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China's Climate Agenda and the Path to 2060

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China's aim to become carbon neutral by 2060 represents a bold step in its energy policy at a time when the country has taken on a global leadership role in climate change negotiations. Given the state of US-China relations, China wanted to restart cooperation and strategic dialogue with the US through climate change, even as other issues remain at stake. Climate is one of the few areas of global consensus but China's carbon-neutral pledge has injected new momentum into global climate negotiations. Japan and South Korea made their own climate-neutral pledges shortly after China's announcement, and recently, India is considering adopting its own 2050 net-zero pledge, which may have been influenced by China's decision.

US-China Series explored every facet of China's climate agenda and featured:

Michal Meidan — Director of the China Energy Program at Oxford Institute of Energy Studies

Yan Qin — Lead Analyst at Refinitiv, Research Associate at Oxford Institute of Energy Studies

Lauri Myllyvirta — Lead Analyst at Center of Research on Energy and Clean Air

Barbara Finamore — Founder of NRDC China, Fellow at Oxford Institute of Energy Studies

The on-the-ground reality in China is complicated, where different priorities and different needs create tensions between short-term demand for energy through fossil fuels and long-term renewable energy goals. For now, the strength of fossil fuels remains steady, along with innovation in renewables. This may be an impossible contradiction that will remain in place.

We discuss the background of this remarkable pledge and the practicalities and complexities of implementing such an audacious goal. We discuss the apparent winners (renewables) with cautious optimism given the technical and political difficulties of weening the Chinese economy away from its dependence on coal and oil. While the upper echelons of the Party have embraced the clean energy agenda, coal remains politically sensitive, employs more people than the population of Norway, and will be difficult to dislodge as a preeminent source of power. The ever-present conflict between the priorities of Beijing, the provinces, and market mechanisms will be a constant threat to the successful implementation of the carbon neutrality pledge.

Innovation is a significant focus of the plan, as China increases its spending on R&D, especially for basic research labs. The country is considering re-orienting its system of research labs and develop systems of national labs. Tax breaks will also be given to companies that conduct

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primary research and work with research institutes. These all come about as China realizes that despite its increased standing in the global innovation index, structural problems in its institutions — including universities, workplace culture, and the lack of a robust intellectual property system — prevent the country from becoming a nation of innovation.

We discuss the growth and development of China's carbon trading markets that could prove instrumental in entwining market pricing into a cleaner industrial base. This could well evolve into a significant opportunity as the push to 2060 begins in earnest.

There is a role for nuclear despite its tarnished global reputation and a role for hydro with all its ecological, societal, and geopolitical complexities. The scale of the Chinese energy transition will mean that every source will play its part.

A special thanks to Michal Meidan who have been a tireless supporter of US-China Series.

Carbon Neutrality: Some Background

Michal Meidan: China's pledge to achieve carbon neutrality by 2060 was a more ambitious pledge than its goal of peak carbon emissions by 2030. External observers and many Chinese citizens themselves were surprised by the commitment to carbon neutrality. However, since a policy blueprint for what the carbon neutrality pledge will look like remains unavailable, many are trying to figure out how it will be implemented.

The biggest driver behind this pledge was the assessment that China's external environment has deteriorated. Issues of energy security have risen on China's policy agenda as it is driven to become energy self-sufficient. Geopolitics also plays its part as China has taken on the global leadership role for climate policy. Moreover, many in China have been aware of the impact of climate change on Chinese cities and the toll it would take.

In the wake of COVID-19, many global entities are scrutinizing China's role in supply chains, and some are hoping to become less dependent. Yet, there is an industrial opportunity in the energy transition, and China understands that it needs to become more environmentally friendly. Other countries' approaches to climate policy — such as the EU Green Deal's carbon border adjustment mechanism — threaten China's industrial structure. The implication is that an increasingly carbon-conscious world would harm the Chinese economic model, whose energy structure is unfit for clean initiatives. These were all significant drivers that informed the carbon neutrality statement, and now it remains to be seen how it will be implemented.

What emissions targets are set for the next years, and will they fall in line with the 2060 pledge?

Yan Qin: China announced its new 2030 targets at the Climate Ambition Summit last December on the 5th anniversary of the Paris Agreement. Some important figures:

- GDP carbon intensity will be reduced by 65%, and the share of non-fossil fuel share in energy consumption will be increased to 25%.
- A combined wind and solar capacity of 1,200-gigawatt would be achieved by 2030.
- Carbon neutrality has been a crucial part of major economic planning. Moreover, the Environmental Ministry is asking provincial governments to draft a concrete 2030 carbon peak action plan by the end of this year as a way to measure the potential for achieving the 2030 goal. Some regions may reach the goal faster than others.

All in all, the work has begun, but the pledge's next steps require more detailed policy announcements. There is a consensus that carbon emissions must decrease, but the risks are apparent. If measures are not strict enough in the near term, the carbon peak point may rise, making it more difficult to achieve carbon neutrality in the future.

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Looking Ahead to 2060

What does the 14th Five-Year Plan tell us about the beginning stages of getting to this end goal, and in the near term, what is the response to such a distant goal?

Lauri Myllyvirta: 2060 may seem far away, but it is an immense task when turning the world's largest coal consumer and CO2-emitting economy into a carbon-neutral one. Progress is broken down into five-year periods, and much has to be achieved during each stage.

The world is looking for signals in this five-year plan to show China's ability to turn around its carbon emissions. It is important to remember that China's emissions went back into growth mode since 2017. As new permits for coal-fired power plants were granted and construction has accelerated, heavy industry volumes have also been growing. This is the background against which President Xi made the pledge, and now it is a question of how fast things can be turned around.

The new five-year plan was not groundbreaking: it was a continuation of past plans in terms of emissions growth, while the increase in non-fossil energy use was a very modest step. To achieve its peak carbon emissions target by 2030, China would have to halve its emission growth in the next five years to achieve zero growth during the next 15th five-year plan.

This plan does not account for these steps. Interestingly, Xi Jinping's speech, which came after the unveiling of this five-year plan, stressed the importance of the next five years and the centrality of decarbonization and green growth as major tasks for the Party. He spoke in strong terms about how these were strategic decisions made by the Central Committee without references to the five-year plan. This is a signal that President Xi and the Central Committee expected a higher level of ambition, while central planners who were behind the five-year plan, including the NDRC, were less willing to see a very rapid turnaround in emissions.

China runs the equivalent of an internal Paris process where different provinces are putting forward their pledges or their projections of achievable goals. After that, it will be up to the Central Committee to decide if they are enough. But many provinces see the next few years as a window of opportunity to build all the fossil-based industries and capacity that they would like, at the risk of more emissions growth. These are all visions and proposals that are being considered within the government, the Party, and society.

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Green Technology and Innovation

Given the importance of industrial innovation and technology leadership, what are China's energy transition technologies, and where does China sit in the global innovation ecosystem?

Barbara Finamore: Innovation is a key part of the process in developing the next generation of technologies that will be needed to decarbonize heavy industry, long-distance transport, and other emissions-heavy sectors. Some key points:

- China has a positive track record in manufacturing innovation in wind, solar, and electric vehicles. While these core technologies were initially acquired from abroad, China has excelled in developing economies of scale and manufacturing innovation.
- The current geopolitical climate means that China will find it challenging to acquire core technologies such as hydrogen, next-generation solar cells, offshore wind, and alternatives to lithium batteries from abroad.
- China's attempt at domestic development is running into stiff competition. For instance, it lacks the capacity to develop next-generation energy storage technologies. But cooperation is also possible: in next-generation perovskite solar cells, China is working with the EU and the US in this domain.
- China also recently opened a production facility that will further its economies of scale and manufacturing innovation on promising new technology such as Hydrogen-2. As the leading producer of hydrogen, China has brought the cost down of alkaline electrolyzers by 80%, and it could achieve similar results with PEM electrolyzers if it obtains access to the technology.

This race will play out in interesting ways as countries vie to become leaders in these fields and the opportunities for cooperation.

Discuss whether China can continue playing a leading role in renewables in the context of barriers to accessing technology, given ongoing geopolitical tensions and the US-China trade dispute.

Lauri Myllyvirta: The peak emissions target makes it necessary to massively scale up the clean energy industry. China's advantage is that its industry scale is already large. Some key points:

- A nuclear target was included in this five-year plan for the first time. There is support in keeping nuclear as a part of the clean energy mix, even as nuclear technology progress has been slow.
- Besides doubling or tripling annual wind and solar installations, much is happening on the storage side of things. However, there should be caution as on-site storage for wind, and solar energy is not yet necessary when China has only achieved a 10% penetration nationwide under proper working conditions.

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- There is concern that engineered solutions are taking precedence over institutional issues that remain, especially adopting more thermal power plants to increase the share of variable renewables. Simultaneously, as variable renewables represent a larger share of the clean energy mix, it is understandable that storage needs to be scaled.
- One significant direction is the process of electrification, where everything — from household heating to industrial manufacturing — adopts electricity. This push will continue because the know-how to produce clean electricity at an economically competitive rate is well-developed.
- Innovative technology will be significant as China tries to achieve breakthroughs in creating smart grids and smart transport.
- Both the State Grid and the Southern Grid have revealed their action plans for carbon peaking and carbon neutrality with fairly modest targets. Building ultra high voltage transmission lines from power generation bases across western, northern, and southern China to demand centers in the east forms a significant part of the plan.

What technologies will be prioritized as China may increasingly be forced to develop its technology at home?

Barbara Finamore: Relations with the US, especially the trade war and technology access restrictions, served as a wake-up call for China. The current five-year plan is the result of this impact. Like other countries, China will prioritize areas such as artificial intelligence, deep-sea research, deep space research, as well as all the technologies highlighted in the Made in China 2025 program, such as new energy vehicles.

Innovation is a significant focus of the plan, as China increases its spending on R&D, especially for basic research labs. The country is considering re-orienting its system of research labs and develop systems of national labs. Tax breaks will also be given to companies that conduct primary research and work with research institutes. These all come about as China realizes that despite its increased standing in the global innovation index, structural problems in its institutions — including universities, workplace culture, and the lack of a robust intellectual property system — prevent the country from becoming a nation of innovation.

Clean energy technologies will form a large part of this institutional restructuring and tech developments.

The Future of Fossil Fuels

How will Beijing balance its target of phasing out coal as part of the carbon neutrality agenda while ensuring adequate energy supply?

Yan Qin: Coal must be phased out as part of the emissions reduction scheme, but this is the most challenging obstacle for China. Over 60% of China's power consumption still comes from coal.

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Several incidents of power shortages last winter triggered a debate about how China's coal-intensive power system can transition into a fully decarbonized power system. To achieve carbon neutrality in 2060, the power system should already be fully decarbonized by 2050; yet there are still 1,100 gigawatts of coal plants running in China, and more plants are being built.

Domestic researchers recognize that China's power consumption will continue to grow alongside economic growth. Under these circumstances, some suggest that electrification will need to grow to reduce emissions, working as a direct replacement for coal. Other suggestions call for coal capacity to grow another 100 gigawatts in the next five years before the carbon peak, after which the reduction period begins.

The latter scenario could lock in high-carbon infrastructure and investment, which will be difficult to divest from in the future. Moreover, the electrification option will not alter the increasing demand for power loads, and this will require very detailed grid planning, such as long-distance and cross-regional transmission.

All in all, the central government wants to limit the use and expansion of coal, and it will plan the phaseout of coal once energy demands are met. That coal plants continue to be built demonstrates that those demands are not yet fulfilled, even though provincial governments are aware that carbon peak has to be achieved before 2030. If regional governments can avoid high carbon lock-in, then that coal phaseout can work in tandem with more extensive plans of infrastructure development and renewables integration.

What are the near-term roles and long-term trajectories for oil and gas in China?

Michal Meidan: While renewable energy has the upward potential over the next decades, oil and gas cannot be dismissed too quickly. Some key points:

- Tsinghua's study on the feasibility of carbon neutrality suggests that emissions growth for coal and oil will remain on track until 2030, then it will fall quite dramatically. This dovetails with ambitions to double the size of the economy by 2035. In this plan, China needs another decade of growth and economic activity that require fossil fuels.
- As China wants to become self-sufficient for chemicals in consumer goods manufacturing, oil demand in China is unlikely to peak before 2030, and the carbon neutrality pledge does not appear to change that in the near term. As a clean, transitional fuel, gas may grow until 2040 before beginning to fall.
- Oil and gas are a part of the infrastructure and industrial uses; they will not go away. That China still has another decade of economic growth in achieving prosperity means there is room for all of these projects to be built.
- It is possible that if the Politburo Standing Committee is given the authority to lead the carbon neutrality process and look at all the different moving parts, perhaps there may be a coordinated blueprint where oil, gas, and certainly coal will be phased out faster than previously thought.

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The on-the-ground reality in China is complicated, where different priorities and different needs create tensions between short-term demand for energy through fossil fuels and long-term renewable energy goals. For now, the strength of fossil fuels remains steady, along with innovation in renewables. This may be an impossible contradiction that will remain in place.

Reform and Regulation

Will pressure on industries to reform come from Beijing or the provincial level?

Michal Meidan: Both industries and provincial governments have very contradictory goals and interests, especially in the near term. In the post-COVID-19 world, state companies are the easiest lever for the Chinese government to generate growth. Yet economic activity from state industries, which often use fossil fuels, steel, and cement, could result in higher pollution levels. In the long-term, different parts of industry and government will push for China to develop cleaner solutions for steel and cement, but growth may come at the expense of the environment in the short term. In summary, the impetuses for economic growth and cleaner energy will be disjointed, especially as a blueprint for achieving carbon neutrality is not yet available.

Lauri Myllyvirta: The critical task in the next five years is to ensure that the provinces and state-owned firms with stakes in fossil fuels will diversify to not end up on the losing side in 5 years when emissions need to begin declining.

But this initiative is competing with the impulse to build as much dirty industrial capacity and coal-fired capacity as possible so that these industries have a comfortable level from which to peak. I believe that oil and gas are in a more precarious situation given the energy security agenda: China's decreasing reliance on imports and push for electrification will seriously affect oil demand. And China may shift away from gas as well, as it will be reluctant to rely on imported hydrocarbons.

How could the conflict between Beijing and provincial priorities and conflicts between market forces — in the form of subsidies and carbon reductions — be resolved?

Barbara Finamore: It is likely that these competing forces coexist in China and have to be accepted. Some key points:

- The West's energy transition involves much decentralization and the prevalence of market forces. But China works in a different way that utilizes more command and control.
- In China, the state gives directions to companies and the market, which develop innovative solutions. Even in the West, there are questions about whether regulations may prevail over market forces that will decide upon the best technologies for the energy transition.

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- Certain provinces will perform differently. Guangdong is already looking ahead to more renewables and more gas in its energy mix, experimenting with power price reforms. Some provinces may rely on market forces more than others. The central government may expand some of the experiments that happen locally and perhaps let other provinces lag.

There will not be a one-size-fits-all solution, and the rhetoric is starting to reflect this reality.

Emissions Trading

With China's emission trading scheme now taking shape, how critical will it be for China's energy transition, and what will be some of the short-term and longer-term impacts?

Yan Qin: China's national carbon market is now covering over 2,000 power companies, mainly coal and gas power plants in the country after a decade in the making and over eight pilot schemes. Some key points:

- Actual trading is expected to start before June. A national carbon price in China will be traded on an exchange.
- While there are many details regarding ETS, there remains no absolute cap nor a declining absolute amount of emissions covered in the carbon market.
- As it is designed right now, the intensity target or emission factor is in line with the average emission factor of China's coal fleet.
- The current impact of the ETS on coal plants' profit margin is very limited. The biggest utility entities in China have ultra-critical coal plants whose emission factors are below the benchmark intensity.
- Overall, the current emissions trading scheme can improve the overall efficiency of the coal fleets. It is an instrument in the toolbox for reaching China's climate goal.
- The government has said that China's ETS will expand to other industry sectors during the 14th 5-year plan. By 2025, China's power and industry sector will be covered in the carbon market, or roughly 70, 80% of China's emissions.
- By then, fossil-fuel power plants and energy-intensive industrial facilities will have to report their emissions like counterparts in the EU.

In the medium-term, if policymakers decide that the carbon market will be the main instrument, then stricter targets and requirements for power plants and industrials could be applied to achieve targets.

How does a common carbon price fit in with broader market reform?

Barbara Finamore: China currently faces a difficult moment as it phases out subsidies for wind and solar energies and electric vehicles. These industries had been built on the back of massive subsidies that led to major deficits in the Renewable Energy Fund.

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The market reform and transition to fewer subsidies will be tricky. The 14th five-year plan showed a great deal of caution in relying on the transition to renewable energy, perhaps due to the uncertainty of what will happen when subsidies are fully phased out. The subsidies that remain will be tied to increased innovation, better energy density, better range, better efficiency for batteries, better performance for solar cells, and other areas. Concerns over integrating renewable energy into the grid could also explain nuclear power's surprising integration as an alternative energy source.

With energy storage, for example, China faces a problem in implementing the correct business models for bearing the costs of energy storage. The grid is moving towards a more market-based status, but it is a complex process that takes years. China has also stepped back on its previous binding target to have 25 percent of all new vehicle sales be new energy vehicles by 2035, instead now aiming for 20 percent as subsidies for electric vehicles phase-out. China is not the only one: Europe faces the same problem as electric vehicle purchases are heavily subsidized.

The 14th five-year plan and carbon neutrality pledges will have to be seen in the context of these very important market reforms that China is trying to push through.

How does China's carbon market compare to the EU emissions trading scheme? What are the prospects for connectivity and the potential for future trade disputes arising from carbon?

Yan Qin: The EU was heavily involved in helping China build its national carbon market, and the two markets can be compared as follows:

- Many similar features can be found between the EU and China's trading systems, including benchmarks and MRV (measurement, reporting, and verification).
- The EU's ETS is a typical carbon trade system with an absolute cap and declining cap for the carbon market, features which China's ETS does not have. However, as China's carbon market matures and an overall reduction target is adopted, caps could be utilized in China's ETS.
- The EU Green Deal has revealed proposals regarding carbon tariffs and a carbon border adjustment mechanism. By June, the European Commission will also reveal details of a carbon water tax.
- Since a carbon tariff is meant for producers to account for carbon costs, there is a trade protection element embedded in carbon prices. But it is also a global carbon pricing initiative, which may ease trade disputes from carbon tariffs.
- We are seeing signs of manufacturers in China preparing for carbon tariffs. Steel and aluminum plants understand the need for greener production lines. Aluminum producers have relocated some plants from coal-intensive Shandong province in the east to hydrogen-based production in Yunnan, thus reducing carbon intensity.

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The more specific trade effects arising from carbon tariffs will become clearer once details emerge from China's carbon neutrality pledge.

Hydro and Geopolitics

What are the geopolitical implications of hydropower projects such as the 60-gigawatt hydropower station on the Yuling River in Tibet, shared by both India and Bangladesh? What role will hydro play, given that some sources of this energy will be cross-border?

Lauri Myllyvirta: Hydro is expensive and often causes concerns, especially regarding transboundary rivers with China's neighbors. The biggest challenge is putting hydro to work with grids so that plans can operate flexibly in conjunction with grids. Even as China expands its hydro capacity, the ecological, social, and geopolitical implications are complicated.

Barbara Finamore: China has the largest hydropower capacity globally, and its dams have caused problems with its neighbors because China is the source of most major rivers in Southeast Asia. Hydropower is interesting as it could serve as a backup energy source for wind and solar, rather than coal as the default backup source.

However, China faces water insecurity, a problem that will be exacerbated by climate change. Decreasing flows of rivers could be detrimental to the potential of hydro plants and dams. The Three Gorges Dam is already undergoing problems, and it is possible that there will be more in the future.

China's Impact on Global Emissions

What is at stake for the Belt and Road initiative?

Michal Meidan: The optimistic perspective would be to expect China to supply green energy and infrastructure for its BRI projects. However, China's domestic push for renewables may create excess capacity for coal, steel, and other fossil fuel-based industries, which would likely be exported abroad. China may be able to export its coal-fired power plants, of which it has been one of the biggest financiers globally.

This could happen particularly as developing countries, left in a difficult economic situation post-COVID-19, will look for energy and development, especially if China is willing to finance it. How green BRI will be going forward will depend on the host countries' willingness to receive infrastructure investments at the cost of the environment.

At the same time, China could also focus more on hydropower, renewable equipment, and its global grid interconnection project as alternatives to traditional, fossil fuel-heavy projects. Among Chinese investors, private financiers and private banks may feel more pressure to comply with higher environmental standards when they go abroad. But state-owned financiers and

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companies are looking for business opportunities, and China would be happy to export "dirtier" investments if there are governments willing to receive them.

It is also possible that China would feel more pressure to shift its investments and projects into greener infrastructure if there a broad international coalition that competes as an alternative to the Belt and Road Initiative.

Lauri Myllyvirta: An increasing number of countries have canceled or revised their plans for new coal-fired power plants last year, including Pakistan, Vietnam, the Philippines, and Bangladesh. China and other international finances must ensure that once those countries start to need more capacity again, they have the market and the energy system in place for greener sources.

Barbara Finamore: The pandemic caused a sharp drop in China's financing of overseas coal plants and infrastructure. China financed more renewable power in its Belt and Road countries than coal because of the pandemic or deeper transitions. For example, Bangladesh is one promising sign where China has stated it does not want to finance fossil fuel infrastructure anymore.

Will the implementation of the global power grid interconnection initiative form part of China's push towards carbon neutrality in the coming decades, or is this purely political rhetoric?

Michal Meidan: Electrification does not necessarily mean decarbonization, as grid infrastructure could be powered by fossil and non-fossil fuels.

The global grid interconnection initiative is slightly counter-intuitive in nature. The renewables industry worldwide is increasingly decentralized, defined by local initiatives and microgrids, and requires little upfront costs. China's global grid initiative does not fulfill these expectations, but China's advantage is that its experience with domestic interconnections could help with grid management and control in projects abroad.

Lauri Myllyvirta: If the power grid interconnection initiative were to succeed, it must be selective in where and how they are built: places with high population densities that cannot produce enough renewable electricity locally have the greatest potential. But those places, such as Bangladesh, Japan, and the Korean peninsula, could involve interesting geopolitical questions if the grid interconnection initiative were to take hold.

What is the impact of Xi Jinping's carbon neutrality pledge on global efforts in fighting climate change?

Barbara Finamore: China's carbon-neutral pledge has injected new momentum into global climate negotiations. Japan and South Korea made their own climate-neutral pledges shortly after China's announcement, and recently, India is considering adopting its own 2050 net-zero pledge, which may have been influenced by China's decision.

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Given the state of US-China relations, China wanted to restart cooperation and strategic dialogue with the US through climate change, even as other issues remain at stake. We may see some minimal areas of cooperation between the US and China on climate: the two countries will jointly lead a G20 study group on climate risk, even though announcements were made separately.

Finally, it is essential to keep in mind that none of China's emissions pledges have been made official in the UN Paris process. The upcoming climate meeting in Glasgow could leave room for negotiation, and it is possible that a stronger climate plan will appear by the end of the year once sectoral plans and provincial plans come out. They may prove to be opportunities with which China could broaden its collaboration or even discussions with the United States and the EU.

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