POLICY BRIEF
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THREAT OR TAILWIND?
CHINESE WIND TURBINE MANUFACTURERS AND THE FUTURE OF EUROPEAN ENERGY

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Long considered a European success story, the wind industry has recently become emblematic of the EU's competitiveness challenges. Despite pioneering the production of wind turbines, European original equipment manufacturers (OEMs) have slowly ceded their global dominant position to foreign competitors. Of 169 gigawatts (GW) of new wind capacity installed worldwide in 2025, 119 came from China (70.41%), with Chinese OEMs capturing eight spots among the top ten global wind turbine makers. This prosperity was not unforeseeable; during the 2010s, China was quietly building one of the most accessible and heavily incentivised wind markets in the world while European policymakers were still debating the merits of wind energy. Ultimately, this allowed Beijing to surpass the EU in turbine installations for the first time in 2015, quickly raising concerns on the competitiveness of European manufacturers in the renewable energies sector.

To address this decline, the EU has launched a series of policy instruments aimed at promoting and advancing the European wind power industry. In 2019, the European Green Deal came as the first effort to fix a binding carbon neutrality target. At the same time, the deal attempted to secure the EU's competitiveness in the global market through complementary acts tackling issues related to the renewable industries and critical raw materials. A further blow arrived as Russia's invasion of Ukraine shed light on energy overdependence and raised the need to diversify power sources and to assume de-risking strategies. Rather than pursuing full de-coupling, the de-risking approach was adopted as an attempt to diversify supply chains, reduce import concentration, and build domestic production capacity in technologies deemed essential to European security and prosperity. To this goal, the REPowerEU Plan was adopted in 2022 to incentivise the EU's investments in renewable sources in replacement of fossil fuel imports. The plan set a target for renewable energies to attain at least a 42.5% share of total consumption by 2030, a goal that has considerably accelerated the installation of new renewable energy capacity across the continent.

Per contra, the recent rise of Chinese manufacturers in energy-related industries has left European stakeholders struggling for relevance. By 2023, China had secured near-total control of the global solar photovoltaic supply chain. The same phenomenon is playing out in the electric vehicles (EV) market, where China now controls 70% of the global production and provides 85% of battery cells. The renewables industry has thus adapted accordingly: after the boom of the EVs and the solar panels markets, global investors now turned their heads towards wind power. As the market for turbines in China continues to grow above global records, Chinese OEMs are now exploring worldwide expansion, making the EU one of the most appealing markets thanks to its wide institutional support for green energy. Haunted by the prospect of an outcome similar to that of solar PV and EVs, European

policymakers are now scrambling to shield the domestic wind turbine market from Chinese competition by any means available.

First, in May of last year the German Ministry of Defence suggested halting the installation of the Waterkant offshore wind farm in the North Sea over concerns that Chinese OEM Ming Yang's control of the power grid could threaten Berlin's national security. Later, in February of this year, the European Commission reached the decision to open an in-depth foreign subsidies investigation into Goldwind Science & Technology Co., the largest Chinese OEM operating in Europe, provoking powerful accusations of adopting unfair competition practices from the Chinese Foreign Ministry.

As part of the EU's efforts to defend its domestic industry, policymakers risk responding to Chinese wind turbine pressure with reflexive protectionism; a strategy that would not address the market's structural weaknesses but rather hinder the energy transition and disrupt strategic trade relations. Instead, the EU should identify how to complement its de-risking strategies with the opportunities arising from the presence of Chinese manufacturers in its domestic market. Ultimately, cooperative engagement with foreign OEMs can lead to spur industrial competitiveness and to expedite the achievement of carbon neutrality goals.

A shifting market structure

Amid Trump's "war on wind" in the US and a slow wind-power takeoff in the rest of the world, the EU and China are still the global leaders in the wind turbines industry. Nonetheless, while the EU was able to secure its primacy thanks to its early-mover advantage, the situation has capsized since 2015. Despite having entered the market later, Chinese manufacturers have managed to quickly overthrow European giants in capacity installation. China also holds the largest wind capacity quota, covering a remarkable 49% of the global share, followed by the EU at 21%. This gap is none other than the result of the two markets' different structures and dynamics. China's extensive domestic installations emerge from a coherent and sustained industrial strategy based on ambitious capacity goals and extensive socio-economic support. Beijing carefully planned large-scale installation of wind capacity since the launch of the Wind Base Programme in 2008. State-level economic support was then introduced in the form of feed-in tariffs that covered the entire operational period of a wind farm. The result was a wind power boom that quickly produced overcapacity and grid curtailment issues, but Beijing proved flexible enough to adapt: a compensation regulation was introduced to address transmission bottlenecks, while installation targets were carefully

staggered across its Five-year plans. Once China had efficiently mainstreamed wind power into the domestic power grid, national support for large-scale capacity expansion curbed, and subsidies have been absorbed at the local level in provinces such as Guangdong, Shandong and Zhejiang. The outcome is a saturated domestic market that instinctively propels Chinese OEMs outward, especially facilitated by access to Belt and Road markets such as Saudi Arabia, Uzbekistan, Brazil, Egypt and Kazakhstan. As a result, after being progressively displaced from the Chinese domestic wind market, European OEMs have similarly ceded their leadership position in countries such as India, where, in 2024, Chinese OEM Envision achieved twice the market share of Suzlon, India's major manufacturer.

The EU's approach has not been entirely dissimilar in ambition to Beijing's strategy. European countries also adopted feed-in tariff schemes for wind power since the 1990s, including the original 1991 German Electricity Feed-in Law and the subsequent shift toward feed-in premiums under EU state aid guidelines. Unlike Chinese subsidies, which were directly state-funded and designed to maximise scale, European support mechanisms largely passed costs onto electricity consumers through supplier levies. This model proved effective at incentivising investment but insufficient to drive the kind of deployment that China achieved through centralised industrial policy. With a total installed wind capacity of 640 GW, China currently outshines the EU, which trails behind with 246 GW. This divergence is not a coincidence, but rather the consequence of China's construction of a robust domestic market. Chinese OEMs, in fact, thrive mostly within their home market. In 2025 alone, 93% of all installations made by leading Chinese manufacturers were domestic. This concentration is not a weakness but an asset. Operating at enormous scale within a single market, supported by coordinated state incentives and local government financing, Chinese OEMs have leveraged strong market-pull forces to drive innovation and reduce costs in ways that Europe's fragmented market cannot replicate. Moreover, this advantage extends beyond subsidies into the structure of the supply chain itself. China's dominance over rare earth extraction, especially for neodymium (Nd), dysprosium (Dy), praseodymium (Pr), and terbium (Tb), gives its manufacturers privileged access to the permanent magnets essential for wind turbine motors. In 2024, the EU adopted the Critical Raw Materials Act as an attempt to secure the undisrupted supply of critical raw materials necessary for the energy transition, including wind technologies. However, while rare earth mining development projects are at the early stages across Europe, the financial and bureaucratic burden of operating a mine, the extreme pollution associated with CRM mining, as well as the insufficient domestic permanent magnet production capacity restrict the EU's ability to reduce its dependence on Chinese components.

A struggling European market

Where China has built a self-reinforcing industrial ecosystem, in which scale, supply chain integration, and market-pull incentives compound one another to produce a structural competitive advantage, the EU still needs to overcome several structural shortcomings. Within the European domestic wind market, scalability is mainly obstructed by regulatory complexity, lack of financial flexibility, and supply chain vulnerabilities. Notably, unharmonised national implementations interfere with cross-border grid connection. One of the causes is inadequate transparency in energy data and modelling, which hinders the stakeholders' ability to take clear trajectories towards energy transition. Reliable data in this field remains elusive, scattered across multiple institutions, inconsistent in methodology, incomparable across member states, and in many cases completely unavailable. Moreover, cross-border infrastructure planning lacks the coordination needed to sustain the pace of renewable energy demand, and fragmented political trust and cooperation, underpinned by diverse national strategic interests, hampers the EU's capacity to develop an interconnected energy infrastructure. Wind farms' permits take considerably longer to be granted in EU member states than in other regions. The Wind Power Planning and Permitting Index (WPPPI), calculated by the World Wind Energy Association (WWEA) in 2021, demonstrated a striking 29-point gap between China, ranked at 13, and Austria, the best-performing EU member state, ranked at 42. This contrast owes primarily to deficient planning and implementation at the national level. Poor auction design based on negative bidding, which obligates wind developers to pay for the right to build wind farms, has shunned investors across Denmark, Germany, and the Netherlands. At the same time, projects have stalled for several years in Poland and Sweden due to restrictive regulations and security concerns. Political commitment has also faltered: in 2024, the European Commission launched infringement procedures against 26 of 27 EU member states for failing to implement permitting acceleration measures under the Renewable Energy Directive, while local opposition has paralysed wind farm projects across Spain and Germany.

European OEMs also struggle to compete with Chinese-made wind turbine costs, which can be up to 30% cheaper. Moreover, despite prices for onshore turbines delivered in China falling by 57% from 2020 to 2024, prices for turbines made outside China increased by 31%. While this gap can be attributed to cheaper manufacturing costs in China, it also highlights the necessity of an integrated supply chain, from raw materials to components, to control costs at every stage of production. In addition, Chinese OEMs, backed by state-owned banks, are able to offer flexible financing terms with deferred payment up to three years. Given the considerable upfront costs of wind farms, interest rates, inflation, and monetary policies significantly affect the levelised cost of electricity (LCoE) for wind, pushing European

wind developers toward Chinese OEMs' more competitive pricing. While the EU has not yet imposed tariffs, it has focused on trying to curb Chinese structural cost advantages through regulatory measures. The foreign subsidies investigation launched by the European Commission has been employed as an instrument designed to expose and offset the distortive effect of state subsidies rather than impose blanket tariffs, while the Net-Zero Industry Act (NZIA) was introduced in 2024 to boost EU wind turbine manufacturing capacity by streamlining investments and public procurement. To remain competitive with Chinese OEMs, the EU must secure easier access to private equity and venture capital for its manufacturers, as the current disparity in capital volume, underpinned by public investment, limits their ability to match their international rivals.

Beyond pricing competition, European OEMs have been slow to adapt to the rapidly shifting competitive landscape, having long relied on the structural advantages of a captive domestic market rather than pursuing the dynamic innovation that the new global competition demands. The two major European companies, Vestas and Siemens Gamesa, have a history of major restructuring which underscores their fragile growth capacity. In particular, the German-Spanish merger Siemens Gamesa has struggled for years to break even. Overambitious scaling goals translated into a series of operational failures that have ultimately damaged the company's reliability. In 2023, the company underwent a major quality crisis after a technical review revealed faulty components in 15 to 30% of its turbine models, generating replacement costs of over €1 billion. As a result, the company reported a deficit of €4.5 billion at the end of the fiscal year, losing investors' and banks' support and prompting the German government to intervene with a €7.5 billion bailout. The year later, the Odal Vind onshore wind farm in Norway had to be partially shut down due to manufacturing defects in the blades that Siemens Gamesa had supplied. Fueled by inflation and competition, quality issues further squeezed already-thin margins, urging stakeholders to reassess the company's economic viability. Moreover, European OEMs failed to anticipate the degree to which their established market position would be eroded. Trump's rebuff of renewable energy signified lower incentives in a market, the US, where companies such as Vestas were deeply involved. Meanwhile, in Europe, inflation and supply chain disruptions contributed to Vestas' thin margins and negative profitability. The fragility of this position was made concrete when Vestas was forced to scrap plans for a new production plant in Poland, a decision driven by faltering demand stemming from insufficient government support. European OEMs cannot afford to be complacent in the established domestic market dynamics, but need the EU wind market to have the structural preparedness to adapt to new realities shaped by growing global competition.

At the same time, Chinese OEMs are en route to seize an increasing global market share. Rejecting innovation and securing the status quo in the EU would mean losing global competitiveness, including in the union's largest wind turbine export market, the UK. In late 2025, Chinese OEM Ming Yang had announced an investment of 1.5 billion GBP (1.72 billion EUR) for the realisation of an offshore wind park off the coasts of Scotland, before it was vetoed by the UK government in March of this year.

Overall, it is clear how current deficiencies of the European wind turbine market need to be reassessed in order to absorb the shock of foreign competitors investing in the region. To address its domestic bottlenecks, the EU should prioritise the streamlining of cross-border capacity mechanisms through harmonised product design, improved adequacy governance, and transparent cost-sharing agreements. Accelerating and standardising permitting processes across member states through greater energy data transparency and deeper political cooperation is essential to tackle bureaucratic stagnation and to align national frameworks with shared climate objectives. Finally, reducing critical raw material import dependency requires a concurrent push across multiple fronts: expanding domestic extraction and processing capacity, promoting the circular economy and the development of material substitutes, and building strategic stockpiles to buffer against supply shocks.

A new blow from China

The Chinese wind industry has managed to penetrate directly into the EU in the past years through substantive investments in both onshore and offshore wind farms. While, within the EU domestic market, imports still accounted for only 12% of wind power installations in 2024, Chinese OEMs exported 230.27 million EUR of wind turbines to the EU, controlling 43% of the import share. Currently, the EU maintains a negative trade balance with China for wind turbines, a deficit that peaked at a record of 462 million EUR in 2022.

Beyond lower turbine manufacturing costs, Chinese OEMs' attractiveness to European wind farm developers derives primarily from flexible financing terms and greater energy efficiency through mega turbines that can absorb fixed costs. Their entry into the European market was not an easy feat. In 2025, Ming Yang's contract to supply 18.5 MW of wind capacity to Waterekke park, an offshore wind farm in the North Sea, was rescinded after the German Ministry of Defence highlighted security concerns over a Chinese company controlling the power grid in a geopolitically sensitive region. Later this year, Goldwind's operations in Europe were temporarily halted by the European Commission's foreign subsidies investigation after having considerably contributed to the region's total capacity, having installed 807.79 MW of cumulative wind power in Europe as of 2024.

On the other hand, Chinese OEMs have been received enthusiastically by some EU member states to establish economic partnerships and speed up the renewable transition. This is attributable to the necessity to localise production to circumvent the prohibitive logistical cost of the transoceanic transport of Chinese-manufactured turbines. The European workforce benefits substantially from Chinese OEMs inaugurating factories across the continent to supply wind projects. Ming Yang's contract to supply Renexa's offshore wind farm off the coasts of Apulia, in Southern Italy, was welcomed by local authorities in preview of the establishment of two production plants in the region that will launch the local supply chain and create job opportunities. Goldwind is also engaged in the European production capacity through Vensys, a subsidiary particularly involved in the supply of the Mamut wind farm in Andalusia. This trend is not only driven by these two wind giants, but multiple Chinese actors are penetrating the European wind supply chain. Further examples include, Zhenshi, a glass fibre manufacturer, setting up shop in Cadiz, Spain, to supply components to European OEMs, and SANY, a heavy equipment manufacturer, currently projecting to begin wind turbine production in Germany.

Per contra, the long-term implications of the Chinese OEMs' footprint in Europe warrant careful consideration. A supply chain dependence that shifts in form does not disappear in substance. Welcoming Chinese companies on European soil requires conditionality. The EU should ensure that foreign firms operating in its market contribute meaningfully to the local industrial ecosystem through cooperation and complementarity in technology transfer, local employment, and transparent supply chain governance. In this manner, the EU can harness the capacity that Chinese OEMs bring to Europe's energy transition while ensuring that this presence strengthens the European industrial base rather than supplanting it.

A common goal

It is undoubtable that the ecological transition is a top global priority. In 2016, the Paris Agreement brought together 196 countries to acknowledge the global risks tied to climate change and commit to mitigate global carbon emissions. Both China and the EU have since adopted ambitious carbon neutrality targets that require steadfast political mobilisation to achieve. Beijing's dual goal vows to peak carbon emissions by 2030 and achieve neutrality by 2060, while the EU is bound by the Green Deal and the European Climate Law to reduce its emissions by 55% by 2030 and attain carbon neutrality by 2050. Although progress towards these goals has gained momentum in Europe in the last year, the transition still falls short of the required pace. To add fuel to the fire, supply route disruptions caused by recent conflicts, combined with the surging energy demand of AI data centres and other digital

infrastructures, have magnified the urgency of resilient energy systems. In light of this demand, the share of electricity generated from renewable sources is set to skyrocket, climbing from its current one-third to more than 50% by 2035 and two-thirds by 2050.

In this context, wind power stands as the backbone of the energy transition, and every available means of accelerating its expansion must be considered. Onshore wind offers the lowest global average LCoE of any renewable energy technology, emphasised by a 70% cost markdown from 2010 to 2024. China is predominantly leading the transition to wind power. GEIDO, a government-affiliated think tank, projected an implicit target of 800 GW of installed wind capacity by 2030; current forecasts now suggest that this figure will be surpassed to such an extent that the overall capacity in 2024 could triplicate within the same timeframe. The EU, which under the REPowerEU plan set a challenging binding target for renewable energy to cover 42.5% of the energy mix, should reach a total of 425 GW of wind capacity by 2030 to accomplish its objectives. Yet, WindEurope forecasts to achieve only 343 GW if installations advance at the current pace.

The Net-Zero Industry Act attempted to address this deficiency by streamlining the permit-granting process and setting domestic manufacturing benchmarks, but regulatory ambition alone cannot close a gap of this magnitude. What Europe needs, beyond its own policy scaffolding, is every available push. While Chinese manufacturers in the EU wind industry may threaten European competitiveness, their presence must be interpreted as an opportunity to boost wind energy production in Europe. China's low-cost market entry in the solar PV industry ultimately strengthened the technology's adoption to the point where solar power became Europe's largest electricity source in mid-2025. Considering Chinese manufacturers as mere competitors for European companies is itself a form of strategic complacency. The advent of Chinese OEMs in the domestic market has already assisted the installation of new wind capacity in recent years, and impeding their access is more detrimental to clean-tech diffusion than advantageous to European manufacturers.

The ecological transition represents an urgent global priority and a pillar of China-EU bilateral relations. The China-EU Energy Dialogue regularly reaffirms the shared obligation to expedite the global adoption of clean energy sources, implementing existing frameworks such as the *EU-China Energy Cooperation Platform* and the *China-Europe Energy Innovation Cooperation Platform*. Ultimately, it is compelling that these instruments are put forth to enhance climate cooperation and prevent trade conflicts. Both regions can build up on their complementary strengths to promote pragmatic cooperation: while China relies on superior manufacturing scale and market-pull incentives, the EU contributes regulatory depth, engineering excellence, and high-quality technological innovation. Dialogue is thus fundamental to guarantee that the flow of knowledge is not unidirectional. The EU must

ensure that its engineers and firms engage meaningfully with Chinese design processes, software, and manufacturing adaptations to play a key role in the technological exchange. An open and predictable market that embraces foreign OEMs and encourages their localisation can foster the establishment of industrial clusters through which knowledge naturally diffuses. Structured industrial dialogue between European and Chinese firms can then unlock spillover effects that strengthen both sides rather than leaving European operators as passive recipients of a manufacturing model they do not fully access.

Ultimately, ensuring that de-risking strategies do not come at the expense of strategic cooperation represents a pragmatic improvement towards decarbonisation. Transitioning from market complacency to collaborative growth is a win-win scenario: it secures the supply chains necessary for the ecological transition targets while ensuring that European firms remain globally competitive through innovation rather than subsidisation.

Europe does not need to choose between naivety and fortress thinking. If Chinese wind turbines are coming, the smarter question is not how to keep every blade out, but how to make sure their arrival helps Europe consolidate a stronger industry of its own.

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