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# Taking Stock of China and the Geopolitics of Energy

## INTRODUCTION

China has a huge and growing influence on the global politics and economics of energy. The topic of China's role in the new geopolitics of energy is hardly new, but the supply chain crisis following Covid and then the Russian invasion of Ukraine in 2022 have combined to further elevate the topic. Decarbonization and the risk of de-globalization are increasingly central to energy policies and are framing the geopolitics of energy. China's energy security concerns are also closely linked to these trends: China is a leading importer of oil and gas, so its energy supplies are exposed to price volatility, which is exacerbated by supply shocks due to instability in producer countries, transportation bottlenecks, and sanctions. But as China has established itself as the world's leading manufacturer of renewable energy sources, and as the energy transition gathers momentum, China's energy security opportunities and challenges are evolving.

From the point of view of the advanced economies of Western Europe and North America, China has long been viewed both as an economic partner and as an industrial competitor. Since the Paris Climate Agreement, China has been viewed as a central actor in climate diplomacy as well as a leader in clean energy, but China's dominance of clean energy supply chains has raised concerns about whether Western countries can catch up. For many years, the example of China's clean energy scale-up acted as a positive spur to more policy action, but since 2020 these efforts have taken on a more urgent and confrontational aspect as governments explicitly target reducing China's dominance in specific technologies (batteries, solar) and critical materials.

In other world regions, attitudes towards the role of China in energy geopolitics are vastly different and are informed, in part, by the deepening rift between China and the US. For Russia, China represents an important energy customer and strategic partner, even though Russia must balance its growing reliance on China with its reluctance to allow China to become too dominant within its economy. For the Middle East, especially the countries of the Gulf Cooperation Council, China's growing diplomatic clout in the region and rising demand for fossil fuel imports, combined with partnerships on investment in clean energy and carbon capture, point to closer ties. But these must be balanced against relations with the US. For India, despite perceptions of deep-rooted competition and mistrust between the two, China represents a partner in climate diplomacy even as it remains a competitor for imports of fossil fuels and clean energy manufacturing. For South-East Asia, China is a key investor and partner in energy infrastructure overall, and clean energy manufacturing, even as the region maintains strong ties to the US.

The rapidly changing role of China in world energy politics makes it important and timely to review the topic. In this issue of the *Oxford Energy Forum*, we present insights and views from 18 experts from around the world, showcasing the broad range of views on China's geopolitical position and trajectory. The issue discusses the role of China and perceptions of it in the geopolitics of hydrogen, renewables, power grids, minerals, finance, and carbon, combined with regional perspectives from Russia, the US, the Middle East, Africa, South-East Asia, and India.

**Overview and sectoral perspectives**

The OEF begins with an essay from **Michal Meidan,** who unpacks some of the Chinese debates around the changes in energy politics and economics. In the Chinese analyses, the tone on the geopolitics of fossil fuels and new energy is shifting. The traditional analysis of the geopolitics of oil and gas—which was historically framed by a discussion of the dynamics between producers, consumers, and transit countries—is increasingly shaped by a 'de-globalization' lens and a view of different global groupings, pitting the US and China against each other. The debates around how to mitigate the vulnerabilities associated with the reliance on oil and gas continue, but all now include a recognition that ultimately, China will be less vulnerable as electrification accelerates. This, in turn, also brings industrial opportunities: building large renewable bases and ultra-high-voltage transmission lines to connect them as well as storage infrastructure and a robust energy internet. These priorities resonate with the central government's penchant for investing in industries of the future while moving very slowly on market reforms. Electrification, however, raises new concerns of cybersecurity and climate risks, but also leads to a new race, once again between developed and developing economies, over access to critical materials, technology, financing, and know-how. These analyses also point to a greater degree of involvement in global governance, as China champions the developing world and can lead in themes such as the energy-food nexus, where global leadership is currently perceived as lacking. Ultimately, geopolitical struggles and challenges will not go away as the energy transition evolves, but their nature is changing with competition between the West and the Rest clearly at the core.

From a Western perspective, diversification of supply chains is clearly one of the main challenges facing decarbonization, alongside decoupling from China or de-risking trade with that country. As renewable energy scales up globally, the sector has

become a new field of geopolitical competition and tension. This issue features three articles focused on critical materials and new energy supply chains. First, **Philip Andrews-Speed** traces the history of critical minerals policies, noting that China is not rich in materials or minerals, but its main advantage is in processing. Its pre-eminence in rare earth mining and processing was achieved through a combination of long-term industrial policy, state investment, export controls, low labour costs, and decades of weak environmental and safety regulation and illegal mining. Andrews-Speed argues that Western efforts to diversify critical materials supplies will only modestly reduce dependence on China through 2030, given the time needed to commission new mines and processing plants, but a sustained effort could eventually diminish China's dominance in these fields after 2030.

**Henry Sanderson's** piece points out the many unresolved policy questions about efforts to de-risk supply chains. For example, to what extent do advanced economies accept Chinese investment in local supply chains or shifting production to third countries? Despite resistance from a number of developing economies, China will seek to retain or increase its dominance in key fields, boost investment overseas, and use investment as an element of climate diplomacy—and in diplomacy overall. Further, China's long history of policies that lead to overcapacity typically result in boom-bust cycles that ultimately keep prices low and drive out competition. Hence, if China is destined to remain a low-cost manufacturer in many fields, what is the cost and political sustainability of efforts to diversify away from China? Ultimately, Sanderson expects the West to remain in a weak position in manufacturing supply chains, and calls for better strategy to balance the need to keep down costs long-term while pursuing near-term efforts at de-risking.

Also addressing the topic of critical materials, **Patrick Schröder** offers an assessment of EU efforts to diversify from Chinese supply chains in the energy field. Like Sanderson and Andrews-Speed, he notes that policy efforts along these lines, including recycling, can enhance supply chain resilience but will take sustained effort over many years. While he notes the costs of de-risking and diversification, he sees these as manageable. At the same time, the EU's trade and investment strategy also aims to secure access to critical materials while ensuring high environmental, social, and governance standards in mining and transparent trade practices. This interlocking set of policy responses has been described as a novel 'security-sustainability nexus' where policymakers and businesses are equating resource security and sustainability policies. Whether this approach will indeed generate the win-win partnership benefits for third countries will depend on high degrees of transparency in mining operations and bringing high-risk investments for higher-value economic activities to third countries. In the end, de-risking will require consideration of the needs of both producer and consumer countries, while closely monitoring China's industrial policies and continuing to engage with China bilaterally and in international settings.

While there is significant discussion about the effectiveness and cost implications of Western efforts to de-risk from China, trade barriers and supply chain diversification are also challenges for China's renewable energy manufacturers. **Herbert Crowther** notes that while China's dominance in renewable energy faces some uncertainty, China is set to retain its 'unavoidable presence' in global supply chains. But efforts in some regions to diversify sources of supply present Chinese renewable energy manufacturers with a dilemma of how to respond: focus on the domestic market and take advantage of local government support, or set up international manufacturing centres that satisfy requirements for market access to places like the US and EU. Ultimately, Crowther argues, China's renewables manufacturers will pursue a combination of both. With active local support for clean energy supply chain build-out, Chinese exports will continue to face trade barriers, suggesting that they will focus on the domestic market and on developing economies. At the same time, Chinese firms will continue to set up production overseas, even in the US; but in developed economies they will grapple with political risk and higher costs as well as the potential for export bans by the Chinese government. When expanding abroad, they could also face the risk of some technology transfer, but this will be a trade-off for expanding China's manufacturing footprint and enhancing its climate diplomacy, especially in Asia and the Middle East.

In a somewhat similar vein, even though China's hydrogen strategy is still very domestic-focused, it has growing international dimensions and some potential overlaps with the challenges faced by renewables manufacturers. **Rainer Quitzow** and **Xiaohan Gong** note that even though China is the world's largest hydrogen consumer, it has been a latecomer to green hydrogen. Its targets are not very ambitious compared to those of the EU, with the exception of fuel cell vehicles. However, provincial ambition on green hydrogen is larger than central government policy would imply, emphasizing how national targets are less important than the policy signal that pushes local governments and state-owned companies to experiment with green hydrogen. Further, hydrogen is a field where foreign investment is encouraged, given China's recognition that it needs to catch up with other countries in fields such as electrolysis and hydrogen transportation and storage. This implies active cooperation

with other countries on hydrogen technology and business models, but it also raises concerns abroad about technology transfer and industrial competition with Europe and others in the long term. In terms of global energy geopolitics, China is actively engaged on hydrogen with countries in Latin America, Africa, and South Asia, opening up a new playing field in energy geopolitics.

Even as Chinese investors look to South-East Asia, their efforts are increasingly complicated by international restrictions. Echoing Schröder's calls for increased coordination rather than fragmentation and competition, **Ji Chen and Shurui Jiang** discuss the role of finance as a factor setting the pace of the energy transition, especially in the developing world. They foresee substantial risk that the fragmentation of clean energy markets resulting from industrial policy and trade disputes will result in both higher technology costs and more difficulty in financing clean energy projects. They note that financing costs for renewable energy projects are already high in many parts of the developing world. But China is the sixth-largest investor in developing countries' clean energy sectors, and its role is set to grow, especially as financing for coal-fired power projects is discouraged. They see China's role in financing the energy transition in the developing world as a positive factor, opening up the possibility of a more rapid energy transition in these regions, but equally note that rising protectionism in supply chains has led to increased investment and trade barriers, which have imposed greater transaction costs for China's financing to developing countries too.

Turning to trade, on carbon markets, **Yan Qin** discusses the overall near-term and long-term impact of the Carbon Border Adjustment Mechanism (CBAM). While she notes that for a decade the CBAM will mostly affect aluminium and steel exports from China, and these sectors will undergo a transitional period when only greenhouse gas emissions reporting is required and the impact is estimated to be limited, the CBAM is nevertheless an important external factor pushing Chinese energy-intensive enterprises to speed up decarbonization and the deployment of more green energy. Meanwhile, at the international level, the CBAM is likely to continue to act as a source of tension between China and the EU, with China arguing that it represents a unilateral and discriminatory trade practice that goes against the principles of common but differentiated responsibilities and climate cooperation.

When thinking of changes in China's appetite for overseas infrastructure investments, **Dan Marks** argues that these are not solely determined by geopolitics. Marks writes that while China's investments in Africa have diminished for a variety of reasons, this results from an inevitable maturation of the Chinese investment approach to the continent rather than from a strategic shift. Chinese investment since the early 2000s was more opportunistic than strategic—despite perceptions to the contrary—resulting in poor returns and high risk due to lack of experience. Funding patterns are shifting towards more commercially oriented institutions rather than export-led or state-led deals. For some African governments, Marks writes, 'the shine has also worn off Chinese money', given past experiences with costly buried loan clauses and political backlash over Chinese labour practices. Crucially, however, Chinese financing remains an important alternative to Western capital or development finance, and investment funding overall is unavailable at the scale required for the clean energy transition in Africa. Geopolitically, therefore, China's changing role in the Africa energy picture is less of a political threat and more of an opportunity for beneficial development.

In a similar vein, **Muyi Yang, Xunpeng Shi, and Weihua Wang** view South-East Asia more as a field of cooperation than of tension. According to them, the energy transition could 'serve as a bridge for fostering cooperation between major powers or, at the very least, establishing channels of communication between them, a modest but essential step towards managing geopolitical divides'. Given that South-East Asia relies on fossil fuels for 80 per cent of its energy needs, and needs financing to meet its energy demand growth and expand clean energy, the region needs help from all sides. Both China and the West can provide needed investment, advice on regulatory matters, and capacity building. For China, South-East Asia offers an attractive base for manufacturing, helping boost the case for cooperation. As for traditional Western trading partners in the US, Europe, and Australia, the region can benefit from private sector investment, capacity building, and development finance.

Underpinning many of the geopolitical shifts and challenges discussed in this issue are the deteriorating relations between the US and China. **Jane Nakano** turns to the topic of US-China relations, where rising political and diplomatic tensions are playing out across the fields of trade and technology. While China leads by far in manufacturing of clean energy and is dominant in critical materials, China is also competing strongly in technology and innovation, threatening what had been a major source of strength for the US economy. Still, Nakano believes that US-China energy relations are not a zero-sum game. Carbon capture and storage remains an area of collaboration, including on CCUS (carbon capture, utilization, and storage) projects inside China

and in third countries. Even in the electric vehicle sector, where the US has erected new trade barriers and initiated subsidies in a bid to better compete with China, the two countries are also seeing business deals and increased integration, in both directions. However, dependence on China for technology is widely perceived as problematic in the US, with a bipartisan consensus that the US must react to China's industrial policies and state capitalism. This has led to a climate of distrust that could lead to costly policy choices, according to Nakano.

The deterioration in US-China ties creates uncertainties for China's future economic growth and energy demand, which in turn impacts the backbone of China's relations with the Gulf Cooperation Council (GCC). **Dongmei Chen** discusses the evolution of relations as the energy transition unfolds. The growing importance of China-GCC relations is largely attributable to their aligned economic agendas: their needs for investment and trade, boosting oil and gas flows, and cooperating on low-carbon technologies, especially CCUS. China seeks to secure oil and gas supplies, build out infrastructure connectivity, and enhance cooperation on nuclear energy, new energy, and space satellite technology. According to Chen, this fits in with the Gulf region's desire to achieve economic diversification and sustainability, building on their geographical location connecting Europe, Asia, and Africa for global trade, finance, logistics, and tourism. While viewing the growing ties in a positive light, Chen does note some important outstanding questions, such as how China and the GCC will balance relations with other strategic energy partners (respectively, Russia and the US), how the GCC countries can coordinate relations with China as a bloc and at the individual state level, and to what extent the GCC countries can improve regional coordination on policy and infrastructure in order to best scale up new technologies.

Shifting to Russia, **Sergey Vakulenko** delves into the long history of Russia-China energy trade and cooperation, noting that while China is a natural partner for Russia, there are also deep and long-lasting tensions. Russia has few viable large alternatives to the China market, and is dependent on imports from China—exacerbating historic tensions about giving too much control of Russian resources or the economy to China. For China's part, although Asia has gained new access to low-cost energy supplies from Russia, China has always been historically wary of becoming too reliant on Russian energy supplies. The sudden availability of large volumes of low-cost energy resources creates a conundrum for Chinese policymakers. The traditional approach of portfolio diversification would dictate limiting the Russian share of the Chinese supply, while cost reasons might nudge towards an increase. At the same time, the use of the Chinese currency to pay for Russian oil and gas is also an advantage for China. Vakulenko argues that the volume of trade between China and Russia is such that it might create a new regional standard and a working currency different from the currently predominant US dollar. Ultimately, Vakulenko says the Ukraine war has created new geopolitical dynamics, 'tipping the balance resolutely in China's favour' and creating an important new factor in global energy politics comparable to the longstanding US-Saudi Arabia connection in the twentieth century.

Related to this point, the appeal of Russian gas in China is still an open question. The deterioration in US-China relations and volatility in global markets following the Russian invasion of Ukraine have led China to focus on energy security and, as it relates to gas, on domestic consumption. But despite this, China will remain heavily exposed to global markets. **Neil Beveridge** notes that despite the weakness in China's gas consumption in 2022, the country's appetite for gas is likely to remain strong, as evidenced by ongoing efforts to sign long-term supply agreements for oil and gas. China's own targets imply nearly 50 per cent growth in gas demand by 2030 from 2022 levels. This means import dependence is set to rise, though domestic production is likely to increase steadily too. For imports, Beveridge estimates that incremental imports are likely to be split about equally between LNG and pipeline gas. The Power of Siberia 2 pipeline is the largest single project that could bring on additional supplies, but the Ukraine war and sensitivities about diplomatic considerations are likely to prevent any big announcements on Power of Siberia in the near term, while the urgency to secure it is somewhat diminished by progress on Central Asia Line D. On LNG, China will remain the largest incremental buyer of new supplies, with Qatar and the Mideast benefitting the most, but Australia and the US also represent potential sources of additional supply, despite ongoing trade and diplomatic tensions.

Finally, turning to India, **Mohua Mukherjee** views the present phase of energy geopolitics as creating both converging and diverging interests. India's overall energy relationship with China can be seen as including both collaboration and competition. Areas of converging interests include their similar positions on climate change policy and acceptance of the role of fossil fuels in bridging the energy transition. Areas of divergence and competition include obtaining imports of low-cost fossil fuels, often from some of the same supplier countries, as well as on industrial policy towards clean energy, where India has the potential to become a major manufacturer. On a positive note, Mukherjee notes that the two countries are actively engaged on a variety of issues in various multilateral institutions and associations. And, as for competition on manufacturing, India has shifted from a

policy of erecting trade barriers and tariffs towards greater support for domestic manufacturing, which could be seen as less threatening in the long term even if the aim is similar.

**Perspective and outlook**

Overall, the articles in this issue of the OEF capture a snapshot of energy geopolitics at a time of rapid transition. They highlight the contradictions between government policies that are pointing towards a greater fragmentation of trade and markets looking to adapt both trade and investment flows accordingly. Similarly, rising concerns over supply chain security are creating new opportunities but risk raising costs and slowing the energy transition. And in many instances, China's relations with its largest energy trading partners are affected by a mix of convergent and divergent interests. For each sector, and for each region, there exists a different picture of China's role in the world and diverse views of China's position. Meanwhile, the view from China is more complex than often recognized in Western debates. The deterioration in US-China ties and rising protectionism in green trade are reshaping the global energy landscape, making this a time of increased uncertainty, risk, and potentially opportunity.

## HOW CHINA THINKS ABOUT ENERGY SECURITY UNDER THE ENERGY TRANSITION

***Michal Meidan***

Following the Russian invasion of Ukraine, concerns about energy security—both the availability and affordability of supplies—have become central to policymaking in Europe, leading to debates about the urgency of the energy transition and the extent to which the energy trilemma is being reframed. In reality, however, the three elements of the trilemma—availability, affordability, and sustainability—remain closely linked as energy security policies and the energy transition are feeding into industrial policies, as governments look to accelerate their energy transitions and support the development of industries of the future in their national jurisdictions.

Meanwhile, the Covid-19 pandemic and ensuing concerns in the West about market concentration for a large number of goods in China have increased the frequency of discussions about 'decoupling' between China and the US (reframed more recently as 'de-risking'). Decarbonization and de-globalization are increasingly central to energy policies and framing the geopolitics of energy, while the Russian invasion of Ukraine has further highlighted energy security, geopolitical risk, and market volatility.

China's energy security concerns are also closely linked to these trends: China is a leading importer of oil and gas, so its energy supplies are exposed to price volatility, which is exacerbated by supply shocks due to instability in producer countries, transportation bottlenecks, and sanctions. But as China has established itself as the world's leading manufacturer of renewable energy sources, and as the energy transition gathers momentum, China's energy security opportunities and challenges are evolving. Electrification is set to reduce China's oil and gas demand, but questions around power sector flexibility and resilience as well as access to critical materials are becoming more dominant. In addition, viewed from China, access to capital and technology are emerging as the key battlegrounds for the industries of the future.

This article lays out some of the key themes that emerge from the academic literature and specialized press in China about energy security and the geopolitics of energy. While it is by no means an exhaustive account of debates in China, it seeks to highlight a number of emerging trends.

**A diminishing threat from oil and gas**

Debates about energy security in China have long revolved around oil and gas. Since China became a net oil importer in the 1990s, the government has sought a variety of commercial, diplomatic, and strategic tools to mitigate the vulnerabilities associated with it.[1] Contemporary analyses still highlight the need to manage this exposure by increasing output of domestic oil and gas—which is currently the main focus of government policy documents—while also arguing that the electrification of end uses will reduce China's reliance on oil and gas.[2]

[1] Meidan, M. (June 2023), *The Outlook for China's Fossil Fuel Consumption under the Energy Transition and Its Geopolitical Implications*, OIES Paper CE8, https://www.oxfordenergy.org/publications/the-outlook-for-chinas-fossil-fuel-consumption-under-the-energy-transition-and-its-geopolitical-implications/.

[2] Zhongquan, M. (16 July 2021), 'World energy order and geopolitical dynamics', https://brgg.fudan.edu.cn/articleinfo_3708.html; Hongyuan, Y. (2019), 'Challenges and responses to China's energy security in the new era', *West Asia and Africa*, 4.

There are different views about the best approach for China in order to achieve security of oil and gas supplies. Some argue for a diversified, stable, and reasonably priced energy supply system domestically,[3] others suggest that China should play a more proactive role in global governance to ensure the stability of producer countries, while still others argue for a greater role for China in financial flows and transactions.[4] None of these arguments are new, and all have been pursued with different levels of central government commitment and success in the past. For example, the creation of a diversified, stable system that focuses on storage and flexibility is mentioned in policy documents (including the 14th Five Year Plan); policy implementation to date has tended to focus more on ensuring supplies through production and stockpiling rather than through price reform and introducing more market mechanisms.

The foreign policy tone of the discussion is notable as it argues for a more prominent role in global governance, and likely dovetails with developments in China's broader foreign policy stance. China's exposure to the Middle East and Central Asia for oil and gas respectively is discussed, as are some of the concerning developments in these regions—including the political turmoil created by lower incomes following the Covid-19 pandemic and the Russian invasion of Ukraine, foreign interference (by both the US and Russia), and the political uncertainty generated by the energy transition. Analyses note that geopolitical developments over the past few years (implicitly the decoupling risk) have also changed the nature of the geopolitics of fossil fuels. Traditionally, these have been analysed through the dynamics between three main groupings: oil and gas producers, consumers, and transit countries.

Another divide is now discussed by Chinese authors: the rivalry between the West and China, or even between the West and the rest of the world. Following the Russian invasion of Ukraine, the argument goes, Western countries are forming a club based on their civilizational identity, bringing in countries with shared values and excluding countries such as China, Russia, Venezuela, Iran, Cambodia, Hungary, Cuba, North Korea, and other countries that 'dare to confront their bullying and coercion'.[5] This notion of clubs—that are formed based on varying attributes—is repeated in other analyses of energy rivalry. This is interesting because Chinese analysts discuss energy security for both fossil fuels and new materials through a decoupling lens that pits the US and China squarely against each other in the competition for access to fossil fuels and for the leadership of the energy transition.

While the US is clearly on the other side of any geopolitical divide, there is also some caution with regards to Russia. Not only is its interference in the Middle East noted as a complicating factor, but in the oil and gas space, authors suggest gas flows from Russia should be limited to around one-third of China's total imports while flows from Qatar and even Turkmenistan and Iran should increase. The flurry of LNG supply deals between China and Qatar seems to be reinforcing the need for less geopolitically contentious flows just as progress on the Line D pipeline from Central Asia also emphasizes these priorities. So, even though Russian supplies are expected to play a prominent role in China's imports, there is also recognition that it should be capped.

Chinese analysts also suggest that China should limit its imports from the US and allies to around 5 per cent of total imports and that even a reliance on Iraq for 11 per cent of China's oil imports is too high. They argue that imports from the Middle East should not rise and should even decrease slightly in favour of greater flows from Africa, South America, and East Asia—and that no single oil producer should gain more than 20 per cent market share in China,[6] a limit that seems to be adhered to at present but could become more challenging to maintain going forward. The extent to which these geopolitical ambitions are rooted in commercial and operational realities remains to be seen.

Finally, beyond relations with producer countries and regions, the discourse on China's role in global governance seems to be increasingly backed by action. There have long been calls for China to play a more significant role in global energy governance;

[3] Daojiong, Z. (March 2023), 'How to improve the national energy resilience capacity', National School of Development, Peking University, https://cnisscad.pku.edu.cn/gd/529129.htm.
[4] Yujie, G. (20 October 2022), 'Accelerate the construction of energy internet to help improve China's energy security and resilience', http://www.coalchina.org.cn/index.php?m=content&c=index&a=show&catid=82&id=143416; Jin, X. (10 March 2022), 'Ten revelations from the Russia-Ukraine conflict concerning China's energy security, https://interpret.csis.org/translations/ten-revelations-from-the-russia-ukraine-conflict-concerning-chinas-energy-security/; 'China's energy security in light of three factors' (9 April 2023), Shanghai Petroleum and Gas Exchange, https://finance.sina.com.cn/money/future/roll/2023-04-09/doc-imypumwi4716190.shtml.
[5] Li, X. (March 2023), 'The civilisational rivalry underpinning energy politics in the context of the Russia-Ukraine conflict: features and recommendations', *The Paper*, https://www.thepaper.cn/newsDetail_forward_22288283.
[6] Zhongquan, M., 'World energy order and geopolitical dynamics'.

and even though foreign policy statements are vague on what this could look like, the Chinese leadership seems more intent on projecting itself as an active mediator in global political hotspots (such as the peace deal between Iran and Saudi Arabia, and recent talks with Israel and the Palestinian Authority, and even between Russia and Ukraine). The stability of oil- and gas-producing countries and regions may not be the sole driver of these efforts (and their effectiveness is still a very open question), but the rhetoric seems to be backed by more activity than at any time in the past. The view is also that China can promote global governance on the food/energy/climate nexus, where leadership under the United Nations is currently lacking. This is novel in that it encompasses a broader view of the energy/food security nexus (which is also reflected in domestic policy documents), but also in that it builds upon the new geopolitical divisions identified by Chinese scholars.

**Electrification and coal—two critical factors**

Notwithstanding these debates about how to manage current exposures, China's energy insecurity has in the past stemmed from domestic policies rather than from international supply cut-offs. In this sense, electrification remains key to enhancing China's energy security and increasing its self-sufficiency, but if ill-managed, could be a vulnerability. Given the rapid deployment of renewables in China, there is considerable discussion about a New Power System for the country. The concept was rolled out in March 2021 as a key part of China's zero-carbon future, but any detailed and concrete consensus on what this means has not been published. Broadly speaking, though, the New Power System recognizes the need for continued growth in electricity consumption, with new energy at its core. Even though renewable power sources are being added rapidly, many are concentrated far from load centres, and since power market reforms are still in progress, coal will still remain critical.

At the same time, the New Power System will need to ensure the extensive and balanced development of green power, support the development of large-scale energy storage as a source of flexibility, and use digital technology and artificial intelligence to enable a smart electric power grid. Demand is also discussed as a participant in system balancing but seems to receive less attention than other, supply-side, priorities.

Part of the challenge lies in the government's own desire to promote large energy bases, discussed in the 14th Five Year Plan too. These bases include large wind and solar parks in northern China and hydropower bases in the south as well as offshore wind along the east coast, connected through long-distance transmission lines with—in most cases—'supporting' coal power plants. Underpinning this system is innovation in energy storage and a critical balancing mechanism: the energy internet.[7] Storage is discussed in passing in analyses focused on energy security[8]—although government policies are focusing heavily on storage, including hydrogen—while carbon capture, utilization, and storage is highlighted in analyses more than in policy support.

Critically, the energy internet is discussed as a means to resolve power outages and deal with the intermittency of a renewables-based energy system, but also as a source of economic growth, job creation, and industrial development. Unsurprisingly perhaps, authors from the State Grid tend to promote these notions and emphasize the energy internet as much as, or even more than, power price reforms as a means of effectively balancing supply and demand. This isn't to minimize the debate about power price reform in China, only to note that in the context of energy security and the geopolitics of energy, the industrial policy lens is significant.

Despite various points of debate, there is clear consensus on the importance of coal, which is mentioned without fail as the backbone of the Chinese energy system and the key to grid reliability and flexibility. This is reflected in policy documents, ranging from the 14th Five Year Plan to government work reports that have over the past few years gradually increased the importance of coal, as seen by the approval of large coal-fired power plants and increases in coal mining in China.

**A new geopolitical landscape**

Electrification enhances self-sufficiency, and with China's growing confidence in its ability to manufacture and deploy renewables, it is increasingly seen as a means to energy security. But electrification also poses a number of challenges and

[7] Gao Yujie, "Where will China's energy security and resilience come from?" (我国能源安全韧性从哪里来?), 20 October 2022, http://www.coalchina.org.cn/index.php?m=content&c=index&a=show&catid=82&id=143416

[8] Jianliang, W. (November 2022), 'China's energy security under the changing situation: challenges and breakthroughs', *National Governance Weekly*, http://www.rmlt.com.cn/2022/1108/659671.shtml.

risks. First, renewables are vulnerable to climate risks,[9] and cyber-attacks are a threat to electricity networks. The analyses reviewed raise the issue of intentional power cuts, as seen in Ukraine in 2015,[10] stating that power-exporting countries could, in the future, cut off flows on transnational power grids.

But the most frequently discussed themes of the new geopolitical landscape are access to critical materials, financing, and technology. The energy transition does not reduce the importance of geopolitics, it merely changes the actors and the dynamics. As rivalry around access to fossil fuels might ease, it will intensify around access to critical materials and key metals (such as copper and nickel).

While authors note concerns in the West about China's dominance in the processing of rare earths and batteries, there is no mention of how China should respond to these concerns. This is due to a combination of factors. First, these geopolitical concerns have only recently risen to the fore in a concerted and systematic way in Western policymaking and resonate less in China, given that China is already well established in both the mining of critical materials and their processing. Second and perhaps more importantly, China's National Plan for Mineral Resources dates back to 2016 and discusses a range of mineral resources, classifying some as 'strategic' and others as 'advantageous', 'protected', or 'strategic emerging industry' minerals, but China does not have a critical minerals list.

For the different categories of minerals, the Plan identifies where China needs to encourage exploration of minerals in short supply, regulate the amount of minerals that China can leverage to pursue strategic objectives, cut production of minerals with excess capacity, and ensure supply of minerals in strategic emerging industries. The Plan identifies three broad categories:

- energy minerals—oil, gas, shale gas, coal, coal bed methane, and uranium;
- ferrous minerals—iron, chromium, copper, aluminium, gold, nickel, tungsten, tin, molybdenum, antimony, cobalt, lithium, rare earths, and zirconium;
- non-ferrous minerals—phosphorus, potash, crystalline graphite, and fluorite.[11]

This list includes metals and minerals that are excluded from developed economies' lists of critical materials but also excludes a number of materials often cited by developed economies (such as vanadium, tellurium, niobium, and others that are used in hydrogen, solar photovoltaic, or wind turbines). So while advanced manufacturing economies with a high dependency on imported raw materials include supply risk as a key parameter, Chinese assessments of 'strategic minerals' use a broader, more flexible set of criteria in which some 'strategic minerals' are subject to supply risk and others are not.[12] On the contrary, the availability of minerals in China give the country leverage. Beyond the strategic emerging industries, though, there are to date no policies aimed specifically at energy-transition-related minerals. To be sure, China's industrial policies—aimed at encouraging the creation of supply chains in China as well as (in some cases) for overseas investments in mining—are now effectively a template used by the West.

Access to critical materials is discussed as a future flashpoint, but analyses note that power system nodes, hubs, and standards are set to replace pipelines and shipping routes for oil and gas as key areas of competition. Equally, technology and financing will be key, but incumbents (mainly developed economies) seek to slow technology transfers and financial flows to the global South in a bid to maintain their dominance in energy trade. The world, therefore, is fragmenting in many different ways and along different fault lines, impacting developing countries' ability to engage in the energy transition and enhance their security.

**Conclusion**

The analyses cited by no means provide a comprehensive overview of the energy security and geopolitics-of-energy debate in China. But they point to a number of new interesting trends. First, the traditional analysis of the geopolitics of oil and gas is

[9] Gao Yujie, "Where will China's energy security and resilience come from?" (我国能源安全韧性从哪里来?), 20 October 2022, http://www.coalchina.org.cn/index.php?m=content&c=index&a=show&catid=82&id=143416 "China's energy security in light of three factors", (三因素叠加下的中国能源安全), Shanghai Petroleum and Gas Exchange, 9 April 2023, https://finance.sina.com.cn/money/future/roll/2023-04-09/doc-imypumwi4716190.shtml

[10] Shoujun, C., et al. (2020), 'Major technological changes and transformations in the geopolitics of energy', *Journal of Natural Resources*.

[11] China Ministry of Natural Resources (November 2016), 'China's 24 strategic minerals', https://www.gov.cn/xinwen/2016-11/30/content_5140509.htm.

[12] Andersson, P. (2020), 'Chinese assessments of "critical" and "strategic" raw materials: concepts, categories, policies, and implications', *The Extractive Industries and Society* 7, pp. 127-137

increasingly being shaped by a de-globalization lens and a view of different global groupings, pitting the US and China against each other. Second, the focus is clearly shifting to electrification and the industrial opportunities it brings: building large renewable bases and ultra-high-voltage transmission lines to connect them as well as storage infrastructure and a robust energy internet.

These priorities resonate with the needs of the incumbents (namely State Grid) to maintain their dominance as the country undertakes the energy transition, but also with the central government's penchant for investing in new industries of the future while moving very slowly on market reforms. This raises new concerns of cybersecurity and climate risks, but also leads to a new race, once again between developed and developing economies, to gain access to critical materials, technology, financing, and know-how.

## CRITICAL MINERALS FOR THE LOW-CARBON ENERGY TRANSITION: WHY CHINA MATTERS

***Philip Andrews-Speed***

The important role played by China in many mineral supply chains came to wide attention in 2009 due to the imposition of export controls by the government. In response, the United States (US), the European Union (EU), and Mexico complained to the World Trade Organization in what became known as the China – Raw Materials dispute. The case involved nine materials including three relevant to the low-carbon energy transition (manganese, silicon metal, and zinc). The decision went against China, even after appeal. This was closely followed in 2012 by the China – Rare Earths dispute, brought to the World Trade Organization by the US, the EU, and Japan. This was triggered by China's imposing export quotas on rare earths, tungsten, and molybdenum. Once again, the panel decided against China.

Since that time, China has been steadily increasing its presence along the supply chains of several non-fuel minerals. Many of these minerals are seen as being important to the low-carbon energy transition due to their role in the manufacture of electric vehicles, wind turbines, solar panels, and other devices. Some are also required by the defence industry. As the urgency and required scale of the energy system transformation has become increasingly apparent, so projections of future demand for key minerals have been drawing the attention of policymakers around the world. In this context, China is seen as a key threat due its strong presence along these supply chains, and governments of industrialized nations have started taking steps to reduce their dependence on China.

The earliest use in the industrial era of the terms 'strategic' and 'critical' as applied to non-fuel minerals was 1939, when the US passed the Strategic and Critical Mineral Stockpiling Act in response to the start of World War Two. These minerals were identified on the basis of their importance to the military and the wider economy. In 1979, the Department of the Interior published a list of 35 minerals and mineral groups deemed critical. However, by this time, most of the pre-existing mineral stockpile had been sold to private businesses. The European Commission started publishing lists of critical minerals in 2014. The latest update, in 2020, contained 30 minerals. In the specific context of the low-carbon energy transition, the International Energy Agency (IEA) published a study in 2021 demonstrating the criticality of 12 minerals and mineral groups.[13]

This article examines China's role in the upstream sections of the supply chains for the 12 minerals and mineral groups identified by the IEA—as well as the metal tellurium, which is a component of cadmium-tellurium photovoltaic (PV) cells and for which China refines more than 50 per cent of the global supply.

The IEA's list of critical minerals is only one of many such compilations and is global in scope. The US, the EU, and the United Kingdom have all published their own lists in recent years that reflect their specific conditions.[14] The manufacture of low-carbon industrial products and equipment is not included in this study, though China also plays a major role in many cases. Suffice it to

[13] International Energy Agency (May 2021), The Role of Critical Materials in Clean Energy Transitions, The Role of Critical Minerals in Clean Energy Transitions – Analysis - IEA

[14] 'Final list of critical minerals 2018', *Federal Register,* https://www.federalregister.gov/documents/2018/05/18/2018-10667/final-list-of-critical-minerals-2018; EUR-Lex - 52020DC0474 - EN - EUR-Lex, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0474; https://www.bgs.ac.uk/download/uk-criticality-assessment-of-technology-critical-minerals-and-metals.

say that China's growing capacity to manufacture these goods is drawing heavily on international markets for critical minerals, and that itself threatens availability for other users.

**China has large geological reserves of only two minerals**

China's strong position along these supply chains does not arise from abundant geological reserves. Of the 13 minerals shown in the table below, it has a significant share of global geological reserves for only two: rare earths and molybdenum. In addition, China is currently the only major miner of heavy rare earths, which are in high demand for permanent magnets. Accumulations of heavy rare earths in high concentrations are relatively rare and tend to occur in weathered surface materials. Such weathered clays occur in large quantities across southern China. In contrast, rare earth accumulations in hard rocks tend to be rich in light rare earths and poor in heavy rare earths.

For all the other minerals in the table, China's geological reserves are either modest at around 15 per cent of the global total or less than 10 per cent. Data is not available for silicon, as the source material (sand) is available in large quantities in many countries.

**China's proven geological reserves and output from mines and processing plants as shares of global totals in selected supply chains. Data from different years 2020-2022.**

| | Technology | Reserves | Mine output | Processing and refining output | Mining interests overseas |
|---|---|---|---|---|---|
| Rare earths | Wind, EV | 34% | 70% | 90% | |
| Molybdenum | Wind | 31% | 40% | ? | |
| Silicon | PV | | 68% | 69% | |
| Graphite | EV | 16% | 65% | 100%[a] | |
| Zinc | Wind | 15% | 32% | 46% | Australia |
| Manganese | EV, wind | 16% | 5% | 95% | Gabon |
| Cobalt | EV | 2% | 1% | 73% | DRC |
| Lithium | EV | 7% | 15% | 55% | Australia, Latin America |
| Tellurium[b] | PV | 9% | | 53% | |
| Copper | EV, wind, PV, networks | 3% | 8% | 42% | DRC, Zambia |
| Nickel | EV, hydrogen, geothermal | 2% | 3% | 35% | Indonesia |
| Chromium | CSP, geothermal | Negligible | Negligible | ? (large) | Zimbabwe |
| Platinum group | Hydrogen | Negligible | Negligible | ? (small) | South Africa, Zimbabwe |

Notes: All numbers are approximate. Yellow shading = 25–50%; orange = 50–75%; red = 75–100%. EV = electric vehicles; PV = solar photovoltaics; CSP = concentrated solar power; DRC = Democratic Republic of the Congo.

[a] This refers to high quality spherical graphite. [b] Tellurium is a by-product of copper mining.

Sources: for reserves and annual mine output, US Geological Survey (31 January 2023), *Mineral Commodity Summaries 2023*, https://www.usgs.gov/publications/mineral-commodity-summaries-2023; for processing and refining output, International Energy Agency (May 2021), *The Role of Critical Materials in Clean Energy Transitions,* The Role of Critical Minerals in Clean Energy Transitions – Analysis - IEA. Many other online sources were used for additional data on individual minerals that were missing from these sources.

Caveats are necessary for any discussion of global geological reserves. First, the scale of reserves varies depending on the price fetched by the mineral. Prices rise and fall as the balance between supply and demand fluctuates. Second, the quantity of reserves varies with the cost of extraction. Falling costs achieved through increased scale of production, improved production technology, state subsidies, or weak environmental and safety regulation will enhance reserves. Finally, more geographically extensive or technologically advanced exploration can boost the level of proven reserves, especially in little-explored regions of the world. For these reasons, data on geological reserves are only a very rough snapshot at a certain point in time and provide very little information on future potential. It is certain that increasing demand for some or all of the minerals required by the energy transition will result in the successful identification of new geological reserves.

**China's advantage comes from the scale of its mining and processing**

Despite the relatively modest scale of its geological reserves for most of the critical minerals under discussion, China has built a disproportionately strong position in the annual output of its mines and processing facilities. It is a global leader in several minerals in these parts of the supply chain, most notably rare earths. Despite hosting only 34 per cent of the world's identified geological reserves of rare earths, China accounts for about 70 per cent of annual mine output and 90 per cent of processing and refining to produce rare earth metals. Most companies that mine rare earths in other countries send their ores (after beneficiation) to China. The major exception is Lynas, which has built a processing plant in Malaysia for rare earth ores from its Mount Weld mine in Australia. Elsewhere, Estonia has a small refining facility, and France hosts a plant for recycling rare earth metals.

China's pre-eminence in rare earth mining and processing was achieved through a combination of early moves into the industry, state investment along the full length of the supply chain including research and development, export controls, low labour costs, and decades of weak environmental and safety regulation and illegal mining and processing.

Aside from rare earths, China's share of global annual mine production is significant for only four minerals: silicon, graphite, molybdenum, and zinc. The country's share of global processed silicon is roughly in proportion to its mine production. In contrast, China is reported to account for 100 per cent of the world's output of spherical graphite, which is used for battery anodes.[15] The share of global zinc supply processed in China is also much larger than the share of global mine production.

There are seven minerals for which China's geological reserves and mine output account for a modest or small share of the global total. Nevertheless, the country has succeeded in becoming the dominant, or at least a major player in the processing and refining of these minerals. The shares of global output range from 95 per cent for manganese to 35 per cent for nickel. This strong position in processing and refining arises, in part, from the government's Go Out policy, which started in 1999 and encouraged state-owned enterprises (SOEs) in several industries to invest overseas. This policy had two main objectives: to build the SOEs into major international players and, in the case of natural resource industries, to secure access to raw materials to support the country's economic growth.

Examples of substantial Chinese overseas mining interests include copper and cobalt in the Democratic Republic of the Congo and Zambia, lithium in Australia and Latin America, nickel in Indonesia, manganese in Gabon, zinc in Australia, platinum in South Africa, and chromium in Zimbabwe. Much of this ore is shipped back to China for processing and refining. Moreover, the SOEs have steadily taken advantage of their low labour and energy (coal) costs and soft budgetary constraints to build processing and refining capacities in China that exceed the requirements of the domestic economy. This is equivalent to what has occurred in the oil industry, where China's refining capacity now exceeds its domestic demand for oil products.

The platinum group metals, principally platinum and palladium, appear to be an exception. South Africa hosts 90 per cent of the world's geological reserves of these metals, and accounts for 75 per cent of global production of platinum and 40 per cent of palladium. Russia is the other major source of supply. China's reserves and mine production are very small, though precise numbers are difficult to find. Processing and refining capacity is probably modest and includes a plant opened by Johnson Matthey in 2016.[16] China has compensated for these weaknesses by importing large quantities of platinum, pushing the global market into deficit—a deficit which has been exacerbated by sanctions on Russia. China is now believed to hold 85 per cent of the world's stocks of platinum, up from less than 5 per cent four years ago.[17]

**What are other countries doing to reduce their reliance on China?**

A combination of deteriorating relations with China and rising demand for minerals critical to the low-carbon transition has led industrialized countries to take steps to reduce their reliance on China for these minerals. Actions include imposing import restrictions, incentivizing domestic investment and production, stockpiling, and building partnerships with other countries. An

[15] 'Graphite emissions fuel search for solutions along EV supply chain', *S&P Global Market Intelligence*, https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/graphite-emissions-fuel-search-for-solutions-along-ev-supply-chain-69599516.

[16] 'Johnson Matthey opens new platinum group metal refinery in China', Johnson Matthey, https://matthey.com/en/news/2016/johnson-matthey-opens-new-platinum-group-metal-refinery-in-china.

[17] 'Platinum market expected to hit record deficit this year', *Financial Times*, https://www.ft.com/content/01352385-372f-4b79-9446-a03c518ba28a?desktop=true&segmentId=7c8f09b9-9b61-4fbb-9430-9208a9e233c8#myft:notification:daily-email:content.

additional priority is research and development to identify alternatives to the currently used minerals, enhance their efficiency of use, and expand recycling.

The US is the most active country in this regard. In February 2021, President Biden signed an Executive Order on America's Supply Chains. Eleven months later, a bipartisan bill was introduced in the Senate to block US defence contractors from buying Chinese rare earths and allowing the Pentagon to build a stockpile. By February 2022, the Department of Defense had invested over US$100 million in US rare earth supply chain resilience. In September 2022, the Department of Energy issued a call for bids for a Rare Earth Demonstration Facility (US$156 million) for the extraction of rare earths and other critical minerals from unconventional sources such as mine waste.

The 2022 Inflation Reduction Act also provides a range of policy instruments. It includes a tax credit of 10 per cent of the production cost for critical components and allows the Department of Energy to provide up to US$40 million in loan guarantees for critical materials projects. The president may direct up to US$500 million of economic incentives to critical materials, which President Biden did in designating battery materials as a priority for domestic manufacturing under the Defense Production Act.

The Inflation Reduction Act also includes targets for the percentage of battery materials that should come from the US or free-trade-agreement partners. Starting in 2025, to be eligible for US purchase subsidies, an electric vehicle battery may not contain any critical minerals that were extracted, processed, or recycled by a 'foreign entity of concern'—presumably including China. The Department of Energy's Critical Materials Institute, founded in 2013, has expanded the range of minerals and materials it researches. Together, these policies are stimulating investment in new mines and plants for processing and recycling. In addition, the Defense Logistics Agency is building up stockpiles not just of ores and metals but also of intermediate goods such as NdFeB (neodymium-iron-boron) permanent magnets.[18]

Australia and Canada are two other industrialized countries where investment in new mining and processing capacity is increasing. Likewise, mining companies from various countries are increasingly active in their search for commercial accumulations of critical minerals across Africa and Latin America.

In 2023, the EU published a draft Critical Raw Materials Act that includes targets for 2030 that specify benchmarks of 10 per cent, 40 per cent, and 15 per cent, respectively, for the amount of mineral extraction, processing, and recycling that should take place in the EU. The Act sets a 65 per cent threshold for the maximum annual consumption from any stage of production or processing that can come from a single third country. It requires monitoring of critical raw materials supply chains, coordination of strategic raw materials stocks among member states, and auditing/stress-testing of strategic raw materials supply chains for large companies.

Realizing that international cooperation was needed, the US led the establishment of the Minerals Security Partnership in June 2022 to 'bolster critical mineral supply chains essential for the clean energy transition'. The first meeting, in September 2022, was attended by official partners Australia, Canada, Finland, France, Japan, the Republic of Korea, Norway, Sweden, the United Kingdom, the US, and the EU. Mineral-rich countries such as Argentina, Brazil, the Democratic Republic of the Congo, Mongolia, Mozambique, Namibia, Tanzania, and Zambia also attended.

Two trends, in particular, should help reduce dependence on China. The first is reducing or obviating the need for supplies of critical minerals. This includes developing sodium-ion batteries for electric vehicles and permanent magnets free of rare earths,[19] as well as increasing the efficiency of use and recycling of the materials. The second trend involves the increasing support given to promoting the domestic production of renewable energy equipment and electric vehicles in the US and Europe, which should result in growing capacity to process and refine metal ores.

Taken together, these moves mark a potential turning point in international policies to address Chinese dominance in the mining and processing of critical minerals. However, the impact is likely to be modest from now to 2030 given the length of time needed to commission new mines and processing plants and to scale up the use of new technological solutions, not least due to environmental and social concerns. Beyond 2030, these and possibly additional policies should start to weaken China's position significantly, provided that the policies are sustained.

[18] https://www.bis.doc.gov/index.php/documents/section-232-investigations/3141-report-1/file.
[19] 'Hina launches sodium-ion battery tests in vehicles', *Electrive.com*, https://www.electrive.com/2023/02/23/hina-launches-sodium-ion-battery-tests-in-vehicles/; 'Substitution of rare earths using nanotechnology', Institute for Rare Earths and Metals, https://en.institut-seltene-erden.de/substitution-seltener-erden-mithilfe-der-nanotechnologie/.

## WHAT COUNTS AS DE-RISKING? THE GEOPOLITICS OF ENERGY AND CHINA

***Henry Sanderson***

Concern around China's dominance of clean energy technologies and their supply chains is now at the top of the geopolitical agenda. It was a core part of discussions at the May G7 meeting in Japan, where leaders vowed to build clean energy supply chains that 'reduce undue strategic dependencies'. Yet despite the rhetoric, the US and Europe realize that in order to decarbonize their economies and reach their climate change targets, they will have to rely on technologies and minerals made or processed almost exclusively in China, such as solar cells, rare earth magnets, graphite, and lithium ion batteries. Even if manufacturing is set up at home for some parts of the supply chain, re-shoring production of every single step would be a gargantuan industrial task. As a result, policymakers as well as corporate executives now talk of 'de-risking' supply chains rather than 'de-coupling' from China.

Yet this de-risking agenda is still set to require large amounts of government subsidies and support, raising questions about the costs versus the benefits. In the US, President Joe Biden has staked his administration on an Investing in America agenda that has seen billions invested in battery plants and solar factories. The European Union has also launched targets for homegrown processing and mining of critical minerals, loosening up state aid rules to achieve them.

There is also no clear acknowledgement of what level of reliance on China is acceptable. If a Chinese company builds a battery plant in Europe or the US, does that count as de-risking or is it a dependency? Should the West import skills and technologies from Chinese companies to learn how to manufacture, or is it better to start from scratch? In addition, should Western countries aim to invest in third countries to secure supplies of critical minerals, or, without a processing industry, will these just go to China? These are questions yet to be answered.

**China's view**

Under President Xi Jinping, China has accelerated investments in clean energy manufacturing as well as the deployment of clean energy technologies such as solar and electric vehicles (EVs). China accounts for over half of the EV market and this year is set to deploy 154 gigawatts of solar, more than the entire US, according to Bloomberg. China also produces 90 per cent of the solar supply chain, 80 per cent of lithium ion batteries, and over 90 per cent of battery anodes made of graphite. It's also home to over 90 per cent of the production of rare earth magnets.

Reducing reliance on China is not just a matter of building plants to produce solar cells or batteries. It requires entire new supply chains outside of China—from mine to finished product. Otherwise, products will contain minerals processed in China, or alternatively, minerals processed outside China will be sent to the country to be made into products.

Xi is fully aware of China's dominance in clean energy technologies and has supported its companies to expand overseas, especially into South-East Asia, where nickel companies have invested heavily in Indonesia. Chinese battery companies have also made large investments in Hungary. This overseas expansion is encouraging China's efforts to boost climate diplomacy, especially in Europe. China has capitalized on its dominance of clean energy to try to enhance ties with Europe, using it as a calling card for cooperation. Premier Li Qiang said during a recent visit to Germany that the countries should become 'green partners'.

Ignoring these suggestions might not be easy for Europe. The West faces a double vulnerability with China—without cost-efficient Chinese clean energy technologies, its decarbonization could be delayed, and it needs China, the largest emitter, to reduce its own emissions of greenhouse gases. Beijing is unlikely to separate climate cooperation from access for its own clean energy companies to European markets.

Europe has not given clear rules about how much Chinese investment is allowable. Its proposed Critical Raw Material Act sets targets for homegrown mining and processing. The draft aims for at least 10 per cent of critical minerals consumed in the EU to be mined in Europe by 2030, at least 40 per cent to be processed in Europe, and at least 15 per cent to be recycled.

Yet it does not say if it should be non-Chinese companies doing this mining or processing. Chinese battery materials companies have been allowed to invest in projects in Hungary and France, for example. And while the European Investment Bank has supported a graphite project in Sweden, a Chinese company is also set to build its own battery anode plant in the country.

At the same time, exports of Chinese EVs are increasing in Europe, challenging European automakers, especially in the cheaper vehicle segment.

**Biden's clean energy agenda**

The US faces a similar problem. Combating China's dominance has galvanized efforts to stimulate US clean energy manufacturing. Clean energy is now seen as fulfilling multiple aims: challenging China, regenerating areas that have lost jobs and industry over the last two decades, and boosting energy security. 'This moment demands that we forge a new consensus,' Jake Sullivan, the US national security advisor, said in April.

So far Biden's Inflation Reduction Act (IRA) has been a success, attracting over $100 billion in investments in clean energy and batteries. The planned battery capacity out to 2030 in the US has grown from around 300 gigawatt hours, when Biden took office, to over 1 terawatt hours—surpassing Europe in just two years, according to Benchmark Mineral Intelligence.

But Biden has yet to define the acceptable involvement of Chinese companies. The IRA said the companies could not receive tax credits for EVs if minerals were processed or extracted by 'foreign entities of concern', which includes China. Yet the administration has not clarified what level of Chinese involvement is prohibitive, despite these rules coming into force in 2024.

The result is that automakers are signing agreements with Chinese companies regardless. And Chinese companies are investing in joint ventures in South Korea (a free trade agreement country) with the hope that their minority equity positions will not fall foul of this requirement.

In June 2023, South Korean steel firm Posco and Chinese cathode precursor maker CNGR Advanced Material announced a joint venture for a 110,000 tonnes per year precursor cathode active material plant in South Korea alongside a 50,000 tonnes a year nickel sulphate refinery. The Posco-CNGR deal is the third deal involving a Chinese battery materials company in South Korea this year.

Ford has even struck a licensing deal with China's largest battery producer, CATL (Contemporary Amperex Technology Co. Limited), to build a plant in Michigan. Ford says it will only use technology from CATL, and that the company will not build the battery factory. Yet any Chinese involvement could damage the future of the IRA. There are concerns that the IRA could be repealed by a future Republican administration. Republicans have already targeted some provisions of the legislation for repeal in Congress.

The US therefore faces a key challenge: Chinese involvement in clean energy supply chains is inevitable if it wants to meet its EV and climate change targets, yet that involvement could invite a Republican counterattack that could end up undermining the IRA.

**Investing overseas**

In both the US and Europe, policies to stimulate clean energy manufacturing also have an overseas dimension. The US IRA says that minerals must be processed or extracted in free trade agreement countries to be eligible for tax credits, while the EU has signed a free trade agreement with Chile, to improve access to its copper and lithium. Yet the IRA definition of 'free trade agreement countries' does not include any African country, limiting the benefits for companies in the US to source from Africa and reducing any strategic efforts to limit China's advance on the continent.

As a result, Chinese companies are the largest investors in lithium on the continent and face little Western competition. Over 90 per cent of lithium supply from Africa this decade is set to come from mining companies partly or fully owned by Chinese companies, according to Benchmark.

Investments in resources in developing countries are also counterproductive if those resources are still sent to China to be processed. As a result, the US Department of Energy is helping to fund a graphite anode plant in the US for Syrah Resources, which mines graphite in Mozambique, which is currently sold to China. Yet there need to be more of these projects.

**Australia and Canada as a solution**

Australia and Canada offer the potential for a solution, and are the key beneficiaries so far of the IRA outside of the US. The US has deepened its engagement with Australia, in the hope that minerals from Australia can be diverted from China to feed US industry. Companies such as Element 25 are building plants in the US to process Australian minerals for batteries.

Australia is also encouraging the buildout of processing facilities at home, with the support of an A$2 billion fund. That aims to redirect the flow of Australian minerals from China to the US and Europe. In Canada, General Motors is building a complex with South Korea's Posco to process battery minerals and produce battery cathodes—a stage where China is extremely dominant.

These two countries are likely to form a key part of efforts to de-risk clean energy supply chains from China for the US and Europe. They are both mining friendly and have access to supplies of renewable energy. Yet the process is likely to be slower than government targets for EV sales allow, meaning some sort of Chinese involvement in clean energy supply chains will be inevitable. And it is yet to be seen how cost-effective processing plants in Australia and Canada can be against Chinese competition.

**Competing on costs**

China faces considerable overcapacity at home in its battery and solar industries, meaning that it needs to export to overseas markets. Its clean energy industries often suffer from cycles of investment and overcapacity.

This can be extremely challenging for overseas companies to compete with, as overcapacity drives down prices. It's unlikely that Chinese companies will willingly give up their market dominance and the economic benefits that has provided. They will most likely cut costs even further, challenging Western producers. Already, building a lithium processing plant in the US can be double the cost of one in China, while a graphite processing plant can be three to four times the cost.

**Conclusion**

The West remains in a weak position in regards to China and clean energy. If 'decoupling' is no longer desirable, it is imperative to define what sort of diversification 'de-risking' requires. While the West has a global alliance of friendly countries with which to build new supply chains that don't involve China, it will be hard to compete on cost with Chinese companies. Thus, continued subsidies may be needed to ensure Western companies can survive. Or consumer companies such as automakers will have to pay more for Western-produced products—to back geopolitical gains, or just to de-risk their supply chains.

Beijing is unlikely to see its dominance go unchallenged, and will use a number of tools to try and defeat Western competition. It will also continue to call for 'cooperation' on climate change, which in reality will mean opening up markets for Chinese companies. The West needs to come up with a strategy to de-risk reliance on China without delaying the energy transition. It will be a difficult balancing act.

## EUROPE'S POLICY RESPONSES TO CHINA'S DOMINANCE OF NEW ENERGY SUPPLY CHAINS

***Patrick Schröder***

In the wake of the Russian invasion of Ukraine, many countries have accelerated their net-zero and clean energy strategies. As a result, the global critical materials landscape is becoming increasingly complex. Europe's efforts to secure these resources for its green transition need to be seen in the light of China's dominance, not only in the supply and processing of critical raw materials (CRMs), but also in the production of low-carbon technologies such as solar photovoltaic (PV) panels and electric vehicle (EV) batteries. China has been and will remain a dominant provider of many raw materials for Europe as the demand for the critical materials needed in its solar, wind, and electric mobility sectors will increase in the coming years and decades.

This article assesses some of the recent policy responses of the European Union (EU) and the United Kingdom (UK) to China's dominance in new energy supply chains, particularly materials used in solar PV, wind turbine magnets, and batteries. Furthermore, it explores the industrial and geoeconomic implications of diversifying critical material supply and re-shoring of manufacturing low-carbon technologies as a strategy to reduce dependence on China.

The EU's trade and investment strategy aims to secure access to critical materials while ensuring high environmental, social, and governance (ESG) standards in mining and transparent trade practices. The EU has signed critical minerals deals with Canada, Kazakhstan, Namibia, and Ukraine and is beginning to engage in negotiations for trade agreements with various countries including Chile, Argentina, and the Democratic Republic of the Congo that address market access, investment

protection, and sustainable sourcing of critical materials. Furthermore, the circular economy for critical materials has received increased attention, not primarily because of environmental concerns, but to provide a stable supply of secondary CRMs through enhanced recycling practices.

This interlocking set of policy responses has been described as a novel 'security-sustainability nexus'[20] where policymakers and businesses are merging resource security and sustainability policies. Whether this approach will indeed generate win-win partnership benefits for third countries will depend on high degrees of transparency in mining operations and bringing high-risk investments for higher-value economic activities to third countries.

**Critical raw material trade disputes**

European trade policy responses to China's dominance in critical materials needed for the clean energy transition are not new. In 2012, the EU, together with Japan and the United States (US), charged China with trade violations through the World Trade Organization (WTO) and filed a case against China's quotas on rare earths. A second case was launched in 2014. In 2015, the WTO found that China's restrictions were inconsistent with WTO rules and as a result China removed the restrictions on rare earths.[21] In July 2016, the EU together with the US launched a third case against China for limiting supplies of 11 raw materials, including graphite, cobalt, and indium.

Despite these previous trade disputes, China still provides 100 per cent of the EU's supply of heavy rare earth elements today. The spectre of rare earth trade restrictions by China emerged again in April 2023 when Nikkei reported that proposed provisions by China would prohibit or limit exports of alloy tech for making high-performance magnets derived from rare earths. This was based on China's commerce and technology ministries announcement in December 2022 of 43 amendments or additions to the country's technology restriction act.[22] Most recently, in July 2023, China announced export restrictions on gallium and germanium, critical materials needed for semiconductor manufacturing.[23]

Europe is over-reliant for CRMs not only on China but also on other countries. For example, Turkey provides 99 per cent of the EU's supply of boron, which is used for high-performance magnets. South Africa provides 71 per cent of the EU's platinum, a critical material used in electrolysers to produce hydrogen and in fuel cells. Furthermore, as a report published in April 2023 by the Organisation for Economic Cooperation and Development pointed out,[24] not only China, but also India, Argentina, Russia, Vietnam, and Kazakhstan introduced export restrictions on critical minerals during the decade from 2009 to 2020.

**European policy responses**

More recently, in March 2023, the European Commission unveiled a proposal for a new Critical Raw Materials Act (CRMA). The objectives of the CRMA are ambitious—it aims to achieve a high degree of self-sufficiency by 2030. EU capacity should reach at least 10 per cent of domestic demand for mining and extraction and at least 40 per cent for processing and refining. But the means to achieve these objectives may be inadequate, given the non-binding nature of the key targets and lack of any additional funding announcement. The CRMA's overarching circular-economy-related target is that by 2030, 15 per cent of the EU's annual consumption of strategic raw materials should be met by EU recycling capacity.

On the same day, the Commission presented the Net Zero Industry Act. While the CRMA aims to address overreliance on China's supply chains, the Net Zero Industry Act has been interpreted as the European response to US clean tech subsidies stemming from the Inflation Reduction Act. It aims to achieve strategic net-zero technologies manufacturing capacity of at least 40 per cent of the EU's deployment needs by 2030.

Also in March 2023, the UK government published the Critical Minerals Refresh, which reinforces the government's commitment to the Critical Minerals Strategy. In addition to safeguarding UK industry and boosting the security of the UK's supply of critical

[20] Riofrancos, T. (2023), 'The security–sustainability nexus: lithium onshoring in the Global North, *Global Environmental Politics*, https://direct.mit.edu/glep/article/23/1/20/111308/The-Security-Sustainability-Nexus-Lithium.
[21] World Trade Organization (2015), *Dispute Settlement DS432: China—Measures Related to the Exportation of Rare Earths, Tungsten and Molybdenum*, https://www.wto.org/english/tratop_e/dispu_e/cases_e/ds432_e.htm.
[22] 'China weighs export ban for rare earth magnet tech', 6 April 2023, *Nikkei* https://asia.nikkei.com/Spotlight/Supply-Chain/China-weighs-export-ban-for-rare-earth-magnet-tech.
[23] 'China's curb on metal exports reverberates across chip sector', 4 July 2023, *Financial Times* https://www.ft.com/content/2fa865a7-176f-4292-8842-38bb6470d732.
[24] Organisation for Economic Co-operation and Development (2023), 'Supply of critical raw materials risks jeopardising the green transition', OECD Paris https://www.oecd.org/newsroom/supply-of-critical-raw-materials-risks-jeopardising-the-green-transition.htm.

minerals, it highlights the UK's ambition to demonstrate 'global leadership on ESG performance to champion high standards and reducing vulnerability to disruption, and levelling the playing field for responsible businesses' and 'exploring how to tackle illegal mining in partnership with third countries'.[25]

Beyond solar and wind, China's lithium battery manufacturing has started dominating the global market. EV sales in China have received support from government policies and economic incentives, including cash subsidies and purchase tax exemptions, and EV sales in China by far outpace sales in Europe and the US. China has extended its breaks for EVs, initially introduced in 2014, until 2027. By the end of 2022, the cumulative tax exemption exceeded RMB 200 billion (US$27.7 billion), and it could surpass RMB 115 billion (US$15.9 billion) in 2023. France has been pushing the EU to launch anti-dumping measures against insurgent Chinese EV makers, while Germany is more cautious and more exposed to potential countermeasures from China.[26]

Furthermore, Europe is investing in and building giga-factories to produce lithium-ion batteries, in part due to ongoing concerns over reliance on China's manufacturing base. The new European Battery Regulation, adopted on 14 June 2023, imposes sustainability and transparency standards for batteries, including the origin of raw materials used in their manufacture.[27] It includes more stringent targets for battery collection, recycling efficiency, and material recovery, as well as a due diligence policy to address associated social and environmental risks across the battery supply chain.

**Building alliances and 'win-win' partnerships**

European solar and wind energy industries have been particularly exposed to different demand and supply risks. The wind industry is more vulnerable to supply bottlenecks and the price volatility of CRMs, especially those used in the production of permanent magnets, a key component in wind turbines.[28] The EU's policy responses to China's dominance in clean energy supply chains includes measures to diversify supply chains and thereby enhance resilience to potential disruptions.

One of these measures is the establishment of the European Raw Materials Alliance (ERMA), announced in September 2020, as part of the European Action Plan on Critical Raw Materials, and the publication of the 2020 *List of Critical Raw Materials*.[29] ERMA focuses on developing sustainable and responsible supply chains for CRMs and fostering partnerships with resource-rich countries other than China. The specific value chains ERMA focuses on are rare earth magnets and motors and materials for energy storage and conversion. Furthermore, the alliance promotes reducing dependency on primary CRMs through circular use and recycling of resources and sustainable products to mitigate potential resource scarcity or cut-offs. There are several barriers to recycling and to finding alternative components for permanent magnets. The ERMA network includes over 50 European and UK recycling companies.

The EU's trade and investment strategy has also started focusing on CRMs. In the CRMA, the EU seeks to build a 'win-win partnership' with resource-rich countries that is beneficial for both sides by applying high ESG standards in mining and creating added value through further processing.[30] The first test of how such a win-win partnership would work is the 2003 trade agreement between the EU and Chile, which the two parties are in the final stages of updating. The aim is to conclude a separate strategic partnership for raw materials, especially lithium and copper. The updated trade agreement will provide better access for EU businesses investing in the raw materials sector in Chile, with EU companies given the same treatment as Chilean companies. A key aspect of the strategic partnership will be to create local added value in Chile rather than purely extract and export the minerals.

[25] UK Government (2023), *Critical Minerals Refresh: Delivering Resilience in a Changing Global Environment,* https://www.gov.uk/government/publications/uk-critical-mineral-strategy/critical-minerals-refresh-delivering-resilience-in-a-changing-global-environment-published-13-march-2023.
[26] Joshua Posaner. Wilhelmine Preussen, "Why Berlin will slam the brakes on France's car war with China", 19 June 2023, *Politico* https://www.politico.eu/article/volkswagen-mercedes-bmw-berlin-will-slam-the-brakes-on-frances-car-war-with-china/.
[27] European Parliament (2023), *Making batteries more sustainable, more durable and better-performing*, https://www.europarl.europa.eu/news/en/press-room/20230609IPR96210/making-batteries-more-sustainable-more-durable-and-better-performing.
[28] Rabe, W., Kostka, G., and Stegen, K. (2017), 'China's supply of critical raw materials: risks for Europe's solar and wind industries?', *Energy Policy*, 101, 692–699, https://www.dahrendorf-forum.eu/wp-content/uploads/2017/01/Chinas-supply-of-critical-raw-materials.pdf.
[29] The EU's *List of Critical Raw Materials* was updated in 2023, and a fifth list covering 34 CRMs was published—https://single-market-economy.ec.europa.eu/sectors/raw-materials/areas-specific-interest/critical-raw-materials_en.
[30] Sinom, F. (2023), EU pushes alternative model to China in global race for raw materials, *EURACTIV*, https://www.euractiv.com/section/circular-economy/news/eu-pushes-alternative-model-to-china-in-global-race-for-raw-materials/.

Other like-minded trade partners rich in CRMs are a key resource for the EU. The current trade agreement with Canada, and new agreements not only with Chile but also with Mexico and Australia, could help the EU diversify its supply of both primary and secondary CRMs.

The UK government is also accelerating its collaboration on critical minerals with international partners, including recent partnerships established with Canada and South Africa and engagement through the Minerals Security Partnership. The Partnership was announced in June 2022 by the US to strengthen critical mineral supply chains. One of the stated aims is 'to ensure that critical minerals are produced, processed, and recycled in a manner that supports the ability of countries to realize the full economic development benefit of their geological endowments'.[31]

**Making resource security, sustainability, and competitiveness work together**

Diversification and re-shoring critical material extraction, production of clean energy technologies, and recycling can enhance supply chain resilience by reducing dependence on a single dominant player like China is perceived to be. Also, diversifying sources and bringing production and recycling closer to end markets mitigates some of the risks of supply disruptions and trade disputes, providing more control over resource availability. Yet building these supply chains will require several years, and meeting the targets will be challenging and will require scaling quickly. For example, Europe aims for its clean energy manufacturing capacity to meet at least 40 per cent of its generation needs by 2030; but currently, Europe has only about half of that capacity.

In addition to scaling up, domestic clean energy production also needs to close the cost gap with external competitors, as this could impact the speed and scale of installation and diffusion.[32] In the case of solar PV manufacturing, European companies already face a cost competitiveness gap of US$0.08 per watt against Chinese producers. For the 450 GW of new solar capacity needed by 2030 under the REPowerEU plan,[33] this would translate to an additional cost of US$36 billion, if all PV panels were manufactured in Europe. However, to put this in perspective, although not an insignificant sum, it would only be about 7.3 per cent additional cost on top of the currently estimated $490 billion (€452 billion)[34] of total solar investment needs.

It remains to be seen if the new CRM trade partnerships and alliances will generate new economic opportunities beyond extraction with added-value for producer countries, while creating decent jobs and sustainable practices on mining sites. New investments are needed, including for re-mining of tailings dams and mining waste valorization,[35] but it is challenging to bring investments into countries with weak ESG standards and high political risk. The European Investment Bank and the EU's Global Gateway Initiative, which announced €300 billion for high-quality infrastructure projects in the global South, will have a key role to play. Transparency and equal partnerships are essential to ensure that European investments contribute positively to development objectives in recipient countries.

Strategic cooperation and alliances among countries can play a vital role in navigating geoeconomic shifts; however, 'friend-shoring' critical material supply and production might also drive further fragmentation in the global economy and threatens to drive up the cost of the clean-energy transition. Europe's effort to secure critical materials for the green transition has seen effective policy responses, including diversification of supply but also circular economy approaches to ensure supply of high-quality secondary materials. Careful consideration of environmental impacts, social factors, and international cooperation is essential to ensure that the 'security-sustainability nexus' works for security, environment, and competitiveness, for both producer and consumer countries.

For the EU and the UK, as the countries are pursuing supply chain diversification strategies, it will remain important to closely follow China's industrial policies to identify any upcoming policy changes that may affect the supply of CRMs and technologies needed for the clean energy transition. Ongoing engagement with China, either bilaterally or in international fora such as the G20, will be important to avoid supply chain disruptions or the need for future WTO dispute settlements.

[31] US Department of State (2022), *Minerals Security Partnership*, https://www.state.gov/minerals-security-partnership/.
[32] McKinsey (2022), 'Building a competitive solar-PV supply chain in Europe', https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/building-a-competitive-solar-pv-supply-chain-in-europe.
[33] European Commission (2023), *Solar Energy*, https://energy.ec.europa.eu/topics/renewable-energy/solar-energy_en.
[34] RystadEnergy (2022), 'REPowerEU: Europe's big budget and bold energy plan may fall short of objectives', https://www.rystadenergy.com/news/repowereu-europe-s-big-budget-and-bold-energy-plan-may-fall-short-of-objectives.
[35] Kinnunen, P., and Kaksonen, A. (2019), 'Towards circular economy in mining: opportunities and bottlenecks for tailings valorization', *Journal of Cleaner Production*, https://www.sciencedirect.com/science/article/abs/pii/S0959652619312508.

## MARKET DILEMMAS AND STRATEGIC BALANCING ACTS: CHINESE RENEWABLE MANUFACTURERS IN AN ERA OF GEOPOLITICAL COMPETITION

***Herbert Crowther***

The politics of renewable energy manufacturing have become an area of central importance in the global energy transition. Particularly as geopolitical tensions escalate, the future geography and efficiency of green energy supply chains is becoming more uncertain. This uncertainty is driven by a combination of factors: green industrial policy coming into vogue in major markets like the US and EU, smaller markets seeking more niche ways to benefit from green industries, and the global green manufacturing incumbent, China, maintaining an unavoidable presence.[36] If managed imprudently, these tensions threaten to result in disjointed supply chains for many green technologies.

Within that picture, Chinese renewable energy manufacturers now face difficult new dilemmas, particularly about which end-markets to prioritize and how to approach new overseas manufacturing investments. How Chinese firms approach these questions will affect many key variables for the global energy transition, from the diffusion of green technology breakthroughs across borders to the political capital of green energy industries in developed markets. These dilemmas make Chinese renewable manufacturers key strategic actors today in a more concrete way than they have ever been before.

**End-market prioritization: balancing local government support with export restrictions**

Even before today's geopolitical headwinds, Chinese renewable energy firms experienced periods of sharply different strategic outlooks. When the solar industry took off in the early 2000s as China's first green champion industry, it was largely oriented towards exports to European markets, where solar purchase subsidies were generous. But by the early 2010s, Chinese firms had consolidated solar supply chains so much that US and EU officials placed tariffs on Chinese solar imports, forcing Chinese producers to look inward for new sources of solar demand.[37]

As the reality of trade barriers on Chinese solar set in in the late 2000s and early 2010s, Chinese solar producers made their first strategic market re-evaluation: pivoting to prioritize the domestic market. Before the 2010s, domestic demand had only been a small part of Chinese solar manufacturing demand. But with export markets becoming less accessible, the Chinese government enacted policies to expand domestic solar demand, most notably the Golden Sun and Solar Roof programs, as well as a national feed-in tariff for solar generation.[38]

These programs helped Chinese solar producers weather this first storm, and provided the initial impetus for China to become the world's largest source of solar demand (today over three times the next largest market by installed capacity).[39] And despite the rising cost for the central government of these programs and the growing international attention to the role of China's industrial policy ecosystem in skewing the playing field, this ecosystem remains significant in China's solar industry.

Just like today, the case for trade restrictions on Chinese solar (and other green industries) in the early 2010s revolved around the policy support that Chinese firms enjoy from local governments. Particularly during China's first solar manufacturing boom, manufacturers could count on incentives from local governments like land concessions, tax benefits, less expensive operating environments, and in some cases, even direct investment.[40] The central government contributed by providing guidance for local officials to adhere to these principles, directing state financing bodies to participate in these projects, and even helping catalyse cost declines in input materials like polysilicon.[41]

[36] Bloomberg NEF, 'Localizing Clean Energy Value Chains Will Come at a Cost,' 7 November 2022, https://about.bnef.com/blog/localizing-clean-energy-value-chains-will-come-at-a-cost/.
[37] Matt Daily, 'U.S. sets new tariffs on Chinese solar imports,' Reuters, 17 May 2012, https://www.reuters.com/article/us-china-trade-idUSBRE84G19U20120517.
[38] Yongxiu He and Sufang Zhang, 'Analysis on the development and policy of solar PV power in China,' Renewable and Sustainable Energy Reviews, Volume 21, May 2013, pp 393-401, https://www.sciencedirect.com/science/article/pii/S1364032113000269?via%3Dihub.
[39] Sandra Enkhardt and Beatriz Santos, 'New global solar capacity additions hit 191 GW in 2022, says IRENA', PV Magazine, 22 March 2023, https://www.pv-magazine.com/2023/03/22/new-global-solar-capacity-additions-hit-191-gw-in-2022-says-irena/.
[40] Chen Gang, 'China's Solar PV Manufacturing and Subsidies from the Perspective of State Capitalism,' Copenhagen Journal of Asian Studies, Volume 33 Number 1, 2015, https://rauli.cbs.dk/index.php/cjas/article/view/4813.
[41] Varun Sivaram, *Taming the Sun: Innovations to Harness Solar Energy and Power the Planet*, MIT Press, 2018, pp 27-52, https://direct.mit.edu/books/book/4478/Taming-the-SunInnovations-to-Harness-Solar-Energy.

Today, traditional mechanisms for local government support are just as accessible for green energy manufacturers as they were before trade restrictions on Chinese green exports began almost 15 years ago. This fact has important implications for how Chinese green manufacturers are likely to approach end-market prioritization and overseas expansion strategies.

The persistence of the traditional model for local support in China is driven by a number of key factors. Firstly, the strength of China's domestic renewable energy demand has been sufficient to make up for lost export markets, leaving Chinese manufacturers with little incentive to refuse local government support. In fact, with the reorientation of Chinese green manufacturers towards the domestic market in the 2010s, the political value of green manufacturers to local governments has become even more salient. With no urgency to change the practices that first attracted US/EU criticism, this industrial policy playbook has further entrenched itself with local officials as an example of how aggressive policy support can expand local industry.

A demonstrative case study of how this ecosystem continues today is the recent growth in China's offshore wind industry. Despite being a relatively nascent industry for much of the 2010s, China's coastal eastern provinces now boast over 20 industrial parks dedicated to offshore wind manufacturing.[42] This process of neighbouring provinces rushing to promote local companies in an emerging green industry mirrors (in some ways) the initial expansion of Chinese solar producers in the 2000s, where local industrial clusters helped spur rapid growth.[43]

Secondly, China's rhetorical focus on 'high quality development' has further singled out green industries as a priority area for local governments. Particularly since the enshrinement of the 'dual carbon' goals in September 2020, promoting green industry has become an effective way for local officials to win central government approval. Xi'an is an example of a city that has become more aggressive in its support for green industries in recent years, especially its local green champion LONGi Solar. Since 2020, Xi'an has used traditional mechanisms like land grants and tax benefits to ensure that a large share of LONGi's manufacturing expansion stays in Xi'an. These incentives have helped LONGi announce multiple new manufacturing investments in Xi'an, helping satisfy Xi'an metrics for high quality development.[44] In Changzhou, another green industrial hub, Trina Solar continues to enjoy strong government support, especially through new government programs that attract top solar talents to Changzhou's renewable industrial base. Xi'an and Changzhou were early adopters of strategies that used green industries as a path to satisfying economic growth metrics, and have clearly doubled down on this approach in recent years.

Thirdly, the intensification of international demand for green technologies has created new potential markets for Chinese green exports. Importantly, a significant share of those markets—particularly developing markets—are unlikely to enact trade barriers in response to Chinese local government support. This is because in countries not aspiring to become green industrial behemoths themselves, the most important consideration in green industrial imports is, almost exclusively, *price*. If Chinese local incentives help Chinese producers reduce prices, that only increases the attractiveness of Chinese exports in those markets. This reality likewise leaves little incentive for Chinese manufacturers or local governments to change course.

The persistence of the traditional local support model means that Chinese renewable energy manufacturers are likely to continue to prioritize the domestic market and developing markets for future demand growth. This persistence also means that market restrictions from the US and EU are unlikely to change. For Chinese manufacturers with even more ambitious international plans that *do* include those developed markets, then, this will mean new dilemmas on how to secure market access.

**New dilemmas: risks in international expansion**

Perhaps the most important new consideration for Chinese renewable manufacturers is how (or whether) to set up international manufacturing centres that satisfy market access requirements in developed markets like the US and EU. In the US, for example, while solar equipment manufactured in China is subject to heavy trade duties, solar equipment manufactured by Chinese companies within the US is not. Particularly with incentives offered by the Inflation Reduction Act, Chinese green

[42] Cheng Chao, Song Gu, Zhao Lei, Yang Li, 'Development trend and suggestions of my country's offshore wind power equipment industrial park/base,' Wind Energy Magazine, 7 November 2021, https://news.bjx.com.cn/html/20221107/1266681.shtml.
[43] Jonas Nahm, 'China's Specialization in Innovative Manufacturing,' *Collaborative Advantage: Forging Green Industries in the New Global Economy*, Oxford Academic, 19 Aug. 2021, https://academic.oup.com/book/39911/chapter/340167345.
[44] Polaris Solar Photovoltaic, 'LONGi Green Energy's annual production of 100GW of monocrystalline silicon wafers and 50GW of monocrystalline cells has landed in Xixian New Area, Shaanxi,' 17 January 2023, https://guangfu.bjx.com.cn/news/20230117/1283736.shtml.

manufacturers are increasingly tempted by the promise of access to the US market. Doing so, however, will require multiple strategic balancing acts.

The first of these balancing acts is managing political risk. This is particularly true in markets already spurned by China's green supply chain dominance. In the US, for example, local and state politics can be even more volatile than federal policy. One recent case of this is Virginia's refusal of a CATL (Contemporary Amperex Technology Co., Limited) battery plant on political grounds.[45] But despite the negative overall atmosphere in the US towards Chinese investment, some industrial states have expressed interest in attracting Chinese green investment. Ohio, for example, this March announced a major project between LONGi Solar and US energy developer Invenergy to construct a 5 GW solar factory outside Columbus.[46] JA Solar announced a new solar factory in Arizona this January, and the CATL plant rejected by Virginia ultimately settled in Michigan.[47] These early projects are all on ambitious timelines, and will be important reference cases as other Chinese renewable manufacturers consider following suit.

The second dilemma Chinese producers will face is how to apply the Chinese domestic model of manufacturing efficiency to other countries. Many of the variables that help Chinese producers dominate green industries will be challenging to replicate in places like the US or EU. These variables include land prices, tax rates, electricity costs, permitting timelines, construction timelines, construction costs, labour costs, and supply chain sourcing (just to name a few). For solar, US scrutiny of input materials like polysilicon from Xinjiang will require the supply chains of US factories to be more complex than those of their Chinese counterparts. Labour costs and labour relations will also offer a stark contrast between Chinese facilities and US or EU facilities. Managing the corporate culture implications of Chinese supervisors at an American factory, for example, will be a tightrope walk in both local politics and financial health.

Third, questions over technology transfer and intellectual property rights will increasingly put China in the opposite position from what it has enjoyed in recent decades. Technology transfer has long been a key criterion for foreign firms securing access to the Chinese market. But with Chinese firms now leading technology innovation across clean technology industries, how Chinese firms allow foreign companies to participate in the technological development of overseas investments will also be a consequential question. Early indications suggest that Chinese firms may be open to technology transfer, with Chinese firms confident that their manufacturing know-how is more important than technological protections. But there are downside risks in the medium and long term if Chinese firms and foreign governments disagree on appropriate technology transfer levels—particularly if disagreements come after factories are already up and running.

Lastly, Chinese firms will also need to consider how foreign manufacturing investments are perceived by the Chinese government. While the Chinese government is generally supportive of foreign expansions because they develop China's industrial footprint and help China's narrative of a 'green Belt and Road', these conditions could change. Reports this year of a draft regulation restricting exports of solar manufacturing technologies are one indicator of China's potential willingness to use green technologies as a tool for strategic leverage.[48] If more of that leverage is lost as Chinese firms set up operations (and/or pursue technology transfer) overseas, they may begin to face a different atmosphere at home.

**Diverging implications: upside and downside risks for Chinese manufacturers' strategic choices**

This strategic landscape for Chinese renewable manufacturers presents several implications and risks. In terms of direct implications, the persistence of China's local industrial support model means that trade barriers on Chinese green imports to countries with green industrial ambition are unlikely to change anytime soon. In a certain way, however, this may be an acceptable equilibrium to both sides. For China, it means a continued prioritization of the domestic market and a growing focus on green exports to developing markets—both of which still provide robust room for demand growth. For developed markets, it means more runway to pursue policy mechanisms that brand green industrial policy as a political winner: as a platform to create blue-collar jobs, to reduce reliance on foreign supply chains, and to reframe the traditional politics of decarbonization.

[45] Dan Mihalascu, 'Virginia Rejects Ford Battery Plant Investment Over CATL's CCP Ties,' InsideEVs, 19 January 2023, https://insideevs.com/news/632160/virginia-rejects-ford-battery-plant-investment-over-catl-ccp-ties/.
[46] Veselina Petrova, 'Invenergy, Longi tie up in 5-GW solar panel production JV in Ohio,' RenewablesNow, 20 March 2023, https://renewablesnow.com/news/invenergy-longi-tie-up-in-5-gw-solar-panel-production-jv-in-ohio-817814/.
[47] Jonathan Touriño Jacobo, 'JA Solar to build 2GW module manufacturing facility in Arizona,' PV Tech, 12 January 2023, https://www.pv-tech.org/ja-solar-to-build-2gw-module-manufacturing-facility-in-arizona/.
[48] Sangita Shetty, 'China May Restrict Exports of Solar Technologies,' SolarQuarter, 3 February 2023, https://solarquarter.com/2023/02/03/china-may-restrict-exports-of-solar-technologies/.

A more nuanced picture emerges when considering how Chinese manufacturers may pursue overseas manufacturing investments. Here, there is a wider range of positive and negative outcomes. On the positive side, successful investments in other markets (especially developed markets) could create stronger green supply chains within those countries. That would also drive down green technology costs globally and present a positive example of Chinese manufacturing investment in foreign markets. On the negative side, the complications involved in replicating the Chinese manufacturing model in other countries could raise the risks of major problems with new projects. From technology transfer to labour relations, Chinese firms will need to demonstrate extreme political and economic shrewdness to minimize downside risks. In those downside risk scenarios, high-profile clashes over Chinese investments could lead to a further bifurcation of green supply chains, and add another irritant to the broader geopolitics of the energy transition.

As such, how Chinese firms approach these dilemmas over the next 12–24 months is a crucial variable in forecasting the speed and tone of the global energy transition. This path will be reflected both in progress on existing projects (like LONGi in Ohio) and in the pace of new project announcements. For large Chinese renewable firms, this represents a strategic position much more prominent—and delicate—than anything they have faced before.

## THE GEOPOLITICS OF HYDROGEN: THE EMERGING ROLE OF CHINA[49]

***Rainer Quitzow and Xiaohan Gong***

The Chinese government is a relative latecomer among major economies to the formulation of a dedicated hydrogen strategy. Its *Mid-and-Long-Term Hydrogen Industrial Development Plan (2021–2035)* was published in March 2022.[50] Moreover, the strategy remains relatively modest when it comes to the promotion of hydrogen supply, targeting 100,000 to 200,000 tons of renewable hydrogen production per year by 2025. This compares with the EU's ambition to install 6 GW of electrolyser capacity by 2024 to produce approximately 1 million tons of renewable hydrogen per year.[51]

China's target for fuel-cell electric vehicles (FCEVs) is more ambitious, aiming for 50,000 FCEVs by 2025.[52] Other dimensions of hydrogen development, including transport and storage infrastructure and other hydrogen end uses, are not subject to formalized, quantitative targets.

Parallel to the rather modest hydrogen-related ambitions at the central level, activities in a number of major cities and provinces are developing dynamically. Indeed, the sum of local and provincial hydrogen targets, for both hydrogen production and FCEVs, surpasses those formulated by the central government.[53] The Autonomous Region of Inner Mongolia alone aims to produce more than 480,000 tons of renewable hydrogen annually by 2025, more than double the central government's target.[54]

This seeming mismatch between local-level ambition and restraint at the national level does not mean that the central government has not identified the hydrogen sector as an important strategic priority. Indeed, the central government declared the hydrogen sector as a strategic emerging industry as early as 2016 in its *13th Industrial Development Plan of Strategic Emerging Industries*.[55] However, government policy remains at an experimental stage, offering important incentives for innovation and industrial development at the local and provincial levels. Most prominently, the central government has launched a pilot city scheme for the development and deployment of FCEVs and related refuelling infrastructure. Additionally, the

[49] The research for this article was conducted in the context of a research project at the Research Institute for Sustainability, Helmholtz Centre Potsdam entitled 'Geopolitics of the Energy Transformation: Implications of an International Hydrogen Economy' (GET Hydrogen) with financial support from the German Federal Foreign Office.

[50] National Development and Reform Commission (2022), *The Mid-and-Long-Term Hydrogen Industrial Development Plan* (2021–2035) (氢能产业发展中长期规划（2021–2035 年）), https://www.ndrc.gov.cn/xxgk/zcfb/ghwb/202203/t20220323_1320038.html?code=&state=123 (last accessed on 22 December 2021).

[51] European Commission (2020), *A Hydrogen Strategy for a Climate-Neutral Europe*, COM/2020/301 final.

[52] National Development and Reform Commission, *The Mid-and-Long-Term Hydrogen Industrial Development Plan*.

[53] Gong X.H., Quitzow R. and Boute A. (2023), *China's Emerging Hydrogen Economy: Policies, Institutions, Actors*, https://publications.rifs-potsdam.de/rest/items/item_6002649_5/component/file_6002687/content.

[54] Inner Mongolia Energy Bureau (2022), *Inner Mongolia Autonomous Region 14th Five-Year Hydrogen Energy Development Plan* (内蒙古自治区十四五氢能发展规划).

[55] State Council (2016), *The 13th Industrial Development Plans of Strategic Emerging Industries* (十三五国家战略性新兴产业发展规划).

government is encouraging local governments and state-owned enterprises (SOEs) to launch demonstration projects across the hydrogen value chain by promoting measures like discounted electricity prices for hydrogen production.[56]

This experimental approach to the sector's development is also reflected in China's engagement with the emerging geopolitics of hydrogen. Chinese policymakers are gradually increasing their international activities, emphasizing exchange with other international actors to promote knowledge acquisition and learning. Importantly, this includes activities to encourage foreign investment in China's hydrogen sector. More outward-oriented activities to develop strategic alliances and partnerships do not yet feature prominently in its international hydrogen policy. Nevertheless, the government has signalled its future intentions to address hydrogen actively within the Belt and Road Initiative (BRI), and SOEs have begun to launch demonstration projects in third countries where these firms have pre-existing investments in the energy sector.

**China's geoeconomics of hydrogen: overcoming technological bottlenecks and promoting industrial leadership though international cooperation**

A central driver of China's international hydrogen policy to date is the concern that it still lags behind Western technology leaders in a number of critical areas of hydrogen technology. This is considered particularly urgent, due to the increasingly hostile geoeconomic competition with the US and worries that Western governments will curtail the transfer of key technologies and know-how to China.[57] Indeed, governments in the US and Europe have voiced their own concerns that Chinese competitors could outcompete their domestic firms in key hydrogen technologies, in particular electrolysers.[58] In 2022, China already had the largest electroliser manufacturing capacity, with 7.6 GW per year, compared to 4 GW in Europe and 1.6 GW in the US.[59] Moreover, according to a study by Bloomberg New Energy Finance, manufacturing alkaline electrolysers in China is estimated to cost less than US$400/kW, compared to around US$1,200/kW elsewhere.[60] On the other hand, for now, Chinese electrolysers are said to have significantly lower operational lifetimes and to be less efficient, due to lower quality materials.[61]

An important priority for the Chinese government is, therefore, the continued acquisition of foreign know-how to further boost China's technological development. The *Catalogue of Industries for Encouraging Foreign Investment 2022* highlights the government's priority areas for the promotion of foreign involvement in China's domestic hydrogen economy.[62] According to the catalogue, China supports foreign investments in different spheres of renewable hydrogen production, refuelling, transport, and storage.

Given that proton-exchange membrane (PEM) electrolysers are considered more suitable for storing excess renewable electricity, a particular priority in this regard is technology transfer in this field, where European firms remain in the lead. Chinese firms still lack the capacity for large-scale manufacturing of platinum catalysts, needed for PEM fuel cell stacks. In addition, China lacks the required know-how in various dimensions of hydrogen storage and transport, including high-pressure gaseous storage and hydrogen liquefaction.[63] This is considered a liability in the development of domestic hydrogen trade between future centres of hydrogen demand in the east and regions with abundant renewable energy resources in the north and southwest.[64]

To encourage foreign investment in the hydrogen sector, foreign companies may receive preferential treatment, such as financial rewards or simplified administrative procedures, when developing hydrogen-related technologies.[65] This has led to

[56] Gong X.H., Quitzow R. and Boute A. (2023), *China's Emerging Hydrogen Economy: Policies, Institutions, Actors*,
[57] Gong X.H., Quitzow R. and Boute A. (2023), *China's Emerging Hydrogen Economy: Policies, Institutions, Actors*.
[58] European Commission (2023), *Proposal for Net Zero Industry Act*, COM (2023) 161.
[59] International Energy Agency (2022), *Electrolyzers*, https://www.iea.org/reports/electrolysers (last accessed on 14 February 2023).
[60] Collins, L. (22 September 2022), 'Cheap Chinese hydrogen electrolysers "likely to become popular worldwide during 2025–30": BNEF', *RECHARGE*, https://www.rechargenews.com/energy-transition/cheap-chinese-hydrogen-electrolysers-likely-to-become-popular-worldwide-during-2025-30-bnef/2-1-1304666 (last accessed 13 June 2023).
[61] Heyward, H. (19 April 2022), 'Beijing hydrogen body admits that Chinese electrolysers cannot compete with Western machines—yet', *RECHARGE*, https://www.rechargenews.com/energy-transition/exclusive-beijing-hydrogen-body-admits-that-chinese-electrolysers-cannot-compete-with-western-machines-yet/2-1-1202835 (last accessed 13 June 2023).
[62] National Development and Reform Commission and Ministry of Commerce (2022), *Catalogue of Industries for Encouraging Foreign Investment (2022 Version)*（鼓励外商投资产业目录（2022年版））, http://wzs.mofcom.gov.cn/article/n/202210/20221003362982.shtml (last accessed 13 June 2023).
[63] Haitong Securities (28 December 2021), *Hydrogen Energy: Challenges and Opportunities* (氢能源：痛点和机会), https://www.htsec.com/jfimg/colimg/upload/20211229/31011640762851799.pdf (last accessed 13 June 2023); Chen L., Zhou K.M. and Lai T.W., (2020), *Hydrogen Fuel Supply Chain Based On Liquid Hydrogen*, (《液氢为核心的氢燃料供应链》), Cryo. & Supercond. 48 (11) pp. 1-7, at 3.
[64] Gong X.H., Quitzow R. and Boute A. (2023), *China's Emerging Hydrogen Economy: Policies, Institutions, Actors*.
[65] Gong, X.H., and Boute, A. (2021), 'For profit or strategic purpose? Chinese outbound energy investments and the international economic regime', *The Journal of World Energy Law & Business*, 14(5), 345–362.

investments in joint ventures and projects by a number of prominent companies across the hydrogen value chain. Among others, Germany's Siemens Energy collaborated with China's State Power Investment Corporation on the construction of a PEM electrolyser for the Beijing Winter Olympics.[66] French Air Liquide has been active in the deployment of refuelling stations around China. It supplied the technology for the Daxing hydrogen refuelling station in Beijing, the world's largest at the time of construction, and signed a joint venture agreement with two Chinese firms to develop an even larger station in Shanghai.[67]

Hyundai and Toyota are major partners for the development of fuel-cell electric trucks and buses, respectively.[68] Hyundai now operates Sichuan Hyundai Motor Company as a subsidiary for the production of fuel-cell electric trucks as well as the related fuel cell stacks. Indeed, Sichuan Hyundai Motor Company became the first wholly foreign-owned automobile manufacturer in China. Toyota, on the other hand, is engaging in a number of joint ventures and strategic alliances with Chinese companies in the field of fuel-cell electric buses.[69]

This cooperation with foreign firms in China—to overcome strategic technology bottlenecks and promote access to technology from cutting-edge foreign suppliers—is complemented by an outward-oriented strategy to promote Chinese industrial leadership in FCEVs. In its *Mid-and-Long Term Development Plan for the Automobile Industry* (2017), the Chinese government encourages the export of FCEV products, services, technologies, and standards via investments in foreign markets and cooperation in technology and standardization. It encourages Chinese firms to take majority stakes in foreign ventures for the production of fuel-cell vehicles and related technologies and engage in technology cooperation in other leading markets.[70] The government is also encouraging Chinese SOEs to lead in the development of industrial parks for the manufacturing of automobiles in countries along the BRI. Complementing this, the Ministry of Industry and Information Technology has also promoted cooperation with the EU, Germany, France, Japan, and the Asia-Pacific Economic Cooperation forum on formulating the standards for fuel cell vehicles,[71] an ambition that has been echoed by China's Standardization Administration.[72]

Finally, the government promotes technological cooperation with a range of actors at the forefront of hydrogen development. NDRC and NEA have stated China's ambition to integrate into global hydrogen value chains by engaging in both bilateral and multilateral technological cooperation.[73] In this vein, China has worked with the International Energy Agency, the International Renewable Energy Agency, the International Partnership for Hydrogen and Fuel Cells in the Economy, and the United Nations Industrial Development Organization in the sphere of technology and to promote exchange on policy and best practices.[74] Moreover, the China Society of Automotive Engineers promoted the launch of the Chinese-led International Hydrogen Fuel Cell Association.[75] In addition, bilateral exchange on research and development and policy-related questions has been launched with Australia, Germany, Saudi Arabia, the UK, and the US.

[66] Radowitz, B. (19 August 2020), 'Siemens Energy and SPIC in green hydrogen deal for major sports event in China', *RECHARGE*, https://www.rechargenews.com/transition/siemens-energy-and-spic-in-green-hydrogen-deal-for-major-sports-event-in-china/2-1-860294 (last accessed on 1 December 2022).

[67] Reuters (6 November 2019), 'Sinopec, French Air Liquide in MOU for hydrogen fuel development in China', https://www.reuters.com/article/china-france-hydrogensinopec/sinopec-french-air-liquide-in-mou-for-hydrogen-fuel-development-in-chinaidUSL3N27M32G (last accessed on 1 December 2022).

[68] Chen, Q.N. (21 December 2021), 'Hyundai's fuel cell strategies in China', *INTEGRAL*, https://www.integralnewenergy.com/?p=32428 (last accessed 13 June 2023).

[69] Chen, 'Hyundai's fuel cell strategies in China'.

[70] Ministry of Science and Technology, Ministry of Industry and Information Technology, and National Development and Reform Commission (2017), *The Mid-and-Long Term Development Plan of Automobile Industry* (汽车产业中长期发展规划), http://www.gov.cn/gongbao/content/2017/content_5230289.htm (last accessed 13 June 2023).

[71] Ministry of Industry and Information Technology (2020), *Key Working Points of Standardizing New Energy Vehicles in 2020* (2020年新能源汽车标准化工作要点), https://www.miit.gov.cn/xwdt/gxdt/sjdt/art/2020/art_6b3143c8375341229ece2c37c65a5373.html (last accessed 13 June 2023).

[72] Standardization Administration (2022), *Key Working Dimensions of National Standardization* (年全国标准化工作要点).

[73] National Development and Reform Commission and National Energy Agency (2022), *Opinions on Improving the Regime and Implementation Measures of Energy Green Low-Carbon Transition* (**关于完善能源**绿色低碳转型体制机制和政策措施的意见).

[74] International Energy Agency-Hydrogen Implementing Agreement (2016), 'People's Republic of China becomes a member of the International Energy Agency Hydrogen Implementing Agreement', https://www.prnewswire.com/news-releases/peoples-republic-of-china-becomes-a-member-of-the-international-energy-agency-hydrogen-implementing-agreement-iea-hia-300348681.html (last accessed on 14 February 2023); International Renewable Energy Agency (7 June 2021), 'IRENA and National Energy Administration of China sign MoU to advance the transition and cooperate on market development', https://www.irena.org/News/pressreleases/2021/Jun/China-and-IRENA-Boost-Ties-as-Leading-Renewables-Market-Eyes-Net-Zero-Goals (last accessed on 14 February 2023); International Partnership for Hydrogen and Fuel Cells in the Economy (2023), 'Partners', https://www.iphe.net/partners (last accessed on 22 April 2023).

[75] Delaval B., Rapson T., Sharma R., Hugh-Jones W., McClure E., Temminghoff M., Srinivasan V. (2022), *Hydrogen RD&D Collaboration Opportunities: China*. Commonwealth Scientific and Industrial Research Organisation, Australia, http://mission-innovation.net/wp-content/uploads/2022/09/H2RDD-China-FINAL.pdf (last accessed 13 June 2023).

**Geopolitics of hydrogen supply: an advantage for renewables-rich China**

While China has been actively engaged in the acquisition and development of hydrogen-related technologies, its engagement with questions of hydrogen supply is more recent. A clear policy only emerged with the *Mid-and-Long-Term Hydrogen Industrial Development Plan* in 2022.[76] As mentioned above, this set the relatively modest target of producing 100,000 to 200,000 tons of renewable hydrogen per year by 2025. This goal might be seen less as a strategy for meeting growing hydrogen demand than as a strategy to promote hydrogen as a storage medium within a power system with increasing shares of renewable energy. Indeed, this rationale is highlighted not only in the national hydrogen development plan but also in the *14th Five Year Plan for a Modern Energy System* and the *14th Plan for Renewable Energy Development*.[77] The latter states that renewable hydrogen production is envisioned both in low-cost sites for renewable power generation and in the vicinity of hydrogen demand centres.

Although the national hydrogen development plan clearly highlights the role of renewable hydrogen, China's policies regarding the production of hydrogen remain ambiguous. No policy has defined the different types of hydrogen production, nor is there a framework in place for limiting greenhouse gas emissions from hydrogen production. As a result, local and provincial governments are pursuing strategies to ramp up all types of hydrogen production, including from coal, industrial by-products, and nuclear power, depending on their local competitive advantage. Also, low-carbon hydrogen production, based on carbon capture and storage technologies, is not emerging as a priority. There are only selected local developments and no clear policy commitment from the central government. This ambiguity by the central government is likely to be a deliberate strategy to secure the needed short-term hydrogen supply to fuel the development of emerging applications over the coming decade. This includes its rapidly growing FCEV sector but also emerging ambitions to deploy hydrogen to decarbonize industrial processes.[78]

In the long term, the government can rely on abundant renewable energy resources in the north and southwest of the country to secure its renewable hydrogen supply. Indeed, abundant renewable energy resources in China offer an important strategic advantage in a future carbon-neutral energy system. The replacement of oil and natural gas with renewables, whether in the form of electricity or hydrogen, would significantly reduce China's current reliance on imported fossil fuels. Consequently, the development of international supply routes and trade-related infrastructure has not emerged as a priority of the central government to date. Rather, as mentioned above, the government has articulated concerns regarding the acquisition of technological know-how in transport and storage to avoid dependence on foreign firms. This technological know-how will play an important role in developing domestic supply routes, given the large distances between future hydrogen demand centres on the coast and renewable energy resources further inland.[79]

**Renewable hydrogen as a building block in China's overseas energy investments**

Despite China's abundant domestic potential, Chinese SOEs have begun to engage internationally in the field of renewable hydrogen production, though largely based on strong pre-existing engagement in the respective countries' energy sectors, most notably in Brazil, Pakistan, and Egypt. Chinese companies have held a strong position in Brazil's electricity market for over a decade, holding more than 10 percent of generation, transmission, and distribution.[80] Both the State Power Investment Corporation and the China Three Gorges International Corporation have invested in research and development activities in Brazil in the field of renewable hydrogen.[81] China Three Gorges, which operates 17 hydropower and 11 wind power projects in Brazil, has also initiated a cooperation with Brazil's National Service for Industrial Learning to develop a transaction platform for renewable hydrogen.[82]

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[76] National Development and Reform Commission, *The Mid-and-Long-Term Hydrogen Industrial Development Plan*.

[77] National Development and Reform Commission and National Energy Agency (2022), *The 14th Five-Year Plan of Modern Energy System* (十四五现代能源体系规划); National Development and Reform Commission, National Energy Agency, Ministry of Finance, Ministry of Natural Resources, Ministry of Ecology and Environment, Ministry of Housing and Urban-Rural Development, Ministry of Agriculture, China Meteorological Administration and National Forestry and Grassland Administration (2022), *The 14th Five-Year Plan of Renewable Energy Development* (十四五可再生能源规划).

[78] Gong X.H., Quitzow R. and Boute A. (2023),

[79] Gong X.H., Quitzow R. and Boute A. (2023),

[80] Global Development Center (25 January 2021), *Lighting Up: China's Arrival in Brazil's Electricity Sector*, https://www.bu.edu/gdp/2021/01/25/lighting-up-chinas-arrival-in-brazils-electricity-sector/ (last accessed 13 June 2023).

[81] Uchôa, V. (18 November 2021), 'Brazil sets its sights on the global green hydrogen market', *Diálogo Chino*, https://dialogochino.net/en/climate-energy/48497-brazil-sets-sights-green-hydrogen-market/ (last accessed on 17 June 2022); China Three Gorges International Corporation (2022), *Operation Information of China Three Gorges International Corporation in 2021 in Brazil*, (CTGI, 2021|稳中求进，突破创新——三峡巴西公司交出精彩答卷), ,
https://www.ctgi.cn/ctgichina/1047999/1166000/1287664/index.html?3IbZtGUb=wiqsTalqEHshOzfEUxGiVZE8f90IixcSXTnk5VHnGJWl3QZ_HN7JErvAJ_ShYFXQH4jcOcKrU2YejP68gG3R9DxnrE6Yv1Fy (last accessed on 25 July 2022).

[82] CTGIC (2022), 'Green hydrogen cooperation between CTGIC and SENAI' (三峡巴西公司与SENAI合作投资创新绿氢项目),
https://www.ctgi.cn/ctgichina/1047999/1166000/1288625/index.html?3IbZtGUb=oCbnualqEHshOzfEUxGiVZE8f90IixcSXTnk5VHnGJWl3QZ_HN7JErvAJ_ShYFXQH4jcOcKrU2KCtiTS2.G0LkGCB0VL6IqS (last accessed on 25 July 2022).

In Pakistan, the project developer Oracle Power has signed MOUs with PowerChina International Group and China Electric Power and Technology Co., a subsidiary of the State Grid Corporation of China, to jointly develop renewable hydrogen production facilities in the country. Two initial projects are targeting 900 MW of electrolyser capacity.[83] After COP27 in Egypt in November 2022, the China Energy Engineering Corporation signed an MOU with the Egyptian New and Renewable Energy Authority, the Suez Canal Economic Zone Authority, sovereign wealth funds, and power transmission companies to develop renewable hydrogen projects.[84] In March 2023, the Egyptian government announced that construction of a US$5.1 billion renewable hydrogen plant would commence in May 2024.[85]

These activities are consistent with China's broader policy to promote the export of energy-related technology, services, and equipment and to increase its role in global energy value chains.[86] In this vein, the development of energy infrastructure has featured prominently in China's BRI, representing between a third and half of investments since 2016.[87] Indeed, Egypt and Pakistan constitute critical building blocks in the initiative. Egypt is a gateway to the African continent and the Mediterranean Sea, while Pakistan is envisioned as an important element in creating new trade routes between China and the Middle East. Both have been the destination of large Chinese energy-related investments in the past. Close to 8 GW of power generation capacity has been developed under the China-Pakistan Economic Corridor since its inception in 2015.[88] In Egypt, Chinese SOEs have invested approximately US$3.5 billion in energy-related infrastructure.[89] While Brazil has not officially joined the BRI, it is a critical player on the South American continent.

**China and the emerging geopolitics of hydrogen**

In sum, China can build on important strengths as it gradually ramps up its domestic hydrogen sector and positions itself within the global geopolitics of hydrogen. Firstly, China is a global manufacturing leader in both electrolysers and fuel cell vehicles. Although it may still confront technological bottlenecks in some segments of the hydrogen value chain, notably in transport and storage, and lag behind in quality, China has demonstrated its ability to catch up and even overtake technology leaders in the past. Indeed, this is the primary focus of its policy to date.

Secondly, China holds abundant renewable energy potential, which it could mobilize to replace fossil fuels with hydrogen and hydrogen-based derivatives in the long term. This is an advantage in terms of energy security and provides the basis for developing competitive green steel and chemical production. The latter may also offer a prospect for the development of lower-income regions with high renewable potential in northern and western China, although this has not been a major priority to date. China's abundant renewable energy resources also provide a vast potential for domestic market development, once Chinese policymakers decide to ramp up the production of renewable hydrogen. The timing of this could offer an important strategic advantage in the global competition for industrial leadership, potentially providing Chinese firms with a lifeline in the face of global downturn.

In terms of its international engagement, China remains clearly focused on building its technological capacities, promoting both inward- and outward-oriented cooperation with international partners. Here FCEVs are a clear priority. Engagement in overseas investments in hydrogen production largely continue the logic of China's broader energy-related investments along the BRI and with other strategic partners. Here hydrogen does not feature as a unique policy agenda but rather as a building block in China's overarching geopolitical strategy.

[83] Whitlock, R. (11 October 2021), 'Oracle Power signs cooperation agreement for green hydrogen facility in Pakistan', *Renewable Energy Magazine,* https://www.renewableenergymagazine.com/hydrogen/oracle-power-signs-cooperation-agreement-for-green-20211011 (last accessed on 19 August 2022).
[84] Seetao (9 December 2022). 'CEEC's hydrogen business goes to sea for the first time', https://www.seetao.com/details/194586.html (last accessed on 1 December 2022).
[85] Reuters (2023), 'China Energy to build green hydrogen project in Egypt with expected investments worth $5.1 bln', https://www.reuters.com/article/egypt-china-greenhyrogen-idUSS8N35D0E9 (last accessed on 1 May 2023).
[86] National Development and Reform Commission and National Energy Agency (2016), *Energy Production and Consumption Transition Strategy (2016–2030)* (能源生产和消费革命战略（2016—2030）).
[87] Wang, C.N. (2023), *China Belt and Road Initiative (BRI) Investment Report 2022*, https://greenfdc.org/china-belt-and-road-initiative-bri-investment-report-2022/ (last accessed on 17 May 2023).
[88] China-Pakistan Economic Corridor Secretariat Office, 'Energy projects under CPEC', https://cpec.gov.pk/energy (last accessed 13 June 2023).
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# FINANCING NET-ZERO TRANSITION FOR DEVELOPING COUNTRIES: CHINA'S DILEMMA IN A FRAGMENTING WORLD

***Ji Chen and Shurui Jiang***

Achieving net-zero transition for developing countries requires significant investment in clean energy. According to the International Energy Agency (IEA), to ensure that the world is on track to meet the 2050 target of net-zero emissions, developing countries would require over $1 trillion in clean energy investment per year by 2030;[90] in contrast, between 2015 and 2023, clean energy investment received by developing economies (China excluded) ranged from $214 billion to $250 billion per year.[91] A significant financing gap thus exists, which will eventually impede global progress toward achieving the Paris Agreement climate goal. 'Geoeconomic fragmentation', as the International Monetary Fund (IMF) describes the tendency of globalization to slow or even reverse,[92] is making it even more difficult for developing countries to close this gap.

China is the powerhouse of the global clean energy supply chain, and has been actively increasing overseas investments. Will China be able to play a bigger role in financing developing countries' net-zero efforts in such a fragmenting world? This article attempts to answer this question by analysing the impacts of global geoeconomic fragmentation on developing countries' financial ability to adopt clean energy, as well as China's willingness and ability to provide more financial resources for developing countries' clean energy sectors.

**Developing countries' weaker capacity for financing clean energy**

Developing countries are confronted with greater challenges in clean energy financing as their net-zero transition is often more expensive than that of developed countries.[93] The fragmenting geoeconomic landscape, as the IMF highlighted, further weakens their financing capability for clean energy, primarily due to three characteristics that increase international financial costs:

1. Disruptions to international payment systems — geoeconomic fragmentation directly results in financial restrictions, including the freezing of financial assets or investment activities, and in extreme cases, shutting down a cross-border payment communication protocol, such as the removal of select Russian banks from SWIFT.[94] These restrictions lead to higher costs of international investment transactions and reduced volume of cross-border payments.
2. Reversal of cross-border capital—investors may allocate less capital to countries that are less aligned on foreign policy issues,[95] for reasons that include financial constraints that increase transaction costs, information asymmetry, general mistrust, and fear of expropriation.[96]
3. Asset price volatility—increased geopolitical tensions could lead to disruptions to commodity markets, which in turn cause higher inflation and justify a tightening of monetary policy. This could depress asset prices, raising borrowing costs for non-financial corporations.[97]

The impact of geoeconomic fragmentation on financing costs is particularly pronounced for developing countries,[98] as evidenced by their substantially larger increase in financing costs resulting from geopolitical tension compared to developed economies. For example, right after the outbreak of the Russia-Ukraine conflict, short-term nominal interest rates of developed

[90] IEA (2021), *Investment Data Explorer*, https://www.iea.org/data-and-statistics/data-tools/investment-data-explorer.
[91] IEA (2023), *World Energy Investment 2023 Datafile*, https://www.iea.org/data-and-statistics/data-product/world-energy-investment-2023-datafile-2.
[92] Aiyar, S., Chen, J., Ebeke, C. H., et al. (2023), *Geoeconomic Fragmentation and the Future of Multilateralism*, International Monetary Fund, https://www.imf.org/en/Publications/Staff-Discussion-Notes/Issues/2023/01/11/Geo-Economic-Fragmentation-and-the-Future-of-Multilateralism-527266.
[93] Buhr, B., Volz, U, Donovan, C., et al. (2018), Climate Change and the Cost of Capital in Developing Countries, UN Environment, https://unepinquiry.org/publication/climate-change-and-the-cost-of-capital-in-developing-countries/.
[94] CNN (2022, February 26), *White House and EU nations announce expulsion of 'selected Russian banks' from SWIFT*, https://edition.cnn.com/2022/02/26/politics/biden-ukraine-russia-swift/index.html.
[95] Portes, R. & Rey, H. (2005), *The determinants of cross-border equity flows*. Journal of International Economics, 65(2), 269-296, https://doi.org/10.1016/j.jinteco.2004.05.002.
[96] IMF (2023), *Global Financial Stability Report: Safeguarding Financial Stability amid High Inflation and Geopolitical Risks*, https://www.imf.org/en/Publications/GFSR/Issues/2023/04/11/global-financial-stability-report-april-2023.
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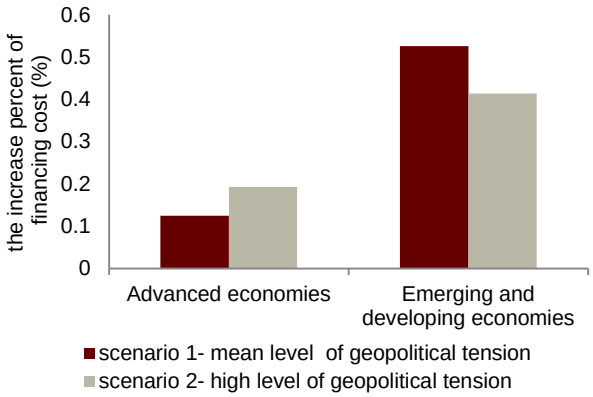
[98] Georgieva, K. (2023, January 16), *Confronting Fragmentation Where It Matters Most: Trade, Debt, and Climate Action*, IMF Blog, https://www.imf.org/en/Blogs/Articles/2023/01/16/Confronting-fragmentation-where-it-matters-most-trade-debt-and-climate-action.

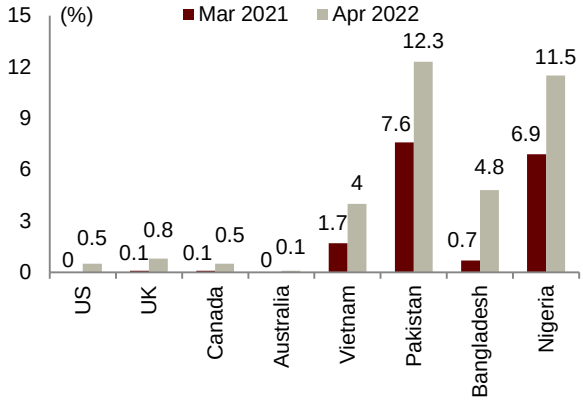
countries increased less than one percentage point in April 2022 compared to March 2021, while developing economies such as Vietnam and Pakistan saw higher increases of 3–4 percentage points. Financing costs in some developing countries rose even more sharply. For example, the short-term nominal interest rate of Zimbabwe reached 80 per cent and that of Argentina rose to 44.5 per cent in April 2022.[99]

**Effect of geopolitical tension on financing costs (2001–2021)**




Sources: International Monetary Fund, China International Capital Corporation Global Institute

**Short-term nominal interest rates (2021–2022)**




Sources: China Economic Information Center, Trading Economics, China International Capital Corporation Global Institute

In addition, successive US rate hikes have lured international capital to the US, impeding the financing capacity of developing countries. According to an IMF report published in 2021, financing costs in developing countries have increased due to US monetary policy, with each percentage point rise in US interest rates tending to immediately lift long-term interest rates by one-third to two-thirds of a percentage point in emerging markets.[100] In particular, US monetary tightening has had a greater financial impact on developing countries than on developed countries. According to the IMF, developed countries are not significantly affected since their higher level of financial development allows them to better hedge against such shocks, but net capital inflows to developing countries might decline significantly when foreign interest rates rise.[101] Moreover, empirical studies show that developing countries experience a greater decline in GDP compared to developed countries after US monetary tightening,[102] making it even more difficult for them to access lower-cost financing.

Higher financing cost impedes developing countries' ability to attract domestic capital for their clean energy sectors.[103] As a result, developing countries are likely to become even more dependent on international capital. The IEA estimates that about one-quarter of total energy investment in emerging and developing economies (China excluded) today comes from international institutions. In the clean energy sector, international investment plays an even more crucial role in some countries or projects. For example, sub-Saharan Africa has long been highly dependent on international capital; 90 per cent of project financing for large-scale natural gas infrastructure in developing countries comes from international sources, providing project debt with long-term off-take agreements. According to the IEA, international investment will remain one of the main providers underpinning clean energy financing in developing countries through 2030.[104]

[99] Neufeld, D. (2022, April 21), *Mapped: Interest Rates by Country in 2022*, Markets in a Minute, https://advisor.visualcapitalist.com/mapped-interest-rates-by-country-in-2022/.
[100] Engler, P. , Piazza, R. , & Sher, G. (2021, April 5), *How Rising Interest Rates Could Affect Emerging Markets*, IMF Blog, https://www.imf.org/en/Blogs/Articles/2021/04/05/how-rising-interest-rates-could-affect-emerging-markets.
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[103] Ameli, N. , Dessens, O. , Winning, M. , et al. (2021), *Higher cost of finance exacerbates a climate investment trap in developing economies*, Nature Communications, 12, 4046, https://doi.org/10.1038/s41467-021-24305-3.
[104] IEA (2021), Financing clean energy transitions in emerging and developing economies, IEA, https://www.iea.org/reports/financing-clean-energy-transitions-in-emerging-and-developing-economies.

More specifically, clean energy investment in developing countries today is highly dependent on international finance from public sources.[105] Efforts are underway to mobilize investment through public finance by employing two main strategies: scaling up public finance and mobilizing private finance. However, both strategies face challenges. First, the prioritization of other issues, arguments in international climate agreements, and the lack of transparency in disclosure of funding aggravate the challenges in scaling up public finance.[106] For example, there is still a gap of $16.7 billion in developed countries' commitment of $100 billion to climate-related financing.[107] Second, the lack of profitability in climate investments,[108] and limited utilization of risk-sharing instruments in mobilizing mechanisms such as guarantees, discourage the private sector from participating.[109] Private financing mobilized by public sources has reached only a 0.4:1 private:public ratio for low-income and middle-income economies.[110]

**China's stronger impetus for investing clean energy in developing countries**

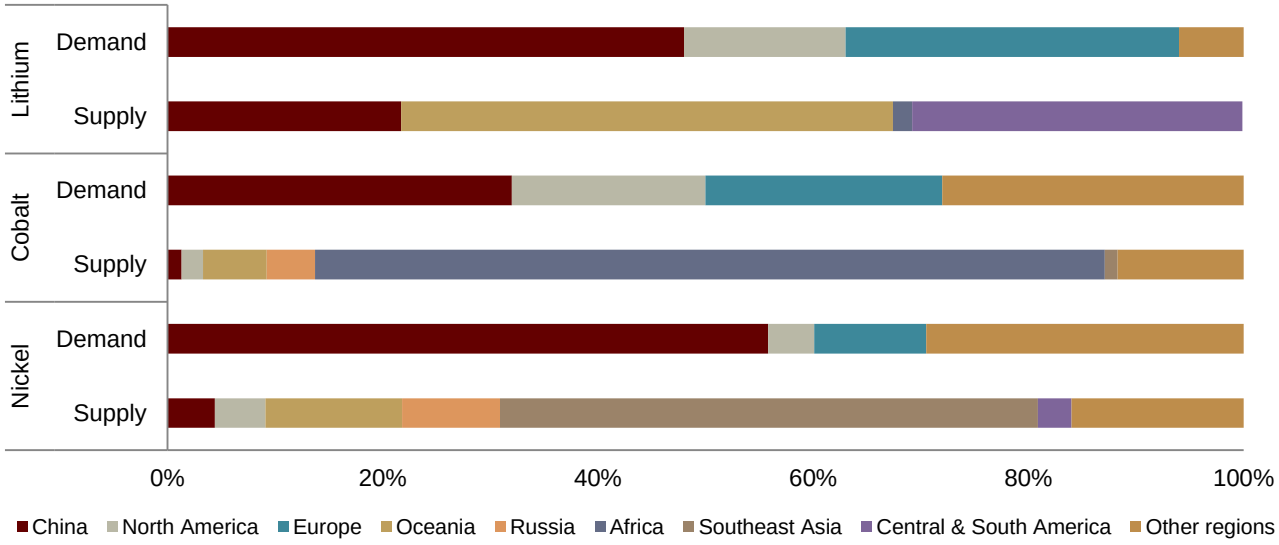
China is one of the top investors in developing countries' clean energy initiatives. China's foreign direct investment (FDI) in the clean energy sector accounted for 6 per cent of the total FDI received by developing countries between 2013 and 2022,[111] making it the country with the sixth-largest investment in developing countries' clean energy sectors. The largest investor in this sense is the US, which accounts for no more than 10 per cent. The following three factors could potentially drive further growth of China's investments in this area:

1. Stopping overseas coal-fired power projects frees up more space for clean energy financing. In September 2021, China committed to ceasing support for building new coal-fired power projects overseas. The transition to clean energy investment has paid off, with China's overseas clean energy investment increasing to over $16 billion in 2021 and $17 billion in 2022, and non-clean energy investment falling rapidly from $13.5 billion in 2021 to $6.9 billion in 2022.[112]

2. Growing demand for new energy minerals (metallic mineral resources—such as lithium, cobalt, and nickel—that play an important role in renewable energy generation and new energy vehicles) drives investment in developing countries with rich mineral resources. New energy minerals exhibit high concentration of supply and uneven regional distribution, resulting in a mismatch between China's supply and demand for renewable energy metals. With a substantial share of global renewable energy production capacity, China's demand for lithium, cobalt, and nickel accounts for 48 per cent, 32 per cent, and 56 per cent of the global total, respectively, while its domestic supply is far lower, with lithium, cobalt, and nickel accounting for only 22 per cent, 1 per cent, and 4 per cent of the global total in 2020.

[105] IEA (2021), Financing clean energy transitions in emerging and developing economies, IEA, https://www.iea.org/reports/financing-clean-energy-transitions-in-emerging-and-developing-economies.
[106] Quatrini, S. (2020), *Challenges and opportunities to scale up sustainable finance after the COVID-19 crisis: Lessons and promising innovations from science and practice*, Ecosystem Services, 48,101240, https://www.sciencedirect.com/science/article/pii/S2212041620301820; Reichenbach, C. (2022), *The missing dispute resolution mechanisms in international climate change agreements,* Global Energy Law and Sustainability, 3(2), 129-158*,* https://euppublishing.com/doi/full/10.3366/gels.2022.0077.
[107] OECD (2022), *Climate Finance and the USD 100 Billion Goal*, https://www.oecd.org/climate-change/finance-usd-100-billion-goal/.
[108] UNEP (2019), *Driving Finance Today for the Climate Resilient Society of Tomorrow*, https://www.unepfi.org/publications/driving-finance-today-for-the-climate-resilient-society-of-tomorrow/.
[109] Gohdes, B. , & Christianson, G. (2017, December 20), *INSIDER: Expanding the Toolbox: A Glimpse at a New Generation of MDB De-Risking Approaches*, World Recourse Institute, https://www.wri.org/technical-perspectives/insider-expanding-toolbox-glimpse-new-generation-mdb-de-risking-approaches.
[110] AfDB, ADB, AIIB et al. (2021), *2021 Joint Report on Multilateral Development Banks' Climate Finance*, http://dx.doi.org/10.18235/0004505.
[111] Data source: *FDI Markets* database, https://www.fdimarkets.com.
[112] AEI (2022), *China Global Investment Tracker*, https://www.aei.org/china-global-investment-tracker/.

**Global market share of lithium-cobalt-nickel supply and end-use demand (2020)**




Sources: US Geological Survey, China Association of Automobile Manufacturers, EV Sales, China International Capital Corporation Global Institute

The mismatch could be larger if China produces more in the global supply chain. According to the IEA, China's cathode production capacity is projected to rise from around 80 per cent of global production to 93 per cent by 2030,[113] a clear sign of the continuous rise in China's demand for renewable energy metals. However, the growth potential of China's renewable metal production capacity is limited. For example, the optimistic projection suggests that China's global share of lithium and nickel production capacity will by 2030 reach 24 and 14 per cent, respectively,[114] which creates considerable potential for China to increase investment in countries with abundant new energy mineral supplies. In fact, Chinese companies have already begun to take action. For example, CATL (Contemporary Amperex Technology Co., Limited), the world's leading battery manufacturer, has strategically positioned itself in Indonesia, integrating nickel mining, refining, battery manufacturing, and recycling in comprehensive power battery projects.[115]

3. Growing market uncertainty brought by industrial and trade policies from a growing number of economies such as the US and Europe are pushing Chinese manufacturers to deploy production abroad. US and European countries have implemented green industrial policies for the clean energy sector, such as subsidies for the domestic lithium and photovoltaic (PV) industries and tariffs on related import products from China.[116] For example, the China International Capital Corporation has compared the total costs of the lithium batteries and PV products manufactured for US markets in China, South-East Asia, and the US.[117] The results indicate that these products enjoy the lowest costs when they are produced in the US, followed by South-East Asia, while products manufactured in China cost the most in this scenario. In fact, a growing number of Chinese solar PV manufacturers have been relocating their production capacity to South-East Asia. LONGi, for example, has established overseas production bases in Malaysia, Vietnam, and other developing countries to minimize its transaction costs.[118]

[113] IEA (2023), *Energy Technology Perspectives 2023*, https://www.iea.org/reports/energy-technology-perspectives-2023.
[114] BNEF (2023), *Energy Transition Investment Trends 2023*, https://about.bnef.com/energy-transition-investment/.
[115] Bloomberg (2022, April 15), *China Battery Giant CATL Joins $6 Billion Venture in Indonesia*, https://www.bloomberg.com/news/articles/2022-04-15/china-battery-giant-catl-joins-6-billion-venture-in-indonesia?leadSource=uverify%20wall.
[116] For the US: The White House (2023), *Inflation Reduction Act Guidebook*, https://www.whitehouse.gov/cleanenergy/inflation-reduction-act-guidebook/; for European countries: European Commission (2023), *The Green Deal Industrial Plan*, https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/green-deal-industrial-plan_en.
[117] CICC (2022, November 11), https://www.research.cicc.com/zh_CN/report?id=1114824 (in Chinese).
[118] Reuters (2021, November 11), *China's Longi plans to set up more manufacturing plants overseas*, https://www.reuters.com/business/sustainable-business/chinas-longi-plans-set-up-more-manufacturing-plants-overseas-2021-11-11/.

In addition, strengthening cooperation with developing countries installing wind and solar power plants also creates opportunities for Chinese companies to diversify their markets, and boosts exports of China's renewable products to developing countries through overseas project investment and development. From 2012 to 2020, Chinese companies accumulated an installed capacity of over 9.4 GW of solar power plants and over 9.3 GW of wind power projects through overseas investment.[119]

**Geoeconomic fragmentation makes things harder**

While there is growing impetus for China to provide more financing to developing countries for clean energy, particularly in new energy minerals and manufacturing, the changing global landscape presents at least two challenges, as elaborated below, impeding Chinese institutions from doing so.

First, being overly concerned about supply security may exacerbate the fragmentation risk for the new energy minerals market. In recent years, there has been a growing emphasis on supply chain security in new energy minerals as a response to geoeconomic fragmentation.[120] It is acknowledged that international trade and FDI liberalization enhance productivity and economic growth.[121] However, overly protecting supply chain security has led to increased investment and trade barriers, which have imposed greater transaction costs on China's financing to developing countries:

1. From the demand side of new energy minerals, alliances such as the Energy Resource Governance Initiative and the Minerals Security Partnership have been launched to strengthen supply chain security by diversifying the sources of supply.[122] These alliances tend to take protectionist and exclusive measures, and hinder the access for other countries to invest in new energy minerals in key supplier countries.[123]

2. From the supply side, resource-rich countries such as Argentina, Bolivia, and Chile are establishing an OPEC-style lithium cartel and promoting nationalization to enable greater state control,[124] raising concerns of potential restrictions on lithium mining and foreign investment,[125] which may not necessarily be beneficial to resource-owning countries in the long run. For example, excessive involvement of the Mongolian government has negatively affected the profitability of mineral projects and caused delays in committed project timelines, resulting in reduced FDI in Mongolia.[126]

Second, the escalation of international trade restrictions will impose higher costs for China's investment in clean energy manufacturing sectors in developing countries. For example, the US government has conducted anti-circumvention investigations against solar PV products from four South-East Asian countries, which may lead to restrictions on product exports when tariff exemptions expire on 6 June 2024.[127] This brings greater uncertainty to the industrial chains in South-East Asian countries. Manufacturers in those countries would encounter constraints and may be compelled to recalibrate their supply chains and production processes to adhere to the potential US anti-circumvention requirements. These uncertainties can result in delays in investment or higher production costs,[128] posing significant challenges for Chinese companies seeking to transfer

[119] WRI (2021, November 5), https://wri.org.cn/insights/green-development-overseas-renewable-energy-investments (in Chinese).
[120] Korinek J. (2018, July 23), *Trade restrictions on metals and minerals*, https://resourcetrade.earth/publications/trade-restrictions-on-metals-and-minerals.
[121] Dabla-Norris,E. , Romain Duval, R. (2016), *How Lowering Trade Barriers Can Revive Global Productivity and Growth*, IMF Blog, https://www.imf.org/en/Blogs/Articles/2016/06/20/how-lowering-trade-barriers-can-revive-global-productivity-and-growth.
[122] Reuters (2020, June 3), *U.S. hopes to expand strategic minerals initiative*, https://www.reuters.com/article/us-usa-minerals-idUSKBN23930I; Vivoda, V. (2023), *Friend-shoring and critical minerals: Exploring the role of the Minerals Security Partnership*, Energy Research & Social Science, 100,103085, https://doi.org/10.1016/j.erss.2023.103085.
[123] Rajan, R. G. (2022, June 4), *Just say no to 'friend-shoring'*, https://www.gulf-times.com/story/718485/Just-say-no-to-friend-shoring.
[124] Bloomberg (2023, March 30), *Creation of 'Lithium OPEC' Underway in South America as EV Demand Surges Worldwide*, https://www.bloomberg.com/press-releases/2023-03-30/creation-of-lithium-opec-underway-in-south-america-as-ev-demand-surges-worldwide; Mining Technology (2023, May 9), *Lithium nationalisation: another step towards protectionism*, https://www.mining-technology.com/comment/lithium-nationalisation-another-step-towards-protectionism/.
[125] *Global Times* (2023, April 24), *Chile's lithium nationalization plan may have negative impact on China's supply*, https://www.globaltimes.cn/page/202304/1289705.shtml.
[126] Ganbold, M. & Ali, S. H. (2017), *The peril and promise of resource nationalism: A case analysis of Mongolia's mining development*, Resources Policy, 53,1-11, https://doi.org/10.1016/j.resourpol.2017.05.006.
[127] US Department of Commerce (2022, December 27), *Department of Commerce Issues Preliminary Determination of Circumvention Inquiries of Solar Cells and Modules Produced in China*, https://www.commerce.gov/news/press-releases/2022/12/department-commerce-issues-preliminary-determination-circumvention.
[128] Hoang, K. (2022), *How does corporate R&D investment respond to climate policy uncertainty? Evidence from heavy emitter firms in the United States*, Corporate Social Responsibility and Environmental Management, 29(4), 936-949, https://doi.org/10.1002/csr.2246.

clean energy production capacity. Furthermore, this might hinder the advancement of developing countries in the clean energy sector, as it potentially reduces cooperation with China's clean energy industry.

In recent decades, globalization has significantly enhanced production efficiency and reduced the cost of clean energy technologies. For example, a study indicates that if countries shifted to complete domestic production starting from 2020, the global prices of solar panels in 2030 would be 20–25 per cent higher compared to relying on a globalized supply chain.[129] Looking ahead, even with the global tendency towards geoeconomic fragmentation, it is critical for the entire international community to create a more collaborative environment so that China's stronger impetus toward financing developing countries' net-zero transition can be fully taken advantage of.

## THE IMPACTS OF THE EU CARBON BORDER ADJUSTMENT MECHANISM ON CHINA'S SUPPLY CHAIN AND CHINA'S RESPONSE

***Yan Qin***

The European Union will implement a carbon border adjustment mechanism (CBAM) on certain imported goods from 2023. This first carbon tariff in the world will have implications for the trade and supply chain of China, the EU's largest trading partner. In the beginning, the EU CBAM will mostly affect China's aluminium and steel exports, and the impact is estimated to be limited.

The response from China to the CBAM to date has been twofold. Internationally, official communications criticize the CBAM as a trade barrier which violates the multilateral principle in global climate talks. Domestically, intense discussions are taking place among enterprises regarding the CBAM's implications for China as well as policy recommendations to both the government and private sector. This could be due to the recognition that, while the CBAM will initially only have a limited impact on China's exports, that impact will increase following the expansion of the CBAM, especially given the potential inclusion of more downstream products.

In addition, the CBAM will be an external factor pushing Chinese energy-intensive enterprises to speed up decarbonization and deploy more green electricity. The latter will also help China to integrate the vast deployment of renewables and reduce curtailment. China's energy-intensive industries are expected to phase down output under the carbon peak and carbon neutrality pathways, and they are already experiencing stress due to the slowdown in the real estate sector. The EU CBAM may also put pressure on China to speed up the expansion of its national emissions trading scheme (ETS) to CBAM-exposed sectors.

**Launching the CBAM**

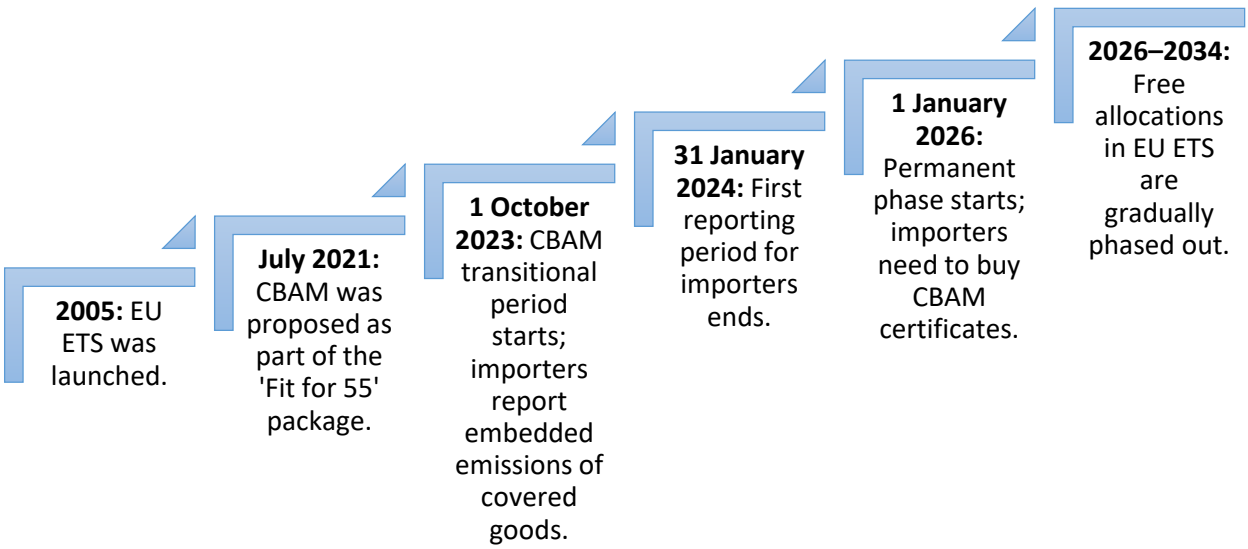
In May 2023, the EU CBAM legislation entered into force,[130] after lengthy negotiations among EU lawmakers since it was officially proposed in July 2021. The transitional period will start on 1 October, marking the beginning of the first carbon tariff in the world. It is an important legislation in the EU's landmark 'Fit for 55' package to put EU on the path to reduce emissions by 55 per cent in 2030 from 1990 levels.

The CBAM will run in parallel with the EU ETS, which has been in operation since 2005. It will follow a careful, predictable, and proportionate transition pathway for EU and non-EU businesses. It will initially apply to certain imported goods: cement, iron and steel, aluminium, fertilizers, electricity, and hydrogen. In the transitional period from 2023 to 2026, importers of goods in these sectors will only have to report greenhouse gas emissions embedded in their imports. From 1 January 2026, the CBAM will formally start. Starting then, importers must purchase CBAM certificates each year based on the embedded emissions of their goods and surrender these certificates to comply. The price of CBAM certificates will be calculated depending on the weekly average auction price of EU ETS allowances. The gradual phase-in of the CBAM will be combined with a gradual phase-out of free allowances for CBAM sectors under the EU ETS until 2034.
The European Commission will release a series of regulations governing the implementation of the CBAM. On 13 June 2023,

[129] Helveston, J. P. , He, G. , & Davidson, M. R. (2022), *Quantifying the cost savings of global solar photovoltaic supply chains*, Nature, 612, 83-87, https://www.nature.com/articles/s41586-022-05316-6.
[130] https://taxation-customs.ec.europa.eu/carbon-border-adjustment-mechanism_en.

the Commission published a first call for feedback on specific reporting obligations in the CBAM's transitional phase. The consultation seeks details about the reporting obligations and information sought from EU importers of CBAM goods, as well as the provisional methodology for calculating embedded emissions released during the production of CBAM goods.

**EU CBAM timeline**




Source: EU CBAM regulation from May 2023

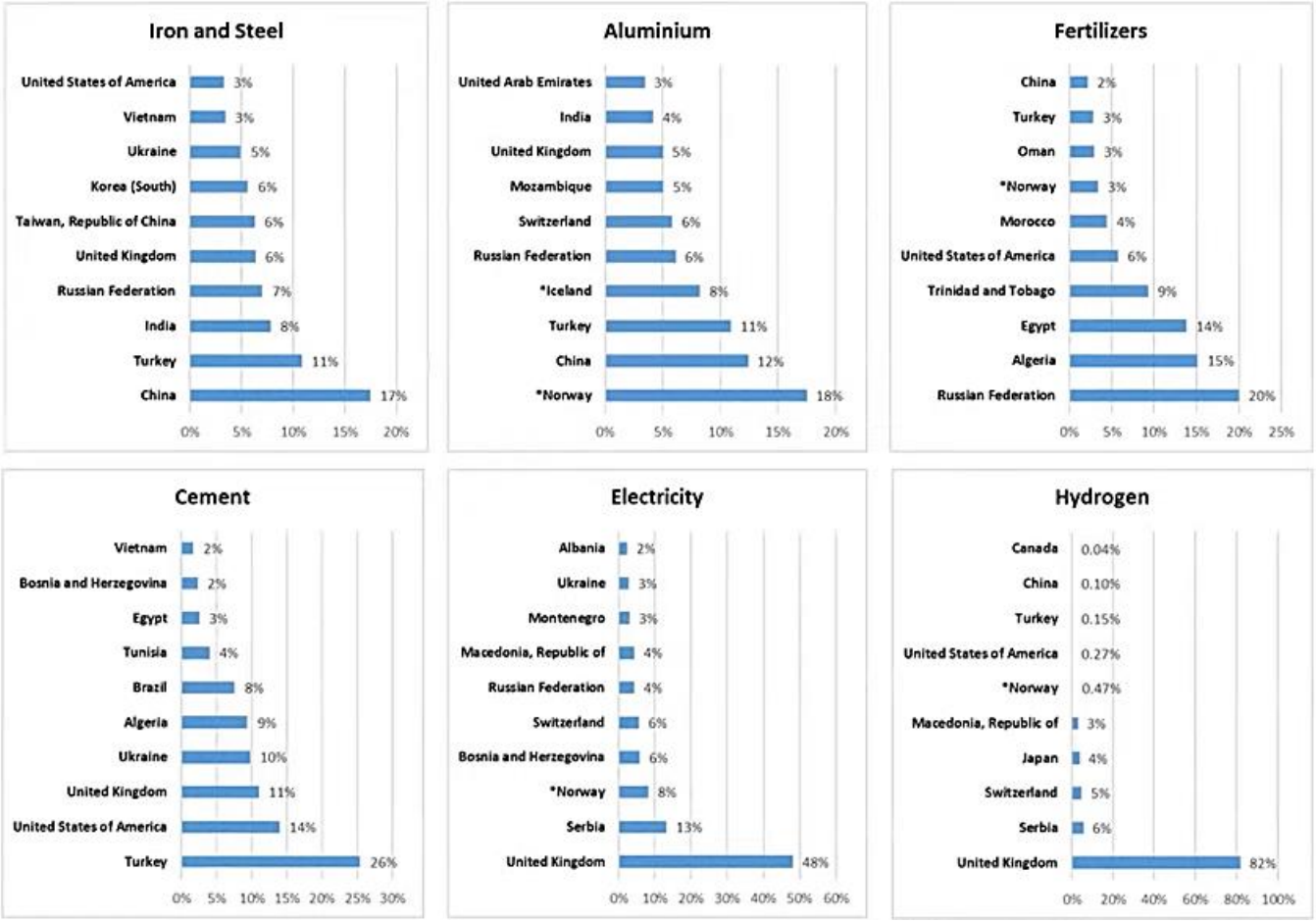
**Limited initial impacts on China's supply chain costs**

The objective of the EU CBAM is to avoid 'carbon leakage', i.e. to prevent EU production from moving to non-EU jurisdictions with less stringent climate policies and carbon prices and EU goods being replaced by energy-intensive imports. By imposing carbon costs on goods imported into the EU, the CBAM could create a level playing field to ensure that the carbon price of imports is equivalent to the carbon price of domestic production and that the EU's climate objectives are not undermined. Without doubt, the implementation of the CBAM will have impacts on the EU's trading partners and global trade.

China was the largest partner for EU imports of goods in 2022, with a 20.8 per cent share according to Eurostat data.[131] Telecommunications equipment and automatic data processing machines are the two most imported products from China into the EU. Among the CBAM-covered sectors under the current set-up, aluminium and steel products from China will be exposed to the additional carbon costs. As can be seen in the figure below, China was the largest exporter of iron and steel in 2022 to the EU, accounting for 17 per cent of total imports by volume. Among the exporters of aluminium to the EU, China's share was 12 per cent, just behind Norway's 18 per cent. Norway is exempted from the EU CBAM since it is already covered by the EU ETS.

[131] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=China-EU_-_international_trade_in_goods_statistics.

**Top 10 exporters to the EU in the CBAM sectors, with their shares of total volume of imports in 2022—provisional data**




Source: Information session on the CBAM organized by the EU at WTO Trade and Environment Week, 14 June 2023 https://www.wto.org/english/tratop_e/envir_e/envir_1206202310_e/envir_1206202310_e.htm.

*Norway and Iceland are excluded as they are covered by EU ETS

The introduction of EU CBAM will bring additional costs to China's exports, albeit limited under the initial scope. Researchers at China's Ministry of Commerce estimated that 3.2 per cent of China's total export value to the EU in 2022 was in CBAM-covered categories (steel, aluminium, fertilizers, and cement).[132]

Although the initial impacts of the EU CBAM on China's exports appear to be limited, the further expansion of the CBAM's scope and coverage will drive up these costs. Before the transitional phase ends in 2026, the Commission will review the scheme and assess whether to extend the scope to other goods at risk of carbon leakage, including organic chemicals and polymers, with the goal to include all goods covered by the ETS by 2030. It will also evaluate whether to extend the scope to indirect emissions and to more products down the supply chain.

Using 2022 trade data as a proxy, it can be estimated that, if the CBAM expands to cover organic chemicals and polymers, 132 export goods from China to the EU will be affected, which will account for US$54.3 billion (or 9.7 per cent) of China's total exports to the EU. China's exports of organic chemicals and polymers to the EU are valued at US$20.75 billion and US$15.42 billion, respectively. Assuming an average EU ETS allowance price of €80/tCO2, these two goods will face an additional carbon cost of €304 million and €341 million, respectively. These carbon tariff costs will balloon further if more downstream products are included in the CBAM later this decade, such as electrical machinery and appliances.

[132] Ministry of Commerce of China (March 2023), 'EU CBAM and its impacts on EU-China trades' [欧盟"碳边境调节机制"及其对中欧经贸的影响], http://www.ccceu.eu/2023-03/02/c_2852.htm.

A recent report calculated three scenarios for the CBAM's impacts on China's exports, based on various assumptions about sectoral coverage, default values, free allocation phase-out, and the inclusion of indirect emissions.[133] One scenario indicated that adding low-value manufactured products containing emission-intensive basic materials further down the value chain could lead to an increase in total CBAM fees from an estimated €485 million to €827 million, assuming an EU ETS price of €60/tCO2 and 2019 import volumes and emissions intensities.

**China's official response: criticism of EU CBAM**

Even though the objective of the CBAM is to create a 'level playing field' and drive decarbonization efforts globally, it inevitably draws critiques from non-EU trading partners since it applies carbon costs at the border. China has been one of the most vocal opponents of the CBAM since this policy got more traction in the EU. China's official response from various ministries has been consistent, criticizing the EU CBAM as a unilateral and discriminative trade measure and barrier.

In April 2021, in a video call with the French and German leaders,[134] Chinese President Xi Jinping said:

> Responding to climate change is the common cause of all humanity. It should not be a bargaining chip for geopolitics, a target for attacking other countries, or an excuse for trade barriers. . . . China will adhere to the principles of equity, common but differentiated responsibilities and respective capabilities, promote the implementation of the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement, and actively develop South-South cooperation on climate change.

This emphasis on common but differentiated responsibilities and an internal climate negotiations framework is persistent throughout the official responses by Chinese government. On 26 July 2021, shortly after the EU officially proposed the CBAM, the Ministry of Ecology and Environment's spokesperson responded to the CBAM in a press conference.[135] The ministry reiterated that

> CBAM is essentially a unilateral measure that unprincipledly extends the climate issue to the trade field, which not only violates the rules of the World Trade Organization (WTO), but also the UNFCCC and Paris Agreement. . . . China has always believed that multilateralism is the only way to solve global problems.

The tone in the response from China's Ministry of Commerce in March 2022[136] was similar: 'China hopes that the relevant legislative measures on the European side should be in line with WTO rules and avoid the formation of new trade barriers.'

During the COP27 global climate talks, Brazil, South Africa, India, and China critiqued the CBAM directly in a statement on 15 November 2022. It said, 'Unilateral measures and discriminatory practices, such as carbon border taxes, that could result in market distortion and aggravate the trust deficit amongst Parties, must be avoided.'[137]

In March 2023, at the meeting of the WTO Committee on Trade and Environment, China proposed to use the Committee as a platform and suggested members start with discussions on the EU CBAM at the June meeting of the Committee on Trade and Environment. The Chinese proposal pointed out that the WTO is an important venue for monitoring and considering trade policies, and that trade policies aimed at achieving environmental objectives should be consistent with the basic principles and rules of the WTO and avoid constituting protectionist measures and green trade barriers.[138] In June at the WTO Trade and Environment Week, China hosted an event 'Energy Transition and the Role of Trade Policy' and circulated a communication calling for 'further elaboration on dedicated multilateral discussions on the trade aspects and implications of certain environmental measures'.[139]

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[133] Sandbag E3G and Energy Foundation (August 2021), *A Storm in a Teacup: Impacts and Geopolitical Risks of the European Carbon Border Adjustment Mechanism*, https://sandbag.be/wp-content/uploads/E3G-Sandbag-CBAM-Paper.pdf.

[134] 'Xi Jinping holds video summit with French and German leaders' (16 April 2021), https://www.fmprc.gov.cn/mfa_eng/qjhdq_665435/3265_665445/3291_664540/3293_664544/202104/t20210419_9169303.html.

[135] China responded to EU CBAM (26 July 2021)[中方回应"碳关税"], https://www.chinanews.com.cn/cj/2021/07-26/9528890.shtml.

[136] China Ministry of Commerce regular press conference (March 2022), http://www.mofcom.gov.cn/xwfbh/20220331.shtml.

[137] 'BASIC Ministerial joint statement at the UNFCCC's Sharm el-Sheikh Climate Change Conference (COP27/CMP17/CMA4)' (15 November 2022), https://www.dffe.gov.za/mediarelease/basicministerialmeeting_cop27egypt2022.

[138] 'China calls for discussion of EU carbon tariffs under WTO framework' (17 March 2023)[中国要求在WTO框架下讨论欧盟碳关税], https://cacs.mofcom.gov.cn/article/flfwpt/jyjdy/cgal/202303/176046.html.

[139] 'China submitted trade and environment policy proposals to WTO' (20 June 2023)[中方在世贸组织提交贸易与环境政策相关提案], http://www.news.cn/world/2023-06/20/c_1129707504.htm.

It can be expected that China will continue its hostility towards the CBAM officially, and stress the multilateral approach whilst potentially challenging the CBAM in international trade courts. The EU designed the CBAM very cautiously to ensure it is compatible with WTO rules,[140] so these disputes will likely be symbolic and end without concrete opposition to the implementation of the CBAM.

**Behind the scenes: Chinese enterprises gear up**

While China's official international stance thus criticizes the CBAM as a trade barrier and calls for a multilateral approach, domestic discussions regarding the CBAM's effect on China and how both the government and private sector should respond have been intense. There are various reports and research projects disentangling the CBAM mechanism from the policy process. Enterprises and industry associations have also kicked off a wide range of projects to help the CBAM-affected sectors deal with the new scheme.[141] The recommendations typically focus on improving the production process, changing the energy mix, building robust emissions accounting and monitoring of products in line with EU standards, boosting the consumption of green electricity, and implementing more advanced technology.

This huge interest from enterprises behind the scenes of the government's official response could be due to concern about the CBAM's longer-term effects. The broad view is that, under its current scope, the CBAM will only have limited impacts on China's exports, and enterprises might shift their production lines, exporting the cleaner and greener products to the EU and the carbon-intensive ones to regions without a carbon tariff. But the stakeholders are aware that the fallout will increase following the expansion of the CBAM, especially the potential inclusion of more downstream products. Some enterprises may hold the view that they can have a competitive advantage in global markets if their products are greener, with more countries likely implementing similar green trade barrier policies.

In addition, the CBAM could be an external factor to help the authorities to push Chinese energy-intensive enterprises to speed up decarbonization and deploy more green electricity. The latter will also help China to integrate the vast deployment of renewables and reduce curtailment. China's energy-intensive industries are expected to phase down output under the carbon peak and neutrality pathway. Pressure from an external factor such as the CBAM will add impetus and accelerate this trend. Some sectors, notably steel and aluminium, are already experiencing stress due to the slowdown in real estate and infrastructure stimulus.[142]

To tackle the challenge from the EU CBAM, there are also calls to speed up the expansion of China's national carbon market to more industry sectors. If importers can prove that a carbon price has already been paid during the production of an imported good, the corresponding amount of carbon costs can be deducted from its CBAM costs. China launched its carbon market in 2021, although it currently only covers the power sector. The regulator already plans to expand the carbon market to more industry sectors. The CBAM could add pressure to accelerate this sectoral expansion, both in terms of carbon costs deduction and robust emissions monitoring and verification. That said, the allowance prices in the EU and China are significantly different, with the former being €90/$tCO_2$ and the latter only €8/$tCO_2$. In addition, all the allowances in China's national ETS are handed out for free, and the intensity-based trading system means that the ETS does not necessarily impose carbon costs on covered enterprises.

Nevertheless, if China speeds up to include more industry sectors in the carbon market, it will provide more leeway in future bilateral negotiations regarding the CBAM. One possible scenario is that China tracks the expansion of the EU CBAM and mirrors its pathway to expand the national ETS accordingly, starting with the aluminium sector, then iron and steel. So, even as China is denouncing the CBAM—and will likely align with other countries that seek to limit its impact—there are already signs that the CBAM is accelerating efforts to decarbonize industries within China, even though implementation is slow.

[140] 'EU carbon border adjustment mechanism: implications for climate and competitiveness' (13 June 2023), https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2022)698889.

[141] 'How can China steel sector tackle the EU CBAM?' (June 2023)[CBAM即将实施，钢铁行业如何应对], http://www.mpi1972.com/xwzx/yndt/202306/t20230612_100344.html.

[142] 'China's property sector set to be persistently weak for years, Goldman Sachs says' (12 June 2023), https://www.reuters.com/world/china/chinas-property-sector-set-be-persistently-weak-years-goldman-2023-06-12/.

## THE NORMALIZATION OF CHINESE INFRASTRUCTURE LENDING IN AFRICA

***Dan Marks***

Many myths have emerged about China's involvement in infrastructure in sub-Saharan Africa in recent decades. In Western capitals, the rapid expansion of Chinese infrastructure investment, mining, and other sectors is often seen as part of a grand strategy that must be met with a similarly grand agenda, such as the Global Gateway and Power Africa.[143] Western projects have appeared promising but ultimately disappoint in terms of new public funds actually available. However, they are important diplomatic assets which have been used effectively as policy and convening tools. In this conception, the reduced flow of Chinese money into African infrastructure more recently must be a strategic shift.[144] The reality is likely somewhat different and likely to extend, also, beyond China's economic slowdown.

Chinese finance for Africa's infrastructure emerged as an alternative to conventional Western development finance. Private investors, especially from the United States, frequently complain that while returns can be good in Africa, on a risk-adjusted basis they are often worse than in 'easier' markets. They argue that this is because the basis for adjusting returns is government bonds, which in Africa frequently offer double-digit rates, with inflation and exchange rate depreciation too frequently tipping into double digits as well. The argument is not uncontested, even within the business community; but added to these challenges, illiquid and unfinanceable markets, the very high risk of delay, long development times, political, regulatory, legal, and reputational risks, challenges accessing sites, too frequent payment challenges, and infrastructure and port blockages mean that private investment in African infrastructure typically requires credit enhancement and concessional support. Unsurprisingly, private capital is therefore not available at the scale required to keep up with rapidly expanding populations and bridge the daunting infrastructure gap.

To overcome the shortage of private capital and their own relatively limited resources, African governments have experimented with a variety of risky strategies. International bond markets have been an outlet in recent years, but very loose conditions on the use of funds have too often resulted in funds being diverted from their intended purpose. Substantial portions of the Eurobonds issued by Zambia and Ghana were earmarked for the power sector but did not always find their way there, or were invested poorly. When combined with sovereign debt crises, this has led to defaults. Ethiopia pioneered the use of diaspora initiatives and the general public to fund its giant dams, but the reality sometimes appeared closer to expropriation of part of the salaries of public-sector workers.[145]

Failure to identify effective alternatives has left sub-Saharan Africa unable to escape its unusually high dependence on Western development finance and the multilateral institutions for infrastructure funding. Development finance has had some extremely important and under-appreciated successes and is behind many of the continent's electricity sector success stories in particular. It has similarly played an important role in a massive and achingly slow process of sector reform over the past two decades across much of Africa. But Western institutions are also accused of overreach in the way programmes are designed and implemented, while developers complain about onerous, prescriptive, and lengthy processes and excessive risk aversion which can undermine development impact. In the end, the main shortcoming of concessional finance is that there is not enough of it compared with global private capital pools and government balance sheets in other parts of the world.

As such it is not surprising that the 2000s and 2010s saw many African governments embrace Chinese funding as it became available. Not only was it quicker and less prescriptive in terms of government policy and behaviour, but Chinese money was the only alternative to development finance available at scale at all. The willingness of Chinese financiers to invest in riskier projects or projects which had become challenging for Western funders, such as coal power plants, was appealing.

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[143] Global Gateway, https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/stronger-europe-world/global-gateway/eu-africa-global-gateway-investment-package_en; Power Africa, https://www.usaid.gov/powerafrica; Yu, S.Z. (4 November 2022), 'What is China's investment end game in Africa?', London School of Economics, https://blogs.lse.ac.uk/africaatlse/2022/11/04/what-is-chinas-investment-end-game-in-africa/.

[144] Pilling, D., and Hille, K. (30 November 2021), 'China cuts finance pledge to Africa amid growing debt concerns', *Financial Times*, https://www.ft.com/content/b7bd253a-766d-41b0-923e-9f6701176916; Bociaga, R. (25 March 2023), 'China's Africa Belt and Road investment drops as West spends more', *Nikkei Asia*, https://asia.nikkei.com/Spotlight/Belt-and-Road/China-s-Africa-Belt-and-Road-investment-drops-as-West-spends-more.

[145] Verhoeven, H., 'The Grand Ethiopian Renaissance Dam: Africa's water tower, environmental justice & infrastructural power', https://direct.mit.edu/daed/article/150/4/159/107371/The-Grand-Ethiopian-Renaissance-Dam-Africa-s-Water.

Chinese lending to infrastructure appears in many cases to have been more opportunistic than strategic. Chinese contractors are not always fussy about where the project is based or who the client is, as long as funding can be found. This author remembers being shown the long active project list for one of the biggest Chinese contractors on the continent, featuring a number of unlikely projects, and being told by the company's head of business development that the strategy was to sign nonbinding agreements and wait to see if the money turned up. Chinese lenders were keen to play their part, fulfilling their mandate to support Chinese businesses abroad and keep order books full.

The upshot has been that China's record in infrastructure financing in Africa is by no means the humbling display of power politics and successful political economy it is sometimes portrayed as in the Western media and some political circles. Some experienced bankers who have worked with Chinese financial institutions on African projects argue that risky loans were sometimes the result of a lack of experience with project finance structures and with African counterparties, particularly African utilities. Consequently, Chinese lenders have faced the same payment challenges hindering everybody else and a similar migration to more profitable regions as high-quality opportunities have dried up.

These trends appear to be significant factors in the retrenchment of Chinese infrastructure investment on the continent, which was apparent even before the Chinese economy ran into trouble during the Coronavirus pandemic and subsequently. Loose lending practices have been tightened up, and financing terms from many Chinese lenders increasingly resemble those of other lenders. Funding patterns also appear to have shifted towards more commercially oriented institutions rather than export credit or development agencies.

The shine has also worn off Chinese money for some African governments, which have occasionally been caught by surprise by the high cost of buried loan clauses and rocked by the political backlash to practices such as importing Chinese workers rather than hiring locals. Some projects have proven to be bad commercial propositions, not having been backed up by effective feasibility studies beforehand, and have become a fiscal drag. Others—such as Morupule B coal power plant in Botswana, the country's largest ever public investment, and the Karuma dam in Uganda—have experienced serious construction faults (a problem which, it should be noted, is not restricted to Chinese projects).[146] More recently, the well-publicized standoff between Chinese and Western lenders in Zambia and Ghana has shown China to be willing to inflict significant pain on African countries where it suits its interests.[147]

At the same time, infrastructure funding on the continent has dropped off more generally, notably in the power sector, which peaked in 2018 in terms of new capacity added before dropping precipitously in 2020 and 2021 and failing to recover significantly in 2022.[148] The continent was hard-hit by inflationary engineering, procurement, and construction costs and tight margins, which, coupled with rigid procurement processes and tight margins, have caused lengthy delays. With macroeconomic and political crises proliferating on the continent, all infrastructure investors are struggling to find suitable projects in which to park their cash. More bustling sectors in off-grid and captive electricity and micro-mobility see a much more limited Chinese presence.

China has encountered the same challenges as other lenders to the continent, with its willingness to lend not always reciprocated by a willingness or ability to pay. African governments appreciate that being able to secure funding for large-scale infrastructure is not necessarily a reason to go ahead with it, and that Chinese money is not a silver bullet for the developmental, geographic, and demographic challenges that make infrastructure development so difficult in many parts of the continent. This has already resulted in a degree of 'normalization' of Chinese infrastructure lending to Africa, with Chinese institutions weighing their lending more carefully. African governments view China as a useful source of additional funding with conditions which can be different, for better or worse, than alternatives, as well as a useful strategic foil for slow-moving and clunky but still extremely important Western lenders.

[146] *The Botswana Gazette* (3 April 2020), 'BPC's unending troubles at Morupule B', https://www.thegazette.news/business-2/bpcs-unending-troubles-at-morupule-b/; 256 Business News (17 May 2016), 'Sinohydro concedes to defects in Karuma Dam concrete works', https://www.256businessnews.com/sinohydro-concedes-to-defects-in-karuma-dam-concrete-works/.
[147] Marks, J. (25 May 2023), 'Ghana agrees debt restructuring deal: history in the making or Groundhog Day?', https://www.africa-energy.com/news-centre/article/ghana-agrees-debt-restructuring-deal-history-making-or-groundhog.
[148] African Energy Live Data (2023), https://www.africa-energy.com/live-data.

The likely trajectory is a steadier relationship where Chinese infrastructure lending more closely relates to the challenges of executing projects and getting paid for them on the ground. China will need to adapt its strategy to the changing nature of opportunities in Africa, which have drifted away from big-ticket, high-risk prestige hydropower and coal plants towards smaller-scale, incremental solar and wind projects. These do not offer the level of return during construction or comparable scale which have attracted large Chinese engineering, procurement, and construction (EPC) contractors over the past decade. While financing margins for renewables have also been squeezed by tightly structured procurement programmes, there are attractive opportunities. Signs that an EPC-plus finance approach may be emerging—used effectively and at reasonable scale for solar power in Ghana and Angola in recent years—could suit a Chinese approach which is able to move much more quickly to lend to public utilities than Western counterparts and has access to greater funds than local capital markets can currently provide.

Chinese financing for infrastructure, particularly electric infrastructure, was never the panacea it was sometimes made out to be. It has been a significant additional source of funding, but ultimately faces the same developmental challenges to investment and projects as other lenders. Bridging the infrastructure gap has always been a much more complex task than simply accessing more sources of capital and depends, ultimately, on the political stability, vision, and will of African states.

## NAVIGATING GEOPOLITICAL COMPLEXITY THROUGH COLLECTIVE ACTION ON CLEAN ENERGY TRANSITION IN SOUTH-EAST ASIA

***Muyi Yang, Xunpeng Shi, and Weihua Wang***

The window of opportunity for humanity to mitigate the worst impact of climate change is rapidly closing. As highlighted in the latest State of the Global Climate report by the World Meteorological Organization, concentrations of the three main greenhouse gases—carbon dioxide, methane, and nitrous oxide—reached a record high in 2021, pushing the global average temperature 1.15°C above pre-industrial levels.[149] This puts the world in perilously close proximity to the 1.5°C threshold that scientists argue could initiate a climate crisis.

To reverse this alarming trend, prompt and concerted global action is crucial, particularly in facilitating a more rapid and deep decarbonization of the energy sector, commonly referred to as clean energy transition. This energy transition, however, faces numerous challenges. A key challenge is how to foster cooperation to address the shared challenge of climate change in an era of geopolitical competition.

Some suggest that if major powers share a common interest in leading the world to address critical global challenges like climate change, it may be possible for international cooperation in a specific area, effectively separating it from geopolitical tensions. Unfortunately, such compartmentalization seems to be unlikely in practice. In September 2021, Wang Yi, then the Chinese foreign minister, warned US climate envoy John Kerry during his visit to China that US-China climate cooperation could not be an 'oasis' surrounded by a desert.[150]

In such settings, a possible approach to shape geopolitics in a cooperative, rather than competitive, manner is to use interdependency as a more organic path to the cooperation and dialogue needed to peacefully manage competition. This article demonstrates why South-East Asia's clean energy transition provides good opportunities to implement this approach. Specifically, it shows that the transition could serve as a bridge for fostering cooperation between major powers or, at the very least, establishing channels of communication between them, a modest but essential step towards managing geopolitical divides.

[149] World Meteorological Organization (2023), *The State of the Global Climate 2022*, Geneva: WMO, https://public.wmo.int/en/media/press-release/wmo-annual-report-highlights-continuous-advance-of-climate-change.
[150] The State Council (2021), 'Wang Yi meets with U.S. president's special envoy for climate issues John Kerry via video conference at request', Beijing, https://www.gov.cn/guowuyuan/2021-09/02/content_5634838.htm.

**The convergence of interests in South-East Asia's clean energy transition**

The energy mix in South-East Asia historically has been dominated by fossil fuels, which accounted for more than 80 per cent of the region's primary energy supply in 2020.[151] This dominance has contributed to the provision of cheap and reliable energy in the region and consequently to its socio-economic prosperity. It has, however, also contributed to escalated air pollution and carbon emissions, highlighting the unsustainable nature of the current, fossil-fuelled development.

It is reported that nearly all people in South-East Asia live in areas with particulate pollution levels higher than the World Health Organization's guideline of 5 μg/m$^3$.[152] These particles—mainly originating from industrial emissions, power generation, vehicle emissions, and forest fires—are one of the deadliest forms of air pollution and could significantly heighten the risks of lung cancer and heart disease. South-East Asia, one of the regions most vulnerable to climate change, is also experiencing fast-growing carbon emissions at an average annual rate of 5 per cent, from 1,039 million tonnes (Mt) $CO_2$-eq in 2005 to 1,815 Mt $CO_2$-eq in 2020.[153]

Recognizing these sustainability challenges, countries in the region are showcasing a strong commitment to the clean energy transition as a means to propel their future development. Facilitating this transition is, however, not an easy task, especially considering the need, in the context of fast-growing economies, to secure a sufficient and reliable supply of clean energy to support their developmental aspirations while advancing decarbonization goals.[154] As South-East Asian countries grapple with the challenge of charting their paths to a clean energy future, international support that can assist their energy transition is highly critical.

One particular area for support is to mobilize the large investment required to progress the transition along 1.5°C-aligned pathways. This need for support is substantiated if one notes that total energy investment by the region's public sector, historically the largest source of funding for energy sector development, was about US$20 billion over the period 2016–2020.[155] This amount is insufficient to meet even one year's investment needs, estimated by the International Renewable Energy Agency at approximately US$40 billion per year to 2030 for the power sector alone.[156]

It is also challenging for the public sector in South-East Asia to increase its budgetary allocation to clean energy projects and systems, especially considering the region's high level of public debt, which is partly due to substantial fiscal spending to protect the vulnerable from the harsh socio-economic impacts of the Covid-19 pandemic. General government debt-to-GDP ratio increased from 40 per cent to 57 per cent in South-East Asia over the period 2015–2021.[157]

China, one of the largest investors in the region's energy sector, can certainly help South-East Asian countries fulfil their climate obligations while meeting their development and clean infrastructure needs.[158] Indeed, Chinese and South-East Asian leaders have made a strong commitment to enhancing cooperation in clean energy transition, either under the aegis of the Association of Southeast Asian Nations (ASEAN) or bilaterally. The ASEAN-China Strategic Partnership Vision 2030, adopted at the 21st ASEAN-China Summit in 2018, emphasized the importance of taking a regional approach to clean energy development. In 2022, the Plan for Action to Implement the ASEAN-China Strategic Partnership for Peace and Prosperity (2021–2025) was released as a guiding document to further enhance ASEAN-China cooperation in areas of mutual interest. Attracting investment

[151] ASEAN Center for Energy (2023), *Outlook on ASEAN Energy 2023*, Jakarta: ACE, https://aseanenergy.org/outlook-on-asean-energy-2023/.
[152] Energy Policy Institute, University of Chicago (2022), 'Southeast Asia fact sheet', *Air Quality Life Index,* https://aqli.epic.uchicago.edu/wp-content/uploads/2021/09/SE-Asia-2022.pdf.
[153] ASEAN Centre for Energy (2022), *The 7th ASEAN Energy Outlook*, Jakarta: ACE, https://aseanenergy.org/the-7th-asean-energy-outlook/#:~:text=In%202020%2C%20ASEAN%20achieved%20an,target%20of%2032%25%20by%202025.
[154] Shi, X. (2016), 'The future of ASEAN energy mix: a SWOT analysis', *Renewable and Sustainable Energy Reviews* 53, 672–680, https://scholar.google.com.au/citations?view_op=view_citation&hl=en&user=BKH-KhUAAAAJ&citation_for_view=BKH-KhUAAAAJ:kRWSkSYxWN8C.
[155] International Energy Agency (2022), *Southeast Asia Energy Outlook 2022*, Paris: IEA, https://www.iea.org/reports/southeast-asia-energy-outlook-2022.
[156] International Renewable Energy Agency (2022), *Renewable Energy Outlook for ASEAN: Towards a Regional Energy Transition*, Abu Dhabi: IRENA, https://www.irena.org/publications/2022/Sep/Renewable-Energy-Outlook-for-ASEAN-2nd-edition.
[157] Economic and Social Commission for Asia and the Pacific (2023), *Economic and Social Survey of Asia and the Pacific: Rethinking Public Debt for the Sustainable Development Goals*, Bangkok: UNESCAP, https://www.unescap.org/kp/2023/economic-and-social-survey-asia-and-pacific-2023-rethinking-public-debt-sustainable#:~:text=The%20Survey%20for%202023%20examines,long%2Dterm%20sustainable%20development%20prospects.
[158] Yao, L., Andrews-Speed, P., and Shi, X. (2021), 'ASEAN electricity market integration: how can belt and road initiative bring new life to it?', *The Singapore Economic Review*, 66 (1), 85–103, https://scholar.google.com.au/citations?view_op=view_citation&hl=en&user=BKH-KhUAAAAJ&cstart=20&pagesize=80&sortby=pubdate&citation_for_view=BKH-KhUAAAAJ:P7Ujq4OLJYoC.

in clean energy and network infrastructure was identified as a priority area for action. Later that year, the ASEAN-China Joint Statement on Strengthening Common and Sustainable Development was made at the 25th ASEAN-China Summit, reaffirming the importance of cooperation in clean energy transition.

To turn these high-level commitments into actual cooperation, China can support necessary policy and regulatory reforms and financial innovations in South-East Asian countries to facilitate large-scale investment in their clean energy transition. This would result in mutually beneficial outcomes. China would gain access to new markets for its clean energy technologies and services, as well as investment opportunities. These would, in turn, provide avenues for market expansion and economic growth. Meanwhile, South-East Asian countries would receive the much-needed financial and technical support to enhance their clean energy supply and manufacturing capacity, thereby fostering a new, more sustainable mode of development driven by clean energy.

Cooperation between China and South-East Asia on clean energy transition also provides a platform that could enable collaboration with Australia, European countries, the United States, and other major countries. These countries have shown strong willingness to support South-East Asia's transition towards a clean and more sustainable energy future, as evidenced by the signing of the Just Energy Transition Partnerships with Indonesia and Vietnam, as well as various ongoing cooperative programmes in clean energy transition supported by Western donor agencies, such as the Clean, Affordable and Secure Energy programme and USAID's Smart Power Program.

The case for China's cooperation with other major countries in supporting clean energy transition in South-East Asia arises from the necessity to increase private participation and leadership in driving the transition process and to deepen clean energy investment from 'billions to trillions'.[159] This necessitates actions that go beyond standard business and financial strategies. Indeed, it requires more fundamental changes to improve the region's underpinning architecture, to lower the risks and costs of clean energy projects, and to support large-scale private investment in clean energy technologies and systems. This architecture encompasses planning practices, permitting processes, regulatory frameworks, market mechanisms, and financial facilities.

China, a global leader in clean energy technologies, has substantial experience in mobilizing large investments in clean energy projects and innovations. Collaborating with Western donor agencies and multilateral development banks would provide valuable channels for effectively translating Chinese experience and good practice into tailored lessons and insights that are more applicable to the specific local contexts of South-East Asia.[160] The value of collaboration with these organizations is further reinforced by their long-established relationships with South-East Asian countries in policy development and capacity building.

**South-East Asia's adeptness in managing geopolitical complexity**

South-East Asia has, over the years, demonstrated a strong capacity to pragmatically manage diverse interests and demands, maintaining a delicate balance between major powers. The region's close economic relationship with all major countries, despite their internal differences and divergent interests, is a testament to this capacity.

When ASEAN was established in 1967, it was strongly criticized by China as an American creation intended to contain communism.[161] But in recent decades, since China started to open up its economy in the 1980s, the regional bloc has forged a strong economic relationship with China, and its bilateral trade with China approached US$1 trillion in 2022, marking a 15 per cent year-on-year increase.[162] This growth solidifies China's position as the region's largest trading partner for over a decade.[163]

[159] World Bank (2022), *Unleashing Sustainable Finance in Southeast Asia*, https://openknowledge.worldbank.org/server/api/core/bitstreams/7ff934ad-de0a-5fd0-bed1-42e1de4f5717/content.
[160] Xu, Q., Yu, J., Shi, X., and Collinson, E. (2022), 'The potential of energy cooperation between China and Australia under the Belt and Road Initiative', *Economic and Political Studies*, 10(4), 369–386, https://scholar.google.com.au/citations?view_op=view_citation&hl=en&user=BKH-KhUAAAAJ&cstart=20&pagesize=80&sortby=pubdate&citation_for_view=BKH-KhUAAAAJ:-mN3Mh-tlDkC.
[161] Chatterji, R. (2021), *China's Relationship with ASEAN: An Explainer*, Observer Research Foundation, https://www.orfonline.org/research/china-relationship-asean-explainer/.
[162] *Global Times* (2023), 'Trade between China and ASEAN grows 15% in 2022, first year of RCEP's enforcement', https://www.globaltimes.cn/page/202301/1283779.shtml.
[163] Xinhua (2022), 'China remains ASEAN's largest trading partner', *China Daily,* https://www.chinadaily.com.cn/a/202208/30/WS630d74bda310fd2b29e74f93.html.

Meanwhile, South-East Asia has successfully maintained strong economic and trade relationships with the United States, which remains the region's largest source of foreign direct investment.[164] Bilateral trade in goods between the two reached US$364 billion in 2021, making the United States the second largest trading partner of South-East Asia.[165] The region also boasts strong economic and trade connections with Australia, European countries, Japan, and South Korea, supported by a range of bilateral and multilateral trade and investment agreements.

South-East Asia's adeptness in managing geopolitical complexity, as demonstrated by its success in forging close economic ties with almost all major powers, will be critical for ensuring clean energy transition becomes a catalyst for collaboration and trust-building, rather than another arena where major powers compete with each other for influence.

**Final remarks**

While it may be unrealistic to expect South-East Asia to solve the current geopolitical puzzle, the region can still play an important role in promoting discussions on collective action that will support its clean energy transition. Such discussions could identify areas where Australia, China, the United States, and other major countries can work with each other, based on mutual understanding, accommodations, and tacit agreements.

A possible starting point for this collaboration could be programme- and project-level activities centred on de-risking clean energy investment. Clean energy projects in South-East Asian countries, like in many other developing countries, are affected by a range of issues—such as complex and non-transparent permitting processes that involve multiple institutions with overlapping and sometimes unclearly defined roles and responsibilities, the unavailability of commercial arrangements (e.g. power purchase agreements) that can provide sufficient and predictable revenues for capital-intensive investments, and lack of credible off-takers of renewable output, due to the provision of electricity subsidies that significantly affect the financial health of the national electric utilities.

These electricity-specific issues could undermine risk-adjusted returns for investors and hence the availability of bankable projects, which are often compounded by broader issues—including restrictions on foreign direct investment, weak governance, currency risks, and weaknesses in local banking systems and capital markets.

In such settings, South-East Asia is very likely to experience substantial investment shortfalls in deploying renewable generation projects and grid infrastructure, as the flows of private investment tend to concentrate on renewable energy projects in low-risk, mature economies. This situation would render many perceived socio-economic benefits associated with clean energy investment unattainable in South-East Asia, thereby posing a significant development financing challenge—a challenge that Chinese Premier Li Qiang called for the international community to jointly address at the Summit for a New Global Financing Pact.[166]

The Global Development Initiative is the proposal made by China to rectify the situation. Here, de-risking clean energy investment in developing countries is not only about creating a safety net for private investors in clean energy assets, protecting their profits from various electricity-specific and broader risks. More importantly, it is about providing stimulus for upgrading local industries, creating job opportunities, and ultimately, fostering a more sustainable development driven by clean energy. After all, de-risking is merely the means to achieve the higher ends.

This initiative serves as a multilateral platform that can mobilize resources, expertise, and knowledge from China, partnering countries, and international organizations, to support the complex and interconnected changes required to facilitate large-scale clean energy investment in South-East Asia. This initiative has found some resonance among South-East Asian countries, with the hope that it would bring prosperity to the region. It also provides opportunities for collaboration with major powers in supporting the region's clean energy transition and green development, offering new markets for their clean energy technologies and services, as well as investment opportunities.

Such collaboration could help create an ambition loop, where clean energy investment in South-East Asia spurs development and job creation. These positive outcomes would give policymakers in the region confidence that they can go further and faster

[164] U.S. Department of State (2022), 'The United States-ASEAN relationship', https://www.state.gov/the-united-states-asean-relationship/.
[165] ASEANstats (2023), *ASEAN Statistical Year Book 2022*, https://www.aseanstats.org/publication/asyb2022/.
[166] Cao, D. (2023), 'Action urged on financing gap', *China Daily,* http://global.chinadaily.com.cn/a/202306/24/WS649640a3a310bf8a75d6b52b.html.

by setting more ambitious targets for driving the transition. These outcomes could also send a positive message to the world that cooperation between major powers is possible and beneficial. This would foster hope and inspire other countries and organizations to join in, leading to ever-widening circles of cooperative efforts in building a clean, sustainable, and prosperous future.

## US–CHINA RELATIONS AND THE GLOBAL ENERGY TRANSITION

***Jane Nakano***

The energy transition has become the latest arena for competition between the United States and China, as the two countries are making significant investments in the development and deployment of clean energy technologies. They seek to seize the economic opportunities and industrial strength that could arise from being a leader in the ongoing transition away from fossil fuel dominance in the global energy system. In 2022 alone, clean energy technology sectors—such as renewables, nuclear, carbon capture, and hydrogen—attracted over US$1.1 trillion in investments.[167]

Bilateral competition in global energy transition is playing out on two fronts: manufacturing and innovation. On the manufacturing front, China leads the world in capacity expansion. In terms of year-on-year global growth in manufacturing capacity in 2022, China's share accounted for 90 per cent in solar photovoltaic (PV), 75 per cent in batteries, 60 per cent in onshore wind turbines, and 40 per cent in electrolysers. In comparison, the US share was less than 3 per cent in solar PV, 7 per cent in batteries, 10 per cent in onshore wind turbines, and 20 per cent in electrolysers.[168]

The competition on the manufacturing front also entails the supply chain for many minerals that are key for the energy transition. China has a commanding presence along the global mineral supply chains, particularly in their processing segment. Although the extraction of various energy transition minerals is robust in multiple countries—including Australia, Chile, and Indonesia—China's share in global processing stands at two-thirds for lithium and one-third for nickel. When it comes to rare earth, China has about 60 per cent of global mining, but accounts for nearly 90 per cent of processing. In contrast, the US supply chains are highly vulnerable to external supply disruptions. Today, the nation depends on imports to meet over 50 per cent of its consumption for 47 minerals, including 100 per cent for 17 of them on a net-import basis. Notably, China is the largest source of imports for 26 of the 50 minerals that are classified as critical by the US Geological Survey.[169]

On the innovation front, China is fast emerging as a global leader. A good proxy for global trends in innovation capacity is who files patents for what technologies and how central the patent is to that technology supply chain. Chinese patent filing trends have shown both quantitative and qualitative growth. For example, Chinese firms hold patents to a rising number of core solar PV technologies.[170] Even for less mature clean energy technologies, such as hydrogen, patent applications by Chinese entities are on a strong rise. In the last decade, international patents were led by the European Union, Japan, and the United States, but China's patent applications grew at 15.2 per cent annually—albeit from a modest baseline—while US filings decreased during the same decade.[171]

In an effort to rectify lagging US competitiveness, the US Congress has passed several important laws in the recent years. The Infrastructure Investment and Jobs Act (IIJA) of November 2021 provides US$7.9 billion to strengthen clean energy supply chains, and US$9.5 billion for hydrogen programs, including US$1 billion for research and development. The Inflation Reduction Act (IRA) of August 2022 provides US$369 billion for climate and clean energy, including the Advanced Manufacturing Production Tax Credit, which aims to facilitate the domestic production of clean energy components, such as PV cells and wafers, solar grade polysilicon, wind energy components, battery cells, and critical minerals. Additionally, the IRA Clean Vehicle Credit seeks to expand US electric vehicle (EV) supply chains through sourcing requirements for critical minerals and battery components.

[167] BloombergNEF (January 2023), *Energy Transition Investment Trends 2023*, https://about.bnef.com/energy-transition-investment/.
[168] International Energy Agency (May 2023), *The State of Clean Technology Manufacturing*, p.17-19.
[169] Zongyuan Zoe Liu, 'How to Secure Critical Minerals for Clean Energy Without Alienating China,' Council on Foreign Relations, May 25, 2023. https://www.cfr.org/blog/how-secure-critical-minerals-clean-energy-without-alienating-china
[170] Zhou, Y., et al. (2018), 'Comparing the international knowledge flow of China's wind and solar photovoltaic (PV) industries,' *Sustainability*, Volume 10, Issue 6. [NB: no specific page number as my statement derived from the entire article]
[171] International Energy Agency and European Patent Office (January 2023), *Hydrogen Patents for a Clean Energy Future*, p.10.

Bilateral relations in clean energy development and deployment are not necessarily a zero-sum competition. In a few sectors, collaboration is persisting. Carbon capture, utilization, and storage (CCUS) is one such area. The United States is the most experienced with CCUS technology. China has become home to around 100 CCUS demonstration projects. These include some of China's firsts, such as the integrated megaton-scale Qilu-Shengli project, and the offshore carbon dioxide storage project by the China National Offshore Oil Corp. To further their technological expertise through testing and demonstration opportunities in China, US companies are pursuing engagement with Chinese companies. For example, Chevron is partnering with PetroChina, together with a few other non-Chinese companies, to evaluate and advance large-scale CCUS through a project in Singapore.[172] Also, ExxonMobil China has agreed with the China National Offshore Oil Corp., Guangdong Development and Reform Commission, and Shell China to jointly study a large-scale CCUS hub in Daya Bay.[173]

The auto sector is another example. Accounting for about 60 percent of global EV sales in 2022, China is the largest EV market in the world and an important market for American automakers. Also, China is currently the main source of competitively priced EV batteries, including for US automakers. For example, Tesla's EV factory in Shanghai, which procures EV batteries manufactured and assembled by China's Contemporary Amperex Technology Co., Limited (CATL), has been its largest export base, supplying cars to markets outside North America.[174] In 2022, the Shanghai factory delivered over 710,000 vehicles, accounting for over half of Telsa's global deliveries that year.[175] The emerging EV market in the United States is attracting Chinese companies, too. For example, CATL has shown interest in participating in US EV value chains through partnership with Ford Motor Co. CATL may be the first, but it is unlikely to be the last Chinese company to seek a presence in the United States.

Additionally, bilateral trade remains strong in liquefied natural gas (LNG), a low-emission hydrocarbon that has become an important energy source in China. Despite its debut as a global LNG importer only in 2016, China has risen to be the world's leading importer in 2021, and US LNG has become a key source of imports. Notably, Chinese buyers have signed a number of long-term LNG contracts with US sellers since 2021.

Despite these synergies, the nature of bilateral competition seems rapidly leaning towards zero-sum in the energy transition arena as China has become a bipartisan focus of concern. Chinese actions in recent years, ranging from military build-up to economic coercion, have turned Washington's mistrust of Beijing into distrust.

Nowhere is this more indicative than in the context of critical minerals supply chains. Since the 2010 Chinese embargo of rare earth supplies to Japan over a territorial dispute, Washington has begun evaluating the security of its access to rare earth and other critical minerals. The US policy emphasis is on helping to expand global supply chains and diversifying stakeholders and sources to safeguard the global energy transition. However, shifting domestic supply chains away from China appears to US policymakers to be a pressing task, in light of the establishment of the state-owned China Rare Earth Group through a mega-merger in December 2021 and the introduction of an export-control law which likely applies to rare-earth supplies.[176]

In fact, Washington has come to view China as a cause of many issues that the United States faces. The Chinese models of industrialization and state capitalism have distorted the level playing field for private enterprises, which are at the core of US economic leadership in the world, for example.

Faced with a rival whose success has been guided by industrial policies, Washington has re-examined the role of government in its economy, including incentivizing clean energy technology development and manufacturing, as well as subsidizing critical mineral projects. The Biden administration has been particularly articulate that the United States needs an industrial strategy to guide investment, facilitate innovation, drive down costs, and create jobs to build a clean energy economy, calling it 'one of the

[172] Bloomberg News (21 September 2022), 'Air Liquide, Chevron, Keppel Infrastructure, and PetroChina form consortium to explore CCUS solutions in Singapore', https://www.bloomberg.com/press-releases/2022-09-21/air-liquide-chevron-keppel-infrastructure-and-petrochina-form-consortium-to-explore-ccus-solutions-in-singapore?sref=B2BBHw9t.
[173] Global CCUS Institute, et al. (March 2023), *CCUS Progress in China,* p.13.
[174] Electrive (8 January 2022), 'CATL delivers first LFP cells to Tesla Giga Shanghai', https://www.electrive.com/2022/01/08/catl-delivers-first-lfp-cells-to-tesla-giga-shanghai/#:~:text=CATL's%20new%20battery%20factory%20near,at%2060%20per%20cent%20capacity.
[175] China Daily (5 January 2023), 'Tesla's Shanghai gigafactory delivers 710,000 vehicles in 2022', https://www.chinadaily.com.cn/a/202301/05/WS63b6d7eea31057c47eba7ea4.html.
[176] Xie, J. and Li, X. (30 November 2020), 'Export control law to affect rare earths, UAVs', *Global Times,* https://www.globaltimes.cn/content/1208529.shtml.

most significant growth opportunities of the 21st century'.[177] Today, there is greater support in Washington for government engagement in revitalizing US industrial competitiveness—even from political conservatives, albeit at a more moderate level and in a nuanced manner.

Illustrative of the highly tenuous environment for bilateral cooperation on the development and deployment of clean energy technologies is how China is largely barred from benefitting from government subsidies and incentives under the IIJA and IRA. The best example is the IRA Clean Vehicle Tax Credit program (IRA Section 30D). Under this consumer tax credit structure, half of the US$7,500 credit is available if battery components (by value) are manufactured or assembled in North America. The other half of the credit is available if battery minerals are extracted or processed in the United States or a country with a free trade agreement, or recycled in the United States. Notably, this section also includes provisions that prohibit the application of tax credits where any components or critical minerals are sourced from a 'foreign entity of concern'—i.e., an entity that is owned by, controlled by, or subject to the jurisdiction or direction of a government of a foreign nation that is a covered nation. According to the Section 2533c(d) of title 10 of the United States Code, 'covered nations' are North Korea, China, Russia, and Iran. While the provisions do not single out China, it's no secret that China is the primary concern, as the country accounted for most of the announced manufacturing capacity expansion plans to 2030 for EV battery components, including 98 per cent for anode and 93 per cent for cathode materials, around the time of the IRA's passage.[178] This remarkable Chinese lead likely means that US domestic EV deployment would slow under the current IRA approach to expanding the domestic EV battery supply chain. Balancing the climate-driven objective to deploy EVs and the security- and economics-driven objective to onshore EV supply chains is no easy task.

There is no indication that China's emergence as a global clean energy leader was driven by some desire to dominate the global economy, or outcompete the United States. Rather, China's commanding presence was largely driven by the economic opportunities that were informed, not only by growing renewable energy interests in Europe, but also by China's own interest in decarbonization. China leveraged its policy consistency and lower-cost capital to make renewables technologies an export industry.[179] As a reaction to the growing push-back on Chinese participation in US green industrialization, however, China's future investment in energy transition sectors may be increasingly driven by its desire to stay ahead of the United States. Since the IRA's passage, China has announced that it is considering adding some manufacturing methods for advanced solar wafer production to its export control list and nationalizing advanced mineral equipment.[180]

Distrust and fear might help mobilize resources to undertake major initiatives, but they could cloud one's judgement. They could also fuel the echo of questions, such as which country will win the competition in the energy transition arena, that might render the idea of zero-sum competition self-fulfilling. A more meaningful question, instead, is if the two countries can seize their respective economic opportunities and industrial strengths in the ongoing energy transition. Its answer would be much more consequential to the welfare of each population as well as global decarbonization efforts.

[177] White House (27 April 2023), 'Remarks by National Security Advisor Jake Sullivan on Renewing American Economic Leadership at the Brookings Institution', https://www.whitehouse.gov/briefing-room/speeches-remarks/2023/04/27/remarks-by-national-security-advisor-jake-sullivan-on-renewing-american-economic-leadership-at-the-brookings-institution/.
[178] International Energy Agency (January 2023), *Energy Technology Perspectives 2023*, p.22.
[179] Chia, T. (26 October 2022), '*How China is Winning the Race for Clean Energy Technology*,' Harvard University Fairbanks Center for Chinese Studies, https://fairbank.fas.harvard.edu/research/blog/how-china-is-winning-the-race-for-clean-energy-technology%EF%BF%BC/#:~:text=The%20Chinese%20government%20provided%20tax,more%20solar%20panels%20for%20less.
[180] Murtaugh, D. (26 January 2023), 'China mulls protecting solar tech dominance with export ban', Bloomberg; Reuters (12 March 2023), 'China to consolidate, boost domestic strategic resources bases', https://www.bloomberg.com/news/articles/2023-01-26/china-mulls-protecting-solar-tech-dominance-with-export-ban?sref=B2BBHw9t.

# THE EVOLVING ENERGY RELATIONS BETWEEN CHINA AND THE GULF COOPERATION COUNCIL

***Dongmei Chen***

China's relations with the Gulf Cooperation Council (GCC) are evolving because of the energy transition and developments in geopolitics. China and the GCC have become increasingly important partners, with that importance extending beyond oil and gas as the transition unfolds. China's technological and industrial advantages are complementary to the needs of the GCC in the areas of renewables, CCUS (carbon capture, utilization, and storage), and hydrogen. However, there are also difficulties to improving policy, infrastructure, and industrial coordination at the GCC regional level and scaling up the deployment of these technologies to reduce the investment cost. To achieve a win-win result, China and the GCC need to work innovatively to address the lack of financial incentives and market regulations. The US-China confrontation imposes risks on global supply chains of net-zero technologies. It creates uncertainties about China's future economic growth and demand for energy, which will directly impact the backbone of the GCC-China energy relations—oil and gas.

**A time with spiking geopolitical uncertainties**

China has scaled up its engagement in the GCC since the inauguration of the Belt and Road Initiative (BRI) in 2013. According to data from the Chinese Ministry of Commerce, both the bilateral trade between China and the GCC and Chinese non-financial outward direct investment (ODI) in the GCC doubled during 2013–2021. Chinese ODI in GCC countries accounts for around 8 per cent of China's total ODI under the BRI, according to Chinese official statistics, with 62 BRI countries in 2021.[181] All six member states of the GCC have endorsed the agreements for BRI cooperation. The countries' business presence in each other's markets has grown, and more integrated supply chains have started to form in the energy, petrochemical, infrastructure, and logistics sectors. Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates (UAE) joined the Asian Infrastructure Investment Bank, the China-led multilateral institute for BRI project financing, as founding members.

The importance of China-GCC relations has grown in both sides' foreign and economic strategies. As of 2023, China has signed comprehensive strategic partnership agreements with Saudi Arabia and the UAE, the highest level in China's diplomatic hierarchy. A partnering country at this level is usually seen as playing an important international role in both the political and economic realms, as well as having high existing levels of cooperation and trust with China.[182] China also signed strategic partnership agreements with Qatar and Oman, the second highest level of Chinese diplomatic agreement. The China-GCC Summit held in Riyadh in December 2022 was the first between China and the GCC as a bloc. Both sides adopted a five-year joint action plan to develop their partnerships in 15 key areas, from comprehensive political and security dialogues to deeper economic partnerships and greater cultural engagement. This is a big step forward based on the China-GCC Strategic Dialogue, which was introduced in 2010 to improve communication and cooperation on trade, investment, and technology.

This progress is largely attributable to the alignment of economic agendas between China and the Gulf states. President Xi Jinping clearly illustrated China's interest in the region in his speech at the China-Arab States Cooperation Forum in 2014. The speech mentioned securing the oil and gas supply, increasing trade and investment, building infrastructure connectivity, and enhancing cooperation on nuclear energy, new energy, and space satellite technology. This is a nice fit with the Gulf region's desire to achieve economic diversification and sustainability. The Gulf states are well positioned to build advantages from their geographical locations connecting Europe, Asia, and Africa for global trade, finance, logistics, and tourism. They also expect to build higher-value industries and net-zero assets on the basis of existing oil and gas knowledge and infrastructure and abundant natural resources. These are the core elements of visions for development by 2030–2035 for almost every Gulf state.

However, this relationship is also affected and shaped by the change in global geopolitics and economics.

As commented by the International Monetary Fund, the global economy faces perhaps its biggest test since the Second World War—the sharply increased risk of geoeconomic fragmentation.[183] Tensions over trade, technology standards, and security

[181] Ministry of Commerce, National Bureau of Statistics, and State Administration of Foreign Exchange (2022), *2021 Statistical Bulletin of China's Outward Foreign Direct Investment*.
[182] Fulton, J. (2020), *Strangers to Strategic Partners: Thirty Years of Sino-Saudi Relations*, Atlantic Council, https://www.jstor.org/stable/resrep26037.
[183] Georgieva, K., Gopinath, G., and Pazarbasioglu, C. (22 May 2022), 'Why we must resist geoeconomic fragmentation and how', *IMF Blog*, https://www.imf.org/en/Blogs/Articles/2022/05/22/blog-why-we-must-resist-geoeconomic-fragmentation.

have been growing for many years, undermining growth and trust in the current global economic system. The Russia-Ukraine war and US-China rivalry add risks of fracturing the global economy into competing blocs. Increasingly, policy choices within these blocs will be shaped by geopolitical considerations. Within this process, trade and supply chain linkages are likely to be redirected, and the flows of capital, talent, technology, and commodities could be impeded. Economic recession and geopolitical tensions may create downward pressure on crude demand and shift the gas flows in the near and medium term.

In response, the Gulf states need to broaden their foreign relations options to secure their growth. And China needs to strengthen its ties with strategic partners so as to break the isolation from the US-led alliances. These, not surprisingly, have elevated the importance of both parties in their foreign relations.

China is playing an increasingly important role in the Gulf region on political, economic, and security fronts. China's mediation to de-escalate the rivalry between Saudi Arabia and Iran brings the prospect of building a new regional security framework. Weeks after announcing a normalization in relations with Iran, Saudi Arabia decided to join the China-led Shanghai Cooperation Organization as a dialogue partner, signalling its attempt to diversify foreign relations in order to preserve regional stability and pursue national economic goals. BRICS (Brazil, Russia, India, China, and South Africa) Plus, a framework designed to include new countries in the BRICS dialogue with a view to promoting multilateralism and multiculturalism, also aims to integrate the Gulf region into its evolving governance structures. The New Development Bank, the lender created by the BRICS group in 2014, has endorsed the membership of the UAE. Saudi Arabia is the latest to discuss joining the bank.

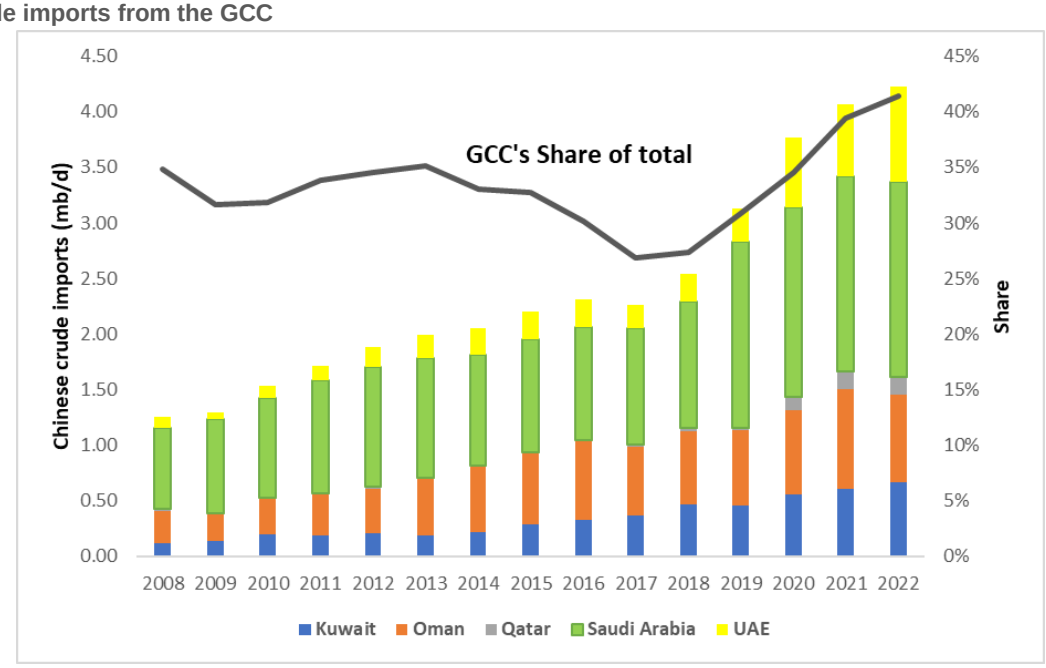
The GCC region is therefore becoming more important for China as a hedge against changes in the global environment. Compared with the BRI's strong momentum four years ago, the international space for China to promote the BRI is shrinking. Higher barriers for investment, reconfigured supply chains, and US pressure on third countries to limit Chinese investments is narrowing investment opportunities for Chinese companies. Nearly 60 percent of low-income countries are now in significant debt distress, compared to fewer than 30 percent in 2015, because of limited domestic revenue mobilization and constrained public financial management capacity,[184] a trend aggravated by the Covid-19 crisis and the Russia-Ukraine war.

**Energy: what has changed and what has not**

Energy is a cornerstone of China's relationship with the GCC. From the China-Arab States Cooperation Forum in 2014 to the GCC-China Summit in 2022, President Xi has repeatedly pointed out the importance of energy in China's cooperation with the GCC. For GCC countries too, securing their market share of oil and gas in China is increasingly strategic as the world is transitioning towards cleaner low-carbon sources. China has become a major and increasingly important destination for GCC crude and gas. China's crude imports from the GCC have remained around 30 percent over the last decade. Even though the Chinese economy has not yet fully recovered from the Covid-19 disruptions, China's crude imports from the GCC reached a record high of 4.23 million barrels per day in 2022. The share of GCC in China's total LNG imports has also grown rapidly, from only 8 percent in 2009 to 26 percent in 2022. A series of long-term deals that China signed with Qatar in 2021 and 2022 has secured Qatari LNG supply until the 2050s.

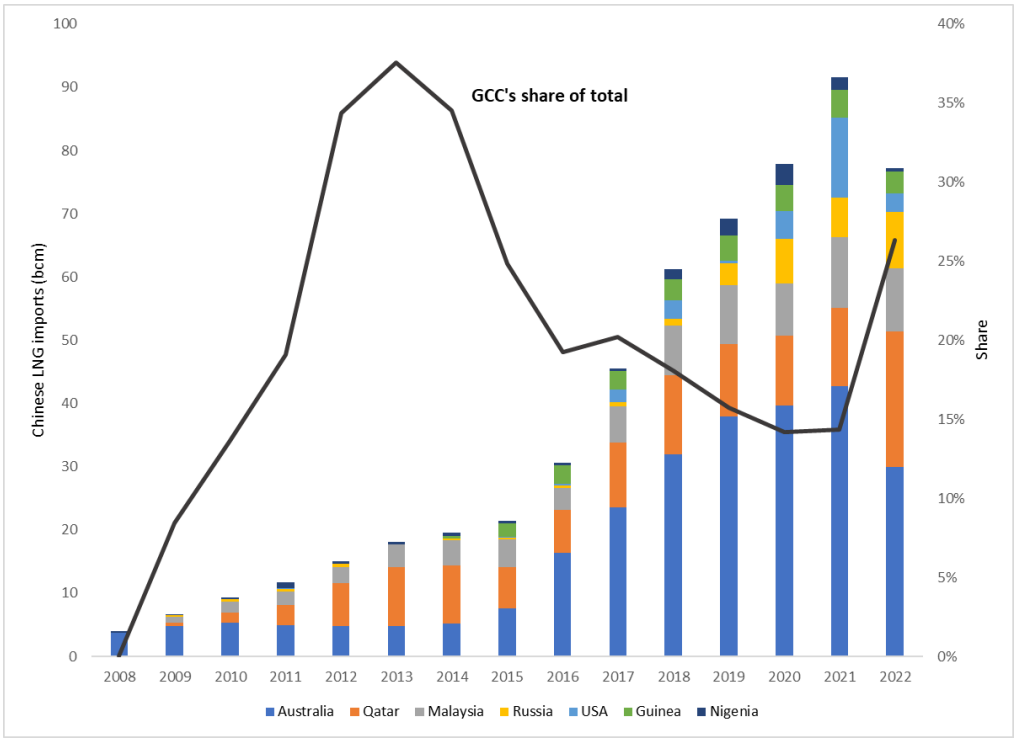
[184] International Monetary Fund (2021), 'Debt restructuring in LICs', https://www.imf.org/en/About/FAQ/questions-and-answers-on-debt-restructuring-in-lics.

**Chinese crude imports from the GCC**




Source: CEIC, ISI Emerging Markets

**Chinese LNG imports from major producers**




Source: CEIC, ISI Emerging Markets

Energy relations built upon crude and gas will likely remain for GCC and China in the future. On the demand side, China's oil consumption by the transport sector is expected to rapidly decline, while oil demand from the petrochemicals sector will only show a slight decline from a peak of 3.8 million barrels per day by 2035 to 3.6 million barrels per day by 2050 under the 1.5°C

scenario.[185] Demand for natural gas will likely continue to rise until 2040, before plateauing at 550 billion cubic metres.[186] In the medium term and possibly beyond, China is expected to continue importing a large share of its domestic oil and gas demand even renewables, energy efficiency and other carbon management technologies will play significant role. On the supply side, political, economic or market change may shape the landscape of suppliers. For example, with Russian pipeline gas ramping up since 2020 and the long-discussed Power of Siberia 2 pipeline nearing agreement, a historic rise of Russian gas to China could be expected. However, this change may have higher impact on other energy producers than on the GCC due to deepened partnership and aligned strategic importance between China and GCC, as discussed earlier.

As energy transition brings about significant structural change in global energy and economic system, it also changes the relations between GCC and China.

The development and deployment of net-zero technologies become prioritized in the GCC. Four of the GCC states have pledged to reach net zero by 2050/2060, Kuwait committed to reaching net zero for the oil and gas sector by 2050, and Qatar announced its intentions to achieve a 25 percent cut of greenhouse gas emissions by 2030. Decarbonization efforts in the oil and gas sectors are becoming crucial to mitigating their negative environmental impact and aiding the transition to a sustainable energy system. Massive investments in renewable energy, hydrogen, and CCUS technologies are expected to build new competitiveness in the GCC states as climate change becomes more prevalent.

As major energy consumer, China has successfully established its position as major global supplier of solar and wind technologies. It has expanded capacity for manufacturing electric vehicles, batteries, and hydrogen electrolysers, and also gained a strong presence in the global supply chain of critical minerals that are needed for clean energy transition. At the same time, decarbonizing emissions from the use of coal and hard-to-abate sectors remains critical for China to achieve its net zero commitment by 2060.

The transition towards clean-energy technologies has made China even closer to the GCC states. China's technological and industrial advantages are complementary to the needs of the GCC. A new, diversified energy equation is gradually taking shape in this partnership, especially in the area of renewables, CCUS, and hydrogen.

The growing efforts of GCC on renewable energy development presents promising opportunities for Chinese investors and industrial manufacturers. Despite supply chain disruptions and project delays caused by the Covid-19 pandemic, the installed capacity of solar and wind in the GCC reached 5 GW in 2022, almost 30 times higher than 10 years ago. As the largest contributor, the UAE aims to increase the contribution of clean energy (renewables and nuclear) in the total energy mix to 50 per cent by 2050 and reduce carbon emissions from the power sector by 70 per cent. Qatar's renewable capacity increased 34-fold in 2022 compared to the previous year, due to a strong push from the World Cup. Oman targets 30 percent of its electricity to be generated from renewable sources by 2030; its renewable capacity jumped to 687 MW in 2022.[187] Saudi Arabia has developed policy frameworks and identified key segments for localization in the near, medium, and long term, to maximize the benefit from the deployment of renewable energy. This can explain why Saudi Arabia was the top destination for energy engagement among the BRI countries in 2022, and solar projects have a strong presence.[188] Broadly speaking, creating a regional market with sufficient size and stable demand is essential to warrant the investment in production facilities for wind and solar products, which fits the needs of both China and the GCC.

China and the GCC are also complementary in CCUS development, with the GCC being well-versed in subsurface work and China being advanced in carbon capture technology.

The GCC is technically competitive with other attractive regions of the world for storage presence. This region has significant subsurface potential for storage, with an estimated 127.5 billion tonnes(Gt) of $CO_2$ in saline aquifers and ophiolite and a further 41.5 Gt of $CO_2$ in depleted gas fields.[189] Clusters of high-purity, low-cost capture industries coupled with nearby geological

[185] Energy Research Institute, Chinese National Development and Reform Commission, (2019), Research on Pathway and Measures to Cap China's Oil Consumption.
[186] Sinopec Economic & Development Research Institute (2021), China Energy and Petrochemicals Industry Development Report.
[187] International Renewable Energy Agency (2023), 'Statistics data', https://www.irena.org/Data.
[188] Nedopil, C. (2023), China Belt and Road Initiative (BRI) Investment Report 2022, Green Finance & Development Center, Fanhai International School of Finance, Fudan University, https://greenfdc.org/china-belt-and-road-initiative-bri-investment-report-2022/.
[189] AFRY and GaffneyCline (2022), *CCUS Deployment Challenges and Opportunities for the GCC*, report for the Oil and Gas Climate Initiative, https://www.ogci.com/wp-content/uploads/2023/04/Gulf-CCUS-challenges-and-opportunities-Mar-2022_compressed.pdf

storage make it possible to develop world-class hubs. Saudi Arabia and the UAE are already advanced with plans for hubs that can match carbon sources from petrochemicals, fertilizers, natural gas processes, and future hydrogen production.

China is an important player in CCUS. It has 59 CCUS projects currently in operation with a capturing capacity of 4 million tons (MT)/year and an injection capacity of more than 2 MT/year, an increase of 35 per cent and 65 per cent, respectively, compared to 2021. Another 40 CCUS projects are in various stages of planning and construction. The overall cost of CCUS technology for different emission sources in China is the lowest globally.

Though the current policies are very much focused on supporting domestic project development, the Chinese government is also considering incentivizing Chinese firms to develop CCUS projects abroad and encouraging Chinese oil companies to develop $CO_2$ storage sites overseas. It is beneficial to identify early CCUS opportunities in BRI countries, e.g. capture from high-concentration sources and applying $CO_2$ for enhanced oil recovery. Chinese deployment of CCUS in fossil power generation, chemicals, and cement, and for direct air capture, is expected to account for around 50–75 per cent of global CCUS capacity across those sectors by 2060, and around 40 per cent in iron and steel.[190] Its domestic deployment of CCUS provides an opportunity for China to export high-value knowledge and technical capacity.

Enhanced oil recovery is a cost-effective option to accelerate the deployment of CCUS projects in the GCC. However, in the long run, financial incentives or the support of a carbon market are needed to improve the feasibility of CCUS investment until its cost becomes competitive. There are opportunities for China and the GCC to explore possible public and private cooperation models and create enablers to roll out the plan of CCUS hubs in the GCC region to exploit economies of scale and reduce capital and operational expenditures.

The movement towards a hydrogen-based economy allows the GCC to play a significant role in the global energy transition. The GCC presents one of the most attractive destinations for low-carbon hydrogen production due to its proximity to strategic demand centres in Europe and Asia and low-cost resource availability. Oman has announced a green hydrogen strategy with a production target of 1 MT per year by 2030. Saudi Arabia and the UAE are in the process of developing a broader low-carbon hydrogen strategy. One of the world's large-scale projects, the NEOM green hydrogen project in Saudi Arabia, is expected to be operational by 2026. The UAE currently has 28 hydrogen projects in the pipeline, and 7 of them have passed the financing stage.

China's participation can help advance the establishment of the hydrogen supply chain in the region. China has been the world's largest producer and consumer of hydrogen since 2010. Hydrogen consumption reached around 33 MT in 2020, accounting for around 30 per cent of the global total. Though coal-based hydrogen takes a major share of the current domestic market, the development of renewable hydrogen is increasingly emphasized as a vehicle for stabilizing an electricity system based on variable renewable energy as well as broader decarbonization efforts. It has advantages established through the efforts of scaling up the hydrogen technology supply chain in the domestic market.

Though China's hydrogen policies are very much domestic-focused at this stage, China has the desire to be part of the global clean hydrogen supply chain, especially in the area of investment and construction of hydrogen infrastructure and export of electrolyser technologies. Advancing research and development in hydrogen-focused technologies and bringing down the cost for industrial deployment are critical to realizing the GCC's ambition on hydrogen export. This is compatible with China's advantage. The development of domestic infrastructure and the use of hydrogen in hard-to-abate sectors could help build the strength of the GCC in energy-intensive industries, such as export of green steel. There might be competition between China and the GCC in the future in this aspect, but the scope and the level of competition are likely to be limited because Chinese industries are more diversified and downstream integrated.

[190] IEA (2022), *An Energy Sector Roadmap to Carbon Neutrality in China*, https://www.iea.org/reports/an-energy-sector-roadmap-to-carbon-neutrality-in-china/executive-summary

**Looking into the future**

China's strategic partnership with the GCC was reaffirmed during the GCC-China summit in Riyadh in 2022, but it should not be interpreted as adversely affecting the GCC's relationships with others. In the search for regional and global security, stability, and prosperity, the GCC states, individually and collectively, are enlisting all those relationships for that purpose.[191] The partnership with China is one of the important building blocks for the GCC in achieving that goal.

China's National People's Congress has again emphasized the importance of BRI this year, signalling continued support for China's overseas investment in BRI countries. China's investment in Asian economies has enjoyed robust growth, while its ODI in North America and Europe has fallen significantly since 2017. The GCC states remain attractive for Chinese ODI due to their significantly improved policy and business environment and new opportunities created from the energy transition.

However, many challenges and uncertainties cannot be ignored when looking at the future of energy relations. Both China and the GCC need to balance relations with other strategic partners. Particularly, China needs to balance energy imports from the GCC and Russia, and the GCC needs to balance its political and economic ties with China and the US carefully.

How can China ensure its economic growth and demand for energy against the backdrop of global geoeconomic fragmentation, especially the US-China rivalry in almost every strategically important area, and what are the implications for its imports from the GCC? The capacity and desire for engagement with China varies among different Gulf states. To what extent can the GCC coordinate its relations with China as a bloc and at the individual state level? Renewables, CCUS, and hydrogen present significant opportunities for future growth in the GCC, but can GCC countries improve policy, infrastructure, and industrial coordination at the regional level to overcome the barriers of scaling up the deployment of these technologies? It remains to be seen what role China will play in the future landscape of energy transition in the GCC.

## MARRIAGE OF INCONVENIENCE—HOW THE WAR IN UKRAINE IS TYING RUSSIA TO THE CHINESE MARKET

***Sergey Vakulenko***

The Russian invasion of Ukraine in February of 2022 has led to a major geopolitical conflict between Russia and the West. As a result, Russia has pivoted to the East and sought to establish new relationships and strengthen existing ones with India and China. Russian priorities have changed, and Russian concerns about giving China too much leverage and influence had to remain unaddressed given Russia's lack of alternatives, which placed it in a weak negotiating position. In one year China has become the major buyer of Russian oil and gas, and its share will only grow. While Russia has managed to sell its oil and LNG to China at market-level prices, it had to agree to relatively low prices for pipeline gas. It is likely that China will keep asking for further concessions and move upstream in the value chain, which Russia has so far resisted.

China is still reluctant to become too dependent on one supplier, but growing tensions with the US create concerns over security of maritime energy supply routes for energy-deficient China and make a reliable overland supply from Russia more important both politically and economically.

Russian dependence on China and Chinese interest in Russian resources may bring the two countries closer in political terms and make China increasingly influential in Russia with the pragmatic goal of maintaining the security of supply of raw materials, access to defence technologies, and the security of its northern flank. These considerations may make a regime change in Moscow and normalization of Russian relationships with the West an undesirable outcome for China and create a rationale for support of the current Russian government.

**History of the energy trade between Russia and China**

The Sino-Russian energy partnership might seem the most natural. As China, one of the largest and most populous economies in the world, shares several thousand kilometres of land border with Russia, one of the largest energy producers, the two

[191] Aluwaisheg, A. A. (13 December 2022), 'China and the GCC plan for a brighter future in the Gulf', *Arab News*, https://www.arabnews.com/node/2215611.

countries seem predestined for cooperation. Soviet planners had an eastern oil pipeline from west Siberia to the Pacific on their drawing board since 1977; a gas pipeline from east Siberia to China was discussed beginning in the early 1990s; and the Yamal–China gas pipeline was under discussion since the early 2000s.

But Russian energy trade has long been heavily oriented towards Europe, and in the 1960s and 1970s this became one of the major international energy trade links. Energy trade with China was seen as an addendum, not a replacement for the European trade. Meanwhile, China cultivated Central Asia's post-Soviet states as the main source of its overland energy supply.

In this vein, China was keen on having a footprint in the whole value chain spanning upstream and midstream elements, and was able to achieve this in Central Asia. Meanwhile, Russia preferred to trade with China while keeping Chinese companies at arm's length. It has been extremely apprehensive about Chinese companies making inroads into its strategic industries. Even when Russia needed capital and China was able to provide it in the early 2000s, Russian stakeholders preferred to borrow capital and avoid giving mainland Chinese companies stakes in major Russian energy companies.

The prime example of this approach was a series of loans taken by Rosneft and Transneft from various Chinese entities between 2004 and 2017. These loans were used by Rosneft as its mergers-and-acquisitions war chest to buy Yukos assets and TNK-BP, and by Transneft to build the ESPO pipeline. Sinopec and CNPC got only minority shares in two less-important Rosneft upstream subsidiaries.

China was also more comfortable with the Central Asian states, with which it enjoyed a monopsonist relationship as a buyer and which offered no rivalry for superpower status.

**What changed for Russia in 2022?**

Vladimir Putin's war with Ukraine and the ensuing radical change in the Russian stance vis-à-vis the Western world, which made Russia a pariah state, led to an almost complete cut-off of trade ties between Russia and Europe, and changed the dynamics between Russia and China altogether.

Russia has managed to divert the majority of its crude oil flows from European markets to Asia—mainly to India, with additional volumes going to China—but at substantial shipping costs. As a result, India and China buy more than 80 per cent of Russian crude oil, with China getting 35 per cent of its volumes via pipeline and the rest split evenly between deliveries from Kozmino in the Far East and Atlantic basin ports. This development made Russia the largest import source for both countries, supplying half of India's total demand and 15 per cent of the Chinese demand (vying closely with Saudi Arabia).

On the gas front, Russia used to export 160 billion cubic metres of pipeline gas per annum to Europe, and a substantial share of LNG exports from the 27 million tons per annum Yamal LNG project was also customarily sold westwards. In 2023, Russian pipeline sales to Europe are less than one-fifth of historical volumes. LNG sales are still holding, and probably would hold until the new plants in LNG and Qatar go online and create a viable replacement; but after that, Russia would most likely lose this market as well.

With such prospects, Russia does not have viable alternatives to the Chinese market.[192] At the same time, Russia is dependent on China for much of its imports, from cars and consumer electronics to drilling equipment and weapons components. Russian society was long suspicious of Chinese ascendancy. There were tales passed around of Chinese farmers taking over prime land in the Far East, Chinese lumber companies mowing clean thousands of hectares of Siberian taiga, and Chinese bottling companies sending trainloads of Lake Baikal water to China. There was a feeling among the general population, the political class, bureaucrats, and business people that cooperation with China should be undertaken carefully, to not allow too much Chinese influence and control over the Russian economy—which might then convert into unequal trade, political arm-twisting, and massive immigration. These concerns did not go away, but now Russia does not have much choice.

Russia is apparently starting to invest in the Power of Siberia 2 pipeline before there is a firm purchase agreement with China, eager to start exporting now-stranded Yamal gas eastwards as soon as possible, making announcements that the deal will be inked by the end of 2023. Meanwhile, the only announcement from China on the expansion of its pipeline import capacity was about the construction of the fourth strand of the pipeline from Turkmenistan. This does not necessarily mean that China has

[192] Sergey Vakulenko "Can China Compensate Russia's Losses on the European Gas Market?" 2023, Carnegie Politika https://carnegieendowment.org/politika/89862

made its choice—there will be demand for the additional 50 billion cubic metres of gas from Russia—but it might send Russian gas further back in the queue. At the moment, China can afford to wait and play Russia and Turkmenistan against each other for the best price for the looming wave of LNG supply which is due to come online in 2025–2026.

**What is the current Chinese perspective on energy supplies from Russia, and how might the new reality change Chinese policies?**

Russian oil and gas are the lowest-cost options for China.[193] While Russian oil became cheaper than other options only after February 2022—because of the Western strategy to keep Russian oil in the global energy balance but to reduce Russian state revenues through embargoes and price cap mechanisms—China had managed to negotiate an extremely beneficial deal for supplies via Power of Siberia 1 back in 2014, before the Russian negotiating position started to weaken. It is likely that Power of Siberia 2, when and if materialized, would have a similar pricing arrangement. This sudden availability of large volumes of low-cost energy resources creates a conundrum for Chinese policymakers—the traditional approach of portfolio diversification would dictate limiting the Russian share of the Chinese supply, while cost reasons might nudge towards an increase.

Much of the Chinese energy supply comes from the Pacific Ocean and via the Strait of Malacca and the Strait of Taiwan. With growing tensions around Taiwan, Chinese strategic planners have to contemplate the security of supply, and overland routes from Russia would play an important role in an escalation scenario. From this point of view, a widening rift between China and the US would push China and Russia closer to each other and facilitate tighter links. But this would also mean that China would be making a strategic bet on the stability and longevity of Putin's (or his successors') regime, while regime change in Russia with a new pro-Western government in Moscow would be seen as a threat in a potential conflict with the West.

Regional separatism, and the potential break-up of Russia that some commentators see as a possible long-term outcome of Russian defeat in its war with Ukraine, would also create a transit states issue for China. This is another reason China might prefer not to commit to major new energy supply agreements with Russia but to adopt a wait-and-see approach. On the other hand, a commitment to such schemes would make China invested in the stability of the Russian anti-Western regime and Russia's territorial integrity, and would serve as a form of insurance for such a regime, albeit at the cost of increasing dependency on China and loss of agency.

The long-term availability of cheap Russian hydrocarbons for China might change China's approach to the energy transition. For China, considerations of energy security and air quality were probably as high a priority as climate concerns, if not higher, in its drive away from oil and coal to a renewables-based energy system. A low-cost traditional energy supply from Russia over secure routes might alleviate these concerns and allow China to concentrate on exports of solar, wind, and power storage hardware to more climate-concerned countries while enjoying the benefits of lower-cost energy. At the same time, the high capacity of gas import pipelines would allow China to increase the share of wind and solar in its power system without investing too much in costly energy storage, using gas generation for balancing instead. This approach would create a very uncomfortable gas demand pattern for Russia, but it would have to live with it for the lack of alternatives.

Growing reliance on Russian energy supplies might also change the Chinese outlook towards the Persian Gulf. In the last years, China has actively built up its relationship with the Gulf states, culminating in brokering negotiations between Saudi Arabia and Iran. With 40 per cent of oil imports and a large share of LNG imports coming from the region,[194] this interest is quite understandable. A higher share of Russian energy in China's supply portfolio would still keep China importing substantial volumes from the Gulf, but the relative importance of these imports, and as a consequence the region itself, might diminish.

**What might be the broader implications of the new Sino-Russian energy alliance?**

Exclusion of Russia from the Western-led global economic system might lead to a fracturing of global trade patterns. So far, the yuan has not been a major currency in international trade. But since 2022, Russia has been busy establishing alternative payment mechanisms that would allow it to avoid money flows through US and European financial systems. China is already paying Russia with yuan for its oil and gas. We might see an emergence of new Asian oil price markers, quoted in yuan. As

[193] Sergey Vakulenko "What Russia's First Gas Pipeline to China Reveals About a Planned Second One" 2023, Carnegie Politika https://carnegieendowment.org/politika/89552

[194] Steven Simon, "China and the Persian Gulf in the Aftermath of a U.S. Withdrawal", 2021, Quincy Brief #17, Quincy Institute for Responsible Statecraft https://quincyinst.org/report/china-and-the-persian-gulf-in-the-aftermath-of-a-u-s-withdrawal/

price cap enforcement mechanisms push Russia to seek non-Western providers for shipping and insurance, a separate market, also quoted in currencies other than US dollars and euros, might emerge in Asia. Russia might try to extend these mechanisms to its trade with India, currently conducted in United Arab Emirate dirhams. In general, the volume of trade between China and Russia is such that it might create a new regional standard and set of tools, with a working currency other than the currently predominant US dollar.

Putin's attack on Ukraine in February of 2022 has accelerated and fortified many developments that were already underway in the Russian-Chinese relationship, but also created new dynamics, tipping the balance resolutely in China's favour. The energy trade between the two countries is turning from a purely transactional trading relationship to a major geopolitical factor, akin to the long-standing US-Saudi relationship, and is creating new factors both in the energy universe and, as a consequence, in the political and financial dimensions.

## CHINA GAS: IS THE GAS DREAM OVER?

***Neil Beveridge***

Last year was the weakest year for gas consumption growth in China since the early 1990s, with demand contracting by 2 per cent mainly because of self-inflicted pain from draconian Covid policies. While there were hopes for a strong recovery from Covid, the reality has been disappointing, Consumer confidence appears to be shattered given the decline in the property market and economic de-risking which has negatively impacted China exports. As a result, gas demand growth in the first half of 2023 is tracking below 5 per cent, which is far lower than the expected 6–7 per cent growth for the year. Demand should pick up in the second half of the year, but it depends in large part on government policies which encourage greater consumption.

While recent gas growth has undershot expectations, we believe that China's long-term commitment to natural gas remains undiminished. Given that coal still accounts for over 50 per cent of the energy mix, there remains considerable scope for coal-to-gas switching to bring down emissions. Anyone who doubts China's long-term commitment to gas should look no further than the recent 27-year supply agreements between China and Qatar, which will take LNG supply beyond 2050. By 2030, China continues to target gas reaching 15 per cent of the energy mix, up from 10 per cent today. This implies gas consumption will increase from 390 billion cubic metres (bcm) this year to roughly 600 bcm by 2030, an increase of 50 per cent or a 6–7 per cent compound annual growth rate through to the end of the decade. Gas demand is expected to increase further beyond then. Despite China's pledge for carbon emissions to peak on or before 2030, gas demand is projected to continue increasing to 2040, whereupon it is expected to peak at or around 700–800 bcm or just under 20 per cent of the energy mix. Put another way, gas demand could still double from current levels.

With rising geopolitical tensions, energy security is back to the fore for China's energy planners. Self reliance is one of the key mantras within Xi Jinping's China, and gas supply will have to accord with China's security needs. Today China's gas imports are around 40 per cent of consumption. Import dependence is expected to continue to rise. While China has tried to stimulate domestic supply, results have been somewhat mixed. Shale gas has not been the panacea which was hoped for. Meanwhile, pipeline reform has not unleashed a wave of private capital into upstream gas exploration and development. Domestic gas supply in China is currently around 240 bcm and is expected to grow at around a 5–6 per cent compound annual growth rate to the end of the decade to reach around 300 bcm.

This leaves China with a gap of about 300 bcm (600 less 300 bcm) for imported gas supply through to the end of the decade. So far China has contracted about 100 bcm of pipeline gas supply and a further 120 bcm of long-term LNG supply, leaving a gap of 80 bcm (or 60 million tons per annum) still to be contracted through to 2030. Increasingly, it looks like Central Asia Line D, with a capacity of 30 bcm, will be part of the solution. Construction has already started on this line from Turpan to Zhongwei, and expectations are that the line will be completed towards the end of 2024. For the remaining 50 bcm, the options are LNG or more pipeline gas. The most credible source of pipeline gas would be Power of Siberia 2 (PoS2). Russian has already secured 48 bcm in pipeline exports to China through PoS1 and Sakhalin. The addition of PoS2 would take Russian pipeline exports to 98 bcm or around 15–20 per cent of China's supply. While Russia is keen to proceed with PoS2 to replace the European market, China must balance energy security requirements with its trading relationship with Europe. It is unlikely that any deal will be done on PoS2 until the Russia-Ukraine war is resolved and much depends on how it gets resolved.

If China does reach an agreement with Russia on PoS2, then the opportunity for significant additional LNG contracts this side of 2030 could be limited. But China will likely need a further 100–200 bcm of gas imports until demand peaks in 2040. As such, China is still likely to be the largest incremental buyer of LNG over the next decade. Qatar is clearly well placed for such supply, but it would be wrong to rule out additional supply from the US and Australia. Much will depend upon how relationships develop from here; and while China is likely to be cautious, trade with the West will continue.

In summary, China has changed in many ways since the outbreak of Covid-19. Slower economic growth has been negative for gas. Moreover, an increased focus on self-reliance and energy security has pushed China towards favouring pipeline gas over LNG. How far China goes with pipeline gas will partly depend on the outcome of the Russian-Ukraine war and how the relationship between Xi, Putin, and the West evolves from here. While opportunities for LNG have to some extent been diminished, a potential doubling of gas demand in China over the next 20 years still means that China will remain the most important market for LNG exporters in the decade ahead.

## COMPLEXITIES IN THE ENERGY SECTOR RELATIONSHIP BETWEEN INDIA AND CHINA IN 2023

***Mohua Mukherjee***

The energy sector relationship between China and India, Asia's two largest, fast-growing energy markets, is multidimensional. Between 2012 and 2023, which roughly corresponds to the rise of the renewable energy revolution in Asia, shifting circumstances have created both diverging and converging interests in different energy areas for China and India. The overall energy relationship has therefore seen both collaboration and competition.

This article first considers some of the two countries' overlapping interests, namely climate change and their stance on fossil fuels as a necessary complement to renewable energy, plus the importance of the Paris Agreement's Common but Differentiated Responsibilities and Respective Capabilities. It is often overlooked that various multilateral geopolitical associations that both countries belong to—such as BRICS (Brazil, Russia, India, China, and South Africa), the Shanghai Cooperation Organisation (SCO), the International Energy Forum, the G20, and the India-China Strategic Economic Dialogue forum—all have joint working groups on energy, ensuring that an institutional energy dialogue mechanism is entrenched.[195] Multilateral energy meetings have therefore continued despite chilly diplomatic relations and the suspension of bilateral contact after deadly border clashes in May 2020.[196] Only the India-China Strategic Economic Dialogue, which is purely bilateral, has not convened a biennial meeting since September 2019 (in Delhi); all other multilateral engagements remain on schedule.

The article then moves to areas of competition, which are primarily around access to fossil fuels, and notes that some of the rivalry subsided in 2022 when both countries switched to Russia as a larger supplier of oil and coal, yet neither's presence was bidding up the price for the other due to unique market circumstances. The article concludes with a look at India's recent efforts to expand its domestic manufacturing sector for renewable energy hardware. This is a pivot away from nearly 90 per cent reliance on Chinese solar imports between 2015 and 2019, which propelled the first phase of India's energy transition.

**Areas of overlapping interests**

Both countries are highly vulnerable to climate change,[197] and they share a view on the importance of coal as a strategic and complementary fuel, alongside renewables, to achieve their economic development targets for another decade or so, meaning that coal use will peak around 2035.

[195] As an example of the scope of the India-China Strategic Economic Dialogue forum, see the minutes from the 4th India China Strategic Economic Dialogue Meeting, http://164.100.94.191/niti/writereaddata/files/document_publication/Agreed%20Minutes%20on%204th%20SED.pdf.

[196] Just one month prior to the deadly border clashes, which have halted communications at present, the Chinese government had published a 128-page booklet celebrating 70 years of the India-China relationship (1950–2020) and looking ahead to deeper ties among the two neighbors— China-India @70, Scaling New Heights (http://in.china-embassy.gov.cn/eng/xwfw/zgxw/202007/P020210622244707034146.pdf). The countries share a 3,800 km border that is ill-defined in certain stretches, at high-altitude peaks and through lakes.

[197] https://www.indiatoday.in/environment/story/china-us-india-top-list-of-countries-most-vulnerable-to-climate-change-2337088-2023-02-20.

India and China depend heavily on coal to power their economic development, though India has recently cut its fossil fuel subsidies by 72 per cent. India and China agreed at the Glasgow COP to phase down coal. China's domestic policy documents state that it will limit coal additions until 2025 and then phase them down; however, at present, in view of unexpected record heat waves and high electricity demand, it continues to build new thermal power plants at a rapid pace.[198] India is pushing for a phase-down of all fossil fuels, not just coal, and was able to secure support from 39 small island countries as well as the EU and the UK at COP27. Ultimately the language was not reflected in the final communique due to opposition from major oil- and gas-producing nations like the US, Russia, and members of OPEC.

India has also strongly resisted, with China's full backing, the effort of developed countries to create new terminology such as 'major emitters' and 'top emitters' and assign funding responsibilities that are not present in the Framework Convention of the Paris Club. India additionally rejects what it calls an 'attempt to forget about historic responsibilities of rich nations '.[199] These are the major aspects of climate diplomacy in which India's and China's interests converge.

Shortly before COP27, in September 2022, the SCO held its Samarkand Summit, which was attended by Xi Jinping and Narendra Modi.[200] (This was their first in-person meeting since their last 'informal summit' during Xi's October 2019 visit to India,[201] just six months before deadly border clashes halted all but defence ministry bilateral contacts).

The Samarkand Summit issued a statement endorsed by both China and India that pushed back against calls for a wholesale move away from polluting fossil fuels in favour of cleaner renewable energy. 'It is important to use the common and complementary advantages of fossil fuels and clean energy sources and, in this regard, to increase investment in the exploration and production of fossil fuels,' SCO members said.[202]

In October 2022, a BRICS Energy Ministers' Meeting chaired by the head of China's National Energy Administration 'reached broad consensus on further deepening BRICS energy cooperation, promoting green and low-carbon energy transition, and intensively participating in global energy issues', just days before COP27.[203]

The G20 is currently chaired by India and is preparing for a heads of state summit in New Delhi in September 2023. India, backed by China, is trying to build a consensus during 2023 at Energy Transition Working Group meetings within the G20 to let countries choose a roadmap to cut carbon emissions instead of setting a common deadline to end the use of fossil fuels. China supported India during the meeting, saying it cannot put a timeline on ending fossil fuel dependence and would want to put all its available resources to optimum use. India is keen on introducing the phrase 'multiple energy pathways' in a communique to be released at the summit in September and has been supported by countries including China and South Africa.[204]

**Areas of competition: coal and oil**

China and India are both large producers of coal. China is also consistently a large importer, whereas India seeks coal imports only during emergencies, and in much smaller volumes. India has no organized coal-procurement agency aggregating orders. On various occasions India has found itself having to pay hundreds of US dollars extra per ton of coal because of China's looming presence and buying power in the global coal market.

But this works both ways. China imposed an unofficial ban on Australian coal in November 2020 after that nation supported calls for an international investigation into China's handling of the coronavirus outbreak earlier in the year. India turned out to be a favourite destination for Australian coal. Shipments from Australia to India grew fivefold in the first three quarters of 2021,

[198] https://india.mongabay.com/2022/11/many-nations-join-indias-call-to-phase-down-all-fossil-fuels/.
[199] https://timesofindia.indiatimes.com/india/attempts-being-made-to-forget-rich-nations-historical-contribution-india-at-cop27/articleshow/95572000.cms.
[200] See Backgrounder—The 22nd Summit of the Shanghai Cooperation Organisation (https://www.idsa.in/backgrounder/the-22-summit-of-the-shanghai-cooperation-organisation-jwahlang-141122; Leaders of SCO sign Samarkand Declaration (http://english.scio.gov.cn/topnews/2022-09/17/content_78424919.htm), which mentions deepening energy cooperation among member states; and another article with the same title, Leaders of SCO sign Samarkand Declaration (https://www.chinadaily.com.cn/a/202209/16/WS63246137a310fd2b29e7826c.html), which references the need to 'stick to a coordinated manner to security threats and challenges in traditional and non-traditional fuels'.
[201] http://www.xinhuanet.com/english/2019-10/13/c_138467153.htm.
[202] https://www.reuters.com/business/environment/sco-leaders-call-balance-global-approach-climate-change-2022-09-16/.
[203] http://brics2022.mfa.gov.cn/eng/zdhzlyhjz/MM/202210/t20221011_10781103.html#:~:text=On%20September%2022%2C2022%2C%20the,journey%20of%2016%20years%20together.
[204] https://www.reuters.com/world/india-china-propose-multiple-pathways-cutting-use-fossil-fuels-sources-2023-05-02/.

rising 503 per cent year on year, to 16.5 million metric tons in the January–September period. While China's coal appetite remained intact, it turned to other suppliers to fill the Australian coal vacuum—such as Indonesia, Russia, and South Africa—until the ban ended in 2023.[205]

India's total imports of thermal coal—used mainly for power generation—grew 14.7 per cent to 161.18 million tonnes in 2022, as domestic coal production and delivery logistics fell short, mainly due to rail-transport constraints after removal of restrictions following the pandemic (passenger and freight trains use the same railway network). Thermal coal imports rose due to a power demand surge from rising industrial activity after easing of coronavirus-related restrictions, but primarily due to an intense heatwave which arrived three months before temperatures were expected to rise. India's thermal coal imports by power plants increased 58.1 per cent to 47.6 million tonnes during the first 11 months, compared with the same period in 2021. Indonesia cemented its place as India's largest (and nearest) overseas supplier of thermal coal, with its share rising to two-thirds in 2022, from over half the market in 2021. Indonesia's share rose at the expense of Australia and South Africa, while Russia overtook the United States to become India's fourth-largest supplier.[206]

China and India are both large crude oil importers, although India's 5 million barrels per day (bpd) are dwarfed by China's 11 million bpd of crude oil purchases. China was already importing oil from Russia and has increased its orders to benefit from discounts of $25 to $30 per barrel relative to Brent crude prices.[207] Other sources put the discount even higher.[208]

India previously sourced less than 1 per cent of its needs from Russia due to high freight rates that made Russia an uncompetitive supplier (relative to the Persian Gulf countries, located more favourably). The OPEC nations had a 72 per cent share of all crude oil India imported in April 2022. This share fell to 46 per cent by April 2023, according to energy cargo tracker Vortexa. In March 2022, India imported just 68,600 bpd of oil from Russia, out of its total 5 million bpd. In 2023 the purchases from Russia have jumped to 1,678,000 bpd. Indian market watchers believe that increased future competition from China for Urals oil will limit the gains from India's imports of Russian crude.[209]

As far back as 2005, India had proposed an Oil Buyers Club for joint sourcing of OPEC crude oil with China, Japan, and South Korea.[210] This was primarily to overcome the much-despised Asian Premium, which saw OPEC countries imposing (since the 1980s) a discriminatory $3 per barrel surcharge (amounting to millions of dollars per day) on Asian buyers to offset the discounts it was offering to North America and Europe.[211] Finally, in April 2019, India and China were nearing agreement to form a buyers' bloc,[212] following the Wuhan summit of April 2018 when Prime Minister Modi travelled to China to meet President Xi, and this was followed by mutual visits of their petroleum secretaries. The agreement did not materialize due to the rupture of the India-China bilateral relationship soon afterwards, but it came very close and was considered a game-changer. If relations are repaired in future, this could come back to the agenda.

India's priority in 2019 was to seal the accord with China first and subsequently invite South Korea and Japan to join the buyers' club. In fact, India had co-hosted the International Energy Forum meeting in Delhi in 2018 with China and South Korea,[213] when relations were closer than ever, and the oil buyers' club to dismantle the Asian Premium looked imminent.

[205] https://www.spglobal.com/commodityinsights/en/market-insights/blogs/coal/121621-china-coal-australia-india-japan; https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/coal/022223-china-starts-buying-australian-coal-as-unofficial-ban-ends.
[206] https://economictimes.indiatimes.com/industry/indl-goods/svs/metals-mining/indias-thermal-coal-imports-up-nearly-15-in-2022coalmint/articleshow/96849584.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst.
[207] https://home.treasury.gov/news/featured-stories/the-price-cap-on-russian-oil-a-progress-report#:~:text=In%20recent%20months%2C%20official%20price,Russia%2C%20evidenced%20in%20public%20reporting (see the text below the graph).
[208] https://www.washingtonpost.com/business/energy/putins-few-oil-buyers-demand-deep-discounts/2022/11/27/0496cf60-6e32-11ed-8619-0b92f0565592_story.html.
[209] https://economictimes.indiatimes.com/news/economy/foreign-trade/indias-imports-from-opec-at-all-time-low-as-russian-oil-buy-peaks/articleshow/100048546.cms?from=mdr.
[210] https://energy.economictimes.indiatimes.com/news/oil-and-gas/india-discusses-oil-buyers-club-with-china-seeks-us-crude-to-counter-opec/64573673.
[211] https://www.indiatoday.in/mail-today/story/india-is-losing-billions-of-dollars-as-opec-charges-extra-price-1254928-2018-06-08.
[212] https://www.livemint.com/industry/energy/india-china-step-on-the-gas-on-oil-sourcing-plan-1556224759083.html.
[213] https://www.indrastra.com/2018/04/Future-of-Asian-Premium-004-04-2018-0025.html.

**The growing self-reliance of India's solar energy industry**

China played a major role in the first phase of India's energy transition, from 2012–2020, when imports from China fuelled India's rapid growth of installed capacity in the solar sector and falling hardware costs due to China's economies of scale allowed Indian developers to quote record low tariffs in highly competitive bidding scenarios. (This was after several Indian solar manufacturing companies went into liquidation around 2014–2015, unable to survive without adequate government support.[214])

Indian solar developers (who were heavy importers from China) found themselves in direct opposition to Indian solar manufacturing associations that were lobbying the government for World Trade Organization–permitted safeguard protections (tariffs). These were eventually imposed in the amount of 15 per cent on solar imports from China and Malaysia and subsequently complemented with basic customs duties as high as 40 per cent, as well as a so-called Approved List of Modules and Manufacturers. As the bilateral relationship with China worsened after 2020, names of Chinese suppliers were removed from the Approved List and more stringent domestic content requirements were introduced to influence the demand for Indian solar panels.

India is looking to distance itself from full reliance on Chinese imports of the large numbers of solar panels and other hardware it will require to meet its solar targets. It is unlikely, given China's decade-and-a-half head start, and the economies of scale and market dominance enjoyed by China, that India would become a serious competitor by 2030. Instead, India is likely to be merely looking to create domestic manufacturing employment to meet a larger share of its own needs.

On the supply side, the second phase of India's post-Covid stimulus package (known as Self-Reliant India), announced in 2021, includes important government-funded financial incentives to domestic and foreign investors to set up facilities in India for the manufacture of solar modules, cells, wafers, ingots, electric vehicle batteries, electrolysers, and other hardware to fulfil India's renewable energy transition. Around 15 companies have announced plans to invest around $3 billion in solar manufacturing facilities in India.

Now solar developers assert that India is likely to require a three- to four-year transition period for its domestic capacity to catch up with the rapid growth in demand for solar installations, and there is anticipation of some imminent readjustment in trade policy to open the door again to imports from China, with lower customs duties during the transition,[215] to reduce loss of momentum in India's solar capacity addition. At present, India is still importing some components (such as wafers and ingots) from China, since domestic upstream manufacturing capacity has not yet caught up with demand.

**Conclusion**

The energy relationship of India and China is multidimensional, and there is more that unites the two countries than divides them. The glut of cheap Russian oil on the market has paradoxically removed a pain point in the relationship. India needs Chinese hardware for the next few years while it builds up domestic manufacturing capacity. India and China are also important dialogue partners in climate diplomacy to further their joint interests in using coal as a complement to their large investments in renewables.

[214] https://www.saurenergy.com/solar-energy-news/indias-solar-manufacturing-a-tale-of-failed-government-initiatives.
[215] https://www.reuters.com/business/energy/india-may-cut-solar-panel-import-tax-make-up-domestic-shortfall-2023-05-30/.

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