CLIMATE Strategies

Stanley Center FOR PEACE AND SECURITY

Clean Energy Perspectives on Security and Resilience

One Transition, Several Debates: Bridging Different Perspectives on Chinese Clean-Tech Dependence

MICHAL MEIDAN

Table of Contents

Executive summary	3
Introduction	4
1. Fragmented debates	6
2. The risks associated with dependence on China	8
3. Dependency risks in the Global South	11
4. A policy framework: buy, build and protect	13
5. Assessing risk holistically	17
References	19
Glossary	23

Author: Michal Meidan

Cite As: Meidan, M. (2026). One Transition, Several Debates: Bridging Different Perspectives on Chinese Clean-Tech Dependence.

Cover Photo: Zongnan Bao (Unsplashed)

Acknowledgment to the project and editorial team from Climate Strategies: Adela Hankus, Gaia Campanelli, Inés Jiménez Rodríguez, Julie-Anne Hogbin, Max Schmidt, Valentina Ruiz Garciadiego; and the Stanley Center for Peace and Security: Cayte Connell, Mark Conway, Rei Tang.

The Energy Clean Energy Perspectives on Security and Resilience is a project supporting the co-creation of technical knowledge on clean energy systems and energy security through building a community of practice bringing together leading experts from across the Global North and Global South. The project is conducted by Climate Strategies in partnership with the Stanley Center for Peace and Security.

Transparency statement: This document has been supported by generative AI tools used in a limited editing capacity related to clarity and consistency of language. The manuscript was originally prepared with sources by the author and copyedited by the listed contributors.

Executive summary

China's dominance of clean-energy manufacturing presents governments with a policy dilemma: Chinese solar panels, batteries, electric vehicles, inverters and related inputs have driven down the cost of electrification and renewable deployment, making them indispensable for a faster, more affordable energy transition. For import-dependent economies, they can reduce exposure to volatile fossil-fuel markets; in many developing countries, they are already improving energy access, reliability and affordability.

Yet this dependence has become increasingly contested. In Europe and the United States, clean-tech supply chains are no longer viewed solely through a climate or energy-security lens. Defence establishments worry about the cyber and operational exposure to Chinese equipment embedded in critical infrastructure while trade and industry ministries fear loss of manufacturing capacity and employment. These concerns are often discussed in bureaucratic silos, producing fragmented policy responses that can slow decarbonisation, increase costs and send inconsistent signals to investors.

This paper lays out four main categories of dependency risk — operational disruption, defence and intelligence, prosperity, and political and geopolitical — in an attempt to unpack what is often flagged as a vague "China risk". The paper also argues that different countries and regions assess the risks and benefits differently. In Europe, the debate centres on strategic autonomy, critical-infrastructure security and industrial competitiveness. In much of the Global South, Chinese technology is more often seen as the fastest and cheapest route to electricity access, and protection from fossil-fuel price shocks. But Global South countries can face distinct vulnerabilities linked to the financing, ownership and contractual structures of Chinese-backed projects.

The appropriate policy response is therefore neither blanket exclusion of Chinese technologies nor passive acceptance of all dependencies. The paper proposes a "buy, build and protect" framework to help governments think through their risk exposure and come up with a more nuanced policy response. Policymakers should ask what specific exposure is at stake; whether it affects current system operation or future deployment; whether it is China-specific or a broader infrastructure vulnerability; how much would full de-risking cost; and whether diversification, standards, stockpiles or partnerships can mitigate the risk more effectively than onshoring. This approach would enable governments to preserve the climate, affordability and resilience gains of clean technology while addressing legitimate security and industrial concerns in a targeted, proportionate way.

Introduction

For most of the last decade, and especially in the aftermath of the Russian invasion of Ukraine, the clean energy transition has been framed as a boon for energy security. Compared to the volatility of imported fossil fuels, solar panels, wind turbines and batteries offer a domestic energy source that does not need to be shipped through a strait or piped across a contested border. China's rise as the world's largest manufacturer and deployer of low carbon technologies has led to dramatic cost declines, further enabling the energy transition. This is the logic that has underpinned much of Europe's post-2022 efforts to accelerate its energy transition, most explicitly in the European Commission's REPowerEU plan (European Commission, 2022).

But increasingly, there are voices in defence communities as well as parts of the trade and industry bureaucracy (Loom, 2026; Clean Energy Wire, 2025) positing that while the energy transition will, over time, reduce one strategic dependency, it also risks creating a new one. Europe is displacing its dependence on Russian gas by building a clean energy system that is reliant on equipment overwhelmingly manufactured in, or supplied from, China. China is estimated to account for 98% of European solar panel imports, 88% of lithium-ion battery imports and 61% of inverter imports in 2024 (Loom, 2026). As a result, the concern is that Beijing could disrupt European energy systems. While the energy industry relies on Chinese inputs to support new energy deployment, mainly due to competitive prices, high quality and availability, businesses are at times unaware of the debate around dependency. Discussions about China's centrality are fragmented in at least two distinct ways. First, as discussed above, within Western governments' energy and climate ministries, whose mandate is to decarbonise quickly and affordably, tend to view Chinese low-carbon technologies as a solution. But defence and security establishments, whose mandate is to minimise strategic exposure, perceive Chinese low-carbon technologies as a potential security risk, while industry and trade ministries, whose mandate is to promote domestic employment and manufacturing capacity, are growing increasingly concerned that Chinese low-carbon technologies will displace local industries.

This fragmentation is compounded by a further, related trend: energy security as a concept is increasingly conflated with industrial and economic policy objectives more broadly. This is unfolding against a backdrop of weaker global consensus on the urgency of tackling climate change compared to a decade ago, with governments increasingly ranking energy security, affordability and industrial competitiveness above decarbonisation among their stated priorities (IEA, 2025).

As such, there seems to be few holistic discussions about the trade-offs between risks and benefits or how to prioritise and reconcile these different agendas. Starting in May 2026, the European Commission introduced guidance that restricts EU funding for projects that use inverters from designated high-risk vendors such as China (Euronews, 2026; pv magazine, 2026); the United Kingdom and Germany have effectively blocked Chinese offshore wind manufacturing investments on national security grounds (South China Morning Post, 2026; Reuters, 2025). The United States has moved further still, using tariffs and rules-of-origin restrictions to substantially decouple its clean-tech supply chains from China, at a measurable cost to the pace of its own transition (Council on Foreign Relations, 2026; Center on Global Energy Policy, 2025).

In addition, the perceptions differ between countries and regions. In Europe, the debate centres on the extent to which dependence on China could impact strategic autonomy, industrial competitiveness and, increasingly, alignment with the United States. In much of the Global South, by contrast, Chinese clean technology is widely welcomed as the most affordable and accessible route to energy access and decarbonisation, especially in light of the recent energy crises that have highlighted the volatility of fossil fuels.

The industrial-competitiveness and security anxieties that dominate Northern debates are less present, although they are not absent, especially in countries that have a domestic manufacturing base at risk of displacement.

This paper argues that this debate can no longer take place in silos and must consider these different perspectives on China's centrality in the low-carbon energy transition. Given the urgency of the climate crisis and the availability of cost-competitive low-carbon technologies, electrification and faster renewable deployment will strengthen energy security and resilience, but could also create other strategic vulnerabilities. At the same time, security and defence concerns cannot lead to a categoric exclusion of all China-made low-carbon technologies: it is still important to assess which threats are China-specific and insurmountable and which can be managed. The debate must also acknowledge broader industrial concerns, without conflating them with security risks. Equally, the concern that Chinese clean tech is driving de-industrialisation and job losses cannot be waved away: if the energy transition delivers job losses rather than economic renewal, public support for decarbonisation will erode (Loom, 2026). Engaging with this seriously would require making the case for the benefits of the transition; addressing the underlying drivers of Europe's industrial-competitiveness problems, most of which predate and extend beyond China; and acknowledging that Chinese industrial policy has, in places, skewed the playing field in ways that warrant a response. Finally, the debate must recognise that while developed economies are grappling with these trade-offs, developing economies see them in a different light.

This paper seeks to map out some of the different risk perceptions as they are framed within governments and within regions. It then proposes a framework for thinking about the trade-offs: which risks should be addressed regardless of the wider geopolitical debate, and which require an explicit choice between decarbonisation speed, cost and strategic autonomy. It distinguishes stock risks in installed equipment from flow risks affecting future supply, and separates operational; defence and intelligence; prosperity; and political and geopolitical risks.

Two caveats apply throughout. First, this paper is not a comprehensive global assessment: it draws on a small sample of country examples to illustrate variation. Second, 'Global North' and 'Global South' are imperfect and imprecise categories: both groupings contain wide variations in income, resource and mineral endowment, industrial ambition and strategic attitudes toward China. But the paper retains the terms for simplicity and because they track real, if imperfect, differences in how the debate is currently conducted.

The paper is structured as follows. Section 1 sets out the framing of the issue: how China's clean-tech dominance evolved from a decarbonisation asset into a contested security and industrial-competitiveness question, and why the resulting debate is fragmented. Section 2 then considers four categories of dependency risk and looks at them through a European lens. Section 3 discusses the risk perceptions in the Global South. Section 4 then suggests a "buy, build and protect" framework for how to think about policy responses to the dependency risk before concluding.

1. Fragmented debates

China's achievements in renewable manufacturing and deployment, and in its rapid electrification of energy end-uses, is well documented. The country manufactures roughly 80% of the world's solar panels, more than 75% of its batteries and 70% of its electric vehicles. Its solar manufacturing capacity alone now exceeds the IEA's entire net-zero-by-2050 requirement (Ember, 2025). Given the urgency of the climate challenge, this scale is essential. But these benefits are increasingly overshadowed by concerns around China's industrial policies and their implications for other countries.

This phenomenon is itself, in large part, a product of trade and globalisation. China's integration into global markets and its access to Western technology, capital and export demand allowed its clean-tech industries to scale up manufacturing. Competition among Chinese producers subsequently pushed costs down further still. The auto sector is a case in point: large-scale Chinese production, sold into open global markets, has been a major driver of the fall in battery and electric-vehicle costs worldwide, at a pace few forecasters anticipated a decade ago, and has gone a long way in making electrification affordable. While it has also placed competitive pressure on auto industries elsewhere, retreating from trade and global scale in the name of security or industrial protection carries a genuine cost to the pace of decarbonisation. Yet it is important to recognise that such a retreat may be partly underway based on perceived industrial and security imperatives
It is important to note that China's clean-tech manufacturing base was not initially built for export dominance (de la Tour, Glachant, & Ménière, 2011; Nahm, 2023). In the 2000s and early 2010s, electric vehicles, solar panels and wind turbines developed in different ways (a full review is beyond the scope of this paper), but there were a number of elements in common: their scale up relied on joint ventures, equipment sales and technology partnerships with European and other Western manufacturers, and they benefitted from various forms of government support and localisation requirements. Over time, Chinese firms internalized some of the technologies, developed others, and out-competed some of their Western partners and rivals. The concern is that after displacing the solar industry, if unchecked, Chinese firms will now do the same in wind, electric vehicles and batteries.

The United States, in response to these changing dynamics, has imposed tariffs and foreign-entity-of-concern (FEOC) clauses into the Inflation Reduction Act's electric vehicle tax credit, leading to a near-decoupling from Chinese cleantech supply chains. This, combined with the Trump administration's opposition to the energy transition, has diverted a larger share of Chinese exports towards Europe.

The surge in Chinese clean-tech exports to Europe, combined with the perceived loss of European competitiveness, is now a critical part of the China debate in Europe. As the Draghi Report on European competitiveness (Draghi, 2024) notes, Chinese competition is driven by "a powerful combination of massive industrial policy, rapid innovation, control of raw materials and the ability to produce at continent-wide scale" (Draghi, 2024). By 2030, Draghi notes, China's annual manufacturing capacity for solar photovoltaics is expected to be double global demand, and for battery cells to at least match it. China's strengths coincide with European weaknesses, including a productivity and innovation gap that the Draghi Report attributes to underinvestment, regulatory fragmentation and a slow scaling of new technologies in Europe. Moreover, in the aftermath of the Russian invasion of Ukraine, the rise in energy prices has further weakened European industrial competitiveness. Finding ways to deal with the 'China Shock 2.0' (European Council on Foreign Relations, 2026a) is now at the top of the EU's policy agenda. This changing industrial relationship also explains why the potential benefits of Chinese clean-tech are increasingly overshadowed in the Western policy debate.

China is also increasingly seen as a security challenge. In Europe, there are rising concerns about China's deepening alignment with, and material support for, Russia. In the United States, by contrast, the concern is framed around China as a systemic, long-term strategic competitor across various technology and military domains.

The benefits associated with Chinese low carbon technologies are well understood among climate and energy stakeholders. Moreover, they are indispensable for the transition. But these same stakeholders are at times oblivious to the discussions underway in industry and defence communities, while the latter are seemingly unaware of the logistical challenges and costs associated with imposing tariffs on, replacing or excluding Chinese equipment. Indeed, defence and trade stakeholders may be less concerned by the implications of their policy choices for energy systems.

Meanwhile, the debate in the Global South is markedly different. Chinese equipment is widely seen as supportive of energy access and Chinese firms are a source of development finance for minerals and materials, even though in some countries Chinese presence is increasingly posing a risk to the domestic industrial base. Outside a handful of Asian economies with manufacturing industrial ambitions, the strategic or security threat perception that dominates Western debate is largely absent. Section 3 develops this further.

This fragmentation matters because ministries pursuing their interests, and the divergences in perceptions, can send mixed and sometimes contradictory signals to the investors in the energy transition, making investment decisions harder and costlier. China, for its part, has been actively building its own legal and regulatory apparatus to maintain its industrial edge and protect itself against Western de-risking measures. This, in turn, could make the energy transition costlier and slower for everyone.

Photo credit: Luo Lei via Unsplash

2. The risks associated with dependence on China

Stock versus flow risk
Europe's post-2022 acceleration of the energy transition was driven, in large part, by the shock of losing Russian gas. Yet at the same time, a range of European stakeholders began flagging the risk that by accelerating the energy transition, Europe was replacing its reliance on Russian gas with a dependence on China. In late 2023, a document prepared for EU leaders' Granada summit on economic security warned that, without decisive action, Europe's dependence on China could become "as serious as the dependence on Russia before the full-scale invasion of Ukraine" (Ridgwell, 2023). The defence and security establishment then chimed in—from former UK intelligence chiefs who cautioned that Britain's clean-power targets risk "handing power to Beijing", to German military officials raising similar concerns about Chinese-built offshore wind turbines (RUSI, 2025; Clean Energy Wire, 2025)—before reaching the EU Climate Commissioner Wopke Hoekstra who in 2026 warned that heavy reliance on Chinese clean-tech manufacturers risked "replacing one strategic dependency with another" (Euronews, 2026). Indeed, already in 2024, China accounted for 98% of European solar panel imports, 88% of lithium-ion battery imports and 61% of inverter imports (Loom, 2026). But this comparison is inadequate: it overstates the impact of flow risks (discussed below) and understates the stock risks.

The energy shock following the Russian full-scale invasion of Ukraine and more recently following the Hormuz crisis highlight the economic impacts of a loss of **fossil fuel flows**. Not only do costs rise, but there is a real risk that certain parts of the economy (mainly transport but also power), no longer function if supplies fall short and stocks are depleted.

The **flow risk** from China's centrality in new energy supply chains is different. The main parallel would be a restriction of raw and processed minerals, such as China's 2023–24 licensing restrictions on gallium, germanium and rare-earth processing technology (Van Assche, 2024). This kind of restriction impacts downstream industrial capacity and revenue: firms that rely on Chinese-processed gallium, germanium or rare-earth inputs face higher input costs, delayed production runs, and in some cases, the need to adjust their supply chains. China's rare-earth controls in 2025 led to sharp declines in export volumes. Some automakers then reduced utilisation rates or temporarily halted operations, and prices outside China rose markedly. The IEA estimates that full implementation of the expanded controls — which is yet to take place — could put $6.5 trillion per year of downstream production outside China at risk across automotive, high-tech, defence and energy sectors (IEA, 2026). However, this flow risk does not threaten the continued operation of the energy system.

An oil or gas outage threatens energy supplies needed for running the economy on a daily basis; a Chinese cleantech export restriction threatens the pace of an energy transition still under way. Both are costly, but they are not the same, and the literature's tendency to highlight the Russian-gas analogy, however rhetorically effective, tends to overstate the flow risk while overlooking and understating some of the stock risks (Loom 2026; RUSI, 2025).

Stock risk is the danger attached to equipment already installed. The debate largely focuses on the 'kill switch' scenario (or China's ability to remotely disconnect equipment), a concern that gained traction after a May 2025 Reuters investigation reported undocumented cellular radios and other unlisted communication devices found inside Chinese-made solar inverters and batteries installed in the United States. Security experts reportedly warned that these could be used to bypass grid firewalls and shut equipment down remotely (McFarlane, 2025). But this overlooks other aspects of the stock risk (Loom, 2026): for example, the operational dependence on Chinese-supplied

equipment, spare parts, maintenance contracts, software updates and the skilled technicians to keep installed equipment running.

A restriction of finished goods such as panels, cells, inverters would slow and raise the cost of future clean energy build-out if alternative suppliers cannot be found quickly. Such scenarios remain hypothetical, but perhaps not without precedent: in 2023, China's Ministry of Commerce proposed restricting exports of key solar-wafer manufacturing equipment and technology on national-technology-security grounds, raising alarm bells with manufacturers outside China precisely because it signalled Beijing's willingness and ability to restrict sales of finished goods (EnergyTrend, 2023).

In July 2025, China extended licensing requirements to core battery-manufacturing technologies (HSF Kramer, 2025). The IEA estimates that a single month's interruption to battery-supply-chain exports would cost around $17 billion in lost output at electric-vehicle plants elsewhere, with close to two-thirds of that loss falling on the EU alone (IEA, 2026). Still, these restrictions do not halt large portions of existing energy supply, since the generation capacity that is already installed keeps running. This is a slower-moving and less dramatic vulnerability than a kill switch, but arguably a more probable one that corporate or government stakeholders can trigger for commercial or geopolitical purposes.

This risk is amplified by Chinese policies aimed at controlling supply chains and limiting de-risking efforts. Between March and July 2026, China's State Council issued three new decrees aimed at protecting Chinese supply chains and giving Beijing a formal legal apparatus for countering sanctions or de-risking efforts that could harm the Chinese economy (Gleiss Lutz, 2026; Linklaters, 2026); while also introducing limits on outbound transfers of Chinese-developed technology, data and skills (The Diplomat, 2026). The stock risk therefore concerns what China might unilaterally choose to disable or restrict, as well as any counter-measures that Chinese stakeholders can take in the event of de-risking.

A broader view of stock risks

When talking about the benefits of relying on Chinese low-carbon technologies, the climate community must also acknowledge the perceived risks associated with dependence on China, or else they might lose political salience. They must factor in concerns around four categories of risk: operational disruption; defence and intelligence; prosperity; and political and geopolitical risk.

Operational disruption. This is the risk that dominates public debate: the physical and cyber vulnerability of clean energy infrastructure already installed (a stock risk), and the possibility that China restricts exports of components, minerals or technology needed for future deployment (a flow risk). Within defence communities, the concern focuses on Beijing's ability to remotely disable installed inverters, electric vehicles or grid equipment, especially in times of conflict. In 2025, official investigations were launched across the US, Japan, South Korea, and parts of Europe following media reports that undocumented or unexplained communication equipment had been found inside Chinese-made solar inverters (McFarlane, 2025; South China Morning Post, 2025; New York Sun, 2025; Reuters, 2025b), but a subsequent US Department of Energy technical review found "no definitive evidence" of malicious wireless functionality in the inverters examined (pv magazine, 2026). This is likely a very high-impact but low-probability scenario, since it would severely damage China's own relations with importing countries and invite retaliation (Loom, 2026). Moreover, the focus on Beijing's ability to disrupt or disable equipment also misses the broader (and inherent) cyber disruption risks, as interconnected energy systems are more vulnerable to cyber attacks. Smaller-scale supply-chain disruptions seem more likely, even if the impact is different: China's 2023–24 licensing restrictions on gallium, germanium and rare-earth processing technology illustrate the flow-risk version of this category (Van Assche, 2024), raising costs and slowing build-out.

Defence and intelligence. Europe's supply chains overlap substantially with the low-carbon sector,

relying on many of the same rare-earth magnets, batteries and manufacturing techniques. As China's dominance of low-carbon technology grows, so does the defence sector's dependence on the same inputs (Loom, 2026). Any restrictions on clean-tech equipment or inputs are detrimental for defence industries. A related concern is espionage: Chinese law obliges domestic firms to share data and system access with the state on request, and sensors embedded in solar, EV and grid technology could in principle be exploited to track military assets or personnel patterns (Loom, 2026). Both are largely China-specific stock risks, following from dependence on equipment and components already, or soon to be, embedded in critical systems.

Prosperity. This covers the economic and industrial risk of continued Chinese dominance: market and price-setting power, and, of greater practical significance to date, the displacement of manufacturing employment in economies that both import and compete with Chinese cleantech. This is the risk driving the EU and US tariff responses to Chinese solar and electric vehicles, and the wider 'China Shock 2.0' framing of industrial-policy debates (European Council on Foreign Relations, 2026a).

Political and geopolitical. The final set of risks are less widely discussed and include three distinct issues (Loom, 2026). The first is geopolitical risk, whereby a third party such as the US could put pressure on a government to limit the use of Chinese equipment. The second is domestic political risk: if decarbonisation comes to be seen as economically costly or job-destroying, because of job losses to China, a change of government could reverse climate policies altogether. The third political risk is that, if sustained, heavy reliance on Chinese equipment across a country's energy system can translate over time into broader diplomatic leverage for Beijing, even without an explicit act of coercion. The mere threat that Beijing could disrupt systems or limit flows of spare parts would be enough to influence government policies.

These four categories of risk are currently being discussed in silos, with few governments weighing all four together or naming the trade-offs between them explicitly. Meanwhile, in the Global South, the risk and benefit perceptions are different.

Photo credit: Ghostmirror via Unsplash

3. Dependency risks in the Global South

For most Global South governments, energy security still revolves primarily around access, reliability and affordability. For many, there is a limited manufacturing base at risk of displacement and no realistic alternative supplier at comparable cost. This is reflected in survey evidence: a 33-country, 32,000-respondent tracking poll found that people in emerging markets are considerably more likely than their high-income counterparts to consider buying Chinese-made solar panels or electric vehicles (Dialogue Earth & GlobeScan, 2026).

The access benefits are real and, in places, dramatic. Chinese equipment and financing have been central to South Africa's solar boom which has, in turn, led to over 300 consecutive days without load-shedding by early 2026 (Zawya, 2026). South Africa's newly approved Integrated Resource Plan (IRP 2025) sets out some 25,000 MW of further utility-scale solar investment through 2039 (Trade.gov, 2025).

Pakistan is another striking success story: Pakistan's PV imports, predominantly from China, rose from under 1 GW in 2018 to more than 51 GW by early 2026, almost entirely on the back of households, farms and businesses installing rooftop panels to escape high tariffs and an unreliable grid (World Resources Institute, 2026; CREA & Renewables First, 2026). The shift is estimated to have driven a 40% drop in oil and gas imports between 2022 and 2024, with the resulting LNG-import savings estimated at around $12 billion between 2021 and early 2026, and a further $6.3 billion potentially avoidable by the end of 2026 if prices stay elevated (CREA & Renewables First, 2026).

A similar dynamic, at a different order of scale, is under way across sub-Saharan Africa. Wood Mackenzie estimates that at least seventeen African countries have more diesel generator capacity than on-grid power capacity, including roughly 28 GW in Nigeria, 10 GW in Ghana and 8 GW in Kenya. Chinese solar panels are now displacing a meaningful share of that diesel demand (Ember, 2026). Nigeria overtook Egypt to become the continent's second-largest solar importer, behind only South Africa, in the twelve months to June 2025, as rising fuel costs pushed households and businesses toward rooftop solar and battery storage (Ember, 2026).

The benefits are evident. As a result, the four risk categories set out in Section 3.2, which were designed to assess Europe's exposure, do not resonate fully in the Global South. In addition, financing and ownership structures can create a distinct form of dependency.

Operational disruption is a less acute concern in the Global South: grids tend to be smaller, less digitised and less tightly integrated, so the 'kill-switch' and cyber-enabled-grid-attack concerns have had limited salience in the Global South. Even so, inverter and component dependence is likely higher in the Global South, given the relative scarcity of alternative suppliers. Moreover, to the extent that grids become larger, more digitised and more tightly integrated, the same kill-switch and cyber-enabled-attack concerns could plausibly become more salient for Global South governments in the years ahead.

Defence and intelligence risks are largely, though not entirely, absent: few Global South states have a defence-industrial base with an overlap into rare-earth magnets and battery-dependent weapons systems like in Europe. India is one exception: it imports roughly 90% of its rare-earths from China, and platforms such as the BrahMos missile and Tejas fighter depend on the same neodymium-based magnets used in wind turbines and EVs (ORF, 2026; VIF, 2025); a roughly 58% fall in Chinese magnet exports to India since January 2025 has already been read in New Delhi as a demonstration of Beijing's willingness to use this leverage, prompting an $800 million domestic

magnet-manufacturing push (VIF, 2025; Gulf News, 2026). More broadly, only a handful of Global South states share the Global North's perception of China as a military or strategic adversary. India is again the clearest case: the 2020 Galwan Valley clash[1] hardened Indian elite and public opinion decisively, and China is now described in Indian policy debate as the country's primary military threat (ISEAS, 2026). The Philippines is a second: recurring South China Sea confrontations have left 74–76% of Filipinos naming China as the country's greatest security threat in recent polling (OCTA Research, cited in South China Morning Post, 2025). Elsewhere in the Global South, this framing is far less common.

Prosperity risks, by contrast, are not confined to the Global North. India's Production-Linked Incentive scheme and Approved List of Models and Manufacturers have reduced but not eliminated Chinese import dependence, prompting China to request WTO consultations in December 2025 against India's own de-risking measures (AlCircle, 2025). In Thailand, the rise of Chinese EV manufacturing has given Chinese brands over 70% of the battery-electric-vehicle market, and Japanese manufacturers have responded by closing plants, putting more than 100,000 auto-sector jobs at risk (Lowy Institute, 2026; Maverick Consulting Group, 2026).

Political and geopolitical risk is at least as prominent in the Global South as in Europe, though it is often conflated with a concern over Chinese "debt-trap diplomacy", which holds that Beijing's infrastructure lending is used, deliberately or not, to extract strategic or political concessions from over-indebted borrowers (Chellaney, 2017). The claim is contested (Chatham House, 2020), but the debate itself is extensive and predates the clean-energy-specific framing. Nonetheless, growing Chinese leverage over energy systems is already translating into wider diplomatic alignment in countries such as Pakistan and Ethiopia (Loom, 2026).

Finally, for the Global South, there is a further dimension that is absent from the debate in the Global North: dependency on the financing terms and ownership structure attached to Chinese-backed investment. This takes at least three distinct forms, each with a different risk and opportunity.

The first is ownership of mineral extraction and processing. Indonesia's ban on exports of unprocessed nickel, intended to build domestic processing capacity, is a case in point: Chinese firms relocated there in response, and Chinese ownership now accounts for around 68% of nickel-sector foreign investment and an estimated 75% of refining capacity (Mineral Economics, 2025; National Bureau of Asian Research, 2026).

The second is ownership of manufacturing capacity. One example is South Africa's Nkangala–Wucheng joint venture to assemble solar panels, which has trained local technicians and localised part of the assembly process. But localisation and technology transfers depend heavily on the specific terms negotiated in each deal: In Thailand, for example, incentives for Chinese EV makers were tied to commitments to produce locally, and the sector has drawn major EV and battery investment, including BYD's first wholly owned overseas factory. Yet Chinese firms import most components and assemble them locally, so the vehicles built there still fall short of the 40% local-content target. Meanwhile, links to local suppliers, R&D and Thai jobs remain weak (Lowy Institute, 2026). Malaysia's solar industry drew billions in Chinese investment, then contracted sharply once US tariffs closed the export route it had been built to serve (Center on Global Energy Policy, 2025). That said, much of this is still unfolding as many projects have only just been signed or started.

The third, and most acute to date, concerns the financing of generation and deployment. Pakistan is the starkest example. Under sovereign-backed, take-or-pay power-purchase agreements under the China–Pakistan Economic Corridor (CPEC), Chinese independent power producers receive

[1] In June 2020, Indian and Chinese troops clashed in the Galwan Valley in Ladakh, the first fatal confrontation on the disputed border in over four decades. At least 20 Indian soldiers were killed; China acknowledged casualties in February 2021, when it confirmed four deaths. The clash triggered a prolonged military stand-off, a ban on dozens of Chinese apps (including TikTok) in India, and a lasting shift in Indian threat perception toward China. BBC News. (2021, February 20). China acknowledges soldiers died in 2020 Ladakh clash with India. https://www.bbc.com/news/world-asia-china-56129552

a contracted capacity payment for making a power plant available, regardless of how much electricity is dispatched. The structure helps secure project finance by shifting demand and payment risk to Pakistan's state power purchaser. If the purchaser cannot collect enough revenue from consumers, the unpaid obligation accumulates as arrears. In Pakistan, arrears accumulated due to high transmission and distribution losses, theft and weak bill collection, as well as tariffs and subsidies that have not fully covered system costs (NEPRA, 2026). Rapid rooftop-solar adoption has compounded the problem by reducing grid sales and because fixed capacity costs are still in place, a larger burden is shifted onto remaining consumers (Carbon Trust, 2025). By the end of fiscal year 2025–26, Pakistan's unpaid dues to CPEC power projects stood at roughly Rs423 billion (around US$1.5 billion), against total power-sector circular debt of around Rs1.8–1.9 trillion (Express Tribune, 2026; Prokerala, 2026). Most of this exposure is linked to coal plants, but similar terms apply to CPEC hydropower and renewable IPPs.

This financing risk is distinct from the equipment and operational risks discussed earlier in this paper: even where Chinese-built plants keep running, sovereign guarantees mean that unpaid dues accumulate as government liabilities, feeding into circular debt that constrains the state's broader fiscal space and gives Chinese lenders and developers leverage in future negotiations over debt relief, project expansion or new investment.

That said, the sovereign-guaranteed, take-or-pay model is reflective of older modes of Chinese overseas energy finance. Chinese policy-bank lending of this kind has fallen sharply since its mid-2010s peak, replaced increasingly by equity investment, corporate balance-sheet financing and a growing share of private Chinese firms in overseas projects (IEA, 2025). But this does not resolve Pakistan's existing exposure, which continues to accumulate from contracts signed under the earlier mode. It does, however, mean the financing-and-ownership risk in Global South clean-energy deals will increasingly look different, more akin to the Indonesia and South Africa ownership-concentration risks discussed above than to sovereign fiscal exposure.

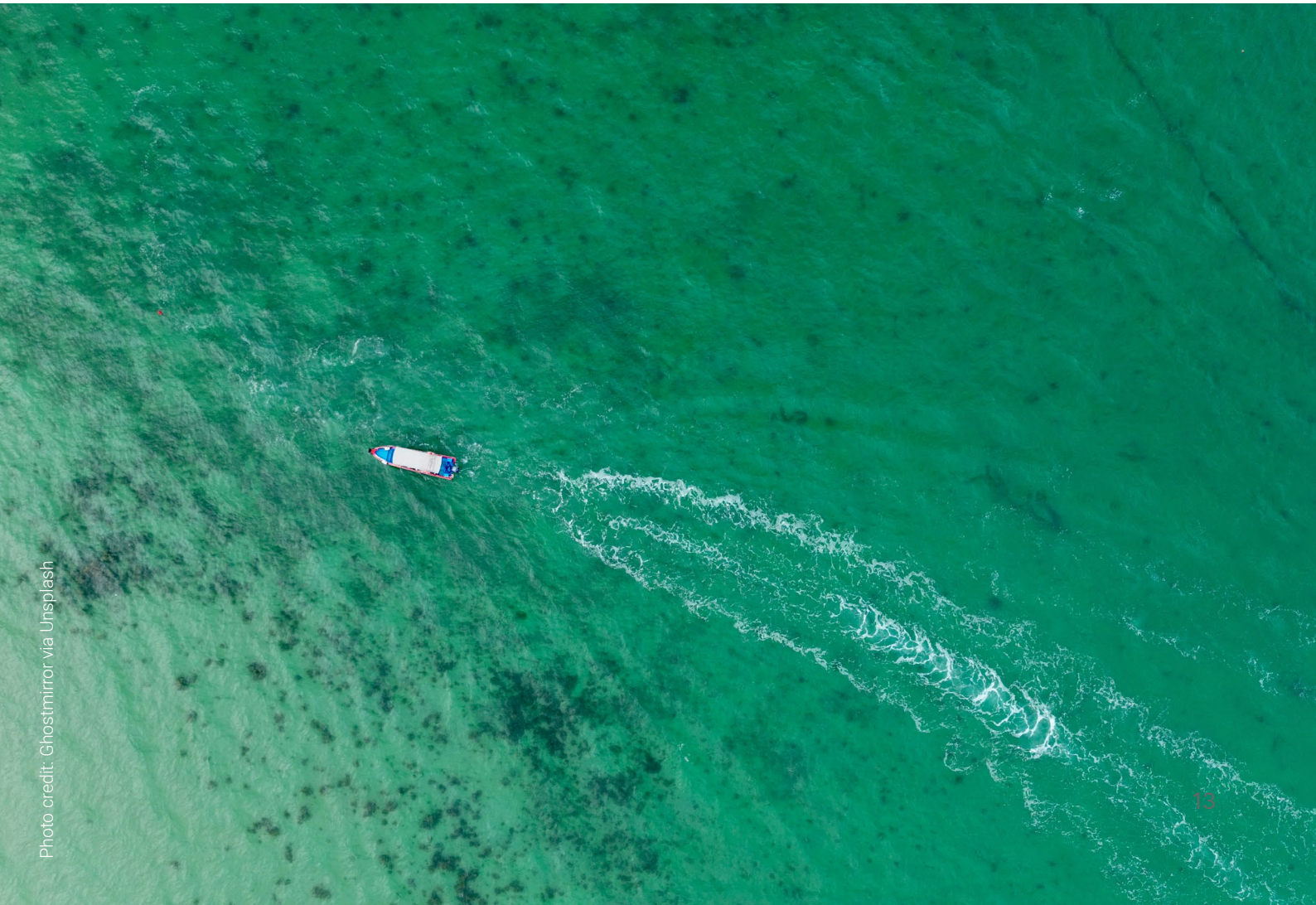


Photo credit: Ghostmirror via Unsplash

4. A policy framework: buy, build and protect

Policy responses must factor in the benefits of reliance on Chinese low-carbon technologies alongside the different risk categories and diverging risk perceptions. Governments must therefore acknowledge and weigh the trade-offs between decarbonisation, industrial competitiveness and security, and how these align with their China policies.

One way of thinking about the policy response is a 'buy, build and protect' framework. There are certain protective actions worth taking regardless of the political or geopolitical debate. At the same time, some low-carbon technologies are best to buy from China, either because the risk is low and/or the available alternatives are limited. Finally, a number of industrial capabilities are worth building because the industrial-defence benefits overlap or the risks of dependence are deemed too high. Put differently: protect no-regret resilience and existing strengths; buy where exposure is manageable and alternatives are costly; and build where strategic or industrial benefits justify targeted support.

When thinking through which technologies to protect, buy or build, four questions could be useful to consider, based on Gordon, Allan, Helmeci and Goldman (2024): how important is the sector to the wider economy, in output and employment terms; how competitive is the country's existing or potential industry, on cost and market share; how concentrated is the supply chain around China specifically; and whether the technology carries a national-security or dual-use dimension.

Protect applies to no-regret risks: action worth taking regardless of the wider political debate, because it defends something already competitive or closes a genuine security gap. It could also relate to a risk that is not China-specific (even though it may be amplified or exacerbated by China) or because there is a consensus across communities about the risk. Grid electronics and inverters are a case in point: they combine high economy-wide relevance (a single point of control over renewable output) with a highest national-security exposure. Cyber-security and data-protection standards for this equipment are sensible regardless of whether the supplier is Chinese, American or European, and necessary as electrified systems become increasingly complex and interdependent; physical security goes hand in hand with robust and resilient flexible power markets.

At the same time, governments should defend existing technological leads: European manufacturers retain roughly 94.5% of the European wind market and global leadership in offshore wind specifically, even as Chinese OEMs now lead in global installed capacity overall on the back of domestic demand (Global Wind Energy Council, 2026). Similarly, heat pumps remain Europe's largest clean-tech employer outside vehicle supply chains, still built on a largely European and Japanese manufacturing base (Bruegel, 2026). Finally, stockpiling rare-earth permanent magnets and other key critical minerals is also a no-regret policy, which could help mitigate the impact of different flow and stock risks.

Buy applies where the scale of China's cost advantage makes onshoring prohibitively expensive relative to the risk it addresses. Solar modules are the clearest case: China holds roughly 80% of global module manufacturing capacity (IEA, 2022) and supplies some 98% of EU panel imports (Loom, 2026), yet solar's economy-wide footprint in Europe sits mainly in deployment rather than manufacturing, and the technology itself carries low-to-moderate national-security relevance. The European Council on Foreign Relations (2024) notes that the cost of EU reshoring would be far greater than the security benefit it buys, and the more sensible response is diversifying suppliers rather than rebuilding domestic manufacturing. A second, less-discussed buy case is battery-grade

graphite anode material, where China dominates an estimated 90–98% of global processing and anode-manufacturing capacity. The reasons to buy differ from solar as the barrier to onshoring is capital and time. Graphitisation furnaces take years to permit and build, and non-Chinese natural graphite processing capacity remains extremely limited. In the near term, diversifying sourcing and processing among allied and partner countries is the more realistic posture than full onshoring, even as the EU Critical Raw Materials Act looks to build domestic processing eventually. Inverters, by contrast, are a case for moving away from buy: at some 61% of EU imports from China (Loom, 2026) and combining stock and flow exposure, there is a clearer agreement on both the risks of dependency and the benefits of protecting and developing homegrown industries.

Build applies where targeted investment and government financial de-risking could plausibly close a competitiveness or security gap within a reasonable timeframe, and/or where the stakes justify the cost. Batteries are the clearest case: China supplies some 88% of EU lithium-ion battery imports (Loom, 2026), but the sector's economy-wide importance is substantial given its link to a much larger automotive employment base than solar, its dual-use relevance to defence, and its growing importance to grid flexibility and AI applications. European gigafactory investments are limited but growing (Bruegel & Rhodium Group, 2025) making targeted, friendshored investment a defensible use of public money. That said, when building, governments should be wary of copying individual Chinese industrial-policy instruments in isolation: subsidies, joint ventures or forced technology transfers do not fully explain China's cost leadership, which rests as much on demand stability, industrial clustering and sustained domestic competition (Hove, 2024).

In practice, 'build' can mean different things in different circumstances depending on the purpose being served: it can include targeted subsidies for the specific stages judged most strategically important (such as cathode and precursor materials, rather than the whole battery value chain), or for batteries for military applications. It could also be targeted at strategic reserves and diversified stockpiles of critical minerals, to buy time in the event of a disruption; investment in workforce training and engineering skills, which are often a bigger bottleneck than capital; and sustained public R&D funding aimed at next-generation technologies, such as solid-state batteries, rather than competing head-on with China on cost in mature ones. Build can also mean partnership-building: mini-lateral coalitions and friendshoring arrangements that pool demand and share investment risk across several countries, government-to-government critical-minerals partnerships that secure offtake agreements with allied or partner-country producers, and joint ventures or licensing arrangements with non-Chinese firms that bring in technology and market access without duplicating an entire supply chain at home.

Using this framework, governments can think through their different risk exposures and how to prioritise risks and benefits, rather than debating abstract 'China risks'. This is an important first step in determining what to buy, build and protect, and can be teased out, initially, using the following questions: what would full de-risking cost, and how does that measure up against continued exposure or a middle-path diversification? Who bears that cost, and is there political buy-in for it? Can the cost be shared through a coalition (friendshoring, plurilateral minerals partnerships) rather than borne alone? Following Van Assche (2024), friendshoring is generally the lower-cost, lower-escalation default, with unilateral action reserved for the clearest national-security cases.

The buy/build/protect logic assumes a government has, or could build, a competing domestic industry. It requires some adjustment to be applicable to the Global South.

Build can take two different forms. The first is host-government-directed build: India's Production-Linked Incentive scheme and Approved List of Models and Manufacturers, or Indonesia's nickel-processing export ban, both use domestic policy levers such as subsidies, market access or export restrictions, to force capacity onshore on the host country's terms. The second, and arguably more common across the wider Global South, is Chinese-led build: Chinese firms locating manufacturing in a third country in order to jump tariffs aimed at China-origin goods, capturing a market protected by the host's own local-content rules, or locking in access to a resource.

In the first version, the host country directs the investment and may look to benefit from access to technology or ownership; in the second, the host government supplies land, labour, and market or resource access, while capital, technology and ownership remain substantially with the investor. Indonesia's own nickel sector illustrates the two blurring together: its export ban was host-government-directed, but the resulting foreign investment is now Chinese-owned in practice (Mineral Economics, 2025; National Bureau of Asian Research, 2026). The existing 'build' examples in the Global South tell a cautionary tale for Europe: depending on how they are framed and negotiated, Chinese-led investments can deliver the jobs and technology-transfer upside or end up closer to a simple assembly line.

Protect looks much like it would in Europe: grid cyber-security standards, applied regardless of equipment origin, are exactly as sensible outside Europe as within it. But in some countries, it is less about defending an existing industry and more about protecting minerals or revenues.

Buy is the default for many Global South governments with no domestic industry to protect or build, and where Chinese equipment is the fastest and cheapest route to energy access. But while European buying happens largely through open markets and competitive procurement, Global South buying is frequently bundled with the financing and the ownership structure of the deal itself, since equipment and financing arrive from the same Chinese state-linked lenders and developers.

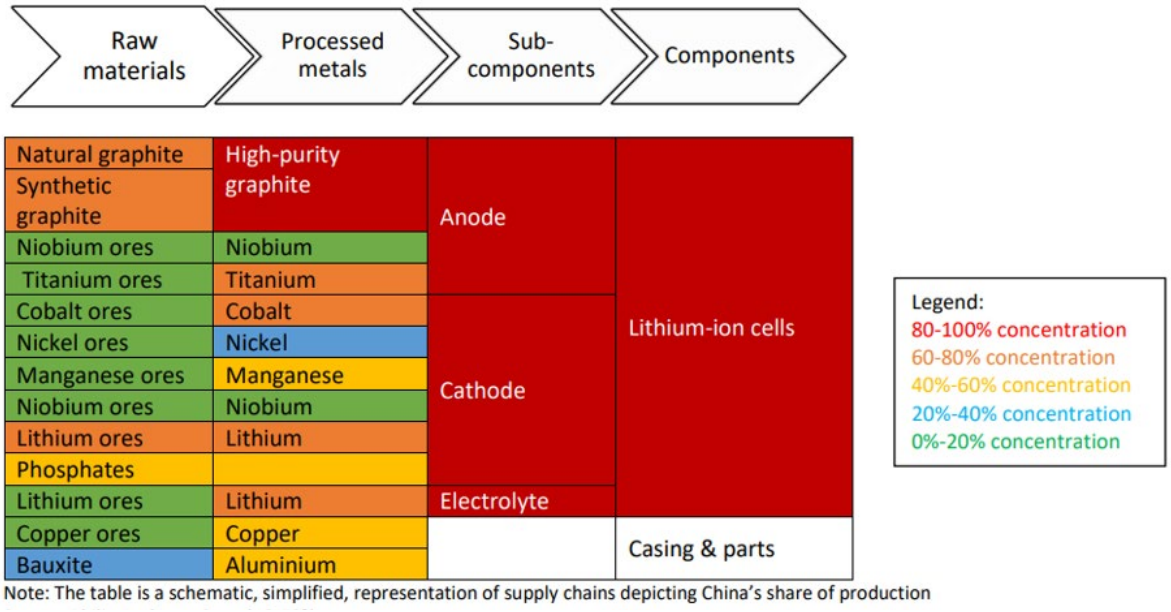
Photo credit: Z Zhang via Unsplash

5. Assessing risk holistically

Moving beyond the current, fragmented debate is critical. Treating all Chinese clean-tech dependency as a security threat could lead to costly, slow, poorly targeted onshoring, unsupported by risk assessments (solar being the clearest case), which in turn will slow the energy transition and raise its cost. But equally, treating all dependency as benign, and viewing it solely through the lens of the energy transition's benefits, fails to address real critical-infrastructure exposure such as inverters and grid electronics.

A genuinely holistic debate could also support a broader, global, energy-security framework. Once the vague 'China risk' is unpacked, it becomes clear that Pakistan's exposure and Europe's inverter security are not the same problem and do not need the same fix. Equally, there is not one single perspective on whether Chinese clean tech is good or bad for energy security. What this paper has sought to do is unpack the risks and suggest a framework for the policy response that governments in very different circumstances can use for their own risks, on their own terms.

Figure 1: Concentration of production in China, lithium-ion battery supply chains



Note: The table is a schematic, simplified, representation of supply chains depicting China's share of production

Source: OIES

Figure 2

Note: The table is a schematic, simplified, representation of supply chains depicting China's share of production.

Source: OIES, Loom (2026)

References

AlCircle. (2025). *India's solar protectionism against China backfires: Fragile supply chain and rising reliance on Chinese cells.* https://www.alcircle.com/press-release/india-s-solar-protectionism-against-china-backfires-fragile-supply-chain-rising-reliance-on-chinese-cells-116730

Bruegel. (2026). *Clean industrial transformation: Where does Europe stand?* https://www.bruegel.org/analysis/clean-industrial-transformation-where-does-europe-stand

Bruegel & Rhodium Group. (2025). *Transatlantic Clean Investment Monitor 3: Battery manufacturing.* https://www.bruegel.org/analysis/transatlantic-clean-investment-monitor-3-battery-manufacturing

Carbon Trust. (2025). *Pakistan's next power chapter: From solar success to system stability.* https://www.carbontrust.com/sites/default/files/documents/resource/public/Pakistan%20focus%20paper-The%20Carbon%20Trust.pdf

Center on Global Energy Policy, Columbia University SIPA. (2025). *US-China trade tensions and clean energy investment in third countries: Implications for US policymakers.* https://www.energypolicy.columbia.edu/publications/us-china-trade-tensions-and-clean-energy-investment-in-third-countries-implications-for-us-policymakers/

Chatham House. (2020). *Debunking the myth of 'debt-trap diplomacy': How recipient countries shape China's Belt and Road Initiative.* https://www.chathamhouse.org/2020/08/debunking-myth-debt-trap-diplomacy

Chellaney, B. (2017). *China's debt-trap diplomacy. Project Syndicate.* https://chellaney.net/2017/01/25/chinas-debt-trap-diplomacy/

Cheng, Y., Chung, M., & Wong, K. (2025). China's climate aid for the Global South—Changing approach and evolving institutions. *Sustainability, 17(5), 2256.* https://doi.org/10.3390/su17052256

Clean Energy Wire. (2025, March). *Military experts warn of security risks through planned Chinese wind turbines off German coast*. https://www.cleanenergywire.org/news/military-experts-warn-security-risks-through-planned-chinese-wind-turbines-german-coast

Council on Foreign Relations. (2026). *How the Big Beautiful Bill Act reshaped clean tech manufacturing, in charts*. https://www.cfr.org/articles/how-obbba-reshaped-u-s-clean-tech-manufacturing-in-charts

CREA & Renewables First. (2026). *The hedge that paid off: How Pakistan's solar boom is shielding it from the Hormuz crisis.* https://energyandcleanair.org/the-hedge-that-paid-off-how-pakistans-solar-boom-is-shielding-it-from-the-hormuz-crisis/

de la Tour, A., Glachant, M., & Ménière, Y. (2011). Innovation and international technology transfer: The case of the Chinese photovoltaic industry. *Energy Policy, 39(2), 761–770.* https://doi.org/10.1016/j.enpol.2010.10.050

Dialogue Earth & GlobeScan. (2026). China's clean-tech charm offensive wins Global South hearts and minds. *Dialogue Earth*. https://dialogue.earth/en/energy/chinas-clean-tech-charm-offensive-wins-global-south-hearts-and-minds/

The Diplomat. (2026, June 30). China's new investment regulations block strategic technology transfer. https://thediplomat.com/2026/06/chinas-new-investment-regulations-block-strategic-technology-transfer/

Draghi, M. (2024). *The future of European competitiveness: A competitiveness strategy for Europe.* European Commission. https://commission.europa.eu/topics/competitiveness/draghi-report_en

Ember. (2025). *China energy transition review 2025.* https://ember-energy.org/latest-insights/china-energy-transition-review-2025/

Ember. (2026). *The first evidence of a take-off in solar in Africa.* https://ember-energy.org/latest-insights/the-first-evidence-of-a-take-off-in-solar-in-africa/

EnergyTrend. (2023, February 23). *China plans to restrict exports of key solar technology that would impact global industry chain.* https://www.energytrend.com/news/20230223-31004.html

Euronews. (2026, May 4). *EU moves to ban high-risk inverters from China over cybersecurity threats*. https://www.euronews.com/my-europe/2026/05/04/eu-moves-to-ban-high-risk-inverters-from-china-over-cybersecurity-threats

Euronews. (2026, August 31). EU climate chief warns China dependence will make EU's green transition more costly. https://www.euronews.com/my-europe/2026/08/31/eu-climate-chief-warns-china-dependence-will-make-eus-green-transition-more-costly

European Commission. (2022). *REPowerEU plan*. https://commission.europa.eu/topics/energy/repowereu_en

European Council on Foreign Relations. (2024). *Trust and trade-offs: How to manage Europe's green technology dependence on China*. https://ecfr.eu/publication/trust-and-trade-offs-how-to-manage-europes-green-technology-dependence-on-china/

European Council on Foreign Relations. (2026a). *Don't look down: How Europeans can escape China's clean-tech gravity.* https://ecfr.eu/publication/dont-look-down-how-europeans-can-escape-chinas-clean-tech-gravity/

Express Tribune. (2026, July). *Rs423b CPEC power dues unpaid.* https://tribune.com.pk/story/2617766/rs423b-cpec-power-dues-unpaid

Farrell, H., & Newman, A. L. (2019). Weaponized interdependence: How global economic networks shape state coercion. *International Security, 44(1), 42–79.* https://direct.mit.edu/isec/article/44/1/42/12237/Weaponized-Interdependence-How-Global-Economic

Gleiss Lutz. (2026). *China's Decrees 834 and 835: Conflicts of obligations between Chinese law and compliance requirements?* https://www.gleisslutz.com/en/know-how/chinas-decrees-834-and-835-conflicts-obligations-between-chinese-law-and-compliance-requirements

Global Wind Energy Council. (2026). *GWEC records sharp rise in wind turbine installations, as five OEMs exceed 100 GW.* https://www.gwec.net/news/gwec-records-sharp-rise-in-wind-turbine-installations-as-five-oems-exceed-100-gw

Gordon, N., Allan, B., Helmeci, D., & Goldman, J. (2024). *Focusing industrial strategy: Which clean energy supply chains should have priority? Carnegie Endowment for International Peace.* https://carnegieendowment.org/research/2024/12/focusing-industrial-strategy-which-clean-energy-supply-chains-should-have-priority

Green Finance & Development Center. (2026). *China issues strict supply chain security and countering foreign extraterritorial jurisdictions—impacts on green economy and international collaboration*. https://greenfdc.org/china-issues-strict-supply-chain-security-and-countering-foreign-extraterritorial-jurisdictions-impacts-on-green-economy-and-international-collaboration/

Gulf News. (2026). *India unveils $800 million push for rare earth magnet production.* https://gulfnews.com/world/asia/india/india-unveils-800-million-push-for-rare-earth-magnet-production-1.500361616

Hove, A. (2024). *Clean energy innovation in China (OIES Paper CE14).* Oxford Institute for Energy Studies. https://www.oxfordenergy.org/wpcms/wp-content/uploads/2024/07/CE14-Clean-energy-innovation-in-China-Final.pdf

HSF Kramer. (2025). *China's battery technology export restrictions – cathode, lithium, gallium*. https://www.hsfkramer.com/notes/mining/2025-posts/china-battery-technology-export-restrictions-cathode-lithium-gallium

Institute for Energy Economics and Financial Analysis. (2025). *Assessing the effectiveness of India's solar Production Linked Incentive scheme.* https://ieefa.org/resources/assessing-effectiveness-indias-solar-production-linked-incentive-scheme

International Energy Agency. (2022). *Special report on solar PV global supply chains.* https://www.iea.org/reports/solar-pv-global-supply-chains

International Energy Agency. (2025). *World Energy Outlook 2025.* https://www.iea.org/reports/world-energy-outlook-2025

International Energy Agency. (2026). *Energy Technology Perspectives 2026: Supply chain risks and industrial competitiveness.* https://www.iea.org/reports/energy-technology-perspectives-2026/supply-chain-risks-and-industrial-competitiveness

International Institute of Green Finance & Institute of Development Studies. (2026). *The landscape of Chinese renewable energy investment overseas (2022 to 2025) [Policy brief and D-CORE database]. IDS OpenDocs.* https://opendocs.ids.ac.uk/articles/report/The_Landscape_of_Chinese_Renewable_Energy_Investment_Overseas_2022_to_2025_/33079145

ISEAS – Yusof Ishak Institute. (2026). *Between rivalry and rapprochement: The trials and trajectory of India-China relations (Kewalramani, M.) [Perspective 2026/1].* https://www.iseas.edu.sg/articles-commentaries/iseas-perspective/2026-1-between-rivalry-and-rapprochement-the-trials-and-trajectory-of-india-china-relations-by-manoj-kewalramani/

Linklaters. (2026). *China—New rules on supply chain security and measures to counter extraterritorial jurisdiction.* https://www.linklaters.com/insights/blogs/digilinks/2026/may/china-new-rules-on-supply-chain-security-and-measures-to-counter-extraterritorial-jurisdiction

Loom. (2026). *Dependence: The national security risks of China's role in Europe's energy transition*. https://loomstrategy.org/dependence/

Lowy Institute. (2026, June 24). *Thailand's auto industry has a bigger problem than China.* https://www.lowyinstitute.org/the-interpreter/thailand-s-auto-industry-has-a-bigger-problem-than-china

Maverick Consulting Group. (2026). *Thailand EV policy 2026: Oil shock, Chinese dominance, and the road ahead.* https://www.mcg-asia.com/featured-insights/thailand-ev-policy-2026

McFarlane, S. (2025, May 14). *Ghost in the machine: Rogue communication devices found in Chinese inverters. Reuters.* https://www.reuters.com/sustainability/climate-energy/ghost-machine-rogue-communication-devices-found-chinese-inverters-2025-05-14/

Nahm, J. (2023). How solar developed from the bottom-up in China [Blog post]. Institute on Global Conflict and Cooperation. https://ucigcc.org/blog/how-solar-developed-from-the-bottom-up-in-china/

National Bureau of Asian Research. (2026). *China's influence in Indonesia's nickel sector and implications for the United States.* https://www.nbr.org/publication/chinas-influence-in-indonesias-nickel-sector-and-implications-for-the-united-states/

National Electric Power Regulatory Authority (NEPRA). (2026). *Performance evaluation report of distribution companies for FY 2024–25*. https://nepra.org.pk/M&E/PER/Distribution/2026/PER%202024-25%20Distribution%20Companies.pdf

New York Sun. (2025, May). *China suspected of installing kill switches and spyware into global supply of solar power inverters*. https://www.nysun.com/article/china-suspected-of-installing-kill-switches-and-spyware-into-global-supply-of-solar-power-inverters

Observer Research Foundation. (2026). 'Chokepoint politics': China's rare-earth statecraft and India's search for strategic autonomy. https://www.orfonline.org/research/-chokepoint-politics-china-s-rare-earth-statecraft-and-india-s-search-for-strategic-autonomy

OCTA Research, cited in South China Morning Post. (2025, August 27). *China biggest security concern to Filipinos amid sea tensions: poll*. https://www.scmp.com/week-asia/politics/article/3323248/china-biggest-security-concern-filipinos-amid-sea-tensions-poll

Outlook India. (2026, July). *Pakistan faces fresh debt blow as Chinese power firms refuse concessions.* https://www.outlookindia.com/international/pakistan-faces-fresh-debt-blow-as-chinese-power-firms-refuse-concessions

Prokerala. (2026, June 3). *Pakistan poised to sink deeper into Chinese debt trap: Report.* https://www.prokerala.com/news/articles/a1770884.html

pv magazine. (2026, May 4). *EU funding ban on high-risk inverters, including Chinese suppliers, extends to BESS.* https://www.pv-magazine.com/2026/05/04/eu-funding-ban-on-high-risk-inverters-including-chinese-suppliers-extends-to-bess/

pv magazine. (2026, January 28). *U.S. authorities find no definitive evidence of hidden devices in Chinese solar inverters.* https://www.pv-magazine.com/2026/01/28/u-s-authorities-find-no-definitive-evidence-of-hidden-devices-in-chinese-solar-inverters/

pv magazine. (2025, June 5). *Danish energy sector probes unauthorized components amid cyber concerns.* https://www.pv-magazine.com/2025/06/05/danish-energy-sector-probes-unauthorized-components-amid-cyber-concerns/

Reuters. (2025, May 21). Unexplained components found in Denmark's energy equipment imports, industry group says.

Reuters. (2025, August 25). Germany's Luxcara may drop Chinese turbine deal for North Sea wind farm. https://www.marketscreener.com/news/germany-s-luxcara-may-drop-chinese-turbine-deal-for-north-sea-wind-farm-ce7c50d8d88df023

Ridgwell, H. (2023, September 20). *Europe "risks dependence" on Chinese batteries, EU report finds.* VOA News. https://www.globalsecurity.org/wmd/library/news/china/2023/09/china-230920-voa02.htm

Royal United Services Institute (RUSI). (2025). *Pick your poison: China in the UK energy system.* https://www.rusi.org/explore-our-research/publications/commentary/pick-your-poison-china-uk-energy-system

Simmons, B. (2024). *US efforts to decarbonize and de-risk the battery supply chains: Are they fundamentally incompatible?* https://www.oxfordenergy.org/wpcms/wp-content/uploads/2024/05/US-efforts-to-decarbonize-and-de-risk-the-battery-supply-chains.pdf

South China Morning Post. (2025, May). *Japan probes Chinese solar panels over hidden device fears, power disruptions.* https://www.scmp.com/week-asia/politics/article/3311400/japan-probes-chinese-solar-panels-over-hidden-device-fears-power-disruptions

South China Morning Post. (2026, March 26). *UK blocks China wind turbine project on 'national security' amid tense business climate.* https://www.scmp.com/economy/global-economy/article/3348039/uk-blocks-china-wind-turbine-project-national-security-amid-tense-business-climate

Trade.gov (International Trade Administration). (2025). *South Africa energy: Greenlights IRP 2025 [Market intelligence brief].* https://www.trade.gov/market-intelligence/south-africa-energy-greenlights-irp-2025

Van Assche, A. (2024). *Strengthening global supply chains for low-emissions technology: The policy playbook and the trade-offs (Commentary 663). C.D.* Howe Institute. https://cdhowe.org/publication/strengthening-global-supply-chains-low-emissions-technology-policy-playbook/

VIF (Vivekananda International Foundation). (2025, November 6). *Weaponised minerals and India's China dependency. https://www.vifindia.org/article/2025/november/06/Weaponised-Minerals-and-India-s-China-Dependency*
World Resources Institute. (2026). The perfect storm fueling Pakistan's solar boom. https://www.wri.org/insights/pakistan-solar-energy-boom

Zawya. (2026). *New deal with Chinese solar giant to spark up South Africa's energy market.* https://www.zawya.com/en/economy/africa/new-deal-with-chinese-solar-giant-to-spark-up-south-africas-energy-market-jb3mbi3c

Zhang, C., & Lin, H. (2024). *China's climate and energy partnerships in the Global South (Policy Briefing 297). South African Institute of International Affairs*. https://saiia.org.za/wp-content/uploads/2024/07/SAIIA_PB_297_ChinaClimateEnergy.pdf

Glossary

China–Pakistan Economic Corridor (CPEC): A programme of Chinese-financed infrastructure, energy and industrial investment in Pakistan and a flagship component of China's Belt and Road Initiative. Its energy portfolio includes Chinese-backed independent power producers (IPPs), including coal, hydropower and renewable projects.

Critical infrastructure: Assets and systems whose disruption would significantly affect economic activity, public safety, national security or essential services. In this paper, electricity networks, grid electronics, renewable generation and connected energy equipment are treated as critical infrastructure.

Critical minerals: Minerals and metals that are economically important, exposed to concentrated supply and difficult to substitute in strategic technologies.

FEOC (foreign entity of concern): A US legal designation used in Inflation Reduction Act-related rules to restrict eligibility for selected clean-energy incentives where supply chains involve specified links to China or other designated countries.

Friendshoring: Locating, sourcing or investing in production and processing in politically aligned or trusted partner countries, rather than relying on domestic reshoring alone. It may lower exposure to geopolitical disruption but does not eliminate supply concentration or political risk.

Grid electronics: Equipment used to convert, control, monitor and manage electricity across generation, storage, transmission and distribution systems, including inverters, converters, controllers, communications devices and related software.

Independent power producer (IPP): A privately owned or sponsored company that develops, owns and operates a power plant and sells electricity under a contract, commonly to a state utility or public power purchaser.

Inverter: A device that converts direct current (DC), produced by solar panels or stored in batteries, into alternating current (AC) usable by electricity networks and most appliances. As inverters control generation and can be digitally connected, they are central to operational and cybersecurity concerns.

Original equipment manufacturer (OEM): A company that designs and manufactures equipment sold under its own name or integrated into a wider system. In this paper, OEM commonly refers to wind-turbine, solar-equipment, battery or electric-vehicle manufacturers.

Rare-earth permanent magnets: High-performance magnets, often using neodymium and other rare earths, used in wind turbines, electric motors, defence systems and other advanced technologies. Their concentrated processing and manufacturing supply chains create both clean-energy and defence exposure.

Reshoring: Moving production or supply-chain activity back to the home country. It can improve domestic capacity but may be expensive, slow and disproportionate where security relevance is limited or local production is not competitive.

Take-or-pay contract: A power-purchase arrangement in which the buyer—often a government, state utility or public power purchaser—must pay for contracted generating capacity or fuel whether or not it is used. It can make investment financeable by shifting demand risk to the buyer, but can create fiscal pressure when demand, tariffs or revenue collection fall short.

Technology-neutral regulation: Rules that apply according to the risk posed by a product or system rather than its country of origin.

Weaponised interdependence: The ability of states or firms occupying central positions in global economic, technological or financial networks to use that position for coercive, intelligence or strategic advantage—for example by restricting access to key technology or materials (Farrell & Newman, 2019).