mineral ores, notably for rare earths, graphite and polycrystalline silicon. Looking downstream, it produces about 75% of the world's lithium-ion cells and accounts for about 60% of the internationally traded lithium-ion cells. About 60% of internationally traded permanent magnets used in wind turbines and 80% of traded solar PV modules come from China. In addition, Chinese companies are expanding their presence overseas, initially in mining but also in ore processing and equipment manufacturing.

Not only does China supply the world with large quantities of clean energy equipment, but it does so at low cost. In this way it can be argued that the country provides a service to the whole world through the supply of cheap and generally reliable renewable energy equipment.

However, this poses threats to many industrialised nations in two ways. First, it threatens the continued existence of these industries due to the low cost of imports. Second, such a concentration of supply is vulnerable to costly disruptions (Andrews-Speed, 2024). Such disruptions may be unintentional, caused by events such as pandemics, natural disasters or industrial incidents. Of greater concern today is the reality of China's export controls which threaten Western car manufacturers and the defence industry, let alone the wider low-carbon transition.

Before China's recent export controls, industrialised nations had developed countermeasures to support the extraction and processing of critical minerals as well as the manufacture of clean energy appliances. These included the US Inflation Reduction Act 2022, the European Union Critical Materials Act 2024 and the Mineral Security Partnership established in 2022.

Still, it is unlikely that these measures will make a serious dent in China's domination of these supply chains over the next ten years. Opening new mines requires time, capital and the social license to operate. The construction of mineral processing plants is quicker, but they consume large quantities of energy and water, and the waste is often toxic. Even manufacturing of clean energy equipment can be challenging, as exemplified by the bankruptcy of the European battery manufacturer Northvolt in 2025.

A further route being followed to reducing dependence on China is through the innovation of new technologies that reduce reliance on these critical minerals. However, China is also researching these technologies and, once again, is likely to be the lowest cost producer.

POLICY RECOMMENDATIONS

As explained above, the policies introduced by the European Union and the United States to combat dependence on China are unlikely to reduce dependence on China significantly in the short-term. Even for long-term success, substantial funding and incentives will have to be sustained for several years (Mennell, 2025). In this context, it is surprising to see that President Trump's recent budget removes the ten percent tax credit for the extraction, refining and recycling of certain critical minerals (Muir, 2025).

In the short-term, governments and companies should take whatever steps they can to reduce dependence on supply chains dominated by China. The nature of such strategies depends, in part, on the nature of the clean energy manufacturing industry in the country concerned. The United Kingdom, for example, hosts no manufacturing capacity for solar modules, and capacity for wind turbines is limited to towers and blades. The issue is not one of critical minerals but rather of equipment supply. The Scottish Government has plans to allow Mingyang of China to construct a wind turbine factory. This is opposed by some on security grounds (Millard and Kerr, 2024). In contrast, the car manufacturing industry is important, which is why the government has supported

the Chinese company AESC in the building, and expansion, of its battery gigafactory in Sunderland (Jessen, 2025). Such an approach supports the local car manufacturing industry and introduces new technologies and skills.

In contrast, the European Union is home to companies involved in the manufacture of components and final products for batteries, wind turbines and solar modules. Of these, it is the wind power industry that is the strongest. Companies in all three industries face tough price competition from manufacturers in China, as well as challenges diversifying their supply chains. The wind power industry is particularly dependent on China for rare earths and permanent magnets. A few European countries are starting to build capacity for processing rare earth ores and manufacturing permanent magnets (Patey and Tsang, 2025). However, if Europe is to push ahead with its low-carbon goals, it will need to expand the currently marginal involvement of Chinese companies in both the deployment and manufacture of the relevant technologies. These include solar photovoltaics, wind turbines and batteries. At the same time, it will be necessary to be vigilant in relation to cybersecurity. ■

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