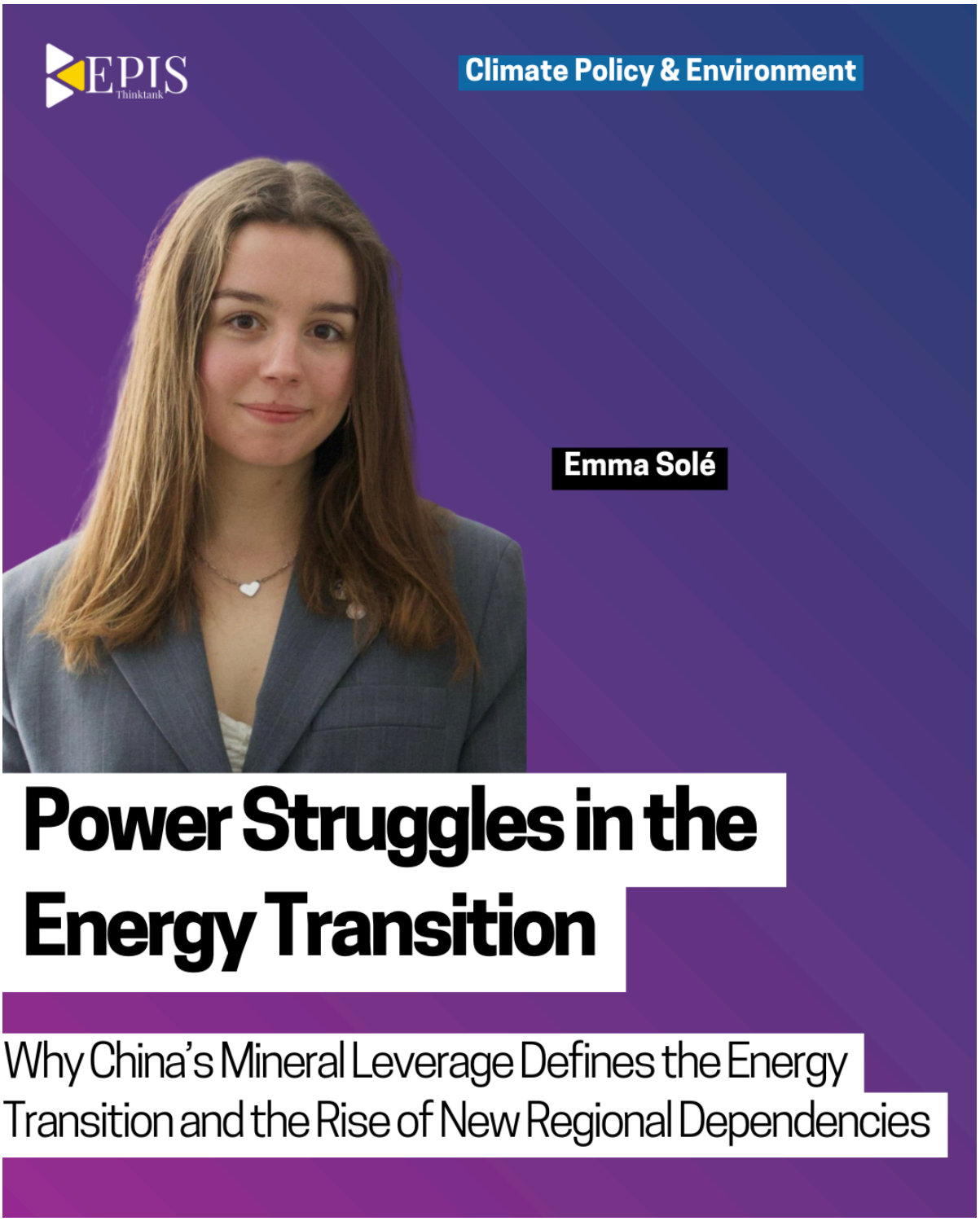

3 Main Points

How does China's dominance in critical minerals and clean-tech manufacturing reshape global power in the energy transition? This brief argues that China's control across the entire

mineral-to-technology supply chain creates asymmetric dependencies that influence national climate strategies and create inequalities. As mineral geopolitics rises, securing diversified and resilient supply chains becomes essential for global climate security.

About the Author

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Power Struggles in the Energy Transition

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The global shift towards clean energy is accelerating, but concerns about strategic dependency embedded within the transition are too. China's unprecedented investment in clean-energy industries has reshaped global markets, effectively positioning Chinese firms at the centre of global supply chains for solar panels, wind turbines, batteries, and electric vehicles (Zou et al., 2024). In 2025 alone, Beijing has installed more than twice the solar capacity as every country in the world combined (Lu, 2025). Academic studies have increasingly emphasised that while decarbonisation aims to reduce vulnerability associated with fossil-fuel supply shocks, it does not eliminate geopolitical risk but redistributes it (Yakovleva & Nickless, 2022). While China's massive deployment and cost-lowering effects have accelerated global decarbonisation, they have also deepened structural dependencies on materials that are essential for electrification. It is reshaping the ability to secure the technologies underpinning the green transition.

This article will therefore examine how China's leadership in clean-energy technologies is inseparable from its dominance in the extraction and processing of critical raw materials and that this combination constitutes a new form of strategic power in the energy transition. As fossil-fuel geopolitics gives way to mineral geopolitics, countries face growing vulnerability in supply chains that underpin climate targets, such as the European Green Deal aiming to cut emissions by at least 50% by 2030 (European Commission, 2025). Hence, this brief argues that China's mineral and clean-tech leverage has created asymmetric dependencies across the world, influencing regional energy transitions and generating new geopolitical risks.

Critical Raw Materials as strategic leverage, China as the main actor

The International Energy Agency (IEA) predicts that in 2040, the demand for minerals for green energy technologies will quadruple to meet the 2015 Paris Climate Agreement (International Energy Agency, 2021). Achieving global climate neutrality by 2050 would demand as much as six times more minerals in 2040 compared to today. This data has spurred leaders to shift away from solely focusing on the production of fossil fuels but rather to see the extraction of minerals as a geostrategic tool. This is the case for China, where in the past decade, investment in renewable energy has skyrocketed, with numbers as high as $625 billion USD in 2024 (Yang et al., 2025). But we may question why the sudden interest, considering they have been the top consumer of coal and the largest carbon emitter in the past years (Lu, 2025). To understand this, we must firstly define what Rare Earth Elements (REE) are, their respective supply chains and why they are considered the backbone of the green transition.

Contrary to their name, most of the 17 REEs are abundant on the earth's surface and can be found in almost all massive rock foundations. However, due to their low ore grade and the complexity of separation, extraction is only profitable in very few locations (Wübbeke, 2013). REEs find extensive use in products across different fields due to their indispensability in clean energy technologies, digital devices, military technologies,

aerospace and biomedical engineering (Wübbeke, 2013). As global electrification accelerates, demands for both light and heavy REEs have surged, intensifying geopolitical competitions to secure supply, which has made major economies redesign their industrial and resource policies (Chen et al., 2024).

At the same time, the uneven geography of global mineral production has reinforced China's centrality. The mineral supply chain can be divided into different processes: extraction, refining, processing, building into products, and finally, recycling. (Müller, 2025). Globally, the mineral supply chain has developed into a highly asymmetrical structure in which Africa, Latin America and parts of Southeast Asia remain positioned at the extraction stage, with their main exports being unprocessed ores (Yakovleva & Nickless, 2022). Europe and Japan occupy downstream industrial segments but lack upstream capacities. Finally, the United States retains some domestic capacity, making it more integrated into commodity supply chains, but the production remains very low, and it still imports 78% of REEs from China (Kalantzakos, 2020). Therefore, China stands out as the only actor with a strong presence across all stages of the supply chain, from overseas extraction to refining and processing, ending with high-value manufacturing (Yakovleva & Nickless, 2022). Currently, they have become the world's most central manufacturing hub, with over 93% of market share (Müller, 2025). This makes them a key player, with authors stating we are almost witnessing a "one-man show" (Lu, 2025). They have managed to effectively link mineral exporters with countries heavily dependent on mineral imports by strategically consolidating a long-term strategy.

Since the 1990s, Beijing has implemented successive industrial policies, such as the "going-out strategy", motivated by mitigating the effects of the oil dependence created in the 1980s, aimed at integrating China into global supply chains (Müller, 2025). According to a report published by EMBER, this shift reflects a recognition amongst policymakers that the previous development paradigm centred on fossil fuels had reached structural limits, especially with exposure to volatile oil markets and mounting environmental pressures (Yang et al., 2025). The response was a policy framework aimed at constructing an "ecological civilisation" integrating economic upgrading with energy security objectives (Yang et al.,

2025). In recent years, the focus has been in rapidly increasing their renewable capacity with the 11th and 12th Energy Five-Year Plans (2006-2015); however, the 13th Plan and 14th plans (2016-2025) marked a pivotal shift by including the power system in a national strategic agenda. This has led investments to multiply and new projects to rise, such as mega dams on the Yarlung Tsangpo and grid development with the creation of 37 major transmission lines (Yang et al., 2025). Just in 2024, the clean energy sector contributed one-tenth of China's GDP, or, in comparison, the total GDP of Australia (Yang et al., 2025). Simultaneously, high levels of R&D investment, reflected in China's dominant share of global clean tech patents, reinforce its technological lead. The result is a deliberately engineered consolidation that places China at the centre of mineral-to-manufacturing supply chains essential for the global transition.

The return of Power Politics and regional dependencies

Throughout the twentieth century, energy access shaped the global balance of power, determining patterns of industrial development and outcomes of war. Today, we see it has not diminished geopolitical competition; it has reconfigured it. As renewables expand, the control of critical raw materials, processing capacity and clean-tech supply chains has become a central arena of strategic rivalry. As Umbach (2018) observes, the shift to green technologies creates new forms of vulnerability because these technologies rely on an uninterrupted flow of critical materials. This dynamic marks a return to power politics, where states increasingly leverage asymmetric interdependence to advance national interests.

This became apparent in 2019, when China signalled that it might restrict rare earth exports in response to escalating tensions with the United States, where they aimed to leverage their trade dispute with rare earth advantage (Kalantzakos, 2020). It exposed the vulnerabilities of a concentrated supply, prompting major economies to reconsider their policy. It is the case for the European Union, which, over the past 20 years, had cut domestic mining productions and realised that they were greatly dependent on Chinese imports

(Müller, 2023). In 2018, studies showed that over 58 percent of the value of Chinese foreign direct investment (FDI) in Europe was concentrated in core industries such as robotics, power equipment, and next-generation IT (Kalantzakos, 2020). This prompted the European Union to respond with the EU Critical Raw Material Act, which seeks to diversify alternatives and strengthen existing sources of such critical materials, like improved recycling and increased stockpiles, to reduce the overreliance on China. (European Commission, n.d.) Similarly, the Draghi Report already warned about this dependency, stating that "the EU is weak in the emerging technologies that will drive future growth" (Draghi, 2024).

Other countries followed similar approaches. In February 2021, the Biden administration announced a strategy to review US supply chains, identify high-risk sectors, and implement measures to reduce vulnerability. Additionally, the Inflation Reduction Act (IRA), introduced in August 2022, offered incentives for American companies to relocate production or processing back to the US, therefore implementing a reshoring strategy to reduce geopolitical exposure (Müller, 2023).

Diversifying, however, will be a difficult task, especially considering China's is "at least a decade ahead of its competitors" (Kalantzakos, 2020). Their key to this success is the involvement in all stages of the supply chain. Chinese firms have built strategic networks that span resource-rich regions, allowing them to expand organisational capacity far beyond their own domestic industry, often through long-term contracts (Müller, 2023). This is reinforced by their "Grand Diplomacy" and the Belt and Road Initiative (BRI), now involving 148 partner countries. It aims to unite Eurasia and Africa and loop South America into a seamless space of trade through new ports, railways, and transport corridors (Kalantzakos, 2020). It will connect extraction sites with Chinese processing centres, ensuring that most mineral and metal supply chains pass through its territory. This has led to the development of strategic leverage; by 2021, it accounted for roughly 93% of global refined output, making China a pivotal partner for both resource-exporting states and industrial economies dependent on processed minerals (Müller, 2023).

A central mechanism that facilitated this expansion has been the "infrastructure-for-minerals" model, where resource-rich countries received favourable loans for infrastructure projects from state-owned banks. Repayment is frequently tied to future deliveries of commodities or revenues from resource projects backed by legal claims on licences. Between 2000 and 2017 alone, Chinese state institutions and companies provided at least $18 billion in loans to African states for mining-related projects (Müller, 2023).

Hence, the intensified global competition for CRMs has also reinvigorated attention to Africa, sometimes described as a "new scramble for Africa" (Hilson, 2020). There is a window of opportunity for African states to strengthen their position in global supply chains and improve governance in the mining sector. Enhanced coordination at the African Union (AU) level and policies under the African Continental Free Trade Area (AfCFTA) could enhance bargaining power and ensure that Africa benefits from its resources (Müller, 2023). However, the majority of resource exports leave the continent unprocessed, reinforcing small economies with weak linkages to domestic industry. Some countries, including Ghana, Liberia, Mozambique, and South Africa, have implemented local content policies aimed at stimulating downstream processing and expanding economic benefits within mining sectors (Hilson, 2020). Yet, academic assessments suggest that progress has been uneven, with structural power asymmetries and the dominance of multinational companies hindering the full realisation of these goals (Hilson, 2020).

Inequalities in Global Supply Chains

Increasingly, Environmental, Social, and Governance (ESG) criteria play a significant role in European and international initiatives in the minerals sector (Müller, 2023). The international pressure on multinational mining companies to implement ESG criteria has significantly increased in the past decade. The 'Marikana massacre' in South Africa in 2012 led to an intense transnational debate about the co-responsibility of international

companies such as BASF in Germany, which imported platinum from the company owning mines (Müller, 2023).

The shift toward mineral-based energy systems exposes longstanding structural inequalities between the Global North and Global South. In resource-rich regions across Africa, Latin America, and Southeast Asia, national development pathways remain deeply tied to extractivism and rent dependence (Müller, 2023). The Fourth Dialogue under the Just Transition Work Programme in Addis Ababa underscored these concerns, highlighting calls for equitable benefit-sharing tied with stronger environmental protections (Climate Action Network International, 2025). Days later, African heads of state explicitly recognised the need for just mineral supply chains, marking the first time this issue surfaced prominently at a continental climate summit. As demand for critical minerals accelerates, these countries must simultaneously navigate opportunities for economic upgrading and the risk of renewed dependency patterns, environmental degradation and the marginalisation of local communities (Climate Action Network International, 2025).

Overall, the current geopolitical competition over critical minerals demonstrates the interplay between global power dynamics, strategic economic interests, and opportunities for regional actors to reshape their roles in mineral supply chains. That is why policy, investment, and governance choices will determine how effectively they navigate this rapidly evolving landscape.

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