HEARING ON CHINA'S ENERGY PLANS AND PRACTICES

HEARING

BEFORE THE

U.S.-CHINA ECONOMIC AND SECURITY REVIEW COMMISSION

ONE HUNDRED SEVENTEENTH CONGRESS SECOND SESSION

THURSDAY, MARCH 17, 2022

Printed for use of the United States-China Economic and Security Review Commission Available via the World Wide Web: www.uscc.gov



UNITED STATES-CHINA ECONOMIC AND SECURITY REVIEW COMMISSION

WASHINGTON: 2022

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CONTENTS

THURSDAY, MARCH 17, 2022

HEARING ON CHINA'S ENERGY PLANS AND PRACTICES

Panel II: China's External Energy Policies

Panel II Introduction by Vice Chair Kimberly Glas	
(Hearing Co-Chair)	53
Statement of Emily Meierding	
Assistant Professor, Naval Postgraduate School	54
Prepared Statement	57
Statement of Edward Chow	
Senior Associate (Non-Resident), Energy Security and Climate Change Program,	
Climate Change Program, Center for Strategic and International Studies	35
Prepared Statement	38
Statement of Gabriel Collins	
Baker Botts Fellow in Energy and Environmental Regulatory Affairs, Baker Institute,	
Rice University) 9
Prepared Statement)3
Panel II: Question and Answer	40

Panel III: China's Climate Change Strategy and U.S.-China Competition

Panel III Introduction by Vice Chair Kimberly Glas	
(Hearing Co-Chair)	156
Statement of Lauri Myllyvirta	
Lead Analyst, Centre for Research on Energy and Clean Air	157
Prepared Statement	160
Statement of Cecilia Han Springer	
Assistant Director, Global China Initiative, Boston University	177
Prepared Statement	180
Statement of Jonas Nahm	
Assistant Professor, Johns Hopkins School of Advanced International Studies	196
Prepared Statement	200
Statement of Nikos Tsafos	
James R. Schlesinger Chair for Energy and Geopolitics, Center for Strategic and	
International Studies	209
Prepared Statement	212
Panel III: Question and Answer	220

QUESTIONS FOR THE RECORD

Response of Henry Lee	
Director, Environment and Natural Resources Program, Harvard University2	32
Response of Gabriel Collins	
Baker Botts Fellow in Energy and Environmental Regulatory Affairs, Baker Institute	
Rice University	34
Response of Emily Meierding	
Assistant Professor, Naval Postgraduate School24	42
Response of Jonas Nahm	
Assistant Professor, Johns Hopkins School of Advanced International Studies2	52
Response of Nikos Tsafos	
James R. Schlesinger Chair for Energy and Geopolitics, Center for Strategic and	
International Studies	54

HEARING ON CHINA'S ENERGY PLANS AND PRACTICES

THURSDAY, MARCH 17, 2022

U.S.-CHINA ECONOMIC AND SECURITY REVIEW COMMISSION

Washington, D.C.

The Commission met in Room 430 of Dirksen Senate Office Building, Washington, DC and via videoconference at 9:45 a.m., Vice Chair Kimberly Glas presiding.

OPENING STATEMENT OF VICE CHAIR KIMBERLY GLAS HEARING CO-CHAIR

VICE CHAIR GLAS: Good morning, everybody. Thank you so much for joining us in this very timely and important hearing on China's Energy Policy and Practices. At the very top of this hearing, I want to acknowledge a few things. Commissioner Friedberg has, unfortunately, had a death in the family and will be unable to participate as the Co-Chair in this hearing setting today, but please note that he was very involved in the development of this hearing and, by every measure, is absolutely the Co-Chair in the development of this important hearing.

I also want to acknowledge the Commission staff and their hard work in pulling together the meeting and talking to the various witnesses. We have an esteemed three-panel discussion today on very important and timely issues, especially more timely, given the world events. I want to acknowledge Taylore Roth, Howard Wang, and Charles Horne for all their incredible work. I also want to acknowledge we have two new Commissioners who have joined the Commission since our last hearing. I want to acknowledge Carte Goodwin is back, has been reappointed by Senator Schumer. And it is a pleasure to see you here today, Carte.

And I also want to acknowledge Jim Mann for his participation on the Commission in this timely year and discussion. So, with that being said, I'm going to start with an opening statement that's melded into some of the comments that Commissioner Friedberg was also going to make here this morning. We will, then, turn to our panelists.

This is the third hearing of the U.S.-China Economic and Security Review Commission for our 2022 Annual Report cycle. Today's hearing will assess China's energy and climate strategy and explore implications for the United States.

The last time the Commission held a full hearing examining China's energy policy was in 2014. Since then, China's energy generation and regulation have evolved; global climate negotiations have confronted new challenges, and competition in clean energy technology has intensified.

The past year alone has been marked by unprecedented climate-related natural disasters and heightened energy market volatility. As both the world's largest energy consumer and carbon emitter, China is central to our understanding of these developments. Its actions will dictate the course of global climate change, and their development in clean energy technologies is unparalleled. China's leaders have announced that China will peak its carbon emissions by 2030 and achieve net zero carbon emissions by 2060. Yet, after making these public commitments, China's government has not followed through with the policies it needs to come close to matching those commitments.

The future China promises would require a complete overhaul of its economic model. Decades of reliance on investment-led growth have cemented the role of energy in carbonintensive industries within China's economy.

Although China is the world's largest consumer of coal, it recognizes the role of clean energy industries in the future global economy, and this sector has been massively bolstered by the Chinese government, helping them dominant their home market and undercut foreign competitors.

Regrettably, we have all seen the reports of how the use of forced labor has also tainted the supply chain.

As China's capabilities in the sector grow, the United States risks allowing some of tomorrow's most critical supply chains to become increasingly China-centric. We have a clear interest in supporting competitiveness of our clean energy industries while ensuring the U.S. investments in renewable energy infrastructure are supported by U.S. jobs.

In addition to the economic ramifications of China's energy plans and practices, this hearing will help us understand how China's leaders assess their energy security. As China has accrued wealth and power, its foreign and defense policies have increasingly reflected the imperatives of energy security.

In recent years, China has deepened its relationship with revisionist governments like Russia and Iran, signing agreements worth billions that support authoritarian rulers in exchange for access to their oil and gas.

This hearing is particularly timely, given world events. And for all of our panelists, I think that will be timely, given all that's happening with Russia right now, and the relationship between Russia and China will lead to further questions from our Commissioners.

China's vision for energy has also become more pressing. And following Russia's invasion of Ukraine, the potential short- and long-term effects of that conflict could have an imminent and enduring impact on international energy markets.

Mere weeks before the invasion, President Putin and General Secretary Xi announced that their friendship between the two countries, quote, "has no limits." And Putin announced oil and gas deals with China worth an estimated 117 billion U.S. dollars. How that relationship evolves, as the war in Ukraine drags on and international pressure on Russia mounts, remains to be seen.

I look forward to the hearing today and our expert witnesses and thank them for joining us to share their expertise.

In addition, I'd like to thank the Senate Committee on Health, Education, Labor, and Pensions for securing this room for our use today.

The testimonies and transcript from today's hearing will be posted on our website, which is uscc.gov. Also, please mark your calendars for the Commission's upcoming hearing on U.S. trade tools to address China's non-market economy practices, which will be on April 14th.

PREPARED STATEMENT OF VICE CHAIR KIMBERLY GLAS HEARING CO-CHAIR



Hearing on "China's Energy Policy and Practices"

Opening Statement of Vice Chair Kimberly Glas

March 17, 2022

Washington, DC

Good morning and thank you for joining us for this very timely and important hearing on China's energy practices. At the very top of this hearing I want to acknowledge a few things. Commissioner Friedberg has unfortunately had a death in his family and will be unable to participate as a co-chair in this hearing setting today. Please note that he was very involved in the development of this hearing and by every measure is absolutely a co-chair in the development of this important hearing. I also want to acknowledge the Commission staff and their hard work in pulling together this hearing and talking to the various witnesses. We have an esteemed three panel discussion today on very important and timely issues, especially given world events. I want to acknowledge Taylore Roth, Howard Wang, and Charles Horne for all their incredible work. I also want to acknowledge that we have two new Commissioners who have joined our Commission since our last hearing. I want to acknowledge Carte Goodwin has been reappointed by Senator Schumer, and I also want to acknowledge James Mann for his participation on the Commission.

My opening statement also includes elements of what Commissioner Friedberg was going to say this morning, then we will turn to our panelists. This is the third hearing of the U.S.-China Economic and Security Review Commission's 2022 Annual Report cycle. Today's hearing will assess China's energy and climate strategy, and explore implications for the United States.

The last time the Commission held a full hearing examining China's energy policy was in 2014. Since then, China's energy generation and regulation have evolved, global climate negotiations have confronted new challenges, and competition in clean energy technology has intensified. The past year alone has been marked by unprecedented climate-related natural disasters and heightened energy market volatility. As both the world's largest energy consumer and carbon emitter, China is central to our understanding of these developments. Its actions will dictate the course of global climate change. And their development of clean energy technologies are unparalleled.

China's leaders have announced that China will peak its carbon emissions by 2030 and achieve net zero carbon emissions by 2060. Yet after making these public commitments, China's

government has not followed through with the policies it needs to come close to matching those commitments.

The future China promises would require a complete overhaul of its economic model. Decades of reliance on investment-led growth have cemented the role of energy and carbon-intensive industries within China's economy.

Although China is the world's largest coal consumer, it recognizes the role of clean energy industries in the future global economy and this sector has been bolstered by the Chinese government, helping national champions to dominate their home market and undercut competitors abroad. Regrettably, we have also seen how the use of forced labor has tainted the supply chain. As China's capabilities in the sector grow, the United States risks allowing some of tomorrow's most critical supply chains to become increasingly China-centric. We have a clear interest in supporting the competitiveness of our clean energy industries while ensuring that U.S. investments in renewable energy infrastructure are supported by U.S. jobs.

In addition to the economic ramifications of China's energy plans and practices, this hearing will also help us understand how China's leaders assess their energy security. As China has accrued wealth and power, its foreign and defense policies have increasingly reflected the imperatives of energy security. In recent years, China has deepened its relationships with revisionist governments like Russia and Iran, signing agreements worth billions that support authoritarian rulers in exchange for access to their oil and gas. This hearing is particularly timely given world events and China-Russia relationship will likely lead to many important questions from our Commissioners.

China's vision for energy has also become more pressing in following Russia's invasion of Ukraine. The potential short and long-term effects of that conflict could have imminent and enduring impact on international energy markets. Mere weeks before the invasion, President Vladimir Putin and General Secretary Xi Jinping's announced that the friendship between the two countries "has no limits," and Putin announced oil and gas deals with China worth an estimated \$117.5 billion USD.ⁱ How that relationship evolves as the war in Ukraine drags on and international pressure on Russia mounts remains to be seen.

I look forward to hearing today's expert witnesses and thank them for joining us to share their expertise. In addition, I would like to thank the Senate Committee on Health, Education, Labor, and Pensions for securing this room for our use today. The testimonies and transcript from today's hearing will be posted on our website, which is www.uscc.gov. Also, please mark your calendars for the Commission's upcoming hearing on U.S. trade tools to address China's nonmarket economy practices, which will be on April 14.

ⁱ Joint Statement of the Russian Federation and the People's Republic of China on the International Relations Entering a New Era and the Global Sustainable Development, February 4, 2022.

https://www.airuniversity.af.edu/CASI/Display/Article/2923495/itow-china-russia-joint-statement-on-internationalrelations-entering-a-new-era/; Vladimir Soldatkin and Chen Aizhu, "Putin Hails \$117.5 Billion of China Deals as Russia Squares Off with West," Reuters, February 4, 2022. https://www.reuters.com/article/olympics-2022-putingas-idAFKBN2K90P7.

PANEL I INTRODUCTION BY VICE CHAIR KIMBERLY GLAS

VICE CHAIR GLAS: Our first panel will examine China's domestic energy systems. First, we'll hear from Mr. Henry Lee, Director of the Environment and Natural Resources Program at Harvard University's Belfer Center, which will address China's domestic energy policies and objectives. Mr. Lee has extensive experience working on U.S. domestic energy policy and has also consulted on energy and environmental projects for multilateral development banks and foreign governments. Mr. Lee is the co-author of Foundations for a Low Carbon Energy System in China, a new book on pathways to decarbonization in China published by Cambridge University Press in late 2021.

Next, we will hear from Dr. Michal Meidan, Director of the Gas Research Programme and China Energy Programme at the Oxford Institute for Energy Studies, who will speak to China's domestic fossil fuel industry. Dr. Meidan previously headed cross-commodity China research at Energy Aspects, and she also headed China Matters, an independent research consultancy providing analysis on China's energy politics. She previously testified in our April 2012 hearing, "China-Europe Relationship and Transatlantic Implications."

Welcome back, Dr. Meidan.

Finally, we will hear from Dr. Michael Davidson, Assistant Professor of UC San Diego's School of Global Policy and Strategy, as well as its Mechanical and Aerospace Engineering Department. Dr. Davidson's teaching and research focus on the engineering implications and institutional conflicts of deploying low-carbon energy at scale, and he is coauthor of Foundations for a Low-Carbon Energy System in China.

Thank you so much for your testimony. I'd like to remind you to keep your remarks to seven minutes.

Mr. Lee, we will begin with you.

OPENING STATEMENT OF HENRY LEE, DIRECTOR, ENVIRONMENT AND NATURAL RESOURCES PROGRAM, HARVARD UNIVERSITY

MR.LEE: Thank you, Vice Chairman Glas and members of the Commission. It's a privilege to testify here this morning.

For the past 20 years, I have been involved in --

VICE CHAIR GLAS: I don't mean to pause. I think that some of the virtual panelists are having a hard time hearing.

MR. LEE: For the past 20 years, I have been involved in many of our projects on China in the fields of infrastructure, energy, and climate. I have submitted written testimony which expands on the issues that I will touch on this morning.

I would like to start with three broad statements. Climate is one of the drivers of China's energy policies, and although it may eventually become the major driver, it remains secondary to energy security, and to some extent, conventional air pollution. China is the world's largest importer of oil and is rapidly becoming one of the larger importers of natural gas.

Initially, the goal of its Going Out Policy, the precursor to the Belt and Road Initiative, was to negotiate oil deals with countries that did not have exclusive arrangements with Europe or the United States.

Another example is its present partnership with Russia, as both the purchaser of oil and gas and an equity participant in several LNG and pipeline projects -- a partnership which influenced China's public reaction to Russia's horrific invasion of the Ukraine.

When electricity blackouts spread through China last September, the country's leadership was willing to temporarily reverse many of its policies around coal, oil, and gas, and slow its climate initiatives.

My second point: China's energy system is dominated by state-owned companies with extraordinary market power. Two electric grid companies wholesale, retail, transmit, and market all of the country's electricity. Three companies dominate the production, refining, and distribution of oil. Hence, the supply and demand of energy is not determined by markets, as it is in the West, but, rather, administratively by government officials. For large energy infrastructure projects, this system works well, but it struggles with smaller projects, intermittent supplies, and demand-side management.

Predicting China's energy consumption and production in 2030 requires one to predict the direction and success of government policies and programs, as opposed to markets -- a most inexact exercise.

My third point: China is the largest supplier of electricity in the world. However, its system was developed during a period of rapid industrial growth, and this growth was dependent on the availability of inexpensive power. This system provided incentives for government stateowned enterprises at both the national and provincial levels to build an enormous fleet of coalfired generators to fuel its rapid economic expansion.

In a world constrained by the threat of climate disruptions, this electricity system finds itself inflexible and overbuilt. To put this problem into perspective, if one changes the protocol used to dispatch power plants and moves to a greater reliance on markets, about 40 percent of China's coal fleet would be uncompetitive within eight years.

I, along with several of my colleagues at Harvard, produced a book on what actions China should take in the next 10 years to put itself in a position to accelerate the deployment of new, clean energy technologies in the post-2030 period. Our conclusion was that institutional reforms would be more important than how many solar PV units are installed or how many electric cars are sold.

Specifically, we concluded that China needed to focus on governance and institutions. And there are multiple, as you know, energy agencies in China which are in a position to affect energy policy, and they often fail to cooperate effectively. To work around this problem, major energy issues are assigned to committees that answer directly to the highest levels of the Chinese government.

The incentives facing provincial leaders are often at odds with the directives emanating from Beijing. As a result, Beijing is much more willing to intervene directly in the management of provincial implementation of national energy policies. Provinces are less autonomous today than they were five years ago. This may benefit the construction of projects like high-voltage transmission lines, but it will not enhance the millions of local decisions that will be required in the journey to net zero carbon emissions.

Finally, this journey will create a substantial dislocation, as jobs and businesses dependent on fossil fuels will be replaced by non-fossil fuel alternatives. China has already lost more than 1 million jobs in its coal industry, and the transition is just beginning. It is worth noting that \$1 million spent on coal production produces 68 jobs in China, while the same amount spent on renewables only produces 30 jobs.

Further, a significant proportion of the existing fossil fuel jobs are located in a few provinces -- provinces that lack the capacity to manage the dislocations that are likely to emerge.

I was asked by your staff if I had recommendations to make to the U.S. Congress, and I will make two.

In its latest five-year plan, China announced that it would increase its energy R&D budget by 7 percent per year for the next five years and its basic science budget by 10.6 percent per year. I think it is imperative that the United States be prepared to also significantly increase its budget in clean energy R&D and basic science, or it will run the risk of having to purchase the clean technologies of the future from China, rather than the United States.

My second is, while the two countries are, and will continue to be, very competitive, the benefits from greater cooperation on the transition away from fossil fuels and to a low-carbon world I think is significant, and I think you should continue and provide incentives for cooperation in this particular area of climate policy.

I would be glad to answer any questions in the Q&A. Thank you very much.

PREPARED STATEMENT OF HENRY LEE, DIRECTOR, ENVIRONMENT AND NATURAL RESOURCES PROGRAM, HARVARD UNIVERSITY

Testimony for the U.S. -China Economic and Security Review Commission

March 17, 2021 Henry Lee, Harvard university

Members of the Commission, it is a privilege to be invited to testify at this hearing on China's energy and climate ambitions. I have been asked to address five areas, but I would like to deviate slightly to put China's energy initiatives into perspective.

Let me make four initial points.

Since the Paris COP in 2015, climate has been one of several drivers of energy policy, but it has not been the only focus and in many cases, it has not been the primary focus. China's energy policies are shaped by many concerns including economic development, jobs, abatement of conventional air pollution, and energy security. China's push for electric cars, for example, has been more driven by energy security and conventional air pollution goals than by climate.

Second, China access to primary fuels has depended on imports. It is the largest importer of oil, and it is rapidly becoming a major importer of natural gas. While it has large coal reserves, the marginal ton of coal into southern China -until very recently—came from Australia. Last September, China faced a perfect storm of draught causing a drop in hydroelectric capacity, combined with coal shortages, leading to power cutbacks. Over 20 provinces were blacked out for measurable periods. These events only reinforced the importance of energy security, forcing the government to directly intervene and temporarily sideline on-going climate mitigation efforts.

Third, to address the supply shortages that threatened China's development efforts in the 1990s, China provided new generators guarantees that their power would be bought, stimulating the construction of hundreds of coal-fired power generators and unlocking 25 years of unprecedented economic growth. The system –that worked so well 20 years ago –is not the system needed to meet China's new goals of carbon neutrality. To put this problem into perspective, if China moves to a market dispatch protocol instead of its equal share protocol, about 40% of its coal fleet would be uncompetitive within eight years

Fourth, China's energy system is dominated by large state-owned companies with extraordinary market power. Two electric grid companies wholesale, retail, transmit and market most all the electricity. Three companies dominate the oil industry. Despite some of the rhetoric, the future of both supply and demand is not made by markets but rather administratively by government officials. For large supply projects, this system works well, but it struggles with smaller projects, intermittent supplies, and demand-side initiatives. Predicting China's energy consumption and production in 2030 requires one to predict the direction and success of government policies and programs, as opposed to markets. —a much more inexact exercise.

What are the indicators of a successful energy policy? Is it the megawatts of solar and wind energy installed? Is it the rate at which coal as a percent of primary energy declines? Is it the number of high voltage transmission lines that China is able to build? I would argue that while each is important, none indicate whether China will be able to meet its 2060 goal of carbon neutrality.

In our recent book, a team of Harvard scholars argued that China must initiate key institutional reforms to put itself in a position to rapidly deploy clean technologies in the three decades thereafter. I will focus on two.

Governance: In a system where the key segments of the power industry are owned and operated by the state and investment decisions are made by the state, how the governance system operates makes a big difference. Ideally you want clear lines of responsibilities between agencies and, where relevant, within agencies. You would also want the incentives for local, provincial and central government officials to be symmetrical. Such is rarely the case in China. To deal with the on-going rivalries between agencies, China is relying more on committees of senior officials from a range of high-ranking positions that report to the State Council—the central policy-making body of the Chinese government.

The relationship between the provincial and central government is also changing. Frustrated by lack of sufficient response by provincial officials to central government directives, China has established more specific guidelines. For example. in 2005, the Politburo announced a mandatory goal of reducing energy intensity. Provincial officials were responsible for designing and implementing policies and programs to meet those goals. Initially, compliance was low and the data exaggerated—particularly those around GDP. In response, the central government introduced a" Target Responsibility System" that evaluates local official performance in meeting the directive. Such steps indicate a willingness by Beijing to intervene in provincial energy initiatives at a more granular level than.

Second, provinces obtain revenue from local power generators and thus there is a strong incentive to use local power sources even though less expensive and cleaner power may be available in a neighboring province. The NDRC announced in October that these disincentives to power trading must be eliminated. However, this is not the first time that Beijing has ordered this practice stopped and past efforts have met with limited success.

Third, China has historically allowed its provinces to make some energy investment decisions—particularly for new generating plants. Provincial debt skyrocketed. Today, Beijing establishes provincial debt limits, which can constrain investments—particularly in new coal powered facilities.

All of these examples, indicate that Beijing is giving the provinces less autonomy in the implementation of energy directives.

Transition Dislocations: Let me start with a few facts to provide a snapshot of the social challenges inherent in the transition. In the last ten years, more than a million jobs have been lost in the coal industry. For every one million dollars invested in China, the coal industry produces 68 jobs and the renewable industry 30. Finally, the fossil fuel industries in China are disproportionately located in a few provinces and the social safety net for dislocated workers is provided by the employer not the government. Unless growing human dislocations caused by the energy transition are more effectively addressed, political forces will slow the transition to carbon neutrality.

What would I recommend to the US Congress? I would make two recommendations—1. China announced in the latest 5-year plan that it would increase its energy R&D budget by 7% per year for the next five years and its Basic Science budget by 10.6% per year. If the United States is to remain competitive, it must be willing to significantly increase its energy R&D budgets. Otherwise, we may be purchasing the energy technologies of tomorrow from China. 2.

Cooperation and coordination between the two countries which seemed so promising in 2014 is fading away. Climate and energy may be an area where the two countries can identify topics where the benefits of greater coordination and cooperation may far outweigh the costs.

OPENING STATEMENT OF MICHAL MEIDAN, DIRECTOR, GAS RESEARCH PROGRAMME/CHINA ENERGY PROGRAMME, OXFORD INSTITUTE FOR ENERGY STUDIES

VICE CHAIR GLAS: Thank you so much, Mr. Lee.

Now, I'm going to turn to Dr. Meidan.

DR. MEIDAN: Vice Chair Glas, other distinguished Commissioners, it's an honor to be testifying before you again today.

I've been asked to discuss the outlook for China's fossil fuel demand, the successes and challenges associated with the fossil fuel supply, and how this fits into the country's low-carbon energy transition.

In my remarks today, I would like to focus, in particular, on one question that was posed to me, and that is to evaluate the successes and challenges of meeting domestic energy demand through fossil fuels -- coal, oil, and natural gas.

And I find the discussion of successes and challenges an interesting and important one because it encapsulates the complexity of the energy transition, not just for China, but also globally, especially in the current context of the Russian invasion into Ukraine. But, in order to assess successes and challenges, I would like to look at three factors. And those are economic stability, supply security, and environmental sustainability. And I would argue that, from Beijing's perspective, the domestic availability of fossil fuels helps China meet both economic stability and energy security, even as it works on enhancing environmental sustainability.

Now, fossil fuels account for over 80 percent of China's energy mix. That is large, but that is not dissimilar to other countries. Fossil fuels, on average, tend to account for 75 to 85 percent of supplies globally. In China, coal accounts for 56 percent of that mix. It's very similar to India, but, in the EU and U.S., for instance, oil and gas tend to account for a third, respectively, and coal for another 10 to 15 percent.

But China's willingness to rely on coal stems from the fact that it has abundant reserves and it is, effectively, self-sufficient for its coal supplies. It imports only fractions of its needs.

China is also a large producer of oil and gas. And even though demand for oil and gas has outstripped its domestic supplies, as you can see in figures 6 and 7 of my written testimony, it does still have resources production equivalent to the UAE for oil, to Qatar for gas, roughly -- still, that reliance on foreign supplies and on global markets to price those supplies.

Broadly speaking, though, China's fossil fuel endowment does give it energy security, but also economic stability. And the previous panelist spoke about this; energy companies are state-owned. They are large employers. They are a source of tax revenue, but also advice and information to the government.

But, just to give you a bit of perspective, the coal industry employs over 2 million people. That's the population of Moldova. The oil and gas companies' workforce is, roughly, the size of Iceland each.

Fossil fuels are, therefore, not just at the heart of China's energy system, but of its political economy. And they have fueled the investment boom in manufacturing, the associated infrastructure, and they are linked to other state-owned companies. They aim to execute government priorities, and in the context of price controls, they can help at times to deliver economic stability, as well as affordability, to end users.

Now, there are two vulnerabilities or challenges that I would like to discuss today

associated with fossil fuels.

The first that has been most dominant historically in the Chinese government's narrative and strategic thinking is the reliance on imported oil and gas. And there have been various policies to deal with both the demand and the supply side of that, with varying degrees of success.

It's likely ironic perhaps that China's supply outages large year did not stem from a curtailment or an external cutoff. And when we think about the past few years, U.S. secondary sanctions, financial sanctions, on Venezuela and Iran and shipping have reduced flows of Iranian and Venezuelan oil to China, but they have not reduced the overall supplies of oil to China.

Instead, the outages in China have emanated from China's own policies -- from governance, from pricing distortions, the mismatch between the soaring cost of coal globally and state-set end-user prices which squeeze the energy majors. Now, I just said that the majors do pretty much what the government tells them to do, but when there are mixed signals regarding their policy priorities, it becomes trickier.

Are they mandated to fuel economic growth or to cut coal supplies and deliver on the energy transition? When their marching orders aren't clear, when the incentive structures no longer work for the state-owned companies, policy implementation is distorted. But I think that, from Beijing's perspective, this is an ailing that can be fixed, or at least tweaked, and is not a fundamental flaw that undermines fossil fuels.

The second vulnerability, of course, is emissions. China accounts for under a third of global CO2 emissions, and energy sector emissions constitute the vast majority of that. Now the Chinese leadership recognizes the need to shift away from fossil fuels, but I would argue that the "30-60" pledges are not due to a climate awakening. I think the threats of climate change have long been known and understood in China.

The urgency to act has increased because extreme weather events are now also threatening food security, but also because geopolitical tensions over the past two-three years, U.S.-China trade wars, concerns about the role of Chinese industry in global supply chains, suggests that Chinese industry will no longer be fit for purpose in a carbon-conscious world. And so, China needs to pursue a clean energy transition.

But, if we take, on balance, supply security, economic stability, and environmental sustainability, the balance I think is still weighted heavily in favor of fossil fuels. And that suggests that they are likely to remain a key part of China's energy economy for years to come, even as the government continues to pursue efforts to tackle air pollution, to switch away from coal and replace it with gas, and to build renewables.

If you look at figure 5 in my written testimony, it summarizes some of the pathways suggested by Tsinghua University, a leading Chinese institution, toward meeting the Paris goals of 1.5 degrees, and they all point to an ongoing role for fossil fuels, certainly, into 2030.

Post-2030, the trajectories diverge quite considerably, but we have to keep in mind that China's leaders still envision a decade of strong economic expansion, ongoing urbanization. So, China's total energy pie, so to speak, continues to grow, even as the share of fossil fuels is set to fall.

Now, China and the world, undoubtedly, benefit from China moving away from fossil fuels at a faster pace, but we cannot assume that this expedited phase-out is reality. And Europe is grappling with a very similar challenge. The long-term ambition is clearly there, but the path to net zero will depend on economic stability and energy security.

The past two years, and certainly the past few months, are pointing to a slower

trajectory, unfortunately. The volatility in global gas markets following the Russian invasion of Ukraine is leading to a renewed emphasis on coal, much like the power outages of last year did, even, again, as the need for more renewables continues.

But I'd like to wrap up here with a recommendation pertaining specifically to fossil fuels. Again, I think we all need to work on expediting the transition and the phase-out of fossil fuels, but we also have to recognize that they are here for probably another decade, to a certain degree, and they have a role in the energy transition.

And so, measuring, reporting, reducing emissions from the entire fossil fuel value chain is critical. And this is a key area for bilateral and multilateral efforts. The U.S. is gradually becoming a larger exporter of oil and gas to China, a supplier to China. And so, reporting emissions, striving to reduce or offset them, along the entire value chain in a transparent manner, would be significant. Lessons, then, can be shared around reporting in the upstream and in the downstream in China as well.

I think additional efforts should include methane emissions reductions, and there are already mechanisms in place to do this, as well as collaboration on CCUS and other abatement technologies that will help scale them up and make them more widely available to other fossil fuel consumers. Again, as we try to move away from them, we have to recognize that they are still here.

I would like to stop there and thank you for your time today, and I look forward to the discussion.

PREPARED STATEMENT OF MICHAL MEIDAN, DIRECTOR, GAS RESEARCH PROGRAMME/CHINA ENERGY PROGRAMME, OXFORD INSTITUTE FOR ENERGY STUDIES



Statement before the U.S.-China Economic and Security Review Commission

Policymaking and Energy Supply and Demand in China's Domestic Economy

> Dr Michal Meidan Director, China energy programme Director, Gas research programme Oxford Institute for Energy Studies

> > March 17, 2021

Testimony before the U.S.-China Economic & Security Review Commission Hearing on Hearing on China's Energy Plans and Practices

Dr Michal Meidan Oxford Institute for Energy Studies

17 March 2022

I would like to thank you for the opportunity to contribute to the deliberations of this commission. My remarks today will focus on the role of fossil fuels in China's energy mix, the current successes and potential challenges of meeting domestic energy demand through fossil fuels; the demand trajectory over time as well as the challenges this presents to China's carbon neutrality pledge. I will also discuss briefly the short term constraints that are informing China's longer-term trajectories by looking at the causes of China's energy shortages in the second half of 2021 and the ensuing policy priorities. I argue that fossil fuels are likely to remain a dominant source of China's energy supplies for the next decade and beyond. The long-term trajectory will be shaped by China's economic growth rates and the pace of structural rebalancing, policy efforts to enhance energy efficiencies as well as efforts to develop and promote new technologies. But the lack of clear roadmap means that future trends could be determined by near term choices, which seem to be increasingly informed by concerns about energy security. This should not be taken to mean that China is walking back from its commitments, but that the short term realities are constraining long term ambition, as is currently the case in many other countries.

Recognizing that fossil fuels will play a role in the energy transition means that, at least to begin with, measuring, reporting and reducing emissions from the entire value chain will be critical. As the US is gradually becoming a large exporter of oil and gas to China, reporting emissions—and offsetting them—along the entire value chain in a transparent manner would be an important step. Engagement should span both government (on all levels) and industrial stakeholders, especially in the context of rising concerns about technological and financial decoupling. Collaboration on CCUS and abatement technologies will also help scale up these technologies and make them more widely available to other fossil fuel consumers, even though this should not replace efforts to promote non-fossil fuels and encourage an accelerated deployment of non-fossil sources in the energy mix.

1. Fossil fuels are the backbone of China's energy system and its political economy

Since China's Reform and Opening up in 1978, the country has undergone a profound transformation. Its Gross Domestic Production (GDP) in 1978, according to the World Bank, was roughly half the size of the Italian economy, while it is now set to overtake the US and become the world's largest. Per capita GDP has grown by nearly 24 times as industrialisation and urbanization have transformed the country's economy and energy consumption trends.

Fuelling the country's rapid industrialization and urbanization process is a voracious appetite for energy, with primary energy consumption increasing rapidly, from 1.5 billion tons of standard coal in 2000, to 5 billion tons standard coal in 2020, according to China's National Bureau of Statistics, accounting for one quarter of global energy use¹.

¹ It is important to note that throughout the 1980s and 1990s, despite strong economic growth in China, the availability of energy efficient technologies led to a dramatic improvement in the country's energy intensity (energy consumption per unit of GDP). Primary energy demand rose on average by more than 8 per cent per year between 2000 and 2010, slowing to 3.4 per cent in the five years to 2015 and just over 3 per cent over 2015-2020. IEA, "An Energy Sector Roadmap to Carbon Neutrality in China", September 2021, https://iea.blob.core.windows.net/assets/9448bd6e-670e-4cfd-953c-32e822a80f77/AnenergysectorroadmaptocarbonneutralityinChina.pdf

Indeed, while the country's economic structure has changed significantly since the start of the Reform and Opening period, shifting from a predominantly agricultural economy to one dominated by industry and increasingly services, the industrial sector rapidly became the largest consumer of energy, accounting for almost two-thirds of China's primary energy demand. Similarly, China has relied heavily on energy-intensive industries to drive economic development as industry now generates around a third of China's GDP.

Due to this development model, China became the world's largest energy consumer in 2009 and its biggest emitter of energy-related CO2 emissions since 2005². Moreover, despite impressive growth in renewables since 2000, fossil fuels still accounted for 85 per cent of China's primary energy mix in 2020 with coal accounting for 57 per cent and oil for one-fifth. Natural gas accounted for an additional 8 per cent (Figure 1). For the sake of comparison, the US in 2020 relied on fossil fuels for 79 per cent of its primary energy consumption, but coal accounted for 10 per cent, with natural gas and oil each representing 35 per cent of energy consumption³. Fossil fuels are therefore prevalent in many countries' energy supply structures but China is heavily dependent on coal, a factor that contributes to the country's large emissions profile.



Figure 1: China's energy mix, per cent

2. China's coal conundrum

Coal is used in China predominantly for electricity and heat generation, with the latter accounting for 60 per cent of total coal use and industry representing an additional 33 per cent in 2020⁴. That year, China had 1,080 GW of installed coal-fired power capacity – more than half of global coal capacity, although this was still within the 13th Five Year Plan (FYP; 2016-2020) target of keeping coal-fired power generation under 1 100 GW.

https://iea.blob.core.windows.net/assets/9448bd6e-670e-4cfd-953c-

3 EIA https://www.eia.gov/energyexplained/us-energy-facts/

4 Buildings, agriculture and non-energy use account for the rest of coal demand, according to the IEA, "An Energy Sector Roadmap to Carbon Neutrality in China", September 2021, p.23

² IEA, "An Energy Sector Roadmap to Carbon Neutrality in China", September 2021,

³²e822a80f77/AnenergysectorroadmaptocarbonneutralityinChina.pdf

Figure 2: China's electricity generation by fuel



Source: BP Statistical Review, 2021

Moving away from coal is challenging given that it is intrinsically linked to industrialisation. The country's economic growth been led by an investment boom in manufacturing and the associated infrastructure, alongside an effort to localize production of the energy-intensive basic products used to construct roads, factories, and buildings. Moreover, since many of these heavy industries are dominated by state-owned companies that benefit from access to cheap capital – through the country's state-owned banks – as well as cheap labour and land, they have been able to reinforce their position as pillars of economic growth and development.⁵

From 2002 to 2013 coal contributed 77 per cent of the overall increase in the country's primary energy demand, with cement, chemicals and steel plants alone accounting for half of this increase. An additional 15 per cent of the total increase in coal demand were driven by the use of electricity generated to fuel these industries, primarily through coal-fired power plants.





Notes: Power sector includes power and heat generation.

Source: IEA

5 Barry Naughton, *The Chinese Economy Transitions and Growth*, Cambridge, Mass.: MIT Press, 2007.

With growing effort to tackle local air pollution and rebalance the country's economic structure toward a more consumption-led development model, starting in 2014, Chinese coal consumption fell for three consecutive years. This was due to a combination of policies discouraging coal use; a cyclical slowdown in coal-consuming sectors including iron, steel and cement as well as a shift in economic activity from manufacturing to the service sector⁶. In its 13th Five Year Plan (FYP; 2016-2020), the government sought to reduce coal's share in primary energy consumption to below 58 per cent by 2020, compared to 64 per cent in 2015, a target that it achieved and even exceeded. The share of coal in the energy mix dropped to 57 per cent in 2020⁷ and to 56 per cent in 2021⁸. But this decline was the result of government efforts to eliminate excess capacity by shuttering old and inefficient power plants, phasing out small coal boilers used for public heating and industrial steam, and reducing coal use at the household level because small-scale coal use contributes significantly to emission of air pollutants. The policy focus was on improving air quality and remediating industrial overcapacity concerns while also supporting China's climate pledges, which consisted of peaking carbon emissions by 2030. But since the pledge did not include an absolute level of emissions (which it still does not) this did not necessarily constrain coal use. The 13th FYP did, however, include an ambition to keep coal consumption below 4.1 billion tons of coal, which it successfully achieved.

But even though China has reached these FYP targets, since 2017, Chinese coal consumption has been rising as energy intensive manufacturing sectors rebounded and heavy construction activity has been growing. In the wake of the COVID-19 pandemic, China's economic expansion has led to a surge in coal consumption and subtle shifts in government policy given renewed concerns about energy security. There have been growing signs that the government is easing restrictions on coal fired power plants, even as it vows to peak carbon emissions by 2030 and reach carbon neutrality by 2060.



Figure 4: Annual growth rate of coal consumption

Source: Sino-German Energy Transition Project

Already in 2020, new coal plant approvals increased substantially as some provinces restricted renewable development, citing inadequate ability to absorb renewables. The China Electricity Council—the industry association representing China's big 5 power companies and the main advocate of major expansion of coal-fired power plants—along State Grid expect China will add hundreds of GW of new coal plants through 2025 to meet growing demand, even as the average

⁶ David Sandalow, Guide to China's Climate Policies, https://chineseclimatepolicy.energypolicy.columbia.edu/en/coal-3 7 Sino-German Energy Transition Project, China Energy Transition Status Report 2021, June 2021,

https://www.energypartnership.cn/fileadmin/user_upload/china/media_elements/publications/2021/China_Energy_Trans ition_Status_Report_2021.pdf

⁸ Statistical bulletin of National Economic and Social Development, National Bureau of Statistics, 28 February 2022, http://www.stats.gov.cn/tjsj/zxfb/202202/t20220227_1827960.html

utilisation hours of thermal power plants remains well under 50 per cent⁹. In 2021, construction of an additional 33 GW of coal fired capacity started¹⁰, the most since 2016, with 25 GW of new coal power plants added to the grid. In early 2022, China restarted 7GW of projects that had been frozen in 2021 due to the leadership's efforts to control high emissions projects.

During the 14th Five Year Plan (spanning 2021-2025), the government reportedly plans to add 28 GW of coal fired generation¹¹ and retrofit 42GW coal power capacity as "matching facilities" that should improve the utilization of renewable power projects. A policy document published in October 2021 set a target of retrofitting 150GW of coal power plants during the 14FYP for the purpose of improving coal utilization efficiency, reducing coal consumption, and promoting clean energy consumption¹². Yet China's 14th Five-Year Plan, issued in March 2021, called for "controls" on the pace and scale of coal power construction through 2025¹³, a pledge reiterated by President xi at the Leaders' Summit on Climate in April, followed by a pledge to gradually "phase down" coal use in the next five-year plan cycle (2026-2030)¹⁴.

With growing pressure to phase down and eventually phase out coal, China's decision makers recognise that they must cap coal capacity additions and gradually wean the country off its coal addiction. Structural changes to the economy and the rapid addition of renewable energy sources will help promote this shift, but there is still a debate within China about the role of coal in the energy transition with arguments made the China should prioritise coal for energy security and as a means of facilitating renewable utilization.

The argument seems to be gaining ground. The National Energy Administration, China's de facto Energy Ministry has highlighted that coal remains an "important support" for peak power generation "under extreme conditions," and that coal will maintain its "fundamental role" in China's electricity structure for "a certain period.¹⁵" The NEA asserts that China should use coal plans as peaking units for moderating intermittent renewable electricity and as stability mechanisms to secure the grid. While in principle, no new coal-fired power plants will be added in the 14th FYP for power generation alone, supportive units that secure electricity supply will be considered. Indeed, phasing out coal is hugely problematic. This is because China's coal fleet is young and efficient (yielding more energy and less pollution per unit of coal). In addition, reducing employment in the coal sector creates substantial worker placement challenges and a strain on local government finances. Finally, there are still concerns in Beijing that it could undermine the country's energy security.

And in the aftermath of the US-China trade war, the COVID-19 pandemic, Europe's energy crisis in 2021 and more recently, the Russian invasion of Ukraine, there are growing questions internationally about China's role in global supply chains, increased volatility in global energy markets as well as concerns within China about how best to insulate itself from a potential decoupling with the West or

http://www.gov.cn/zhengce/zhengceku/2021-11/03/content_5648562.htm

12 Liu Hongqiao, "Analysis: Beijing Rethinks Coal in the Aftermath of 2021's Energy Crunch", 3 March 2022,

https://liuhongqiao.substack.com/p/analysis-beijing-rethinks-coal-in?s=r

13 Full Text of the 14th Five Year Plan can be found here http://www.gov.cn/xinwen/2021-03/13/content_5592681.htm 14 "Full Text: Remarks by Chinese President Xi Jinping at Leaders Summit on Climate", Xinhua, 22 April 2021, http://www.xinhuanet.com/english/2021-04/22/c 139899289.htm

15 Quoted in Liu Hongqiao, "Analysis: Beijing Rethinks Coal in the Aftermath of 2021's Energy Crunch", 3 March 2022, https://liuhongqiao.substack.com/p/analysis-beijing-rethinks-coal-in?s=r

⁹ Sino-German Energy Transition Project, China Energy Transition Status Report 2021, June 2021,

https://www.energypartnership.cn/fileadmin/user_upload/china/media_elements/publications/2021/China_Energy_Trans ition_Status_Report_2021.pdf

^{10 &}quot;Most coal power plants since 2016 entered construction in China in 2021, investment in coal-based steelmaking accelerated", CREA Briefing, February 2022, https://energyandcleanair.org/wp/wp-content/uploads/2022/02/EN-China-coal-and-steel-briefing-Feb_2022.pdf

¹¹ Circular from the National Development and Reform Commission and the National Energy Administration on Carrying out the Transformation and Upgrading of Coal-fired Power Plants, October 2021,

even sanctions. So the question of energy security has been rising rapidly on the political agenda. This suggests that coal consumption is unlikely to peak before 2025 and the pace of decline then varies considerably, depending on the policy choices. But even in some of the more ambitious scenarios put forward by Tsinghua's Institute of Climate Change and Sustainable Development (ICCSD)¹⁶, for instance, fossil fuels still account for over half of China's energy mix through 2030, with coal falling to 35 per cent of the mix in 2030 and oil dropping from 18 per cent currently to 13 per cent. But since overall energy use is set to grow, oil demand levels only start to fall in the mid-2030s.





Source: Tsinghua ICCSD

These concerns around energy security, namely supply security and affordability have also been key factors in China's oil and gas policies. But while China is by and large self-sufficient for coal, it relies heavily on global oil and gas markets for its supplies.

3. Limiting China's thirst for oil... but not just yet

Demand for oil and natural gas has also grown considerably since 2000. Oil use has increased at an annual average rate of 5%, complementing the use of coal in heavy industries and meeting rapidly rising demand for personal transport and freight. Gas demand has grown more dramatically since 2015 with strong policy support, particularly for industrial uses, as well as residential and commercial space and water heating. The share of gas in power generation, while still limited to under 5 per cent in 2020, has been growing in light of its ability to support peak shaving and the intermittency of renewable sources. But despite significant domestic production of oil and gas, China relies heavily on imports, which met over 70% of its consumption of oil and 45% of gas in 2020. China surpassed the United States to become the largest importer of oil in 2017 and became the largest net importer of natural gas in 2018, ahead of Japan.

China's domestic oil production averaged just under 4 million barrels per day in 2020, which is just shy of Iraq's oil production. But production growth has slowed while demand continues to rise strongly (crude imports averaged 10 mb/d in 2021). Meanwhile, the continued growth of oil consumption is undermining China's efforts to constrain and eventually reduce its carbon emissions. According to the International Energy Agency, in 2019, oil combustion contributed 15% of the country's carbon dioxide emissions from energy, up from 13% in 2010. But replacing oil in end uses is easier said than done: Oil is used in transport, which accounts for over half of the country's total

¹⁶ This authoritative report by Tsinghua University, is reported to have been one key input into President Xi's 30-60 pledge. Jiankun He, Zheng Li, Xiliang Zhang, "China's Long-Term Low Carbon Development Strategies and Pathways", Springer, July 2020

oil demand, as a feedstock for petrochemicals which accounts for another 23 per cent of oil end use and to a lesser degree in power generation and industrial use.



Figure 6: China oil imports and domestic production, mb/d

Source: China Customs, National Bureau of Statistics

Concerns about energy security and import dependency on oil can be tackled through increases in domestic production as well as through switching to other energy sources. Beijing's efforts to develop and electric vehicle supply chain have been devised with a view to responding these challenges and enhancing China's industrial competitiveness. But these options do not necessarily help tackle environmental degradation: the electrification of the fleet, if fuelled with domestic coal, is not conducive to the 30-60 targets. Coal can also be used as a feedstock for petrochemicals and while this helps to satisfy supply security imperatives, it undermines environmental ambitions.

Nonetheless, China continues to electrify transport at a rapid pace. In 2020, there were around 367 million internal combustion vehicles in China, with 19.3 million sold in 2020 alone (1.1 million EVs were sold in China that year, bringing the total EV count to 4.9 million, or 1.75 per cent of the fleet).¹⁷ But with strong increases to China's overall vehicle fleet, electrification will not materially dent oil demand in the coming decade. Policy makers have already introduced emissions limits for all vehicle types that are among the most stringent in the world, with additional efforts to support sales of alternative-fuel vehicles. According to CNPC, China's largest oil company, oil demand for transport is set to peak in 2025 but by 2030 will fall back to 2020 levels. Steeper declines in demand due to substitution are only expected after 2030. But oil demand for petrochemicals is expected to continue rising until 2030 and only gradually fall through 2050 before declining more sharply in the following decade.

4. Natural gas: A bridge fuel for China

China's total gas consumption reached 320 bcm in 2020, rising to 370 bcm in 2021 and roughly doubling from 2015 levels. Domestic production accounted for 204 bcm that same year. Gas is the fastest growing fossil fuel in China as it is considered a clean fuel and very much part of the country's energy transition away from coal. The 13th FYP had originally included a target for gas to account for

17 Wang Zi, '2020年全国机动车保有量达3.72亿辆 机动车驾驶人达4.56亿人', People, 7 January 2021, at <u>http://auto.people.com.cn/n1/2021/0107/c1005-31992870.html</u>.

10 per cent of the energy mix—largely due to fuel switching away from coal—but that target was revised down to 8 per cent, which was ultimately met (and exceeded). Unlike many OECD countries, gas in China is used predominantly in the industrial and commercial sectors. According to the National Energy Administrations Natural Gas Development Report, in 2020, industrial demand accounted for 37 per cent of total gas use, while power generation consumed an additional 16 per cent¹⁸ and the chemical industry 9 per cent. While the NEA attributes the additional 38 per cent of consumption to city gas, this is a combination of residential use, estimated at around one-fifth of total consumption, as well as gas used in transport and commercial uses.

Throughout the 13th FYP, the government promoted coal-to-gas switching in industrial and residential use as a means of phasing out dispersed coal, suggesting that this gas demand is unlikely to be displaced rapidly. Indeed, residential and industrial uses are expected to continue growing in the future as more coal is phased out. In the power sector, gas is also likely to play a larger role as a balancing fuel to help deal with the intermittency of renewables¹⁹.



Figure 7: China's gas supplies, bcm

This suggests that gas demand in China will continue to rise for at least another decade, with most estimates in China expecting its use to peak around 2040. Even though estimates of future demand vary widely, the country's incremental gas demand is likely to rise by averages of anywhere between 20 and 30 bcm every year (this is equivalent to the monthly gas consumption of Netherlands or Italy). Nonetheless, the share of gas in China's energy mix is unlikely to exceed 15 per cent.

The Chinese government has sought to maintain and expand domestic upstream production in a bid to limit the country's import dependency²⁰ and has made efforts to develop overland pipeline supply routes as well as attract flows of LNG. Domestic production in China is expected to peak at around 300-350 bcm in the mid-2030s, suggesting that China will grow increasingly dependent on imports. There are few viable alternatives to gas in the near term: indeed, even in the power sector, where

¹⁸ National Energy Administration, "China's Natural Gas Development Report (2021)",

http://www.nea.gov.cn/1310139334_16294604014501n.pdf

¹⁹ See Yan Qin, "Natural gas in China's power sector: Challenges and the road ahead", OIES Energy Insight 80, December 2020, https://www.oxfordenergy.org/wpcms/wp-content/uploads/2020/12/Insight-80-Natural-gas-in-Chinas-power-sector.pdf

²⁰ See Zhe Ruan, "The Chinese majors' responses to the collapse in global oil prices and the COVID-19 pandemic: an upstream perspective", OIES Energy Insight no 78, November 2020, https://www.oxfordenergy.org/wpcms/wp-content/uploads/2020/11/Insight-79-The-Chinese-majors-responses-to-the-collapse-in-global-oil-prices-and-the-COVID-19-pandemic-an-upstream-perspective.pdf

renewable energy sources are encouraged and being added, gas will be required to play a balancing role. More rapid deployment of renewables would limit the growth of gas demand, but not displace it entirely.



Figure 8: Estimates of China's future gas demand, bcm

Even though there is no set path for how China will achieve net zero, fossil fuels are likely to remain dominant until 2030 as the country continues to develop economically and urbanise. The pace of demand growth depends on the rate of economic expansion as well as on measures to enhance energy efficiency, while the scope and speed of the subsequent fall in fossil fuel consumption depends equally on policy choices and on technological innovation. Deployment of carbon capture utilisation and storage technologies would allow fossil fuels to play a larger share of future energy uses. As of early 2022, however, China has published no detailed plan for CCUS, and has not issues targets or commercial incentives. It will be important to see if a CCUS plan is issued in the context of the 14th FYP or the carbon peaking plans given the likelihood that coal will play a significant role in the nation's energy mix for many years to come²¹.

The long-term trajectory is therefore informed by China's economic growth rates and the pace of structural rebalancing, policy efforts to enhance efficiencies as well as efforts to develop and promote new technologies. But the lack of clear roadmap means that future trends could be determined by near term choices, which seem to be increasingly informed by concerns about energy security.

5. China's energy insecurity stems from domestic policies

Chinese decision makers have long been concerned about supply security and the risk of imports being curtailed by hostile power. Yet in reality, China's energy outages have all resulted from domestic policies. In September-October 2021, China experienced a severe electricity supply crisis

Source: CNPC ETRI 2060 Energy Outlook, 2021; Tsinghua ICCSD, State Grid Energy Research Institute, OIES research

²¹ Philip Andrews-Speed, "China's policies and actions on carbon capture, utilization, and Storage (CCUS)", Oxford Energy Forum 130, https://a9w7k6q9.stackpathcdn.com/wpcms/wp-content/uploads/2022/01/OEF-130.pdf

that affected 20 provinces. Industrial activity was curtailed, and even households suffered prolonged outages in some areas. China has already experienced outages, none of which have been related to an external source curtailing supplies. For instance, in 2003–2004, when soaring economic growth outpaced the construction of new power plants, China suffered from power cuts. In 2005, the country faced a shortage of gasoline because the oil companies preferred to export gasoline and diesel to offset losses because of the domestic pricing mechanism. In 2010, provinces curtailed industrial activity in a bid to meet energy intensity targets. In all these cases, the principal causes were domestic and usually involved either poor policy coordination or a clash between market forces and government plans and administrative measures. 2021 was no different.

The 2021 power crisis resulted from the tensions between long-term aspirations and short-term reality and between the market and the plan. At the heart of the outages was the mismatch between the price of coal, which continues to be set by market forces, and the wholesale tariff for coal-fired power generators, which remains tightly constrained. Rapid economic growth in the first half of 2021 drove rising coal demand. In its efforts to control inflation, the government discouraged coal miners from raising prices, until the upward pressure was too great. When coal prices accelerated upwards, power generators reduced both their purchases of coal and their generation of power. In response, the government ordered coal mines to increase production while also raising the tariff range at which coal-fired generators could sell their output. This, in turn, has led to a renewed emphasis on coal as a key element of domestic energy security.

In addition to pricing distortions, mixed policy signals also contributed to the power outages: Coal mining in China has been constrained by efforts to reduce overcapacity, by mine safety inspections, environmental protection, and corruption probes. At the same time, the 'dual control' policy (central-government mandated caps on provincial energy consumption and energy intensity) led provinces to slow rising energy use²². The demand surge and limited supplies then came as a complete surprise to Chinese coal importers or more broadly, to macroeconomic and energy planners. Yet in early 2021, the China Electricity Council was warning of power shortages and in June 2021 the NDRC was looking to increase coal output. The slow response from utilities and provincial governments may in part be a signal that they need clearer marching orders from the government²³, especially since they are expected to assume much of the responsibility for the low-carbon transition.

6. One step forward, two steps back

Even though the power shortages have largely subsided in early 2022 as coal production in China recovered, issues of availability and reliability of supplies will remain a concern. Supply security, namely improving domestic production and supply capacity, topped the agenda in both government and CCP annual work meetings, highlighted also in an op-ed penned in the People's Daily entitled "The energy rice bowl must be in one's own hands²⁴". While accelerating the development of low-carbon energy came a close second, decision makers are calling on all political actors to "correctly recognise and grasp peaking emissions and carbon neutrality" so that the phase-out of conventional energy will be done based on safe and reliable new energy supplies. Interestingly, over the past few months, the terminology used by China's leaders has alternated between "reducing" coal and "phasing out" coal, with the latter arguably beginning to be used more widely. Similarly, in previous policy statements,

22 For more discussion on these contributing factors see Philip Andrews-Speed, Michal Meidan, "The 2021 energy crisis: Implications for China's energy market and policies", Oxford Energy Forum Issue 131, March 2022 23 Michal Meidan, Philip Andrews-Speed, "China's power crisis: Long-term goals meet short-term realities", November 2021, https://a9w7k6q9.stackpathcdn.com/wpcms/wp-content/uploads/2021/11/Chinas-power-crisis.pdf 24 The energy rice bowl must be in one's own hands, People's Daily, 7 January 2022, http://opinion.people.com.cn/n1/2022/0107/c1003-32325750.html the government talked about "first building [new energy supplies] then breaking [old supplies]" but is now discussing "breaking while building".

In the near term, the emphasis on coal is clear, but equally renewable targets are ambitious: China's Electricity Council expects the country will add 140-150 GW wind and solar capacity combined this year—compared to an estimated 134 GW of renewable capacity in 2021—with wind accounting for around 50 GW and solar for up to 100 GW, bringing China's non-fossil fuel installed capacity to 1300 GW in 2022, or over half of installed capacity. But coal—ideally "clean" coal—remains the backbone of China's energy system.

These contradictory policy signals will likely remain through this year and perhaps even into 2023, especially as the Russian invasion of Ukraine has generated considerable uncertainty and price volatility in global energy markets. Yet even before the invasion, a high level Politburo standing committee study group on 24 January 2022 focused on "Deeply analysing the situation and tasks, and promoting the carbon peak and carbon neutrality efforts²⁵" and summarised the issues as four "relationships" that must be handled:

- The first is the relationship between development and emissions reduction. Emissions
 reduction, argue China's top leaders, is about creating synergies between low carbon
 transformation and economic growth. It is not about reducing productivity or not emitting at
 all.
- The second is the relationship between the whole and the part: finding ways to meet the central government's target while pursuing province-appropriate strategies.
- This dovetails with the third relationship, between long-term goals and short-term goals as the leadership warns against looking for quick successes, and urges local and industrial leaders to move forward gradually, referring again to the need to "correctly recognise and grasp peaking emissions and carbon neutrality" (essentially asking local officials not to rush into anything).
- The final relationship is between the government and the market, which remains an ongoing balancing act.

From the government's statements, it is therefore clear that China's energy transition must go hand in hand with the country's economic transformation and will advance insofar as it supports economic expansion. But if the two are at odds, economic stability still seems to prioritised.

This has further been exacerbated by the Russian invasion of Ukraine with energy security and stability rising even higher on the policy agenda. Soaring commodity prices will place considerable pressure on the Chinese economy and could become a distraction in this politically important year. With a leadership transition at the end of the year, in which Xi Jinping will be sworn in for an unprecedented third term in office, Beijing would have likely preferred to avoid the inflationary pressure related to higher commodity prices and the geopolitical challenges associated with the crisis. Moreover, the surge in oil-indexed gas and LNG prices will weigh on China's importers (and to a lesser degree on end-users given domestic price controls) while power plants will seek to switch back to coal where possible. And given China's informal ban on Australian coal alongside volatility in Indonesian coal exports, domestic production will likely increase, complicating China's environmental pledges.

7. Industrial actors take their cues from the government

Even though China's decision makers remain committed to the 30-60 targets, short term actions and policy choices matter greatly, as discussed above. Approvals of new coal fired power plants as well as steel and cement plants will lock in emissions for decades to come and government signals around the short term policy priorities will also inform corporate strategies.

China sees state-owned energy companies as playing a central role in the country's economic and technological development. China's energy SOEs are among the world's largest energy companies: State Grid is likely the world's largest electricity grid owner and operator. China's Big Five state-owned power generation companies (produced approximately 44 per cent of China's electricity in 2019, a percentage roughly unchanged from previous years.²⁶

SOEs remain tasked with achieving policy goals related to employment, investment, and social stability. SOEs still employ a huge fraction of the urban workforce,²⁷ and are especially dominant in regions that rely on older manufacturing or extraction industries.²⁸ Further, SOE reform has tended to strengthen existing SOEs through forced mergers, aiming to create national champions that dominate certain sectors rather than encouraging competition. In addition to asset ownership, SOEs have a lead role in planning and advising the government. Whereas both outside observers and officials may portray government targets as based on objective technical conditions, in practice there is a large element of industry bargaining inherent in such targets.

And while the state-owned companies have recognized the importance of decarbonizing China's energy system, they were arguably more focused on adapting their strategies to other political priorities such as price reform, at least until late 2020 and increasingly now to energy security. In the oil and gas sector, for instance, the majors have had to contend with new private actors as well as PipeChina, the new central SOE that was created in late 2019 to manage pipelines and thereby address anti-competitive behaviour by SOEs that had stalled construction of national infrastructure. In recent years, China's oil majors had tended to use control over liquefied natural gas (LNG) terminals, pipelines, and other oil and gas assets to hinder competition, and were reluctant to grant third-party access to pipelines or terminals, or to construct pipeline interconnections. The central government's creation of PipeChina to manage and expand pipeline assets and encourage third-party access, was an attempt to resolve these issues.²⁹

Since China's dual carbon pledge, however, the SOEs have been issuing their own carbon peaking plans and looking to align with the latest priority from the central government. One recent review has found that SOE plans released so far lack specifics and suggests that many firms are waiting for more direct, industry-specific signals from central leaders.³⁰ China's oil companies have made initial plans for carbon neutrality, although they have not aggressively sought to transform their businesses³¹.

Going forward, the role of China's SOEs in the energy transition will depend on central government policy and whether they receive clear policy guidance and strictly enforced mandates. In the absence

26 Anders Hove, Michal Meidan, Philip Andrews-Speed, "Software versus hardware: how China's institutional setting helps and hinders the clean energy transition", OIES Paper CE2, December 2021, https://a9w7k6q9.stackpathcdn.com/wpcms/wpcontent/uploads/2021/12/Software-versus-hardware-how-Chinas-institutional-setting-helps-CE2.pdf

27 Karen Jingrong Lin et al., 'State-owned enterprises in China: A review of 40 years of research and practice', *China Journal of Accounting Research* 13(1), March 2020, at <u>https://doi.org/10.1016/j.cjar.2019.12.001</u>.

28 Andrew Batson, 'Mapping China: base and superstructure', Andrew Batson's Blog, 16 April 2015, at https://andrewbatson.com/2015/04/16/mapping-china-base-and-superstructure/.

29 Erica Downs and Sheng Yan, 'Reform Is in the Pipelines: PipeChina and the Restructuring of China's Natural Gas Market', Columbia University, Center on Global Energy Policy, 16 September 2020, at https://www.energypolicy.columbia.edu/research/commentary/reform-pipelines-pipechina-and-restructuring-china-s-natural-gas-market.

30 Edmund Downie, 'Getting to 30–60: How China's Biggest Coal Power, Cement, and Steel Corporations Are Responding to National Decarbonization Pledges', Columbia Center on Global Energy Policy, 25 August 2021, at

https://www.energypolicy.columbia.edu/research/report/getting-30-60-how-china-s-biggest-coal-power-cement-andsteel-corporations-are-responding-national.

31 Anders Hove, Michal Meidan, Philip Andrews-Speed, "Software versus hardware: how China's institutional setting helps and hinders the clean energy transition", OIES Paper CE2, December 2021,

https://a9w7k6q9.stackpathcdn.com/wpcms/wp-content/uploads/2021/12/Software-versus-hardware-how-Chinas-institutional-setting-helps-CE2.pdf

of strong policy signals – including personnel policies and incentives structures – the SOEs will likely tend towards risk-averse decisions, protecting existing business activities and hindering innovation. The future direction of SOE reform will also need to be well defined: if SOEs are encouraged to become more economically competitive, they could resist clean energy policies that hurt short-term profits but conversely, could also be discouraged from investment in assets that could become stranded. Or, SOEs could be guided, by economic or administrative signals to invest massively in fields where such investment will likely be needed.

8. The role of fossil fuels in China's energy mix and future trajectory

Despite China's heavy reliance on imported oil and gas, given its large domestic reserves of coal (and to a lesser degree oil and gas), the country remains relatively self-sufficient for its energy needs. In terms of energy security, this could be considered a success.

While China's decision makers have been concerned about the strategic vulnerabilities associated with imported oil and gas (including supply cut offs and sanctions limiting energy flows), geopolitical events around the world have not resulted in reduced supplies for China³², although they have translated to higher prices (as they have for all other consumers). And as argued above, to date, supply disruptions in China have all been the result of domestic policies.

To the extent that China's fossil fuel use has allowed it to maintain supplies for its economy, and the large domestic resources offer it some degree of control over prices, its reliance on fossil fuels is largely a positive contributor for the country's ability to continue its economic expansion. The political groups associated with fossil fuels and heavy industry are, however, both a help and a hindrance: The existence of large state-owned groups and important constituencies has allowed and will continue to enable to government to determine outcomes, as long as policy signals are clear and consistent. In the absence of strong policy signals, however, as discussed above, the SOEs will likely tend towards risk-averse decisions, protecting existing business activities and hindering innovation.

But while China's reliance on fossil fuels (given the relative abundance of domestic supplies) offers it some supply security, the environmental cost has been rising, challenging the country's ability to continue relying on unabated fossil fuels. China accounted for 27.9 per cent of global emissions in 2019 compared to 7.5 per cent in 1980.³³ Based on various estimates, China's emissions have grown by a factor of 4 since 1990, reaching around 13.7 billion tons of CO_2 -equivalent in 2020³⁴, or 9 t CO2 per capita – 45 per cent higher than in the rest of the world³⁵.

Energy sector CO2 emissions reached more than 11 Gt in 2020 and made up almost 90 per cent of China's total GHG emissions, compared with under 60 per cent for the rest of the world, reflecting its emissions-intensive energy mix and a large heavy industry sector. About 70 per cent of China's energy-related emissions in 2020 came from coal, 12 per cent from oil, 6 per cent from natural gas. Clearly then, the reliance on fossil fuels comes at the expense of China's energy transition. Kicking the fossil fuel can down the road will make it politically more challenging and economically costlier to reach

- 32 Michal Meidan, "China's Energy Security at 70", OIES Comment, October 2019,
- https://www.oxfordenergy.org/publications/chinas-energy-security-at-70/
- 33 'China: What share of global CO₂ emissions are emitted by the country?' Oxford Martin School, accessed on 23 February 2021, at <u>https://ourworldindata.org/grapher/annual-share-of-co2-</u>

emissions?tab=chart&stackMode=absolute&time=1753..latest&country=~CHN®ion=World.

34 'China: Country Summary', Climate Action Tracker, 21 September 2020, at

https://climateactiontracker.org/countries/china/, based on data from the International Energy Agency; Lauri Myllyvirta, 'Analysis: China's CO2 emissions surged 4 per cent in second half of 2020', Carbon Brief, 1 March 2021, at

https://www.carbonbrief.org/analysis-chinas-co2-emissions-surged-4-in-second-half-of-2020.

35 IEA, "An Energy Sector Roadmap to Carbon Neutrality in China", September 2021,

https://iea.blob.core.windows.net/assets/9448bd6e-670e-4cfd-953c-

32e822a80f77/AnenergysectorroadmaptocarbonneutralityinChina.pdf

China's 2060 targets. Concerns about energy security and reliability of supplies are impeding rapid progress toward the phase out of fossil fuels, and mainly coal, in China. This should not be taken to mean that China is walking back from its commitments, but that the short term realities are constraining long term ambition, as is currently the case in many other countries.

Recognising that fossil fuels will play a role in the energy transition means that, at least to begin with, measuring, reporting and reducing emissions from the entire value chain will be critical. As the US is gradually becoming a large exporter of oil and gas to China, reporting emissions—and striving to reduce or offset them—along the entire value chain in a transparent manner would be an important step.

Bilateral and multilateral efforts should include engagement on improving data reporting and monitoring—including on quantifying upstream emissions—and industrial emissions. Engagement should span both government (on all levels) and industrial stakeholders, especially in the context of rising concerns about technological and financial decoupling. Collaboration on CCUS and abatement technologies will also help scale up these technologies and make them more widely available to other fossil fuel consumers.

The US-China statement on methane emission reductions, issued in Glasgow in November 2021, is an important basis for collaboration. US efforts to reduce methane emissions by remediating abandoned coal mines could prove valuable for China. While methane emissions from coal in the US account for a smaller share of total emissions than in China, reclamation projects that employ dislocated energy workers touch on key questions of social justice in China's energy transition and could be valuable experiences. This should not replace efforts to promote non-fossil fuels and encourage an accelerated deployment of non-fossil sources in the energy mix.
OPENING STATEMENT OF MICHAEL DAVIDSON, ASSISTANT PROFESSOR, UNIVERSITY OF CALIFORNIA SAN DIEGO

VICE CHAIR GLAS: Thank you so much, Dr. Meidan.

And the final panelist, Dr. Michael Davidson.

DR. DAVIDSON: Thank you, Commissioners, for holding this timely hearing on China's energy plans and practices.

I'm going to speak today about China's clean energy development. China is the world's largest investor and consumer of clean energy, which I'm going to define here as renewable energy, civil nuclear, and generation with carbon capture and sequestration, or CCS. In 2021, one-third of China's electricity came from clean energy and 88 percent of their annual investment in electricity generation was in clean energy. Of those, wind and solar are the fastest-growing clean energy sources, adding 100 gigawatts of new capacity in 2021.

Now, China's clean energy growth is the result of deliberate government policies to support technological development, manufacturing scale-up, and deployment. Their renewable energy law in 2005 set the foundation for wind and solar deployment through the establishment of feed-in tariffs, or FIT. As costs of wind and solar equipment have fallen, China has phased out the FIT and is replacing it with provincial renewable portfolio standards.

China's wind energy equipment manufacturing sector developed quickly following demand-pull of the FIT and complementary policies. By contrast, the domestic solar manufacturing sector was built, first, on export-led demand, and later supported by robust domestic deployment.

China has a mature planning process for large hydropower development, and China also has the largest pipeline of active nuclear development domestically and has begun exporting.

CCS, carbon capture and sequestration, is widely assumed in many long-term energy growth models for China and many other countries, including the U.S. Yet, commercial CCS projects are still only at very small scales globally. China has a few companies in oil and gas, power generation, and industry exploring pilots, including a small test run of a post-combustion capture retrofit on a coal-fired power plant, which could be a model for future growth.

Specifically related to variable renewable energy, such as wind and solar, China has faced several barriers in the energy sector stemming from institutional structures, as well as technical characteristics. Three prominent barriers have been grid connection delays, subsidy delays, and curtailment. And of these, curtailment is the most systemic and will become even more acute, as China goes forward to reach carbon neutrality.

Intermittency of wind and solar creates challenges for the grid to balance supply and demand. If a renewable energy plant's output is not accepted up to its full availability, the foregone output is referred to as curtailment, and this is, in essence, wasted free energy. Curtailment rates in China peaked in 2016 when 17 percent of wind and 10 percent of solar was curtailed.

And these causes of curtailment include technical factors, such as insufficient transmission capacity or demand, as well as institutional factors, such as inter-provincial trade barriers, and insufficient incentives for flexible supply and demand, such as through markets.

And to achieve carbon neutrality by 2060, China will likely need between 2,000 and 3,000 gigawatts each of wind and solar capacity, which is a tenfold increase over today. At these levels, China will face extreme technical challenges to keep curtailment levels low;

accommodate the very large land-use footprint inherent in deploying wind and solar at this scale, and develop complementary infrastructure, such as storage and transmission.

Institutionally, China will likely continue to rely upon trusted methods of commandand-control targets and bureaucratic incentives to expand clean energy. And many of the above challenges, however, raise the cost of even minor inefficiencies induced by these rigid planning measures. And as a necessary means of cost control, China has been embracing more marketbased mechanisms in recent years, including a power market reform round since 2015 and launching a nationwide carbon emissions trading scheme last year.

Now climate change joins a host of other energy policy priorities of China's central state, including energy security, affordability, industrial structure, and air pollution. And I will make a few remarks on the policy alignment here.

First, deploying clean energy and accelerating power market reforms are aligned with energy security. In response to the power crisis of 2021, China relaxed some restrictions on electricity markets, effectively, raising the price of coal-based electricity, and reiterated the need for more clean energy.

On the other hand, short- and long-term misalignments do exist between climate and other energy policy goals. The response to the power crisis, for example, also expanded domestic coal production. And while policies replacing low-efficiency industrial facilities with newer, higher-efficiency plants, which have been a major element of China's climate strategy, have immediate benefits in terms of energy security and emissions reductions, these efforts will lock in carbon-intensive processes, making climate change action more difficult.

Finally, the Chinese state desired industrial structure for the energy sector promotes efficiency, reduces overcapacity, and preserves local autonomy and sources of growth, and maintains a leading role for the state sector. Many efforts to date indicate a desire for managed competition, with state-owned enterprises leading the way. The private sector, which played an important role in the growth of the renewable energy sector, is retreating from generation due to policy uncertainty and other barriers to competition.

Now, in terms of my policy recommendations for the Commission and the Congress, these are threefold.

One is enhancing visibility into and understanding of China's energy sector challenges. As the multiple energy crises in recent years revealed, China's energy sector decision making reverberates globally. And it's critical for Congress to fund programs that enhance U.S.-based expertise of China's energy challenges, including programs like the Fulbright and through research funding for international initiatives at NSF, DOE, EPA, and other agencies. My own journey began with a Fulbright Fellowship to China.

Two, support China's energy sector transitions through select clean energy cooperation. It is in the U.S. national interest to support China in its efforts to transition away from coal, to scale up clean energy development, and to reduce greenhouse gas emissions. The U.S.-China Joint Glasgow Declaration agreed to last November lays out several potential areas of cooperation. Beyond policy dialog, scientific R&D cooperation in areas that are less risky politically should be encouraged, particularly in emerging low-carbon technologies such as CCS. And three, study the dependence of the U.S. clean energy transition on developments in China. The primary contributors to the following costs of low-carbon technologies in the U.S. over the last decade have been efficiencies created by economies of scale and globalized supply chain. And many policies introduced or proposed to expand low-carbon technology manufacturing deployment in the U.S., including import tariffs and local content obligations, run counter to these causes of historic declines.

Congress should fund studies into the costs and benefits of integration with China on R&D and manufacturing of mature and emerging low-carbon technologies, and further research is needed on the economic and national security risks at the level of specific technology pathways, given degrees of integration and ongoing developments in China.

Thank you very much, and I look forward to your questions.

PREPARED STATEMENT OF MICHAEL DAVIDSON, ASSISTANT PROFESSOR, UNIVERSITY OF CALIFORNIA SAN DIEGO

March 17, 2022

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Testimony before the U.S.-China Economic and Security Review Commission Hearing on "China's Energy Plans and Practices"

1 Executive Summary

On the road to becoming the world's largest clean energy consumer, China has embraced a range of policies, including both demand-pull and supply-push, to shape energy markets. Resulting integration challenges such as high levels of curtailment are a symptom of both technical and institutional barriers, and will be attenuated in China's long-term path to carbon neutrality. Energy policy priorities for China include energy security, affordability, industrial structure, air pollution, and climate change, which can be misaligned in the short- and long-term. The 2021 power shortages have revealed some interesting political discourse surrounding these various objectives, which have at least for now bolstered market reforms.

Recommendations for this Commission and for Congress:

- 1. Enhance visibility into and understanding of China's energy sector challenges
- 2. Support China's energy sector transitions through select clean energy cooperation
- 3. Study the dependence of the U.S. clean energy transition on developments in China

2 China's Clean Energy Status and Policy Evolution

China is the world's largest investor and consumer of clean energy, defined as renewable energy, civil nuclear energy, and generation with carbon capture and sequestration (CCS) for the purposes of this testimony. In 2021, 33% of China's electricity generation (greater than 2,700 gigawatt-hours, GWh) came from clean energy. Completed investments in clean energy totaled 486 billion RMB (US\$77 bn), 88% of annual investment in electricity generation. Wind and solar are the fastest growing clean energy sources, adding 100 GW of new capacity in 2021.¹

Across all energy carriers, non-fossil sources accounted for only 15% of primary energy in 2020.² Roughly half of China's coal, for example, is used outside of the electricity and heating sectors, primarily in industry where cost-effective clean energy substitutes are not widely available.³ The majority of this testimony will focus on the electricity sector, because long-term energy system evolution trends predict large rates of electrification in other sectors (industry, transportation, household).

¹ CEC, "2021 Electric Power Industry Statistics."

² China's methodology for calculating primary energy differs from international conventions and those used by the U.S. Energy Information Administration. See: Lewis et al., "Understanding China's Non–Fossil Energy Targets."

³ Davidson, "From Barrier to Bridge: The Role of Coal in China's Decarbonization."

China's clean energy growth is the result of deliberate government policies to support technological development, manufacturing scale-up, and deployment. The Renewable Energy Law in 2005 set the foundation for the deployment of wind and solar by establishing connection rules and the mechanisms for fixed feed-in-tariffs (FIT) for onshore wind (2009), solar photovoltaic (2011), and offshore wind (2014). FITs provide a guaranteed stream of revenues, which in China are paid in two parts: the grid company (or direct consumers) pay up to the benchmark coal tariff and the central government pays the difference out of a central fund of renewable energy surcharges on electricity consumption. China also offers a value-added tax (VAT) reduction for renewable energy projects.

Drawing on earlier international business relationships, China's domestic wind energy equipment manufacturing sector developed quickly following strong demand-pull policies of the FIT and complementary policies.⁴ By contrast, the domestic solar energy manufacturing sector was built first on export-led demand, and later supported by robust domestic deployment. Both sectors were facilitated by bottom-up manufacturing policy support of local governments.⁵

As costs of wind and solar equipment have fallen, China phased out the FIT for new onshore wind and solar as of 2021, forcing project developers to take the coal benchmark tariff or sign competitive market-based contracts. A complementary set of renewable portfolio standards (RPS) will create requirements at the provincial level to procure wind and solar, and incipient green electricity trading pilots could generate more revenue streams for projects.

Hydropower and nuclear energy tariffs have historically been determined on a project-by-project basis based on standards of cost-recovery. China has a long history of both small run-of-river and large reservoir hydro, and a mature planning process for large hydropower development. National five-year-plans typically establish lists of major hydropower projects and early-stage assessment priorities by river system.

China's civil nuclear energy fleet contains designs from France, U.S., Russia, and Canada, as well as indigenous development. Central government ambitions for nuclear energy were somewhat reduced following the Fukushima disaster, after which China slowed down new project development, conducted safety tests, and added additional safety measures to existing plants.⁶ Nevertheless, China has the largest pipeline of active nuclear development domestically and has begun exports as well, supported by export credit.

Carbon capture and sequestration (CCS) is widely assumed in long-term energy growth models for China and many other countries, yet commercially operational CCS projects are still only at small scales globally. China has a few companies in oil & gas, power generation and industry exploring pilots. State-owned China Energy Investment Corporation completed a small test run of a post-combustion capture retrofit on a coal-fired power plant, which could be a model for future development.⁷ CCS has been given a jolt following China's carbon neutrality

⁴ Lewis, Green Innovation in China.

⁵ Nahm, "Exploiting the Implementation Gap."

⁶ World Nuclear Association, "Nuclear Power in China."

⁷ Global CCS Institute, "Global Status of CCS 2021."

commitment, with the 14th Five-Year Plan and subsequent documents indicating an expansion of demonstrations and technological development.⁸

3 Development and Integration Challenges of Clean Energy

Variable renewable energies such as wind and solar have faced several barriers in the Chinese energy sector, stemming from institutional structures and unique technical characteristics. Three prominent barriers have been grid connection delays, subsidy delays, and curtailment.

First, wind and solar plants can be built quickly—in less than a year—which can create bottlenecks if grid connections do not keep pace. At one point, as much as 34% of China's wind generating capacity was built but not yet connected to the grid.⁹ Causes for this delay include overzealous local government permitting and reticent grid companies.

Second, subsidies to cover the gap between the FIT and coal benchmark tariffs have also been extremely delayed. Causes for the delay reflect mostly a yawning deficit in the central fund that administers the subsidies based on surcharges on electricity consumers. Central officials have been unwilling to raise the consumer surcharge, which was a major factor leading to the end of the FIT program.

Third, intermittency of wind and solar creates challenges for the grid to balance supply and demand. If a renewable energy plant's output is not accepted up to its full availability, the foregone output is referred to as curtailment, and is in essence wasted free energy. Curtailment rates in China reached very high levels in 2016 when 17% of wind and 10% of solar was curtailed, and have since fallen. Causes of curtailment include technical factors such as insufficient transmission capacity or demand, as well as institutional factors such as interprovincial trade barriers and insufficient incentives for flexible supply and demand.¹⁰

Technical and institutional challenges in expanding clean energy to achieve carbon neutrality will be even more acute than recent difficulties. By 2060, China will likely need between 2,000-3,000 GW each of wind and solar capacity, a ten-fold increase over today. At these levels, China will face extreme technical challenges to keep curtailment levels low, accommodate the large land use footprints of the deployment scale, and develop complementary infrastructure such as storage and transmission.

Curtailment levels under increasing penetrations of wind and solar will be driven largely by the flexibility of conventional generators to change output as needed and of demand to respond to changing grid conditions. China's massive coal fleet will likely continue to be repurposed via flexibility retrofits to form a "bridge" to a low-carbon energy system, rather than relying on large-scale replacement of coal with more flexible natural gas.¹¹ Demand response is primarily

⁸ Hwabao Securities, "Carbon Capture Utilization and Storage Technologies: The 'Last Mile' of the Road to Zero Carbon."

⁹ Lu et al., "Challenges Faced by China Compared with the US in Developing Wind Power."

¹⁰ Davidson, Kahrl, and Karplus, "Towards a Political Economy Framework for Wind Power: Does China Break the Mould?"

¹¹ Davidson, "From Barrier to Bridge: The Role of Coal in China's Decarbonization."

deployed currently via time-of-use (TOU) rates for commercial and industrial customers that increase the cost of electricity during peak evening hours after the sun has set. Chinese localities will likely expand use of TOU rates—including by increasing the ratio between peak and valley pricing—as well as efforts to include demand in real-time energy markets.

Land use concerns have been largely muted in China's wind and solar buildouts to today as the most productive resources are located in the west and north where population density is lower. However, in increasing deployment by an order of magnitude, more facilities will need to be built nearby coastal demand centers where land is at a premium. Conflicts with agriculture, in particular, are likely to push some solar into smaller-scale distributed projects at factories and buildings, and could incentivize more creative multiple use arrangements for land.

China has the world's largest ultra-high voltage (UHV) transmission network, but this will need to expand still to accommodate large-scale balancing of clean energy sources. Transmission siting and permitting are relatively streamlined in China due to the scope of the country's two large grid companies as well as little public participation in the planning process. Many more high-capacity transmission corridors will need to be built, which could surface siting conflicts not present today. Battery storage projects will also need to be built at unprecedented levels.

Institutionally, China will likely continue to rely upon trusted methods of command-and-control targets and bureaucratic incentives to expand clean energy, while slowly embracing more market mechanisms. Targets laid out in planning documents and used in determining promotions are key levers to influence the behavior of government officials and state-owned enterprise (SOE) managers. These are a key fixture of China's energy and climate policy implementation and will continue to play a central role.¹²

Many of the above challenges, however, raise the costs of even minor inefficiencies induced by rigid planning measures. As a necessary means of cost control, China has been embracing more market-based mechanisms in recent years. In 2021, 45% of all electricity in China was sold via markets, up from just a few percent at the beginning of the current reform round in 2015.¹³ Power sector reforms face substantial barriers from incumbent actors unwilling to give up generous central planning benefits, opportunistic local governments designing markets to favor certain interest groups, and central officials hesitant of provoking electricity price increases.¹⁴ Current market designs are mostly in the form of medium to long-term contracts, which do not address the flexibility challenges of intermittent renewable energy and could, in fact, make integration worse.¹⁵

Last year, China also launched its national CO2 emissions trading scheme (ETS), which encapsulates the power sector at first, accounting for around 4.5 billion tons of CO2, and is targeted to expand to include up to 8 billion tons, or 70% of annual emissions. Due to the unique performance benchmark system, China's ETS does not create the same set of incentives as a normal cap-and-trade, and therefore, prices coming out of the market should not be directly

¹² Davidson et al., "Policies and Institutions to Support Carbon Neutrality in China by 2060."

¹³ CEC, "National Electricity Market Transactions in 2021."

¹⁴ Guo et al., "Power Market Reform in China."

¹⁵ Davidson and Pérez-Arriaga, "Avoiding Pitfalls in Reforming China's Electricity Sector."

compared with EU's ETS.¹⁶ In addition, the market provides limited fuel switching benefits, as renewable energy does not participate directly. It is better to think of the ETS as a means to accelerate the divergence between inefficient and efficient coal-fired power, begun under energy efficient dispatch and continued in electricity markets. In the long-run, the ETS can help build capacity for measuring, reporting and verification of emissions, and when combined with steady improvements in electricity markets could become a meaningful component of China's long-term climate goals.¹⁷

4 Alignment of Climate and Energy Policy Priorities

Climate change concerns are being added to a list of other energy policy priorities of China's central state, which include energy security, affordability, industrial structure, and air pollution. Reducing greenhouse gas (GHG) emissions may or may not align with these other goals, and the timeframe over which misalignment may occur varies. I will discuss a few examples.

First, deploying clean energy and accelerating power market reforms are aligned with energy security and other priorities. Energy security, encompassing the ability to satisfy consumer demand for energy and enhancing self-sufficiency, is improved if China can reduce its reliance on imported fossil fuels, prices for fossil electricity pass through costs, and more clean energy is installed. In response to the power crisis in 2021, China relaxed some restrictions on electricity markets and reiterated the need for more clean energy.¹⁸ The more pressing need for supply security now aligns with the original promise of market reforms to enhance affordability through efficient production.

Second, measures to address air pollution generally align with long-term climate goals (such as deploying clean energy and building transmission), though may have some short-term misalignment. For example, China has rapidly scaled up installation of end-of-pipe controls that use more energy and emit more carbon, the same trade-off that the U.S. and many other countries make. These efforts also demonstrate that air pollution concerns have been more prominent than climate to date in energy sector planning.

Third, there are many long-term misalignments between climate and other energy policy goals. The response to the power crisis also included expanded domestic coal production to alleviate shortages and some language recentering the role of coal in the energy system. Another major effort has been to replace low-efficiency industrial facilities with newer, high-efficiency plants. These have immediate benefits in terms of energy security, reducing emissions, and addressing overcapacity and the financial health of sectors, but in the long-run, these efforts will lock-in carbon-intensive processes.

Fourth, the desired industrial structure for the energy sector from the perspective of the central state promotes efficiency, reduces overcapacity, preserves local autonomy and sources of growth, and maintains the leading role for the state sector. In electricity, large state-owned

¹⁶ Goulder et al., "China's Unconventional Nationwide CO 2 Emissions Trading System."

¹⁷ Davidson et al., "Policies and Institutions to Support Carbon Neutrality in China by 2060."

¹⁸ Davidson, "China's Power Outage."

incumbents dominate and are increasing in strength. Many efforts to date indicate a desire for managed competition, such as in the Northwest region where the five largest SOEs have each been given a province where they should consolidate capacity. The private sector, which played an important role in the growth of the renewable energy sector, is retreating from generation due to policy uncertainty and other barriers to competition.

5 Policy Recommendations for Congress

1. Enhance visibility into and understanding of China's energy sector challenges

As multiple energy crises in recent years reveal, China's energy sector decision-making reverberates globally. In this context, it is critical for Congress to fund programs that enhance U.S.-based expertise of China's energy challenges, including programs like the Fulbright and through research funding for international initiatives at NSF, DOE, EPA and other agencies.

2. Support China's energy sector transitions through select clean energy cooperation

It is in the U.S. national interest to support China in its efforts to transition away from coal, scale up clean energy deployment, and reduce GHG emissions. The "U.S.-China Joint Glasgow Declaration on Enhancing Climate Action in the 2020s" agreed to last November lays out several potential areas of cooperation.¹⁹ These include sharing lessons on policies to support the integration of intermittent renewable energy, encourage effective transmission system balancing, and deploy distributed generation. Congress should support efforts by the State Department, DOE and other agencies for policy dialogue.

Beyond policy sharing, there is still much value in scientific R&D cooperation in areas that are less risky politically and where mutual benefits are possible, particularly in emerging low-carbon technologies such as CCS.²⁰ No country has adequately funded demonstration projects for the scale of CCS potentially required by mid-century. By leveraging and coordinating resources from more governments and firms, Congress can help accelerate the learning process.

3. Study the dependence of the U.S. clean energy transition on developments in China

The primary contributors to the falling costs of low-carbon technologies in the U.S. over the last decade have been efficiencies created by economies of scale and globalized supply chains. Many policies introduced or proposed to expand low-carbon technology manufacturing and deployment in the U.S., including import tariffs and local content obligations, run counter to the very causes of historic declines. Congress should fund studies into the costs and benefits of integration with China on R&D and manufacturing of mature and emerging low-carbon technologies. Further analysis is also needed at the level of specific technology pathways into the economic and national security risks of various degrees of integration and of ongoing developments in China.

¹⁹ https://www.state.gov/u-s-china-joint-glasgow-declaration-on-enhancing-climate-action-in-the-2020s/

²⁰ Karplus, Morgan, and Victor, "Finding Safe Zones for Science."

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PANEL I QUESTION AND ANSWER

VICE CHAIR GLAS: Thank you, Dr. Davidson. I think all of us appreciated hearing the state of play in China right now in terms of its energy sector and the pathways, based on your analysis in terms of the energy mix moving ahead.

In terms of the next stage of this process, I'm going to recognize Commissioners, each Commissioner for five minutes of questions. If we have time at the end, we will go for a second round. This is a very meaty topic.

I'm going to take the liberty of going first, but, then, I will go in alphabetical order and recognize Commissioner Borochoff.

Dr. Meidan, in your testimony, in your written and your verbal testimony, you talked about the U.S. has gradually become a larger exporter of oil and gas to China. To what extent are our companies fueling the industries of China, and do you see that trajectory increasing over time?

And then, the second question I have, that I might direct to Dr. Davidson and Mr. Lee, is, to what extent -- I'm trying to get a handle on, recognizing the state provides massive subsidies and other kinds of regulatory frameworks to help the coal and oil industries in-country, how does that match with the subsidies that the Chinese are offering in the clean energy technology race?

So, with that, I will start with you, Dr. Meidan.

DR. MEIDAN: Thank you for that question.

I think U.S. supplies of oil and gas to China, I mean, these are globally traded markets. So, as long as there is demand, U.S. companies might as well be part of the supply story.

I mean, for oil, and for gas, actually, it's interesting that the phase 1 trade deal mandated an increase of flows to China. So, I think, more broadly, for oil, China's demand will likely peak in the next decade. Gas is widely seen as part of the energy transition. It is a cleaner fuel than coal, and it is a viable alternative to coal. It will be needed, also, to help deal with some of the intermittency of renewables in the power sector. And so, gas will play a part in the energy transition.

And I think as long as U.S. companies can do so, and as I suggested, ideally, in a way where there is greater transparency on the methane and other greenhouse gas emissions along that supply chain, if we can do it, again, in a cleaner way, or in a more transparent way, then the U.S. should certainly, those companies should certainly be at the forefront of those supplies. But those supplies will reach China one way or another. Again, these are global markets. And so, I think there is no reason to stop U.S. companies from selling into China.

VICE CHAIR GLAS: Thank you.

And on the second part of the question, Dr. Davidson, do you want to go first, and then, Mr. Lee?

DR. DAVIDSON: Sure. Happy to. Thanks for the question.

In terms of subsidies for coal and other fossil fuels, China does not directly internalize any of the externalities associated with those to the degree that is required, such as a carbon tax at the level of what the cost of carbon is.

Specifically related to renewables, China has historically provided very generous subsidies for renewable energy, as I mentioned the FIT, which is being phased out. And so, going forward, a lot of the subsidies that will be going towards the renewable energy sector are

going to be more implicit through, for example, state-owned enterprises that will need to meet these very aggressive clean energy targets and will be required to incorporate them into their long-term planning regimes.

VICE CHAIR GLAS: Thank you.

Mr. Lee?

MR. LEE: Yes, let me, if I may take the liberty of saying a few added things to both of those questions.

In terms of gas, I think the point that this was part of the trade deal, there was a lot of argument over this. They spent a year fighting as to how much we would have to send, and we wanted to send more; China wanted to have to send less. And eventually, we arrived at the targets.

And gas in China has not really been used much in the electricity sector. It is mostly to replace coal use in the industrial sector and in the district heating sectors. And last year, it's interesting to note, we doubled our gas exports to China, and China is now our second-largest recipient of gas exports, only behind South Korea.

In terms of the regulatory area, China recognizes this is a drain on their budget, and they're trying very much to substitute command and control. I'll just give you one example.

In electric cars, they've heavily subsidized electric cars. Those were supposed to be phased out in 2020; they were not. They were continued, at least partially, but now they're having a whole bunch of regulatory programs. But most specific is every car company must sell a certain number of electric cars in their overall portfolio.

VICE CHAIR GLAS: Thank you.

Commissioner Borochoff?

COMMISSIONER BOROCHOFF: Thank you, and thank you to all of the witnesses today.

I am not an expert on energy, but I live in a community in Houston, Texas, which is completely dominated by the energy industry, and has been for a long time. So, just living there, we learn a lot about it.

I'm interested, particularly, in reading and listening to Dr. Davidson and Dr. Meidan's comments, there is a slight disconnect, I think. I'd like you to go first, Dr. Davidson. You mentioned the renewables, and specifically, the wind and solar. And I got the impression from listening to you that you think it's moving at a quicker rate perhaps than Dr. Meidan thinks it can do, because there are geographical impediments to those two.

So, my question is -- and it's based on some experience in watching wind and solar try to be rolled out in America -- how realistic is it that wind and solar are really going to eventually be a big part of the renewable industry in China. And I would like both of you, if you would, to answer that. And then, Mr. Lee, if you have a comment, feel free.

DR. DAVIDSON: Sure. Very happy to address this.

I think clean energy -- we're talking about wind and solar, in particular -- have been growing at a faster rate in China. We had over 100 gigawatts of wind and solar capacity, roughly, 50 of that in solar, compared to the U.S. which had a banner year of 20 gigawatts of new solar development last year.

So, China's growth in wind and solar expansion, the growth rate is increasing, and it's going to have to increase even faster to reach 2060 goals, likely exceeding 100 gigawatts each of wind and solar, up to, potentially, 300 gigawatts, cumulative, towards the mid-century a year. That's an enormous increase, and that, as you rightly point out, it's going to create a lot of

constraints on, particularly, land use and grid integration.

So, first, on land use, China has benefitted quite significantly to date from very rich wind and solar resources which are in relatively unpopulated and less contested areas in the west and the north. Going forward, to reach 2060 targets, it's going to have to start deploying at a much faster rate in the more populated eastern coastal areas, where conflicts with urban areas, as well as agriculture, are going to become much more severe. So, that is one potential constraint.

The second is on grid integration. As I talked about curtailment rates, which peaked around 2016, and have since fallen off, we are not yet out of the woods yet on that from the Chinese perspective.

Now, from Texas, you may recall Texas had a really large wind growth in the early 2000s, which led to really high curtailment rates around 2007-2009. And those were addressed by building more transmission corridors from the windy west to the demand centers in the east, as well as establishing a very effective locational market.

China has built a lot of transmission lines, but the causes of curtailment are much more varied and connected, to the large extent, with institutional structures related to markets. And thus, it's not necessarily the case that China is going to follow Texas' path in being able to control curtailment, even as wind and solar increase very rapidly.

COMMISSIONER BOROCHOFF: Thank you.

Dr. Meidan?

DR. MEIDAN: Thank you.

Well, to follow on from that, I mean, certainly, renewables are going to grow, and they're going to grow rapidly. That is in government policies and statements, that renewables will account for incremental, the bulk of incremental growth of supplies in China. That doesn't mean that -- coal and fossil fuels still have a role to play, certainly, in the coming decade.

I think where China has been very good, historically, it has been adding infrastructure, right? It's been building the hardware of new supplies, not so much as sort of the software of integrating it and demand management, and not so much of creating losers, right? It's easy to build new industries. How quickly can you phase out coal? How do you use it? How do you retrain and work on the social justice piece of mainly coal, but other fossil fuels? I think that is part of the challenge for China. There is now talk of coal being used as a balancing mechanism for renewables, which doesn't make a whole lot of sense, but it goes to these questions of economic stability and supply security.

So, I do think that China will add a whole lot of renewables, but I also think that China can meet its 30-60 target, so to peak emissions before 2030 and reach net zero by 2060. It could do that much faster or it can do it -- so, it can reach it ahead of those targets or it can reach it on target. The way we're going now, we're unlikely to be ahead of target, certainly not for 2030, or much ahead of target.

VICE CHAIR GLAS: Thank you.

I'm now going to recognize Commissioner Fiedler.

COMMISSIONER FIEDLER: Thank you.

I'd like to probe the internal interest, the fossil fuel interest versus the renewable interest, within China. You discussed the state. Everything is state-owned. So, what are the politics? What do we know about the politics of energy and the continued use of fossil fuels in China?

DR. MEIDAN: I'm happy to go first on that, and then, maybe my co-panelists. COMMISSIONER FIEDLER: Please.

DR. MEIDAN: I mean, the fossil fuel industry has been extremely powerful and remains so. It's interesting that, when you hear of some of the discussions at the sidelines of the parliamentary session that has just concluded, for instance, in China, when you talk about energy security, it is quite rare for the renewables industry to come up and say, "We are energy security." Because, I mean, to a certain degree, and to a great degree, renewables do provide a huge amount of energy security, but that is not a narrative. And actually, the coal lobby, the power lobby, is still quite forceful in talking about the importance of stability and reliability of coal, and certainly, oil and gas are very influential ex-ministry and participants in the energy debate.

Now we have to recognize climate change and the concerns, but, again, I would argue it's not just about climate; it's also about industrial policy. And those voices are gaining prominence; they are loud, and they are becoming more influential in policymaking. But, structurally, fossil fuels I think are more deeply embedded in the political economy and the politics of China.

COMMISSIONER FIEDLER: Anyone else?

DR. DAVIDSON: Yes, I'm going to jump in here for a second.

I think that there are some very key distinctions between the fossil and the clean energy interests. But one thing where there is, potentially, a big difference with other countries, such as the U.S., is that China's SOEs, the generation side, are incredibly diversified. And so, a lot of the renewables that is going to be built, wind and solar, are going to come from the same SOEs that are building out all the coal and the gas.

And so, they see, potentially, there's an off-ramp. As their coal and gas assets reduce in value, as their generation decreases and they're facing the pinch of all their sunk investments, that they can start deploying a lot more wind and solar to meet investment targets and to, also, address these other political priorities.

This is why I think markets are going to be very key for cost competitiveness and cost control, but they're not necessarily going to spark a new renaissance of private sector activity in the generation side. But that doesn't mean that markets aren't important. It just means that we should recalibrate our expectations about what the purpose of markets are in the Chinese context, which are primarily to achieve efficiency and reduce overcapacity, and they also help service other goals, such as reducing overcapacity, which has plagued China's energy sector for some time.

MR. LEE: I would add a few things. And I agree almost totally with what Michael just said.

The first is that there is ongoing tension, and has been for a long time, between the provinces and the provincial government and the central government in Beijing. And a lot of that has to do with this transition and will become more imperative, as you look at where the fossil fuels are -- four or five provinces primarily -- and the rest of them don't have that. And so, the dislocations in those provinces are very severe, and it's beyond the means of those provinces alone to deal with that.

Our studies that we have not released yet have looked at how one can deploy more renewables. One of the findings is that storage becomes really important, and that if you can have more storage, you can actually accelerate the deployment of renewables. And China is beginning to put a lot of effort -- although they have not announced a definitive storage policy, they have put out guidelines with why storage is important.

My last point that I would make is that, if you look at where the deployment of

renewables has been in the last year, it has moved eastward. In fact, there was more renewables deployed in the eastern provinces than in the central and western provinces, where, historically, they have been deployed, in the last 12 months.

COMMISSIONER FIEDLER: Thank you very much. VICE CHAIR GLAS: Thank you. Commissioner Goodwin? COMMISSIONER GOODWIN: Thank you, Chair. And my appreciation to the panelists for your great testimony. To follow up on Commissionar Fiedlar's quantion. Lappreciate

To follow up on Commissioner Fiedler's question, I appreciated, Mr. Lee, your last comment about this tension, and this political tension, noting that it's regional and geographic, not simply between long-term aspirations and short-term market realities, but also a tension between producing regions and energy-consuming regions, with the dislocation disproportionately affecting some of those producing regions -- a tension and a dislocation that will sound familiar, I think, to West Virginia. So, I appreciated your answer on that.

My question is, actually, about carbon capture and sequestration. Dr. Meidan and Dr. Davidson, you both touched on the deployment of carbon capture, suggesting that it will allow fossil fuels to continue to play a significant role in future energy shares and is built into their assumptions for future energy models. My question is, how far away are we from the sort of large-scale, commercial-level deployment of that technology of a size and scope that makes it appropriate and realistic to have it built into those future models, especially in light of some of the fits and starts and challenges that we've seen with similar projects in the technology here in the U.S.?

DR. DAVIDSON: Sure, I can start off here.

I don't think any government in the world has funded CCS to the level that's required to meet our long-term energy goals, based on what is assumed in many energy growth charts. Now there are energy scenarios that don't require any CCS, but, usually, a lot of CCS is built in countries that are heavily dependent on fossil resources to provide a firm balancing low-carbon generation.

China is, like other countries, not funding enough. But I feel like there is a potential opportunity here for us to learn from the Chinese experience because there are a significant amount of demonstration projects which are underway and which are qualitatively different than the several decades of smaller-scale CCS projects that have been undertaken elsewhere globally, which are primarily for enhanced oil recovery.

These new demonstration projects include, as I mentioned in my testimony, a postcapture combustion retrofit on a coal plant. So, if we think about what might need to happen to China's massive 1100-gigawatt coal fleet, some of that might require post-combustion capture retrofit technologies, and China has started demonstrating on those. They're still very costly, but there are some demonstrations. There also have been demonstrating projects with more pure streams of CO2, such as coming from industrial processes.

I don't think I can speculate on when we could have a very large-scale CO2 uptake from carbon capture. I do think that we need to deploy a lot more resources to this, if we expect to have it available by 2050, though.

DR. MEIDAN: If I could add onto that, I mean, I think the short answer is, no, nowhere near enough. I mean, as Michael said, there are some -- you know, the U.K. is working, and we may have a business model that emerges from the U.K. later this year, but, really, we are far from anywhere near the kind of scope and scale that we would need to.

In China, it's interesting that the regulatory framework doesn't seem to be there. The sort of legal, again, regulatory encouragements are far from being there. And historically, when I would have conversations about this with industrial actors in China, they used to say, I mean, look, China is more worried about air pollution than carbon reductions; and therefore, we haven't focused very aggressively on CCUS.

With the policy change since the 30-60 announcements, that has become a clear area that China would need to focus on. And in some of the assessments, CCUS does start to kick in sort of in the 2030s.

But the other thing that I have been told quite often is that, for China, the focus would be on sort of viewing carbon as a commodity, and sort of the focus would be on carbon capture utilization. Rather than the storage or the sequestration, it would be how to use this in innovative processes in their sort of circular economy.

It all remains to be seen, but I think, again, these are very interesting areas that would fit collaboration. Because, just as we have benefitted from integrated supply chains and working together to scale up renewables, there are other technologies that, by working together, we can scale up and commercialize faster.

COMMISSIONER GOODWIN: Thank you.

MR. LEE: Can I add one point to this? It is that, remember when you were debating the Build Back Better here in Congress, the projection was you would need about \$120 subsidy to get CCUS in the United States. And that was the Biden Administration's position. So, to put that in perspective, this is expensive.

And China is moving in the direction of really seriously exploring CCUS. But, until about five years ago, at least half the hierarchy did not support CCUS. Now they're beginning to think there's a good argument for it. But, just like us, they are still pretty slow in moving ahead because of the subsidies it's going to require in the beginning.

COMMISSIONER GOODWIN: To your point, do you think it's mostly skepticism about the technology or more financial concerns?

MR. LEE: Financial.

COMMISSIONER GOODWIN: Okay.

VICE CHAIR GLAS: Thank you so much.

Now, I'd like to recognize Commissioner Mann.

COMMISSIONER MANN: I'm going to pass on questions. I look forward to being there in person at the next hearing, but I'm here on a lousy phone line and will defer to the next questioner.

Thank you.

VICE CHAIR GLAS: No problem.

Commissioner Schriver?

COMMISSIONER SCHRIVER: Thank you, and thank you to all the witnesses for the excellent statements and contributing your expertise today.

I want to focus on a couple of the recommendations and ask for some further thoughts.

So, Mr. Lee, you're -- and I know we're going to have a panel later on U.S.-China competition and more of the bilateral aspects -- but one of your recommendations is support cooperation and coordination between the United States and China in these areas, which seemed so promising in 2014. So, my question is, what happened since 2014 that thwarted this? Is it a matter of the agenda itself and running into obstacles? Things got too hard? Is it the overall political climate and tension in the relationship? Because I think, depending on that answer,

fixing it and getting to your recommendation here has some implications.

MR. LEE: Well, I guess it does have implications. And it's based on my belief that, while there may be costs in terms of cooperation, I think that the benefits, since we both have a large stake in each one of our countries being able to meet our transition targets, I think the benefits outweigh the costs.

Why has it dropped off the radar screen? Well, you had four years of the previous administration that was not very supportive of climate and was not very supportive of continuing these discussions. As far as I know, in talking to Chinese officials, I have not heard that the U.S. was very involved and asked to be involved during that period.

I think when this administration, the present administration, came back, you almost had to start all over again. It became much more difficult because the two countries have become much more competitive than they were five years ago. And while there are people who want to have that, it's really difficult to have it high on the political agenda.

For example, the Glasgow communique between the United States and China that was released in November set up a commission to work jointly between China and the United States. It's my understanding that nobody has been appointed to it and there's been no discussion in either country on what they want to do with it.

And we're continuing to have sort of track two discussions with Chinese academics, but even those have been proven much more difficult than they used to be. We are still doing it because we believe very much in building and maintaining this bridge, but it has been, at times, somewhat disappointing.

COMMISSIONER SCHRIVER: I appreciate the answer. I am a bit concerned that there is going to be some ask or some price to pay in an area outside this area of climate and energy cooperation that the Chinese are going to insist upon as a trust-building measure to get us back to a more cooperative environment. But personal opinion.

Speaking of personal opinions, in one form or another, and in Dr. Davidson's case very explicitly, you talked about the need for greater transparency. That's, for somebody who's worked on military relations, transparency becomes one of these trigger words. I can produce documents from the mid-nineties and documents from last week where we said one of our goals is greater transparency with the Chinese military.

Now I don't know if this is analogous, because I don't have the expertise that you have in this area, but how tough a nut are we talking about to crack here? And are the Chinese incentivized to be more transparent? It just hasn't been sort of institutionalized through their bureaucracy? Or is this going to be a fight? Is there going to be a lot of resistance to this?

And I, of course, think about the Chinese complaints about the U.S. Embassy reporting on air quality. That's a minor part of the overall emissions and climate issues.

So, how difficult is this going to be, and what should we be, with greater specificity, trying to do here?

DR. DAVIDSON: Yes, thanks for the question.

What I interpreted was, how do we gain a better understanding into China's developments in its energy sector, its plans, institutions, governance, et cetera? I think those are really good questions.

I think it's imperative that we have a lot of Chinese language speakers that spend time in China, that understand how the Chinese system works, and that can fluently read the very cryptic Chinese government text, as well as generate their own networks within China to understand these developments.

I will note that there is a very robust community in China around energy policymaking through social media and other trade presses. And so, you see a lot of experts participating in that, including foreign experts. And there's a great amount of information there.

What I'm suggesting is that we need to enhance those; we need to continue, not shut us off from China, but we need to, actually, invest more in understanding China and creating more of these connections where people have the opportunity to learn from and create networks, so that we can have a better understanding into internal developments within China.

DR. MEIDAN: If I could add to that, I mean, I think there is a plethora of data coming out of China on its energy sector. We don't always understand what it exactly means. And so, collaboration through the IEA or through other mechanisms on unpacking that data is critical.

The Chinese government is also working -- I mean, part of the emissions trading system is to try to benchmark and understand and just gather data domestically. Now releasing that data to others is becoming increasingly difficult, but that's where some of these communities, the online communities exist, but also we need to build trust.

And to go back to the first question, I think there's the political climate between the U.S. and China has certainly not been conducive to collaboration, but people-to-people exchanges have slowed considerably, and that's COVID as well. I think that's one of the areas that we need to get back to quickly.

And part of the Glasgow mechanism, and other mechanisms, should involve very different levels of interactions -- central governments, provincial governments, scholars. We just need to get people in touch again.

VICE CHAIR GLAS: Thank you.

Commissioner Scissors?

COMMISSIONER SCISSORS: I have to start with an extremely snide remark that is not aimed at the witnesses, but it's aimed at everybody involved in this process. The idea that Xi Jinping has promised net zero in 2060 is one of the most ridiculous things I have ever heard anyone take seriously. Come on. He's not going to be there. It's 40 years from now. Do I need to go back 40 years and see what China looked like 40 years ago, and say, "Oh, well, we can make binding promises about 2060."? So, like, again, that's not aimed at the witnesses. It's aimed at this entire discussion.

But let's say, after he's dead, and he's judged 70 percent correct -- I don't know where I got that idea from -- this is one of the things in which he has judged correct, and China should strive for, you know, net zero in 2060.

Professor Davidson, the snide remark is not aimed at you. This question is. You pointed out -- correctly, in my view -- the extreme challenges to expanding wind and solar. The Chinese are pretty good at picking the easy fruit off of a tree in their policies. We have seen that for decades. And then, they struggle with the harder fruit, as is natural. They've done a lot, and they have much more to do.

In particular -- and I may have missed one -- I think they either need innovation in the actual wind and solar technology, so its land footprint is lower, or innovation in the grid, or innovation in storage, as was mentioned by Mr. Lee, and perhaps others. And these areas, to have this kind of breakthrough, the breakthrough necessary, most of these areas are dominated by the state, which is not innovative. I mean, State Grid is an incredibly powerful political company; it's not an innovative company, for example.

So, where do you think -- you identify the challenge -- where do you think the innovation is going to come from to try to make progress on this challenge? And I'm sorry if I

throw you with the 2060 argument. I don't care what Xi Jinping says about 2060. But let's say China, in 2040, is committed to a net zero target. Where is the innovation going to come from? Is it going to come from wind and solar generation itself? The grid? Storage? And please don't say, "All of them," because I'm asking a specific question about -- you know, we have to have a realistic path. Where is China most likely to be innovative, given the dominate role of the state?

Sorry, Professor Davidson, it's your -- yes, I got distracted by how angry I am at Xi Jinping.

(Laughter.)

It was your original observation which motivated the actual question about how much expansion in wind and solar is necessary and the feasibility of it.

DR. DAVIDSON: Yes, the challenges to deploy wind and solar at the scale needed by 2050-2060 are enormous. And that is not something that the Chinese state has to deal with so far. They've not had significant, for example, contestation around land, around transmission corridors, because these facilities have been mostly built in relatively less populated areas. Now they're going to have to face those conflicts, just as we face those conflicts here in this country.

I think that this is not necessarily a scope where technological innovation is going to solve. I don't think the land-use footprint is going to be dramatically reduced by some new technology. We know how much solar panels take up. We know what their efficiencies are. We know what the cost-effective way of deploying it is; the same with wind.

I think there are going to be some innovative opportunities to co-locate, for example, wind with agriculture and other mixed-use kind of arrangements. We've seen some floating solar panels. You know, there are different kinds of innovations. I think those will be mostly small.

I think it's just going to have more need for innovations in terms of the institutional and the market side. And as you pointed out, China has a difficult time dealing with very complex and advanced issues with grid and with integrating new technologies. I think the infrastructure build is not the problem. I think the problem is integrating it with existing infrastructure, and the institutions are required to deal with that. And as I mentioned before, I think that markets are going to be a key component of China to try to achieve that, not necessarily to get more private sector involvement, but to ensure that there is a cost-effective deployment of the existing technology.

COMMISSIONER SCISSORS: So, I just want to quickly summarize. What you think is the key innovation here would be market discipline on pricing? And if that's not right, complete it. But you're focused on the institutional side, and I'm understanding you to say market discipline on pricing.

DR. DAVIDSON: Market discipline in terms of the efficiency with which renewables are deployed and where they're deployed. I do think storage and all those other technologies which we still don't have a grapple with, the CCS, long-duration storage, all of those are technological innovations that we still need. And China and many other countries are trying to develop those technologies that will be deployed at a large scale, but we're talking about conventional, very mature technologies, wind and solar.

In that scope, I think what we're really talking about is how to incentivize the most costeffective deployment of these assets, given the fact that there's going to be some very clear tradeoffs in terms of where you deploy it, either in the less populated western areas or more populated eastern areas, close to demand centers or at the end of long transmission lines.

COMMISSIONER SCISSORS: Thank you.

VICE CHAIR GLAS: Commissioner Wessel?

COMMISSIONER WESSEL: Thank you. Thank you to our witnesses. Thank you to our two Chairs.

And I also want to commend the Chair for today's hearing, who is the former Executive Director of the BlueGreen Alliance and brings an enormous amount of knowledge and understanding on these issues, and appreciate her contribution of what is a critical issue for all of us.

I have a lot of questions. So, if there is a second round, please put me down.

But, first -- and I'm happy to have our witnesses respond in writing on this -- is, Mr. Lee, you mentioned that China was both a recipient as well as an investor in Russian energy assets. And I don't want to be totally distracted, although we all are, for good reason, with the situation in Ukraine. I'd welcome any knowledge from our witnesses on exactly what all those supply relationships are -- I know we're going to discuss this later -- but also what China is doing to assist Russia in the development of its energy sector from both just cash to products like line pipe, oil country tubular goods, et cetera. We need to understand how China is aiding and abetting Russia in its activities. So, that's really for responses in writing.

Dr. Meidan, I'd like to dive a little deeper into your comments on fossil fuels, which you indicate -- and again, correct me if I'm wrong -- that you see those declining dramatically in importance in the next 10 years. MIT has estimated that the use of internal combustion engines will still dramatically dominate the Chinese market well into the future. I'm looking at a headline here. By 2030, they say only 40 percent of the vehicles sold in China will be electric. There's a dramatic increase in ownership of cars in China, as its development level and income rises, and as you well know, a dramatic need for trucks and transmission, et cetera.

So, can you provide a little more knowledge for us in terms of fossil fuels used in the transportation sector and what your estimates are of the penetration and needs in that sector going into the next couple of decades?

DR. MEIDAN: Thank you for that question.

I mean, Chinese policies on substituting oil in the transportation sector have been quite aggressive. It is the largest EV market today. And we all have to bear in mind that, even though there are more cars on the roads in China, there are under 200 cars per 1,000 inhabitants in China. Compare that to Western countries, where anywhere from 500 to 700 cars per 1,000 inhabitants. And China's not going to reach those penetration numbers probably while it scales up electric vehicles.

I mean, most of the assessments do see oil demand in transport peaking in the mid-2020s. There are going to remain lots of ICE vehicles on the roads, but, gradually, EVs are going to displace them and ICE vehicles will be phased out. It's actually the use in the chemical sector that will continue to drive demand for oil through 2030 probably, but oil demand will peak in the early 2030s.

I think the other question is, what happens after it peaks? Does it flatline or does it start to drop? And we need to get to a position for global climate efforts that it starts to drop quite rapidly, rather than peak and slowly decline.

But the question of electric vehicles, then, goes back to the power sector, right? Do we have enough clean power to fuel those electric vehicles? Because if they are going to be fueled with coal, then we haven't done much to help. And then, of course, we get to the questions about lithium for the batteries and battery technologies, and the dominance and the availability of battery technologies, and how that is used.

But, certainly, oil in transport, and there's a lot of work on fuel cell vehicles and

hydrogen, of displacing oil with gas. And fuel efficiency standards in China are among the highest in the world.

So, I think there has been -- and again, it hasn't necessarily been for climate. It's for industrial policy. China has wanted to be ahead of the curve on its industrial policies, and I think it's made quite a significant leap in that respect. Oil is still dominant, but I think there are trajectories for oil demand to decline quite rapidly.

COMMISSIONER WESSEL: Thank you.

And, Madam Chair, if there is another round, I'd welcome the opportunity. Thank you. VICE CHAIR GLAS: Thank you, Commissioner Wessel. There will definitely be another round.

But I want to recognize Commissioner Wong.

CHAIRMAN WONG: Thank you.

Dr. Davidson, you mentioned briefly in your written testimony the role of nuclear energy in China's policy. I want to delve into that a little bit more.

My understanding is that nuclear power constitutes a pretty small sliver of China's current energy output, but that, in absolute terms in the past 20 years, it's probably increased by 2,000 percent, roughly. In addition to that, I know that China has been taking measures in recent years to perhaps stockpile and ensure its uranium import relationships. In addition, I understand that the export of nuclear technology and the building of nuclear generators is a significant component of China's export strategy and its One Belt One Road strategy.

So, my question going to you is, what role is nuclear playing in China's domestic energy planning? And in addition to that, how dependent is that technology in China on foreign imports, foreign cooperation, commercial relationships with foreign companies, nuclear cooperation agreements with countries like us? I'm just trying to delve into how China sees the nuclear piece here.

Thank you.

DR. DAVIDSON: Yes. Thanks for the question. I'll do my best here.

So, first off, as you note, nuclear constitutes a fairly small fraction of China's total clean energy, but it is growing and it does constitute, I'd say, a moderate component of China's long-term energy strategy. Most energy planning models for mid-century, for example, will show around 200-250 gigawatts of nuclear power installed around mid-century. This is based on the assumption that China's going to continue to build nuclear fleets only on the coastal areas. Inland plants were put on hold following the Fukushima disaster, and there have been other safety cost improvements made as a result of that which have slowed down, but not deterred, China's long-term nuclear ambitions.

In terms of the foreign dependence, as I mentioned in the written testimony, China has designs from many countries globally, and including indigenizing its own designs, which it's now marketing for export.

I think it's actually in the very strong interest of countries such as the U.S. and others to maintain very close connections and cooperation with China on a safe nuclear fuel cycle. This is absolutely imperative for nonproliferation reasons, as well as to ensure that there are no serious nuclear accidents, such as Fukushima, that could generate further problems with developing nuclear.

So, I think there's a strong need to maintain those relationships, and it's a need to maintain those relationships such that we can have a good visibility into what's happening within the Chinese nuclear fuel cycle.

VICE CHAIR GLAS: Thank you so much.

I think there is interest to have a second round of questions. And I just want to list off the Commissioners: Commissioner Wessel, Commissioner Scissors, Commissioner Goodwin. Is there any other Commissioners? Okay, and I also have a second round of questions.

A couple of things, Mr. Lee. In your recommendations to Congress, you, essentially, are making two recommendations -- well, a few recommendations. But one is related to research and development and what the U.S. Congress should do to fuel more research and development for clean energy technologies here in the United States.

Can you elaborate on that a little bit more? And what other measures do you think the United States Government should take to increase our domestic competitiveness, as, obviously, China is winning the race in the clean energy technology, regardless of they're the largest emitter in the world on carbon emissions?

And the other thing that was mentioned in a few testimonies here today, but with you, Mr. Lee, is the great economic and political difficulty of transitioning from the fossil fuel industry in China's economy, given the concentration of these industries in certain provinces and the job dislocation. Is there anything that we can learn from how, or any practices, based on your analysis, of how workers have transitioned in China? Has there been any path?

And as you know, Congress has long debated -- and I think this is a real sticking point related to clean energy here in the United States -- is, oftentimes, our fossil fuel industry has better paying jobs and more economic security in areas of the country that need it. So, are there any lessons to be learned whatsoever related to China's transition for workers?

MR. LEE: Well, I think let me start with the second, and then, I'll go to the first.

It is that this is a very difficult transition for every country. You've got to remember that we started being worried about climate around 1990. And 30 years later, we went from 80 percent dependent as a world on fossil fuels to 78 percent dependent on fossil fuels. So, by that test, this is not so easy.

What China is trying to do right now -- and I don't think it will be very successful -- but they are trying to say, well, those people who work for smaller firms or middle-sized firms, those firms do not have the ability to help the transition.

Remember, in China, it's not the government per se. It is, basically, these companies, which are mostly state-owned, that provide for sort of the life of a person. They provide the pensions and they provide the training, and in some cases they provide the housing. And a lot of these smaller can't do it for this transition.

So, what they're trying to incentivize is for a lot of these companies to merge. So, you have, for example, the largest coal company merge with one of the larger power companies. I think that will be a small increment, but, eventually, because so many of these are in places like Shaanxi province, Inner Mongolia, they're going to have to make a much bigger effort to deal with a safety net and to have a program that deals with not only retraining, and I don't mean retraining from, oh, we're training for renewables if you did fossil fuels, but retaining broadly, because not everybody who does fossil fuels is ideal for a renewable industry.

So, anyway, this transition is hard. We all can learn from it. We're all struggling with it. And China I think is going to be particularly because they don't have the safety nets that you have in the United States.

In terms of the R&D, this is an issue we've been hammering on up at Harvard for literally 25 years, where the United States has a couple of times been able to put a significant amount of money in R&D, but it's usually within two years it falls off. And usually, it comes at a

time in which we're trying to stimulate the economy because we're in a recession.

I think there has to be a concerted effort, in the same way that China is now putting money into a concerted effort, to develop the innovative portfolio of new technologies. Because if you ask how we're going to deal with the climate problem, I don't think you're going to just deal with it by pricing it. Pricing I think is important, but I think you also need to develop a new portfolio of commercially competitive technologies, and you're only going to do that if you begin to invest in this. And we have the capacity in this country to do that, but we do need a stronger financial base for it.

VICE CHAIR GLAS: Thank you.

DR. MEIDAN: Can I jump in on that question, please?

VICE CHAIR GLAS: Yes.

DR. MEIDAN: I think we have to be a little bit careful or define well what we mean by winning the race. China does a lot of the midstream processing of the lithium-ion battery, of rare earths. Those are energy-intensive and quite polluting processes that I'm not convinced that Western countries or that the U.S. would necessarily want to undertake in the U.S. or would be able to do competitively.

And we don't necessarily have time to recreate supply chains. So, some we need more of, and we need them to be sort of local, but not all of them. So, I think we need to study the supply chains and to have a close look at which technologies and which parts of those supply chains for new materials we need to compete on constructively, and in which we just need to use globalization to the best advantage and scale up.

And perhaps the other issue is to focus on the standard-setting and the origination, I guess, of ideas, rather than on the manufacturing specifically.

VICE CHAIR GLAS: Thank you.

I'm going to go to Commissioner Scissors, and then, Mr. Wessel, and then, Commissioner Goodwin.

COMMISSIONER SCISSORS: Thanks.

In our briefing book, Mr. Lee's testimony was first. And early on, he said, "local officials can meet their targets by growing a local economy at ever faster rates," referring to carbon intensity. And, you know, of course, the first thought that pops into my head is they can even more easily meet their targets with carbon intensity by lying about growth rates. And, you know, that's a pretty common practice already, and now, we've given them another incentive to do so.

So, I have a question about data quality. And I'll start with you, Dr. Meidan. You said in your written testimony, and in your oral testimony, that reporting emissions along the U.S. energy supply chain to China would be useful. I agree with that.

I want to ask you -- and then, if possible, the other panelists -- where is our biggest information gap? And I want to encourage you to be as specific as possible -- not everything, not emissions totals -- but where do you think the most damaging information gap is in your work? You don't have to think about all of U.S. energy policy. So, where in your work, where you're trying to improve global climate performance, do you think we're missing the most important piece of information from the Chinese or from U.S.-China relations?

And, Dr. Meidan, I'll start with you, please.

DR. MEIDAN: Thank you.

I think upstream emissions, right, just getting a handle, throughout the supply chain, upstream/downstream of processing and refining in chemicals, transport. Every company has to

be responsible for trying to estimate emissions, and not through accounting firms. We need sort of technical people to go -- obviously, there's kind of nameplate capacity and there's sort of standard capacity, and therefore, emissions that are baked into, I guess, your users' guide. But we actually, I think, need people on the ground to go and assess the emissions, to keep it simple, again, upstream, midstream, downstream transport.

COMMISSIONER SCISSORS: Thank you.

Mr. Lee?

MR. LEE: I guess I would say, even within China, if you're an agency within China, you have an information problem because you can't get it from the other agencies.

I think some of the areas that I would say was financial. The development banks, you cannot get information out of them. It's really hard to penetrate. When I spent time with the Asian Infrastructure Bank, which is a multilateral bank, they could not get information out of the China Development Bank.

And the second one is local. It just doesn't exist in many cases, and China itself has to do a much better job of collecting local emission data.

And so, I think that those would be my two areas.

COMMISSIONER SCISSORS: Thank you.

Any thoughts, Professor Davidson?

DR. DAVIDSON: In the interest of answering the highly specific question, I think methane emissions. I think there is a significant gap in our knowledge of what the level of methane leakage is in China's natural gas infrastructure, as well as from coal mines. This was a focus of the U.S.-China statement in Glasgow, which, to me, recognizes that it's maybe less sensitive of an area compared to other parts of the relationship. So, there might be some opportunities for joint exploration; doing more exploration of technologies for methane leakage and control.

I think this is quite important and is relatively understudied because you could have a situation where China shifts from coal to gas for air pollution reasons, but also, nominally, climate reasons, but, due to methane leakage, it could actually be worse than some coal plant, mine mouth plants, for example. So, I think it's really important for us to have a good handle on that.

MR. LEE: Can I add to that one thing? I think it's important. It is that we're about to embark on a new technology using satellites to detect methane emissions. And these satellites are incredibly accurate and they will be released in the next two years into space. And we'll have the ability to do a much better job on tracking methane everywhere in the world.

COMMISSIONER SCISSORS: I'm sure China will very much appreciate --MR. LEE: I'm sure.

COMMISSIONER SCISSORS: -- the very accurate U.S. satellites tracking their methane emissions and you know probably nothing else. No Lappreciate that answer an

methane emissions, and, you know, probably nothing else. No, I appreciate that answer and everyone's answer.

Thank you. I yield back.

VICE CHAIR GLAS: Thank you.

Commissioner Wessel?

COMMISSIONER WESSEL: I thank you all. This is very illuminating and there are still a lot of questions.

Dr. Davidson, I believe you're the one who talked about market efficiency, and I want to follow up because I always get confused when somebody says "market efficiency" with regard to

China; that's a non-market economy. I don't know how that analysis sort of squares.

So, for each of the witnesses, can you -- and going back to Mr. Lee's first comments about climate taking a second seat to energy security -- can you help me on the structure of the market, whether market signals will ever really drive China's policies? High-tech industries need very stable sources of supply; can't rely on renewables; need either storage, nuclear, or the provision of some other kinds of secure and stable supplies.

Is there two-tiered energy pricing in the market, with preferred users still getting lower prices? And do you know what the subsidy value of that is? Help me on whether there is ever a chance for China to have a market-based energy development transmission and utilization system.

Dr. Meidan, do you want to start?

DR. MEIDAN: Sorry, I thought it was for Dr. Davidson.

(Laughter.)

COMMISSIONER WESSEL: Let's let Dr. Davidson start, then you. Again, it's really about the question of whether there is ever going to be a market-based approach for energy utilization in China. It seems to me, with the SOEs, with governmental policy focused on energy security and economic growth, that non-market factors are always going to be dominant in terms of their markets.

DR. DAVIDSON: Sure, I can kick us off here. I think this is a very interesting and difficult topic.

So, I guess, first off, I will note that China already sells greater than 40 percent of its electricity through markets, and this is up a few percent prior to the current reform round in 2015. So, greater than 40 percent.

Now not all of those markets are perfectly competitive. There are all sorts of design issues in those markets, as there are with electricity markets everywhere. But, nevertheless, it shows that there is a pretty substantial shift away from the former exclusively governmentdirected planning allocation and price-setting mechanism to a mixed market now, where you still have production and allocation plans with benchmarked prices, et cetera, and you have a lot of markets, mostly bilateral contracts, but also some exchanges.

And the second thing I would note here is that Chinese actors are very rational. So, given the sets of incentives, they tend to behave as we expect them to be. So, for example, many of the provincial-level electricity market designs are designed in a way that just does not engender a very competitive, efficient single energy market. And that's largely because the local governments control this process. They capture this process. They want to distort the market designs to favor particular interest groups or to create protectionist barriers.

But when you set up those incentives, the actors go out and they behave in them in a somewhat rational way. So, there is some very interesting bidding behavior that I've analyzed around the Yunnan electricity market, for example, where you see some very rational actors facing a set of very irrational incentives in a fairly straightforward way. And that, in some sense, gives me hope that, if there are efficient market signals put in place, so the correct institutions put in place, that market actors will behave in a way that makes sense.

Now, having said that, the state ownership is a very clear barrier to this if it is too concentrated. So, we've seen some consolidation taking place, for example, in the northwest, where the central government has aimed to consolidate a lot of capacity into individual provinces. Now, if you do that, you will, of course, run into immediately concerns around market power. That is, I think, a dissonance that is not fully appreciated at the moment in Beijing, and how you can create a very competitive market when you have that level of concentration, which you can't, right? And so, you need to find ways of generating, of kind of de-consolidating, de-concentrating at the level of the size of the market that you're thinking about.

COMMISSIONER WESSEL: Just a quick follow-up. Is the provision of energy being used as competitive advantage or a tool by various provinces? Again, semiconductors and a number of other industries need very stable, secure supplies. Is that being used as a siting and development tool?

DR. DAVIDSON: The classic example here is aluminum --

COMMISSIONER WESSEL: Yes.

DR. DAVIDSON: -- where aluminum is very energy-intensive. Greater than half of its input costs come from electricity. And you have provinces with very low-cost surplus energy, like Yunnan, like Inner Mongolia, that have created preferential tariffs for industry to relocate there.

Those tariffs are now formally illegal in China, as of last year, as they're trying to move towards more competitive markets that don't give preference to energy-intensive industry. Now that doesn't mean that those practices don't still exist, but there is this historical legacy of siting plants, these energy-intensive plants, in these locations due to local government preferential tariffs.

COMMISSIONER WESSEL: Thank you.

Any other witnesses with comments?

MR. LEE: Yes, I'll make one.

Those are really excellent questions that you've posed, and that debate goes on in China all the time. And the NDRC has been taking sort of we need more markets and more reliance on markets. And these big, state-owned companies have said you need more focus on energy security, and if you reduce our role, you will end up reducing your security.

And that debate, I have seen this for 15 years in China, and I think I'll probably see it for the next 15 years. So, you have touched on really one of the core issues and the core debates within the Chinese government at the moment.

DR. MEIDAN: And perhaps sort of a seeming contradiction, because, as Michael suggested and talked about, there are markets that operate sort of at the local level. There are price assessments. There is rational -- well, behavior that is based on the movement of those prices locally.

And the government has said that it wants the market to play a decisive role in the economy, and yet, I think they still have a limited role. Yes, they can help deal with some overcapacity and some inefficiencies, but, fundamentally, I think the government still wants to determine outcomes. And it wants to determine them effectively rather than in an economically efficient manner most of the time.

So, we can, and I think we will, see more experiments with market mechanisms, but, unless and until we get more fundamental change in the institutional makeup of the energy governance in China, markets are going to play a secondary role that meets government's broader targets.

COMMISSIONER WESSEL: Thank you.

VICE CHAIR GLAS: Commissioner Goodwin?

COMMISSIONER GOODWIN: Thank you.

I want to follow Commissioner Scissors' lead and indulge in a little cynicism or skepticism about Xi's climate commitments here, but maybe come at it from a little different

direction.

I think, to Commissioner Scissors' points, we have pretty good reason to question the reliability of international commitments made by China, and certainly, to question the data that they may provide to demonstrate meeting such international commitments.

But I want to indulge the cynicism in the other direction, which is not whether they will meet these commitments, and they don't necessarily care, but whether they're too easy. Is it the case that they feel fairly confident that they could meet these, and are the targets insufficient? Could they do more, not simply in terms of their policies and efforts to implement those policies to meet the targets, but are the targets themselves insufficient?

DR. MEIDAN: Could I try a first answer at that?

COMMISSIONER GOODWIN: Sure.

DR. MEIDAN: I think, when we look at it historically, China has met the international climate commitments. And I think it's a fair point, could they be doing more potentially? Yes, they could potentially have more aggressive targets.

And we have to think that they're going from 80 percent fossil fuels to 80 percent nonfossil fuels in 40 years. And beyond that, it is about the restructuring of the political economy, right? We think about the energy transition as coal, and heavy industry has to lose. These are the sectors that ultimately lose in China because they are state-dominated, and we should have seen that the state doesn't lose. So, I think there's sort of a fundamental issue there.

And, yes, the targets could be more aggressive. If we get to even those targets, we're already in good standing. We're already sort of starting a good process.

But I would temper your skepticism a little bit. As I mentioned earlier, I don't think the 30-60 targets are a climate awakening or the benevolence of Xi Jinping for the greater good. I think there is a real urgency in China to rebalance the economic structure, to make the industry fit for purpose in a carbon-conscious world, because, otherwise, Chinese industry will lose out.

And that is the legacy and the heritage of Xi Jinping and the Chinese Communist Party. I think there are, again, these issues of energy security and food security that mean that, for China, the energy transition is, obviously, an opportunity, like Build Back Better is an opportunity, but it is also, potentially, a threat for China's role in global supply chains. And therefore, I think they recognize that they need to embark on this transition for their own good. And I think this is where we should generate more global momentum and try and push and accelerate that process.

MR. LEE: I guess I would add that, one of the things that they worry a lot about in China is this whole ability to somehow control the pace of the transition; that we will be able to only have so much unemployment one year versus the next year, versus the next year. And they feel that, if you went to a total market system, that they wouldn't be able to control it; they would have large unemployment, large short-term dislocations. And that fear that that would happen is a very dominant concern within the Party.

And so, they're trying very much to do -- that's what Belt and Road is mostly about. It's finding an outlet for the cement industry, the steel industry, for the workers, so they haven't lost their jobs back in China. But, if you go through these Chinese cities, they all have one or two huge plants; employ, either directly or indirectly, thousands of people. Some of these plants are 30-40 years old, and it's about time they moved on. But they are very fearful of moving too fast.

So, when you set the goal, for example, 2030, it's my understanding that the studies show they could have done that in 2025, but they wanted that extra five years to control the pace and control the dislocations.

COMMISSIONER GOODWIN: Thank you.

DR. DAVIDSON: I will say just that, in terms of the easy 2030, yes, I think it's doable. I think China could go more aggressive, but I don't think, politically, has any incentive to strengthen its international climate commitments, because there was not much pressure up until just this past year to do so.

I think the 1200-gigawatt wind and solar target by 2030 is very easy. They're on track to meet that many years early.

I think the 2060 target, by contrast, is not easy. I think that is going to take enormous reshaping of China's energy structure, particularly given how much dependent it is on coal and how it's going to, essentially, be relying on coal as a bridge to this low-carbon future, as opposed to relying on a massive coal-to-gas transition first, and then, bridge towards low-carbon sources, for example, as we have been doing here in the U.S.

VICE CHAIR GLAS: Thank you so much to our esteemed panelists here. I want to spend a moment and recognize Dr. Meidan, Dr. Davidson, and Mr. Lee for coming before the Commission today on this very timely topic.

For Commissioners, we are going to promptly reconvene right at 11:35. We have witnesses that are here and ready to go. So, I would ask for everyone to take a short break, and those who are joining virtually, join a couple minutes early.

Thank you.

(Whereupon, the above-entitled matter went off the record at 11:23 a.m. and resumed at 11:35 a.m.)

PANEL II INTRODUCTION BY VICE CHAIR KIMBERLY GLAS

VICE CHAIR GLAS: First, I want to thank our esteemed panelists virtually and in person here today to talk about one of the most critical issues facing the global economy. And obviously, there is a lot of interest with the international discussions on the world stage right now with respect to Russia and the Ukraine situation.

Our panel will examine China's external energy policies.

First, we'll hear from Ms. Emily Meierding. Am I pronouncing --

DR. MEIERDING: Meierding.

VICE CHAIR GLAS: -- Meierding -- Assistant Director in the Department of National Security Affairs at the Naval Postgraduate School. Dr. Meierding will address China's energy security and foreign policy. Her research focuses on international disputes over energy resources, the political stability of petrostates, energy sanctions, and great power competition for international influence.

Next, we will hear from Mr. Edward Chow, a Senior Associate in the Energy Security and Climate Change Program at the Center for Strategic and International Studies. Mr. Chow will speak to China's energy relationship with Russia, one of its key supplier of oil and gas. He previously worked at the Chevron Corporation for over 20 years, including as Country Manager in China and as head of International External Affairs.

Finally, we will hear from Mr. Gabriel Collins, the Baker Botts Fellow in Energy and Environmental Regulatory Affairs at Rice University's Baker Institute. Mr. Collins will address China's energy procurement infrastructure and military capability to ensure its energy security. Mr. Collins previously worked in the Department of Defense as a China analyst and, also, worked as a private sector global commodity researcher.

Thank you all so much for your testimony, and the written testimony was extremely well done and well thought-through. And I just want to thank you for being key experts before the Commission this year on such a timely topic.

I'd like to remind you to keep your remarks to seven minutes.

Dr. Meierding, we'll begin with you.

OPENING STATEMENT OF EMILY MEIERDING, ASSISTANT PROFESSOR, NAVAL POSTGRADUATE SCHOOL

DR. MEIERDING: Well, thank you, Members and Staff of the Commission, for inviting me to testify today. It's an honor and a pleasure to be here.

In my opening remarks, I'll speak briefly about China's overseas efforts to strengthen its energy security, highlighting some of the core takeaways from my written testimony. These remarks are my own. They don't represent the views of the U.S. Navy or the U.S. Department of Defense.

My remarks focus on oil resources, because oil imports are China's greatest energy vulnerability. China depends on oil imports for more than 70 percent of its oil consumption, and this figure has been rising over the last 15 years -- from 50 percent in 2007 to 72 percent in 2021.

Since 2018, Chinese oil companies have intensified efforts to expand their country's domestic oil production. However, these initiatives are unlikely to significantly reduce China's dependence on oil imports.

Recognizing this vulnerability, over the last quarter century, the Chinese government has employed an all-of-the-above approach to strengthening the country's oil security. In addition to attempting to increase domestic production, these measures include:

Raising fuel efficiency standards; increasing the use of alternative fuel vehicles; stockpiling oil resources; investing in other countries' oil industries, often in projects that generate equity oil that can be shipped back to China; issuing loans for oil that are repaid in petroleum deliveries; building relationships with oil suppliers; diversifying oil suppliers; diversifying oil trade routes by building pipelines and developing alternative sea routes; constructing a domestic tanker fleet; adopting alternative means of paying for oil, including yuan-denominated purchases and barter-based transactions, and developing an alternative financial messaging system.

China's efforts to secure its access to foreign oil supplies are often viewed with suspicion by outside observers. However, many of these activities are completely normal. Managing domestic energy demand, securing access to foreign oil supplies, and even diversifying trade routes are standard practices for many energy-importing states or for oil companies.

The scale of some of China's activities -- for example, its loans for oil -- is exceptional. However, these are still quantitative, rather than qualitative, differences.

Additionally, it's notable that Chinese national oil companies' investment decisions, as well as their choices about where to direct the resources that they receive as repayments for loans for oil or as equity oil, have been driven primarily by commercial interests, not geopolitical concerns.

Some of China's strategies for securing access to oil are uncommon: constructing a domestic tanker fleet, for example, or de-dollarizing oil transactions, and developing an alternative financial messaging system. However, these activities are also rational for a country that is extremely dependent on oil imports with a regime that depends on robust economic growth and believes it could be targeted by U.S. sanctions.

As a result, it would be a mistake to interpret China's unusual energy activities as a sign of malign intent. They are hedging strategies adopted by a vulnerable state.

China's most problematic international energy activities, from a U.S. foreign policy

standpoint, are its oil-related engagements with countries under U.S. sanctions; specifically, its oil purchases and energy-related investments in Venezuela, Russia, and Iran.

For Chinese actors, U.S. and multilateral sanctions are an opportunity. Chinese refineries and trading firms can purchase sanctioned oil producers' resources at discounted prices. China's national oil companies, investment funds, and sovereign wealth funds can invest in sanctioned countries' oil projects without international competition. These actors' willingness to engage with a sanctioned country's government, when other countries will not, may also buy political goodwill over the long run.

From the United States' perspective, these Chinese engagements could be significant impediments to foreign policy goals. China appears to be throwing Venezuela, Iran, and Russia an economic lifeline, which could undermine the effectiveness of U.S. and multilateral sanctions. As a result, the instinct may be to tighten enforcement on existing sanctions or expand secondary sanctions against actors that engage with targeted countries.

That being said, there are at least three reasons to hesitate before taking this response.

First, historical cases suggest that impeding an oil-importing country's access to foreign petroleum resources is read as a very hostile action, since it endangers the country's national military and economic security. That interpretation is particularly likely in this case, given intensifying Sino-American competition and because, from Beijing's perspective, it's not doing anything illegal by continuing to engage with sanctioned countries.

Second, given this potential for provocation, the United States should be fairly certain that blocking China's oil-related engagements will actually achieve the desired results. That is, it will compel the targeted countries to change their behaviors to align with U.S. preferences. However, given sanctions' uneven track record, it's unclear whether that would happen. If it doesn't, the United States will have antagonized China without achieving the goals of its sanctions campaigns.

Third, the more the United States pushes China on this issue, the stronger Beijing's incentives to find ways to circumvent U.S. and multilateral energy sanctions. In particular, Chinese actors are likely to intensify their efforts to develop means of paying for oil that don't depend on access to the U.S. financial system. This will include denominating oil transactions in currencies other than dollars, and probably other than euro, to reduce China's vulnerability to European sanctions. This will also include the accelerated development of China's cross-border interbank payment system, as an alternative to the SWIFT financial messaging service.

There are substantial obstacles to these shifts, including the limits that the Chinese government has imposed on the yuan's internationalization and most oil producers' preference for continuing to sell their resources in dollars. Nonetheless, the more the United States pushes, the stronger China's incentives to find ways to overcome these obstacles.

The result could be a network of petro-pariahs -- major oil importers and exporters targeted by the United States that create a parallel energy trading system that isn't vulnerable to U.S. sanctions. If that occurs, the United States will lose an important source of international leverage and strengthen the ties between our adversaries and competitors.

Thank you very much.

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March 17, 2022

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Testimony before the U.S.-China Economic and Security Review Commission

Hearing on China's Energy Plans and Practices Panel II: China's External Energy Policies

China's Overseas Efforts to Strengthen Energy Security

Since becoming a net oil importer in 1993, China has taken numerous steps to enhance its energy security. These initiatives have primarily targeted the state's rising dependence on oil imports. Based on data from the International Energy Agency (IEA), China's oil import dependence has risen steadily over time, from less than 50% in 2007 to 72.5% in 2019.¹ The state reports that its import dependence was 73.6% in 2020 and 72% in 2021.² Even with last year's decline, which was likely exceptional, China is still estimated to import more than 10 million barrels per day (MMbpd) of oil.³ It replaced the United States as the world's leading crude oil importer in 2017.⁴

Oil still constitutes less than 20% of China's energy consumption: a smaller share than in OECD countries.⁵ However, oil is critically important to the state's military performance and transportation sector. Until recently, oil has also been non-substitutable as a transportation fuel. For these reasons, China's leading energy security concerns focus on stable access to oil supplies.

In the early 2000s, as the price of oil rose and expectations of "peak oil" intensified, one of China's leading energy security concerns was access to increasingly scarce oil resources. This concern has diminished since the United States' "shale revolution" dramatically increased U.S. oil and gas output, reducing its competition with China for energy imports. In contrast, the

¹ "Oil, gas and coal import dependency in China, 2007–2019," International Energy Agency (IEA) (last updated December 18, 2020), <u>https://www.iea.org/data-and-statistics/charts/oil-gas-and-coal-import-dependency-in-china-2007-2019</u>.

^{2007-2019.} ² Zheng Xin, "China's oil dependence on imports sees drop," *China Daily* (February 24, 2022), https://www.chinadaily.com.cn/a/202202/24/WS6216e135a310cdd39bc889be.html.

³ "Covid-Zero policies and pollution curbs stunt China's oil demand," *Bloomberg* (December 14, 2021), <u>https://www.bloomberg.com/news/articles/2021-12-14/china-s-oil-demand-hemmed-in-by-virus-pollution-and-probes</u>. The decline in 2021 was caused by Chinese companies choosing to draw down their stocks rather than maintain previous purchase levels, in response to rising oil prices. Chen Aizhu, "China's annual crude oil imports drop for first time in 20 years," Reuters (January 13, 2022), <u>https://www.reuters.com/markets/commodities/chinas-crude-oil-imports-post-first-annual-drop-20-years-2022-01-14/</u>.

 ⁴ U.S. Energy Information Administration (EIA), "China surpassed the United States as the world's largest crude oil importer in 2017," Today in Energy (December 31, 2018), <u>https://www.eia.gov/todayinenergy/detail.php?id=37821</u>.
⁵ Based on author's calculations from IEA data, oil's share of China's primary energy consumption was 19.1% on 2019. Based on EIA data, it was 18.4% in 2019.

security of oil transportation from oil-producing states to China has remained a persistent, leading Chinese energy security concern. An intensifying energy security concern, over the last decade, has been China's ability to process oil-related financial transactions, in light of the United States' increasing use of sanctions as a foreign policy tool.

Secondary Chinese oil security concerns include high oil prices, inadvertent supply shutoffs caused by political instability or infrastructure attacks in its major supplier states, and deliberate, multilateral embargos by supplier states. Deliberate, unilateral embargos by a single supplier are a tertiary concern, unless they are enacted by one of China's leading suppliers and the oil market is tight.

Over the last two decades, China has pursued numerous strategies to moderate these oil security concerns. From the late 1990s to early 2010s, these efforts focused on securing access to overseas resources through upstream investments that produced "equity oil" and the use of "loans-for-oil." Additionally, China attempted to diversify its oil suppliers and energy transportation routes, and built up a domestic tanker fleet. Since the mid-2010s, China's approach to energy security has become more market-oriented, in response to the new oil abundance created by the U.S. shale revolution, domestic pressures on China's national oil companies (NOCs), and revealed shortcomings in China's original energy security strategies.

The initiation of the U.S.–China trade war in 2018 stalled this transition somewhat by underscoring the risks of relying on markets for access to strategic resources and technology. Recent international sanctions against Russia for its invasion of Ukraine have also underscored the risks to China's energy-related financial transactions, an area in which the state has made limited progress towards enhancing its oil security. That being said, China's peacetime oil security is currently high and the state has substantially reduced many threats to its wartime oil access.

Strategies for enhancing oil security

Over the last quarter-century, China has pursued a comprehensive approach to strengthening its oil security. Its strategies can be grouped into four categories: those focused on supply, demand, transportation, and financial transactions.

Demand

China has attempted to moderate its demand for oil in the transportation sector through efficiency gains and fuel substitution. The state has implemented high fuel efficiency standards for gasoline and diesel-fueled vehicles, although their efficacy in terms of reducing overall growth in China's oil consumption has been counteracted by the increased popularity of SUVs and pick-up trucks.⁶ The use of alternative fuel vehicles ("electric vehicles, compressed natural gas vehicles, and trucks and trains running on liquefied natural gas") is also rising rapidly.⁷ Between 2020 and 2021, China's electric car sales almost tripled, to 3.4 million. In December

⁶ IEA, "Fuel economy in China" (December 13, 2021), <u>https://www.iea.org/articles/fuel-economy-in-china</u>. ⁷ EIA, "Country analysis executive summary: China" (last updated September 30, 2020), <u>https://www.eia.gov/international/analysis/country/CHN</u>.
2020, they comprised 20% of the country's overall car market.⁸ This shift is enhancing China's energy security by increasing the substitutability of transportation fuels.

Supply

China has attempted to secure its access to oil supplies through domestic resource development, stockpiling, investments in other countries' oil industries, loans-for-oil, and diversification of oil suppliers.

In the realm of domestic production, although China remains the world's sixth largest crude oil producer, its output peaked in 2015.⁹ In July 2018, as the U.S.–China trade war intensified, President Xi instructed China's NOCs to increase their investment in domestic exploration and production in order to boost China's oil output and reduce the country's oil import dependence.¹⁰ The government also attempted to revive domestic production by loosening restrictions on foreign and private investment in the upstream oil industry in 2020.¹¹ These policy shifts contributed to small domestic production increases in 2019–2020.¹² However, analysts are skeptical of China's ability to significantly boost domestic output over the long term, especially if oil prices fall.¹³ As the U.S. Energy Information Administration (EIA) notes, "most of the country's production comes from legacy fields that require expensive enhanced oil recovery techniques."¹⁴ Development of China's tight oil resources has also been stymied by these projects' complexity and costs.¹⁵

China's efforts to stockpile oil resources have been more successful. Although the state does not systematically release data on its holdings, the market intelligence firm Kayrros estimates that China held 950 million barrels of crude oil in government and commercial inventories in early 2022.¹⁶ Other estimates are similar, suggesting that China currently exceeds the IEA's

¹⁴ EIA, "Country Analysis: China."

⁸ Leonardo Paoli and Timur Gül, "Electric cars fend off supply challenges to more than double global sales," IEA (January 30, 2022), <u>https://www.iea.org/commentaries/electric-cars-fend-off-supply-challenges-to-more-than-double-global-sales</u>.

⁹ Based on data from the EIA, IEA and the BP Statistical Review of World Energy (2021).

¹⁰ Erica Downs, "High anxiety: the trade war and China's oil and gas supply security," Columbia SIPA, (November 2019), <u>https://www.energypolicy.columbia.edu/research/commentary/high-anxiety-trade-war-and-china-s-oil-and-gas-supply-security</u>.

¹¹ Kunfeng Zhu and Nick Sharma, "China further opens oil and gas upstream to foreign investors: how much impact can we expect?" IHS Markit (April 24, 2020), <u>https://ihsmarkit.com/research-analysis/china-further-opens-oil-and-gas-upstream-to-foreign-investors.html</u>.

¹² Based on data from the BP Statistical Review of World Energy (2021).

¹³ Downs, "High Anxiety"; Zhe (Sheryl) Ruan, "The Chinese majors' responses to the collapse in global oil prices and the COVID-19 pandemic: an upstream perspective," Oxford Institute for Energy Studies (OIES) Energy Insight 79 (November 2020), <u>https://www.oxfordenergy.org/publications/the-chinese-majors-responses-to-the-collapse-in-</u> global-oil-prices-and-the-covid-19-pandemic-an-upstream-perspective/.

¹⁵ Chen Aizhu, "PetroChina's Gulong shale project may bolster China's oil output," Reuters (September 30, 2021), <u>https://www.reuters.com/business/energy/petrochinas-gulong-shale-project-may-bolster-chinas-oil-output-2021-09-</u> <u>30/</u>; Wood Mackenzie, "Shale oil in China: the long journey ahead" (December 16, 2019), <u>https://www.woodmac.com/news/opinion/shale-oil-in-china-the-long-journey-ahead/</u>.

¹⁶ Chen Aizhu and Dmitry Zhadannikov, "China boosts oil reserves, ignoring U.S. push for global release," Reuters (February 27, 2022), <u>https://www.reuters.com/business/energy/exclusive-china-boosts-oil-reserves-ignoring-us-push-global-release-2022-02-25/</u>.

recommended target of 90 days of import coverage.¹⁷ The state's first auction of supplies from its strategic petroleum reserve (SPR), in September 2021, also indicates that it perceives its current reserves as sufficient and that it is capable of implementing an SPR release. China could choose to further expand its strategic stockpile, since the state's total storage capacity, including government and commercial tanks, is estimated to be 1.2 billion barrels.¹⁸

Turning to oil imports, China has adopted multiple strategies for ensuring stable flows of resource supplies. First, since the 1990s, China's three major NOCs—the China National Petroleum Corporation (CNPC), China Petrochemical Corporation (Sinopec), and the China National Offshore Oil Corporation (CNOOC)—have invested in overseas oil projects and companies, often under the auspices of China's "going out" strategy. By 1998, the CNPC had made large upstream investments in Sudan, Kazakhstan, Venezuela, and Iraq. Through these ventures, the company acquired "equity oil": a share of resource output that it could book as reserves and sell wherever it chose. In practice, the NOCs have often sold their equity oil to buyers outside of China for commercial reasons.¹⁹ However, the state retains the option of directing the companies to ship these resources to China, if needed. Chinese NOCs purportedly overpaid for these early deals in order to enhance national energy security.²⁰ Additionally, as newcomers to overseas investments, with limited technological skills, the NOCs struggled to make their bids competitive. To increase their appeal, the Chinese government supported the NOCs' efforts with favorable loans, as well as high-level diplomatic visits and broader investment deals with host states.²¹

China's NOCs acquired their new assets through mergers and acquisitions (M&A), in which they purchased full or partial shares of existing energy companies, and through investments in specific oil blocks and oil fields.²² The latter investments have often taken the form of joint ventures, in which the Chinese NOC holds a share of a project, while other foreign oil companies and/or the host state's NOC hold the remainder. Through these deals, Chinese NOCs have established partnerships with many of the world's leading international oil companies (IOCs), including ExxonMobil, Chevron, Total, BP, and Eni, as well as other countries' NOCs. After expanding their overseas investments some in the early 2000s, the NOCs went on a buying spree after the global financial crisis. The downturn created a window of opportunity for the NOCs, as other oil companies, which were more exposed to the crisis, divested themselves assets and

¹⁷ Aaron Clark and Sharon Cho, "China's oil reserves are close to reaching storage capacity," *Bloomberg* (February 25, 2021), <u>https://www.bloomberg.com/news/articles/2021-02-26/china-s-oil-reserves-are-close-to-reaching-storage-capacity</u>.

¹⁸ Michal Meidan, "China's SPR release: A test of mechanisms rather than a show of market might," OIES Energy Comment (September 2021), <u>https://www.oxfordenergy.org/publications/oxford-energy-podcast-chinas-spr-release-a-test-of-mechanisms-rather-than-a-show-of-market-might/</u>.

 ¹⁹ Erica S. Downs, "The Fact and Fiction of Sino–African Energy Relations," *China Security* 3, no. 3 (2007): 42–68.
²⁰ Xiaoyi Mu, "Have the Chinese national oil companies paid too much in overseas asset acquisition?" USAEE

Working Paper no. 20-430 (January 23, 2020), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3524134.

²¹ Erica Downs, *Inside China, Inc.: China Development Bank's cross-border energy deals*, John L. Thornton China Center Monograph Series, no. 3 (March 2011); Michal Meidan, "The structure of China's oil industry: past trends and future prospects," OIES Paper: WPM 66 (May 2016), <u>https://www.oxfordenergy.org/publications/structure-chinas-oil-industry-past-trends-future-prospects/</u>.

²² Monique Taylor, "China's evolving energy security strategy," Asian Affairs 52, no. 4 (2021): 890–913.

refrained from new investments, and host companies struggled to find international partners.²³ The NOCs also increased the share of their investments in less-risky locales, following reforms to China's "going out" policy in 2006, which prioritized the profitability of overseas investments and gave the companies greater autonomy in investment decisions.²⁴

China's NOCs have continued to acquire equity oil through some of these upstream investments, but not all of them. In 2020, the CNPC reported that its equity holdings of oil and natural gas were over 2 MMbpd.²⁵ Chinese NOCs have also pursued investments that enable them to enhance their technological and managerial skills through collaboration with foreign partners, in areas such as deep-water and unconventional oil and gas development. China's NOCs are now active in every region of the globe and their investment choices are driven predominantly by commercial opportunities, not geopolitical strategy.²⁶ That being said, the NOCs have also seized economic opportunities created by international politics: in particular, strengthening their connections with countries that are targeted by American or multilateral sanctions and therefore have limited access to alternative sources of foreign direct investment (FDI) and international credit markets.

Chinese NOCs have also invested in downstream projects overseas: building or purchasing refineries, gas stations, pipelines, and storage facilities.²⁷ They have partnered with foreign NOCs and IOCs to develop upstream and downstream projects in China. Again, these decisions are driven primarily by commercial interests. However, they also expand China's economic ties with oil-exporting states and create additional incentives for these states to maintain stable oil flows to China.²⁸ The Silk Road Fund, a state-owned investment fund, and the China Investment Corporation (CIC), one of China's sovereign wealth funds, have also invested in some foreign oil and gas projects and companies.²⁹

Second, China has attempted to secure its access to foreign energy supplies through loans-for-oil. In these agreements, a state policy bank—the China Development Bank (CDB) or, to a lesser

²⁵ China National Petroleum Corporation (CNPC) "2020 annual report,"

²⁶ Julie Jiang and Chen Ding, "Update on overseas investments by China's national oil companies: achievements and challenges since 2011," IEA (2014), <u>https://www.oecd.org/publications/update-on-overseas-investments-by-china-s-national-oil-companies-9789264247505-en.htm</u>.

²³ Julie Jiang and Jonathan Sinton, "Overseas investments by Chinese national oil companies," IEA (February 2011), <u>https://www.iea.org/reports/overseas-investments-by-chinese-national-oil-companies</u>.

²⁴ Adam William Chalmers and Susanna Theresia Mocker, "The end of exceptionalism? Explaining Chinese National Oil Companies' overseas investments," *Review of International Political Economy* 24, no. 1 (2017): 119– 143.

http://www.petrochina.com.cn/ptr/ndbg/dqbg_list.shtml. In 2019, the Chinese Ministry of Natural Resources reported that China's equity oil from all overseas investments totaled over 2 MMbpd. Yong Zhao, Xunpeng Shi, and Feng Song, "Has Chinese outward foreign direct investment in energy enhanced China's energy security?" *Energy Policy* 146 (2020): 1–8.

²⁷ Ibid.

²⁸ Jennifer Lind and Daryl G. Press, "Markets or mercantilism? How China secures its energy supplies," *International Security* 42, no. 4 (2018): 170–204.

²⁹ Chen Dia, "Silk Road Fund to support Uzbek oil and gas projects, *China Daily* (June 9, 2018), <u>https://www.chinadaily.com.cn/a/201806/09/WS5b1bd84fa31001b82571f188.html</u>; Farah Elbahrawy, "Aramco closes \$12 billion pipeline deal with China, UAE backing," *Bloomberg* (June 19, 2021), <u>https://www.bloomberg.com/news/articles/2021-06-19/aramco-closes-12-4-billion-deal-with-beijing-abu-dhabibacking</u>.

extent, the China Export-Import Bank (China Exim Bank)—lends money to an oil-producing state's government or a state-owned enterprise. The recipient uses this money to finance oil projects or for other purposes. After a grace period, the recipient repays the loan through oil sales to a Chinese NOC. The loan terms specify a minimum amount of oil that the producer must sell to the Chinese NOC daily, over the course of the repayment period. The price that the NOC pays for this oil varies over the course of the repayment period, as market prices change. As a result, the total amount of oil the producer will sell to the NOC in order to repay the loan is indeterminate at the agreement's outset. China's loans-for-oil have been appealing to borrowers because they are offered at low interest rates, with longer repayment periods than many other loans. Chinese banks have also offered these loans during periods when oil producers have struggled to find alternative sources of funding, such as after the global financial crisis and after oil prices collapsed in 2014.³⁰

Although data on China's loans-for-oil are incomplete, Venezuela is widely regarded as the largest recipient, borrowing at least \$50 billion between 2008 and 2015.³¹ However, after 2015, China's lending to Venezuela dropped precipitously, due to the state's inability to repay existing loans by supplying the oil that it had already promised to China.³² Russia was the second largest recipient of loans-for-oil during this time period, receiving \$33 billion. Most of that debt was incurred through a \$25 billion agreement in 2009, in which Russian state-controlled companies, Rosneft and Transneft, agreed to supply the CNPC with 300,000 bpd of oil for the next twenty years.³³ In 2013, the CDB granted Rosneft another \$2 billion loan-for-oil.³⁴ Other leading recipients of Chinese loans-for-oil, between 2004 and 2017, were Brazil (\$30 billion), Angola (\$11.5–\$21.5 billion), and Ecuador (\$7–\$13.8). Bolivia, Chad, Equatorial Guinea, Ghana, the Republic of Congo, and South Sudan have also received loans-for-oil.³⁵

³⁰ Eugene Gholz, Umul Awan, and Ehud Ronn, "Financial and energy security analysis of China's loan-for-oil deals," *Energy Research & Social Science* 24 (2017): 42–50; Michal Meidan, "China's loans for oil: asset or liability?" OIES Paper: WPM 70 (December 2016), <u>https://www.oxfordenergy.org/publications/chinas-loans-oil-asset-liability/</u>.

³¹ These loans-for-oil figures are much higher than the figures from the China's Global Energy Finance project because the loans finance a wide range of infrastructure projects, not just oil. David Mihalyi, Aisha Adam and Jyhjong Hwang, "Resource-backed loans: pitfalls and potential," Natural Resources Governance Institute (February 27, 2020), <u>https://resourcegovernance.org/analysis-tools/publications/resource-backed-loans-pitfalls-potential</u>.

³² Stephen B. Kaplan and Michael Penfold, "China-Venezuela economic relations: hedging Venezuelan bets with Chinese characteristics," The Wilson Center (February 2019); Jeremy Page, "China counts the costs of its big bet on Venezuela," *Wall Street Journal* (February 1, 2019), <u>https://www.wsj.com/articles/china-counts-the-costs-of-its-big-bet-on-venezuela-11549038825</u>.

³³ Robin Paxton and Vladimir Soldatkin, "China lends Russia \$25 billion to get 20 years of oil," Reuters (February 17, 2009), <u>https://www.reuters.com/article/uk-russia-china-oil-sb/china-lends-russia-25-billion-to-get-20-years-of-oil-idUKTRE51G3S620090217</u>. This agreement also financed the Daqing pipeline spur.

³⁴ Gholz et al., "Financial and energy security analysis of China's loan-for-oil deals." In 2013 and 2014, CNPC and Sinopec also agreed to prepay for substantial amounts of Russian oil. James Henderson and Tatiana Mitrova, "Energy Relations between Russia and China: Playing Chess with the Dragon," OIES Paper: WPM 67 (August 2016), <u>https://www.oxfordenergy.org/publications/energy-relations-russia-china-playing-chess-dragon/</u>.

³⁵ Figures are derived from Gholz et al., "Financial and energy security analysis of China's loan-for-oil deals," Mihalyi et al., "Resource-backed loans: pitfalls and potential," and Patricia I. Vasquez, "China's Oil and Gas Footprint in Latin America and Africa," *International Development Policy* 11, no. 1 (2019).

On paper, these oil-backed loans gave Chinese NOCs assured access to an estimated 1.6 MMbpd of oil by 2015.³⁶ Yet the state is unlikely to have ever received that much, primarily due to Venezuela's declining output. Chinese NOCs and oil trading companies also often choose to sell the resources they receive through loan repayments to other buyers, rather than ship them to China. The limited benefits derived from these loans, in terms of energy security and the returns on investments to policy banks, have likely contributed China's decreasing use of this instrument over the past few years. Whereas the CDB and China Exim Bank loaned oil-producing countries \$75 billion for oil-related projects, specifically, between 2007 and 2017, after 2017, policy banks' financing for oil-related projects largely evaporated.³⁷ During the earlier time period, most of the banks' oil project financing went to Brazil (\$26.6 billion), Russia (\$25 billion), Angola (\$10.2 billion), and Venezuela (\$7.7 billion), through the recipients' state-controlled energy companies (Petrobras, Rosneft, Sonangol, and PDVSA). The CDB also financed the construction of the Daqing spur of the Eastern Siberian–Pacific Ocean (ESPO) pipeline in 2009.

In contrast, Chinese policy banks' financing for gas projects, including liquified natural gas (LNG) projects, has remained robust; between 2008 and 2020, the CDB and China Exim Bank committed almost \$40 billion to these endeavors. The leading recipients of this financing were Russia (\$17.3 billion), Turkmenistan (\$7.1 billion), Uzbekistan (\$3.4 billion), Nigeria (\$3.2 billion), Pakistan (\$2.7 billion), and Myanmar (\$2.4 billion).³⁸ The fact that China's policy banks have continued to issue loans-for-gas, while cutting back on loans-for-oil, could reflect changing national energy security priorities, as natural gas becomes a larger share of the country's energy mix. Alternatively, gas-producing countries may currently be seen as more reliable borrowers or possess more promising energy projects than oil producers.

Overall, since the mid-2010s, China has devoted less effort to securing access to oil supplies through loans-for-oil and upstream investments that produce equity oil. This shift has occurred for at least four reasons. First, the U.S. shale revolution created a global oil supply glut and removed the United States as a competitor for oil imports. Second, Chinese NOCs and policy banks learned from their early investments and loans, which often underperformed. Third, President Xi's crackdown on corruption in the oil industry in the mid-2010s increased scrutiny on NOCs' overseas investments. Fourth, after oil prices crashed in 2014, NOCs had to be more cautious with their capital expenditures.³⁹ Fifth, since 2018, President Xi has encouraged the NOCs to prioritize domestic resource development.⁴⁰

³⁶ Meidan, "China's loans for oil."

³⁷ All data are from the China's Global Energy Finance project at Boston University's Global Development Policy Center, <u>https://www.bu.edu/cgef/#/intro</u>.

³⁸ All data are from the China's Global Energy Finance project at Boston University's Global Development Policy Center, <u>https://www.bu.edu/cgef/#/intro</u>.

³⁹ Ruan, "The Chinese majors' responses to the collapse in global oil prices and the COVID-19 pandemic"; Taylor, "China's evolving energy security strategy."

⁴⁰ Downs, "High Anxiety."

Transportation⁴¹

One major limitation of loans-for-oil and equity oil, as means of enhancing China's energy security, is that the resources acquired through these strategies must be shipped back to China, rendering them vulnerable to transportation interruptions. Since China became a net importer of oil, one of its leading energy security concerns has been the risk of interference with its seaborne oil imports. In 2003, President Hu Jintao warned of the "Malacca Dilemma": the risk of interruptions to oil and gas shipments passing through the Strait of Malacca. These interruptions could arise from accidents or interference by local states and violent non-state actors. However, China's primary concern is that U.S. naval forces will attempt to interrupt oil shipments to China.

In actuality, even in the 2000s, it would have been difficult for the United States to physically interdict China's sea-borne energy deliveries. The United States cannot implement a distant blockade—intercepting Chinese energy shipments as they travel through chokepoints like the Strait of Malacca, Sunda Strait, or Lombok Strait—without also interrupting shipments to U.S. allies Japan and the Republic of Korea. While it is usually possible to determine oil and gas tankers' origins using tracking systems, these methods cannot ascertain their destinations. Nor can direct visual contact. Consequently, American sailors would need to board every tanker traveling through the maritime chokepoint and consult its documentation to determine which ones to seize. All tankers are required to carry bills of lading, stating their origin and destination. However, documents can be forged or resource cargoes can be resold during transit, enabling them to legitimately change their destination after passing through a blockade.⁴²

Nonetheless, to counter this transportation threat, China has constructed a sizeable domestic tanker fleet, which it can insure through state-owned companies.⁴³ If Beijing compels these tankers to run a naval blockade, U.S. sailors would need to forcefully board or sink each tanker in order to intercept energy shipments, heightening the likelihood of environmental damage, international opprobrium, and Chinese retaliation.⁴⁴ The United States could simplify this interception process by implementing a near blockade closer to China's coastline, where tankers' destination would be evident. However, China's A2AD capabilities limit this approach's viability and heighten the risks of conflict escalation.

China is also attempting to diversify its maritime energy transit routes by encouraging development of the Northern Sea Route (NSR), along Russia's Arctic coast. By using this route, tankers can travel from export terminals in Murmansk and the Yamal Peninsula to China's Pacific ports without passing through maritime chokepoints, including the Suez Canal, Bab al-Mandab, and Strait of Malacca. The route also cuts shipping times nearly in half. The first LNG delivery from the Yamal Peninsula to China occurred in July 2018 and the first Russian oil

⁴¹ Portions of the following two sections are adapted from Emily Meierding, "Weaponizing Energy Interdependence," in Daniel W. Drezner, Henry Farrell, and Abraham L. Newman (eds), *The Uses and Abuses of Weaponized Interdependence* (Washington, D.C.: Brookings Institution Press, 2021).

⁴² Gabriel B. Collins and William S. Murray, "No oil for the lamps of China," *Naval War College Review* 61, no. 6 (2008).

⁴³ Andrew Erickson and Gabe Collins, "Beijing's energy security strategy: the significance of a Chinese state-owned tanker fleet," *Orbis* 51, no. 4 (2007): 665–684.

⁴⁴ Lind and Press, "Markets or mercantilism?"

shipment transited the NSR to China in September 2019.⁴⁵ Over the last three years, hydrocarbons have made up the bulk of international shipments along the NSR. Most of these shipments have traveled west towards Europe, but the share traveling east is increasing. In 2019, seventeen Yamal LNG carriers traveled to Asia via the NSR; in 2020, 35 transited the route; and in 2021, 34. PetroChina, the CNPC's flagship subsidiary, has contracted for 3 million tonnes per year (or, 4.1 billion cubic meters) of deliveries from the Yamal LNG project, an estimated 19% of Yamal's 2020 contracts.⁴⁶ If Russia's Arctic hydrocarbon production increases as planned—an uncertain prospect since the invasion of Ukraine—this volume is likely to increase. However, multiple additional factors could impose a ceiling on Russian LNG shipments to China along the NSR. The route remains ice-bound six months a year, regional support facilities are extremely limited, and delivery costs to China from Yamal are substantially higher than delivery costs from Australia, Indonesia, and Qatar, the state's leading LNG suppliers.⁴⁷ Moreover, oil shipments along the NSR are likely to remain a fraction of LNG volumes transiting the route.

China has also attempted to reduce its dependence on sea-borne energy transportation by building pipelines. Three international oil pipelines currently enter China: the Kazakhstan–China pipeline (400,000 bpd), the ESPO pipeline's Daqing spur (600,000 bpd), and the Myanmar–China pipeline (440,000 bpd). The combined capacity of these pipelines is 1.44 MMbpd. Additionally, the ESPO pipeline transports another 1 MMbpd to its terminus in Kozmino, from which it can be shipped by tanker to Chinese ports. These pipelines have therefore reduced the share of China's oil imports that travel long distances by sea. However, the pipelines could not replace China's sea-borne imports in the event of transportation interruptions, especially if they were already operating near capacity.

Financial Transactions

The leading contemporary threats to China's oil security pertain to financial transactions. To purchase oil imports, customers (usually refineries or oil trading firms) must be able to pay for them. Because most oil trades are denominated in dollars, these customers must have access to the U.S. financial system, either through American branches of their own banks or through correspondent banks in the United States. If sanctions block U.S.-located banks from engaging with oil-purchasing companies or their home countries' banks, these customers cannot complete their oil transactions using dollars. These financial sanctions are therefore an enormous impediment to oil purchases. Additionally—or alternatively—targeted banks may be blocked from the Belgian-based SWIFT financial messaging service. SWIFT handles the lion's share of

⁴⁵ "Russia's Novatek ships first LNG cargo to China via Arctic," Reuters (July 19, 2018),

https://www.reuters.com/article/us-novatek-cnpc-lng/russias-novatek-ships-first-lng-cargo-to-china-via-arcticidUSKBN1K90YN; Shu Zhang and Olga Yagova, "Russia's Lukoil sells rare Arctic crude oil to China," Reuters (October 2, 2019), https://www.reuters.com/article/us-russia-oil-china/russias-lukoil-sells-rare-arctic-crude-oil-tochina-sources-idUSKBN1WH165.

⁴⁶ Vitaly Yermakov and Anastasia Yermakova, "The Northern Sea Route: a state priority in Russia's strategy of delivering Arctic hydrocarbons to global markets," OIES Energy Insight: 105 (November 2021), <u>https://www.oxfordenergy.org/publications/the-northern-sea-route-a-state-priority-in-russias-strategy-of-delivering-arctic-hydrocarbons-to-global-markets/</u>. All conversions factors are taken from BP's Statistical Review of World Energy.

⁴⁷ Vitaly Yermakov and Jack Sharples, "A phantom menace: is Russian LNG a threat to Russia's pipeline gas to Europe?" OIES Paper: NG 171 (July 2021), <u>https://www.oxfordenergy.org/publications/a-phantom-menace-is-russian-lng-a-threat-to-russias-pipeline-gas-in-europe/</u>.

interbank messaging, so removal from the network is a significant inconvenience. However, there are other, more costly and less efficient work-arounds for the system, such as encrypted telegrams or email. In contrast, there are currently no viable substitutes for access to the U.S. banking system. If Chinese oil customers or their banks were blocked from the system, they would not be able to purchase nearly enough oil to cover national import needs.

Although China could adopt a number of strategies to reduce its vulnerability to blocking sanctions, there are obstacles to large-scale adoption of each of them. First, Chinese customers could denominate oil transactions in currencies other than dollars. The state's most recent gas deal with Russia, in February 2022, will be settled in euro.⁴⁸ However, denominating in euro or pounds does not fully eliminate this insecurity, as European countries could block Chinese banks' access to their financial systems, preventing these transactions. Chinese customers have also paid for some Russian, Venezuelan, and Iranian resource shipments in yuan.⁴⁹ Yet, most oil producers are likely to resist the de-dollarization of oil sales. Oil has historically been traded in dollars because they are abundant and reliable. The yuan cannot presently compete in terms of liquidity or stability.⁵⁰ It currently accounts for only 3% of all international payments, in contrast to the 40% of the world's payments transacted in dollars.⁵¹ It also has yet to become a leading global reserve currency, despite its addition to the IMF's special drawing rights basket in 2016.⁵²

Second, China could reduce its vulnerability to blocking sanctions by establishing barter-based agreements with oil producers. It has already pursued this strategy with Venezuela; the state has supplied oil to China in exchange for food staples.⁵³ However, barter-based oil trade is not practical on a large scale. Third, Chinese customers could funnel their oil transactions through third-party banks that are not under sanctions. Yet, this strategy is still vulnerable to secondary sanctions, which penalize actors that do business with targeted financial institutions.

To accelerate the yuan's internationalization and create an alternative to the SWIFT system, in 2015, China's central bank launching the Cross-Border Interbank Payment System (CIPS). The system's primary purpose is to settle yuan-denominated cross-border payments with international financial institutions. However, CIPS also functions as a financial messaging service. At present, CIPS is far smaller than SWIFT; 11,000 institutions across 200 countries are connected to SWIFT, whereas 1280 financial institutions in 103 countries are reportedly connected to CIPS. Over 500 of the latter are in mainland China and only a small number of international banks are

⁴⁸ Aizhu, "Russia, China agree 30-year gas deal via new pipeline, to settle in Euros."

⁵¹ David Brancaccio, Erika Soderstrom, and Alex Schroeder, "Could China's payments system be a SWIFT workaround for Russia?" NPR Marketplace (aired March 1, 2022), <u>https://www.marketplace.org/2022/03/01/could-chinas-payments-system-be-a-swift-workaround-for-russia/</u>.

⁵² "China's yuan joins elite club of IMF reserve currencies," Reuters (September 30, 2016),

https://www.reuters.com/article/us-china-currency-imf/chinas-yuan-joins-elite-club-of-imf-reserve-currenciesidUSKCN1212WC

⁴⁹ Maha Kamel and Hongying Wang, "Petro-RMB? The oil trade and the internationalization of the renminbi," *International Affairs* 95, no. 5 (2019): 1131–1148.

⁵⁰ The liquidity and reliability issues also precludes crypto-currencies from being a viable alternative to U.S. dollars or euro; they are not attractive enough to recipients or traded in large enough volumes to cover a substantial share of China's energy transactions.

⁵³ Corina Pons and Mayela Armas, "Venezuela in talks with China over support amid pandemic, oil price drop," Reuters (March 25, 2020), <u>https://www.reuters.com/article/us-health-coronavirus-venezuela-china-ex/exclusive-venezuela-in-talks-with-china-over-support-amid-pandemic-oil-price-drop-sources-idUSKBN21C2LB.</u>

directly connected to CIPS. Banks that are not directly connected to the system must still communicate with CIPS using SWIFT.⁵⁴ As another indicator of SWIFT's dominance, in one day (March 1, 2022), the system handled over 40 million messages, while CIPS handled approximately 11,500.⁵⁵ CIPS is likely to face considerable growing pains, as long as the yuan remains a less attractive global currency than the dollar or euro. Financial institutions that are connected to SWIFT also have limited incentive to participate in an additional system, unless they expect their SWIFT access to be endangered in the future.

Over the next five to ten years, further internationalization of the yuan and de-dollarization of oil transactions are likely to be Chinese energy security policy priorities. To increase the attractiveness of the latter, China is likely to couple these efforts with other diplomatic, economic, and military overtures to oil-producing states. That being said, these initiatives are still likely to be a tough sell, other than for countries with restricted access to the U.S. financial system, such as Iran, Russia, and Venezuela. A leading risk of the United States' increased use of sanctions as a foreign policy tool is that it will push these countries together, creating an energy-based network of U.S. competitors and adversarial states.

China's Relationships with Specific Oil Suppliers

China's top ten suppliers of crude oil in 2021 were Saudi Arabia, Russia, Iraq, Oman, Angola, the UAE, Brazil, Kuwait, Malaysia, and Norway. Table 1, at the end of this document, identifies the volume of crude oil that China imported from each supplier and the share of China's crude oil imports that came from each. Collectively, these ten states accounted for almost 84% of China's crude oil imports.⁵⁶

Several countries' shares of China's crude oil imports have declined significantly over time. Angola's contribution to China's imports has more than halved over the last decade. During the same time period, Kazakhstan's contribution to China's imports also fell substantially. Iran's share of China's imports has been declining for the last two decades; it dropped further from 2018–2019, after the reimposition of U.S. sanctions and cancellation of waivers granted to Iran's major oil importers. Sudan and Venezuela's shares of China's imports have also fallen since 2012: the former due to South Sudan's independence and ongoing instability, and the latter reflecting the deterioration of the state's oil industry and intensification of U.S. sanctions from

⁵⁴ "Factbox: What is China's onshore yuan clearing and settlement system CIPS?" Reuters (February 27, 2022), <u>https://www.reuters.com/markets/europe/what-is-chinas-onshore-yuan-clearing-settlement-system-cips-2022-02-</u> <u>28/</u>; Peng Qinqin, Denise Jia, and Kelsey Cheng, "Analysis: China's CIPS cannot rescue Russian banks from SWIFT ban," *Nikkei Asia* (March 3, 2022), <u>https://asia.nikkei.com/Spotlight/Caixin/Analysis-China-s-CIPS-cannot-</u> rescue-Russian-banks-from-SWIFT-ban.

⁵⁵ Christian Shepherd, "China not emerging as lifeline for sanction-slammed Russian economy," *The Washington Post* (March 2, 2022), <u>https://www.washingtonpost.com/world/2022/03/02/russia-economy-sanctions-china-support-ukraine/</u>.

⁵⁶ Import data are from China's General Administration of Customs, reported in Oceana Zhou, "CHINA DATA: Iranian crude inflows seen in Dec for first time in 2021, at 62,000 b/d," S&P Global (January 20, 2022), https://www.spglobal.com/commodity-insights/en/market-insights/latest-news/oil/012022-china-data-iranian-crudeinflows-seen-in-dec-for-first-time-in-2021-at-62000-bd; Oceana Zhou and Wendy Wells, "China's 2020 crude imports from US surge 211% to 396,000 b/d, valued at \$6.28 bil," S&P Global (January 20, 2021), https://www.spglobal.com/commodity-insights/en/market-insights/latest-news/oil/012021-china-data-2020-crudeimports-from-us-surge-211-to-396000-bd-valued-at-628-bil.

2017–2019. However, some of China's reported imports from Malaysia may actually be transshipments from Venezuela and Iran.

In contrast, Russia's share of China's crude oil imports rose dramatically over the last decade. China's imports from Iraq also climbed substantially after 2012. Brazil's share of China's imports has more than tripled since 2014, and the shares from Kuwait and the UAE have also risen. The United States became one of China's top ten oil suppliers in 2019. However, this trade declined significantly after Beijing retaliated for the Trump administration's trade restrictions by increasing tariffs on U.S. energy imports in 2018–2019. American oil sales to China recovered some in 2020, after the states' Phase 1 trade deal, only to fall again in 2021.

The Persian Gulf

Over the last two decades, China has diversified its oil imports by increasing the number of countries from which it purchases crude. However, China remains heavily dependent on Middle Eastern suppliers, receiving 50% of its oil imports from the region in 2020.⁵⁷ These flows have also continued to increase in volume year-on-year, as China's total oil import levels continue to rise. China has become the leading purchaser of many Gulf states' oil, including Iraq (34%), Kuwait (28%), Oman (83%), and Saudi Arabia (24%). It purchases 22% of the UAE's crude oil exports, behind Japan, which purchases 27%.⁵⁸

Energy cooperation has been the core of China's approach to the Persian Gulf: the "1" in its "1+2+3" regional policy framework.⁵⁹ In addition to purchasing large shares of the region's oil, Chinese NOCs have invested in oil projects. Since 2009, they have invested almost \$12 billion in redeveloping Iraq's oil industry, based on data from the American Enterprise Institute's China Global Investment Tracker.⁶⁰ In 2017 and 2018, the CNPC purchased stakes in multiple oil exploration and development projects in the UAE.⁶¹ Chinese NOCs have also been partnering with Saudi Aramco, Saudi Arabia's NOC, to construct refineries and other downstream facilities in China and Saudi Arabia for over a decade. The Chinese refineries are supplied with Saudi crude.⁶²

The relationships between China and the Gulf states have expanded beyond energy. China became the largest source of foreign investment in the Middle East in 2016, partly through its energy investments, but also through extensive construction projects financed by Chinese lenders

⁶⁰ Jiang and Ding, "Update on overseas investments by China's national oil companies."

⁶² Jiang and Ding, "Update on overseas investments by China's national oil companies."

⁵⁷ Based on data from the BP Statistical Review of World Energy (2021).

 ⁵⁸ All data with the exception of Oman are from BP Statistical Review of World Energy (2021). The Oman figure is from Robert Mogielnicki, "Growing China–Gulf economic relations have limits," The Arab Gulf States Institute in Washington (February 16, 2022), <u>https://agsiw.org/growing-china-gulf-economic-relations-have-limits/</u>.
⁵⁹ Government of the People's Republic of China, "China's Arab Policy Paper" (January 2016), http://english.www.gov.cn/archive/publications/2016/01/13/content_281475271412746.htm

⁶¹ Anthony Di Paola and Aibing Guo, "China's CNPC pays \$1.18 billion to purp oil in Abu Dhabi," *Bloomberg* (March 20, 2018), <u>https://www.bloomberg.com/news/articles/2018-03-21/cnpc-is-said-to-be-poised-to-win-stakes-in-abu-dhabi-oil-fields</u>; Anthony Di Paola and Mahmoud Habboush, "China wins big with stakes in \$22 billion Abu Dhabi oil deal," *Bloomberg* (February 19, 2017), <u>https://www.bloomberg.com/news/articles/2017-02-19/abu-dhabi-awards-china-s-cnpc-stake-in-main-onshore-oil-deposits</u>.

and often undertaken by Chinese firms.⁶³ In 2020, China replaced the EU as the GCC's largest trading partner.⁶⁴ The UAE and Qatar have both established currency swaps with China to facilitate cross-border trade and investment, and the UAE established a clearing center for yuan-denominated transactions.⁶⁵ Under the auspices of the Belt and Road Initiative, China has established Comprehensive Strategic Partnerships or Strategic Partnerships with all of the region's oil-producing states. China has also recently expanded its arms sales to Persian Gulf states, although these are still dwarfed by U.S. sales.⁶⁶

The Gulf states have welcomed China's increasing engagement in the region, both for the economic opportunities it offers and as a hedge against declining U.S. engagement, precipitated by the United States' falling imports of Middle Eastern oil and its withdrawal from Iraq. That being said, there is little indication that the Gulf's oil producers prefer partnership with China over partnership with the United States. Instead, they are likely to strategically exploit the great powers' competition for regional influence in order to extract advantageous deals from both countries.

China's relationship with Iran is a greater U.S. security concern. China has been the leading purchaser of Iranian oil exports since the United States reimposed sanctions on the country in 2018, and continued these purchases after waivers expired in May 2019. To evade sanctions enforcement, China does not accurately disclose the volume of oil it imports from Iran. However, commodity analysts indicate that, after declining significantly in 2019, China's purchases rose some in 2020 and increased to an average of at least 590,000 bpd in 2021.⁶⁷ Chinese buyers have concealed these deliveries partly through transshipment of Iranian oil through Oman and Malaysia.⁶⁸ In March 2021, China and Iran also signed a deal (drafted in 2020) for an estimated \$400 billion of Chinese investments in numerous areas, including "banking, telecommunications, ports, railways, health care and information technology," over the course of the next 25 years. This financing would be repaid with steeply discounted oil deliveries.⁶⁹

⁶³ "China is largest foreign investor in Middle East," Middle East Monitor (July 24, 2017),

https://www.middleeastmonitor.com/20170724-china-is-largest-foreign-investor-in-middle-east/.

⁶⁴ Frank Tang, "China meets Gulf oil bloc with sights set on free-trade agreement and energy security," *South China Morning Post* (January 12, 2022), <u>https://www.scmp.com/economy/china-economy/article/3163121/china-meets-gulf-oil-bloc-sights-set-free-trade-agreement-and</u>.

⁶⁵ Jonathan Fulton, "China's growing presence in the Gulf," East Asia Forum (March 26, 2019), <u>https://www.eastasiaforum.org/2019/03/26/chinas-growing-presence-in-the-gulf/</u>.

⁶⁶ Camille Lons, Jonathan Fulton, Degang Sun, and Naser Al-Tamimi, "China's great game in the Middle East," European Council on Foreign Relations (October 21, 2019),

https://ecfr.eu/publication/china_great_game_middle_east/.

⁶⁷ "China ramps up Iran oil purchases after getting new quotas," *Bloomberg* (December 16, 2021), https://www.bloomberg.com/news/articles/2021-12-16/china-teapots-boost-iran-oil-imports-after-getting-newquotas; Benoit Faucon, "Iran seeks closer ties with China as nuclear talks drag on," *The Wall Street Journal* (January 14, 2022), https://www.wsj.com/articles/iran-seeks-closer-ties-with-china-as-nuclear-talks-drag-on-11642155508.

⁶⁸ "China may be taking rebranded Iran oil amid increased scrutiny," *Bloomberg* (March 22, 2021), <u>https://www.bloomberg.com/news/articles/2021-03-22/china-may-be-taking-rebranded-iran-oil-amid-increased-scrutiny</u>.

⁶⁹ Farnaz Fassihi and Steven Lee Myers, "China, with \$400 billion Iran deal, could deepen influence in Mideast," *The New York Times* (March 29, 2021), t<u>https://www.nytimes.com/2021/03/27/world/middleeast/china-iran-deal.html</u>.

There are nonetheless reasons to question the degree to which China's engagement is actually undermining U.S. sanctions' effectiveness against Iran. Although China has thrown the state an economic lifeline through its oil purchases, Iran is not receiving foreign exchange for these sales; instead, they are denominated in yuan or consist of barter-based arrangements.⁷⁰ The CNPC withdrew from its investment in Iran's South Pars gas field in 2019, in response to U.S. sanctions, and Sinopec's plans to develop the Yadavaran oil field stalled.⁷¹ The 2021 investment agreement is very unlikely to be implemented in full. More broadly, China does not want to endanger its financial relationship with the United States or its growing partnerships with other Gulf states by drawing too close to Iran.

Russia

China has also expanded its energy engagement with Russia. In addition to significantly increasing its Russian oil and gas purchases over the last decade, as well as granting the state loans-for-oil and loans-for-gas, often connected to international pipeline projects, Chinese NOCs and financial institutions have invested in Russia's Arctic energy projects. The CNPC acquired a 20% stake in the Yamal LNG project in January 2014. The project's majority owner, Novatek, was sanctioned six months later, after Russia's initial interference in eastern Ukraine. These sanctions prohibited western energy companies from investing in projects in the Russian Arctic, creating another window of opportunity for Chinese actors. In 2015, the Silk Road Fund acquired a 9.9% stake in Yamal LNG and loaned the project \$804 million.⁷² The CDB and China Exim Bank then loaned the project an additional \$12 billion, denominated in euro and yuan.⁷³ In 2019, CNOOC and a CNPC subsidiary, CNODC, purchased a 20% stake in the Arctic LNG 2 project.⁷⁴ These investments and loans have been critical to the projects' development.

The widespread withdrawal of western oil companies from Russia since its invasion of Ukraine in February 2022—a group that now includes BP, Shell, ExxonMobil, and Equinor (Norway's NOC)—may create significant new opportunities for China. Russia will need foreign investment in its energy industry to maintain current levels of oil and gas production. If western companies do not return, Chinese NOCs and financial institutions will be some of its few sources of capital. Recognizing this bargaining advantage, they are likely to push for highly favorable contract terms, including substantial discounts on resource prices and denomination of loans and resource payments in yuan. However, China is unlikely to pursue these deals or significantly increase its Russian oil and gas purchases in the near term, in order to avoid provoking international censure

⁷⁰ Faucon, "Iran seeks closer ties with China as nuclear talks drag on."

⁷¹ "Iran says China's Sinopec might not develop Yadavaran oilfield," Reuters (May 2, 2019),

https://www.reuters.com/article/us-iran-china-oil-idUSKCN1S8192; Arsalan Shahla and Verity Ratcliffe, "CNPC quits flagship Iran gas project as U.S. sanctions bite," *Bloomberg* (October 7, 2019),

https://www.bloomberg.com/news/articles/2019-10-06/iran-says-china-s-cnpc-is-no-longer-part-of-giant-gas-project.

⁷² "Russia's Novatek completes deal to sell Yamal LNG stake to China's Silk Road," Reuters (March 15, 2016), https://www.reuters.com/article/russia-novatek-china-yamal-idAFR4N0ZC01H.

⁷³ "China lenders provide \$12 bln loan for Russia's Yamal LNG project-sources," Reuters (April 28, 2016), <u>https://www.reuters.com/article/russia-china-yamal/china-lenders-provide-12-bln-loan-for-russias-yamal-lng-project-sources-idUKL2N17V2MI</u>.

⁷⁴ Katya Golubkova and Maria Kiselyova, "Russia's Novatek to sell 20 percent in Arctic LNG 2 to China," Reuters (April 25, 2019), <u>https://www.reuters.com/article/us-russia-gas-novatek-cnodc/russias-novatek-to-sell-20-percent-in-arctic-lng-2-to-china-idUSKCN1S11WY</u>.

or secondary sanctions while Russia's energy transactions are under heightened scrutiny.⁷⁵ China is likely to strengthen integration between CIPS and Russia's financial messaging system, SPF. It may also become more supportive of Russia's proposed Power of Siberia 2 pipeline project, which would transport natural gas from Yamal to northeastern China.

Venezuela

Over the last decade, China has also been an economic lifeline to Venezuela, another state facing U.S. sanctions. As noted above, Venezuela was the leading recipient of Chinese policy banks' loans-for-oil between 2005 and 2017. In conjunction with these loans, the CNPC and Sinopec acquired stakes in exploration and development projects in the Orinoco extra-heavy oil belt.⁷⁶ However, these loans and investments proved to be a cautionary tale for China's later overseas energy engagements.⁷⁷ Insufficient reinvestment of resource revenue into Venezuela's NOC, PDVSA, coupled with low oil prices after 2014 and President Maduro's failure to implement economic reforms, sent the company into a tailspin. With its oil production falling rapidly, PDVSA could not fulfill its resource repayment commitments to China. To expand production from CNPC–PDVSA joint ventures, in 2016, Venezuela was allowed to tap a new \$2.2 billion Chinese credit line.⁷⁸ Two years later, it received access to another \$5 billion credit line, again for the purpose of boosting oil production. The CNPC also purchased additional shares of its Sinovensa joint venture with PDVSA.⁷⁹

None of these initiatives reversed Venezuela's production decline, which was subsequently exacerbated by the imposition of tighter U.S. sanctions, starting in 2017. After the United States sanctioned PDVSA itself in January 2019, China became Venezuela's largest crude oil importer, receiving an average of 350,000 bpd. When the United States tightened sanctions further that August, the CNPC formally halted direct purchases of Venezuelan oil. However, China continued to import oil through other purchasing companies, using various means of disguising the oil's origins, including ship-to-ship oil transfers and "doping" of Venezuelan crude. Using these mechanisms, between mid-2019 and 2021, China likely imported between 250,000 and

⁷⁵ Shepherd, "China not emerging as lifeline for sanction-slammed Russian economy"; Nathaniel Taplin, "Can Russia's sanctions pain be China's gain?" *The Wall Street Journal* (March 1, 2022),

https://www.wsj.com/articles/can-russias-sanctions-pain-be-chinas-gain-11646144467.

⁷⁶ Marianna Parraga, "Venezuela approves Chinese role in Orinoco oil block," Reuters (October 11, 2020), <u>https://www.reuters.com/article/venezuela-oil-china/venezuela-approves-chinese-role-in-orinoco-oil-block-idUSN1115418820101011</u>; Daniel Wallis, "CNPC to help develop Junin 10 project in Venezuela," Reuters (September 18, 2013), <u>https://www.reuters.com/article/venezuela-cnpc-idCNL2N0HE13520130918</u>; Jonathan Wheatley, "Lawsuit shows China losing patience with Venezuela," *Financial Times* (December 6, 2016), <u>https://www.ft.com/content/d627460a-da8e-11e7-a039-c64b1c09b482</u>.

⁷⁷ Jeremy Page, "China Counts the Costs of Its Big Bet on Venezuela."

⁷⁸ Alexandra Ulmer, "Venezuela taps China credit line for \$2.2 billion oil output push," Reuters (November 17, 2016), <u>https://www.reuters.com/article/us-venezuela-oil-cnpc/venezuela-taps-china-credit-line-for-2-2-billion-oil-output-push-idUSKBN13D031</u>.

⁷⁹ "Venezuela sold 9.9 percent of joint venture to China oil firm: Maduro," Reuters (September 18, 2018), <u>https://www.reuters.com/article/us-venezuela-china/venezuela-sold-9-9-percent-of-joint-venture-to-china-oil-firm-maduro-idUSKCN1LY2NN</u>; Kaplan and Penfold, "China-Venezuela Economic Relations."

325,000 bpd of Venezuelan crude oil. Most of this was purchased by China's "teapot" refineries, which are less exposed to the United States' secondary sanctions.⁸⁰

Chinese government representatives maintain that their country's Venezuelan and Iranian oil imports are all perfectly legal. Beijing has not imposed trade restrictions on either country and opposes the United States' unilateral sanctions, including the punishments that U.S. secondary sanctions inflict on Chinese entities that do business with Venezuela or Iran.⁸¹ Most Chinese actors have nonetheless complied with the sanctions in order to avoid being blocked from the U.S. financial system. While China has therefore flouted U.S. sanctions through its oil purchases, its sanctions-busting, beyond this area, is more limited. It is also unclear whether, in the absence of Chinese oil purchases, targeted states would have changed their behaviors, to comply with U.S. demands.

Conclusion

Although actors outside of China often view the state's efforts to strengthen its oil security with concern, one of the most striking features of most of these activities is their normalcy. Many other countries and oil companies have implemented fuel efficiency standards, championed diversification of energy sources, attempted to increase domestic oil output, pursued overseas upstream and downstream investments, acquired equity oil, strengthened relationships with oil-producing states, offered loans-for-oil, and diversified transportation routes. The scale of China's loans-for-oil from 2007–2017 is exceptional, as is the level of state support that the Chinese government and policy banks provided for Chinese NOCs' overseas acquisitions, especially before the 2014 oil price crash. These are nonetheless quantitative, not qualitative differences in behavior. It is also notable that China's NOCs have regularly sold most of their equity oil and loan repayment oil wherever it can generate the greatest profits, rather than shipping it back to China, suggesting a strong market orientation, instead of an exclusively mercantilist one. Additionally, over time, Chinese NOCs have become increasingly profit-oriented and, relatedly, more risk-averse, in their overseas acquisitions. In short, they now behave very much like other international oil companies.

China's construction of a domestic tanker fleet is unusual, as is its establishment of an alternative clearing and settlement, and financial messaging system. However, these activities are also unsurprising for a country that consumes very large volumes of oil, depends on imports for over 70% of its oil consumption, is ruled by a regime whose legitimacy depends on strong economic growth, has experienced a history of deliberate oil supply shutoffs by producer states, and believes that it may be in the cross-hairs of the international system's leading actor. Under these circumstances, robust efforts to enhance national energy security, focused on neutralizing the

⁸⁰ Luc Cohen and Marianna Parraga, "Special Report: How China got shipments of Venezuelan oil despite U.S. sanctions," Reuters (June 12, 2020), <u>https://www.reuters.com/article/us-venezuela-oil-deals-specialreport/special-report-how-china-got-shipments-of-venezuelan-oil-despite-u-s-sanctions-idUSKBN23J1N1</u>; Lucia Kassai, "Doctored and rebranded oil blacklisted by U.S. winds up in China," *Bloomberg* (January 21, 2021), <u>https://www.bloomberg.com/news/articles/2021-01-22/china-imports-oil-doctored-to-skirt-u-s-sanctions-on-venezuela</u>; Jonathan Saul, Chen Aizhu, and Marianna Parraga, "China's CCPC takes centre stage in Iran, Venezuela oil trade-sources," Reuters (July 22, 2021), <u>https://www.reuters.com/business/energy/exclusive-chinas-ccpc-takes-centre-stage-iran-venezuela-oil-trade-sources-2021-07-22/.</u>

⁸¹ Saul et al., "China's CCPC takes centre stage in Iran, Venezuela oil trade-sources."

domains in which the United States is most dominant—naval power and financial transactions are national strategic imperatives. The United States should therefore not assume that China's oil-related activities are an indication of malign intent. They are hedging strategies, implemented by a vulnerable state.

For this reason, the United States' energy engagements with China should focus on enhancing the country's energy security, rather than undermining it. This could include helping China develop its shale oil and gas resources, as was attempted under the Obama administration. It might include promoting China's continued diversification of its energy sources, especially in ways that decrease its reliance on sea-borne oil shipments. It could also include further integration of China into the IEA's governance structure, especially for decisions about SPR releases. Most importantly, the United States should refrain from explicitly or implicitly threatening China's oil access. As observed in the historical cases of Japan in 1941 and Iraq in 1990, rising powers that believe they are facing existential threats to their oil imports or exports can respond very aggressively.⁸² Even if China does not yet feel backed into a corner, further U.S. pressure will accelerate the state's efforts to develop alternative means of processing energy transactions and strengthen its relationships with oil producers that are hostile to the United States. In short, aggressive U.S. action is likely to undermine the remaining oil weapons that the United States has at its disposal against China.

The greatest obstacle to U.S. restraint in this area is China's continued oil engagements with countries that the United States has sanctioned: currently, Russia, Venezuela, and Iran. From Chinese actors' perspective, American and multilateral sanctions constitute an opportunity; they can pick up resources, investments, and influence on the cheap, since oil producers have few other partners to turn to. Collaborating with sanctioned countries is therefore a rational activity— and a legal one, from Beijing's standpoint. From the United States' perspective, this engagement appears to undermine U.S. sanctions efforts. As a result, there seem to be strong incentives for the United States to crack down hard on China's activities. However, before taking action, it is important to accurately assess the significance of the lifeline that China's oil engagements are actually providing to sanctioned states. If impeding these activities will not change the targeted states' behavior—a distinct possibility, given international sanctions' uneven track record—then strongly enforcing secondary sanctions will merely antagonize Chinese actors, without advancing U.S. foreign policy goals.

The United States can also endeavor to maintain its own positive relationships with oil-exporting states. The United States remains many producers' preferred security partner, on the basis of its military capabilities and technological expertise. The United States' diplomatic clout, which appears to be rising as a result of Russia's invasion of Ukraine, will also reinforce its status as a preferred partner. The United States will have greater difficulty competing with China in the economic domain, given the latter's expansive trade ties and the amount of financing that it deploys overseas, especially in developing countries. The United States can nonetheless play to its comparative advantages through initiatives like the Build Back Better World (B3W).

⁸² Emily Meierding, *The Oil Wars Myth: Petroleum and the Causes of International Conflict* (Ithaca, NY: Cornell University Press, 2020).

Supplier	Volume (MMbpd)	Import share
Saudi Arabia	1.8	17.1%
Russia	1.6	15.5%
Iraq	1.1	10.5%
Oman	.9	8.7%
Angola	.8	7.6%
UAE	.6	6.2%
Brazil	.6	5.9%
Kuwait	.6	5.9%
Malaysia	.4	3.6%
Norway	.3	2.6%

Table 1: China's Top-10 Crude Oil Suppliers (2021)⁸³

⁸³ Import data are from China's General Administration of Customs, reported in Oceana Zhou, "CHINA DATA: Iranian crude inflows seen in Dec for first time in 2021, at 62,000 b/d," S&P Global (January 20, 2022), <u>https://www.spglobal.com/commodity-insights/en/market-insights/latest-news/oil/012022-china-data-iranian-crude-inflows-seen-in-dec-for-first-time-in-2021-at-62000-bd</u>; Oceana Zhou and Wendy Wells, "China's 2020 crude imports from US surge 211% to 396,000 b/d, valued at \$6.28 bil," S&P Global (January 20, 2021), <u>https://www.spglobal.com/commodity-insights/en/market-insights/latest-news/oil/012021-china-data-2020-crude-imports-from-us-surge-211-to-396000-bd-valued-at-628-bil.</u>

OPENING STATEMENT OF EDWARD CHOW, SENIOR ASSOCIATE (NON-RESIDENT) ENERGY SECURITY AND CLIMATE CHANGE PROGRAM, CENTER FOR STRATEGIC AND INTERNATIONAL STUDIES

VICE CHAIR GLAS: Thank you.

Mr. Chow?

MR. CHOW: That was right on time. That's a tough act to follow.

(Laughter.)

Good morning. It is my honor and privilege to testify before this Commission --VICE CHAIR GLAS: I think participants are having a hard time hearing. Is your microphone on?

MR. CHOW: Can you hear me now?

VICE CHAIR GLAS: Yes.

MR. CHOW: I was asked to focus on China's energy relationship with Russia and place it in the context of China's broader energy relations in the world.

Since you have my written testimony, which I hope you will have a chance to read, I will not attempt to summarize what I wrote, but will, instead, highlight points that might be germane to your deliberations. With seven minutes, I will try to make seven points.

The first point I would make is that we meet at a time of seismic shock to the international energy system. One has to go back at least to the twin oil shocks of the 1970s, which I just entered the energy industry, to find shocks of a similar magnitude. Reverberations will take years, if not decades, to play out.

Russia is the largest exporter of oil and gas combined. There is simply no substitute for Russian volumes in the short to medium term. Western sanctions imposed on Russia because of its unprovoked and unjustified all-out attack on Ukraine, even without an oil and gas embargo, already restrict Russian exports.

What's more, denial of access to international capital and export controls raise serious questions about Russia's long-term capacity to produce and export oil and gas. Every country, every industry, every company -- indeed, every consumer -- will have to recalibrate their future actions.

The Chinese system, the second point I will make is that the Chinese system is not very good at responding to such crises or unexpected shocks. In fact, most of the time, the system freezes. It is with great admiration that I read newspapers and pundits write and speak with such great certitude about what China will or will not do, when Chinese are still trying to figure out what just happened and what it means for them, three weeks into Russia's war on Ukraine.

I will tell you what Chinese leaders, particularly this Chinese leader, don't like: disorder, unpredictability, and now, a third strike on Putin, incompetence. This Russian disaster might also raise questions about maximum leaders who stay too long and military action against motivated local forces armed with modern weapons. But, then, I digress.

Back to energy. China is the largest energy consumer in the world. It is the largest importer of oil and gas combined. Oil imports dependence is at a dangerously high level, as my colleague just said, of over 70 percent. Natural gas imports will grow from less than half today, since China underconsumes gas when compared to the world average. Imports come mostly by sea. So, it is logical for China to look to Russia and Central Asia to provide some balance with land-based pipelines to diversify import sources and import routes.

Unfortunately for them, there are serious economic hurdles, given the distances

involved and expensive, new infrastructure that must be built. Financial risks are high on projects costing tens of billions of dollars and commercial negotiations complicated. However, given high-level political guidance and the national oil companies involved on both sides, obstacles can be overcome as part of a package deal that goes beyond energy.

Fourthly, there may yet be tensions and competition between Russia and China over Central Asian oil and gas in the future, even though the two countries seem to have worked out a sort of modus vivendi since the creation of the Shanghai Cooperation Organisation in 2001, which allows China to penetrate Central Asia economically without upsetting Russia's security interests.

With European economic sanctions against Russia after its war against Ukraine, and Russia's current dependence on Russian market for export of oil and gas, Russia will be desperate for new markets, particularly in Asia. China will try to take full advantage of weakness in Russia's bargaining position. After all, the financial risks and economic hurdles are still there, and Russia's country risks just went up. Russia will resist and look for other markets, especially India.

China's growing energy relationship with Russia will not dissuade China from expanding and deepening its energy cooperation in the Persian Gulf, particularly with Saudi Arabia and Iran -- by the way, Iran is the largest reserve holder of foreign gas combined in the world -- but also in Africa and in South America. It will continue to want to diversify its import sources and gain equity control over supply. Seaborne cargoes offer commercial advantages not available to pipeline imports, even if they are more exposed to a hostile navy.

Although China's and Russia's energy interests converge in the short run, they diverge in the long run with China's energy transition away from fossil fuels for both environmental and national security reasons. China's long-term energy interests are more compatible with those of other advanced economies.

Smart American policy would endeavor to accentuate the differences between the two countries, rather than push the two of them closer together, as we seem determined to do in recent years.

Thank you.

PREPARED STATEMENT OF EDWARD CHOW, SENIOR ASSOCIATE (NON-RESIDENT), ENERGY SECURITY AND CLIMATE CHANGE PROGRAM, CENTER FOR STRATEGIC AND INTERNATIONAL STUDIES

Testimony Before U.S.-China Economic and Security Review Commission Hearing on China's Energy Plans and Practices March 17, 2022 Panel II: China's External Energy Policies

Edward C. Chow

It is my honor and privilege to testify before this Commission.

We meet at a time when world energy markets are experiencing the greatest turmoil in more than forty years. In my four and half decades as a practitioner in and observer of the international oil and gas industry, there has not been such a seismic event since the twin oil shocks of the 1970s. Reverberations from Russia's unprovoked and unjustified war against Ukraine will be with us for years to come. Until now, Russia is the world's biggest exporter of oil and gas combined. There are no ready substitutes for Russian volumes in the global market. It is as if the availability of Saudi oil and Qatari gas were both put into question at the same time.

The Commission staff asked me to focus on China's energy relations with Russia. Every country will have to recalibrate their external energy relations not only with Russia but with the rest of the world, not least of all China which is the biggest importer of oil and gas combined. Immediately after a geopolitical shock, one must resist the temptation for instant analysis that happens to fit into one's worldview. I am afraid this has been the tendency in Washington of late across administrations and congresses, especially on energy. The seismic shift set in motion will take years if not decades to play out since nothing happens quickly in the energy industry, much to the dismay of policymakers. It is impossible to forecast the end state while all countries are reexamining previous assumptions about global energy and recalibrating their policies.

At this time, it is best to assess objective facts based on first principles, which is what I will try to do here, and not to draw premature conclusions.

After more than four decades of historically unprecedented economic growth, China is the second largest economy of the world and its largest energy consumer. Growth was driven initially by agricultural production and light manufacturing. However, much of economic growth in the second half of this period was compelled by energy-intensive heavy industry and infrastructure investments. China became a net oil importer in 1993. Although the Chinese petroleum industry maintained the level of domestic oil production and increased gas production, it has not kept pace with burgeoning demand. By 2013 China became the largest net oil importer, surpassing the United States. More recently it became the largest importer of natural gas even though gas consumption remains low by world standards.

Overreliance on domestic coal, which still represents much more than half of energy consumption, severely damages the environment and the health of the Chinese population in ways that are increasingly unsustainable and politically unacceptable. Although high energy demand growth will ease with economic transition to the expanding service sector, Chinese oil and gas import dependence will continue to grow in the foreseeable future, albeit at a somewhat

slower pace. Today the average Chinese consumes less than 40% energy than the average American and less than two-thirds of average citizens of OECD countries.

Import dependency for oil has reached a dangerously high level of 70%. The vast majority of China's imported oil comes from distant sources and is transported through maritime routes over which China as-yet has little control and can be subject to interdiction by a hostile navy. In many respects, China's oil import vulnerability is much greater than this ever was for the United States because most American imports came from the Western Hemisphere, i.e., Canada, Mexico, and South America. Chinese oil imports come primarily from far away and more volatile regions of the Middle East and Africa, where China cannot project power currently to protect oil flows.

Since the largest oil and gas importer and the largest oil and gas exporter in the world – Russia – share a common border, one would think that this is an energy match made in heaven. Moreover, Russia is highly dependent on Europe as the destination of its oil and gas exports for reasons of geography, geology, and history. Europe is much closer to Russia's traditional oil and gas producing provinces and infrastructure was built even during the Cold War to transport Russian oil and gas to markets in Europe. However, demand for oil and gas in Europe is stagnant to declining for economic, demographic, and climate change policy reasons. Development of new Russian producing provinces such as East Siberia and the Arctic region will depend on finding new markets where demand for oil and gas is still growing.

Objectively, it serves both Russia and China's interests to diversify respectively their oil and gas export markets and supply sources, as well as supply routes. The need for diversification grew more urgent for Moscow in 2014 when Western economic sanctions were imposed because of Russian aggression against Ukraine. This need will become much more acute after Russia launched its all-out war against Ukraine on February 24. European countries will want to reduce their reliance on Russian oil and gas imports, restrict investments, and limit exports of oilfield equipment and services to Russia. Where will Russia get the capital and technology needed for its most important industry, which at peak represented half of central government revenue and two-thirds of export earnings? The risk premium for all Western companies to do business in Russia, including or especially in oil and gas, just jumped.

At the same time, heightened concerns in the West over China's rise (or renaissance in Chinese minds) and increasingly assertive behavior abroad caused Beijing to reassess its dependence on an open international market to supply it with oil and gas. Equity oil from Chinese companies operating overseas, bilateral deals with friendly governments, and land-based pipelines all become more important in the face of American penchant for trade restrictions and unilateral, extraterritorial economic sanctions, such as those on Iran. This was true even before Washington's so-called Indo-Pacific strategy to contain China through a series of regional alliances and partnerships.

Unfortunately for Russian and Chinese strategic planners and policymakers, their dream of connecting the two economies through oil and gas flows runs into the harsh economic realities and commercial logic of the petroleum industry. The Soviet Union had planned to ship West Siberian oil to China, but this was never realized. Fact is the Chinese market is at least three times farther away from Russia's oil and gas producing regions than main European markets.

Industry fundamentals call for pipelines to be built to where producers can gain the highest price after subtracting the cost of transportation ("netback to wellhead").

Diversification may be desirable strategically for both Russia and China, but it requires the building of expensive new infrastructure and can result in earning lower revenue due to high transportation cost. The financial risks of investing tens of billion dollars demand complicated commercial negotiations. Generally speaking, oil pipeline deals are easier than gas deals to conclude, as transportation costs represent a smaller portion of the end value and oil is more easily traded to other markets. Oilfield development can start before the final market and transportation method are determined. New gas field development from a remote area does not start until there are sales contracts with creditworthy buyers who are willing to provide adequate financial guarantees.

The idea of an oil pipeline from Siberia to China was revived in the mid 1990s, but it took years to negotiate. A deal was concluded finally in 2009 with China providing loans to Transneft, the Russian state-owned oil pipeline monopoly, and Rosneft, the majority state-owned Russian oil producer, totaling \$25 billion. Oil from the pipeline started flowing directly to northeast China in 2011 and almost immediately an oil price dispute broke out, which illustrates the commercial complexities of such bargains. The pipeline was further extended to the Pacific Coast in 2013 (replacing shipments by rail) so that Russian oil can be sold from there to other Asian markets, particularly Japan and South Korea.

Despite initial difficulties, the East Siberia Pacific Ocean (ESPO) pipeline with a current capacity of 1.6 million barrels per day provides real benefits to Russia and China and even to the Asian oil market as a whole. With the arrival of a major new crude supply, the so-called Asian premium charged by Persian Gulf producers to Asian buyers narrowed and practically disappeared. Today Russia and Saudi Arabia compete to be China's largest oil import source as both countries recognize China as the premium growth market, particularly when compared with the less friendly West. This competition has geopolitical overtones not unlike in the 1970s when Iran under the Shah and Saudi Arabia competed to be the second largest (after Canada) oil exporter to the United States.

Diversification costs, but if state-owned and controlled companies are willing and able to pay the price, then strategic projects can be realized. The success of ESPO allowed both Russia and China to proceed with a more economically challenging gas pipeline project. The so-called Power of Siberia contract was signed in Shanghai in May 2014 between Gazprom, the state-controlled Russian gas giant, and China National Petroleum Corporation (CNPC) under the watchful eyes of presidents Vladimir Putin and Xi Jinping. This deal took ten years to negotiate. It is questionable whether it would have been done still if not for Putin's urgent need to show Russia cannot be isolated after the imposition of Western sanctions due to its illegal annexation of Crimea and hostile actions in the Donbas region of Ukraine.

Gazprom's investments in two gas field developments in East Siberia and the pipeline to northeast China were supposed to cost upward of \$55 billion. Development of the two fields, Chayanda and Kovykta, is critical for linking the infrastructure of East Siberia and the Russian Far East, a national priority, and would not be possible without the export market in China. Interestingly, there was no offer of Chinese loans this time, only a guarantee to purchase up to 38 billion cubic meters per year (bcma) of natural gas under an agreed pricing formula.

It is difficult to evaluate the commerciality of Power of Siberia from the outside since it is impossible to know all the elements included in a package under the direction of the two countries' presidents. What we do know is, around the same time, China agreed to be the first foreign purchaser of Russia's most advanced S-400 air defense system. Indications are that the Chinese side did a good job in negotiations with China paying a fraction of the gas price Europe currently pays for Russian gas.

The Power of Siberia story reveals the inherent vulnerability of such deals: they take a long time to negotiate, finance, and complete; project costs and financial risks are high; market conditions will change in a notoriously cyclical industry; political guidance may make deals easier to make but does not guarantee commercial success, in fact it may do the exact opposite. Power of Siberia finally started flowing a small volume of gas to China at the end of 2019 and is still not at full capacity today.

It may, however, presage things to come for Russian-Chinese gas trade. On February 4, when Vladimir Putin visited Beijing before the Winter Olympics, Gazprom and CNPC signed a 10 bcma deal for gas from Sakhalin Island to China. The unsuspecting general press bought the Russian narrative that this is an important step in deepening its energy relations with China. Meanwhile some of us wondered what happened to the 50 bcma Power of Siberia II project that is supposed to bring Russian gas all the way from the Yamal Peninsula through Mongolia to China. Gazprom had completed the feasibility study for the Mongolian segment at the end of last year and I at least expected a deal to be signed when Putin visited Beijing.

One can only surmise that China did not agree on gas price and Chinese negotiators believed that time is on their side in the negotiations. With new intensive Western sanctions against Russia because of its brutal war against Ukraine, including the suspension if not cancellation of the recently completed Nord Stream 2 pipeline to carry gas from the Yamal Peninsula under the Baltic Sea to Germany, and European reluctance to prolong its dependence on Russian gas, Russia will look desperately for alternative export markets as well as sources of capital. It may be that this new 50 bcma deal will be signed between Russia and China when Putin next meets Xi (they have only met 37 times in the last ten years), but one suspects the terms will be in China's favor.

It is telling that neither the Russian oil pipeline nor gas pipeline projects went forward until after China first built pipelines from Central Asia. The Kazakhstan to China oil pipeline was completed in 2005 with a further extension finished in 2009. The first gas pipeline from Turkmenistan through Uzbekistan and Kazakhstan to China was completed in 2009 with two additional lines built in quick succession.

For China, the big difference is Kazakhstan and Turkmenistan welcomed Chinese equity investments in oil and gas fields whereas Russia resisted initially granting large upstream ownership rights to Chinese companies, preferring instead long-term supply contracts and loans. In Central Asia, China was given opportunities in the more lucrative part of the oil and gas business, exploration and production. In Russia, it was merely a purchaser of oil and gas. For Central Asian countries, China represented an alternative to reliance on Russia as their only export route for oil and gas. In fact, for Turkmenistan, China replaced Russia as the offtaker of almost all its gas.

Competition between Russian and Central Asian oil and gas favors China. It is able to drive advantageous bargains with Central Asian countries that seek financing and options to balance Russian dominance. Contracts in Central Asia allow China to wait for the right commercial deals with Russia. Tension may yet emerge between Russia and China over conflicting interests in Central Asian oil and gas. It will be interesting to see if and how Russia asserts its influence in Central Asia with the full development of the Kashagan oilfield in Kazakhstan and the Galkynysh gas field in Turkmenistan, two world-class projects of interest to China.

It is useful to note that Chinese activities in Central Asian oil and gas and Russian interest in supplying the Chinese market with its own oil and gas long preceded President Xi Jinping's 2013 announcement in Kazakhstan of China's policy for the New Silk Road, subsequently renamed One Belt One Road and now Belt and Road Initiative (BRI). Development of oil and gas relationships coincided more with the creation of the Shanghai Cooperation Organization in 2001, which essentially recognized Chinese economic interests in Central Asia without challenging Russian political interests. The real connection between oil and gas and BRI is that these are resources that China needs and wants to invest in Central Asia, Russia, and elsewhere. To the extent that oil and gas projects are profitable, they help pay for other projects with a lower or marginal economic return, such as in infrastructure, and income from oil and gas allows countries to buy more Chinese goods and services.

However, pipelines from Russia or Central Asia suffer one major commercial disadvantage. They only bring oil and gas to the relatively poor interior regions of China and the Chinese rust belt in the northeast. The more prosperous premium markets are in the central and southern coastal areass of China that enjoy easy access to seaborne cargoes of oil and liquefied natural gas (LNG) from the world market that are much more flexible commercially and favored by traders.

Belatedly, Russia made large investment opportunities available to Chinese comapnies. In 2013, CNPC bought 20% of the \$27 billion Yamal LNG project, majority-owned and operated by the "independent" Russian gas company Novatek. When an additional 9.9% stake became available the next year, a Chinese policy bank, the Silk Road Fund, stepped in to purchase the interest. Yamal LNG shipped its first cargo in 2017. In 2019, Novatek and partners made the final investment decision on a separate \$21 billion LNG project named Arctic 2. CNPC and China National Offshore Oil Corporation (CNOOC) each own 10% of Arctic 2. In buying into these two large LNG projects, Chinese companies are pursuing a classic strategy of major LNG buyers to "claw upstream," as they had already practiced in Australia and elsewhere.

LNG made the Northern Sea Route more economically important to Russia and China as it has the potential to shorten the voyage time between the Yamal Peninsula and northeast Asia. For Russia the Northern Sea Route is also militarily important for its control of the Arctic region and for China it strengthens its claim to be a near-Arctic nation. These projects may also indicate a preference by Chinese companies to deal with private Russian companies, such as Novatek, with theoretically the same profit motivation and interest in cost control as they do. No doubt the presence of a major European oil company, Total, and the extensive use of Western contractors in both projects gave additional comfort. All this may change with new Western sanctions (including by Japan) against Russia for its war against Ukraine.

National champion companies such as Gazprom and Rosneft tend to have their own peculiar *modus operandi* and are measured differently by their majority owner, the state. The Chinese companies understand this all too well from their own domestic experience and years of negotiating with Russian state companies. Chinese national champion companies have to be internationally competitive to survive and learned from bitter experience in places like South Sudan and Venezuela. The Russian national champions enjoy homefield advantage in exploration and production, prospects of which are scarce inside China. There may be limits to the country risks that Chinese companies are willing to entertain in Russia.

Chinese companies continue to spread their economic interests in other oil and gas producing countries in the Persian Gulf, Africa, and South America. China cements increasingly close working relationships with Russia's strategic competitors in Saudi Arabia, Iran, and elsewhere in the oil patch. It will seek to gain long-term advantage by doing so and not just for short-term tactical advantage as often seems the case for Russia. For example, Saudi Arabia is China's largest oil supplier and holder of the largest, most economic-to-extract crude oil reserves in the world. Iran is the largest reserve holder of oil and gas combined. Access to resources in the Persian Gulf will remain important to China regardless of its energy relations with Russia. Relationship with Venezuela is trickier because, even though resources are large, the oil is harder to extract and less valuable, and the politics is messier. China will continue to pay attention to oil and gas producing countries in West and East Africa.

At the same time, China is in the forefront of the global energy transition. It is the largest producer of renewable energy from wind and solar. It is the largest producer of electric cars. It is the largest builder of new nuclear power plants. As part of its innovation strategy, it invests heavily in research and development of new energy technologies whether they are in clean coal, carbon capture and sequestration, batteries and other energy storage, super grids for long-distance electricity transmission, advanced materials, robotics, artificial intelligence and computing power for energy applications. China does this partly but not solely because it recognizes its overdependence on oil and gas imports and the security vulnerability this causes. For energy transition, China has the advantage of economic scale in a manner no country has enjoyed since post-World War II America.

Although China and Russia's energy interests converge in the short to medium term, they may well diverge in the long run. China wants to be the global leader in a post-oil and gas world. Russia wants the petroleum era to last for as long as possible. Not only is it the key sector of its economy, oil and gas help Russia to punch above its economic weight internationally. If the global economy actually moves beyond fossil fuels (which still represents more than 80% of global energy consumption), the Russian and Chinese economies will have much less to offer each other. Russia would have little to sell China and less money to buy from China.

China's decades-long reform path is based on opening to the global economy. Success in reform allowed China to build an internationally competitive economy that relies on open markets to supply its ever-increasing demand for petroleum and other natural resources. Chinese equity investments abroad represent a small share of the oil and gas it imports. Its energy interests are not so different from Europe or Japan's. As the world's largest merchandise trader, a functioning international trading system is fundamental to Chinese prosperity. China does not want to overturn the international system; it wants to inherit it or at least be one of the rule setters. China aspires to be a standard bearer of the new global economy.

Russia under Putin is a revanchist power, which sees the very existence of the international system, led by the United States, as unfair to Russian interests. It sees oil and gas as one of the few tools, besides military force, it has to protect and advance its regional and global interests. It prefers bilateral arrangements rather than multilateral institutions to achieve its objectives, including in energy.

Thus, the two countries present very different challenges to U.S. power. A more thoughtful and nuanced American foreign policy would try to accentuate divisions between the two instead of unintentionally pushing them together. As the two largest economies and energy consumers in the world, America and China have overlapping interests in energy innovation. On current trajectory, we appear destined to compete in this space rather than to cooperate as we once tried to do.

Sino-Russian relations may be a marriage of convenience arranged by oil and gas. However, arranged marriages have a way of lasting. Over time, one gets used to the other's annoying habits and understands the other side better. One becomes attached to the progeny that comes from the relationship. It is particularly helpful if there is a common enemy, like an overbearing neighbor.

Both presidents Putin and Xi have declared the current state of their two countries' bilateral relationship as the best in history. More of their citizens are learning each other's language, exchanging visits, studying and doing business together than even in the peak of 1950s period of fraternal Communist friendship. There are other fruitful areas for cooperation, such as in military technology. Energy trade facilitates the deepening of their relationship.

Their respective attitudes toward the United States play a contributing if not decisive factor. American policy can choose to see the Russian and Chinese challenge to American power as essentially the same and draw them closer or pursue differentiated policies that tries to separate the two. Energy is a good place to start recognizing their differences.



Figure 3. China's crude oil imports by source, 2019

eia

Source: FACTS Global Energy Services, *China Oil Monthly*, February 2020 Note: Total may not equal 100% because of independent rounding.





Figure 2. Russia's crude oil and condensate exports by destination, 2020



Source: Graph by the U.S. Energy Information Administration, based on Russian export statistics and partner country import statistics from Global Trade Tracker



Figure 6. Russia's natural gas exports by destination, 2020

eia Source: Graph by the U.S. Energy Information Administration, based on Russian export statistics and partner country import statistics from Global Trade Tracker and on delivery statistics from Gazprom

OPENING STATEMENT OF GABRIEL COLLINS, BAKER BOTTS FELLOW IN ENERGY AND ENVIRONMENTAL REGULATORY AFFAIRS, BAKER INSTITUTE, RICE UNIVERSITY

VICE CHAIR GLAS: Thank you so much, Mr. Chow. And now, I'll recognize Mr. Collins. MR. COLLINS: Thank you.

It's an honor to testify before this esteemed Commission, as the global strategic competition between the United States and the People's Republic of China continues to intensify. For the purposes of my testimony today, energy security means stable energy supplies at an affordable price. I focus on crude oil and natural gas, given China's near self-sufficiency in coal, which still provides almost 60 percent of the country's total primary energy.

China now imports, as the previous speakers have noted, about 70 percent of its oil consumption, about 40 percent of its natural gas. Only about 14 percent of that oil in 2021 came via overland pipelines, and you've got about a third of natural gas through such routes. And since 2018, almost all of the incremental growth in both oil imports and gas imports has come by sea. So, maritime routes are very important.

Of particular relevance, more than one in every four barrels of oil used in China comes from the Middle East, which is the region that's, arguably, most subject to security-driven, globally impactful outages. By comparison, the U.S. gets about 4 percent of its oil supply from that region.

The economic dislocations caused by energy price spikes and physical supply disruptions rippling through an economy are a preoccupation for any major energy consumer. There are several ways to manage these risks.

The first pathway emphasizes diversity of supply. As Winston Churchill memorably put it in 1913, "Safety and certainty in oil lie in variety and variety alone." China has followed Churchill's maxim, but, despite taking cargoes from tens of countries, cannot escape its reliance on Middle Eastern supplies.

This brings us to the second pathway, using storage to insulate against market shocks and physical supply disruptions. China now has more than 1.3 billion barrels of total oil storage capacity, at least 400 million of this residing in government-run strategic petroleum reserve sites. For perspective, U.S. storage capacity on the commercial side is about 840 million barrels, with about 727 million barrels of SPR capacity. We should expect this oil storage to grow.

China's natural gas storage is much less developed than its crude oil inventory sector is. It currently stores, relative to demand, only about a fourth of what the United States does, also suggesting that we're likely to see significant growth moving forward. Supply diversity and storage manage supply-side challenges, while the third pathway, policy and technological solutions, address demand.

China prices gasoline and diesel oil at prices lower than Western Europe with its steep fuel taxes, but substantially higher than those in the United States. It's also working to restrain, and perhaps ultimately roll back, oil usage by electrifying its transport sector. It's now the world's largest electric vehicle market and sold about five times as many plug-in electric vehicles in 2021 as were sold in the United States.

This brings us to the fourth pathway, the crux of the questions that I was asked to discuss: the securitization of imported energy supplies. Beijing and Washington interface the national security aspects of oil and gas import security much differently than other countries,

because the U.S. already projects power into the Persian Gulf, the oil- and gas-exporting region of greatest importance, while China is rapidly building up a blue water naval force that in the future could conceivably permit such power projection.

Amplifying the situation, each of our countries is locked in a strategic competition that's centered on Asia, but conduct it globally, that will define what our world looks like in 2050, and likely beyond.

U.S. engagement in the Middle East commenced in 1945, when President Franklin Roosevelt hosted King Ibn Saud aboard the USS Quincy in the Great Bitter Lake. The subsequent construction of a Pax Americana in the Gulf region and astride key global maritime oil routes required decades of diplomatic work and hundreds of billions of dollars in military investment, excluding the wars in Iraq and Afghanistan. Whether China is willing to make such investments or take on such risks remains far from clear.

Equally unclear at this point is how America's strategic posture in the Middle East will emerge from multivariable calculus, incorporating a number of vital strategic economic interests, including:

One, U.S. domestic energy and climate policies.

Two, a perceived need to refocus on competition with China and redeploy forces from other parts of the world.

Three, the potential for generational distancing from the Gulf region, as a younger generation of American policymakers and advisers gain influence.

And four, European energy sourcing responses to Russian aggression in Ukraine, which may actually increase their dependence on the Gulf region, and they are key allies of ours.

China's variables are equally complex.

First, the country could experience oil demand growth into the mid-2020s, and potentially, gas demand growth for decades beyond that.

Second, demand growth in China has far outstripped domestic oil and gas production, despite significant investments in the latter.

Third, Gulf region oil and gas exports are increasingly Asia- and especially China-centric.

Fourth, vehicle electrification remains a key wildcard, given the tremendous existing size of China's vehicle fleet and the tens of millions more EVs that would need to be deployed to begin materially reducing fuel demand.

And five, the reality that certain technocratic measures to restrain and reduce oil and gas demand that might be politically infeasible in the United States could prove more palatable in China.

Furthermore, force projection is expensive. A highly securitized Chinese oil and gas import protection policy, incorporating pipelines in a greater presence in the Middle East, could add \$50 billion or more to the country's annual oil import tab alone.

Beijing would almost certainly avoid voluntarily assuming such an economic burden, especially as its economy slows and other cost centers begin to buy. It is likely to be further disincentivized by the opportunity costs that would be imposed on China's ability to generate combat power in its existential and vital home region.

Nonetheless, U.S. policymakers should remain vigilant, given the potential downside risks to the U.S. and its allies of Chinese pursuit of hegemony in the Gulf region or, for that matter, as other speakers have referenced, Chinese construction of a parallel network of petrostates that, potentially, sidesteps many levers of U.S. economic influence.

Thank you for having me today, and I would now welcome any questions the Commissioners have.

PREPARED STATEMENT OF GABRIEL COLLINS, BAKER BOTTS FELLOW IN ENERGY AND ENVIRONMENTAL REGULATORY AFFAIRS, BAKER INSTITUTE, RICE UNIVERSITY

China's Energy Import Dependency: Potential Impacts on Sourcing Practices, Infrastructure Decisions, and Military Posture

Gabriel Collins, J.D., Rice University's Baker Institute for Public Policy, Center for Energy Studies¹

Executive Summary:

- China is likely to remain heavily reliant on seaborne crude oil, and to a lesser extent, on liquefied natural gas supplies. Sustained high oil and gas prices could incrementally ameliorate the trend by incentivizing conservation, making domestic drilling more profitable, and further accelerating vehicle fleet electrification efforts. Oil and gas storage capacity in China is also likely to expand substantially in coming years.
- More gas will come overland from Russia, particularly in the wake of the invasion of Ukraine and the likely subsequent move by European consumers to reduce imports of Russia-origin gas.
- China will generally seek to maximize benefits while minimizing costs, which means a default path of continuing to rely substantially on U.S. control of the global maritime commons outside of East Asia. Certain energy exporter states, particularly in the Gulf Region, seek to play the U.S. off China to maximize their strategic leverage but it remains unclear whether China would try to supplant the U.S. as the chief security guarantor and assume the many burdens that come with that status.
- A key exception to this trend would come if the U.S. decisively stepped back from the region and left a security vacuum and access to a physical infrastructure presence network constructed over several decades. A lesser, but still impactful version of this scenario could arise if U.S. partners in the Gulf continue doubting long-term U.S. commitments to their security. This dynamic may already be playing out in its early stages.
- Emphasizing overland oil and gas transit routes for suppliers other than Russia and the Stans would impose steep economic penalties on Chinese consumers. Adopting a more militarized oil and gas import security policy would augment these economic costs and also impose military tradeoffs Beijing would very likely seek to avoid.
- Rather than spend what could be upwards of \$50 billion per year to move seaborne oil onto pipelines and build a Middle Eastern base network, China is more likely to rely on

¹ The content of the piece exclusively reflects the author's views and in no way reflects opinions or assessments of Rice University or the Baker Institute for Public Policy. The report covers a dynamic subject area and the author reserves the right to update as may be warranted by events. Author contact: <u>gabe.collins@rice.edu</u>

market means (inventories and fuel pricing) and technological transformation—especially electric vehicles—to try and manage oil dependence.

• China is likely to continue its accelerated naval modernization program, including both quantitative and qualitative improvements to its naval and air assets, as well as special operations forces. Oil and gas import security do not appear to be a core driver of these efforts, but naval, air, and special operations capabilities are fungible across theatres on relatively short notice. A key warning indicator of strategic intent will be pursuit of facility access in energy-rich regions, especially facilities with deep draft ports and airfields able to accommodate mass aerial entry of personnel and materiel and access agreements that permit placement of munitions and execution of kinetic combat operations.

Intro:

This testimony focuses on China's interests in fossil energy resources and how they affect its energy procurement infrastructure and ability to commercially and physically safeguard this sourcing footprint and the economic interests that depend on it. "Fossil energy resource" means "coal, crude oil, and natural gas," with the primary emphasis on crude oil and natural gas since China has abundant domestic coal reserves and can rapidly scale up production in response to energy crises, as it did in late 2021 and continues to do. The assessment addresses four core topical areas to set up the final section, which offers four recommendations for actions Congress can take to uphold and advance key U.S. national interests. Key topics are:

- **1. Energy Demand and Sourcing:** What does China's current infrastructure for obtaining imported energy look like, was strategic framework was it built under, and how have sourcing approaches evolved over time?
- 2. Energy Supply Geography: What volume of energy resources does China import overland versus by sea? To what extent do overland routes offer a potential shortcut to the Persian Gulf?
- **3. Handling Energy Supply Disruptions:** How is China postured to handle energy supply disruptions, including those from armed conflict?
- 4. Military Defense of Energy Sources and Transit Routes: What are China's current and prospective future capabilities for securing energy imports, both at the source and along key transit routes? To what extent has energy import dependency shaped development of military capabilities including air and naval power projection and ground forces, including special operations?
- 5. Recommendations for Congress
I. China's Energy Demand and Sourcing

Oil and natural gas are China's second and third-largest sources of energy and now account for about 28% of China's total primary energy use, up from 22% in 2010 (**Exhibit 1**). Natural gas use alone is now larger than hydropower and exceeds wind, solar, and "other" renewables by about 50%. For oil in particular, China has for years been the world's largest source of incremental demand growth and even in pandemic-crimped 2020, still saw demand increase by about the same volume of oil that the entire country of Israel consumed daily that year.

Exhibit 1: China's Primary Energy Use, By Source



note: in raw energy terms, 1 exajoule = ~80 supertankers' worth of oil

Source: BP Statistical Yearbook of World Energy 2021, Author's Analysis

The analysis excludes hydropower, renewables (which in China primarily means wind and solar), and nuclear energy. The reason for doing so is that for PRC policymakers, "energy security" is synonymous with "import dependence."¹ While American analysts might view events such as the 2021 Texas Blackout as energy security issues, their Chinese peers broadly view challenges that are localized and soluble through domestic action as being outside of the securitized paradigm that imported resources fall into. Put differently, Chinese decisionmakers are more likely to

consider oil disruptions national security problems (国家安全问题) and electricity supply issues as social/economic problems (社会经济问题).²

Accordingly, Yangtze River water spinning generation turbines at the Three Gorges Dam and solar panels produced domestically—or for nuclear power, a combination of domestic uranium reserves, multi-year intervals between refueling, and a mandated 10-year reactor fuel stockpile-mitigates the risks of import disruption and places those energy sources in a non-securitized category.³ In contrast, oil and gas have both become increasingly vital vectors of import dependency for China. By 2020, China imported more than 70% of its oil and 40% of its natural gas. For perspective, China's present oil import dependence ratio approximates where the United States was in the early 2000s, a period of acute anxiety over resource security and one where fateful policy decisions—including the invasion of Iraq—were undertaken for various stated reasons, but all under a cloud of oil insecurity.





1.0 = fully self-sufficient, 0 = fully import dependent

Source: BP Statistical Review of World Energy 2021, Author's Analysis

Furthermore, the past 20 years make one thing increasingly clear: unlike the United States, China is not going to drill its way to lower crude oil and natural gas import dependence. Between 2000 and 2013, China's "Big 3" (PetroChina, Sinopec, and CNOOC) ramped up their combined annual

capital investment, which peaked in 2013 at about seven times the 2000 level and declined subsequently (Exhibit 3).



Exhibit 3: PetroChina, Sinopec, and CNOOC Combined Investment and Production, 1998-2020

Source: Bloomberg, Author's analysis

This massive effort brought oil production from 3 million bpd in 2000 up to about 4.4 million bpd in 2020. Gas production grew more substantially, rising about 10-fold. But for both commodities, import dependency steadily deepened because domestic production simply could not keep pace with demand growth despite cumulative nominal expenditures of more than \$1 trillion USD.² For perspective, U.S. shale producers invested roughly a trillion dollars between 2010 and 2020, during which domestic light tight oil production leapt nearly nine-fold from 842 thousand bpd to 7.4 million bpd.³ Indeed, it is likely that China's domestic oil production peaked in 2015.⁴

Instead, Beijing is taking a different tack: (1) taking in additional imports of oil and gas (with seaborne shipment dominating incremental volumes), (2) seeking to maximize its oil and gas procurement flexibility, and (3) aggressively promoting transport electrification to reduce oil demand. China sold more than 3 million plug-in EVs last year into a car parc of approximately 225 million vehicles—the world's second largest after that of the United States. As such, even if it

² With RMB/USD exchange rate movements amplifying the effective cost borne by PRC firms since domestic costs are generally RMB-denominated.

³ Author's estimate based on data from Rystad Energy (CAPEX) and the EIA (production)

doubles the current annual sales rate, fleet turnover is still a multi-decade endeavor. And as the example of Norway shows, even as EVs grab a much greater share of the fleet (more than 80% of new vehicle sales in 2021 and about 20% of the total passenger vehicle fleet), motor fuels demand can remain persistently high.⁵

Oil is consumed by far more than just passenger and light business vehicles and the heavy transport, aviation, and shipping sectors will likely be tougher to electrify. Natural gas, meanwhile, is playing a key role in helping large coastal cities in China improve residents' health and lives by reducing emissions from home heating and industrial boilers that formerly burned coal.⁶ Oil and gas also yield critical petrochemical building blocks—including for materials needed by EVs and other energy transition technologies such as wind turbines and solar panels.⁷ In short, multiple empirical realities point to a long time to come in which China's leadership will have to grapple with significant, and perhaps even larger, oil and natural gas import dependence.



Exhibit 4: China Self-Sufficiency, By Fossil Energy Source

Source: BP Statistical Review of World Energy, Author's Analysis

It is helpful to frame analysis of China's energy sourcing with the lens of energy security, which the Chinese government (like other major global energy consumers) presumably seeks to attain via its energy resource-related policies and activities abroad. Energy security incorporates three core concepts: (1) adequacy and diversity of supply, (2) stability of price, and (3) maintaining a

relatively low price.⁸ For China specifically, the need to ensure adequate and diverse oil and gas import supplies drives an increasing dependence on seaborne imports but is generally handled through day-to-day activity by firms that while often state-controlled, generally behave commercially.

Trying to maintain price stability and affordability presents more complex challenges, ones that implicate internal dynamics in both the importer and exporter countries and thus feature intertwined political, diplomatic, and potentially, military dimensions. For its entire post-Mao industrial rise to date, it has been able to free ride off on U.S. efforts to maintain unencumbered flows of oil and LNG from the Middle East and the ensure free maritime transit for the tankers that bring molecules to market.

The U.S. retains deep energy-centric interests in the Persian Gulf region.⁹ Yet a combination of increased domestic energy abundance over the past 15 years, a breakdown in the historical U.S.-Saudi "oil for security" partnership as OPEC increasingly views U.S. shale producers as competitors, and a push from some quarters to de-emphasize Washington's military role in the region suggest a much more uncertain future. Multiple scholars now question the wisdom of U.S. military presence to defend Gulf oil and gas flows, while China-focused scholars and strategists frame the Persian Gulf region as a secondary priority that should not detract from strategic focus on China.¹⁰

Pullback discussions may represent perception more than reality, especially as oil prices rise in early 2022. U.S. policy has for decades emphasized paying close geopolitical attention to key oil producing countries. Indeed, multiple U.S. National Defense Strategy documents acknowledge energy's importance to national security and the resultant perceived need to engage forward to, as the 2018 NDS puts it: *"…foster a stable and secure Middle East that…is not dominated by any power hostile to the United States, and that contributes to stable global energy markets and secure trade routes."*¹¹

While price stability is a strategic objective, it has been fleeting in the global oil market and the future looks increasingly inclined to volatility. From 1928, when the so-called Seven Sisters⁴ met at Scotland's Achnacarry Castle to form an oil pricing cartel, until the 1960s when producer country nationalism began to erode their arrangement, oil prices enjoyed a remarkable run of stability. As the Achnacarry Agreement yielded to the next oil cartel, OPEC, oil price volatility followed with the Arab Oil Embargo of 1973 and the Iranian Revolution a few years thereafter. Oil prices were rangebound (in historical terms) from the mid-1980s to late 1990s, and then volatility ensued again as a product of China's demand and the U.S. shale boom thereafter (**Exhibit 5**).

⁴ Anglo-Iranian Oil Company (now BP), Royal Dutch Shell, Standard Oil Company of California (SoCal, later Chevron), Gulf Oil (now merged into Chevron), Texaco (now merged into Chevron), Standard Oil Company of New Jersey (subsumed into ExxonMobil), and Standard Oil Company of New York (also subsumed into ExxonMobil)



Exhibit 5: Historical Global Oil Spot Prices, 1861-2020 (2020\$)

Source: BP Statistical Yearbook of World Energy, Author's Analysis

The confluence of continued strong demand for oil, increasingly intense efforts to starve the sector of capital to try and force accelerated decarbonization¹², and the return of "blood and iron" great power politics—exemplified by Russia's February 2022 invasion of Ukraine—portends price volatility ahead. Simultaneously, fundamental dynamics in the U.S. domestic energy security discussion suggest a future in which the Persian Gulf's importance and military resourcing is more likely to be downgraded than would have been the case 10-15 years prior.

The U.S. appears clearly positioned to be the world's largest oil consumer and second -largest importer (after China) for years to come, since even intensified energy transition efforts will take decades to meaningfully shift American oil consumption patterns. Unlike China, the U.S. also appears likely to remain the world's first or second-largest oil producer through at least 2030. Anti-fossil fuel domestic policies could change the trajectory, but in doing so would risk triggering a political backlash that likely ultimately leads to stronger consensus on the need to maximally exploit domestic shale resources to manage price volatility and perceived import risks.¹³

Coming years will likely feature increasing pressure upon Beijing to reduce oil import dependence by decreasing demand through transport electrification but also, potentially, to assume a more prominent role in Persian Gulf security if the U.S. elects to reduce its large residual military position there. It is even possible that a future U.S. administration more hospitable to domestic oil and gas resource development and less inclined to maintain large forward deployments in the Middle East might actively seek to force a leading Chinese role in Persian Gulf security. This would end its 40-year run of being able to "draft" off the United States and instead make it confront a strategic dilemma Washington has now grappled with for at least a decade—how to allocate combat power between its highest priority theater and the Gulf region.

Convergence of these factors—many of which are mutually reinforcing—points to China likely having to contemplate assuming a more substantive security role in key oil and gas producing geographies (aside from North America). Chinese support for Saudi ballistic missile production and revelations in late 2021 of apparent Chinese attempts to build military infrastructure at the UAE's Khalifa port suggests that Beijing may now be trying to lay more serious diplomatic and physical infrastructure for future energy security efforts.¹⁴ It had made attempts to establish a presence in the region before, including continuously deploying vessels on "anti-piracy" missions off the Horn of Africa since 2008 and building a permanent military base in Djibouti capable of docking any ship in the PLA Navy.¹⁵

II. China's Energy Supply Geography and Infrastructure

Looking at China's oil imports by region, a few things immediately jump out. First, it is having to go further from home to buy barrels, with the Asia-Pacific's share of imports declining from almost 21% in 2005 to only 3.5% in 2020. Among key oil import supply zones, three regions stand out. Russia and Latin America each saw exports to China rise by a bit less than 20% over the past 15 years. Volumes from the Middle East rose by nearly 50%, and account for close to half of China's total imports (**Exhibit 6**). For natural gas, imports come from more geographically adjacent locales, with the biggest portion originating in the Asia-Pacific (primarily Australia, Indonesia, and Malaysia) and Russia/CIS (primarily Turkmenistan and Kazakhstan, with expansion expected from Russia).



Billion Cubic Meters

Exhibit 6: China's Oil and Natural Gas Import Sources, By Region

Million tonnes per year

Some of the regional sourcing makes immediately clear how the molecules actually arrive in China. For instance, hydrocarbon supplies from Africa or Latin America obviously come by sea. Other exporters—especially Russia—supply significant volumes of oil and gas to China through both pipelines and maritime channels. Readers seeking a glimpse of the future need look no further than the respective capacities of overland and seaborne import routes for oil and gas. The three inbound oil pipelines at full tilt can transport a combined 70 million tonnes per year roughly 14% of China's total crude oil imports in 2021. In contrast, data from the Baker Institute China Energy Map suggest the country's oil ports can take in 670 million tonnes per year—about 1.3 times what China actually imported in 2021 (Exhibit 7).

Source: BP Statistical Yearbook of World Energy, Author's Analysis

Overland routes fare better on the gas side, with approximately 105 billion cubic meters per year of pipeline capacity currently in service versus 169 BCM of gas actual imports in 2021. But like oil, seaborne import capacity is higher than overland (145 BCM/yr vs. 105 BCM/yr) and is also poised to grow faster than pipelines over the next 2-3 years.¹⁶ By the late 2020s, the planned Power of Siberia 2 pipeline, now in the planning phase, could add 80 BCM/yr of pipeline supply (equivalent to about 50 million tonnes of LNG).

Intensifying economic warfare by the U.S. and Europe against Russia in the wake of that latter's invasion of Ukraine in February 2022 is likely to make pipeline routes to China more attractive to Russia due to loss of European market share if consumers there diversify gas supplies and more attractive to China, which would rather procure preferentially-priced, semi-captive supplies via pipeline from Russia instead of bidding against European, Japanese, and South Korean consumers for premium priced seaborne LNG.



Exhibit 7: China Energy Import Routes Map

Sources: Baker Institute China Energy Map, GADM, S&P Global Platts

For both oil and gas, seaborne supplies have supplied most of China's incremental import growth. Most additional oil import volumes—including from Russia—have come by sea since 2018. Pipeline gas was the largest source of imports in the early 2010s, but after 2016, inbound LNG supplies steadily rose while overland pipeline deliveries remained steady (**Exhibit 8, Exhibit 9**).



Exhibit 8: China Seaborne vs. Overland Oil Imports, 2006-2021 (Million tonnes)

Source: China General Customs Administration



Exhibit 9: China Natural Gas Imports, 2006-2021 (Billion cubic meters)

Source: China General Customs Administration

Do Current or Proposed Pipeline Routes Create Shortcuts to the Permian Gulf?

In a purely geographical sense, oil pipelines running north through Iran or offloading ships at Gwadar, Pakistan would each reduce the distance between Middle Eastern oilfields and China's key refinery clusters by a few thousand kilometers. For instance, the sailing distance from the Strait of Hormuz to Zhoushan's massive oil terminals is about 11,000 km by sea but closer to 7,000 km if tankers injected their cargoes into a hypothetical Pakistan-China pipeline beginning at Gwadar.

Yet there are distinct reasons such projects have not been built and these same factors are likely to induce Chinese policymakers and parastatal firms to continue favoring seaborne transit of oil and to a lesser, but important extent, natural gas. Key restraining factors include: (1) scale, (2) cost, (3) transit country risk, (4) flexibility of seaborne energy trade and vulnerability of pipelines, and (5) the opportunity costs of capital and excess shipping cost that could be deployed elsewhere in China's economy—or in its military budget.

This subsection focuses on scale, cost, and pipeline vulnerability. The approximate quantification of capital and operational costs will illustrate the opportunity burden for the Chinese economy and military budget if Chinese importers were to favor pipelines of unprecedented size over proven maritime routes. This analysis runs through the scenarios and seeks to quantify approximate cost burdens not because the author thinks China will build massive pipelines to reduce maritime transit risk, but rather, to illustrate the sheer economic irrationality of doing so.

<u>Scale</u>

To make a real dent in China's seaborne oil dependency, an overland pipeline project would have to be huge. It would be on par with Saudi Aramco's East-West Pipeline, whose two parallel lines of 48 inches and 56 inches in diameter run 1,200 km from the country's oil rich Eastern Province to the Red Sea port of Yanbu and can move 5 million barrels per day of crude oil.¹⁷ Aramco is currently working to expand the system's capacity to 7 million bpd and aims to complete the expansion by 2023.¹⁸

Put more bluntly, China would need additional import capacity in the same league as the world's single-largest oil pipeline. And it would have to build it under much tougher physical and economic conditions. We'll get into the economics shortly but consider the physical hurdles alone: While the Saudi East-West Pipeline climbs to a maximum elevation of approximately 1,000 meters, a pipeline transporting oil from coastal Pakistan into Western China would need to traverse the 4,700-meter Khunjerab Pass and oil would need to travel approximately 7,000 km to reach delta oil refining hubs near Shanghai or in Shandong. The distance would be even further to reach China's third refining and petrochemical cluster in the Pearl River Delta.

Gas presents a slightly different situation. Unlike the United States over the past 15 years, it does not appear that China will enjoy a domestic gas production resurgence large enough to roll back its rising import dependence. China is the logical market for gas reserves in Eastern Siberia that would otherwise be stranded by distance from Europe and the European market's general lack of gas demand growth compared to China's. Furthermore, the unfolding Ukraine crisis and Russian revanchist actions may finally prompt European consumer governments to take more dramatic action to reduce their dependence on gas piped from Russia, thus eliminating a potential source of future demand and further incentivizing Gazprom to construct export routes to China.¹⁹

China's overall economic growth slowdown introduces uncertainty about how much its gas imports may grow by over the next decade, but it appears likely that Central Asia can only satisfy perhaps 25 BCM/yr of additional demand by 2030—roughly what the country's gas use is forecast to grow by in 2022 alone.²⁰ Central Asian producers, especially Turkmenistan, have large reserves, but "above ground" issues will likely impede full development of the resource. Furthermore, a post-Ukraine invasion Russia isolated from opportunities in Europe will be incentivized to stifle (or gain economic control over) additional Central Asian exports to China, lest those displace future Russian gas sales into the increasingly indispensable Chinese market.

Despite Russia's planned Power of Siberia 2 pipeline project (slated to bring 80 BCM of capacity online, likely in the late 2020s), even a slower rate of gas demand growth in China will thus likely exceed what overland suppliers can provide.²¹ Accordingly, unless Chinese energy demand slows dramatically (possible) or there is a U.S. "shale boom-style" domestic gas production revolution (unlikely), the country's gas import future also looks to be substantially seaborne, but with potentially significant expansion of pipeline gas supplies from Russia.²² Having greater pipeline capacity and expanded LNG import facilities will give China optionality for gas sourcing, while also minimizing the perceived risk associated with seaborne imports.

<u>Cost</u>

Several real-world examples help quantify the costs and difficulties likely to be associated with a pipeline that would have to traverse difficult topographical, seismic, and temperature environments, we can examine several real-world examples. **Figure 10** summarizes important aspects of the projects, which are discussed in more detail below.

Figure 10: Comparable Cost Examples From Selected Major Oil and Gas Pipeline Projects

Name	Countries	Commodity	Capacity, MTPA	Length, Km	Cost, Million USD (Raw)	USD Million/KM
East-West Pipeline	Saudi Arabia	Crude Oil	249	1,200	Not Reported	Unknown
Abu Dhabi Crude Oil Pipeline	UAE	Crude Oil	75	380	\$3,290	\$8.7
East Siberia-Pacific Ocean Pipeli	Russia	Crude Oil	50	4,857	\$22,000	\$4.5
Goreh-Jask Oil Pipeline	Iran	Crude Oil	50	1,096	\$2,000	\$1.8
OCP Pipeline	Ecuador	Crude Oil	22	503	\$1,475	\$2.9
Atasu-Alashankou Oil Pipeline	Kazakhstan, China	Crude Oil	20	965	\$850	\$0.9
Myanmar-China Oil Pipeline	Myanmar, China	Crude Oil	20	770	\$1,500	\$1.9
Trans-Ecuadorean Pipeline	Ecuador	Crude Oil	19	500	-	-
Transandino Pipeline	Colombia	Crude Oil	9	305	-	-
Name	Countries	Commodity	Capacity, BCM/y	Length, Km	Cost, Million USD (Raw)	USD Million/KM
Power of Siberia 1	Russia, China	Natural Gas	38	3,968	\$15,912	\$4.0
West-East Pipeline II	China	Natural Gas	30	8,819	\$20,000	\$2.3
West-East Pipeline III	China	Natural Gas	30	6,840	\$20,000	\$2.9
Central Asia-China Gas Pipeline	Turkmenistan, Uzebekistan, Kazakhstan, China	Natural Gas	25	1,833	\$7,000	\$3.8
West-East Pipeline I	China	Natural Gas	17	4,000	\$5,700	\$1.4
Central Asia-China Gas Pipeline	Turkmenistan, Uzebekistan, Kazakhstan, China	Natural Gas	15	1,833	\$7,300	\$4.0
Central Asia-China Gas Pipeline	Turkmenistan, Uzebekistan, Kazakhstan, China	Natural Gas	15	1,833	\$7,000	\$3.8
Myanmar-China Gas Pipeline	Myanmar, China	Natural Gas	12	770	\$1,040	\$1.4

Note: tan-shaded cells are for project considered especially representative

Sources: CPC (West-East gas pipeline data), Ecopetrol, Global Energy Monitor Wiki, KCP (Atasu-Alashankou data), Offshore Technology (WEP I and II cost data), Petroecuador, OCP Ecuador, Radio Free Europe (ESPO cost)

To illustrate the costs imposed by high mountain ranges, consider the Transandino, Trans-Ecuadorean, and OCP pipelines in Colombia and Ecuador. Each transports oil from lowland oilfields across the Andes Mountains with a peak line altitude of approximately 4,000 meters. The Transandino line ranges from 10 to 18 inches in diameter, spans 305 km, and can move up to 190,000 barrels per day.²³ The Trans-Ecuadorean line is 26 inches in diameter, about 500km long, and to move its design capacity of 360,000-to-390,000 bpd of crude oil, incorporates more than 101,000 HP of pumping capacity.²⁴ The OCP line is designed to move up to 450,000 bpd (22 MTPA) of heavier crudes along a 503km route similar to that of the Trans-Ecuadorean system.²⁵ Transport costs are significant—from \$2.14 to \$3.50 per barrel on the OCP system (roughly \$0.56/100km moved), more than \$2.50 per barrel (roughly \$0.50/bbl/100km moved) for the Trans-Ecuadorean line and more than \$4.50 per barrel for the Colombian project (roughly \$1.50/bbl/100 km moved).²⁶

These pipelines are much smaller in terms of size and daily capacity than what a Chinese route designed as a shortcut to the Persian Gulf would be and cross less physically severe mountains but incorporate other systems, such as massive uphill pumping capacity and pressure reduction stations for the downhill portions of the line. The capital costs would be enormous. Data for oil pipelines in Exhibit 10 above—Abu Dhabi Crude Oil Pipeline, East Siberia-Pacific Ocean Pipeline, Goreh-Jask Pipeline, OCP Pipeline, Atasu-Alashankou Pipeline, and Myanmar-China Oil Pipeline—yield an average completed cost of about \$3.5 million per km. Assuming a route on the order of 3,500 km linking coastal Iran to China's western border in Xinjiang, this would imply a capital cost of at least \$12 billion for a single line with 1 to 1.5 million barrels per day of capacity. This in turn would imply that a corridor of four such lines capable of meaningfully offsetting China's maritime oil import dependence could cost \$50 billion just to get oil to the Xinjiang border. The corresponding domestic infrastructure expansion necessary to actually get the oil to refineries could realistically double that cost.

Taking the simple average of these three lines' transportation costs—about \$0.85 per bbl per 100 km moved—and applying it to a roughly 3,500km pipeline from Gwadar, Pakistan to Turpan, China would suggest a transport tariff exceeding \$25/bbl. Maritime transport from the Persian Gulf to China typically costs closer to \$2/bbl. Assuming a round arithmetic transport cost premium of \$25/bbl, this means that a 5 million bpd line operating at full capacity would effectively impose an annual tax of nearly \$46 billion on Chinese oil consumers—equal to about 18% of China's total crude petroleum import bill in 2021.

Russia's Eastern-Siberia-Pacific Ocean Pipeline (ESPO) offers a second example and one that might be more illustrative of the costs if China undertook the highly unlikely choice of building a pipeline route from the Persian Gulf into Turkmenistan along its existing natural gas import pipelines. ESPO traverses nearly 5,000 km from the East Siberian city of Taishet to the Pacific Ocean port of Kozmino, with a spur line delivering oil south to China. ESPO had to be built in a remote environment with severe climate, but fewer topographical and seismic challenges than a trans-Himalaya route would face. It cost more than \$20 billion (roughly \$4.5 million per km). As such, its construction costs were about 12.5% higher per km compared to what China's three large gas import pipelines from Central Asia cost. The costs were about 2.5 times higher per kilometer than Iran's Goreh-Jask Pipeline.

Russian pipeline operator Transneft charges a tariff of approximately 2,969 rubles per tonne (\$3.79/bbl) for oil delivered to the Chinese border (\$0.08/bbl/100km moved).²⁷ Here it's worth noting that when Russia began pipeline oil shipments to China in 2011, a USD was on average worth about 30 rubles. The rate in early March 2022 is closer to 110 rubles per USD as Putin pursues Ukraine's subjugation. As such, a Chinese-financed line paid for either in USD or RMB whose value remains tightly linked to the dollar would likely have a tariff that in dollar terms would be closer to 3.5 times the Transneft rate, implying a rate on the order of \$0.30/bbl/100km or \$10.50/bbl to transport oil from the Persian Gulf region to Xinjiang and double that amount to refineries in the Shanghai area or Qingdao. Five million barrels per day of oil delivered at a transport cost of \$21/bbl would mean an annual cost of \$38 billion—likely 10 times what it would cost to bring the oil by tanker.

Seaborne oil import facilities are generally more cost-effective than pipelines because the builder does not have to pay for the steel vessel that moves the oil from producer to the offload point. Consider the following: Huanghua Port near the city of Cangzhou along the Bohai Gulf is presently constructing an oil berth capable of accommodating 300,000 deadweight ton supertankers. The facility will be able to offload 13 million tonnes of crude annually (about 260,000 bpd) and cost approximately 3 billion RMB (approximately \$460 million at a 6.5 RMB/USD exchange rate, or half what the Kazakhstan-china Oil Pipeline cost to deliver a similar average volume).²⁸ Furthermore, oil ports have the added bonus of being able to import crude from anywhere on earth that can access tidewater.

Vulnerability of Pipelines

Pipeline present three prominent vulnerabilities. First, projects such as the Myanmar-to-China pipeline or a hypothetical Pakistan-to-China pipeline are not overland per se, but rather maritime chokepoint bypasses that must still receive inbound tankers. They therefore simply concentrate the target set for an adversary seeking to disrupt oil shipments to China.²⁹ Interdiction could take the form of a naval blockade, kinetic strikes against the unloading terminal and associated pumping facilities, or denial of access through standoff mining using munitions such as the Quickstrike-ER sea mine.³⁰

Second, even fully inland pipeline infrastructure is vulnerable to attack. In some instances, attackers sabotage the line itself. Damage can often be repaired fairly quickly, but a high attack tempo of even simple assaults can cause serious cumulative loss of throughput. For instance, the Caño Limón pipeline in Colombia has been attacked more than 1,300 times during its 36 years in service and has spent at least 3,800 days offline since it entered service in 1986 due to attacks.³¹In 2013 a series of almost daily attacks forced Colombia to reduce oil production by 35,000 bpd, a loss equal to almost 1/5 of the line's nameplate capacity.³² Chinese firms now grapple with a lower-intensity, but broadly similar threat in Myanmar where there have been multiple attacks against the Myanmar-China pipeline corridor over the past year.³³ The threat is still nascent, with attacks to date directed at regime soldiers guarding pipeline related facilities but could evolve

into a more complex threat where anti-regime elements begin targeting the line itself as rebel groups in Colombia do.

More sophisticated attackers can cause more serious disruptions by targeting pumping stations, whose equipment is more expensive and difficult to replace than the hollow steel tube of the line itself. For example, Houthi rebels targeted two pump stations on Saudi Arabia's strategic East-West oil pipeline with seven explosive-laden drones in May 2019.³⁴ The Saudi Energy Minister noted that the drones caused "a fire and minor damage to Pump Station No.8."³⁵ Houthi militants often employ drones of the Qassem-1 class with a 30kg warhead for these types of attacks.³⁶

The Houthi attacks highlight two key issues. First, a non-state actor was able to strike and damage assets approximately 800km from the Yemeni border (assuming launch from within Yemen). Second, relatively high-resolution imagery now exists of pipeline pumping stations and other energy transport facilities that is sufficiently accurate to program UAV loitering munitions' guidance and navigation systems.

As an example, consider **Exhibit 11** which shows Saudi Aramco's Pump Station Number 8 and was pulled directly from freely available Google Maps imagery.⁵ Deriving precise latitude/longitude data from such imagery software is straightforward. Facilities vulnerable to non-state groups with drones would be even more exposed to modern national militaries, who could target key facilities in remote, sparsely populated areas and rapidly disable pipelines carrying oil or gas into China.³⁷ Cyberattacks are also a key risk from both state and non-state actors, as the roughly weeklong disruption caused by a ransomware attack on the vital U.S. Colonial Pipeline demonstrated in 2021.³⁸

⁵ Used as an example for operational security reasons since this particular facility has already been targeted and this basic photo has been widely published in news media.

Exhibit 11: Example of High Availability of Imagery Capable of Guiding Attacks on Energy Transport Infrastructure



Source: Google Maps

Pipelines' fixed nature also makes them proportionally more vulnerable to natural disasters than maritime shipping. Routes traversing mountain ranges such as the Andes or Himalayas are especially vulnerable given the risk of landslides and seismic activity.³⁹ Indeed, in December 2021 a landslide damaged the Trans-Ecuador Pipeline and forced a multiday shutdown.⁴⁰ Routes crossing Central Asia might generally be less vulnerable given that many of those cross open steppe, but any route between Pakistan and China would have to cross seismically active mountains with severe, landslide-prone topography.

III. Handling Disruptions and Military Defense of Energy Sources and Transit Routes

In thinking about maritime trade versus overland pipelines, three core themes arise. The first entails assessing the impact of various disruptive threats upon either the supply of, or demand for, crude oil and natural gas. The second centers on the probability of the event (**Exhibit 12**). Third is how to best protect oneself via proactive and reactive countermeasures.





Source: Gabriel Collins, "Global Energy Security Implications of a Potential US Strategic Pivot Away From The CENTCOM AOR," Baker Institute Working Presentation, 13 November 2019, Houston, TX, <u>https://www.bakerinstitute.org/media/files/files/e769e044/ces-collins-centcom-111319.pdf</u>

Potential responses to naval blockades, hurricanes, pirates, producer country instability, and complex market environment threats such as the uncertain state of affairs and price spikes after Russia's February 2022 invasion of Ukraine sometimes overlap but can also differ substantially. Many potential threat events—including some of the highest impact ones—do not have a military solution, as the world learned from the covid-19 pandemic, for instance. This section will examine how China is postured to handle various types of oil and gas supply disruptions.

Other disruptors, such as naval warfare, may require direct military engagement to break blockades. Still others, such as piracy, producer country internal problems, and maintaining security of maritime transit lie on a spectrum in between, where kinetic power projection is important, but its degree can vastly differ. For instance, security teams embarked on tankers can repel pirates whereas attacks by nation-states on oil and gas production areas or transit routes via blockade/interdiction campaigns often require high-end combined arms capabilities to deter or defeat. Accordingly, the analysis will assess China's current and prospective future capabilities

for securing energy imports, both at the source and along key transit routes. It will also work to tease out to what extent energy import dependency may have shaped development of military capabilities including air and naval power projection and also ground forces, including special operations.

A three-part taxonomy helps classify Chinese energy security (i.e. oil and gas import security) actions. Some clearly stand apart, while others are mutually reinforcing. Category one encompasses market-oriented solutions including supply diversification, expansion of storage, and longer-term demand management approaches such as transport electrification. Category two covers "hybrid" solutions such as state-flagging of oil tankers and deployment of private security firms to defend resource producing assets or transport supply lines that layer implied or actual kinetic protection capacity atop commercial activity by private or quasi-private actors but doing so short of explicit military involvement by China's armed forces. Category three involves direct deployment of the PRC government's nation state diplomatic and military capacity.

Market-Oriented Solutions

Chinese crude oil and natural buyers have worked to try and diversify their supply sources for many years now. Oil has been the primary focus, given that it remains largely without substitutes as a transport fuel and because efforts to increase domestic supplies have faltered. China's oil imports more than tripled between 2005 and 2020 and the supplier base has been diversified during that time. But one thing has remained constant—a high dependence on the Middle East, which in 2020 accounted for close to half of China's oil imports (Exhibit 13). Middle Eastern supplies are unique because they concentrate both producer country risk (key fields geographically close to each other) and transit risks (shipments must transit either the Strait of Hormuz or the Red Sea.





Source: BP Statistical Review of World Energy, Author's analysis

Diversification helps insulate an importing country from potential coercion by specific exporter countries or small subsets of them. What it does not do is protect against price spikes caused by removal of oil supplies from the global market, whether the shortfall results from purposeful action like an embargo or attack, or unexpected outages—like an industrial accident at a major oilfield or export facility. Protection against such events comes through two primary pathways: (1) the cushion provided by inventories and (2) policies to manage demand and reduce an economy's oil intensity per unit of output.

China now has more than 1.3 billion barrels of total oil storage capacity, of which approximately 400 million barrels resides in government strategic petroleum reserve sites (**Exhibit 14**).⁴¹ The largest storage bases are located near key oil ports and major refining centers. The smaller dots in far Northeast China, far Western China, and Yunnan are all associated with oil import pipeline routes (as well as adjacent domestic production).

Exhibit 14: China Oil Storage Locations, Spring 2020

Bubble size reflects scale of site



Source: Ursa Space Systems

For perspective, U.S. commercial crude oil storage capacity in 2021 was approximately 840 million barrels, plus 727 million barrels of strategic petroleum reserve capacity run by the Department of Energy.⁴² Data vendor Kayrros estimates that as of late February 2022, China's total oil inventories were approximately 950 million barrels—92 days of import coverage at 2021 intake rates.⁴³ As such, although China is not a member state of the International Energy Agency (IEA), its crude oil inventory holding level is now in line with the IEA's requirement that each member country *"hold emergency oil stocks equivalent to at least 90 days of net oil imports."*⁴⁴

The author's prior research indicates that at multiple key Chinese oil storage locations, utilization rates between late 2016 and early 2019 were typically between 50% and 70% of nameplate capacity.⁴⁵ U.S. commercial crude oil storage facilities show similar usage patterns between 2011 and 2021.⁴⁶ Having some degree of "headroom" in the national oil storage tank fleet suggests that if circumstances warranted, oil inventories could increase substantially beyond present levels. Indeed, oil inventory data observable from space provide a key strategic warning indicator of potential PRC military action against Taiwan.⁴⁷ China is also constructing subterranean rock caverns for oil storage—with the 19 million barrel Huangdao site in Shandong online and several other locations either online or under construction.⁴⁸ Underground sites can be cheaper to build

in areas with high land costs and also offer far more protection against precision guided munitions strikes in the event of a conflict, unlike surface oil tanks that are readily broken open and ignited.

China's natural gas storage is much less developed than its crude oil inventory sector is. The country had 14.5 billion cubic meters of working gas space at year-end 2020, according to CEDIGAZ.⁴⁹ At the 2020 demand level of 330 BCM, this means China has about 16 days of working gas inventory. For comparison, the United States has approximately 137 BCM of working gas storage capacity against 2020 demand of 832 BCM, implying a storage cushion of closer to 60 days.⁵⁰ It is thus likely that if China continues to become more dependent on natural gas, the government will encourage firms to expand storage capacity. Gas storage in China may also assume a different form than is the case in the U.S., for instance. At least one company, CNOOC, appears to be "oversizing" the cryogenic storage tanks at one of its LNG import terminals with largest of kind tanks that can literally each hold the entire capacity of the world's largest class of LNG tanker.⁵¹

China also has options for "stretching" its existing crude oil and natural gas inventories. Fundamentally, there are proactive options— using fuel pricing to manage demand in the near-term and transport electrification over the medium and long-term—as well as the "reactive" option of demand rationing in the event of a severe disruption. For natural gas, the country can throttle up coal-fired power plants to increase electricity supplies. This option is already in use and appears poised to accelerate as the energy crisis of 2022 continues to unfold.⁵² Vice Premier Li Keqiang noted at a National Energy Commission meeting on October 9, 2021 that China must maintain stable and secure energy supply chains and that this effort will include greater development of domestic coal, oil, and gas resources.⁵³ Just two weeks later, Premier Xi Jinping emphasized the importance of energy security, telling workers at the Shengli Oilfield that China must "ensure that its energy livelihood remains in its own hands" (能源的饭碗必须端在自己手 里).⁵⁴

Fuel Pricing

Fuel pricing can be used as a mechanism for managing demand and encouraging more efficient energy consumption behaviors. In parts of Europe, for instance, motor fuels are taxed at very high rates to encourage greater fuel-efficiency in vehicles and use of public transport or nonpetroleum powered modes of transportation (bicycles, walking, etc.). In China's case, the National Development and Reform Commission sets gasoline and diesel fuel prices.

In the mid-2000s, prices tended to stay fixed for periods of many months and often not only lagged behind crude oil price movements, but also undershot them as the Chinese authorities sought to minimize impacts on consumers. The 2010-2014 period saw the wholesale prices of gasoline and diesel begin to track international crude prices more closely and from 2014 onwards the alignment of price movements has been tight (**Exhibit 15**).

Exhibit 15: Wholesale Gasoline and Diesel Fuel Prices in China vs. Crude Oil Prices



Monthly Index, May 2005 =1

The NDRC pricing mechanism states that if international oil prices change by more than 50 RMB/tonne (about \$1/bbl) and remain at that level for 10 working days, oil products prices will be adjusted in accordance.⁵⁵ But while China's official price setting tracks relative global crude price movements, it does not accurately track their absolute level. In fact, for 7 years and running, both gasoline and diesel prices in China have consistently exceeded their U.S. counterparts by a substantial margin. While U.S. Gulf Coast gasoline spot prices closely track the relative movements and absolute levels of key global crude oil benchmarks, China's wholesale gasoline price presently exceeds that of its U.S. counterpart by nearly 1/3. A plausible explanation is that the NDRC prefers to keep prices high to restrain oil demand growth, promote efficiency, and perhaps also make electric vehicles more attractive to Chinese consumers.

Transport Electrification

China's historical position vis-à-vis the nexus of transportation and energy has been one in which supply insecurity motivated strategic thinking. On the national security side of the ledger, reducing crude oil import dependency could confer significant strategic benefits. Chinese leaders have long worried that in a conflict, an opposing navy could interdict oil shipments to China via a so-called distant blockade. Even if such a campaign ultimately failed to force China's capitulation

Source: Bloomberg, EIA, Federal Reserve Bank of St. Louis, Author's Analysis

in a conflict, it would very likely cause the country substantial transport disruptions and economic damage.⁵⁶ Policies such as vehicle electrification that eventually drive down crude oil dependence can help address these deep-seated strategic concerns by making oil imports a less attractive strategic pressure point for potential adversaries. There is also a financial dimension. With China now importing more than 3.5 billion barrels of crude oil per year, the expenditures are significant—with a dollar price tag second only to that incurred from semiconductor imports.

Finally, China's industrial policy seeks to make electric vehicles an area of global competitive advantage. The Made in China 2025 concept specifically names "new energy vehicles" as one of 10 priority sectors.⁵⁷ The State Council's New Energy Vehicle Development Plan 2021-2035 articulates EV development and market penetration in holistic terms, noting that policymakers aim to encourage broad collaboration and synergistic activities invoking not just the auto industry, but also the energy, transport, and IT sectors.⁵⁸

Transport electrification, however, allows China an opportunity to harness industrial prowess and a unique hardware + software domestic tech development ecosystem to gain technological first mover advantage, and have a real shot at becoming the prime global market shaper in a manner that was simply never possible with petroleum-based transport fuels and technologies. Indeed, the 15-year new energy vehicle plan released by the State Council in November 2020 emphasizes the "promotion of integrated industrial development" (推动产业融合发展).

The State Council's "Energy Conservation and New Energy Vehicle Industry Development Plan for 2012-2020" [节能与新能源汽车产业发展规划 (2012-2020年)], which was published in July 2012, laid out these policy goals as well as a set of concrete numerical targets. Most specifically, the document sought to have China achieve production and sales of 500 thousand battery and hybrid-electric vehicles per year by 2015 and 2 million units per year by 2020. China's automakers fell just short in 2020, but saw a dramatic 2021 in which 3.3 million battery EVs and plug-in hybrids were sold in China (**Exhibit 16**). The EV sales proportions reached in late 2021 are actually ahead of the target established in the State Council's New Energy Vehicle Industry Development Plan for 2021-20135 [新能源汽车产业发展规划(2021-2035年)], which seeks to have battery and plug-in hybrid vehicles comprise 20% of total new vehicle sales by 2025.



Exhibit 16: China Battery and Plug-In Hybrid EV Sales, Units and Proportion of Total New Passenger Vehicles Sold, Monthly

China's EV fleet is growing quickly and approximately 8 million vehicles have been sold (versus a total passenger vehicle fleet of 225-235 million units). Rapid EV expansion does not yet appear to have significantly cut into gasoline or broader transport fuel usage. Norway offers a rough yardstick because it has one of, if not the, largest global EV fleet as proportion of total vehicles.

Data from Statistics Norway allow a small temporal snapshot between 2016 and 2020, with 2019 being the most representative year since it did not suffer pandemic impacts to fuel demand patterns. In 2019, sales of diesel fuel—the largest fuel source for Norway's car fleet—fell by about 3% year-on-year after posting a slight increase in 2018.⁵⁹ Gasoline sales declined by 5.5% YoY, an acceleration from 2018, when they declined by 3%. Battery EVs and plug-in hybrids accounted for about 13% of the Norwegian passenger car fleet in 2019. China will need 30-35 million EVs to reach the same fleet proportion that Norway attained in 2019, suggesting that EVs as a demand management strategy still have a long way to go before they impact oil demand sufficiently to relax policymakers' concerns about oil import dependency.

Source: CAAM, InsideEVs, Author's Analysis

Rationing

In the event of a severe oil supply disruption imposed on China specifically (i.e. an oil blockade) rationing could significantly extend inventory life. The author calculated in a 2018 study of how China might respond to a maritime oil blockade that if China was cut off from seaborne oil imports but did not implement rationing, inventories would last approximately 3 months. The numbers would be broadly similar today. Rationing substantially extended inventory life, as a 35% demand reduction would extend inventory life to 10 months and a 45% demand reduction would stretch stock life to nearly 2 years.⁶⁰ There is a historical precedent for such drastic action during a time of conflict. Between 1941 and 1944, the United States used a mix of voluntary and compulsory measures to decrease private and commercial highway gasoline consumption (i.e., transportation-driven gasoline demand) by 32 percent.⁶¹

Hybrid Solutions

Maritime transportation of oil to China, especially if carried in tankers owned or chartered by PRC firms, may lend itself to intermediate protection options. Specifically, tankers can be PRC-flagged and if necessary also embark armed security teams from PRC private security firms. The issue deserves close attention because PRC oil trader Unipec has for multiple years been the world's largest charterer of very large crude carriers (a/k/a "supertankers") and in 2021 chartered more VLCCs than the next five charterers combined.⁶²

State-flagging tankers is fundamentally a deterrent strategy for situations of heightened tensions but short of full-scale war. A PRC-flagged tanker in government service would enjoy the substantial protection of China's flag. If an outside power interdicted such a vessel, China would have grounds to claim a sovereignty breach that could justify an armed response.⁶³ The fact that China's main oil trading firms are parastatal and are substantially owned/controlled by the PRC government would introduce some degree of ambiguity as to whether a vessel was in "government service" but if Beijing needed to make the argument, it would likely be relatively straightforward. The result is, as we put it nearly 15 years ago an escalatory barrier that "would thus deter adversaries from interdicting PRC oil shipments unless hostilities were either imminent or already underway. It is difficult to imagine a scenario short of major war in which an adversary would risk triggering escalatory behavior by Beijing."⁶⁴

If Chinese interests wished to augment protection for energy shipments—likely against non-state actor threats—but without incurring the potential diplomatic and economic costs of a military deployment that would be overkill relative to the problem, they could hire from the PRC's burgeoning private security sector. Embarking armed personnel on ships would reap the bonus of credible protective capacity while minimizing the legal, diplomatic, and practical liability onus that arises when deploying private security forces ashore.⁶⁵

China's domestic private security contractor (PSC) scene has burgeoned, with one analyst estimating that more than five thousand domestic PSC's in China employ at least three million people.⁶⁶ Yet their overseas operational footprint remains small and Chinese law restricts them

from conducting armed missions.⁶⁷ Moreover, even if this restraint were removed, Chinese PSCs are very different than their competitors from the United States, the Former Soviet Zone, and other jurisdictions with a substantial supply of highly-trained and combat-hardened ex-military personnel. For the meantime it is therefore likely that even Chinese-flagged vessels needing armed protection short of direct military escort would hire contractors from other countries.

IV. Military Defense of Energy Sources and Transit Routes

Chinese analysts fall into two basic camps, which Zha Daojiong characterizes as "globalists" who favor greater reliance on the market and accelerated energy transition efforts to reduce oil dependence and "nationalists" who favor a more forward-leaning mercantilist posture to protect China's energy security, which is synonymous with oil and gas import dependence.⁶⁸ Many of China's national-level approaches to date, including maximizing supply diversity, expanding oil storage, solidifying PRC firms' global presence in key oil procurement and trading nodes, managing domestic demand through fuel pricing, and aggressive pursuit of transport electrification emphasize market reliance with an undercurrent of mercantilist state industrial policy.

A key question remains and the potential answers to it regularly and dynamically evolve: to what extent, if at all, are energy security concerns shaping China's military development? At present, capabilities are growing but do not appear to be driven by a specific mission focus on energy security. Chinese ground forces are not oriented toward large-scale foreign deployments nor are its air assets, perhaps beyond heavy lift assets useful for evacuating Chinese citizens from distant conflict zones.⁶⁹ For naval force modernization and posture, the energy security question is more pressing. Ultimately, seapower is highly fungible and oil/gas import security likely comprises an incremental subset of what has become a broad array of potential "far seas" missions for the PLA Navy.

Examining a historical archive of China Defense White Papers dating from 1995 to 2019 supports such a holistic view. The term "energy security" first appeared in the 2004 edition, the same year China's oil imports ballooned.⁷⁰ The 2006 White Paper noted that concerns about energy resource security (along with multiple other non-traditional security threats) were mounting.⁷¹ The 2008 and 2010 White Papers used similar language. The 2019 White Paper offers more nuanced views that likely more accurately reflect leadership thinking about the intersection between naval power and commerce protection, noting that with respect to China's overseas interests "The PLA conducts vessel protection operations, maintains the security of strategic SLOCs, and carries out overseas evacuation and maritime rights protection operations."⁷²

How recognition translates into reality on the ground (and more importantly, at sea) remains to be seen. China is clearly building naval forces capable of operating further afield. The PLAN is now building its third aircraft carrier, one that will be closer in size and operational orientation—including catapults—to U.S. carriers.⁷³ It has also launched a total of at least 25 Type 052D destroyers and at least eight Type 055 cruisers, each of which could project serious combat power

far from China's shores.⁷⁴ It has also commissioned 10 amphibious ships (8 X Type 071 and 2X Type 075) with more on the way.⁷⁵

China's quantitative and qualitative improvements to its naval forces, and indeed across its military services, have been impressive in recent years. But it is also worth bearing in mind that seeking to protect energy shipments coming from far overseas ultimately means seeking to contest control of the global commons. As Barry Posen of MIT puts it:

"The specific weapons and platforms needed to secure and exploit command of the commons are expensive. They depend on a huge scientific and industrial base for their design and production ... The development of new weapons and tactics depends on decades of expensively accumulated technological and tactical experience embodied in the institutional memory of public and private military research and development organizations. Finally, the military personnel needed to run these systems are among the most highly skilled and highly trained in the world. The barriers to entry to a state seeking the military capabilities to fight for the commons are very high."⁷⁶

Whether China wants to take this challenge on is far from clear, given the potential distraction from the core strategic priorities of re-incorporating Taiwan and establishing control over the country's adjacent maritime environment. Furthermore, the PLA Navy would likely need to expand further precisely as its first growth stages are now reaching midlife and becoming more expensive to sustain.⁷⁷ It would also require significantly increasing China's basing and access footprint across the Middle East and Indian Ocean Region.⁶ China presently has one permanent base—a logistics-focused facility at Djibouti with an approximately 400-meter runway. In contrast, the U.S. maintains access to dozens of sites in the region, with runways able to handle any aircraft in the inventory and full basing abilities (including munitions storage, repair, and host country approval for kinetic operations) at multiple of these across several countries.

The U.S. Gulf Region experience is not definitive for hat China might face but offers useful insight into the time it takes to build a credible, comprehensive security presence in oil and gas-exporting areas, the number and types of capabilities and platforms for handling various situations, and the potential cost to combat power in other theaters of interest. Diplomatic relationships, the base facilities and access that resulted from them, and the force deployments dedicated to the region cost decades of time and hundreds of billions of cumulative dollars—not including wars.

The U.S. presence in the Gulf Region commenced in the late 1940s, grew in the shadow of the dominant British role, and then assumed greater prominence after the 1956 Suez Crisis and Britain's subsequent decolonization moves. Conjunctive diplomatic action and military

⁶ The ensuing discussion focuses on the Middle East and Persian Gulf region because of its central importance to global oil supplies and also LNG. Furthermore, the region must move its resources to market through a handful of vital chokepoints that are frequently threatened with physical attacks by nation-state and non-state actors. Finally, the region has a greater risk of high-intensity warfare than China's other key oil supply regions (Africa and Latin America) because of potential for conflict between well-equipped, significantly capable nation state militaries.

deployments by the U.S. intensified in the 1960s through multiple crises.⁷⁸ U.S. policy toward the region became more explicitly securitized following the 1979 Iranian revolution and the Soviet Union's 1979 invasion of Afghanistan. In 1980, President Jimmy Carter introduced the "Carter Doctrine" that came to characterize U.S. policy toward the region as it still exists today, noting that ""Let our position be absolutely clear: An attempt by any outside force to gain control of the Persian Gulf region will be regarded as an assault on the vital interests of the United States of America, and such an assault will be repelled by any means necessary, including military force."⁷⁹

The "Tanker War" that ensued a few years later when Iraq and Iran began firing on tankers carrying oil through the Gulf helps illustrate the potential level of military commitment that China could face, were it to become the region's lead security guarantor. In 1984, Iraq intensified its targeting of tankers serving Iranian export facilities and Iran responded against ships carrying Iraqi oil, as well as vessels loading at Kuwait, which was using a portion of its oil revenues to support Iraq's war effort.⁸⁰ By early 1987, the situation had escalated to the point that Kuwait sought to reflag tankers carrying its oil as American for protection. Worried that the Soviets might seize the opportunity to reflag the tankers under the hammer and sickle and project naval power directly into the Gulf, Washington swung into action and launched Operation Earnest Will to escort tankers and Operation Prime Chance, a covert parallel action to interdict Iranian minelayers and tanker assailants.⁸¹

Operation Earnest Will saw 13 U.S. warships deployed within the Gulf for escort missions and a total force that included a carrier battle group in the Gulf of Oman that brought the entire deployment to between 25 and 30 vessels in theatre at a given time.⁸² U.S. special operations forces also deployed, with the Army's 160th Special Operations Aviation Regiment (the "Nightstalkers"), Navy SEALs, Special Boat Units, Marines, other Navy personnel and two oil platform construction barges that were converted into floating sea bases.⁸³ Chinese forces at present would likely struggle (or even be outright unable) to sustain this level of forward deployed maritime combat power due to a combination of inexperience and lack of a well-developed logistics system. Moreover, deployments approaching this scale would materially reduce available naval combat power in East Asia, China's priority theatre. Smaller deployments such as the ongoing anti-piracy task forces have value for "showing the flag" but offer limited capability for handling nation-state challenges that are less likely, but are the low-probability, high-impact scenario that a robust naval presence ultimately aims to insure against.

Gulf operations also wrought significant battle damage and loss of life on U.S. forces. In May 1987, an Iraqi aircraft struck the guided missile frigate USS Stark with two Exocet anti-ship missiles, killing 37 crew members and nearly sinking the vessel. Less than a year later, the frigate USS Samuel B. Roberts hit an Iranian sea mine and was nearly lost, precipitating Operation Praying Mantis, the U.S. Navy's largest surface engagement since World War II.⁸⁴ The PLA Navy's battle damage management skills and the national leadership's risk tolerance could be rapidly and severely tested.

Major forward deployments motivated by energy concerns also incur substantial financial costs, both for the directly deployed forces and for changes that may ripple through the entire force structure as a result of specific military commitment in energy-rich regions. And even significant force deployments still do not calm market forces. As one analyst put it, "...force projection is not a remedy for market power but a strategy to contend with its consequences."⁸⁵ If force projection increases propensity to become involved in conflicts, costs can balloon much further—as the U.S. experienced with a multi-trillion dollar campaign in Iraq.⁸⁶

Combining the likely capital and operational costs of Persian Gulf bypass pipelines estimated earlier in this testimony with the fact that a baseline force structure akin to that the U.S. has maintained in the Gulf Region since the 1980s could realistically cost upwards of \$20 trillion per year suggests that a maximally securitized Chinese oil and gas import protection policy could add \$50 billion or more to the country's annual oil import tab. Beijing would almost certainly avoid voluntarily assuming such an economic burden, especially as its economy slows and other cost centers begin to bite. The economic dynamics and political complexity of major distant force projection, plus the opportunity cost for China's ability to generate combat power in its existentially vital home region, will likely disincentivize militarized, overland-focused oil and gas security policies.

V. <u>Recommendations for Congress</u>

Recommendation 1: Identify and monitor key warning indicators of PRC intent to try and establish greater control over key oil and gas exporting regions. Congress should consider creating an annual "China Global Energy Supply Influence Report." The public version could assess PRC involvement in arms trade, weapons development, financial transfers to, and facilitation of corruption and/or financial influence activities in key oil and gas-exporting countries. It should also track attempts to establish military presence in these areas, particularly efforts such as those seen in the UAE and Equatorial Guinea in late 2021 that could lead to permanent forces access and presence. A non-public addendum to the report could identify targets and methods for legislative, legal, diplomatic, and if necessary, physical actions to address PRC encroachment in areas identified as key energy security interests of the United States and its allies.

Recommendation 2: *Impose costs on China's attempts to upgrade its presence in the Gulf Region, deny it hegemony over key Gulf states.* Key state leaderships' interactions with the Chinese are by all appearances more about keeping the U.S. interested and invested in the region than they are an actual attempt to trade the traditional security guarantor for a new one. U.S. presence is desirable to our partners and they want us there, but they are concerned about our level of commitment.⁸⁷

Do not make the "Bagram mistake" of effectively abandoning high value strategic outposts. Maintain current forward presence in the CENTCOM AOR and the associated diplomatic, economic, and military equipment supply partnerships. If the U.S. were to exit certain facilities, China could gain access at relatively low cost. Conversely, to build its own basing network from scratch, it will face steep diplomatic and economic costs to construct the network and then maintain/sustain it. Finally, forcing Beijing to build its own proprietary basing network creates strategic warning indicators of Chinese intent because the necessary actions take years to unfold and are physically impossible to conceal in most cases.

Recommendation 3: *Refocus U.S. high-end maritime combat power further east, build a lowerend footprint in Latin America, Africa, and the Middle East.* The transition is already well underway for 5th Fleet, with Bahrain now homeporting Cyclone-class patrol boats and two Coast Guard cutters.⁸⁸ Latin America and Africa also offer rich upside for enhanced naval presence with smaller craft that have missions distinct from their larger blue water brethren. Put more bluntly, having a DDG hunting pirates, drug smugglers, terrorists, and confronting radical Iranian elements in the Gulf is not sensible. Performing these missions with fast, low-draft vessels of 100to-1,000 tons displacement that can be built in the United States <u>does</u> make sense and preserves high-end platforms for contingencies involving China, Russia, North Korea, and the like.

Ultimately, maintaining a strong lower-end presence aligned with more unconventional threats, while being able to surge higher end forces (air and naval) as necessary in response to crises underpins longstanding relationships in key regions while minimizing opportunity costs for readiness and concentration of combat power in key zones of the Indo-Pacific.

Recommendation 4: *Facilitate upgraded U.S. combat power in the Indo-Pacific by reaching a détente with Iran.* This is a multi-year process under the best of circumstances, but the time to start is now. Iran is not an existential threat to the United States, even if it were to acquire nuclear weapons. If it did do so, it will be highly deterrable given the juxtaposition of a small number of Iranian weapons versus a multi-thousand warhead, highly survivable U.S. nuclear triad. Deterrence has worked to date with North Korea and there is no indication it would not also with Iran. Furthermore, the same reduction of tensions with Iran that would facilitate greater U.S. high-end focus on the Indo-Pacific region would also likely reduce Iran's incentive to obtain and deploy nuclear weapons—especially weapons designed to be delivered outside the Gulf region.

Recommendation 5: Maximize U.S. strategic room for maneuver through a combination of carbon fees, greater exploitation of domestic energy resources, and promotion of nuclear energy. Carbon fees can help create incentives for deeper electrification of transportation, more efficient use of domestic natural gas, and more rapid deployment of nuclear energy that would help insulate the U.S. and its allies against energy coercion. Imposing costs per unit of carbon emitted is admittedly not a popular subject now amidst high inflationary pressures. But the conversation should begin now because American energy abundance—and by extension, our technological and industrial capacity to outcompete the People's Republic of China—depends on it.

Recommendation 6: Promote a policy of "climate competition" to foster domestic energy transition and innovation efforts, enhance American international climate partnership credibility, and disincentivize coal use in China.⁸⁹ Adopting a competition-oriented approach

can help insulate the U.S. from climate traps in which the PRC demands concrete upfront concessions corrosive to the rules-based order in exchange for a "definite maybe" on its part.⁹⁰ If successful, it can also help the U.S. build a pro-energy abundance climate coalition that could use carbon border adjustment taxes to help lever China off of its present course, which could see more than one hundred billion additional tonnes of coal burned in the next 25 years and drive up the atmospheric CO2 concentration by an additional 10% relative to today's level.

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PANEL II QUESTION AND ANSWER

VICE CHAIR GLAS: I want to take a moment to thank all of you for your oral testimony before the Commission today.

In terms of the next part of this process, I'm going to recognize Commissioners in reverse-alphabetical order for five minutes of questioning each. A Commissioner can feel free to pass, if they do not have any questions. But I will take the liberty of starting this process and ask you some questions.

Obviously, we're all trying to unpack the situation with the destabilization with Russia and the attacks on Ukraine. And we've seen the public affirmation between President Xi and Putin leading into the Olympics and their constructive relationship that has been demonstrated on the world stage for a number of years.

I'm just wondering to what extent this is really an energy-driven relationship. And in your written testimony and the oral testimony, Dr. Meierding, as well as Mr. Chow, you talked about the landscape changing very quickly related to energy, especially with this complicated relationship with Russia; and that, with Western companies exiting out of Russia -- the big names like ExxonMobil, Shell, BP -- as a result of this conflict happening in Ukraine, that that's actually provided an opportunity to the Chinese.

And you cautioned a bit about the limitations of sanctions or ways that the U.S. Government should think about sanctions moving ahead. And I know this is an active conversation, both in the Congress and in the Administration.

So, I was wondering if you could answer, for lawmakers who are trying to figure out how best to turn up the heat a bit on the situation unfolding on the nightly news with Ukraine, how best to try to address some of these critical issues, as well as to talk about what opportunities exist for the Chinese, given what's happening in Russia right now.

Dr. Meierding, do you want to start? And then, Mr. Chow?

DR. MEIERDING: Sure. I can start.

First, in response to your initial question about to what degree is this driven by energy, certainly, that's a shared interest at this point, but I would say it's certainly not China's and Russia's only point of commonality, one of those being the fact that both of them believe that they're targeted by the United States, both of them being committed to a different form of government. So, I think there are some sympathies that go beyond the energy relationship.

Certainly, Western companies, oil companies, pulling out of Russia provides a potential opportunity for Chinese companies to invest in the long term. It also, potentially, creates an opportunity for China to buy more Russian oil, although the amount that's actually available hasn't necessarily increased for them as much at the moment, because only the United States is sanctioning purchases. That being said, China has certainly been engaging in self-sanctioning at the moment, partly because of the difficulty of financing oil purchases.

So, my recommendation moving forward would be to see if there are any ways to engage China constructively on this conflict, to involve them in the negotiations, and to not speak too loudly about the possibility of jumping on them, should they continue to purchase or purchase small amounts more of Russian oil.

VICE CHAIR GLAS: Thank you.

Mr. Chow?

MR. CHOW: With the proviso that I gave at the beginning of my testimony that it's
hard to read Chinese minds when they're still trying to make up their mind, I would point out a few points that may be relevant.

One, China was Ukraine's largest trading partner, except for EU as a block. So, what happens is big for China as well. And I don't believe the stories that they were told on February 4th exactly what Vladimir Putin was going to do. I don't think even Vladimir Putin is crazy enough to trust another country to say, "You know what? Twenty days from now, I'm going to start a war." I just don't believe any of this reporting from The New York Times or anywhere else.

The way I would look at energy, because I'm a recovering oil company guy, is that energy trade provides the cash that facilitates everything else. Without energy, what does Russia have to sell to China? Not very much. You know, the military technology that may still be, soon be antiquated, once the Chinese reverse-engineer the stuff that they receive. So, you know, it's hard to have a relationship with this cash lubricating everything else.

I would not take the BP and Shell withdrawal announcement at face value. I'm sorry. I mean, Yale just published a listing of Western companies who say they're going to withdraw. It will take time. Who are they supposed to sell their interest to? Nobody will want to buy it now, including the Chinese. Why should the Chinese pay top dollar for assets that no one else wants to have?

So, if I were Rosneft, I would take BP's share back as Treasury shares, and if I were Shell, I mean, if I were Gazprom, I would take Shell's interest in Sakhalin-2 and pocket it, and then, look for buyers. So, it's not going to be the clean break that people seem to think it would be. So, I just don't think that it is really as quick as all that, as the press would like us to believe.

Secondary sanctions is what matters, whether the U.S. is going to apply secondary sanctions on China, but not only on China. Think of India, right? Today, if you went out and bought Russian export blend crude oil, you would get a \$20-some-per-barrel discount because no one else wants to buy it. Well, India wants to buy it. India was asking Russia if it would take rupees for the oil, right? The Saudis are talking about trading oil in RMB, rather than in dollars. Why? Because everyone's trying to figure out a way, in the future perhaps, not immediately, of how to avoid the impact of secondary sanctions applied by the United States unilaterally.

So, this is something to watch in the future, but I would certainly caution Congress to maybe consider some of the unintended consequences of doing something too quickly and too broadly.

VICE CHAIR GLAS: Thanks to both of you.

I'm now going to recognize Commissioner Wong.

CHAIRMAN WONG: Thank you.

Mr. Collins, I took note with interest your recommendation regarding a policy of climate competition. And I understand there was a longer article you and a partner put out in Foreign Affairs, and then, I think your Baker Institute put out an even longer explanation. So, I didn't read all of those. I read a lot of it.

And I thought it was very interesting because, you know, a lot of the discussion on climate with regards to the U.S. policy towards China talks about cooperation with China, coordination with China, getting binding agreements and a plan to which we will both act.

But there is another strain of thought out there that, if making reductions in greenhouse gases is a true interest of China from an environmental, security, and political perspective, that we could have more of a policy of taking actions in parallel that are not necessarily coordinated and binding, but that we should both, if it's in both of our countries' interest, we can move in

parallel.

So, I saw your recommendation to be somewhat a part of that. But I wanted to give you a little moment to expand upon the general recommendation of a climate competition policy and what that would entail.

MR. COLLINS: Certainly, and thank you for the question.

To sum up our baseline reasoning behind why we think climate competition, especially in the early stages, makes more sense than immediately seeking cooperation is, if we situate the U.S. position versus China in the context of the broader geostrategic competition that's well underway, there's an enormous risk that the United States will, effectively, be asked to make concrete commitments and sort of, so to speak, a cash down payment upfront, and will get a "definite maybe" in return. And we think this is something that, potentially, introduces long-term strategic disadvantage.

And I think a second factor in why it's important to move in parallel and to adopt a competition first mindset is it helps us make changes in our own energy system that not only contribute to reducing and managing emissions globally, but also ensures long-term energy abundance in the United States, which is a critical pillar of our industrial competitiveness. It's, ultimately, going to underpin our economic competitiveness, and therefore, our ability to remain a leader in every other dimension.

CHAIRMAN WONG: Are there any specific items in a competitive climate policy that you would recommend that perhaps Congress can act on?

MR. COLLINS: So, I'll start with the most unpopular one. And there's a few Members we've spoken with. So, we know it's probably not going to be popular, but it needs to be on the table now. And that is some type of meaningful price on carbon. I mean, the words "carbon tax" I think have a bit of a semantic kiss-of-death aspect to them. But I think, whether you want to call it a carbon fee, or whatever other term that my legal brethren come up with when they draft the legislation, I think this is a conversation that we need to really start having in earnest now, because it plays to so many of our strengths here.

China still gets about 60 percent of its primary -- a little bit less than that -- but close to 60 percent from coal. We're very natural-gas-centric. We're proportionately much more nuclearheavy than China is. We have the ability to expand this. There's so many things that play to our strength.

And I think taking an approach toward a carbon tax or carbon fee that really opens the playing field for both technological innovation in developing new things, as well as greater capital deployment toward things we already have, I think is something that would really serve us well in the longer term, but time waits for no one on this and it's really something that we need to move on urgently.

CHAIRMAN WONG: And just to be clear on your recommendations, that carbon tax, obviously, would be domestically applied to our industries and citizens, but you do have, what I gather, some sort of tariff-like fee, a recommendation against Chinese products arising from their carbon-heavy industries?

MR. COLLINS: That is correct, and that is exactly why I talk about this differential in carbon intensity. What it does, if we commence with putting a fee on carbon here in the United States, is, hopefully, these efficiency changes get set into motion, deepening what we've already accomplished. It sets us up to apply carbon border adjustment taxes, not just unilaterally vis-a-vis China, but, ideally, in concert with our partners in Europe and elsewhere in the industrialized democracies. The European Union is already looking at a carbon border adjustment plan. So, I

think it's something that plays to our specific interest, but it's also something that could be operationalized in conjunction with our allies abroad.

CHAIRMAN WONG: Thank you.

VICE CHAIR GLAS: Commissioner Wessel?

COMMISSIONER WESSEL: Thank you all, and thanks, again, to our Chairs, because this is a timely and interesting hearing.

Dr. Meierding, you seem to argue a cautious approach with regard to sanctions in terms of potential unintended consequences and China's response to that. I want to understand, to the extent you all can help me, and Mr. Chow as well.

It seems to me that, over the last couple of years, China has been the senior partner, shall we say, with Russia, as Russia has encountered so many problems. But that its energy dependence, rising energy dependence on Russia, has now created enormous problems for China, in that Putin played China somewhat as a fool, if you will, in terms of the current international problems.

China has to be concerned about the resolve of the West, the rapidity at which sanctions were imposed, and the breadth and potential continuation of sanctions. Does this drive China into further dependence on Russia? And do you see China seeking new routes for enhancing its energy security in other areas of the globe?

And, Dr. Meierding, do you want to start?

DR. MEIERDING: Sure, once I get my mic working.

Thank you very much for the question.

So, I completely agree with your characterization that, in terms of the energy relationship between Russia and China, that China has been the senior partner; that Russia needs it more than it needs Russia, and that is only accelerated because of Russia's invasion.

In terms of dependence on Russia, I'm looking to my notes to figure out how much of it is oil and natural gas China imports from Russia. The share from Russia at this point is 15.5 percent. I don't have natural gas at my fingertips.

COMMISSIONER WESSEL: But expected to grow, as I recall, with pipelines and other investments that are being made.

DR. MEIERDING: So, from an oil standpoint, there are not plans for further pipelines at this point.

COMMISSIONER WESSEL: Okay.

DR. MEIERDING: There are plans for further gas. So, certainly, China could be tying itself more to Russia in terms of its gas imports. That being said, my guess is that China sees this primarily as an opportunity to pick up resources on the cheap, if it can do so without inviting censure from American and European governments.

I also think that, certainly, Chinese oil companies will be trying to avoid a situation in which they increase their energy insecurity by becoming too dependent on any one supplier. So, the desire to maintain diversification versus the desire to pick up gas on the cheap, I think there will be some hesitation before a Power of Siberia 2 is actually established, for example. I don't think anybody in China is rushing to move forward with these deals.

COMMISSIONER WESSEL: Mr. Chow, thoughts?

MR. CHOW: Thank you for the question.

I would have to beg to differ with your premise of who's taking advantage of whom. Chinese imports of natural gas is something on the order of paying a quarter or a third of the price that Europe currently pays for Russian gas. So, who took whom to the cleaners, I guess is the question, on the Power of Siberia 1 deal that was signed in 2014? I would suggest to you that the Chinese negotiated it pretty well in 2014, precisely because the Russians wanted to show that they cannot be isolated after Western sanctions because of the annexation of Crimea and the hostilities in Donbas.

If you had a chance to read my paper, I pointed out that the big deal that Putin and Xi Jinping announced on February 4th had to do with a measly 10 billion cubic meters a year from Sakhalin Island, rather than the deal that the whole industry anticipated, which was a 50-billion-cubic-meters-a-year deal running Russian gas through Mongolia to China. That was what everyone was waiting for.

So, why wasn't it signed when the two leaders met? I suggest -- and this is a guess -- that the Chinese did not agree on price, just like they didn't agree on price on Power of Siberia 1 for 10 years before the deal was concluded. So, I tend to think that the Chinese do pretty well on the energy side.

On the question of sanctions, and secondary sanctions in particular, I think a concern is whether we overuse it. If all you have is a hammer, then every problem is a nail. And we seem to use economic sanctions on everything, and that may diminish the centrality of the dollar in the international trading system over time, as different countries, including the EU and others, try to figure out workarounds.

You'll recall that the EU tried to figure out a workaround after the United States withdrew from the JCPOA agreement on Iran sanctions. They didn't succeed, but that doesn't mean that people -- EU, India, China, South Korea, Japan -- wouldn't try, if we ever started to overuse sanctions to a point where they see it as being against their national interest.

COMMISSIONER WESSEL: Thank you.

VICE CHAIR GLAS: Commissioner Scissors?

COMMISSIONER SCISSORS: I told Emily before the hearing started I was going to ask her an unfair question. And now, Greg has put his foot into -- Greg? -- Ed has put his foot into the unfair question mud as well.

I'll make an editorial comment. The No. 1 thing we can do to promote use of the dollar is have more responsible fiscal and monetary policy. And everything we do on secondary sanctions is quantitatively unimportant compared to that. I'm not saying -- obviously, you guys weren't addressing that.

But I want to pull you away from the secondary sanctions question, but to the topic of this hearing, which is energy trade, and ask you an unfair question. You'll be on record forever, but I won't hold you to it.

Do you think anything is going to come up, after years of failure in the Saudi-Chinese negotiations, about denominating some portion of oil exports on yuan? And the reason I'm asking that question is Ed certainly knows -- and, Emily, I don't know where you focus; you may know -- Wall Street is absolutely obsessed with this question. So, if you have anything that you can take a shot at, like "I don't really know, but this is an important factor," or "It won't happen at least in the next two years because of this," any light you can shed on that question of Saudi-Chinese progress on some share of oil exports being denominated in yuan?

DR. MEIERDING: So, I can jump into this first.

So, those two countries have been negotiating this or discussing this since at least 2016. There is certainly an interest from China in denominating more of its oil purchases in renminbi. And it's possible that -- I think this is a case where we don't want to -- Saudi Arabia could denominate some of its sales in yuan and not all of them. It is something it could do partially.

It's possible that, if it is actually paying for, if China is paying in yuan, Saudi Arabia can use some of that money to pay, for example, Chinese construction firms that are engaged in infrastructure projects. There are, basically, a number of ways that that could, that the Saudis could, essentially, give something to China and still make practical use of it.

That being said, with the current capital controls on the yuan, the attractiveness of it as a major form of payment still seems quite low. And until China becomes more flexible with its currency, which I don't get a sense is in the cards, especially where things are going in China politically at the moment, I can imagine seeing a bit of this, but not that much.

From my perspective, though, Saudi Arabia certainly has a strong incentive to give the impression that it might sell oil in yuan, because at this point, essentially, many oil producers are in an attractive position, which is they have a lot of interest from the United States and from China, and they're probably going to make the most of it.

COMMISSIONER SCISSORS: Thanks.

Ed?

MR. CHOW: Well, Derek, as I told you, I'm desperately trying to retire. So, it doesn't matter what I say on the record; no one will care.

(Laughter.)

I'm with Emily; I'm very skeptical about the idea. First of all, as everyone knows, the yuan is not convertible. So, how much Chinese stuff does Saudi Arabia want to buy?

I also agree that this is really more signaling by the Saudis than anything to us -- signaling to us, not to anyone else, but to us. If the emir of Qatar can score a White House meeting just by saying he would consider producing more LNG, MBS is saying, "What about me? You all come and ask me to produce more oil." And as you know, this White House has tried, up until now, to distance themselves from the Crown Prince. So, I really think this is a matter of signaling by the Saudis, and I'm very skeptical that this would be taken very seriously in the immediate term.

But, you know, talk is talk, and if you talk long enough, at some point five, ten years from now -- not five, ten months from now -- would something come of it? Maybe, but I'm skeptical that it would have much impact in the short run.

COMMISSIONER SCISSORS: Thank you.

VICE CHAIR GLAS: Commissioner Schriver?

COMMISSIONER SCHRIVER: Thank you to our witnesses. Appreciate the testimony and the thoughtful statements.

I have two questions, if there's time, or maybe we can circle back. I'll start with Dr. Meierding.

You made a recommendation which, although it may be a little subtle, it is actually quite radical to me. If I understand the argument, it's that China has a strategic vulnerability, and even though we're in competition with them, we should actually solve that problem for them, help solve that problem for them and that vulnerability. And as I understand the logic, it's they don't have malign intent; it's more hedging; and that, taken to an extreme, if we continue down this path, this could be 1941 or 1990, which didn't end well for anybody. By the way, it particularly didn't end well for Japan and Iraq.

And the challenge here, of course, is getting into the counterfactual, but can you give me any reason for hope or optimism that, if we sort of turn this on its head, help them address this problem -- I mean, to me, it's a little bit of a version of the engagement strategy overall we tried, and I was a part of, and several Administrations. Is there any specific evidence you can cite to that making this pivot would result in less malign behavior, more cooperative and constructive behavior? Because, again, I think there's versions of this in the past. We all remember constructive stakeholder.

So, thank you.

DR. MEIERDING: So, thank you for the question.

I am sympathetic to the skepticism. The question of, will this actually result in a more positive relationship, I'm actually less focused, I would say, on it resulting in a more positive relationship than it not resulting in a more negative relationship.

The question that I would ask is, what do we gain by threatening China's energy security? Maybe if we enforce our sanctions, enforce secondary sanctions related to Iran or Venezuela, we limit their oil sales some; we create more pressure on them. Maybe they comply with sanctions. In the meantime, we antagonize Beijing, and I'm not sure what the payoffs are from a more assertive energy strategy.

So, my hesitation comes from seeing a strong potential to worsen relations; to, essentially, confirm Beijing's beliefs that the United States is trying to prevent its rise as a great power; that the United States is determined to undermine its security. Basically, it's one more component of this downward spiral in bilateral relations.

And because oil imports are such a fundamental source of insecurity for China, and so vital to the regime's security, threatening them in that way is very high on the list of things that are likely to confirm their beliefs that we are locked in this irremediable competition, and that they should be immediately doing whatever they can to insulate themselves against the American threat.

Is it possible that this will happen anyway, even if we are more restrained in our energy policy? Yes, it is possible, but I think this is an area where we have very little to gain from being more aggressive and plenty to lose.

COMMISSIONER SCHRIVER: Thank you.

I'm not sure I can get a second question in, or the answer in, but maybe I'll introduce it.

Mr. Chow, you made a comment in your written testimony, "A more thoughtful and nuanced American foreign policy would try to accentuate differences instead of drive them together." I might editorialize, "thoughtful and nuanced" is not something the USG is particularly good at. But I think that's an important point.

Again, is there greater specificity? What are the one or two things we should be doing to accentuate the competition between Russia and China, potential competition, and not drive them together?

MR. CHOW: If we have time, I'll give you two specific examples.

As you recall, the Trump Administration was very bullish about increasing U.S. LNG exports. In order to increase U.S. LNG exports, you have to invest in export terminals, costing billions of dollars. And the way you do that, the way you put that deal together, is to sign up long-term contracts from creditworthy buyers. Who's around at that time that needed the gas most? Well, China did. So, starting a trade war with China is completely contradictory to our interests in expanding our export capacity for liquefied natural gas.

Another, more current example is the latest IEA coordinated drawdown of strategic stock. When the Biden Administration did that the first time, after February 24th, it coordinated with China. For the life of me, I cannot understand why we didn't coordinate with China this time on the withdrawal. A really simple thing to do. It would be good for them; it would be good for us to work together to dampen the price shock. But we didn't do that. It was a simple

diplomatic thing to do. They would have been willing, I'm fairly certain, and we didn't do that. And so, part of the problems that other countries have with us on sanctions is that we

don't bring them in on the takeoff. They only find out on the landing what's going to happen.

And so, more consultations on things, maybe small things, relatively speaking, that are of mutual interest, to work out a relationship that would establish some trust down the road is the sort of thing that you would expect American diplomacy to do.

VICE CHAIR GLAS: Commissioner Goodwin?

COMMISSIONER GOODWIN: Thank you, Madam Chair.

Mr. Collins, I'd like to ask you a question about Chinese domestic gas production. And, Dr. Meierding, you actually touched on this in passing a little bit in your written testimony as well.

Mr. Collins, you indicate that the level of production in China just is not sufficient to affect the rising dependence on imports. My recollection was that several years ago they had identified a significant amount of reserves of deep shale resources. Is that accurate, No. 1? And if so, what have the challenges been to production? Are they market-based? Is it technological skill and knowhow of the operators? What have the challenges been to getting that production ramped up.

MR. COLLINS: So, as a native Permian Basin West Texan, I love this question.

So, there are large reserves, if you look in the Sichuan Basin. They're more challenging than what we have here in the United States, whether you're looking at Appalachia, whether you're looking at North Dakota, whether you're looking at Texas. As you indicate, they tend to be deeper. My understanding is the rock is more ductile, which means it's not as conducive to being hydraulically fractured and yielding the hydrocarbon molecules the way that our rock tends to here.

And then, there's some fairly serious, above-ground impediments. One of the things you see in the United States that I think has really made the shale revolution take off across all of our different basins throughout the country that produce unconventional oil and gas is we have an above-ground infrastructure. And by this, what I mean, we have hundreds of different companies early on engaging in experimentation, each drilling and completing kind of with their own flavor.

Imagine a really big barbeque contest where you have hundreds of cooks entering. The best recipes percolate up to the top, and as those recipes percolate up to the top, we have very deep and liquid capital markets here that can respond quickly; fund these ventures as they become de-risked, and really, really support the scaling-up and the rest of the industrial value chain that's needed -- the pressure pumping and the workforce, and all these other things.

We had a lot of elements in place because of our existing oil and gas production, but we also, I think, have a mix that globally is very unique in terms of being able to really test techniques, to find what works, and then, to really fund quickly and scale things up to the level that they're globally impactful, where the United States is now, by a fairly significant margin, not only the biggest producer of gas in the world, but, at the end of last year, we became the world's largest liquefied natural gas exporter, which I think is something that's maybe not as widely recognized yet, but will be, as this Ukraine conflict continues to unfold.

COMMISSIONER GOODWIN: Thank you.

I will say -- dangerous to use a barbeque metaphor this close to the lunch hour, but -- sorry I couldn't resist.

(Laughter.) VICE CHAIR GLAS: Commissioner Fiedler? COMMISSIONER FIEDLER: Thank you.

So, I've been listening in both panels, and it strikes me -- well, actually, let me ask it in the form of a question. When do you think the Chinese leadership will not be concerned about energy security? Anybody?

MR. COLLINS: Do you want a one-word answer? COMMISSIONER FIEDLER: "Never," right? MR. COLLINS: As long as they're an industrial power, never. COMMISSIONER FIEDLER: Never.

MR. COLLINS: I think it will always -- I think, for any industrial power, this is an abiding concern. We may move to different sources, and perhaps it morphs from being an external concern to one that's more internal, but, at the end of the day, whether you're talking oil, gas, electricity from any source, energy and energy abundance are the bedrock of a modern, industrial civilization.

COMMISSIONER FIEDLER: And given the fact that the U.S. is virtually energyindependent, or near, certainly, as compared to China, I believe -- and tell me I'm wrong -- that they will never be anything but suspicious about us and their energy security, given the fact that they're so insecure. Right?

MR. COLLINS: Well, so I'll give you -- the idea of energy independence we have to use very carefully, because even if we're a net exporter of molecules or electrons, we're still tied into a larger global market pool. For instance, if you look at recent events in Ukraine, we actually export crude oil now, and yet, we have gasoline at record prices in many markets in the U.S. So, we're irrevocably tied in.

I think -- and then, I'll yield back to the rest of the panelists -- I think in terms of your question about Chinese suspicions of the United States, again, I think we can do Zhongnanhaiology and try to guess what people are thinking, but I think they have a lot of reason to be suspicious, given what they want to achieve in the world. But I think the exact same applies to us as well on this side of the Pacific.

COMMISSIONER FIEDLER: Yes, I think that they are more susceptible to, I mean more vulnerable geopolitically than we are, and therefore, they will never diminish the priorities -- for instance, if we're talking about climate change versus energy security, given their political goals, geopolitically, energy security is always going to dominate.

And since you've already established that they'll never be secure, never feel secure, this is going to be a continuing volatile political problem between the United States and China, no matter what we do on any given day in our own policies. We may aggravate it momentarily, but we're never going to put them at ease, right?

DR. MEIERDING: So, if I can jump in on this one, sort of repeating the theme of my answer to Commissioner Schriver, this isn't necessarily an all-or-nothing issue. China may never be completely energy secure, but I do think they could feel more energy secure than they do now; for example, through the increased use of renewable energy; increased use of nuclear energy; basically, increased use of energy sources that are within their borders.

And I do think that, for example, we've seen in the United States that, as the U.S. has become a major oil and gas producer, there has, after a very long lag since 1973-74, there has been more of a sense of energy security. And I do think that that sense of reduced vulnerability can, in fact, make a difference to people's thinking about national security.

So, while I don't think that China can become energy secure, I do think that measures that would increase that some could make a difference. Will it stop the problem entirely? I don't

think so, but I think it's worth -- this is a situation where I think some incremental progress is worth the effort.

COMMISSIONER FIEDLER: I'm not sure I understand why it's in our national interest to make China feel more energy secure.

DR. MEIERDING: In my experience -- not my experience -- but, based on my research, energy-insecure countries tend to do very aggressive things. And so, trying to avoid a situation in which the Chinese leadership feels increasingly pushed into a corner I think is a good move.

As I said before, it's possible that we will end up in that position, even if the United States is more restrained on our energy policy, by why throw more fuel on the fire?

MR. COLLINS: I think there's reason to cause them to incur costs. One of the fundamental questions we're looking at is related to aggregate and amass combat power in East Asia versus, potentially, especially given their maritime dependency, having to think about spreading it out. I don't think we should do necessarily, by any means, what we did to Japan in the summer of 1941, but I think there are very strong strategic motivations for maintaining a degree of unease on their side that's substantial enough that it makes them think about two, or even three, very distinct naval and air theaters of operation as opposed to one centered around their own littoral and keeping us out of that, and achieving certain objectives within it.

COMMISSIONER FIEDLER: I agree.

Thank you very much.

VICE CHAIR GLAS: Commissioner Cleveland?

COMMISSIONER CLEVELAND: Good morning, and thank you to our witnesses. Nice to see you again, Ed. It's been a few years.

I want to build on what Commissioner Fiedler just raised in terms of concerns about energy-insecure countries and aggressive paths.

Mr. Chow and Dr. Meierding, you noted, I think, in your testimony, written and oral, that the Chinese have over the years gone on buying sprees at fire sale prices, taking advantage of their financial position, and that they've negotiated access for projects over extended periods of time, to China's advantage.

And, Mr. Collins, you pointed out that there is a possibility -- I may be misstating that part -- of petropowers sidestepping U.S. economic influence.

I want to talk a little bit about the practices part of this panel mandate and the fact that sidestepping U.S. economic influence, in essence, means sidestepping transparency and agreements, the Foreign Corrupt Practices Act, and kind of a rule of law, when it comes to negotiating agreements.

So, if you could, all of you, could you identify the development impact of the equity oil stakes and loans for oil that you all discussed in your testimony? And in particular, I'm interested in the development impact, the improvement in standard of living, in Burma, Angola, Russia, and Chad. And then, I'd like you to, if you could, talk a little bit about when these projects are negotiated, how transparent the terms are, and to whom. And then, finally, could you discuss longstanding concerns about corruption and, in particular, bribery when it comes to negotiating these deals?

MR. COLLINS: I'm happy to speak to all of those. I just wanted to advance one clarification for the record. It's that was, basically, from listening to Professor Meierding. I agree with her, but the idea you've attributed to me is actually from her. But I'll reserve to the other two and loop back in to answer --

COMMISSIONER CLEVELAND: You're talking about the possibility of petropowers?

MR. COLLINS: Yes, ma'am.

COMMISSIONER CLEVELAND: Yes. Okay.

MR. COLLINS: The parallel system. I think that was almost verbatim from her testimony, but I agree with her on that point.

COMMISSIONER CLEVELAND: Okay. Thank you.

MR. COLLINS: If the other panelists -- I was going to give them a chance.

As far as the transparency dimension, I think this is a critical concern. I think a lot of this discussion we tend to frame in sanctions terms alone, but I do think, if we're going to step back and look holistically at a broader competition of systems, and one I think at its core is about an axis of autocracy and control, and the other is about a more open-rules-based order, I think this question is really important in that context.

And if we move beyond sanctions and we ask, what types of deals do we want to see negotiated, do we want to see deals where everything is extremely non-transparent; there's various types of payments and other sweeteners thrown in that would not be allowed, certainly, under United States or under U.K. or most EU law, or do we want to see a system where there's more transparency, and where, despite all the imperfections of a model that heavily leverages natural resources for development, you still have a better chance of using those monies for the actual betterment and improvement of people's lives? And I think that one is a critical question and I think it is something we have to think about.

I think, with Russia, things, for the time being, may be a little bit too far gone. But I think, when we look at our own neighborhood, we look at Latin America, and, also, when we look at Chinese energy and resource dealings in Africa, these are critical concerns. And these are ones, if we don't address them, the consequences are likely to show up at our border and to show up at European ally country borders as well.

MR. CHOW: I guess on both of those last two questions I have a little bit of a problem with the premise of the question. If you look at the four countries that you just cited, who first discovered gas in Myanmar? Unocal. Who is the biggest operator of oil production in Angola? Chevron. Who made the discoveries and developed the oil in Chad? Exxon. You know I just don't see this as -- it's a governance problem, I agree with you, but it's not particular to one set of oil companies or a different set of oil companies, with one important distinction which I would get to.

If you're a Chinese company, and you wake up one day in 1993 and discover that, hey, we just became a net oil importer, and now we have to start thinking about investments overseas in order to source some oil, all these opportunities were already taken by Western oil companies. So, what do you do? You know, you have to pay a high entry fee. And what are the advantages that you have? Well, corruption is one of them -- corrupting local officials.

It's not so different from, when I was with Chevron eons ago, that we accused the Italians and the French of doing in the '70s and '80s. It's not so different. So, I guess I'm trying to understand what the basis of the question is.

Large resource-extracting states that don't have a diversified economy tend to produce rent-seeking on the part of a lot of people, and maybe industry is complicit with that. With no offense to anyone else, look at Louisiana.

But the real problem that we have here with China is that most of those investments are done by national oil companies. So, that's the difference, right? They're not purely profitmaximizing corporations. They also serve a state function and are susceptible to political guidance from political leaders. And that makes their lack of transparency much harder to unwound than if you're talking about a multinational oil company that may over time, for their own corporate reputational and other reasons, transform themselves into some of the governance practices that we would all be in favor of.

I also don't really understand why, just because the United States is energy abundant and China is not, therefore, we will automatically have a conflict. I mean, when the U.S. was the largest oil importer in the world, and we imported most of our oil from Canada, we didn't have a conflict with Canada. The problem wasn't energy; the problem is that China and the United States have different issues with each other. Now, whether oil passage is involved or not, China doesn't want American hegemony over the Western Pacific. It doesn't matter whether they have any oil or not. That's a contradiction that has to be worked through, if we're not going to have a conflict over it.

So, I mean, maybe it's because I look at everything from an economics and industry point of view rather than a political or foreign policy point of view. I look at what's practical and what is not.

VICE CHAIR GLAS: Thank you so much, Mr. Chow.

We are going to do -- I'm going to recognize Commissioner Borochoff. I know there are some Commissioners, with time permitting, who are interested in a second round. I've got Commissioner Scissors, Commissioner Wessel, and Commissioner Cleveland. And we'll do a rapid round because we will be having to break at around 1:05.

COMMISSIONER BOROCHOFF: I have a quick question. Mr. Chow, we have a lot in common. And so, I'm trying to figure out the answer to the question that Commissioner Schriver asked. It's very clear that there's some agreement amongst at least two of you, and possibly all three, that sanctions might be counterproductive against China. Do you have a hard, specific recommendation what we could do instead that would tilt them perhaps a little away from the Russians and toward us?

MR. CHOW: I would say that sanctions is a tool and we have to be careful how to use the tool. But it has to be backed with a political/diplomatic strategy to achieve the ultimate policy objectives, whatever they are.

Sanctions, for example, on Iran got the Iranians to the negotiating table for JCPOA, but it wasn't going to -- sanctions by itself would not force them to behave the way we want them to behave. So, if the objective is to get people to talk to us seriously about issues that are important to us, I think sanctions can be a tool. The threat of sanctions can be a tool.

But overusing is what I'm concerned about, you know, seeing that every problem, big or small, the first instinct in this town now is to apply sanctions to it. And if it doesn't achieve the objective initially, let's do more. And where does that lead us? To a point where perhaps the utility of sanctions, which is a important tool, is diminished over time.

So, I would rather see us have a strategy that uses sanctions as one tool in a toolkit, rather than as the only tool that we would apply.

COMMISSIONER BOROCHOFF: Within a broader strategy?

MR. CHOW: Yes.

COMMISSIONER BOROCHOFF: Okay. Thank you.

DR. MEIERDING: So, I would agree with that. I think the judicious use of sanctions is very important. Having clarity on the goals that they are attempting to achieve; having clarity about what are the conditions required for them to be lifted, they can't be effective as a compellent threat if we don't tell a country, also, how they can get out of them. Because, otherwise, why change your behavior?

I think that, with sanctions, I'm not saying they're easy to implement because, obviously, especially getting a consensus for multilateral sanctions is difficult. But I think that, in the current case, the fact that sanctions have been -- that we've been so successful in implementing them may lead us to overestimate their actual effectiveness. And the tendency to run ahead in terms of implementation without thinking through the goals, and clarifying the conditions for lifting them, I think is concerning, especially because of the possibility that, if we overuse them, countries will have a stronger incentive to develop means of resisting them.

COMMISSIONER BOROCHOFF: It's like using the same play in football three times in a row.

DR. MEIERDING: I also compared it to Jurassic Park. Your scientists were so busy thinking about whether they could do it, they didn't think about whether they should.

COMMISSIONER BOROCHOFF: Thank you very much.

VICE CHAIR GLAS: All right.

MR. COLLINS: Just one very quick. I think of sanctions as antibiotics. They have their tool, but if you overuse them, you promote resistance and it can blow back on you in a huge way.

I think, as we think about the China-Russia alignment, I think any major action to try to pry the Russians away is probably premature at this point, just because they really need to be rolled back in Ukraine, and that venture needs to be addressed first. If they're allowed to achieve a revisionist name there that in many ways aligns with what China would like to do with Taiwan, and then, they're allowed to solidify some of that, and we go and, then, try to offer them something to pry them away from the Chinese, I think that sets a terrible precedent.

So, I think there's a big order-of-operations question here. And I would almost argue that, if we're looking for any place to pry out of the Chinese orbit and to reach detente with, I would look to Iran, and then, I would look to Venezuela in our own hemisphere first before Russia.

COMMISSIONER BOROCHOFF: And I agree with that. I wasn't implying we would try to pry Russia toward us; it was the opposite. But I totally agree with what you just said.

Thank you.

VICE CHAIR GLAS: Okay. Commissioner Scissors?

COMMISSIONER SCISSORS: I'm going to take a shot at a question that Randy first brought up, and then, Carte brought up, but I want to change it, so that we're not poking at war.

I wanted to hear what Emily has to say first, because she brought this up, but the other two panelists as well. I don't want to talk about energy insecurity. The Chinese are energyinefficient at the aggregate level in all sorts of wonderful ways. Their energy use as a share of the global share is bigger than their population; it's bigger than their GDP; it's bigger than their share of world trade; it's bigger than everything. They are just energy-inefficient. We could get into micro versions of this as well. There are lots of them.

If it were really low-cost -- I'm not saying a heavy lift for us, low cost -- do you think the U.S. should help China become more energy-efficient? Because I know my answer to that question, and I know some of the witnesses' answer to that question who are currently not present, and those answers are different. So, we're not talking about threatening their energy security. And we're not talking about we have to spend hundreds of billions of dollars to help them, because we're not going to do that. At low cost, should the U.S. help China become more energy-efficient? And I'm interested in your answer first, but the others as well.

DR. MEIERDING: So, my initial answer, instinctive answer, is yes. I think that, in general, reducing global energy use is probably a positive, both from an environmental

standpoint, from a resource consumption standpoint. This also appears to be an area where there could be productive possibilities for cooperation. So, my short answer is yes.

COMMISSIONER SCISSORS: And, of course, my answer is we have a huge advantage over them and we don't give it away.

But yes?

MR. CHOW: Well, you know, if you're going to do it based on population or GDP, we're not terribly energy-efficient, either, no, mainly because of the transportation sector, but that's a different story.

I suppose, conceptually, I don't have any problems with helping China improve its energy efficiency, but I struggle with how we do that. What are the problems of energy efficiency? Well, centrally-dictated pricing. You know? So, they basically have to change their system to get away from that. State subsidies of unefficient, non-efficient, dirty energy production, that's the other problem. So, how does an external power help China on structural problems that leads to their energy efficiency? I don't know how you do that.

COMMISSIONER SCISSORS: Yes, I completely agree with you, and I think that is reflected in a lot of people desperately trying to find a way the U.S. and China can cooperate, when, actually, we can't.

Sorry. Mr. Collins, if you have any thoughts?

MR. COLLINS: Yes, sir. So, I think you've already partially answered mine. The answer would be no. And one of the fundamental reasons for that is we want to not only preserve, I think we, ideally, want to expand the global industrial share and manufacturing share that United States, its allies, and also, neutral countries, when you're looking at the U.S.-China strategic competition, occupy. And I think if we were to be investing technologically to help China move the other way, we may be occupying an immediate, or we may be fulfilling an immediate energy and emissions goal, but it may be at the price of a much bigger set of strategic objectives whose ramifications also will rebound for decades.

COMMISSIONER SCISSORS: Thank you.

I'm going to summarize, against their will, the views of the last two panelists. No. 1, we probably can't help the Chinese. No. 2, if we do, it's going to undermine our manufacturing competitiveness. And I wish witnesses in a much broader discussion would remember that in our race to cooperate with them on this issue. And again, I'm not talking about threatening them. I'm talking about not cooperating with them.

VICE CHAIR GLAS: Thank you.

Commissioner Wessel?

COMMISSIONER WESSEL: Let me parse that issue in a slightly different way. And in part, this comes from discussions with Senator Wicker and others. Senator Wicker has been a friend of the Commission, has sought to be briefed on our work each year. He's also, of course, keenly interested in the future of our maritime fleet, having Pascagoula in his State.

And it seems to me that, both with the phase 1 China deal, with the energy commitments there, as well as some who believe that sharing our energy resources is a good idea -- Derek, I think I agree with you a lot on those issues. But if we're going to be shipping it, shouldn't we be harvesting more of the rents of that by requiring that the shipments occur on U.S.-produced vessels, U.S.-flagged vessels, and making sure that our export terminals utilize American products? Again, all of that will be included in the price of the exports. But, from Senator Wicker's public comments, this would be hundreds of thousands of U.S. jobs created in the manufacturing sector to strengthen our country while we are also exporting those products.

Mr. Collins, your thought?

MR. COLLINS: Yes, sir, and that's an excellent question. So, I'll give you a two-prong response.

I would tend to weigh in against specific Buy American requirements for a couple of reasons. One is we don't produce large LNG tankers anymore. It's primarily our ally country, South Korea, in shipyards run by Daewoo and Hyundai. And I'm not sure if Samsung produces them.

COMMISSIONER WESSEL: That's why these would be U.S.-produced. This is a way of reestablishing U.S. production in that arena.

MR. COLLINS: It takes many, many years to build that value chain. And basically, what we would be trying to do in LNG ships is the equivalent of what China is trying to do vis-a-vis us and Taiwan with semiconductors, where you spend an enormous amount of money and you still can't catch up, and you're always five or six years behind.

I think probably some of the same applies on the liquefaction plant side. I think we also have to think about, again, these are ally country relationships. A lot of those inputs come from South Korea and Japan. And so, there's an economic and a strategic dimension to it.

I think the other thing we have to really think about is our big policy focus really needs to be on energy abundance here. Because if we look at any specific supply chain, you can maybe get into the low six figures of jobs. If you look at the positive impact of American energy abundance, it's millions, if not tens of millions, of jobs across multiple value chains that often do reside within our borders.

And so, my respectful suggestion there would be to focus on the abundance part first and have much less emphasis on who actually makes the liquefaction systems and the ships carrying the molecules.

COMMISSIONER WESSEL: Okay. Any other witnesses with thoughts?

MR. CHOW: I guess I will have to confess that I'm an industry economics guy, and I'm not in favor of distorting the market signals in order to achieve some other objective.

Why did Boston Harbor import Russian LNG all the way from the Yamal Peninsula? Because we have the Jones Act. Instead of shipping U.S. LNG from the Gulf Coast to Boston, Boston bought a cargo all the way from the Yamal Peninsula. Why did West Coast refineries import Russian oil all the way from the Russian Far East? Because the Jones Act requires us to not only ship U.S. goods from U.S. port to U.S. port on U.S. bottoms, but U.S. crew.

You know, extending Jones-Act-like inefficiency into international trade is probably against WTO rules. And we will have allies and trading partners filing cases against us; never mind our adversaries. So, I think that is a really, really bad idea.

DR. MEIERDING: Lastly, we wouldn't be cost-competitive. The cost of building American ships, the cost of crewing them with Americans, I don't think that American LNG would be -- no one would want to buy it at those prices.

COMMISSIONER WESSEL: Thank you.

VICE CHAIR GLAS: I think this concludes Panel II.

I know Commissioner Cleveland had some additional questions, but she's waived that.

I also encourage our Commissioners, if there are follow-up questions of our witnesses, to please submit those in writing, and we will socialize that with all the Commissioners as well.

So, I want to thank our panelists who have joined us here today. We want to recognize you, Dr. Meierding, Mr. Chow, and Mr. Collins, for appearing before the Commission on this very timely issue. And thanks to all of you for your expert opinions.

With that being said, we will reconvene promptly and start Panel III right at 2:05. So, I would ask our virtual participants to arrive a couple of minutes early, and look forward to seeing you soon.

(Whereupon, the above-entitled matter went off the record at 1:04 p.m. and resumed at 2:05 p.m.)

PANEL III INTRODUCTION BY VICE CHAIR KIMBERLY GLAS

VICE CHAIR GLAS: Good afternoon, everybody.

I want to acknowledge our panelists, both here in the room and virtually, who are joining us this afternoon on our final panel of the day -- final, but one of the most important panels of the day.

This panel will examine China's domestic energy systems.

First, we'll hear from Mr. Lauri Myllyvirta, Lead Analyst and Co-Founder of the Centre for Research on Energy and Clean Air, an independent research organization headquartered in Finland. Mr. Myllyvirta has worked for the past decade as an energy analyst covering climate, energy, and air pollution issues across Asia and was based in Beijing in 2015 through 2019. He will discuss China's international climate commitments and climate diplomacy strategy.

Next, we will hear from Dr. Cecilia Han Springer, Assistant Director of the Global China Initiative at the Boston University Global Development Policy Center, who will speak to China's overseas energy investments. Dr. Springer manages the GDP Center's China Global Power Database, and her research focuses on the environmental impacts of China's overseas investment, energy and climate policymaking processes within China, and industrial decarbonization.

Then, we will hear from Jonas Nahm, Assistant Professor of Energy, Resources, and Environment at Johns Hopkins School of Advanced International Studies, who will focus on China's clean energy technology industry. Dr. Nahm's recent book, Collaborative Advantage: Forging Green Industries in the New Global Economy, investigates the political economy of innovation and industrial development in highly renewable energy industries, with a focus on China, the United States, and Germany.

Finally, we will hear from Nikos Tsafos, James Schlesinger Chair for Energy and Geopolitics at CSIS, who will focus on the geopolitics of the global clean energy transition. His research focuses on managing the geopolitics of energy and climate change; advancing industrial policies for clean energy; ensuring a just transition for workers and communities, and equipping U.S. foreign policy in a multilateral system to deal with climate change and the energy transition.

Thank you all so much for your written remarks, your submission to the Commission. I appreciate the thought and time you put into providing your expertise to the Commission on this important topic.

I'd like to remind everyone to keep your remarks to seven minutes.

Mr. Myllyvirta, we'll begin with you

OPENING STATEMENT OF LAURI MYLLYVIRTA, LEAD ANALYST, CENTRE FOR RESEARCH ON ENERGY AND CLEAN AIR

MR. MYLLYVIRTA: Vice Chair, Commissioners, thank you so much for the chance to share my thoughts.

So, to start with, China is, obviously, the world's largest greenhouse gas emitter and was responsible for more than half of the increase in global emissions over the past decade. China has a very energy-intensive economic model, industrial model, and a coal-heavy energy model. So, that's the starting point.

Why does Xi Jinping and why does the Chinese leadership want to strive for carbon neutrality? There are very strong domestic reasons for that. Obviously, unfettered climate change is a national security threat to China in the longer term, with the potential to destabilize neighboring countries, to threaten food and water security, and so on.

One key driver has been air pollution from fossil fuels, a key social issue. That also enters security. The previous panel discussed how China will not achieve energy abundance through reliance on fossil fuels. So, China's best bet for energy abundance is a massive expansion in clean energy.

And then, there are industrial policy motivations. China wants to be a leader in the key technologies and markets around this. And it also aligns with the economic policy shifting to high-value industries and services.

Carbon neutrality has a high political priority in China and domestically. It's not just an international team that you fly to Davos or Glasgow to talk about. I think always also what is preeminent is the achievable. What it takes is doubling or tripling the annual investment in wind and solar and nuclear, the key clean energy technologies, to get to carbon neutrality by 2060, which is very much in reach for China. The key question, therefore, isn't about "whether," but it's about how fast the transition can start.

And China's emissions goals and commitments for the next 10 to 20 years leave a very wide range of possible outcomes, which I've highlighted in my written statement.

The CO2 peaking action plan that the country has created is an ambitious regulatory program and a policymaking program, but it doesn't have a lot of quantitative benchmarks. So, there's a wide range of possible outcomes that could come from this.

And the key question for the U.S. and anyone else who wants to strive for a good outcome is, what can other countries do? The first, that is that Chinese policymakers and the Chinese energy and climate community follows the U.S. very closely. As a European, I'm a bit jealous of them, about how closely, but that is a fact. So, if the U.S. can move faster, if China sees the U.S. moving faster on this, they will want to do more to keep up. There is this kind of a competitive dynamic that is very important. And so, therefore, it's important that the U.S. targets and ambitions are met.

What I've been calling for is for the U.S. and everyone else who wants to promote climate protection to make climate a cross-cutting priority issue in all kinds of bilateral and multilateral diplomacy. And so, it should be clear to all major emitters that success in reducing emissions, or lack thereof, is going to have an impact on the bilateral relationship.

I would call on the U.S. to monitor China's progress more closely and objectively; consider a regular, formalized assessment of how China is doing against reasonable benchmarks to inform all of this policy.

On grave policy issues, it would be important to prioritize those trade distortions in China that lead to this energy-intensive economic model. There's a lot more that should be done there.

Because China's goals for the next decade are so ambiguous, the process that is going to run this year, or where all countries are supposed to revisit and strengthen their climate commitments, is incredibly important. And everything that the U.S. can do here to create momentum will be important.

In terms of China's influence on third countries, the Belt and Road Initiative made China the largest public financier of overseas coal-fired power plants over the past decade. Now a stop has been put to that, which is a very important step.

There are other types of fossil fuel projects that are still being funded that deserve attention, but there's also a genuine attempt by China to start building energy diplomacy around clean energy. And this is an area where it's very important for the U.S. and for Europe to step up, because the need for clean energy investment in the developing world is enormous, and, frankly, no one has been doing enough in this space. Whether you think about that as your contribution to global development or counterbalancing China's influence is secondary. It's just important that it gets done.

Thank you.

PREPARED STATEMENT OF LAURI MYLLYVIRTA, LEAD ANALYST, CENTRE FOR RESEARCH ON ENERGY AND CLEAN AIR

China's Climate Change Strategy and the U.S.–China Relationship

Testimony before the U.S.–China Economic and Security Review Commission Lauri Myllyvirta, Lead Analyst, Centre for Research on Energy and Clean Air

Vice Chair Glas, Commissioner Friedberg, distinguished members of the US-China Economic and Security Review Commission,

Thank you for the opportunity to share my work and views with you regarding China's climate change strategy and the U.S.–China relationship. Below is my written testimony.

Summary

This section provides the highlights of each of the following sections in the statement, followed by policy recommendations.

How China became the world's top emitter

China's GHG emissions **more than quadrupled** over the course of the past two decades, making China **the primary driver of global emissions growth** over the period. Emissions growth in 2000-2008 was predominantly driven by an export-driven industrial and investment boom. From 2009 to 2021, emissions growth was driven by two waves of real estate, infrastructure and industrial expansion. China's high emissions relative to GDP are due to both a coal-heavy energy structure and an economic structure relying heavily on construction and energy-intensive industry.

China's emissions surged after the onset of COVID-19, due to economic recovery policies aimed to stimulate construction and industrial output, including export industries. Now, the country's emissions are falling. The cool-down is not primarily driven by deliberate climate policies but by economic policies aiming to tamp down on real estate speculation and low-value construction projects.

China's motivations to act on climate

China has a strong self-interest in climate action, due to pressing environmental challenges at home, as well as the impacts of climate change on food security, water resources, and the regional security environment and other key aspects of national security. Climate action aligns with China's long-term economic and industrial goals, including the ambition to become a technological and market leader in the essential technologies of the 21st century.

There are also strong interests that oppose climate action and reduction in fossil fuel use in China, including provinces and state-owned enterprises with a high reliance on coal and coal-related industries.

China has been able to leverage climate diplomacy to meet its global agenda. China wants to be seen as a steady partner and a crucial contributor to solving global environmental issues. Climate policy and diplomacy have allowed China to pursue many foreign policy goals - shaping the international rules, portraying China as a responsible stakeholder and provider of important public goods, building a multipolar world, and increasing China's influence and presence in developing and emerging markets.

Assessing China's commitments and implementation

China's long-term target of achieving carbon neutrality before 2060 is **aligned with the low end of the Paris agreement goals** (limiting global temperature rise at 2°C) but *not* the high end (1.5°C). The level of ambition is at least comparable to that of most developed economies (net zero emissions by 2050).

The CO2 emissions peaking and carbon neutrality targets are a **high domestic political priority**. President Xi Jinping has staked his personal credibility on delivering the first of the two, peaking CO2 emissions before 2030. **This target is, therefore, very likely to be met.**

China's emissions target of peaking emissions before 2030, with no specific emissions pathway or ceiling, is **much less ambitious than required** for the global climate effort to succeed, **nor does the target reflect the country's capacity for emissions reductions.** This undermines the global effort to peak and decline emissions as a matter of urgency. The target for peaking "before 2030" leaves space for either an earlier emissions peak and decline or a significant rise in emissions before 2030 and slow emissions reductions thereafter. This makes it difficult to assess whether the country is on track to meet the long term goal.

The construction and industrial slowdown and coal shortage in the second half of 2021 led to the government focusing its current priority on boosting industrial output and stable economic growth, which means that the temporary slowdown might soon be replaced by an emissions rebound.

State-owned enterprises in the coal power and steel sectors continue to invest in coal-based capacity. These sectors are China's two largest emitters of CO2, and there is no sign of investment in coal-based capacity being scaled back yet. A complete shift of new investments into clean capacity is needed to put China on track to peak CO2 emissions and avoid a glut of unneeded power and industrial capacity.

China's narratives and messaging on climate

China's international messaging on climate seeks to portray the country as **a responsible stakeholder**, and **a reliable and committed contributor to international efforts**.

China's messaging obviously **aims to strengthen the legitimacy of the party and the government**. Both internationally and domestically, narratives focus on the country's perceived strength in implementation and long-term planning. However, this contrasts with the country's failure to pin down a specific emissions trajectory or to place a cap on the increase in emissions until 2030.

China's diplomatic aims and international influence

A significant focus for Chinese negotiators continues to be communicating the actions that China is taking, and defending the country against criticism. China is under pressure from both developed countries and the most vulnerable developing countries to increase its ambition.

China's climate diplomacy also **seeks to further broader foreign policy aims**: proactively shape the international system; move from a U.S.-led system to a "multipolar" system by building developing country alliances; and establish China as an important contributor and partner to solving global challenges and for economic development; and spreading Chinese technology and technology standards.

The Belt and Road Initiative is a key vehicle of China's diplomacy and influence. Investments under the initiative have been coal and fossil fuel-heavy in past years, but **China has taken the first steps to align these with the climate effort.** New coal power projects abroad have been excluded, and investments in clean energy have increased. However, investments into certain other types of carbonintensive projects have continued. These include oil- and gas-fired power plants, oil and gas production as well as coal-based industrial capacity. Chinese financing and construction is a genuine value proposition that plays to China's strengths and responds to demand from many developing countries. Further progress in cleaning up the investment portfolio is in part conditional on creating the enabling conditions for faster clean energy take-up in the developing countries hosting the projects.

In addition to financing, engineering and construction, China also has an increasing footprint on international aid. The Global Development Initiative (GDI) includes climate change and green development as one of eight focus areas.

Climate change and the U.S.-China bilateral relationship

China puts a lot of emphasis on the US-China bilateral relationship, and pays very close attention to US climate politics and policymaking. There is a hope of **climate as a stabilizing element** in this relationship, and over the past year, China demonstrated a willingness to take meaningful steps to achieve this. Effectively leveraging the relationship to make progress on climate likely requires making the issue a part of a broader set of negotiations encompassing other aspects of the relationship, rather than seeking to make climate a standalone issue.

Outside of dedicated climate talks, the U.S. has influenced China's economic, energy and climate policies in numerous ways, both positive and negative, particularly through trade policies. There is a lot of scope to increase and better target this influence.

Policy recommendations

- Monitor and assess China's progress and efforts closely. Consider publishing a regular, formalized assessment of China's performance (possibly along with that of other major emitters).
- Elevate climate change and emissions reduction performance into a cross-cutting priority issue in bilateral and multilateral diplomacy and foreign policy. It should be clear to other major emitters that success in reducing emissions will affect all aspects of their relationship with the U.S.
- Ensure that U.S. targets and ambitions on emissions and climate are met failure to do so would make it far easier for China to renege on its commitments. Conversely, rapid progress in the U.S. would be a powerful factor to spur China on.
- Dramatically increase financing and support for clean energy and energy transition in developing countries. This should include enabling measures, such as improving electrical grid infrastructure, regulation, markets and institutions, as well as technology transfer and establishment of manufacturing capacity in key developing markets. Financing should expand from a project-by-project approach to financing and underwriting auctions or other policy programmes that can advance a large number of projects. Such enabling measures would also support a shift towards clean energy in China's outbound investments. It's essential for the U.S. to develop a genuine value proposition towards developing countries in this field.
- Engage with China and other major emitters to obtain a successful outcome from the process set up in the Glasgow Climate Summit, where all countries agreed to "revisit and strengthen" their 2030 emissions targets in 2022. This involves and requires bringing up enhanced targets for the United States.

The best thing the U.S. can do to push China to do more on climate, and to contend for global leadership, is **to institute a domestic climate action program** comparable in scale and ambition to China's carbon neutrality goal at home, and **a global clean energy initiative** at least comparable in scale to the energy investment under the Belt and Road Initiative. If China's leadership sees the U.S. and allies pulling ahead with 100 percent clean electricity, smart grids, electrified transport, zero-carbon manufacturing, and major financing and technology partnerships with the developing world, that would spur the country to speed up its own transition, given **the country's ambition to lead or compete** in these technologies.

The more competitive and even confrontational state of international geopolitics has also opened the door to **building mechanisms to track progress and sanction laggards**. It is essential for the U.S. to articulate its expectations towards China, measure the country's emissions trends and policies against those expectations in a systematic way, and be prepared to take action, whether positive or negative, through trade, diplomatic, economic, security and other policies as appropriate.

This approach of **elevating climate to a cross-cutting foreign policy priority**, where all available levers are used to persuade other countries to do their fair share, doesn't only apply to China of course: the approach should be applied equally to *all* countries and *not* selectively to China — both to make it clear that **the purpose is not to pick unfairly on China** and because the policies of other emitters matter as well.

Addendum: How Russia's invasion of Ukraine could affect the content of this testimony

The sanctions against Russia will have indirect negative consequences for the global and Chinese economy. This, combined with the new Covid-19 outbreaks makes the "medium-high" GDP target of 5.5% that China just published for 2022 even harder to meet and means more pressure to increase investment spending and ease policy towards the real estate sector. This in turn will tend to increase coal demand and CO2 emissions.

The breadth of the sanctions imposed on Russia likely reinforces the determination of China's leadership to pursue technological, financial and economic self-sufficiency. Regardless of the clear justification for the measures, they demonstrate how western countries retain control over significant parts of the global financial and economic system that the Chinese leadership resents.

Similarly, the fossil fuel price shock and security of supply issues will mean redoubling the efforts to increase domestic energy production—both fossil fuel and clean energy—and reduce reliance on imports e.g. through electrification in oil and gas using sectors, and through the production of synthetic fuels from coal.

On foreign policy, China's leadership appears to be walking a tightrope of sticking to the content of the recent China-Russia declaration of "friendship without limits", and the strategic calculus that led to it, while refraining from crossing the red line for the U.S. and Europe—active measures to help Russia circumvent or offset the economic impact of the sanctions.

China's options are open to either distance itself gradually from Russia's attrocities and prevent further damage to China's international standing, and the credibility of its long-held "non-interference" policy; to position itself to benefit from the subservience, natural resources, and economic and technological vacuum of a weakened and isolated Russia; or to maintain the current ambiguity.

Pragmatically, the leadership must be carefully weighing the potential downsides of siding more closely with Russia, and the potential upsides of taking a more neutral or anti-war stance. This includes but is not limited to the ramifications for China's relationship with the U.S. and Europe.

How China's position evolves, and how that affects the relationship with the U.S., obviously matters a great deal to the outlook for bilateral climate interactions. My policy recommendations aim to suggest a range of steps the U.S. could take depending on the overall tenor of the relationship.

Introduction: How China became the world's top emitter

China is **the world's largest greenhouse gas emitter today**, and the second-largest historical emitter, after the United States. In 2019, it produced 27% of global greenhouse gas emissions, with 18% of the world's population and GDP. China's share of global emissions rose to this level from less than 10% in 1990. China was responsible for 60% of the increase in global CO2 emissions from 2010 to 2019, and is the only major emitter to increase emissions after the beginning of the COVID-19 pandemic (see Figure 1). The country's high emissions relative to GDP are due to both a coal-heavy energy structure and an energy-intensive economic structure that relies heavily on construction and smokestack industries.

China has committed to CO2 emissions and clean energy targets since the Copenhagen climate summit in December 2009. Actions to achieve these targets have made the country the world leader in deploying renewable energy and nuclear power, but have not been sufficient to peak CO2 emissions from fossil energy consumption.

China first committed to peaking CO2 emissions "around 2030", in the Obama-Xi climate declaration in 2014. In 2020, President Xi Jinping pledged that China would target carbon neutrality before 2060 and peak CO2 emissions "before" 2030.

The increase in China's emissions in the 2000s was driven by its rapid industrial growth after the export and investment boom started by the WTO accession. This boom came to a head with the global financial crisis, and in 2008 the leadership responded with an unprecedentedly large infrastructure stimulus program that drove even faster emissions increases in 2009-2012. This spending was predominantly directed at the most energy-intensive parts of the economy - construction and heavy industry, particularly steel, cement and other construction-materials industry.

When the effect of the stimulus programme started to wear out in 2013, coal, steel and cement consumption began to fall. This fall was compounded by the "war on corruption" launched by General Secretary Xi Jinping, curbing local government permits and enthusiasm for construction projects.

The leadership's initial response to the slowdown of the industrial economy was to brand the changes as a part of an "Economic New Normal" in which household consumption, services and high valueadded industries would become the key drivers of growth. This was also the time when Presidents Xi and Obama announced the "climate deal" between the two countries, including China's CO2 peaking commitment and paving the way for the Paris agreement, and the air pollution crisis dominated domestic headlines, creating a unique window of opportunity to limit coal consumption at least in the more prosperous coastal areas.

However, falling demand and prices for key commodities and heavy industry products led to major financial distress at state-owned enterprises towards the end of 2015. A new wave of stimulus was launched in late 2015. This stimulus-driven growth continued in the following years and intensified as the government sought to offset the economic impact of the COVID-19 pandemic with construction supply-side stimulus measures.

China's motivations to act on climate

Relevant questions from the Commission: To what extent does the CCP see climate change and environmental concerns as issues that impact its domestic legitimacy? How does it approach this challenge domestically?

The announcement of the 2060 carbon neutrality goal aimed to both inject momentum to the international climate negotiations, in which it succeeded, and to pre-empt the US and European pressure, and occupy moral high ground before the 2020 elections and the inauguration of president Biden.

Domestically, Xi Jinping has set low-carbon development as a strategic priority for China¹. There are obvious reasons to do this:

- **Pressing environmental challenges at home can threaten the CCP's legitimacy**. China's climate and clean energy policies since the early 2010s were strongly motivated by the urgency of tackling air pollution and other pressing domestic environmental issues. Air pollution became a turning point because it led to social unrest and civil society movements that confronted CCP's governance, undermining its credibility and accountability.
- Climate is a national security issue. food security, water resources, and the regional security environment, all key strategic issues, would be jeopardized by runaway climate change. In Xi's concept of "holistic national security", climate change is considered part of the "risks on environment and resources". In that sense, the CCP considers climate change a national security issue.
- Climate action aligns with China's long-term economic and industrial goals. The carbon neutrality goal aligns with China's priorities of "high-quality development", which means transforming its development model, energy and economic structure. China's ambition is to become a technological and market leader in the key technologies of the 21st century, including low-carbon technologies.
- Leveraging climate diplomacy to meet its global agenda. China wants to be seen as a steady partner and a crucial contributor to solving global environmental issues. Climate policy and diplomacy have allowed China to pursue many foreign policy goals shaping the international rules, portraying China as a responsible stakeholder and provider of important public goods, building a multipolar world, and increasing China's influence and presence in developing and emerging markets.

It is important to acknowledge that Xi's personal interest in foreign policy and environmental issues also plays an important role. Xi pays attention to foreign policy more than any Chinese leader since Mao, and has a far more ambitious foreign policy agenda. Xi appears to also be using international announcements and commitments to advance his domestic economic and environmental goals.

There are also strong interests that oppose climate action and reduction in fossil fuel use in China, including provinces and state-owned enterprises with a high reliance on coal and coal-related industries. In general, putting a stop to China's carbon-intensive growth pattern is something the country is still grappling with: the leadership has been talking about addressing the unbalanced nature of the economy and excessive reliance on heavy industry and investment spending for more than a

decade, but in the past years, steel production again outpaced overall economic growth, indicating that the importance of heavy industry and construction increased.

Assessing China's commitments and implementation

Relevant questions from the Commission: How do China's climate commitments compare to those of other countries, and to what extent do they contribute to achieving global climate goals relative to the commitments of other countries? Is China on track to uphold its climate commitments? How do we assess the credibility of Chinese leader statements and commitments on climate?

China's long-term goal of carbon neutrality by 2060 can be seen as compatible with the goal of limiting global temperature rise to 2° C - according to the IPCC's sixth assessment report, major developing countries should reach carbon neutrality between 2050 and 2070. It is not compatible with the 1.5 degree target, which requires net zero emissions globally by 2050^2 . However, given that China's emissions haven't peaked yet structurally, and the country's average living standards are still low, the long-term goal is at least comparable in ambition to the 2050 net zero goals of most large developed economies.

In the nearer term, besides pledging to peak CO2 emissions before 2030, China has committed to reducing CO2 intensity by at least 65% from 2005 level by 2030, and by 18% from 2020 to 2025. The country also has a target of raising the share of non-fossil energy sources (renewable energy and nuclear) to 20% by 2025 and 25% by 2030. The country is on track to meet or exceed these targets. However, they still allow total emissions to rise by up to 10% by 2025 and 20% by 2030, compared with the 2020 level^{*}.

Over the next two decades, which are the crucial period for achieving rapid reductions in global greenhouse gas emissions, **China's goals are neither ambitious nor specific enough to correspond to the urgency to act.** The target of peaking CO2 emissions before 2030 leaves space for emissions increases until late this decade and for a very wide range of possible emissions trajectories over the decade that follows (see Figure 2).

To keep the Paris agreement goal within reach, **it's essential that China's emissions peak and decline much faster** than required by the pledged targets. Both when assessing China's progress and commitments, and when engaging with Chinese decision-makers, making a distinction between the requirement to fulfil formal commitments, and the need for those commitments to be either overachieved or strengthened, is important.

The initial expectation communicated by China's policymakers after the carbon goals were announced was that the Central Committee of the CCP and State Council top-level policy documents on CO2 peaking and carbon neutrality would specify a timetable and a roadmap for carbon peaking³. These documents were released before and form the basis for China's Nationally Determined Contribution.

However, in the second half of 2021, China experienced two developments that led to **shifting political signals that might lead to less stringent climate actions in the near-term**. First, the government's measures to tamp down on real estate speculation and limit lending to the sector led to a

* Assuming GDP growth averages 6% in 2021-25 and 5% in 2026-30.

steep slowdown in construction and heavy industry. The production of steel, cement and other construction materials is the largest source of CO2 emissions in China. Secondly, the country experienced a shortage of coal caused by price controls and heavy-handed anti-corruption and mine safety campaigns at a time when coal demand was increasing fast. The shortage led to electricity cuts and rationing across the country.

Reflecting the changed priorities, in September 2021, in the depth of the coal and electricity crisis, premier Li Keqiang said "in light of the current situation, we must deepen the calculations and analysis, and…propose a timetable and roadmap for peaking emissions"⁴, indicating that the government was **not yet prepared to pin down a more specific pathway for emissions**.

Accordingly, the top-level climate policy documents, which the Chinese authorities call "1+N" policy framework⁵, and China's updated climate pledge (formally, its nationally determined contribution)⁶, published just before the Glasgow COP26 climate summit, were **very light on targets and did not specify the emissions peaking timeline or peaking level.**

Instead, the plan relies on implementing a long list of actions and policies, including the promotion of clean energy, electric vehicles, electricity market reform, carbon trading, green financing, low-carbon industrial development, green transport infrastructure, circular economy, recycling, innovation capability and numerous other aspects of the low-carbon transformation. However, **almost all of these policy areas lack measurable or verifiable targets**.

A large number of sectoral and thematic implementation plans have been published thereafter and they have continued the same theme. It seems to be a case of throwing everything at the problem and seeing how far it gets you. As all these policies go into action, **this could entail the possibility of earlier emissions peaking, but provides no guarantees**.

The hesitancy to commit to a specific emissions pathway or ceiling for this decade might seem like a paradoxical result from the current downturn in emissions. However, the real-estate slump and coal crisis have increased the uncertainty over China's economic outlook.

Through the policies and actions outlined in China's climate plans, the government aims to create the political and economic preconditions for rapid emissions reductions in the following decades.

The lack of ambitious and measurable medium-term emissions goals means that both China's progress towards the long term target, as well as the credibility of the target, is **not straightforward to measure analytically**. Under the targeted trajectory, it might take 15 years or more for China's emissions to fall at a rate consistent with reaching carbon neutrality by 2060 (Figure 1), but the government can still say everything is going to plan.

Chinese state-owned enterprises have continued to invest in new coal-based power and steelmaking capacity⁷, which the government argues is not in conflict with the country's carbon goals but certainly is not consistent with the rapid emissions reductions required by the Paris agreement. Under such an emissions trajectory, there isn't space for existing coal power or coal-based steel plants to be utilized until the end of their conventionally assumed lifetimes, let alone for new ones to be added^{8,9}.

Since the third quarter of 2021, China's coal consumption and CO2 emissions have been falling. However, the government's near-term economic policy for 2022 has **shifted to supporting and** accelerating carbon-intensive infrastructure and industrial projects, as well as the "steady" growth of energy intensive industry output¹⁰. In a further indication of the shift of priorities, the government workplan for 2022 focuses on boosting GDP growth and, unusually, refrained from setting targets for reducing emissions intensity of GDP¹¹, presumably to allow for more energy intensive growth.

The recent measures aim to smoothen the current slump in construction and heavy industry. However, it is **too early to assess** whether they will lead to the resumption of rapid growth in emissions which, if it happens, would severely undermine the global climate effort.

China's narratives and messaging on climate

Relevant questions from the Commission: How do Chinese policymakers use the issue of climate change to influence global perceptions of China? What narratives is the CCP pushing on climate change? Is there a difference between China's international and domestic posturing on this issue?

China's international messaging on climate seeks to portray the country as **a responsible** stakeholder¹², and **a reliable and committed contributor** to international efforts.

In the government's communication both domestically and internationally, climate targets and green development are tied to modern, technologically advanced country that is moving ahead fast.

Domestically, environmental goals are a **part of the CCP's vision of turning China into a modern, socialist country by 2035**. The vision includes green production and lifestyle, a clean and low-carbon energy system and an economic system with green development; fundamental improvement in air and water quality and reduction in soil contamination; protection of natural ecosystems; as well as falling CO2 emissions. The modernization goal also envisions China playing a more important role in addressing global climate change.¹³

According to opinion surveys, Chinese people are among the most concerned in the world about climate change¹⁴, highly supportive of government climate action¹⁵, and there is very little denial of the science. However, **the impacts of climate change are not communicated very actively.** For example, some reporting in China's top state media on the catastrophic floods in Henan in summer 2021 mentioned climate change as a contributing factor, but much less prominently than international coverage. The official news agency Xinhua published a story on extreme weather events linked to climate change outside of China at the time of the floods.

The "dual carbon goals" became a top-level political priority and media issue in early 2021, after Xi gave speeches on the issue. This evidences that **messaging on climate issues is very top-down**.

Domestic media coverage focuses on technological and engineering achievements, such as records being broken for clean energy capacity and output.

For developing countries, **China's message is a compelling story**: it involves integrating climate with modernization, industrialization, digitalization and economic growth, and presenting climate measures as a part of moving forward Developed country messaging is often heard as positioning climate action as a barrier to development.

China's messaging obviously aims to strengthen the legitimacy of the party and the government. Both internationally and domestically, narratives focus on the country's perceived strength in implementation and long-term planning. The country has met and exceeded its previous commitments. This is in particular contrast with the U.S., which the Chinese perceive as gridlocked and unable to implement ambitious and consistent climate policies.

While many outside of China share the frustration over U.S. federal climate policy, the weakest aspect of China's messaging is the fact that the country's emissions continued to increase until very recently, and the country's targets anticipate a rise until late this decade.

At the Glasgow Climate Summit in November 2021, China's international narrative faced multiple obstacles. **The country's new climate pledge failed to pin down a specific emissions trajectory or to place a cap on the increase in emissions by 2030.** This made it difficult to position China as the country capable of long-term planning and implementation. In response, the Chinese delegation adopted a new line of communication¹⁶, emphasising concrete action¹⁷ and the large number of policies that China has in place in favor of quantitative targets. The messaging also implicitly called into question the value of other countries' commitments.

Diplomatic aims and tools

Relevant questions from the Commission: How do Chinese diplomats use "climate diplomacy" to advance their objectives related to climate change and energy security? How is Beijing using diplomatic and other tools to achieve its objectives related to climate change? Conversely, how is Beijing using the climate change issue to try to advance its other diplomatic objectives (i.e. dissuading the US and other countries from opposing its initiatives in other areas for fear of disrupting possible cooperation on climate issues)?

China's climate and environmental diplomacy has come a very long way in the past decade, reflecting both the increased priority of environmental issues and climate in the Communist Party's policies and ideology, and a more assertive and proactive foreign policy stance overall.

China has viewed international climate policy and diplomacy as **an opportunity to proactively shape the international system**, starting at least from the early 1990s. The first key aim was the acceptance of the principle of "Common But Differentiated Responsibilities", placing the primary responsibility for climate action on developed countries, and uniting developing countries behind this principle. As China's emissions grew, the country started to face pressure from vulnerable nations, particularly small island developing nations. China has a history of opposing the 2°C and later 1.5°C targets, because they required more ambitious emission reductions in China, as a mathematical necessity.

In the negotiations, **China has gradually accepted more responsibility, but continues to stick to its classification as a "developing country"**: China refuses to participate in the negotiations on "loss and damage" from historical emissions, despite its ranking after the second-largest historical emitter after the U.S., and on climate finance.

A significant focus for Chinese negotiators continues to be communicating the actions that China is taking, and defending the country against criticism. China is under pressure from both developed countries and the most vulnerable developing countries to increase its ambition.

China has placed a strong emphasis on the commitment of developed countries to mobilize \$100 billion in climate financing for developing countries. This is not because China wants a cut but because the country wants to defend the position of the broader bloc of developing countries and strengthen their negotiating position.

Beyond climate policy, a core aim of China's diplomacy overall is to move from a U.S.-led system to a "multipolar" system. Building up the G77 as a unified developing country group, as a counterweight to developed countries, aligns with this effort, as does establishing the BRICS group.

After the U.S. retreat from the Paris agreement in 2017, Xi sought to profile China as the defender of the agreement¹⁸. There was however little diplomatic follow-up to this — the EU-Canada-China ministerial process made little headway. **China's climate-related diplomacy has focused more on tangible investment projects and collaboration** than on encouraging stronger targets or aiming to shape countries' negotiating positions.

China has had a more proactive and more positive stance in biodiversity negotiations and in supporting the UN Environment Programme, particularly in south-south capacity building, and of course around infrastructure (BRI). The likely reasons for this are that Chinese leaders have confidence that the country has important contributions to make and a demonstrable track record, and that these issue areas have a much less developed international framework and are less contested than climate, **allowing China to play the role of a "rule-setter"**.

Climate change and the U.S.-China bilateral relationship

China puts a lot of emphasis on the US-China bilateral relationship, and pays very close attention to US climate politics and policymaking. This includes symbolic aspects, such as the fact that Kerry was the only senior US official visiting China during the first year of the new administration. There is a hope of climate as a stabilizing element in this relationship. However, the changes in the priorities of the U.S. between the Obama, Trump and Biden administrations have understandably given the Chinese side whiplash. The inability of the Biden administration to pass legislation on climate so far obviously has not helped. Therefore, after these experiences, climate is seen as a short-term issue in the relationship where any concessions should produce quick returns.

In the run-up to the Glasgow Summit, the U.S. side sought to deal with climate as a standalone issue, while apparently having little to bring to the table by way of additional commitments or concessions that the U.S. could (credibly) make. China's response indicated that progress on climate would be affected by progress in other aspects of the relationship. The Chinese delegation's statements indicated a willingness to move on climate as a part of a broader set of negotiations that could encompass trade and security¹⁹.

China signing on to the Kigali Amendment and pledging to stop building new coal power plants abroad is a lot more than the U.S. committed to as a result of these exchanges, so it does demonstrate a willingness to take meaningful steps.

Obviously, **the Chinese government would want to see reciprocity**. Making major unilateral concessions in response to U.S. advances on climate would be particularly problematic, because China has the sense that it has delivered on its international commitments while the U.S. has not.

There is plenty of scope for the U.S. to influence China's emissions trends and policies outside dedicated climate talks. The tariffs on China's exports enacted by the Trump administration mainly affected relatively high value-added, low-carbon sectors. China's policy response was to offset the economic shock by boosting construction and carbon-intensive manufacturing, in a backward step for economic transformation and low-carbon development. The U.S.–EU carbon-based sectoral arrangement for steel²⁰ and the EU carbon border tariffs are examples of trade policies that are aiming to exert a positive influence.

A part of the motivation for China's leadership to pursue the carbon neutrality target is **achieving technological and market leadership in key zero-carbon technologies**, such as wind, solar, nuclear, electric vehicles, electrical transmission and storage, high-speed rail, green hydrogen, green steel and others. Whether China's leaders feel they need to step up efforts in these areas therefore depends strongly on what other major economies are doing and whether China is keeping up or pulling ahead. Besides raising the bar, progress in other major economies also reinforces the idea that **zero-carbon technologies are central to economic success** in the 21st century.

There is also scope for **a race to the top in international negotiations and commitments**. For example, the decisions by South Korea and Japan to stop financing overseas coal power projects helped pave the way for China's decision, as did direct diplomatic engagement.

China's international influence

Relevant questions from the Commission: How has China attempted to position itself as a global leader on climate issues? How and to what end has China exerted its influence on climate change in international organizations and standard-setting bodies addressing global green energy and emissions? Do China's efforts to position itself as an international leader on climate change align with its global energy investments, including along the BRI?

China's official line is to portray itself as an **"important participant, contributor, and torchbearer"** to addressing climate change²¹. The concern about declaring China as a "leader" on climate was that the country doesn't have enough influence or soft power to play the role of a leader, and also that this positioning would set up high expectations for China's own climate action that the leadership is not prepared to meet.

The Belt and Road Initiative (BRI) is a key vehicle of China's diplomacy and influence. The BRI is a loosely coordinated brand tying together a wide range of projects and investments carried out by hundreds of actors with different aims and motivations. The initiative includes both projects that are engineered politically in a top-down manner and projects that are pursued by Chinese firms bottom-up. The first category of projects has to align with economic, diplomatic, geopolitical or other political objectives, while for the second category it's sufficient not to cross political red lines. Due to the diversity of actors and projects, there are few universal truths about the nature of the initiative. However, the projects are in general only possible because they respond to real demand from developing countries, and they play to China's strengths in infrastructure, financing and project execution.

First through the "going out strategy" and later through the Belt and Road Initiative, **China became the largest financier of coal power plants abroad.** Risk appetite, low-cost financing, equipment supply and construction enabled many coal power projects in the developing world to move ahead that would not have been viable otherwise. In this way, China's domestic structural subsidies to state-owned enterprises worked to skew the energy choices of other countries.

In September 2021, Xi Jinping announced that China would "**no longer build coal power plants abroad**". He also promised that China would support the development of green energy in developing countries, which reflects the increase in clean energy investments under the Belt and Road Initiative that is already taking place. In 2021 the amount of investment clean energy in outbound energy investments increased to a record, while the overall volume of energy investment shrunk. The average size of deals has decreased, which is conducive to more clean energy projects.²²

With these policies, **China has begun to align outbound investments with the climate policy.** In fact, this alignment has progressed faster than in the case of domestic investments, which still include a lot of coal-fired power.

There is a major gap between the growing energy needs of developing countries and the amount of financing and equipment supply available to expand clean energy. **China is filling this gap with financing, construction services and technology.** This will certainly enforce China's "climate leadership" on the global stage, especially in the global south where countries have been repeatedly been short-changed by developed countries on climate finance.

While coal-fired power plants have been excluded, other types of carbon-intensive projects are still being financed, including captive coal-fired power plants linked to industrial complexes; oil- and gas-fired power plants; steel plants and other coal-based industrial capacity; coal-to-chemicals projects and oil&gas production.

After Xi announced the ban on new coal power abroad, **China has started to build "post-coal" energy diplomacy**, for example by incorporating clean energy investment and regional renewable energy centers to China–ASEAN talks and the Forum on China-Africa Cooperation (FOCAC). There hasn't been a similar overture yet in the Central and Eastern Europe initiative (16+1).

The BRI is about big, shovel-ready projects. There is readiness and ambition to shift the investments to clean energy but a lot of institutional bias towards traditional sectors and types of projects remains. On the host country side, a lot of work is needed to remove barriers and create an enabling environment for clean energy and other low-carbon investments. This includes improving electrical grid infrastructure, regulation, markets and institutions, as well as technology transfer and establishment of manufacturing capacity in key developing markets.

China's involvement includes financing, engineering and construction, but also increasingly aid. The Global Development Initiative (GDI) proposed by President Xi at the UN General Assembly, has become a significant part of foreign policy. In speeches and interviews at the end of 2021, the Minister of Foreign Affairs Wang Yi vowed to make the rolling out of the GDI one of his top priorities for 2022. **The initiative includes climate change and green development as one of eight focus areas**, along with others such as digitalization and industrialization²³.

China has also built up influence by **engaging in south-south cooperation through UNEP and BRI projects**, as well as integrating the BRI into the UN structures. The country is collaborating with the International Energy Agency and has a representative in the Executive Committee²⁴.



Figures

GDP in constant 2010 prices

Figure 1. The CO2 emissions from fossil energy use for the world's largest emitters, shown in terms of absolute total emissions, emissions per capita and emissions per unit of economic output. China is by far the world's largest emitter in terms of absolute totals. The country's per capita emissions have overtaken the EU and the OECD, while remaining far below those of the U.S. The emissions intensity of China's economy is close to that of India, a much poorer developing country, and far above that of developed economies, despite steady reported progress in reducing intensity. Sources: CO2 emissions until 2020 from BP Statistical Review of World's Energy; 2021 from Global Carbon Budget; other data from World Bank databank.



Figure 2. The wide range of emissions outcomes allowed for by China's commitments. The orange line shows the highest possible emissions pathway that China could follow while meeting the 2025 and 2030 CO2 intensity targets, and the commitment to peak emissions before 2030. After 2030, emissions fall slowly and gradually, requiring very rapid reductions in 2040s and 2050s. This does not violate China's commitments but results in large cumulative emissions and does little to demonstrate the commitment to the long term goal over the next two decades. The "consistent effort" pathway shows a path to the carbon neutrality target in which emissions plateau until 2025 and start falling thereafter, avoiding a steep increase in the amount of effort required in the following decades. The 1.5-degree pathway would be extremely challenging to achieve, but it is what China and other countries should strive towards based on the Paris agreement. Sources: CO2 emissions until 2020 from BP Statistical Review of World's Energy; author analysis.

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OPENING STATEMENT OF CECILIA HAN SPRINGER, ASSISTANT DIRECTOR, GLOBAL CHINA INITIATIVE, BOSTON UNIVERSITY

VICE CHAIR GLAS: Thank you so much.

I'd like to now recognize Dr. Cecilia Han Springer.

DR. SPRINGER: To Vice Chair Glas and the Commission, good afternoon. My name is Cecilia Han Springer. I'm the Assistant Director of the Global China Initiative at the Boston University Global Development Policy Center.

I work with an interdisciplinary team at Boston University, as well as with partners at academic institutions, think tanks, and civil society around the world.

Thank you for the opportunity to share our research today, and I hope these findings are helpful to you.

I've been asked by the Commission to provide information on China's finance for overseas energy infrastructure, its associated carbon footprint, and trends in Chinese investment into overseas renewable energy.

I want to begin by placing our research in the context of an ongoing global infrastructure investment gap. In order for countries to meet global collective targets, such as the Paris Agreement and the Sustainable Development Goals, a dramatic scaling of sustainable infrastructure financing, on the order of 2 percent of global GDP, will need to be mobilized each year through 2030. Taking the example of just renewable energy, in order to achieve net zero emissions by 2050, there is an investment gap of around \$700 billion per year.

It is clear that global demand for infrastructure investment is far greater than what the U.S., its allies, and multilateral development banks have been interested in or capable of fulfilling. The resulting infrastructure gap, particularly for energy infrastructure in developing countries, means that many of these countries are eager for new sources of infrastructure provision. It is, in part, thanks to this host country demand, that China has emerged as a major provider of international debt, equity, and other forms of support for infrastructure development around the world. There are several key trends driving China's recent overseas energy infrastructure engagement.

First, China's overseas development finance for energy infrastructure has declined in recent years with no new loans from China's policy banks in 2021 for the first time this century. However, in the energy sector, cumulative Chinese development finance has already far exceeded Western development finance.

Second, looking beyond development finance, China's foreign direct investment -- that is, provision of equity investment from Chinese companies -- has remained relatively constant in the energy sector, with an increasing trend towards the electricity sector and transmission and distribution projects.

This leads to an important focus in our research on China's engagement, specifically, in overseas power generation infrastructure. Here, our research shows that coal has been the largest destination for Chinese development finance and foreign direct investment into overseas power-generating capacity.

Our research also attempts to explain why China has favored carbon-intensive energy infrastructure overseas. Over two-thirds of China's overseas energy development finance is in fossil-fuel-related activity. Host countries play a large and underappreciated role in what we call pull factors in directing Chinese infrastructure support to carbon-intensive energy sources.

Within China, trends in domestic coal overcapacity, among other push factors, have led

to an increase in policy bank support for China's coal enterprises and equipment and service providers in going overseas.

This carbon-intensive overseas energy infrastructure could have major global environmental impacts. All together, the carbon dioxide emissions associated with China's fossilbased overseas power-generating infrastructure could reach over 300 million tons of emission per year, or even as high as 600 million tons per year, if all future plants come online and contracting arrangements for overseas are considered in addition to capital provision. This is an amount nearly equal to Canada's annual energy-related carbon dioxide emissions.

However, it is important to note that, within all public and private finance for overseas coal plant development in recent years, China is only responsible for 13 percent of generating capacity. And in addition, there is evidence that China's overseas coal plants are relatively more advanced in terms of emissions intensity, and therefore, technology quality.

In contrast, China's support for overseas renewable energy development has been at very low levels, but growing in recent years, driven by foreign direct investment. China's policy banks remain wary of financing renewable energy, and host countries have yet to significantly increase their demand for renewable energy.

It remains to be seen if Xi Jinping's announcement from last year that China would increase support for low-carbon energy in developing countries and not build new coal-fired projects abroad will drive a major shift in the composition of China's overseas power sector engagement and scale-up of renewable energy development. As with coal, host country policies play a major role in directing Chinese support towards or away from renewable energy.

Considering this analysis, and the pressing need for infrastructure finance to meet climate and sustainable development goals, I outlined policy recommendations for the U.S. in two key areas.

First, the U.S. must increase the scale of its overseas energy engagement and direct the composition of this engagement towards clean energy, to no longer lag behind China, and to lead by example in achieving global collective goals. This will require a systematic mobilization of bilateral and multilateral U.S. development finance institutions, as well as concrete frameworks from the emerging Build Back Better World partnership.

Second, the U.S. must expand its modes of cooperation with countries seeking infrastructure finance, especially in the realm of clean energy. Here, the U.S. can draw on its relative advantage, decades of experience and long-term relations, to provide technical assistance in capacity-building. These actions will bolster opportunities for U.S. renewable energy developers to go overseas and increase U.S. contributions towards global collective goals.

Thank you very much, and I look forward to the discussion.

PREPARED STATEMENT OF CECILIA HAN SPRINGER, ASSISTANT DIRECTOR, GLOBAL CHINA INITIATIVE, BOSTON UNIVERSITY

Testimony before the U.S.-China Economic and Security Review Commission China's Energy Plans and Practices

Dr. Cecilia Springer Assistant Director, Global China Initiative Boston University Global Development Policy Center March 17, 2022

Introduction and Summary

In order for countries to meet global collective targets such as the Paris Agreement and the Sustainable Development Goals, a dramatic scaling of infrastructure financing on the order of 2 percent of global GDP will need to mobilized each year through 2030.¹ Taking the case of renewable energy, in order to achieve net zero emissions by 2050, annual capacity additions will need to achieve a pace five times higher than the recent average growth rate. This creates an investment gap in renewable energy alone of around \$22.5 trillion through 2050, or \$700 billion per year.²

Global demand for infrastructure investment is far greater than what the U.S., its allies, and multilateral development banks (MDBs) have been interested in or capable of fulfilling. The resulting infrastructure gap, particularly for energy infrastructure in developing countries, means that many developing countries are eager for new infrastructure investment projects. It is in part thanks to this local demand that China has emerged as a major provider of international debt, equity, and other forms of support for infrastructure development.³

This testimony assesses trends in Chinese engagement in the global energy sector and the drivers behind these trends. First, I assess overall trends. I focus on China's overseas development finance for energy infrastructure, which, despite declining in recent years, has historically far exceeded Western development finance. In contrast, China's foreign direct investment (FDI), that is, provision of equity investment from Chinese companies, has remained relatively constant in the energy sector, with an increasing trend towards the electricity sector and transmission and distribution projects. Finally, I focus on China's engagement in overseas power generation infrastructure, showing how coal has been the largest destination for Chinese development finance and FDI in overseas power generating capacity.

Next, I place these trends in the context of China's overseas carbon footprint and explain why carbon-intensive energy infrastructure has been favored. Over two-thirds of China's overseas energy development finance is in fossil fuel-related activity. Host countries play a large role in directing Chinese infrastructure support. Within China, trends in domestic coal capacity have played a large role in increasing policy bank support for China's coal enterprises and equipment and service providers in going overseas. Altogether, the emissions associated with China's fossil-

based overseas power generating infrastructure could reach over 300 million tons of carbon dioxide emissions per year, or even as high as 600 million tons per year if all future plants come online and contracting arrangements for overseas coal plants are considered in addition to capital provision, an amount nearly equal to Canada's annual energy-related carbon dioxide emissions. However, it is important to note that within all public and private finance for overseas coal plant development in recent years, China is only responsible for 13% of generating capacity,⁴ and in addition, there is evidence that China's coal plants are relatively more advanced in terms of emissions intensity and therefore technology quality.⁵

In contrast, China's support for overseas renewable energy development has been at very low levels, but growing in recent years, driven by foreign direct investment. China's policy banks remain wary of financing renewable energy, and host countries have yet to significantly increase demand for renewable energy. In September 2021, Xi Jinping announced at the 76th United Nations General Assembly that China would increase support for low-carbon energy in developing countries and not build new coal-fired power projects abroad. It remains to be seen if this announcement will drive a major shift in the composition of China's overseas power sector engagement and a scale-up of renewable energy development. Like the case for coal, host country policies also play a major role in directing Chinese support.

Considering this analysis, and the pressing need for infrastructure finance to meet climate and sustainable development goals, I outline policy recommendations for the U.S. in two key areas. First, the U.S. must increase the scale of its overseas energy engagement and direct the composition of this engagement towards clean energy, to no longer lag behind China and to lead by example in achieving global collective goals. Second, the U.S. must leverage its decades of experience to expand technical assistance and capacity building activities with countries seeking infrastructure finance, especially in the realm of clean energy. In addition to bilateral channels for scaling up finance and cooperation, the Build Back Better World (B3W) Partnership is also a key opportunity for the U.S. to increase the scale of global infrastructure development and set policies that move this development towards clean energy.

Trends in China's Overseas Energy Infrastructure Engagement

To assess trends in energy infrastructure projects around the world that have received support from China, it is first critical to define the ways in which Chinese actors channel this support. China is not a monolithic entity; rather, China's overseas energy infrastructure engagement is channeled by a diverse range of actors with varying motivations.

My research has focused on several channels through which China supports overseas energy infrastructure development, including development finance, commercial finance, FDI, and export services in the form of contracting. Based both on my research background and the relative weight of these areas in China's overall overseas energy engagement, the below sections focus on China's overseas development finance and FDI, as well as China's engagement in overseas power generation infrastructure. I define these channels of engagement, summarize noteworthy trends and identify the actors involved.

Overseas Development Finance

China's official overseas development finance is defined as lending commitments from China's two policy banks, the China Development Bank (CDB) and the Export-Import Bank of China (CHEXIM), to overseas borrowers with public ownership. These two banks were capitalized in 1994 and are solely owned by the Chinese government under the direct leadership of the State Council. CDB was initially designed to primarily assist with domestic infrastructure priorities, but has transformed since the 2008 global financial crisis into the one of the world's largest overseas lenders. CHEXIM is tasked primarily to facilitate the country's foreign trade and foreign economic cooperation, and it provides finance to Chinese energy companies primarily in the form of export credits, credit guarantees, and concessional loans.⁶ While initial mandates focused on domestic and overseas infrastructure development respectively, these two banks have coordinated with Chinese commercial banks, state insurance provider Sinosure, and government ministries to enable overseas projects in strategic areas and sectors, a model termed the strategic or coordinated credit space.⁷ This model has driven the rapid takeoff of China's overseas development finance since 2008 to a level that is on par with World Bank lending (Figure 1).⁸

Taking the above definition, the Boston University Global Development Policy Center's China's Overseas Development Finance (CODF) Database shows that for all sectors, China's overseas development finance amounted to 858 loans totaling \$460 billion between 2008 and 2019.⁹ The energy sector has been the dominant destination for this finance, receiving 273 loans totaling \$225 billion over that same time period.

Looking at the energy sector over broader time period, from 2000 until the end of 2021, the Boston University Global Development Policy Center's China's Global Energy Finance (CGEF) Database shows that China has provided \$235 billion in development finance for the overseas energy sector, with most of this lending concentrated in the years 2008 to 2019.¹⁰ Putting this in context, China's policy banks have provided as much overseas lending as all the major Westernbacked multilateral development banks (MDBs) combined, tripling the amount of energy financing available to national governments over the time period tracked in our database.¹¹

Despite this boom, it is important to note that China's overseas development finance for energy infrastructure has continually decreased since 2016 (Figure 2), reflecting an overall decline in China's overseas development finance in recent years. This decline has been driven by a variety of factors. First, although host countries face a pressing need for more infrastructure, many have hit bottlenecks in the ability to absorb new projects, especially as external debt grows to unsustainable levels. Second, within China, slowing economic growth and dwindling current account surpluses have limited the amount of dollars for outward finance. Even before the pandemic, Chinese regulators tightened the reigns on domestic and overseas financing by

strengthening financial regulations and emphasizing prudent and sustainable lending.¹² In 2021, China provided no new development finance for energy-related projects, with the prior factors exacerbated by the economic effects of the COVID-19 pandemic.

Regarding the energy activities that China's development finance has supported, power generation has received the largest share of lending (\$110 billion), followed by exploration and extraction (\$71 billion) and transmission and distribution (\$39 billion), with the remainder going towards multipurpose projects and energy efficiency-related activities.

Foreign Direct Investment

Given the recent decline in China's overseas development finance for the energy sector, and across all sectors, it is important to note that China's overseas energy engagement is far from gone – it has to some extent shifted towards other channels, including commercial lending from Chinese commercial banks, provision of equity in the form of FDI, and export services in the form of contracting. This section covers Chinese companies' FDI in the overseas energy sector.

Even though China's annual energy sector FDI has also decreased in general in the past few years, on average, China's energy sector FDI has remained much more stable than development finance. FDI can be further classified into greenfield FDI for new projects, and mergers and acquisitions (M&A) for existing projects. Greenfield investment represented a larger share of FDI than M&As in 2018, 2019, and 2020. Due to the COVID-19 pandemic, China's overseas energy sector development finance and greenfield investment were dramatically reduced relative to prior years in 2021, but M&As remained at a constant level of roughly \$6 billion per year (Figure 3).

An additional trend is the growing importance of the electricity sector in China's overseas FDI. Investments in coal, oil, and natural gas exploration, extraction, and transportation activities have decreased since 2015, making the electricity sector the primary destination for China's energy FDI, largely driven by M&As. Within the electricity sector, transmission and distribution rather than power generation has been a focus of these M&As in the past three years.

China's Overseas Engagement in Power Generation Infrastructure

As noted above, the power sector has received the largest share of China's overseas energy sector development finance to date. The power sector is also a major recipient of loans from Chinese commercial banks and equity investment from Chinese companies. In addition, Chinese engineering and construction companies may be contracted by overseas project developers to provide equipment, procurement and construction (EPC) services or other types of construction and operation arrangements, such as Build-Operate-Transfer (BOT). Given the importance of the power sector in China's overseas energy engagement, this section breaks down the channels through which China has been involved in overseas power plant development. For analyzing this

sector, it is helpful to use the generating capacity of power stations as a unit of comparison (in megawatts, MW, or gigawatts, GW), rather than dollar value of lending or investment, based on both data availability and relevance for environmental impact.

According to the Boston University Global Development Policy Center's China's Global Power (CGP) Database, which tracks China's overseas development finance and equity investment in the form of FDI, China has supported 557 overseas power plants representing 106 GW of generating capacity through these channels since 2000.¹³ FDI supported the majority of this capacity, at 57 GW, with CDB and CHEXIM providing development finance for 42 GW of capacity. A small amount of capacity, 6 GW, was co-financed with both Chinese development finance and FDI. However, by number of projects, 81 percent of the projects are supported by FDI, while 23 percent involve debt financing from Chinese policy banks, with a 4 percent overlap. This shows the policy banks have been investing in much larger projects by capacity than FDI, and this has been heavily weighted towards coal and hydropower projects.

It is also important to note that there is also a significant amount of pipeline capacity in the form of plants that are under construction or are planned to receive Chinese development finance and/or FDI. Forty-three GW are currently under construction, while 37 GW are under planning. For plants that are under planning, plans may change frequently, and this estimate represents the CGP Database's assessment based on best available information as of mid-2019. High-level policy announcements, such as Xi Jinping's statement in 2021 that China would not build new coal plants overseas,¹⁴ may affect planned plants.

Power sector FDI is heavily concentrated in several Chinese companies. Among the 63 Chinese companies that have participated in FDI in the power generation sector, the top ten companies have contributed to 77 percent of the total capacity. These top ten companies are: China General Nuclear Power Group, China Three Gorges Corporation, China Huaneng Group, State Power Investment Corporation, PowerChina, State Grid, China Huadian Corporation, Shenhua Group, China Datang, and Canadian Solar. Except for Canadian Solar, which is one of China's biggest solar companies, nine of the top ten investing companies are state-owned enterprises, and are also among the biggest power companies in China.¹⁵ Besides Canadian Solar, which has been investing solely in solar power, all other top ten companies are investing in multiple energy sources. Companies such as China Three Gorges and Shenhua, which have specific technology focuses, do have FDI portfolios more concentrated on their area of expertise (hydropower and coal, respectively).

China's Overseas Carbon Footprint

China's overseas energy sector engagement to date has been heavily weighted towards fossil fuels. According to the CGEF Database, more than two-thirds of China's overseas energy sector development finance has gone towards fossil fuel-related projects, with oil (\$75.8 billion) and coal (\$51.6 billion) receiving the largest shares.

For power generation specifically, looking at both development finance and FDI, China has channeled support to 65 GW of fossil fuel-based generating capacity out of 106 GW capacity. Coal has received the largest share (41 GW) (Figure 4) and is highly regionally concentrated in Southeast Asia (40 percent), South Asia (31 percent), and Africa (16 percent). Development finance and FDI differ in the types of generating capacity they have tended to support; Chinese policy banks contributed to 73 percent of overseas coal power generation capacity tracked in the CGP Database, while most gas-fired power plants and renewable power generation projects were supported by FDI.

For overseas power plants that are planned and under construction, 40.6 GW are fossil-based, out of a total of 80 GW (50.8 percent).¹³ Although the future share of fossil-based generation receiving Chinese capital may decrease, most power plants have a decades-long lifetime, and thus will continue emitting carbon dioxide (CO₂) decades into the future.

Overseas fossil-fuel based power plants receiving Chinese development finance and FDI are currently leading to approximately 314 million tons (Mt) of CO₂ emissions per year, which is about 3.5 percent of the annual CO₂ emissions from the global power sector outside of China. Assuming no retirement by 2030, cumulative CO₂ emissions from 2018 onward from these fossil fuel power plants will reach approximately 5.9 Gigatons (Gt), which would consume 1.3 percent of the global carbon budget for a 66 percent chance of limiting global warming to 1.5 degrees Celsius, according to the Intergovernmental Panel on Climate Change (IPCC) Special Report.¹⁵

Overseas Coal Power Plants

China's overseas support for the development of coal-fired power plants is particularly important based on the information discussed above – coal represents the largest share of China's development finance and FDI for overseas power generating capacity, and the second largest share by dollar amount for China's overseas energy development finance. In addition, China's overseas coal plants will operate for decades to come – the oldest plant tracked in our CGP Database is from 2003, less than 20 years old, with the majority built in the past decade.

In September 2021, Xi Jinping announced at the 76th United Nations General Assembly that China would increase support for low-carbon energy in developing countries and not build new coal-fired power projects abroad. Although a clear commitment to greening China's overseas activity, the wording of the announcement left significant room for interpretation. My recent policy brief quantified the potential range of coal generating capacity that could be affected by this announcement.¹⁶ In addition to development finance and FDI, I also estimated China's support for future coal plants through Chinese commercial banks and contracting arrangements.

For capital provision, I found that Chinese policy banks, commercial banks, and companies are supporting a total of 23.5 GW of coal plants under construction and 18.4 GW of coal plants under planning.¹⁶ These institutions' support for overseas coal plants is further broken down below, and summarized in Figure 5.

China's policy banks and their development finance have supported 29.6 GW of currently operational coal plants around the world since 2000. Another 9.3 GW are under construction and 3.9 GW are under planning. Including co-financed arrangements between Chinese policy banks and Chinese companies, these numbers are 33.5 GW of currently operational plants, and 16.5 GW of plants under construction.

Between 2011 and 2020, Chinese commercial banks supported 8.3GW of coal-fired power generating capacity abroad (excluding those co-financed with CDB and CHEXIM and with Chinese FDI). Another 3.9 GW are under construction and 4.9 GW are under planning. Much of the capacity under planning is associated with the Bank of China, which announced in late 2021 that it would not finance new coal mining or coal power projects abroad.¹⁶

Chinese companies have provided greenfield FDI to 3.3GW of operating coal plants overseas, 3.1GW of coal plants under construction and 9.6GW of planned plants (not including plants with both FDI and Chinese policy bank finance). Chinese companies have invested in 4.2GW of already-existing coal plants via M&As. There are also 3.8GW of already operating plants, and 7.2GW of plants under construction that had capital participation of both Chinese policy banks and Chinese companies.

I also found that Chinese companies providing engineering and construction services, such as through EPC contracts, represent a larger amount of overseas future coal capacity than for the capital arrangements discussed above. The capacity associated with construction arrangements alone (with no associated Chinese finance) is roughly 27 GW of coal plants under construction, and 32 GW under planning.

Taken together, the emissions associated with the capital as well as construction arrangements could amount to nearly 600 million tons of CO₂ per year, if all these plants came online.

However, it is critical to place these findings in the context of other developers of coal-fired power plants and their relative financial flows and technology quality.

First, Chinese policy banks, commercial banks, and companies are responsible for only a small share of recent coal plant development, relative to Western institutional investors. While it is true that China is the largest public (i.e., development) financier of overseas coal plants, with its two policy banks providing \$15.6 billion, or 50 percent of global public finance commitments in overseas coal fired power plants that reached financial closure between 2013 and 2018 (40 percent by generation capacity), the inclusion of private finance paints a drastically different picture: 87 percent of public and private finance for overseas coal plants is funded by entities

outside China. Chinese policy banks, commercial banks, and companies financed 32 GW of overseas capacity, accounting for just 13 percent of the coal power capacity outside China that was operational or under development over that same time period.⁴

Second, empirical evidence from my research on coal plants in Asia indicates that those with Chinese parent, engineering, and/or construction companies have relatively lower CO_2 emissions intensity, compared to similar plants with non-Chinese parent, engineering, and/or construction companies.⁵ This indicates that Chinese companies may play a role in providing relatively more efficient or high quality technology, even as absolute emissions associated with coal plants remain a serious issue for climate change and air pollution.

Drivers of China's Overseas Fossil Fuel Infrastructure Development

To analyze the factors driving the kinds of energy Chinese institutions support overseas, it is useful to classify these drivers into a "supply push, demand pull" framework. Supply push refer to factors within China that determine overseas engagement choices. Demand pull refers to factors in host countries and on the part of decision-makers in those countries that determine energy choices related to Chinese engagement. To some extent, prior discourse has underplayed the role of host countries, which play a key role in shaping what types of energy Chinese actors finance and invest in.¹⁷

For coal-fired power plants, from the perspective of demand pull, many host countries where coal plants have been built with Chinese support are highly dependent on foreign capital for infrastructure development. With China as the leading provider of energy development finance, as discussed above, as well as the gradual and systematic withdrawal of MDBs and leading Organization for Economic Co-operation and Development (OECD) bilateral financiers from coal finance, host countries turned to China's policy banks to meet growing needs for increasing electricity generation. In some cases, host countries have preferential policies for coal plant development, and lack an enabling policy environment for renewable energy.¹⁸ Large coal resource endowments in certain countries also play a large role in seeking external support for coal plant development, such as in Pakistan.¹⁹ Another driving factor for this turn to China is the lack of technological know-how for the installation of large-scale generation capacity, with up to 60 percent of coal power capacity additions outside of China from 2010 to 2015 relying on imported equipment.²⁰

These demand pull factors are highly aligned with supply pushes from within China's coal industry. Since the 2008 global financial crisis, Chinese coal companies faced a shrinking domestic development space, due to economic slowdown and shifting environmental policy within China. At the same time, domestic overcapacity in coal-fired power generation became an increasing challenge, one that continues today. Researchers from the Boston University Global Development Policy Center identify 2013 (also the year the Belt and Road Initiative (BRI) was announced) as a turning point in Chinese leaders' strategy towards facilitating overseas coal

plant development. Previously, overseas coal plant development was largely industry-led from major coal state-owned enterprises (SOEs), which operate with support from China's policy banks in the coordinated credit space model discussed above. However, in 2013, Xi Jinping highlighted the specific role overseas development could play in relieving excess production capacity, leading to subsequent policies on promoting China's equipment manufacturing sector (particularly for coal) in accessing overseas markets.¹⁷

While not a fossil fuel, hydropower has also been a major destination for Chinese finance, investment, and contracting in the overseas energy sector, and reflects many similar trends in the push-pull framework as China's overseas coal story.²¹ Particular to hydropower plants in the Greater Mekong Subregion with support from Chinese companies, many plants have cross-border electricity export arrangements for supply to China.²²

China's Overseas Renewable Energy Development

According to the Boston University Global Development Policy Center's CGP Database, renewable energy in the form of wind and solar generating capacity has accounted for 11 percent of total capacity supported by Chinese overseas development finance and FDI. By number of projects, this share is higher, at 17 percent, which makes sense because renewable energy projects tend to be much smaller in capacity than fossil fuel and hydropower plants.

As mentioned above, FDI on the part of individual companies has been a key channel for Chinese support of overseas renewable energy development, far dwarfing development finance. Of the 63 companies tracked in the CGP Database, 34 are investing purely in renewable energy (including hydropower). Over half of them are private companies. This shows that even though investing in small volumes, a more diverse range of Chinese companies, including both private firms and SOEs, are investing in renewable energy overseas.¹⁵

Focusing on China's greenfield FDI in overseas power generation, since 2014, greenfield FDI in alternative/renewable energy on average has nearly doubled the amount of annual investment in previous years. Fossil fuel power generation peaked in 2015 (Figure 6).

Drawing again from the supply push, demand pull framework to analyze the drivers of China's overseas renewable energy (henceforth wind and solar only) finance and investment, such finance is constrained by lack of enabling factors on the part of both China and host countries. The small amount of development finance that has been channeled to overseas renewable energy development (13 projects, according to the CGP Database), has primarily been driven by demand from host countries, including direct requests for assistance from the governments of Ethiopia, Kenya, Argentina and Pakistan.²³ Beyond development finance, many host countries face a web of actors with objectives that strongly favor fossil-based power development, especially coal, leading to weak demand for renewable energy when it comes to engagement with China.²⁴

Chinese development finance for renewable energy has also been constrained by perceptions on the part of China's policy banks that renewable energy projects have high bankability risks. This perceived bankability risk has led policy banks to turn away from small and distributed renewable energy projects, which are also seen to face technical and infrastructural bottlenecks in developing countries. Finally, the Chinese policy banks worry about financial risks, including profitability and future cash flows from renewable projects.²³ Taken together, these factors – whether real or perceived – limit the likelihood of China's policy banks approving loan applications or seeking out opportunities for engagement with host countries on renewable energy development.

However, a major policy shift may be at hand, following increasing narratives of a green BRI and the provision in Xi Jinping's September 2021 announcement that China would increase support for low-carbon energy in developing countries and not build new coal-fired power projects abroad. Depending on how this announcement is interpreted and executed, state support for renewable energy development overseas could increase.

Policy Recommendations

The major differences in approach and scale of Chinese engagement in overseas energy infrastructure warrants a response from the U.S. government, which is also a player in global infrastructure development and shares collective goals with China and developing countries in achieving Paris Agreement targets and the Sustainable Development Goals.

Based on the above trends and determinants in China's overseas energy engagement, the U.S. policy response should focus on 1) increasing the scale of U.S. overseas energy engagement and directing the composition of this engagement towards clean energy and 2) expanding U.S. cooperation with countries seeking infrastructure finance, especially in the realm of clean energy.

First, given the global infrastructure finance and investment gap, and the relative scale of Chinese development finance, the U.S. should support calls for a capital increase in the multilateral development banks that it participates in, as well as a renewed and increased commitment for infrastructure support overseas through bilateral development finance channels, particularly for clean energy. The U.S. has a number of development financing institutions that can channel this support, including the Development Finance Corporation, USAID, EXIM, the Millennium Challenge Corporation, and the U.S. Trade and Development Agency. The Department of Energy can provide expertise and technical assistance, while overall interagency coordination can be improved with the goal of increasing the scale of U.S. clean energy support overseas. Given President Biden's recent announcement of the Build Back Better World (B3W) Partnership, there is also a clear policy opportunity to clarify and define B3W's future overseas activities, set goals for engagement in clean energy, and work with global partners to increase the scale of this activity.

The U.S. should focus not only in the scale of infrastructure finance, but also the composition. The U.S. has an opportunity to lead by example in opening a path for a new generation of sustainable, low-emissions energy infrastructure that could stand in contrast to the fossil-heavy portfolio of China's overseas energy engagement. In addition, the U.S. should align its overseas energy financing with domestic energy development trends. Since 2010, two thirds of added generating capacity domestically within in the U.S. has been in the form of wind and solar renewable energy; however, the overseas generating capacity receiving U.S. bilateral finance and investment has been two thirds fossil fuels.²⁵ Aligning the composition of U.S.-supported overseas energy infrastructure with what is being done domestically will support climate goals and provide opportunities for U.S. renewable energy businesses to go overseas.

Second, the U.S. should engage in technical assistance and capacity building through bilateral and regional partnerships focused on energy development in countries seeking overseas infrastructure finance. In contrast to China, the U.S. has long-term relationships and decades of experience working with host countries to provide technical assistance and capacity building. It is critical for the U.S. to bilaterally help countries formulate policies and devise incentives for renewable energy, as well as build the regulatory and institutional capacity to support these policies. Existing examples include regional programs, such as Power Africa, the Mekong-U.S. Partnership and the Japan-U.S.-Mekong Power Partnership. As an example, given Chinese dominance of hydropower development in the Mekong region, U.S. efforts should focus on renewable energy alternatives to hydropower. In the power sector, U.S. technical expertise can assist host countries in identifying low-cost, reliable electricity planning options that deploy renewables, as well as developing enabling policy environments for renewable energy deployment. Doing so could both address climate change and provide opportunities for U.S. renewable energy developers.

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Figures

Figure 1: China and World Bank Annual Overseas Development Finance, 2008-2019



Figure 2: China's Annual Overseas Energy Finance from Policy Banks, 2000-2021



Source: China's Global Energy Finance (CGEF) Database, 2022. Boston University Global Development Policy Center.



Figure 3: China's Overseas Energy Investment and Development Finance, 2016-2021

Source: Dealogic, 2021; fDi Intelligence, 2021; China's Global Energy Finance (CGEF) Database, 2022. Boston University Global Development Policy Center.

Figure 4: Overseas Power Generating Capacity Receiving Chinese Development Finance and FDI by Fuel Type, 2000-2019



Source: China's Global Power Database, Boston University Global Development Policy Center, 2020.



Figure 5: Overseas Future Coal Capacity Associated with Different Types of Chinese Capital Participation

Source: Boston University Global Development Policy Center China's Global Power Database, Global Energy Monitor

Figure 6: Chinese Greenfield FDI in Fossil Fuels vs. Alternative/Renewable Energy in the Electricity Sector



Source: Ma and Springer 2022.

OPENING STATEMENT OF JONAS NAHM, ASSISTANT PROFESSOR, JOHNS HOPKINS SCHOOL OF ADVANCED INTERNATIONAL STUDIES

VICE CHAIR GLAS: Thank you so much.

I'd like to recognize Dr. Jonas Nahm.

DR. NAHM: Vice Chair Glas, Commissioner Friedberg, Members of the USCC, thank you for inviting today to speak on this subject that I think is of great importance, both for the future of global emissions, but also U.S. economic competitiveness. And so, I want to focus in my testimony on four short facts on China strategy in new energy industries and the U.S. response to the strategy.

And so, the first fact is that China's investments in R&D for new energy technologies and the manufacturing capacity for these products have long been part of broad strategy to position China's domestic economy and key emerging industrial sectors in new energy. And so, beginning with the wind industry in the early 2000s, and then, followed by the solar sector after the 2009 financial crisis, and more recently, in electric vehicle and battery storage industries, the Chinese central government has supported new energy technologies as ways to combine climate and economic goals, and to create export-ready industries really.

And so, China is now a leader in the mass production of key technologies most needed to address the climate crisis, and in large part because of China's investments in this space, the cost of these technologies has fallen sharply.

But, even though China has moved to a dominant position in the production of these new energy technologies, it remains for now embedded in global networks of industrial ecosystems really. According to my own work, Chinese firms continue to work with foreign suppliers, customers, R&D partners, to access technologies, components, materials, production equipment from abroad. And this is the case even though a number of central government initiatives over the past two decades have really pushed this idea of technological independence in this space.

The second factor I want to sort of highlight here is that Chinese firms in new energy sectors have focused their efforts on building research and development capabilities around the commercialization and mass production of these energy technologies. And so, in Chinese firms, designated R&D teams are focused on rapidly translating new technologies into mass manufacturable products really.

And so, the development of these capabilities in manufacturing innovation relied on two unique institutional features of the Chinese domestic economy: central government incentives for R&D on the one hand, but also a lot of local government support for manufacturing. And so, since the beginning of the reform period of the 1980s, the central government in Beijing has really pushed or encouraged the development of domestic R&D, including in applied research for new energy.

Meanwhile, provincial and municipal governments, dependent on tax revenue from the local manufacturing economy, have supported the local firms in building out manufacturing capacity. And so, they have, for instance, brokered bank loans, provided land facilities and tax incentives to manufacturers, including in the new energy technologies that we're talking about today that were unable to attract large-scale financing for manufacturing in many other parts of the world.

And so, today, no other economy has really been able and willing to devote a similar level of resources to the expansion of manufacturing capacity and manufacturing R&D in these

sectors.

The third point I want to make is that China has historically created an uneven playing field in its domestic market in favor of Chinese firms, but the U.S. has not mounted an adequate policy response to this. And so, indeed, in sectors such as wind, foreign firms have been systematically pushed out of China's domestic markets through discriminatory government purchase policies, for instance. And even though local content requirements for wind turbines were removed in 2009, and no formal nationality requirements were part of feed-in tariffs, foreign wind turbine manufacturers, among others, have complained about being systematically excluded from government tenders, for instance.

And other industries, such as the auto sector, for instance, have been forced to share IP and profits with Chinese partners in order to gain market access, and China has also announced future plans to use standard-setting as an industrial policy tool in this space, but such plans are, for now, just plans. And so, the situation is improving in some areas, including in strengthening IP courts, the removal of joint venture requirements for electric vehicle manufacturers, but the U.S.'s response has not really been adequate in this space.

As China began to dominate these supply chains for a number of different key energy technologies, the U.S. has mainly responded with a series of trade barriers against Chinese imports. And despite the justification across Administrations that these trade barriers would bring manufacturing back, this has not actually occurred as a result. And so, tariffs have, instead, led to the relocation of some production capacity to other Asian economies, including Vietnam and Malaysia, but they did not forge a reorganization of global new energy industries or promote the expansion of manufacturing in the United States.

And China continues to account, roughly, for two-thirds of global production capacity in solar, and most of the U.S. panels continue to be imported, and its dominance in batteries is even more pronounced.

And so, fourth, I want to say that, historically, the U.S. has been the largest investor in clean energy research and development, and it continues to lead in many areas critical for fixing the climate problem. But the U.S. risks losing its leadership position, particularly as other economies, including the European Union, have made strengthening these sectors a key national, or transnational priority in the case of the EU. And so, particularly on climate-related technologies, the U.S. really needs to accelerate its R&D investments to defend its technological lead.

More importantly, though, the technologies that emerge from these efforts must eventually be scaled and deployed. And for now, there are few alternatives to using Chinese supply chains, or parts of Chinese supply chains, to move these new technologies to market.

And so, to change this, the U.S. really needs to improve conditions for segments of clean energy supply chains that are currently not very well supported domestically. And that means investing in domestic manufacturing capacity as part of a national strategy for innovation. And so, for instance, the creation of a government-controlled Industrial Finance Corporation that could fund domestic manufacturing projects that the U.S. financial system has been unwilling to fund would be a start. Renew investments in vocational training, technical colleges. A more stable regulatory framework to support domestic markets for these technologies would also improve national competitiveness in these industries.

But, even then, it's highly unlikely that entire value chains for complex energy technologies would ever lie entirely within national boundaries. And so, the U.S. should also not lose sight of the fact that there are substantial economic benefits from investment in these

technologies and the use of these technologies, even if a share of them is still manufactured abroad, including in China.

And with that, I'll conclude my remarks, and thank you for your time.

PREPARED STATEMENT OF JONAS NAHM, ASSISTANT PROFESSOR, JOHNS HOPKINS SCHOOL OF ADVANCED INTERNATIONAL STUDIES

Jonas Nahm Assistant Professor for Energy, Resources, and Environment Johns Hopkins School for Advanced International Studies, Washington DC

Testimony before the U.S.-China Economic and Security Review Commission

Hearing on "China's Energy Plans and Practices" March 17, 2021

Thank you for inviting me today to speak on this topic of great importance for both the future of global emissions reductions and U.S. economic competitiveness. I am a political economist by training and an expert on economic and industrial policy. My research focuses on new energy industries and, in particular, China's role in the global development of wind, solar, battery and electric vehicle sectors. I will focus in my testimony on outlining (1) China's pursuit of these technologies over the past two decades, describe (2) the broad policy environment that has enabled China to dominate the production of new energy technologies, examine (3) U.S.-China competition in this space, and conclude (4) with policy recommendations.

1. China's Pursuit of New Energy Technologies

China's investments—not just in research and development for new energy technologies, but particularly in manufacturing capacity for these technologies—has long been part of a broad strategy to position China's domestic economy in key emerging industrial sectors. Beginning with the wind industry in the early 2000s, then followed by solar sector after the financial crisis in 2009s, and, more recently, in electric vehicle and battery storage industries, the Chinese central government has supported new energy technologies as ways to combine climate and economic goals and create export-ready industrial sectors.

China is now a world leader in the mass production of the technologies most needed to address the climate crisis by decarbonizing the electricity and transportation sectors. These new energy technologies include wind turbines, solar panels, electric vehicles, and batteries. Since joining the World Trade Organization in 2001, China has rapidly grown its global share of solar photovoltaic production, leaping from less than 1 percent to more than 60 percent of the world's solar panels. China is one of the world's largest producers of electric cars; it makes over one-third of global wind turbines, and a much larger share of components for wind turbine installations around the world. China is home to over two-thirds of the world's production capacity for lithium-ion batteries needed for electric vehicles and storage. Together with the European Union, China is now also one of the world's largest markets for electric vehicles.¹

In large part because of China's unprecedented investment in manufacturing in green technology sectors, the cost of clean energy technologies has fallen sharply. Since 2009, global prices for wind turbines and solar panels have decreased by 69 percent and 88 percent, respectively, making these

technologies competitive with conventional sources of energy in many parts of the world.² Wind and solar become especially competitive when they are deployed in conjunction with battery storage, where China's massive investments in new manufacturing capacity have also generated rapid cost declines. The development of these capabilities in manufacturing innovation relied on two features of China's domestic economy that supported investments in both innovation and manufacturing: central government incentives for R&D and local government support for manufacturing. To date, no other economy has devoted a similar level of resources to the expansion of manufacturing capacity and manufacturing R&D in new energy industries.³

Although China has moved to a dominant position in the production of new energy technologies, it remains, for now, embedded in broader global industrial ecosystems. According to my research, Chinese firms continue to work with foreign suppliers, customers, and R&D partners to access technology, components, materials, and production equipment. This is the case even though a number of central government initiatives over the past two decades—most importantly China's indigenous innovation initiative and more recently the Made in China 2025 initiative—have pursued broad goals of technological independence.⁴ While Chinese firms are dominant players in the production of new energy technologies, their market position often belies their embeddedness in such global networks of firms.

China's new energy technology firms have primarily bet on a set of conventional new energy technologies, including silicon-based solar PV technologies and traditional lithium-ion battery chemistries. The economies of scale—and resulting cost declines—that China has achieved in these sectors have created concerns about technology lock-in, as their cost competitiveness makes it difficult for next-generation technologies to break into the market. This has particularly been a concern in the United States, which has traditionally excelled at the development of next-generation energy technologies and is home to a number of firms seeking to commercialize these products.⁵

China's rise in clean energy industries has promoted European economies in particular to try to develop domestic alternatives to the reliance on Chinese manufacturers. For instance, the European Union's "Fit for 55" proposal seeks to marry climate and economic goals by investing in low-carbon industries that guarantee jobs and prosperity as Europe pushes emissions reductions. Such goals are also noticeable in Europe's transportation sector, where the EU has proposed reducing new vehicles' average emissions by 55 percent in 2030 and 100 percent in 2035. This amounts to an outright ban of internal combustion engine vehicles by 2035, expanding on policies that have already passed in individual member states, including in France.⁶

The EU proposals send a strong signal to European firms that they need to participate in the transition away from fossil fuels or be left behind in a global industrial policy competition with China. In combination with promises to expand renewable energy capacity and charging infrastructure, to increase taxes on conventional fuels, and to develop low-carbon sources of hydrogen, these policies for clean energy industries build on ongoing EU efforts to close key gaps in industrial supply chains. The EU has, for instance, funded a European Battery Alliance to establish a competitive European battery industry that would reduce Europe's dependence on China.

All this fits with a broader response of the EU to China's rise in new energy industries. The EU is seeking to push back globalization and to create domestic sources of growth, particularly in strategic clean energy sectors with rapidly growing global markets and domestic security implications.⁷ More than forty percent of Europe's pandemic stimulus package is dedicated to projects that further both economic competitiveness and address greenhouse gas emissions through support for green industries.⁸

2. China's Policy Environment

Particularly in new energy technology sectors, skills in the commercialization and mass production of new technologies are now concentrated in China. In the late 1990s and early 2000s, when the first Chinese firms entered wind and solar PV sectors, few global manufacturers of wind turbines and solar panels were producing at scale. While technology could be accessed in global networks through licensing and joint venture agreements, mass production knowledge was rare in these emerging industries. Chinese firms subsequently focused their efforts on building research and development skills around the commercialization and rapid scale-up of complex wind and solar technologies. Designated R&D teams focused on rapidly translating complex technologies into mass-manufacturable products. Such tasks required improvements to process designs long associated with manufacturing innovation, but also entailed changes to product designs to accommodate manufacturing requirements, to incorporate new materials and components, and to meet cost targets for final products.⁹ The majority of these producers continued to license technology and source components and production equipment abroad.¹⁰

The development of these capabilities in manufacturing innovation relied on two unique institutional features of China's domestic economy that supported investments in both innovation and manufacturing: central government incentives for R&D and local government support for manufacturing. To date, no other economy has been willing and able to devote a similar level of resources in the expansion of manufacturing capacity and manufacturing R&D in new energy technology sectors. Since the beginning of the reform period in the 1980s, the central government in Beijing has used state incentives to encourage the development of domestic R&D, including applied research in manufacturing. Such government R&D support expanded in 2006, when the central government began encouraging "indigenous innovation" to reduce dependence on foreign technologies through increased domestic R&D efforts. Efforts further accelerated under President Xi's Made in China 2025 initiative, which has also designated the development of domestic new energy technology sectors as a strategic national priority. Provincial and municipal governments, dependent on tax revenue from the local manufacturing economy, augmented central government R&D support with incentives for mass production. China's provincial and municipal governments repurposed central government resources to broker bank loans and provide land, facilities, and tax incentives to manufacturers, including in energy technology sectors that were unable to attract large-scale financing in other parts of the world. Such loans for manufacturing facilities were provided even as central government policies encouraged industry consolidation. It is estimated that between 2010 and 2012 alone, wind and solar firms received credit lines of USD 47 billion by Chinese banks. The China Development Bank, one of three state-owned policy banks, reportedly extended USD 29 billion in credit to the 15 largest wind and solar firms.¹¹ Other reports suggest that state-owned banks provided USD 18 billion in loans to large wind and solar firms for

the expansion of manufacturing facilities. These loans were backed by municipal and provincial governments, allowing firms to expand manufacturing capacity even after the global financial crisis in 2009, when the collapse of European markets led to global overcapacity and few lenders were willing to fund further expansion of manufacturing plants.¹²

While national policies designated strategic technologies and provided funding for R&D, local policies diverted those resources into mass manufacturing clusters. In this environment, Chinese manufacturers continued to center their R&D efforts on production improvements rather than new product R&D.¹³ To ensure that firms would rapidly contribute to the local economy, local administrations have frequently made subsidies conditional on meeting production targets and revenue requirements. In many instances, firms were contractually obliged to build facilities with pre-determined manufacturing capacity by a particular date or risk losing government grants, tax reductions, and discounts on land prices. In other cases, local governments informally exerted pressure on firms to rapidly scale production.¹⁴ As Chinese manufacturers in energy technology sectors focused on commercialization, scale-up, and cost reduction, their innovative manufacturing capabilities (rather than basic factor cost advantages) emerged as a key source of competitive advantage. ¹⁵ Yet, even with China's highly supportive domestic institutions and rapid developmental pace, it took nearly four decades for Chinese firms to establish the capabilities in commercialization and scale-up that the world now needs to bring new energy technologies to market.

A growing body of research suggests that Chinese firms have also been able to acquire knowledgeintensive manufacturing capabilities in electric vehicle and battery industries, following a pattern similar to that of wind and solar. In the automobile industry, the engineering capabilities of Chinese firms have allowed them to create products particularly suited for China's "middle market" (based on cost and functionality). Although China's automakers are not (yet) outcompeting global incumbents for high-end products, they are able to make changes to product designs to reduce cost and optimize functionality.¹⁶ The ability of Chinese automotive suppliers to build such capabilities marks an unintended consequence of the sequencing of China's economic reforms, which first focused on nurturing domestic manufacturing capabilities before allowing foreign direct investment and trade liberalization.¹⁷ At the same time, Western incumbents, established long before the opening of China's economy to foreign firms in the 1980s, prevented Chinese firms from moving into desirable parts of the supply chain.¹⁸

In today's automotive sector, incumbent firms appear to be losing—however gradually—their ability to control global supply chains.¹⁹ Technological change, including the growing importance of electronics in engine control and safety equipment, has made auto manufacturers dependent on collaboration with suppliers which offer expertise that automakers historically did not possess. These changes have only accelerated in the transition to electric vehicles, which introduced new components, including batteries and electric drivetrains. The division of labor in the electric vehicle sector now bears some resemblance to what I have outlined in the renewable energy sectors, as Chinese firms have applied their capabilities in manufacturing to focus on scale-up and mass production. Relying on the same state resources that buoyed aspiring wind and solar manufacturers, Chinese firms now control more than two-thirds of the global production capacity for lithium-ion batteries while rapidly reducing the associated costs.²⁰

3. U.S.-China Competition

China has historically set an uneven playing field in its domestic market in favor of Chinese firms, and in some sectors, such as wind energy, foreign firms have been systematically pushed out of China's market through discriminatory government procurement policies.²¹ Even though local content requirements for wind turbines were removed in 2009 and no formal nationality requirements were part of China's feed-in tariffs, foreign wind turbine manufacturers complained about being systematically excluded from government tenders and undercut by local competitors.²² Despite having established local manufacturing facilities in China, foreign manufacturers argued that central and subnational governments were making use of the government procurement clauses included in the indigenous innovation legislation to purchase from domestic firms.²³ Many foreign firms ceased to participate in public tenders and subsequently scaled down planned investments in China-based manufacturing facilities. In other industries, such as the auto sector, foreign firms have until recently been forced to share IP and profits with Chinese partners in order to gain market access. Although forced partnerships have often failed to produce serious Chinese competitors, such policies did not create an inviting environment for collaboration. Allowing foreign firms fair access to its domestic market is one step China should take to level the playing field for foreign firms.

In some areas the situation is improving. In 2018, the central government announced it would remove the joint venture requirement for electric vehicle manufacturers so that foreign firms could wholly own their enterprises in China, and this ruling will extend to all auto manufacturers in 2020. Tesla was one of the first foreign manufacturers to build its own manufacturing facility in China as a result of these changes, much to the chagrin of local competitors who complained about the subsidies it received from the Shanghai government. ²⁴ China's IP institutions are also strengthening, even though IP theft remains a serious problem. In 2014, China established the first dedicated IP courts in Beijing, Shanghai, and Guangzhou, with additional courts added in 2017. Researchers estimate that the vast majority of the cases in the Beijing and Shanghai courts have ruled in favor of foreign plaintiffs against Chinese infringers. Damages paid to foreign plaintiffs were on average three times greater than those paid to domestic victims of IP theft. Nonetheless, domestic firms are increasingly making use of the courts to protect their IP. In 2015, 88.5 percent of the roughly 11,000 patent cases involved a Chinese plaintiff and Chinese defendant.²⁵

China has announced ambitious plans to use standard-setting as an industrial policy tool in the future, including in new energy industries that will be critical to addressing global emissions. Although such plans are, for now, just plans, they dovetail with broader goals to become a key producer and exporter of climate-related technologies. Technical standards could eventually become a way of controlling global markets for new energy technologies and leverage China's dominant position for the production of such technologies for political and economic purposes. China's "Standards 2035" project and the related National Standardization Development document outline future goals, even if China is not currently dominating standard-setting for current new energy technologies.²⁶

As China began to dominate global supply chains for an array of key clean energy technologies, the U.S. responded with a <u>series of trade barriers</u> against Chinese imports. Initially targeting Chinese wind turbine towers, tariffs were expanded to Chinese solar panels under the Obama

administration. Tariffs were renewed in 2018 under the Trump administration, again targeting Chinese solar cells despite vocal opposition from the domestic solar industry which feared the impact of rising prices in the large U.S. solar installation and maintenance industry.²⁷

Despite the justification of trade barriers across both Democratic and Republican administrations, manufacturing has not "come back" to the United States. Tariffs have instead led to relocation of production capacity to other Asian economies, including to Vietnam and Malaysia, but they did not forge a reorganization of the solar industry in the United States or promote the expansion of domestic manufacturing capacity. China continues to account for roughly two-thirds of global production capacity in the solar sector and most US panels are imported.²⁸

More recently, the Biden administration launched a broad investigation into gaps in domestic supply chains from both economic and security perspectives in the context of China's dominance in key industrial sectors. But the administration has thus far continued to primarily rely on tariffs implemented under previous administrations as its main tool to improve the competitiveness of domestic firms.²⁹ The Strategic Competition Act, which seeks authorization to assist U.S. companies with supply chain diversification away from China, proposes new investments in domestic infrastructure to compete with China and emphasizes the need to build alliances to counteract China's growing international influence. Yet, for now, it remains stalled in Congress.³⁰ The Infrastructure and Investment Jobs Act, which passed in November 2021 with bipartisan support, includes investments in the domestic grid and EV-related infrastructure, but does not directly address the competitiveness of domestic clean energy technology firms.³¹

4. The Way Forward for the United States

Historically, the United States has been the largest investor in clean energy research and development and continues to lead in many areas critical for fixing the climate crisis. U.S. companies are at the forefront of developing next-generation technologies that could make decarbonization cheaper and more efficient, including next-generation solar technologies, advanced battery chemistries, new building materials, smart grid technologies, and software to manage complex energy systems.³²

Yet the United States risks losing its leadership position, particularly as other economies, including the European Union, have made strengths in clean energy sectors a priority. From offshore wind turbines to hydrogen and battery technologies, Europe has combined economic and climate objectives in its recovery plans. China, meanwhile, is closing the gap in research and development expenditure, including in the area of new energy technologies.³³ In both Europe and China, climate policy is taking on an economic imperative, as governments seek to expand market shares for domestic firms in growing markets for clean energy technologies.³⁴

Addressing grand challenges like climate change will require fundamental advances in technology, where the United States is uniquely equipped to be at the global frontier. In United States, this means continuing to support the core strengths of U.S. firms and universities—the invention of new technologies—through investments in basic and applied research. Particularly on climate-related technologies, the United States should rapidly accelerate its research and development

investments to defend its technological lead.³⁵ The technologies that emerge from these efforts must eventually be scaled and deployed, and for now, few alternatives exist to Chinese supply chains to move new technologies to market.³⁶

To change this, the United States needs to improve conditions for segments of clean energy supply chains that are currently not well-supported domestically. This means investing in domestic manufacturing capabilities as part of a national strategy for technological innovation. The creation of a government-controlled industrial finance corporation that could finance domestic manufacturing projects that the U.S. financial system has been unwilling to fund, renewed investments in vocational training and technical colleges, and a stable regulatory framework to support domestic markets for clean energy technologies are needed to improve national competitiveness in clean energy technologies would lie entirely within national boundaries. European economic recovery strategies offer instructive lessons on how strategic policy intervention can improve national competitiveness in clean energy industries, while maintaining open trade relationships with China that are necessary to meet climate goals in the short-term.

The United States should also not lose sight of the substantial domestic economic benefits from investments in clean energy industries, even if a share of these technologies is, for now, manufactured abroad, including in China. Investments in clean energy infrastructure, upgrades to the grid, sustainable transit solutions, renewable energy installations—including offshore wind— and energy efficient building retrofits create local jobs in construction, installation and maintenance, and related service industries, regardless of where these products are manufactured. Even aggressive investments in clean energy sectors will need to be complemented by stable regulatory measures to create domestic clean technology markets if the goals is to create domestic industrial sectors that develop, commercialize, and produce such technologies in the United States.³⁷

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OPENING STATEMENT OF NIKOS TSAFOS, JAMES R. SCHLESINGER CHAIR FOR ENERGY AND GEOPOLITICS, CENTER FOR STRATEGIC AND INERNATIONAL STUDIES

VICE CHAIR GLAS: Thank you so much.

Mr. Tsafos?

MR. TSAFOS: Vice Chair Glas, Members of the Commission, thank you so much for having me today.

My starting point is that the energy transition is happening; it is happening quickly, maybe not quickly enough to meet our climate targets, but quickly enough to recreate and reshape industries and rewire trade flows. And without a course correction, this low-carbon world is going to be a world made in China. They are leaning into the transition in a way that we are not. I would like to highlight two interrelated problems.

First, China is the world's factory for low-carbon goods. They are the dominant force in the supply chain for photovoltaics in the solar industry. When we discover that forced labor is being used in the production of polysilicon, we are, then, forced to balance our commitment to human rights with our commitment to climate. We should not be put in that position.

China has a similarly dominant role in the battery market. Think about the importance of the auto sector in building the middle class and the economy of this country over the last 100 years. And now, think what the U.S. economy looks like if we are no longer a leading force in this sector. Well, to be a leading force in this sector, we have to be part of the supply chains and the batteries, which are the building block of this new economy. And so, today, this sector is owned by China to a great degree. This is a fundamental problem that we must grapple with.

Second, we have a commodity challenge. China is the world's largest consumer of energy. We have seen their ability to use their purchasing power to affect oil and gas markets. However, they are constrained in how much they can do because they are the largest consumer. So, they have to deal with everyone. But, more importantly, their behavior in oil and gas is constrained by the fact that these are markets governed by Western institutions. They have to play by the rules that we and our allies have created over the last 40, 50, 60 years.

Look ahead, however, and the trade in oil and natural gas will eventually be superseded by the trade in critical minerals, especially if we are successful in reducing our greenhouse gas emissions. Copper, nickel, lithium, cobalt, rare earth elements, China is a major producer of some of these minerals, but, more importantly, it is the refining capital of the world for these commodities. This is where products go to acquire value. They are the indispensable node in the market for these new commodities.

And we can already see the fault lines in mining from Serbia to Chile, from Indonesia to the Democratic Republic of Congo. We can see what a struggle it will be to balance the needs of people, companies, and the environment. We must understand that this is a strategic threat.

What can we do? My colleagues and I at the Center for Strategic and International Studies have been asking this question a lot. So, I want to share with you some of the conclusions that we have reached. I would like to summarize them in three words: reshore, reroute, rebalance.

Reshore. We must really think about reshoring supply chains, not blindly and not at all costs, but we cannot be indifferent to where things are made. We need to understand our industrial base here at home and figure out places where we can be competitive.

And we need to really understand that technological leadership is not an innovation challenge. We excel at innovation. No one does it better. But this is not an R&D challenge; it's an industrial challenge. We need to create industries and we need to regain some of the muscle memory that we have lost over the last few decades in how to support these industries.

Reroute. The problems we face in clean energy supply chains and in critical minerals are very familiar to those of us, like myself, that have a background in hydrocarbons. We have faced concentrated supply. We have faced human rights abuses. We have faced the challenges of dealing with corruption, environmental degradation. These are not new challenges. The terrain, the domain is different, but the challenges are very familiar.

We have in the past used our ability to shape trade routes, to diversify them, to invest in new places. We have done this in the solar industry very recently with the U.S. International Development Finance Corporation supporting a company to build a factory in India for solar. We need more of such initiatives. We need to be the ones investing in Africa, in Asia, and in the Americas. The Chinese, in response, to the trade barriers that we erected for their industries, went and did this in Southeast Asia. Why couldn't we have done it instead?

Rebalance. We will not be able to eliminate all forms of dependence, but we can manage whatever dependence remains. We have used in the past, and we can continue to use, rules to govern what kind of products can be sold in the United States of America. We can lead efforts to create norms and bound acceptable behavior. We can deter adversaries through other means from interfering in supply chains. We can create buffers, where buffers make sense.

We have done this in oil and natural gas before. We need to look back at that toolkit and take out the good ideas from that long experience in enhancing energy security and thinking about how those lessons might apply for supply chains and for critical minerals.

Let me finish with two additional recommendations.

We really need to scale up our analytics for the low-carbon era. We have an incredible public infrastructure in oil and gas, and we can follow what happens in those markets. That infrastructure doesn't really exist in supply chains for clean energy and for critical minerals. We need an Energy Information Administration equivalent for the low-carbon era. We need to support it. We need to expand it. It is hard to make good policy when all the good information sits behind a pay wall.

And finally, we need to have an understanding with China. We cannot depend fully on China, but we cannot cut China out completely. How much dependence is too much? How do we leverage the products we have to get access to the products we need? How do we find that right balance? These are really important questions that I think we should keep grappling with.

And with that, I will finish and look forward to our discussion.

PREPARED STATEMENT OF NIKOS TSAFOS, JAMES R. SCHELSINGER CHAIR FOE ENERGY AND GEOPOLITICS, CENTER FOR STRATEGIC AND INTERNATIONAL STUDIES



Statement before the

U.S.-China Economic and Security Review Commission

"China's Climate Change Strategy and U.S.-China Competition"

A Testimony by:

Nikos Tsafos

James R. Schlesinger Chair for Energy and Geopolitics

Energy Security and Climate Change Program

Center for Strategic and International Studies (CSIS)

Thursday, March 17, 2022

Virtual

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Back to the Table of Contents
Vice Chairwoman Glas, Commissioner Friedberg, and distinguished members of the US-China Economic and Security Review Commission, I am grateful for the opportunity to appear before you today to testify about China's climate change strategy and its impacts on U.S.-China competition.

China sees the energy transition as an opportunity to lead in technologies and products not currently dominated by the West. In pursuing this ambition, China will rewire the energy system: it is already drawing commodities like oil, natural gas and coal; and it totally dominates the markets for the critical minerals that will enable the energy transition. These developments present two interlinked challenges for U.S.-China relations.

First, it is an industrial challenge. China already dominates the global supply chain for solar photovoltaics, is a major player in lithium-ion batteries, and has a strong, but lesser position, in wind manufacturing. As the energy transition unfolds, this list will grow. Western economies will depend on China for key products, with all the complications that such dependencies entail. Other countries will also turn to China for solutions to meet their energy needs in a low-carbon world. China will secure jobs, exports and be a source of international investment. China is well positioned to be the central node in the multi-trillion-dollar green economy.

Second, it is a commodity challenge. As the world's largest energy consumer, China is both subject to market forces and a shaper of those forces. A slowdown or an acceleration in Chinese demand could mean the difference between crashing and booming prices in markets like oil or liquefied natural gas (LNG). But these commodity markets are still governed by Western structures—China plays by the rules set by others. Over time, this will change as demand for hydrocarbons decreases and demand for critical minerals increases. The market for critical minerals, in particular, is far less developed. China can shape it—and in doing so, secure a foundation for its industrial ambitions as well as spark conflict, spread corruption, and cause immense environmental harm.

The Industrial Challenge

The energy transition is an industrial transition—one led by Chinese firms. China shipped twothirds of global solar photovoltaic (PV) shipments in 2020, and its true market share is higher given the presence of Chinese firms in Southeast Asia.¹ Chinese firms are among the top manufacturers of wind turbines, although Western firms continue to lead.² And China leads the mid and downstream value chains for batteries, with market shares that near 80 percent.³

This leadership is, in part, a product of long-standing features of Chinese industrial policy. But it is also tied to deployment. In 2010, the United States was a bigger market than China for solar, wind and electric vehicles. By 2020, China had 3.4x more installed capacity in solar and 2.4x in wind.⁴ In electric vehicles, China's registrations in 2021 were 3.4 million compared to 0.7 million in the United States.⁵ China's rapidly growing market for low-carbon energies is a centerpiece of its industrial strategy for manufacturing.

China's position presents several challenges for the United States. For one, it ties U.S. energy priorities to Chinese industrial practices and location-specific shocks. In 2020, floods and an

explosion at a Chinese plant cut polysilicon production for months, raising prices sharply.⁶ In 2021, it became clear that the solar PV value chain almost certainly included products made by forced labor in Xinjiang. This presented a peculiar problem for the United States.

China's central role in the solar value chain limited the options available to U.S. policymakers to deal with human rights abuses. The United States could not independently verify which products included forced labor given that Chinese firms controlled the first steps in the supply chain. And China's market size meant that China could reshuffle shipments, choosing what to send to the United States, while continuing its practices in Xinjiang.⁷ This was a not a good position for the United States.

The most important challenge, however, is industrial. The energy transition presents a massive economic opportunity. The market for low-carbon goods is impossible to quantify precisely, but spending on low-carbon goods already tops \$500 billion—with most money going to renewable energy generation and electric vehicles.⁸ As the energy transition accelerates, this number will increase substantially. The market for electric vehicles and charging infrastructure, for instance, could reach \$7 trillion by 2035 according to a forecast by BloombergNEF's.⁹ Similar growth rates are expected in other markets.

Who will capture these markets? This is a high-stakes question. So much of U.S. industrial strength has been built on technologies related to the energy—from oil and natural gas, to electricity, automobiles and aerospace. What happens if future technologies are invented or matured in China? What are the implications for U.S. prosperity? Can the United States maintain its technological and military edge if it lags in the technologies that power the world? It's a hard question to answer, but one that should be asked more often.

The Commodity Challenge

In 2009, China became the world's largest energy consumer, a position that gives it influence in markets like oil and natural gas. From 2005 to 2019, excluding the impact of Covid-19, China accounted for 45 percent of the global growth in oil demand, and 23 percent of the global growth in gas demand.¹⁰ Suppliers want to sell into the Chinese market, and China's choices can shape the demand for commodities. But the markets for these products are well-established. China must integrate itself and play along. That limits China's influence.

Consider the market for LNG. China started to import LNG in 2006. By 2021, it became the world's largest LNG importer, surpassing Japan, having accounted for 47 percent of the growth in LNG demand from 2015 to 2021.¹¹ But China's thirst for LNG has also limited its options. For years, Chinese companies avoided any purchase agreements with U.S. LNG projects, having finalized only one contract before 2021. In the last quarter of 2021, however, that restraint was eased. Chinese firms signed several contracts to buy U.S. LNG. The reason was simple: China needed LNG and the United States was one place it could find it.¹²

China's reliance on Australian LNG has been similarly difficult to shed. When China put economic pressure on Australia following the latter's demand for an investigation into the origins of Covid-19, it seemed like LNG from Australia might be hit too.¹³ But Australia is the world's biggest LNG

supplier, and avoiding Australian LNG was not an option for China. In fact, China's imports from Australia grew in 2021. The United States and Australia together supplied almost half of China's LNG in 2021.¹⁴

The limits of China's influence can be seen in other ways. For years, China has sought to develop a domestic pricing benchmark for natural gas (and for oil too). By providing a price that reflects Chinese market fundamentals, China has aspired to import fuels with reference to that price, rather than international benchmarks. That effort began in the mid 2010s, and so far, it has produced limited results.¹⁵ In Asia, the reference price remains the Japan-Korea Marker. Nor has China succeeded in replacingoil indexation, the standard mechanism for pricing natural gas. As a result, China is just as exposed to international prices as anyone else.¹⁶

In established markets, China has followed in the footsteps of Western firms. It signs the same contracts as those firms, with the same provisions, governed by the same laws, financed by the same banks, and priced in the same way.¹⁷ From time to time, when an opportunity arises, China might do a deal that Western firms do not. But it still operates in a market designed and operated by Western institutions.

All this will change over time, and this will be especially true in critical minerals.¹⁸ Demand for minerals like as copper, cobalt, graphite, lithium, manganese, nickel, and rare earth elements is expected to grow rapidly as the world reduces its greenhouse gas emissions, driven by the need for batteries and electricity networks.¹⁹ These markets are still nascent. The market size for lithium, cobalt, rare earth elements and palladium is less than \$10 billion (each).²⁰ By 2050, under one scenario, demand for manganese might increase by a factor of 22, for cobalt, nickel and graphite by a factor of around 30, and for lithium even more than that.²¹

China is already the driving force in the market for critical minerals. For some minerals, China is a major producer (rare earth elements, lithium, and copper).²² But its influence comes chiefly from its position in processing. China turns commodities into products. China has a dominant market share in the processing of rare earths (over 80 percent), and a nearly dominant position in cobalt and lithium (circa 60 percent). Even in more diversified markets, like copper and nickel, China's processing share ranges around one-third.²³ These minerals are the foundation for the green industrial economy discussed below. But China's position presents other challenges too.

Mining can lead to conflict. There are hundreds of stories about cobalt in the Democratic Republic of the Congo.²⁴ Friction between mining companies and local stakeholders is felt in Chile, Portugal and the United States.²⁵ A permit for a lithium mine in Serbia was recently canceled in response to public protests.²⁶ Chile wants to rethink the basic governance structure for mining. Peru is seeking to raise taxes.²⁷ Indonesia wants investment in domestic processing and has often turned to export bans on raw nickel exports to force companies to invest (a call that Chinese firms have heeded by investing billions in the country).²⁸

If China is the dominant investor and market for these commodities, how will these conflicts be managed? Will China pay the same attention to environmental, social and governance standards as Western firms do? Will local communities will be consulted and invited to partake in the benefits of mining? Will there be a similar commitment to transparency and to fighting corruption?

Will the revenues benefit local populations or end up in offshore bank accounts? What levers will the West have to manage these conflicts if all the transactions go through China or only involve Chinese players?

By 2050, one scenario by the International Energy Agency shows that the international trade in critical minerals could exceed, in the value, the trade in oil and gas.²⁹ In a low-carbon world, the "geopolitics of energy" will mean the geopolitics of critical minerals. Except, on current trends, this will be a world dominated and governed by China. How to prevent this from happening is a strategic challenge of the first order for the United States and its allies.

Recommendations

The United States has lost ground in the energy transition. But the transition itself is a multi-decade process. Existing markets will expand multifold and new markets await to be created. It is not too late for the United States to catch up. In a 2021 report on supply chain security, the Energy Security and Climate Change Program at the Center for Strategic and International Studies crystallized its recommendations around three themes: reshore, reroute, and rebalance.³⁰

Reshore. There is great policy interest in reshoring. That makes sense—after decades of offshoring, attracting capital back into the United States is sorely needed. But reshoring can also be taken too far, a futile quest to subsidize industries where the United States is not competitive and never can be. Smart reshoring begins from understanding the industrial strengths of the country and mapping the linkages between established industries and those industries that will be needed in the energy transition. Reshoring requires a strong market pull, enabled by policy; and it requires a holistic supply push, from research and development, to demonstration, to tax and other policy that supports production and, crucially, to trade practices that support domestic companies and jobs. This is the kind of industrial policy that the United States has avoided for years. It is needed now.

Reroute. Not every factory must be built in the United States. In certain cases, like critical minerals, the ability to reshore is limited by geology. In others, lower labor costs and proximity to markets might make reshoring to the United States impractical. But this does not mean that the United States can do nothing. It can invest in allies and partners, helping them build their supply chains or mining industries. In 2020, the U.S. International Development Finance Corporation (DFC) invested in Techmet, a company with plans to produce nickel and cobalt in Brazil.³¹ A year later, the DFC support First Solar's effort to build manufacturing capacity in India.³² These are examples where public money can support diversification of supply chains. More such deals can support U.S. companies overseas and deliver economic security for the United States.

Rebalance. It is impossible to only trade with and depend on allies and partners. The United States, Europe and Japan have a long experience dealing with energy insecurity. The lessons they have learned in the process can be useful for the low carbon era. Countries have used domestic institutions to shape the behavior of suppliers (chiefly anti-trust policy). They have sought to create interdependencies that can act as ballast in case of a conflict. They have built institutions to promote transparency and strengthen governance. They have established buffers and other

strategic stocks for critical commodities. And they have used deterrence for threats that cannot be managed otherwise. This toolkit has relevance for confronting China during the energy transition.

In pursuing these strategies, the United States could benefit from two additional initiatives: a stepup in analytics; and a clearer focus on interdependencies.

Analytics. Over the past 50 years, advanced economies have built an extraordinary open-source infrastructure to monitor energy markets in order to manage the risks therein. Institutions like the International Energy Agency and the U.S. Energy Information Administration provide a foundation for robust public discourse in energy markets and related security matters. That infrastructure is nascent when it comes to low-carbon energies and critical minerals.

The U.S. Geological Survey, for example, provides excellent information on critical minerals, but the information could be much deeper and updated more frequently. Information on supply chains for clean energy exist in various publications by the National Labs and by the U.S. Department of Energy. But it is still scattered and not systematized (the periodic surveys by the National Renewable Energy Laboratory on the Solar Industry are a bright exception).

Managing the risks of the energy transition will require the creation of new mental models and maps. It will require policymakers to understand where supply chains and critical minerals exist and where they are being developed. At this point, that information is scattered around multiple locations and often relies on private information providers. The United States can provide an immense public service by stepping up its investment in open-source information related to the energy transition.

Interdependencies. China has a commanding position in the supply chains for clean energy. But it is also a major economy, and so it is impossible to imagine China not playing a role in supply chains. The United States needs to be find a balance and discover how much dependence on China it can live with. Right now, the United States is a major energy provider to China. That gives the United States some leverage—losing these flows would hurt China a lot.

It is possible to imagine the United States and China finding an acceptable level of interdependence in the energy system to mitigate the risks that each sees in depending on the other. Complete decoupling is not an option. It is also not desirable. And as the solar industry shows, having limited touchpoints along the supply chain can present massive risks for the United States. There must be some middle point between complete decoupling and unfettered cross-border investment. This is a prime area for serious thought leadership over the next few years.

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PANEL III QUESTION AND ANSWER

VICE CHAIR GLAS: Thank you to all of our panelists.

In terms of the next step here, I will recognize the various Commissioners in alphabetical order for five minutes of questions. I'm going to start.

Mr. Tsafos, I really appreciated, particularly, your recommendations related to reshoring and your discussion of the critical minerals, which, obviously, is a defense security issue. It's an environmental issue, and whatnot. And I want to delve into this a little bit more with you.

I think you said in your testimony that, as China is leading the way in creating the lowcarbon economy and manufacturing those next-generation products, they're probably making those products with the most carbon intensity. It's embedded in your windmills, your construction of solar panels.

I know, Dr. Cecilia Han Springer, in a previous project that you worked on, you did some benchmarking related to the steel sector and some of these critical raw materials that are used in the clean energy economy.

I appreciated your comments about retooling some of our manufacturing base here, and I also think that it will help solve some of the emission issues associated with that.

Can you talk about that a little more? Are we doing enough? And for both of you, are we doing enough to advance the sustainable mining here in the United States? Because we do need those raw materials in a way that is helping support our clean energy economy and bringing some of those manufacturing processes here.

And then, can you also talk about the emissions associated with -- you know, maybe Dr. Cecilia Han Springer -- with some of the raw material production for clean energy technologies in China versus manufacturing those items here in the United States?

MR. TSAFOS: Well, thank you very much for that question. Let me begin with some observations.

And here, I will agree with my former colleague, Dr. Nahm. We have a lot of elements of industrial policy that often don't come together. We give manufacturing tax credits and we build an industry, but, then, there are Chinese goods that come a few years later and they undercut that. It takes us a few years to put tariffs them, and then, we don't really do anything else to support them.

So, it's not that we don't do the right things; we don't do them together and in a coordinated way. Some ideas that I would put forward for you to think about:

We have a big bill that is being discussed in Congress. I look at a lot of the credits that we offer, and they don't necessarily match our strategic objectives. We have a goal, for instance, at the Department of Energy to eliminate nickel and cobalt from batteries to address some of the security concerns that we have. Well, let's give a tax credit that's higher to batteries that don't have nickel and cobalt.

You talk about the emissions intensity. Well, why don't we have -- we have emission intensity targets for the hydrogen production credit proposed in the legislation -- why don't we have something similar for other goods, where we incentivize companies, not just to do solar, but to do good solar. I think those are the kind of ideas that I would like to see advanced to support the reshoring and rerouting of industries.

One final comment on sustainable mining. It is a very difficult topic to grapple with because so much of it depends on the idiosyncrasies of individual projects. But it does seem to

me that whatever balance we have found is the balance that leaves everyone unhappy and doesn't produce any minerals.

And it seems to me that we do need a more considered effort to create standards that are high, but also standards that could be met. Because if we just have very high standards and nothing ever comes out of the ground, we haven't really accomplished anything. And I do fear that sometimes we don't try to think about tradeoffs as much as we try to think about an ideal standard that we would like to meet.

DR. SPRINGER: Thank you for the question.

I think it's incredibly important to focus on the variability in carbon intensity of production of these really energy-intensive materials, like steel, and then, aluminum and cement. Although they are global commodities, and China is a top producer of many of them, there is huge variability.

So, if you look at steel, U.S. steel is relatively less carbon-intensive than steel produced in China, which is mostly following relatively outdated routes of production. Yet, cement is the opposite story.

So, it's incredibly important, when designing these new policies, whether it be a carbon tax that's applied to imported commodities or federal procurement standards, state-level procurement standards that also take into account the carbon intensity of these commodities, to look at the relative differences across countries and their impacts, potentially, on U.S. producers, where in some sectors the U.S. does produce much less carbon-intensive materials.

And in terms of the environmental impacts, not just the climate impacts, like Nikos mentions, it's important to look at these emerging supply chains that are going to feed China's new climate economy as it moves towards carbon neutrality by 2060. This is going to take place in Africa, like cobalt in the Democratic Republic of the Congo, as well as in Latin America and the Caribbean region, looking at lithium, in particular, balsa wood, molybdenum. This is an emerging area that needs a lot of attention, especially through U.S. partnerships like the Build Back Better World partnership.

VICE CHAIR GLAS: Thank you so much.

Commissioner Borochoff?

COMMISSIONER BOROCHOFF: Thank you very much, and thank you to all of you for your testimony.

This is for you, Mr. Tsafos. Did I say it correctly?

MR. TSAFOS: Tsafos.

COMMISSIONER BOROCHOFF: Tsafos. Thank you.

Your three "R's" that you mentioned are all related to increasing our competitiveness. And I understand completely what you're doing there. The two other ones, analytics and interdependency, I wanted to just ask a question about interdependence.

In your written testimony, you say that we need to find a balance to discover how much dependence on China we can live with, where the U.S. is a major energy provider to China, which gives us some leverage. And then, you say just completely decoupling won't work. So, we have to find a way to make us more interdependent.

In your mind, you probably have an idea. Is it simply that you want to see us become greener faster in order to be more competitive? I'm trying to understand exactly what you're saying. In that arena, how are we going to become interdependent? What do you have in your mind?

MR. TSAFOS: Thank you.

When I think of interdependence, I think of trying to find ways in which to integrate our supply chains, if possible. I come to this question with a slight hydrocarbon mix. And so, if you look at the oil sector, we have Venezuelan-owned refineries in the United States; we have Saudi-owned refineries in the United States. That gives us some leverage in dealing with those supplier countries.

And I would hate to use this example today because, you know, one can take issue about how successful it has been. But, you know, the German approach to Russia for a long time was based on the idea that investing in each other's sectors would provide a ballast for the relationship. Clearly, there are limits to how far that can go. But it is that kind of idea that I would like us to think about, not just completely saying, if it's China, we don't want to touch it, but findings ways to create a web of relationships that binds us to each other, and therefore, maybe insulate us from just being totally exposed to whatever they do.

COMMISSIONER BOROCHOFF: Does anyone else have a comment on that? (No audible response.)

Okay. Thank you very much.

VICE CHAIR GLAS: Commissioner Cleveland?

COMMISSIONER CLEVELAND: Having thought about, in the year 2001, a hydrogen credit, when I served in a different position, we are always ever hopeful.

So, I'm interested in focusing on cement, and whether or not it is all realistic, given the investment or the priority that China attaches to real estate, in particular, whether there is any scenario under which they could achieve their carbon emissions reductions, given the role that cement plays in the economy.

MR. MYLLYVIRTA: Maybe I'll start with that. Thank you for the question.

In the short term, the fact that China is aiming to shift away from low-quality infrastructure and real estate -- in fact, it can give a head start on bending the emissions. So, what we've seen since last summer is a fall in China's emissions, precisely because the government clamped down on speculative real estate, and that has resulted in a slump in the volume.

So, if this economic transition is successful, that will reduce the overall demand for cement from the incredibly high level that China is currently at. And, of course, infrastructure and real estate are being saturated overall. So, that will contribute.

But, then, you're definitely right that in the longer term, to get to zero emissions from cement production is one of the other sectors, and one of the most likely ones for applying carbon capture and storage, rather than coming out with a process that is entirely CO2-free.

The current Chinese plans for reaching carbon neutrality also include the use of carbon capture and storage from the burning of biomass, which produces negative emissions and offsets some of those hard-to-abate sectors. So, those plans are there. The more you can do with actual technological innovation, better materials, rather than slapping these carbon capture devices on cement plants, the easier it will be economically. But that's the current plan for that.

COMMISSIONER CLEVELAND: Anybody else?

DR. SPRINGER: Yes, I would just add I agree with Mr. Myllyvirta that there are incremental gains that can be made from technological improvements in the production of cement in China, but truly transformational change will require either carbon capture and storage, but, more importantly, structural economic transition. And this is a major part of the strategy that underlies China's 2060 carbon neutrality target.

COMMISSIONER CLEVELAND: If I had to bet, I don't think real estate is going to decline as a priority in China.

Can you all put the climate change priorities in the context of China's strategy on dual circulation? No?

MR. TSAFOS: Sorry, could you say that last word? On what?

COMMISSIONER CLEVELAND: Dual circulation. Sorry. Essentially, their emphasis on consumer-led growth, acquisition of materials that they need for industrialization of their economy from abroad and consumer-led growth domestically. How do you see climate change or carbon emission objectives fitting into that dual circulation strategy?

MR. MYLLYVIRTA: I was just trying to be polite and let someone else start.

But I think there are some clear synergies of course on oil and gas, where China is heavily import-dependent. Replacing those with clean solutions will help with that a lot. China has the key supply chains for the key low-carbon technologies -- wind, solar, nuclear, batteries, and so on, that we heard -- and that makes that transition a lot more attractive economically. So, I think there is good alignment.

COMMISSIONER CLEVELAND: Thank you.

MR. TSAFOS: If I could maybe add, I do think that, if you look objectively at sort of Chinese policy, a lot of times reduction of emissions is sort of a derivative benefit to other things, whether it's energy security or local air pollution, or domestic industrial growth and strength.

It does seem to me that, over the last few years, climate change has become more important in response to international pressure and the branding of the Belt and Road Initiative, and the desire of China to be able to show up at the U.N. and COP26 and say nice things.

But I would not, at least in my assessment, elevate it as a sort of No. 1 objective in its own right, but as piggybacking on other things that the Chinese like to do. And therefore, you know, if those things would be in conflict, I'm not sure that climate change would eventually prevail in the conflict.

COMMISSIONER CLEVELAND: Thank you.

VICE CHAIR GLAS: Commissioner Fiedler?

COMMISSIONER FIEDLER: The Biden Administration, or the President actually, named former Senator and Secretary of State John Kerry as the

Administration's -- what? -- Special Envoy on Climate Change. And he seems to have struck out with the Chinese. Can anyone give me an update on sort of that relationship and why it's going nowhere? Apparently, going nowhere?

MR. TSAFOS: I can take it first.

COMMISSIONER FIEDLER: Yes, please.

MR. TSAFOS: I've heard of that.

I mean, in my understanding, the Chinese would like to place our bilateral diplomacy on climate change as part of the broader political relationship between the two countries. For lack of a finer description, they would like concessions to play nicer on climate with us. And that, again, in my estimation, is an unacceptable condition for the United States, and rightfully so.

So, I think what the Special Envoy has tried to do is see if there are areas of carving out places where we can collaborate together within the context of a broadly adversarial relationship, where we are not going to make any concessions to China to get them to play nicer.

The final thing I would say to that is, in my assessment, we are past the point where we really need a deal with China. Like they have their own targets. They have their own ambition. They're getting pressured by others to act. They see the opportunity in the energy transition.

So, I am less worried about the absence of "a deal," quote-unquote, between the U.S.

and China because we each have our targets; we are each trying to march ahead on our targets. And frankly, we're probably entering a new era in international climate diplomacy, with the arrival of Europe's Carbon Border Adjustment Mechanism, where we are probably going to rely a little bit more on coercion and a little bit less on collaboration -- to nudge each other to ever greater levels of ambition. So, I'm not too worried if the Special Envoy may not be making as much progress as he would have liked.

MR. MYLLYVIRTA: If I can --

DR. NAHM: If I can jump in? Sorry.

MR. MYLLYVIRTA: Yes. Of course, it's natural for you in the U.S. to ask what did Kerry get you, but the other side of the coin is, what did he have to give or offer? And there are a two things about that. What did he have to offer on climate? You can make the argument that China, in fact, took more meaningful steps, as a part of the dialog that took place over the past year, signing the Kigali agreement, committing to meeting the action plan and, also, probably influenced by this process, committing to stop new coal projects at all.

But, sir, either you have to be prepared to offer something to change on climate or you have to be prepared to engage on a broader set of issues. And that doesn't necessarily mean that you are making concessions. Whether you are making concessions or you are making it clear that the relationship will become more unpleasant unless progress is made, that's just about setting your baseline. But you have to have some chips to bring to the table, if you're going to negotiate.

DR. NAHM: Yes, I would add to that, if I can, this idea that I think, in the early days of the Administration, Kerry came to the negotiating table I think with very little to offer from the U.S. I mean, we are the place that dropped out twice out of these international agreements, and yet, came back with this idea that international agreements could somehow fix the situation.

And I think everyone else, or at least these two big other blocks, the European Union and China, have moved way beyond that and have focused, instead, on how to combine climate and economic objectives domestically.

And so, the European response to China is to very aggressively build out its domestic supply chains for these technologies, also, with export industries in mind, and not to cede China the entire market there globally. And so, the Battery Alliance, for instance, is one of these examples. Europe has spent more than 40 percent of its economic recovery funds in the COVID pandemic on clean energy technologies.

And so, I think that's a very different approach from the one that the U.S. tried to apply here, and one in which we just didn't have much to bring to the table, actually, as the one who is sort of unreliable in terms of international agreements and doesn't have a lot of domestic industrial power to bring to the table, either. And so, I think that's where a lot of this has stalled.

COMMISSIONER FIEDLER: Thank you.

VICE CHAIR GLAS: Commissioner Goodwin?

COMMISSIONER GOODWIN: Thank you, Madam Chair.

And my appreciation, again, to the panel for their great testimony.

Dr. Han Springer, I wanted to talk with you a little bit about the financing of overseas coal projects by the Chinese and get a little bit more clarity into what goes into these projects.

So, when they build a hypothetical coal plant in, say, Pakistan, a Chinese policy bank or commercial bank may be providing the financing. Steel firms, cement firms, construction firms may be involved in the construction of the power generation facility itself. A Chinese energy company may also be participating in that and operating the plant at some future date.

Do Chinese coal mining operations play any role in the project? Do they mine the coal

in the host country? Do they provide expertise or labor for those projects? And then, long term, do they contemplate exporting any coal to these projects, as the transition continues? I would assume they don't export any coal today, but, as the transition continues within China, do they see that as a potential development?

DR. SPRINGER: Thank you for the question, and I think you really hit the nail on the head that there are a lot of different actors involved in China's overseas energy engagement, and including for the development of coal-fired power plants.

So, in our databases at Boston University, we focus on China's policy banks, the China Development Bank and the China Export-Import Bank, as providers of loans for these large infrastructure projects.

And we also track China's foreign direct investment. So, equity investments on the part of individual Chinese companies into some of these projects. There are also commercial Chinese banks that are involved in lending.

And then, like you said, there are many Chinese companies that are providing equipment and construction services for the building of these coal plants, and in some cases, they are operating those coal plants after they're built.

And so, what's really unique about this model is that China's policy banks are the institutions that were really responsible for taking the overcapacity that was happening within coal-powered generation within China and moving it overseas. And they operate with those other actors, with the commercial banks and the companies, in coordinated credit space that really allows Chinese finance to be mobilized much more quickly, for coal plants to be built much more quickly overseas.

And so, that's why Xi Jinping's recent announcement that China would not build new coal power plants overseas could be a really big deal, both in terms of emissions, as well as shifting China's overseas engagement away from coal and towards renewable energy.

The coal plants that China has already supported overseas will continue to operate for decades. So, I think there is an opening there to think about how they could be operated in a way that minimizes environmental impacts or even retired early.

To your question about mining, a lot of these plants are using commodity coal. There are some mine mouth plants where the coal is mined onsite, and then, burned. But you're right that China is a net importer of coal at this point, and local electricity generation, where those so-called Chinese plants overseas are being built, are largely for the local grid.

COMMISSIONER GOODWIN: So, on these plants, obviously, we had the announcement last fall that they would be financing no additional construction of coal-fired power plants. But, as you note in your written testimony, there are a significant number of plants either under construction or within the plant now, in addition to the existing fleet.

Given their stated commitments to transitioning to a carbon-free economy, are they simply exporting those emissions? That is, how can they comply and actually meet these commitments, if they're simply shoving them across a border or two?

DR. SPRINGER: Yes, thank you for the question.

China's climate goals are solely governing emissions that are occurring within China. And so, the overseas carbon footprint is, to some extent, going to be related to the regulatory approaches of the countries where those plants, those coal plants, are operating.

And so, I think that this is part of a really important role that China is going to have to play in enabling a clean energy transition in a lot of those countries that it's working with, and which it is well poised to do. We talked earlier about the manufacturing capacity that China has, especially in wind and solar technology, and its expertise in deploying that technology.

I think there's also a role here for the U.S. to draw, again, on its own experience in providing technical assistance and capacity-building for helping those host countries transition away from coal and towards renewable energy.

COMMISSIONER GOODWIN: One of this morning's panels talked --

MR. MYLLYVIRTA: If I could just add one --

COMMISSIONER GOODWIN: I'm sorry, go ahead.

MR. MYLLYVIRTA: Thank you.

One thing. The amount of coal-fired power plants being built by China in other countries is, of course, much smaller than what was getting built at home, and now the discrepancy is they are bigger. So, in fact, China moved faster on the overseas sites to stop the new coal; whereas, quite a bit of new coal-fired power plants are still being built in China.

And for other things like steelmaking capacity and other metals capacity, the situation is the same, that the domestic side is moving slower. So, I don't think that idea of exporting the emitting industries really holds true at the moment.

COMMISSIONER GOODWIN: A quick question, if I can, Chair.

This morning we touched a little bit on some of the political tensions between coal producers, coal-fired power plant companies, and these policy goals to shift to a carbon-free economy. I would suspect those same political tensions are at play with this decision to not finance any additional coal plants overseas, since a lot of the excess capacity is what will drive that decision in the first instance.

So, what is your sense of the political dynamic in response to Xi's announcement in September of 2021, and how do you think that will play out?

MR. MYLLYVIRTA: Simply the fact that so few plants were getting built just made that very easy. We found that, for every coal plant that went into construction overseas with China's involvement over the past few years, I think four or five got cancelled. So, there was very little take-up. And as I said, the Chinese domestic market for new coal plants is far bigger than the market in the rest of the world.

DR. SPRINGER: I agree with Mr. Myllyvirta, too, that it's been relatively easy to pull the plug on China's future overseas coal investment. However, what may be harder is shifting support towards renewable energy, which is part of Xi Jinping's statement that he made, was that China would step up support for low-carbon energy, in addition to phasing out the support for coal.

And I think a lot of that comes down to factors in the host countries themselves, the politics not favoring the development of renewable energy, as well as China's own policy banks being quite reluctant to move into that space and perceiving renewable energy as risky investments. And so, these are a major part of Xi Jinping's announcement that has received relatively less attention compared to the coal part, but it is incredibly important going forward to look at how to make that an enabling environment in order to meet the massive and growing energy demand in a lot of these countries.

COMMISSIONER GOODWIN: Thank you. Thank you.

VICE CHAIR GLAS: Commissioner Schriver?

COMMISSIONER SCHRIVER: Thank you, and thank you to our witnesses. I appreciate your statements and your contributions today.

I think there's probably a lot more to be said about the potential use of climate change as an issue in the broader context of Chinese foreign policy goals. I'd welcome any thoughts on that. I mean, certainly, things that you hear, when you travel among allies and partners, you know, what is the U.S. going to give up to get the Chinese to come to the table or cooperate? Whether it's a negotiation or not, there seems to be this fear out there, and it gets more acute when you go to places like Taiwan, where, you know, are we going to be sacrificed, so you can get to the table even?

I think it exposes a lack of seriousness on the part of the Chinese about the fundamental underlying problem. If we have to buy their cooperation or even buy a seat for them at the negotiating table, they, clearly, can't be seized with the urgency of this and believe it's an existential threat if their cooperation is for sale or not.

So, just to further that, I wanted to ask if you think like I do and are a little skeptical of their ultimate motivations. And they may see this as a tool in the toolkit to achieve other foreign policy aims. And you really "red team" that, and you think, you know, what is it Beijing might seek in this area? You've talked about they want it as part of a broader foreign policy conversation or bilateral conversation.

What are the kinds of things we might expect to arise in that kind of conversation with the Chinese? I didn't direct it at anybody, but, Mr. Tsafos, you, I guess, introduced this notion the most.

MR. TSAFOS: Yeah, thank you. A couple of observations, one, I do think that the commitment to reducing emission is serious but it's not, as I said before, sort of top tier at the expense of other things. And frankly when you look at the numbers and you say, how are they going to get to net zero, it's hard for everyone. It's especially hard for them, right? And I don't think that anyone should underestimate that.

I do think that it's important to think of their commitment to climate action as an industrial strategy that they see this is an opportunity to go build factories around the world, to export their commodities, to be part of these new markets. We were looking at doing some research at the CSIS on the Chinese-Middle Eastern relationship. And if you look at -- we know what comes from the Middle East to China.

But if you look at the other way around, there's a lot of installed capacity that's happening in renewable energy products in the Middle East that is of Chinese origin and Chinese financed. So there's clearly an element of geoeconomics that they see these are the new industries that might be spur growth later on. In terms of the tradeoff, I'm purely speculating.

But we have a lot of things that we disagree with the Chinese, anything from tariffs to human rights, security. And so I imagine that any number of those things could be on the table that they would like to see. Having said that, I don't sense there's any -- there's zero appetite.

And for all the discussions about Special Envoy Kerry, the only thing that has happened during the first year of this administration is we put more restrictions around human rights for solar products, right? So if anything, we have restricted our trade and clean energy goods with China versus what we had under the Trump Administration. So I just don't see that appetite existing.

But I can imagine a lot of things that they would like. I'm sure they would like us to do a lot of things. But I don't know that we've ever gotten to anything specific on the table and said, this is what we want. And in exchange, we'll do that. But I also suspect that that would be highly confidential anyway.

COMMISSIONER SCHRIVER: Anybody else on this particular question? In fact, it can -- well, let me just add. Sometimes it takes the form not of a specific ask but of a U.S. negotiation with itself.

We better not sell this weapon to Taiwan. We better not do this, or we won't get to the table on climate change. So I don't know if there's anybody else how has specific concerns or information or if this is a concern at all, among others.

DR. NAHM: It seems to me that there's been sort of a long arch of industrial development in China in these industries that has really impacted how China has behaved at the negotiating table, right? If you compare sort of the Kyoto negotiations for China and was very adamant about being a developing economy exempted from any kind of requirements and then sort of the long trajectory to Paris, both of which are agreements that the U.S. ultimately left and then maybe rejoined in the Paris case. That was really about the growth of export oriented industries domestically that China would hope would benefit from international negotiations on this stuff, right?

So I think sort of the economic imperative has gone greater. And so I don't know if there's even a need for this sort of negotiating table because we've also switched internationally to a system where it's about national contributions and essentially national politics and national sort of accountability and motivation on these issues. China has really moved forward on a lot of these fronts, all these problems notwithstanding. So I'm not seeing sort of what the negotiation should be at the table, if you will, when this is really about using technologies and selling them to others. That would also then create emissions reductions.

COMMISSIONER SCHRIVER: Thanks. That's very helpful.

VICE CHAIR GLAS: Commissioner Wessel? I think he may have stepped away, so --COMMISSIONER WESSEL: No, I'm just starting things up. Sorry.

VICE CHAIR GLAS: No problem.

COMMISSIONER WESSEL: Thank you. Thank you all for your testimony. And Mr. Tsafos, you raised the CBAM issue and others are certainly aware of all of the European and other mechanisms being used to try to address this. Last October as part of the U.S.-E.U. negotiations on 232, they committed to a two-year path for the global arrangement which half of which is designed to address carbon intensity.

Essentially it appears a club of clubs in subsequent negotiation with Japan on 232, Japan asked to be a member. They'll have to earn their way in. Presumably something similar will be done with the U.K. and the 232 negotiations there. Can you comment on the global arrangement and a U.S.-E.U. partnership on carbon intensity which again presumably will have some kind of common border adjustment mechanism as a way a growing club of clubs to address China's carbon intensity and approach? To each of the witnesses, but Mr. Tsafos, if you want to start.

MR. TSAFOS: Yes, thank you for that question. I think we can identify the end result which is that it would be great to have such a club, both to protect our own industries from increased ambition and the cost of such ambition might put on them. But also to incentivize others including China to be more ambitious themselves.

And while we can all identify, I think, the end result, I have no idea how we get there. When I talk to European policy makers about the steel and aluminum agreement that the U.S. and E.U. signed around COP 26 and asked them how we will be compatible with the CBAM or how it will interact with the CBAM, the answer is we don't know yet. How can the United States join the Carbon Border Adjustment Mechanism when we don't have a carbon price domestically? We don't know yet.

We understand that having a partnership would be good. But we don't really have a road map. The German Chancellor has talked about the creation of climate clubs, an idea that in the

academic discourse and the policy discourse has been around for a long time.

If you push people hard enough and you ask them what is a climate club, you'll get incredibly different answers, right? So I think we have the broad vision of what this looks like. And we all agree it will be great to have it.

But I would say from policy conversations I'm in, there's still a long, long way to go to even get our house in order among western countries about what this architecture looks like and how we can all agree on a common foundation that we can then take to China and say, these are the rules that we are setting up. How do you play? What do you have to say? I'm afraid that we're a few years away from being able to do that.

COMMISSIONER WESSEL: Other witnesses' thoughts?

MR. MYLLYVIRTA: If I can add from the European Union perspective. So the E.U. CBAM is of course a much clearer construct. There is a clear carbon price, and it's a countervailing tariff to make the high carbon prices that we're going to meet our emission reduction targets palatable economically and trade-wise.

And that is a very good tool to push others, including China, to extend carbon pricing to their steel sectors and so on. I think that absent a carbon price or other policies that would impose a similar price in the U.S, the most potential that I see towards China would be policies that would encourage green steel, zero carbon steel production. Right now for the global climate effort, it's crucial to get hydrogen based steel making and other zero carbon steel making off the ground and even niche markets where U.S. want could catalyze that development would be incredibly helpful.

COMMISSIONER WESSEL: Thank you. Anyone else? Thank you, Madam Chair. VICE CHAIR GLAS: Thank you. Commissioner Wong?

COMMISSIONER WONG: I think I will defer and skip to any second round of questions.

VICE CHAIR GLAS: Thank you. Commissioner Cleveland?

COMMISSIONER CLEVELAND: Thank you. I raised with the earlier panel concerns about the nature of the deals that Chinese policy banks and non-state banks strike overseas. And Mr. Myllyvirta, in your testimony, you note that when it comes to clean energy and technology that Chinese financing and construction is a genuine value proposition that plays to China's strengths and response to demand from many developing countries.

I think we can stipulate there's a lot of demand for energy. But I'm interested in the nature of those agreements and who they favor and what the levels of transparency and accountability might be. Mr. Tsafos, you said we have a long history when it comes to human rights concerns and as they collide with commercial and economic interests.

But I'm interested in what you all have to say about the nature of the lending that's going on. And then really specifically, what leverage do we have, if any, to enhance transparency and accountability? And Dr. Han Springer, we've had somebody testify from your center before, really, really helpful testimony. But in this specific energy context, I'd like your thoughts on the nature of the agreements, how transparent they are, how accountabile they are, and what leverage do we have to improve, if any, transparency and accountability.

MR. MYLLYVIRTA: Thank you so much, Commissioner Cleveland. And I think this is already clear from your question. But the Chinese overseas investment has a very large diversity of different kinds of deals for renewable energy.

A lot of them are simply Chinese firms bidding for projects that have been -- have had cause for vendors from the host countries. And what China is bringing to the table is the

integrated equipment supply, financing, and engineering procurement construction at a low cost and in a streamlined way. Renewable energy tends to be more transparent than large fossil fuel deals. I'm sure you can find an exception from that.

In terms of what the U.S. could do and should be doing, I think both myself and Dr. Springer have been calling for U.S. to work on those enabling conditions frameworks for clean energy in developing countries. So for example, the U.S. could finance and underwrite clean energy auctions that would create transparent set ups and get a large number of projects -- clean energy projects off the ground in those developing countries that are eager to expand clean energy. And that would, of course, put the U.S. in a place to promote transparent contracts and pricing and competitive terms.

DR. SPRINGER: Thank you for the question. Yeah, I think that it's really important to note what's unique about China's overseas lending and what's not unique about it. So I think as I mentioned earlier, the scale at which China has been able to provide overseas lending in a relatively short period of time relative to what western development finance institutions have done as well as the speed with which it's able to develop individual projects.

What's not unique about China's overseas lending, it's not a debt trap diplomacy. There's no empirical evidence that China is in ensnaring borrowing countries in debt traps. China also faces -- Chinese banks going overseas also face relative similar conditions in terms of their risk appetite, the interest rates that they provide, as well as stipulations around using Chinese workers or technology.

So I think it's important to set the record straight about what they do and they don't do. That being said, I think there is great opportunity for improving transparency and accountability in terms of what Chinese development finance institutions are doing overseas. And a major way to do so is to move towards multilateral cooperation as well triangular cooperation with multiple actors involved.

In the face of this major infrastructure gap, it's only beneficial to bring more actors together. And that way when working together, they can rise to the best standard in terms of the environment and social governance for those projects whereas in the past up until very recently China's practice was to defer to the host country standard in terms of the governance of projects overseas. There have been voluntary guidelines issued recently that indicate a change potentially in this approach. But this is an area where international actors are really crucial to hold China accountable and move these projects towards higher standards.

DR. NAHM: If I could have ten seconds before we move on. I just would like to emphasize that point. We've also sort of ceded the field to Chinese institutions in this space. And there isn't really a great alternative to a lot of the Chinese financing institutions in this space.

I think the European Union has now moved to kind of make the European investment bank a more central player in this and then sort of slapped more climate conditions on that. And they've lent half of their money to climate related matters last year. But there isn't really kind of a western alliance that would counteract or counterbalance sort of Chinese influence in this space.

And I think it would really help move transparency standards and sort of environment standards in a meaningful way. And so I think there's a lot of homework for us to be done in this space. Thank you.

MR. TSAFOS: If I could also make a very quick intervention. One, I would say let's not forget civil society in terms of holding people accountable and corporations accountable. And I think especially when we talk about environmental degradation and human rights, that's a place

where we can show our support.

The second comment is on the financial terms. Agree with everything that's been said. I would just really underscore every time I've tried to look into the financial terms of transactions, the Chinese make a good profit.

Like, they're not giving money away. They may lend you the money away and so the money goes back to other Chinese. But if you look at the rate of returns that they require to make investments in a place like Pakistan, they're making good money. They don't like to lose money.

COMMISSIONER CLEVELAND: How do you square that with the subsidies? I mean, that's an interesting point, that you're saying that their return on investment is worth the risks. But policy banks along with the -- in the enterprises that are going abroad are heavily subsidized by the CCP. So how are they making good money as you say?

MR. TSAFOS: Yeah, I'm saying in terms of, like, what they require from the host country, right? So the host country is not necessarily getting a fantastic deal. They're getting a package deal, right?

And so whether or not you're subsidizing the loans and the cheap loans enable the high right of return, that's largely kind of like an intra-Chinese. How do we split the pie? I was primarily commenting on the fact that from the host country perspective, the attraction is that it's a package deal and they can bring all the things together. But it's usually not a cheap offering, at least in most transactions that I've looked at with a caveat that the transparency of transactions is not fantastic.

COMMISSIONER CLEVELAND: Thank you.

VICE CHAIR GLAS: Just going to open it up for any other questions from Commissioners.

(No audible response.)

VICE CHAIR GLAS: All right. Well, thank you so much to all of you who have testified before us today. Thank you, Mr. Myllyvirta, Dr. Han Springer, Dr. Nahm, and Mr. Tsafos. We really appreciated the time for you to take coming before the Commission today and your written submission.

And for our esteemed Commissioners here today, our next hearing is on April 14th. We will explore the U.S. trade tools to address China's non-market economy practices. Thank you all for joining today, and this meeting has come to a close.

(Whereupon, the above-entitled matter went off the record at 3:22 p.m.)

QUESTIONS FOR THE RECORD

Response from Henry Lee, Director, Environment and Natural Resources Program, Harvard University

China is both a recipient as well as an investor in Russian energy assets. Can you please help us understand exactly what types energy relationships exist between Chinese and Russian entities in this space? What is China doing to assist Russian development of its energy sector including but not limited to purchasing Russian energy and supplying financing, components and services for Russia's extraction activities?

If you go back about ten to fifteen years, Russia decided to develop their huge gas reserves in the Yamal peninsula in western Siberia. Its problem was it lacked the capital to cover the necessary investments. Russian officials asked their European counterparts, who would be the principal customers for the gas--to provide a portion of the capital to finance the complex.. The EU and its member countries were open to the opportunity, but only if they could purchase the gas directly from Russian producers, bypassing Gazprom's exclusive license to export all gas from Russia. In other words , they would not have to purchase the gas from Gazprom who would become a carrier as opposed to an owner of the gas. The Russians refused and insisted that Gazprom retain its monopoly on all exported gas. The Europeans declined to provide the capital--although Total --the French company-- did make an equity investment in the first Yamal project.

Simultaneously Russia was negotiating with Japan to purchase a significant portion of the gas from a major find at Purpeiskaya, near Irkutsk in eastern Siberia. The Chinese were upset that the proposed pipeline would bypass China and send most of the gas to Vladivostok and then onto various customers in East Asia. Again, the Russians needed capital to develop these gas fields.

Around 2012, China entered negotiations to purchase gas from Russia. Initially, the negotiations failed. The Russians wanted the Chinese to buy the gas for the same price plus transportation costs that the Europeans were paying which China felt was too high. China insisted that the price be no higher than the price that they were paying to Turkmenistan, which the Russians felt was too low. Gazprom feared that accepting the Turkmenistan price would encourage the Europeans to renegotiate their existing contracts.

In 2014, the Russians accepted most of the Chinese demands--primarily due to the US sanctions post Crimea.

There are three pipelines which would ship Russian gas to China. The first is a spur line from the Power of Siberia pipeline to Vladivostok. This line began shipping a small amount of gas from eastern Siberia to China in 2019. It should be fully operational by 2024 and is scheduled to ship 38 billion cubic feet of gas. This line will provide less expensive energy to the three provinces in the northeast part of China, which are heavily dependent on imported energy -- both from other Chinese provinces and from foreign sources. The plan is to meet a significant portion of the local gas demand in the three provinces with gas from the Power of Siberia line and divert much of the imported domestic gas and coal to other parts of China.

The second project is a proposed line from Sakhalin Island again to northeast China. The Chinese have signed an agreement to purchase 10 billion cubic feet per year in starting in 2025 or 2026.

The third project-Power of Siberia 2- would traverse Mongolia and will transport gas from western Siberia. It will include a spur, allowing Russia to redirect some of the gas that they could otherwise send to Europe. That is Russia is giving itself the option to send the gas east to China or west to Europe. China is negotiating with Gazprom but has not yet agreed to any contract to purchase gas supplies from this proposed line as of April of 2022.

To help Russia finance the gas fields in eastern Siberia, China has agreed to purchase "up to 38 billion cubic meters per year in gas. Six years earlier, China agreed to lend \$25 billion to Transneft, the Russian state owned oil pipeline monopoly and to Rosneft--its oil monopoly. The Eastern Siberia-Pacific Ocean oil pipeline now moves about 1 million barrels a day of oil . I do not believe that China has lent any money to Russia for the gas pipeline, but the guaranteed purchase of gas allowed Russia to finance the project.

China has also agreed to help finance the huge LNG complexes that Russia is building on the Yamal peninsula . There are at least two major LNG complexes--Yamal and the Arctic projects. The Chinese Export-Import Bank and the China Development Bank have lent about \$12.1 billion (out of \$27 billion total) to the Yamal complex. I think the Silk Road Fund has a small equity interest in several of the LNG trains. For the Arctic LNG complex, CNPC and the China Offshore Oil company have both taken a 10% ownership share in the first three LNG trains. (Interestingly Mitsui --the Japanese firm-- has a small stake in this same project). I am told that the Russians are still in the process of seeking loans for the Arctic LNG complex, and it would be surprising , if they did not approach the Chinese Ex-Im bank and the China Development bank again. As of now, I have no first hand knowledge of such discussions.

Russia needs China both as a source of capital and as a customer--particularly if the EU countries reduce or eliminate their purchase of Russian gas. China, on the other hand, is wary about becoming overly dependent on any one country. China purchases 8% of its LNG from Russia and in 2021 Russia was only the third largest source of imported gas into China behind Australia and Turkmenistan and only slightly ahead of Myanmar. China is likely to continue to increase its purchases of Russian gas over the next decade , but it will be careful not to become overly reliant. Russia's announcement that it will suspend gas sales to Bulgaria and Poland only reaffirms the wisdom of proceeding slowly.

I hope this addresses the commission's questions.

Follow Up Responses to Commissioners' Questions

Gabriel Collins, J.D.¹

Rice University's Baker Institute for Public Policy, Center for Energy Studies. 15 April 2022

1. How are concerns over energy security likely to shape China's foreign and defense policies in the short and medium term? (*Commissioner Friedberg*)

Energy security is likely to be one among the bundle of Beijing's key geostrategic priorities over the next 3-5 years — infused into many, but not overtly standing above any. Being able to potentially retake Taiwan by force and the pursuit of regional hegemony via, among other things, localized air and naval overmatch are the over-riding PRC foreign and defense policy priorities. Energy would factor into a conflict but primarily as a result of US/allied reactions such as naval blockades or strikes against PRC oil ports and associated storage facilities.¹

Chinese policymakers appear to broadly view energy challenges that are localized and soluble through domestic action as being outside of the securitized paradigm that imported resources fall into. Put differently, Chinese decisionmakers are more likely to consider oil disruptions national security problems (国家安全问题) and electricity supply issues as social/economic problems (社会经济问题).

Beijing, provincial, and local officials each respond robustly to both sets of challenges, but with petroleum more overtly securitized than other energy sources. While PRC policymakers often view oil security through a lens tinged by US military power, the reality is that many of the most disruptive events (such as pandemics, internal conflict within producer countries, Middle Eastern terror attacks, or ships blocking chokepoints) generally do not have military solutions that can be effectively implemented by a distant importer country.

Key preparations by a Chinese leadership concerned with energy security therefore emphasize expansion of inventories and vehicle electrification—with efforts robustly underway on all fronts. PRC energy security approaches functionally bifurcate into the "now" approaches like stockpiling and the "starting now, full effect later" approaches like transport electrification. The latter activities are rooted in an understanding that technological preeminence is far more powerful than basic commodity production or a specific supply chain. Namely, the country that establishes technological dominance does not just get the prime corner of the sandbox. It also determines the box's shape, the type

¹ The assessments and opinions expressed in this document are the author's alone.

of sand and, at a basic level, the terms that others must meet if they wish to enter the box and play.²

Reducing petroleum use intensity while also attaining dominant position along new technology supply chains is therefore a high priority for the PRC, as exemplified by the Made in China 2025 initiative. As we've noted before, the more of China's car and truck fleet that can be connected to the grid (and thus powered by domestically-abundant, blockade-resistant coal, hydro, nuclear, or renewables), the less domestic political burden Beijing would face if it had to weather a maritime oil blockade imposed in response to actions it took against Taiwan or other major revisionist adventurism.³ A simple estimate assuming the average car drives 30km/day and consumes 1.8 gallons of gasoline per 100km driven would mean that each million EVs could displace 12,000-to-13,000 barrels per day of gasoline use—roughly 0.4% of China's daily average gasoline consumption in 2021.⁴

China's passenger vehicle fleet, now approximately 225 million units strong, counts nearly 9 million EVs among its ranks, the lion's share of which are full-battery electrics. The State Council seeks to have EVs account for 20% of new vehicles sold in China by 2025. This target has already tentatively been achieved over the last few months, meaning at least 3.5 to 4 million (and eventually many more) new EVs will enter China's car fleet annually from now on.

2. How are recent events in Ukraine likely to influence the CCP leadership's assessment of China's energy security going forward? (*Commissioner Friedberg*)

Events in Ukraine are likely to prompt major re-examination of Chinese military posture and planning. However, the country's energy security approach is less likely to be fundamentally altered. Key actions—such as renewed focus on ensuring coal and petroleum supplies and accelerating transport electrification efforts—grow from seeds planted long before Russian forces crossed into Ukraine.

3. What military capabilities do Chinese leaders consider important for their energy security but beyond their current capacities? Along what timeline is China likely to achieve those capabilities? (*Commissioner Friedberg*)

China already demonstrates the capacity to "show the flag" along key energy sea lanes, exemplified by its nearly 15-year-old "anti-piracy" deployment off the Horn of Africa. Setting such demonstrative missions aside, two key question marks remain:

(1) Would China have the naval and air capacity to keep the Strait of Hormuz open in a regional crisis during the next 5 years? and

(2) Could the PLA Navy "break" a distant blockade of crude oil and LNG shipments mounted by the United States, and possibly, American allies and partners?

For Question 1, the short answer is "likely yes" against a non-state actor such as the Houthis, al-Qaeda, or other such groups that have in the past sought to attack maritime

traffic in and near key chokepoints. Against a nation-state challenger, the picture becomes murkier. The 1980s "Tanker War" when Iraq and Iran began firing on tankers carrying oil through the Gulf helps illustrate the potential level of military commitment that China could face, were it to become the region's lead security guarantor. In response to depredations, Washington ultimately launched Operation Earnest Will to escort tankers and Operation Prime Chance, a covert parallel action to interdict Iranian minelayers and tanker assailants.⁵

Operation Earnest Will saw 13 U.S. warships deployed within the Gulf for escort missions and a total force that included a carrier battle group in the Gulf of Oman that brought the entire deployment to between 25 and 30 vessels in theatre at a given time.⁶ U.S. special operations forces also deployed, with the Army's 160th Special Operations Aviation Regiment (the "Nightstalkers"), Navy SEALs, Special Boat Units, Marines, other Navy personnel and two oil platform construction barges that were converted into floating sea bases.⁷

Chinese forces at present would likely struggle (or even be outright unable) to sustain this level of forward deployed maritime, air, and SOF combat power due to a combination of inexperience and lack of a well-developed logistics system. Moreover, deployments approaching this scale would materially reduce available naval combat power in East Asia, China's priority theatre. In quantitative terms, a single carrier strike group⁸ composed of the CVG plus 2 X Type 052D destroyers, 1 X Type 055 destroyer, and 1X Type 054A frigate as escorts would mean 352 anti-ship and anti-air missile launchers sent far afield: roughly 5% of the missile firepower the PLAN currently has afloat.⁹

U.S. experience suggests the force draw could double or triple, depending on the threat magnitude. It is thus highly unlikely that Beijing would conclude "security at the source" for oil and gas flows from the Gulf region is worth seriously eroding its capacity to rapidly generate localized naval overmatch in the East Asian littoral. Sending capital ships further afield could also expose them to accelerated attrition by US submarine and aerial attack, depending on the nature of the precipitating scenario.

Smaller deployments such as the ongoing anti-piracy task forces have value for "showing the flag" but offer limited capability for handling nation-state challenges that are less likely, but are the low-probability, high-impact scenario that a robust naval presence ultimately aims to insure against.

For Question 2, the answer between now and the late 2020s is "perhaps, but at a steep opportunity cost to the PLAN's ability to generate naval combat power within the East and South China Sea zones that would likely be critical focal points in multiple plausible future crisis scenarios." Again, directly contesting a blockade with naval forces would expose key PLA assets to destruction by US and allied submarine, surface, and air platforms as the Chinese forces ventured further from home. If the blockade were imposed in response to PRC blockade/invasion of Taiwan, Beijing would have to carefully consider the downside of spreading its forces. The more likely immediate response would be to rely on domestic energy stockpiles, demand management through rationing, and perhaps also asymmetric actions including cyberattacks against key U.S. energy assets.

Seapower is ultimately fungible. At this point—and for the next 5 years—China will likely quietly seek relationship and physical presence toeholds in the Gulf region but eschew meaningful force deployments unless forced by circumstances—the primary of which would be a precipitous American withdrawal from the region.¹⁰ The primary focus will remain on achieving naval supremacy in East and Southeast Asia, with global force projection missions an important, but clearly secondary priority.

4. What are Chinese leaders' objectives for stockpiling energy resources like petroleum? What types of energy disruptions do Chinese leaders believe they need stockpiles to blunt, and what does the recent emphasis Chinese leaders have placed on stockpiling energy resources indicate about how they see China's energy security? (*Commissioner Friedberg*)

The most direct way of hedging against potential disruptions is to hold larger inventories. Stockpiling also happens to be a lower opportunity cost modus operandi than deploying and sustaining an oil protection force or building expensive pipelines that tie Chinese consumers to a single supplier or small handful of suppliers all moving crude along a single, predictable, and thus more vulnerable path.

China has grown into the world's second-largest crude oil inventory holder after the United States and now holds close to 1 billion barrels.¹¹ Growth in stockpiles does not transmit much information on specific contingencies they are intended to handle. Such information would come from the management policies associated with the oil storage facilities. For instance, countries such as the US that belong to the International Energy Agency are obligated to hold oil stocks equal to at least 90 days of net imports and can decide the release individually or collectively in response to "a severe oil supply disruption."¹² Such situations are not specifically defined but could include war-related supply shortages, hurricane disruptions, or other instances of market turmoil.

Chinese energy policymakers have generally been highly opaque about their decisions concerning stockpiles of petroleum and energy commodities.¹³ This trend has intensified in recent years, for instance China Customs' 2018 decision to stop publishing many port-level data streams of petroleum and refined products volume and value data. Accordingly, actions offer a more reliable barometer of intent than sparse official statements.

China does not yet have extensive history of petroleum reserve releases from which analysts could begin to empirically deduce the intent behind the stockpile. That said, the available evidence suggests that the Chinese government and the state-owned oil companies that control most of the country's crude oil tankage see inventories as (1) a hedge against supply disruptions and (2) something to be maintained for operational purposes, rather than speculative trading or other applications divorced from security and market stability.¹⁴

Three trends bear close observation. First, to what extent will China potentially expand crude oil storage capacity in coming years? Second, if China's oil demand levels off or even declines, will companies continue to maintain and invest in tankage to attain greater import coverage levels? Third, to what extent will future storage build use aboveground tanks (suggesting commercial orientation) versus underground mined caverns (suggesting more of a security orientation)?

5. China is both a recipient as well as an investor in Russian energy assets. Can you please help us understand exactly what types of energy relationships exist between Chinese and Russian entities in this space? What is China doing to assist Russian development of its energy sector including but not limited to purchasing Russian energy and supplying financing, components and services for Russia's extraction activities? (*Commissioner Wessel*)

Chinese entities' investments in the Russian energy sector break down along three primary lines: (1) investments in oil & gas producing assets, (2) investments in firms that provide drilling and other services that facilitate oil & gas production, and (3) investments in electricity generation and grid assets. The latter to areas do not appear material from a national security perspective at this time given that electricity production supplies demand within Russian borders.

Furthermore, the most capable global oil & gas service companies tend to hail from North America and Europe and are now largely precluded by sanctions from working in Russia. Chinese firms might grab market share opened by Western firms' departure but will generally not be able to add the high-level technical expertise that firms like Halliburton and Schlumberger bring. As such, even a greater PRC corporate presence in the Russian oil and gas value chain likely will not result in production gains or other strategic "needle movers."

Chinese firms' equity investments of approximately \$12 billion in Russian energy production assets over the past 15 years often captures the most attention. But Chinese banks' loans to Russian energy companies may have actually had a bigger impact, with more than \$50 billion deployed since 2005 (**Table 1**).

Equity Investments						
Year	Amount, USD Million	Asset	Asset Ownership, %	Energy Source	PRC Investor	Russian Recipient
2006	\$3,490	Udmurtneft	49%	Oil & Gas	Sinopec	Rosneft
2006	\$500	Rosneft IPO	-	Oil & Gas	CNPC	Rosneft
2013	\$620	Rosneft	49%	Oil & Gas	CNPC	Rosneft
2014	\$990	Vankorneft	10%	Oil & Gas	CNPC	Rosneft
2014	\$940	Yamal LNG	20%	Gas	CNPC	Novatek
2016	\$1,200	Yamal LNG	10%	Gas	Silk Road Fund	Novatek
2019	\$2,020	Arctic LNG-2	10%	Gas	CNPC	Novatek
2019	\$2,020	Arctic LNG-2	10%	Gas	CNOOC	Novatek
Loans						
Year	Amount, Million	Asset	Term, Yrs	Energy Source	PRC Entities	Russian Recipient
2005	USD 6,000	Yuganskneftegaz	-	Oil & Gas	Multiple state banks	Vneshekonombank/Rosneft
2009	USD 15,000	Corporate Level	20	Oil & Gas	China Development Bank	Rosneft
2009	USD 10,000	Corporate Level	20	Oil & Gas	China Development Bank	Transneft
2015	USD 2,170	Corporate Level	5	Gas	Bank of China	Gazprom
2016	EUR 9,300	Yamal LNG	15	Gas	Export-Import Bank of China	Novatek
2016	EUR 9,800	Yamal LNG	15	Gas	China Development Bank	Novatek

Table 1: Selected Russian Energy Deals by Chinese Entities

Source: AEI China Global Investment Tracker, Baker Botts, Morningstar, Reuters, Survival (Charap et.al.), Yamal LNG, The Wall Street Journal

With the U.S. government looking to enforce sanctions against actors that materially assist Russia in the wake of its Ukraine invasion, Chinese equity investors and lenders will likely be more cautious in their approach to large deals in Russia. Activities designed to skirt sanctions are likely, but their precise form—including perhaps loans denominated in RMB—remains to be seen. I fully expect that as Russian natural resource producers' financial distress increases and global capital markets remains inaccessible, more Chinese firms will be tempted to capitalize. In addition to RMB-denominated financial terms, parties in China might also create a Zhuhai Zhenrong-style "BadCo" expressly designed to deal with sanctioned Russian assets at financial terms very favorable to the Chinese side and heavily insulated from Western sanctions enforcement.

Chinese firms will opportunistically capitalize on Russian natural resource exporters' financial distress to try and secure preferentially priced raw materials. But at a high strategic level, Chinese policymakers will likely seek to ensure that Russian or other entities wear the majority of financial risk for any transactions such as gas pipelines that require expensive, single-purpose infrastructure with a long payback period. China Development Bank's refusal in 2018/2019 to bear a major share of loan risk for the massive Amur Gas Processing facility offers one example.¹⁵ Chinese parties will also likely move to ensure that increased gas (and possibly, crude oil) pipeline projects are materially balanced by seaborne import capacity able to access molecules from any exporters on the planet, in case Russia engages in future mischief.

With respect to Russia's strategic "trustworthiness" in Beijing's eyes, Moscow's war of choice against Ukraine has effectively "strafed" a key Chinese BRI investment hub and important global food supplier.¹⁶ Had Russia been able to quickly and neatly achieve its

revisionist objectives in Ukraine, this would have tightly aligned with PRC interests in advancing an international relations approach of "might makes right" within regional spheres of influence. But the longer the war rages on without Russia consolidating a political endstate worthy of the costs incurred, the more deeply global (and generally, negative) the war's consequences will become for Beijing. China is significantly exposed to energy and food supply and price shocks and would also loathe the impacts of unpredictable and less-contained escalation.

Assuming oil prices generally remain at \$90/bbl or higher, China is likely to continue a near-term carbon retrenchment that emphasizes <u>greater domestic coal production</u>. Wind and solar installations will also likely continue at a robust pace. In the medium term, I expect continued aggressive pursuit of transport electrification led by the passenger vehicle sector, but also increasingly incorporating heavier-duty applications such as trucks that tend to burn diesel fuel. One big impact of the Ukraine war may be to help reinforce electrification that prioritizes replacement of oil imports over reduction in carbon emissions – a reality perhaps most accurately characterized as "coal-to-road."

Downside paths for Beijing could include <u>a cyberattack gone global</u>, intensified NATO military-industrial mobilization, increased emphasis in the West on reducing Chinese entities' presence in supply chains, and <u>sanctions/economic warfare actions</u> against PRC firms believed to be materially supporting Russia. Russia's invasion of Ukraine is also likely to accelerate allied efforts to "harden" Taiwan and complicate potential future military coercion efforts by the PRC against the island.

¹ Gabriel Collins, "A Maritime Oil Blockade Against China—Tactically Tempting but Strategically Flawed," Naval War College Review: Vol. 71: No. 2, Article 6. <u>https://digital-commons.usnwc.edu/nwc-review/vol71/iss2/6</u>

² Gabriel Collins, "Brains vs. Grains: US Technological Leadership Faces a Stiff Challenge as Competition With China Heats Up," Issue brief no. 06.25.18. Rice University's Baker Institute for Public Policy, Houston, Texas, <u>https://www.bakerinstitute.org/media/files/files/5d3f109d/bi-brief-062518-ces-techrace.pdf</u>

³ Gabriel B. Collins and Andrew S. Erickson, U.S.-China Competition Enters the Decade of Maximum Danger: Policy Ideas to Avoid Losing the 2020s (Houston, TX: Baker Institute for Public Policy, Rice University, 20 December 2021). <u>https://www.bakerinstitute.org/media/files/files/b63419af/ces-pub-china-competition-121321.pdf</u>

⁴ Oil Market Report—January 2022, IEA, <u>https://iea.blob.core.windows.net/assets/3c169b3b-9a7c-4467-9029-d2b76caddc6c/-19JAN2022_0ilMarketReport.pdf</u>

⁵ Robert Schneller Jr., "Anchor of Resolve: A History of U.S. Naval Forces Central Command/Fifth Fleet," https://www.history.navy.mil/content/dam/nhhc/browse-by-topic/War%20and%20Conflict/operationpraying-mantis/AnchorOfResolve.pdf (15)

⁶ Ibid. 15

⁷ Dwight Jon Zimmerman, "Operations Prime Chance and Praying Mantis: USSOCOM'S First Test of Fire," Defense Media Network, 27 October 2021, <u>https://www.defensemedianetwork.com/stories/ussocoms-first-test-of-fire-operations-prime-chance-and-praying-mantis/</u>

⁸ Adam Kehoe, "China's Liaoning Carrier Strike Group Passes Through Japan's Miyako Strait," The Drive WarZone, 4 April 2021, <u>https://www.thedrive.com/the-war-zone/40051/chinas-liaoning-carrier-strike-group-passes-through-japans-miyako-strait</u>

⁹ Calculated as follows: 112 vertical launch system ("VLS") tubes and 24 other surface to air missiles per Type 055 vessel, 64 VLS tubes and 24 other SAMs per Type 052D, and 32 VLS tubes plus 8 other anti-ship cruise

missiles per Type 054A. Total PLA anti-ship and anti-air missile launchers afloat (counting all DDG, FFG, corvettes, and Type 022 missile boats) comes out to 7,328 total fixed launchers in my model. ¹⁰ Jared Malsin, Summer Said, and Warren P. Strobel, "Saudis Begin Making Ballistic Missiles With Chinese Help," The Wall Street Journal, 23 December 2021, <u>https://www.wsj.com/articles/saudis-begin-making-ballistic-missiles-with-chinese-help-11640294886</u> and Gordon Lubold and Warren P. Strobel, "Secret Chinese Port Project in Persian Gulf Rattles U.S. Relations With U.A.E.," The Wall Street Journal, 19 November 2021, <u>https://www.wsj.com/articles/us-china-uae-military-11637274224</u>

¹¹ https://www.uscc.gov/sites/default/files/2022-03/Gabriel_Collins_Testimony.pdf

¹² "Oil Stocks of IEA Countries," <u>https://www.iea.org/articles/oil-stocks-of-iea-countries</u>

¹³ Gabriel Collins and Elsie Hung, "Using Satellite Data to Crack the Great Wall of Secrecy Around China's Internal Oil Flows," Baker Institute Report no. 09.07.18. Rice University's Baker Institute for Public Policy, Houston, Texas. <u>https://www.bakerinstitute.org/media/files/files/5b820dd5/bi-report-090718-ces-</u> <u>satellitechinaoil.pdf</u> and Gabriel Collins, "Satellite-based radar assesses CNPC management of crude pipelines," Oil & Gas Journal, 1 September 2019, <u>https://www.ogj.com/pipelines-</u> <u>transportation/pipelines/article/14039798/satellitebased-radar-assesses-cnpc-management-of-crude-</u>

pipelines

¹⁴ Michal Meidan, "China's SPR release: a test of mechanisms rather than a show of market might," The Oxford Institute for Energy Studies, September 2021, <u>https://www.oxfordenergy.org/wpcms/wp-</u>

<u>content/uploads/2021/09/Chinas-SPR-release.pdf</u> and Diaz-Rainey, I., Roberts, H., and Long D.H., "Crude Inventory Accounting and Speculation in the Physical Oil Market," Energy Economics, Vol.66, August 2017, pp.508-522.

¹⁵ Китайские деньги не пошли в «Газпром», Kommersant, 29 January 2019, <u>https://www.kommersant.ru/doc/3867131</u>

¹⁶ Pete Sweeney, "China's Belt and Road strafed by Vladimir Putin," Reuters, 3 March 2022, <u>https://www.reuters.com/breakingviews/chinas-belt-road-strafed-by-vladimir-putin-2022-03-03/</u>

April 19, 2022

Dr. Emily Meierding Assistant Professor, Naval Postgraduate School

U.S.-China Economic and Security Review Commission

Hearing on China's Energy Plans and Practices Panel II: China's External Energy Policies

Questions for the Record

Submitted by Commissioner Mike Wessel:

• China is both a recipient as well as an investor in Russian energy assets. Can you please help us understand exactly what types of energy relationships exist between Chinese and Russian entities in this space? What is China doing to assist Russian development of its energy sector including but not limited to purchasing Russian energy and supplying financing, components and services for Russia's extraction activities?

China's energy relationships with Russia include purchases of oil and natural gas; financing for pipeline projects; participation in Russia's Arctic LNG projects via investments, policy bank financing, and construction; and supporting upstream Russian energy exploration. This engagement is likely to expand as a result of Russia's invasion of Ukraine.

China's imports of Russian crude oil have more than tripled over the last decade (See Figure 1). In 2016, Russia overtook Saudi Arabia as China's leading oil supplier, although Saudi Arabia retook that position in 2019. Based on data from China's General Administration of Customs, in 2021, the state imported 1.6 million barrels per day (bpd) of Russian crude oil This accounted for 15.5% of China's total imports.¹ Approximately half of this oil travels to China by pipeline: mostly through the Daqing spur of the Eastern Siberia Pacific Ocean (ESPO) pipeline, but also through the Kazakhstan–China oil pipeline, which primarily transports Russian oil.² China's other Russian oil imports arrive by tanker; these are predominantly shipped from the Russian port of Kozmino at the ESPO pipeline's terminus.

On February 4, 2022, Rosneft signed a 10-year supply deal with one of China's national oil companies (NOCs), the China National Petroleum Corporation (CNPC), for approximately 200,000 bpd of crude oil, to be shipped through the Kazakhstan–China pipeline. This deal will

¹ "Factbox: A look at key Russia-China crude oil ties as Ukraine crisis rages," S&P Global (March 8, 2022), <u>https://www.spglobal.com/commodityinsights/es/market-insights/latest-news/oil/030122-factbox-a-look-at-key-russia-china-crude-oil-ties-as-ukraine-crisis-rages</u>.

² Rosemary Griffin, "Russia, China sign new energy deals following Ukraine tension," S&P Global (February 4, 2022), <u>https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/oil/020422-russia-china-sign-new-energy-deals-following-ukraine-tension</u>.

replace a similar contract, signed in 2009, which was due to expire next year.³ In another 2009 contract, China helped finance the Daqing spur of the ESPO pipeline by providing \$25 billion in loans to the Russian state-controlled energy companies, Rosneft and Transneft, in exchange for 300,000 bpd of oil for the next twenty years.⁴ In 2013, the CDB granted Rosneft another \$2 billion loan-for-oil.⁵

Figure 1⁶:



China is a relatively new importer of Russian natural gas. Only one gas pipeline travels from Russia to China: the Power of Siberia (POS), which began operations in December 2019. In 2014, the Russian state-controlled gas company, Gazprom, and the CNPC signed a 30-year supply contract, with an estimated value of \$400 billion, for gas shipped through the POS. These supplies are expected to reach 38 billion cubic meters (bcm) per year in 2023.⁷ However, in 2021, Russia supplied only 10.4 bcm through the POS. The same year, China imported an estimated 4.61 million metric tonnes per annum (MTPA) of LNG (equivalent to 6.3 bcm) from Russia. This LNG came from the Yamal LNG project in the Russian Arctic and from the

⁴ Robin Paxton and Vladimir Soldatkin, "China lends Russia \$25 billion to get 20 years of oil," Reuters (February 17, 2009), <u>https://www.reuters.com/article/uk-russia-china-oil-sb/china-lends-russia-25-billion-to-get-20-years-of-oil-idUKTRE51G3S620090217</u>.

⁵ Eugene Gholz, Umul Awan, and Ehud Ronn, "Financial and energy security analysis of China's loan-for-oil deals," *Energy Research & Social Science* 24 (2017): 42–50. In 2013 and 2014, CNPC and Sinopec also agreed to prepay for substantial amounts of Russian oil. James Henderson and Tatiana Mitrova, "Energy Relations between Russia and China: Playing Chess with the Dragon," OIES Paper: WPM 67 (August 2016),

https://www.oxfordenergy.org/publications/energy-relations-russia-china-playing-chess-dragon/.

⁶ "Factbox: A look at key Russia-China crude oil ties as Ukraine crisis rages."

⁷ Alexei Anishchuk, "As Putin looks east, China and Russia sign \$400-billion gas deal," Reuters (May 21, 2014), <u>https://www.reuters.com/article/us-china-russia-gas/as-putin-looks-east-china-and-russia-sign-400-billion-gas-deal-idUSBREA4K07K20140521</u>.

³ Olga Tanas and Dina Khrennikova, "Russia signs oil and gas deals with China as relations with the West sour," Bloomberg (February 4, 2022), <u>https://www.bloomberg.com/news/articles/2022-02-04/russia-s-gazprom-signs-new-gas-supply-contract-with-china</u>.

Sakhalin-2 project, off of Russia's Pacific coast. In total, Russian pipeline gas and LNG made up 10% of China's natural gas imports in 2021.⁸

On February 4, 2022, Gazprom and the CNPC signed another 30-year supply contract for an additional 10 bcm per year of gas, which will travel from the Russian Far East to northeastern China. Gazprom did not specify which fields will supply this gas, but it is likely to come from Sakhalin or the offshore South Kirinskoye field in the Pacific. Deliveries are likely to begin in two to three years and China will pay for the gas in euro.⁹

Russia and China have also been discussing a second Power of Siberia pipeline that could supply 50 bcm per year of gas from Russia's Yamal fields to China, via Mongolia. On January 25, 2022, Gazprom announced that a feasibility study for the Mongolian section of the pipeline had been completed. In late February, Gazprom stated that it had signed a contract to design the new "Soyuz Vostok" pipeline across Mongolia. However, China and Russia have not yet reached a supply agreement, which will be crucial for the project to move forward.¹⁰ With European markets hardening against Russian gas imports, China is in a strong bargaining position for establishing a new contract.

Over the last eight years, China has also been a major investor in Russia's Arctic LNG projects. In the words of leading energy analyst Erica Downs, "China's investments have catalyzed the development of LNG projects in Russia's Far North. Specifically, Chinese entities played a key role in helping Novatek, Russia's largest independent natural gas producer, deliver Yamal LNG on-time and on-budget in December 2017 despite Western sanctions."¹¹ In 2013, the CNPC agreed to acquire a 20% stake in the Yamal LNG project and pledged to purchase at least 3 million tonnes of LNG per annum (MTPA).¹² In March 2016, China's Silk Road Fund purchased a 9.9% stake in the project, receiving an equity stake of 1.6 MTPA of LNG.¹³ The same year, China's two leading state-owned policy banks, the China Development Bank and China Export-Import Bank, loaned Novatek an equivalent of \$12 billion for Yamal LNG, through two 15-year credit lines denominated in euro and yuan.¹⁴ Much of this funding was used to pay Chinese contractors, who performed the majority of the project's construction.

⁸ Figures are from China's General Administration of Customs. "Factbox: Key China-Russia oil and gas deals, joint projects and energy investments," S&P Global (March 8, 2022),

https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/natural-gas/022822-factbox-key-china-russia-oil-and-gas-deals-joint-projects-and-energy-investments.

⁹ Vladimir Solkatkin and Chen Aizhu, "Putin hails \$117.5 bln of China deals as Russia squares off with West," Reuters (February 4, 2022), <u>https://www.reuters.com/world/putin-tells-xi-new-deal-that-could-sell-more-russian-gas-china-2022-02-04/;</u> Tanas and Khrennikova, "Russia signs oil and gas deals."

¹⁰ "Gazprom paves way to new China gas deal as sanctions hit Russia," Bloomberg Quint (February 28, 2022) <u>https://www.bloombergquint.com/business/gazprom-paves-way-to-new-china-gas-deal-as-sanctions-hit-russia;</u> Tanas and Khrennikova, "Russia signs oil and gas deals."

¹¹ Erica Downs, "Q&A: China-Russia energy relations: Will new oil and natural gas deals help Russia weather economic sanctions?" Center on Global Energy Policy, Columbia SIPA (March 16, 2022), <u>https://www.energypolicy.columbia.edu/research/qa/qa-china-russia-energy-relations-will-new-oil-and-natural-gas-deals-help-russia-weather-economic#_edn5</u>.

¹² Stephen Bierman and Ilya Arkhipov, "CNPC buys stake in Novatek's Yamal LNG project in Russian Arctic," Bloomberg (September 5, 2013), <u>https://www.bloomberg.com/news/articles/2013-09-05/cnpc-buys-stake-in-novatek-s-yamal-lng-project-in-russian-arctic</u>. The purchase was completed in January 2014

¹³ "Factbox: Key China-Russia oil and gas deals."

¹⁴ Downs, "Q&A."

China has also been a significant investor in another Novatek project, Arctic LNG 2. Another Chinese NOC, the Chinese National Offshore Oil Corporation (CNOOC), acquired a 10% stake in this project in April 2019, receiving an equity volume of approximately 2 MTPA of LNG. A CNPC subsidiary (CNODC) purchased a 10% stake in June 2019 and also received an equity volume of 2 MTPA.¹⁵ The project's other shareholders, in March 2022, were Novatek (60%), Total (10%), and Japan Arctic LNG (10%).¹⁶ China has also provided financing for the project. In November 2021, Novatek announced that it has raised \$2.5 billion from the China Development Bank and China Export-Import Bank.¹⁷ Additionally, several other Chinese companies have established supply contracts with Novatek. In February 2021, Shenenergy, a company owned by the Shanghai government, signed a 15-year contract for 3 MTPA of LNG from Arctic LNG 2.¹⁸ In January 2022, Zhejiang Energy Gas finalized a 15-year contract for 1 MTPA.¹⁹

However, Russia's invasion of Ukraine has made the fate of Arctic LNG 2 uncertain. It is projected to consist of three LNG trains, each with a 6.6 MTPA capacity. The first train, which is scheduled to start production in 2023, is likely to move forward, but Novatek announced in late March 2022 that it would put the other two trains' development on hold.²⁰ This decision arose partly from the project's now-limited access to financing. A few days before Novatek's announcement, Total announced that it would stop funding the project.²¹ More generally, Western sanctions on Russian banks could impede Arctic LNG 2's access to capital. A second impediment is access to Western technology. The Russian-developed Arctic Cascade technology, employed in the fourth train of Yamal LNG, proved to be highly problematic, leading Novatek to announce that it would use foreign technology for future LNG projects.²² However, the EU's fifth package of sanctions, announced in April 2022, prohibited the delivery of goods and technologies related to gas liquefaction to Russia.²³

Turning to Arctic energy exploration, between 2017 and 2020, Chinese oil rigs owned by the China Oilfield Services (COSL) company conducted exploratory drilling in Gazprom's Arctic license areas in the Kara Sea. In 2017, the *Nanhai-VIII* (also known as the *Nan Hai Ba Hao*), a

¹⁵ "Factbox: Key China-Russia oil and gas deals."

¹⁶ Downs, "Q&A."

 ¹⁷ Trym Eiterjord, "What does Russia's invasion of Ukraine mean for China in the Arctic?" The Diplomat (March 25, 2022), <u>https://thediplomat.com/2022/03/what-does-russias-invasion-of-ukraine-mean-for-china-in-the-arctic/</u>.
¹⁸ Amanda Battersby, "China to import more LNG from Russia," Upstream (March 1, 2022),

https://www.upstreamonline.com/lng/china-to-import-more-lng-from-russia/2-1-971417.

¹⁹ Sanja Pekic, "Zhejiang Energy buys LNG from Novatek's Arctic LNG 2 project," Offshore Energy (January 22, 2022), <u>https://www.offshore-energy.biz/zhejiang-energy-buys-lng-from-novateks-arctic-lng-2-project/</u>.

²⁰ Vladimir Afanasiev, "Russia's Far East LNG project suspended as authorities debate industry support measures," Upstream (April 4, 2022), <u>https://www.upstreamonline.com/production/russia-s-far-east-lng-project-suspended-as-authorities-debate-industry-support-measures/2-1-1196140</u>.

²¹ Christopher E. Smith, "TotalEnergies to stop funding Arctic LNG 2," *Oil & Gas Journal* (March 24, 2022), https://www.ogj.com/pipelines-transportation/lng/article/14269942/totalenergies-to-stop-funding-arctic-lng-2.

²² Atle Staalesen, "Russia's new Arctic LNG project will be built with western tech," *The Barents Observer* (February 21, 2022), <u>https://thebarentsobserver.com/en/industry-and-energy/2022/02/russias-new-arctic-lng-project-will-be-built-western-tech</u>.

²³ "Russia's LNG plans face rethink after EU sanctions on equipment," Reuters (April 12, 2022), <u>https://www.reuters.com/business/energy/russias-lng-plans-face-rethink-after-eu-sanctions-equipment-analysts-</u>2022-04-12/.

semi-submersible rig, drilled in the Leningradskoye license. In 2018 and 2019, it drilled in the Rusanvoskoye license. Both of these areas are west of the Yamal Peninsula. In 2020, the *Nanhai-VIII* was joined by a jack-up rig, the *Nan Hai Jiu Hao*, also owned by COSL. During the 2019 and 2020 drilling seasons, the rigs made additional finds at the Leningradskoye field, expanding its gas reserves.²⁴

Intensifying U.S. and European sanctions are creating a window of opportunity for China to assume an even larger role in Russia's Arctic energy industry. However, Chinese firms do not yet possess the technological capabilities necessary to perfectly substitute for Western expertise. Although they were responsible for the majority of construction for the Yamal LNG project, including much of the equipment for its LNG trains, Chinese companies were generally contractors for Western companies that designed the equipment. Similarly, although Chinese shipbuilding companies are expanding their capacity to design and construct larger, more sophisticated vessels, they are not yet capable of independently executing some higher-value projects, such as Arc7 ice-class gas tankers.²⁵ Lastly, although Chinese oil rigs can operate in the ice-free Arctic, the state's NOCs do not yet possess the technical capabilities of more experienced Arctic players, like ExxonMobil or Norway's Equinor.

Intensifying sanctions, including Western oil companies' announcements that they will voluntarily withdraw from Russian energy investments, are also creating opportunities for China outside of the Arctic. Chinese buyers can purchase Russian oil and natural gas at steeply discounted prices. Russian oil sellers are also attempting to encourage these purchases by accepting payment in yuan.²⁶ In the early weeks of the war, China's NOCs fulfilled their contracted purchases of Russian oil and gas, but shied away from additional spot purchases, due to fears of expanding sanctions against the Russian energy industry. China's independent refineries, which are less exposed to international sanctions and were more eager to increase their purchases of Russian oil.²⁷ However, they had difficulty financing these transactions, as China's leading banks stopped issuing dollar-denominated letters of credit for Russian commodity purchases.²⁸ Chinese buyers have also attempted to escape international censure by negotiating oil deals privately and by purchasing LNG through bilateral transactions, rather than international auctions.²⁹

²⁶ "Russia coal and oil paid for in yuan starts heading to China," Bloomberg (April 6, 2022), <u>https://www.bloomberg.com/news/articles/2022-04-07/russian-coal-and-oil-paid-for-in-yuan-to-start-flowing-to-china</u>.

²⁷ Chen Aizhu and Florence Tan, "China state refiners shun new Russian oil trades, teapots fly under radar," Reuters (April 6, 2022), <u>https://www.reuters.com/business/energy/exclusive-china-state-refiners-shun-new-russian-oil-trades-teapots-fly-under-2022-04-06/</u>.

 ²⁸ "China state banks restrict financing for Russian commodities," Bloomberg (February 25, 2022), https://www.bloomberg.com/news/articles/2022-02-25/chinese-state-banks-restrict-financing-for-russiancommodities; Chen Aizhu and Florence Tan, "Chinese refiners tap alternative payments to keep Russian oil flowing," Reuters (March 4, 2022), <u>https://www.reuters.com/article/ukraine-crisis-china-oil-idUSL3N2V60K7</u>.
²⁹ "China is quietly taking cheap Russian crude as India buys more," Bloomberg (March 23, 2022),

https://www.bloomberg.com/news/articles/2022-03-24/china-is-quietly-taking-cheap-russian-crude-as-india-buys-

²⁴ Thomas Nilsen, "With Chinese rig, Gazprom makes another major Kara Sea discovery," *The Barents Observer* (October 12, 2020), <u>https://thebarentsobserver.com/en/industry-and-energy/2020/10/chinese-rig-gazprom-makes-major-kara-sea-gas-discovery</u>.

²⁵ Kim Bo-eun, "Korean shipbuilders bracing for fallout from Russia war," *The Korea Times* (April 20, 2022), https://m.koreatimes.co.kr/pages/article.asp?newsIdx=326196.

As the war has continued, without stronger sanctions against Russian energy sales, China's NOCs have become less inhibited. In early April, Sinopec and PetroChina were reportedly in negotiations to purchase spot cargos of discounted Russian oil.³⁰ Sinopec and the CNPC have also purportedly been in discussion with Gazprom about purchasing stakes in the company.³¹ Although these conversations are preliminary, if Western energy companies like BP and Shell follow through on their pledges to abandon their Russian investments, China's NOCs could scoop up distressed assets on the cheap.

That being said, Chinese companies must balance the appeal of fire sale prices with uncertainty about Russia's postwar political and economic stability. For now, short-term Russian energy purchases are likely to be more attractive than long-term Russian energy investments. However, if Russia emerges from the war fairly stable and Western companies continue to eschew participation in the country's energy industry, Chinese companies are likely to seize the opportunity to expand their stakes. The danger, for Russia, is that it will be the junior partner in these deals. Yet it may have little choice, if it wants to maintain energy production and sales.

Submitted by Commissioner Aaron Friedberg:

• In your written testimony, you identify key transportation and financial chokepoints to which China's energy imports are subject. What measures has China's government pursued to circumvent maritime chokepoints and the U.S. dollar system, and how effective do China's leaders believe that they been? Regarding maritime chokepoints, please elaborate on the role of China's domestic tanker fleet and the possible control of ports and other facilities by Chinese companies in maintaining sufficient maritime oil imports in the event of a crisis. Regarding financial chokepoints, please assess the efforts of China's government to gain more participants in its Cross-Border Interbank Payment System and to conduct energy trade denominated in RMB. Along what timeline will China most likely have the capabilities to address its key energy vulnerabilities along transportation and financial chokepoints?

Like China's "going out" strategy for securing upstream access to crude oil supplies, the development of China's domestic tanker fleet was fueled by a combination of strategic concerns and commercial interests. The leading strategic concern was that the U.S. Navy would attempt to interrupt oil shipments to China, particularly as they transited maritime chokepoints like the Strait of Malacca and Lombok Strait. The leading commercial interest was the development of China's domestic shipbuilding industry. Between 2000 and 2012 alone, China's share of the global shipbuilding market increased from 7% to 42%. Since then, China has vied with South Korea as the world's leading shipbuilding nation. China fulfills ship orders for many countries. However, Chinese shipping companies have been particularly inclined to concentrate their orders

³⁰ Stapczynski, "China gas buyers seek cheap Russian fuel."

³¹ "China considers buying stakes in Russian energy, commodity firms," Bloomberg (March 8, 2022), <u>https://www.bloomberg.com/news/articles/2022-03-08/china-considers-buying-stakes-in-russian-energy-commodity-firms</u>.

<u>more</u>; Stephen Stapczynski, "China gas buyers seek cheap Russian fuel shunned by the world," Bloomberg (April 3, 2022), <u>https://www.bloomberg.com/news/articles/2022-04-04/china-gas-buyers-seek-cheap-russian-fuel-shunned-by-the-world</u>.

in domestic shipyards. From 2017–2019, 90% of orders from Chinese ship owners (including those based in Hong Kong) were placed in Chinese shipyards.³²

Bulk carriers are the dominant ship type constructed by China, but oil tankers have constituted a substantial share of China's shipbuilding: 21% by tonnage from 2017–2019. Between 2010 and 2019, Chinese shipyards constructed 30% of the world's oil tankers (by tonnage). China also held a 29% share of the world's VLCC (Very Large Crude Container) orders in early 2020. In the last few years, China has been attempting to increase its production of higher-value energy transportation vessels, such as LNG tankers. However, it is still far outpaced in this area by South Korea, which held 92% of global LNG tanker orders in early 2020, compared to China's 7%.³³

China's two leading energy shipping companies, COSCO Shipping Energy Transportation and China Merchants Energy Shipping (CMES), both of which are state-owned, have built up substantial fleets of Chinese-flagged oil tankers. The former's website lists a fleet of 55 VLCCs, 49 of which are flagged in mainland China or Hong Kong. The fleet list also includes a sizeable number of smaller tankers: 6 Suezmax, 20 Aframax, and 40 Panamax.³⁴ CMES does not provide a fleet list on its website. However, one source estimated in late 2021 that the company owned 51 VLCCs.³⁵ Together, these 106 tankers represent approximately 14% of VLCCs active globally.³⁶ Many of these Chinese-owned tankers do not currently transport oil to China. Instead, like China's NOCs selling their equity oil to non-Chinese buyers, China's state-owned energy shipping companies lease their tankers to whomever will give them the best commercial deal.

Beijing nonetheless possesses the authority to order these companies to use their tankers to ship oil to China. Were the government to make this demand, it is very unlikely that the two companies currently possess sufficient tanker capacity to fulfill all of China's oil import demand. In 2021, China's oil imports were 10.26 million bpd, with approximately 90% arriving by sea. Each VLCC can carry approximately 2 million barrels of oil. China would therefore require 4.5 VLCC deliveries per day to maintain its current import levels. China's seaborne oil deliveries arrive primarily from the Persian Gulf and West Africa. A one-way VLCC trip from Saudi Arabia's Ras Tanura export terminal to Qingdao, one of China's leading VLCC-capable ports, takes approximately 21 days, with a VLCC traveling at an optimal laden speed of 12.2 knots.³⁷ Return trips would be slightly shorter, as VLCCs' ballast speeds are marginally faster. However, a round-trip sailing between the Persian Gulf and China is still likely to take at least 40 days, including loading and unloading times. Accordingly, China would need a minimum of 180 active

http://en.energy.coscoshipping.com/col/col1442/index.html (accessed April 15, 2022).

³⁵ Cichen Shen, "China Merchants continues to trim non-eco VLCC fleet," Lloyd's List, <u>https://lloydslist.maritimeintelligence.informa.com/LL1139135/China-Merchants-continues-to-trim-non-eco-VLCC-fleet</u>.

³⁶ "Where do the world's VLCCs sail," The Maritime Executive (January 9, 2020), <u>https://www.maritime-executive.com/editorials/where-do-the-world-s-vlccs-sail</u>.

³⁷ Liz McCarthy, "12.2 knots: the secret to efficient VLCC chartering," Lloyd's List (April 11, 2013), <u>https://lloydslist.maritimeintelligence.informa.com/LL040003/122-knots-the-secret-to-efficient-VLCC-chartering</u>. Distance and time were calculated using <u>https://sea-distances.org/</u>.

³² OECD, *Report on China's shipbuilding industry and policies affecting it*, OECD Science, Technology, and Industry Policy Papers, No. 105 (April 2021).

³³ Ibid.

³⁴ "Fleet Structure," website of COSCO Shipping Energy Transportation Co., Ltd,
VLCCs (40 day return trip, multiplied by 4.5 tankers/day) to maintain its current oil imports. Even if Chinese shipping companies' smaller tankers were also called into service, their combined capacity probably falls short of this figure.

China is nonetheless far better positioned to ship its own oil than it was two decades ago. First, if the state rationed its oil consumption, a smaller tanker fleet could fulfill its import needs.³⁸ Second, there are multiple advantages to controlling tanker transportation. Beijing can direct the operations of state-owned vessels. It can also insure them, so they are not deterred by the extremely high rates that private insurance companies are likely to charge for transportation through war zones.³⁹ In a crisis short of war, using Chinese-flagged tankers to transport oil could also deter U.S. interference. Although these tankers would be easy to spot-a significant disadvantage of using state-owned vessels-interdicting one would almost certainly be viewed as an escalatory act. If Beijing ordered its tankers to resist interdiction, the results would be even more damaging, politically and environmentally. Consequently, the United States is unlikely to forcefully interdict Chinese-flagged oil tankers, in a situation short of war. Even during a war, the United States would have to weigh the benefits of an attempted energy blockade against the risks, including damaged Chinese tankers potentially blocking key straits, thereby impeding the passage of energy resources and other goods to U.S. allies, including Japan and South Korea. In short, the utility of attempting to interrupt maritime energy shipments to China is already questionable, even with China's current state-owned tanker fleet.

China has not attempted to exert control over foreign ports in order to enhance the security of its domestic tanker fleet, as VLCCs do not need to stop for refueling during their journeys from the Persian Gulf or West Africa to China. China does, however, possess a strong incentive to maintain influence over operations of the Kyaukpyu port in Myanmar, as this is the terminus of the Myanmar–China oil pipeline, one of the alternative oil transportation routes to the Strait of Malacca.

Turning to financial transactions, China has made less progress towards circumventing the U.S. dollar system. Chinese state-owned companies have attempted to conduct a larger share of their energy transactions in other currencies. Chinese customers have paid for some Venezuelan and Iranian resource shipments in yuan.⁴⁰ The CNPC's February 2022 agreement to purchase an additional 10 bcm per year of Russian natural gas will be settled in euro. China's development banks have denominated their loans to Russian energy projects, like Yamal LNG, in euro and yuan. Since Russia's invasion of Ukraine, some Russian oil sellers have allowed Chinese buyers to conduct their purchases in yuan, in order to compensate for declining Western demand.⁴¹ Chinese buyers have also had easier access to yuan-denominated credit lines than dollar-denominated credit lines since the invasion, as leading Chinese banks shut down the latter due to fear of broadening U.S. sanctions.⁴²

³⁸ Gabriel Collins, "A Maritime Oil Blockade Against China," *Naval War College Review* 71, no. 2 (Spring 2018): 49–78.

³⁹ Andrew Erickson and Gabe Collins, "Beijing's energy security strategy: The significance of a Chinese stateowned tanker fleet," *Orbis* (Fall 2007): 681.

⁴⁰ Maha Kamel and Hongying Wang, "Petro-RMB? The oil trade and the internationalization of the renminbi," *International Affairs* 95, no. 5 (2019): 1131–1148.

⁴¹ "Russia coal and oil paid for in yuan starts heading to China."

⁴² "China state banks restrict financing for Russian commodities."

Saudi Arabia also recently made headlines for its "accelerated" talks with Beijing about denominating some of its oil sales in yuan. However, the anxiety precipitated by these discussions is overblown. Riyadh and Beijing have been discussing oil pricing in yuan since 2016, with limited progress. The Saudis' current (apparent) receptivity can be attributed to their declining confidence in their relationship with the United States. It may also be useful for the state to sell some of its oil to China in yuan, because it can use this income to pay Chinese construction firms, which are very active in the country.⁴³

It is nonetheless very unlikely that Saudi Arabia—or any other oil producer that is not confronting international sanctions—will shift a large share of its energy transactions to yuan. The currency is not very attractive internationally, due to the capital controls maintained by Beijing. Consequently, countries have little interest in holding large amounts of yuan in their foreign exchange reserves. They are therefore only likely to accept enough of these payments to cover their yuan-denominated purchases of Chinese goods and services. They may accept less. Most countries have little incentive to undermine the dollar's status as the global reserve currency. Doing so would endanger their own dollar-denominated investments. Additionally, no other currencies, including the yuan, are more appealing alternatives.

China's Cross-Border Interbank Payment System (CIPS) is also not a viable alternative to the SWIFT financial messaging service. CIPS is primarily a clearing and settlement mechanism; like the United States' Clearing House Interbank Payments System (CHIPS), it moves funds from one institution to another and finalizes those transactions. The system's main purpose is to facilitate cross-border transactions in yuan by enabling global banks to clear them in mainland China, as well as through offshore yuan hubs. CIPS includes a financial messaging service. However, the system currently relies on SWIFT for most of its communications, including with any banks that are not directly connected to the CIPS network. Consequently, restricting China's access to SWIFT would also hobble CIPS.⁴⁴ This means that CIPS is not very helpful for countries, like Russia, that are trying to evade international sanctions.

CIPS is growing. At the end of January 2022, it stated that 1,280 financial institutions in over 100 countries were connected to the system. In 2021, CIPS reportedly processed approximately 80 trillion yuan (\$12.68 trillion) of transactions, which represented a 75% increase in value from 2020.⁴⁵ However, SWIFT processed \$5 trillion of transactions *daily* in 2021. CIPS also has only 75 direct participants and most of those are overseas branches or subsidiaries of Chinese banks.⁴⁶ CIPS's membership will probably continue to expand, but it is unlikely to challenge SWIFT. As with yuan-denominated energy transactions, there is currently little incentive for actors that are

⁴³ Summer Said, "Saudi Arabia considers accepting yuan instead of dollars for Chinese oil sales, "*The Wall Street Journal* (March 15, 2022), <u>https://www.wsj.com/articles/saudi-arabia-considers-accepting-yuan-instead-of-dollars-for-chinese-oil-sales-11647351541</u>.

⁴⁴ Emily Jin, "Why China's CIPS matters (and not for the reasons you think)," Lawfare (April 5, 2022), https://www.lawfareblog.com/why-chinas-cips-matters-and-not-reasons-you-think.

 ⁴⁵ "Factbox: What is China's onshore yuan clearing and settlement system CIPS?" Reuters (February 27, 2022),
<u>https://www.reuters.com/markets/europe/what-is-chinas-onshore-yuan-clearing-settlement-system-cips-2022-02-28/</u>.
⁴⁶ "Sanctions on Russia puts focus on China's Central Bank," Bloomberg (February 28, 2022),

https://www.bloombergquint.com/global-economics/sanctions-on-russia-puts-focus-on-china-s-central-bank.

not threatened by sanctions to participate. They do not need a SWIFT alternative. If anything, they would prefer to maintain the current system's strength and efficiency.

To summarize, although China is likely to deepen its financial ties and increase its share of yuandenominated energy transactions with international pariah states (such as Iran, Russia, and Venezuela), it is unlikely to shift other oil producers' behaviors in these directions. This means that China will not be able to purchase enough oil to cover its import needs, without using dollars. Consequently, the state will remain exposed to international sanctions that target its energy-related financial transactions.

It is difficult to estimate how long China will maintain this vulnerability because it is, in part, self-imposed. Beijing's capital controls have limited the yuan's viability and attractiveness as a global currency. This discourages commodity sellers from transacting in yuan, which in turn limits financial institutions' incentives to participate in CIPS. Until Beijing is willing to accept greater capital volatility by relaxing these controls, it will continue to stymie its own purported goals of internationalizing the yuan and limiting its exposure to international financial sanctions. It seems unlikely that President Xi will be willing to make this tradeoff. However, the more the United States uses financial sanctions as a foreign policy tool, the stronger China's incentives to alter its calculus.

Response from Jonas Nahm, Assistant Professor, Johns Hopkins School of Advanced International Studies

Jonas Nahm Johns Hopkins SAIS

What factors have contributed to China's success in mass manufacturing clean energy technologies, and in particular its ability to innovate manufacturing processes in this sector? How could the United States employ similar strategies to support domestic manufacturing of clean energy technologies?

China's rise to dominance in clean energy manufacturing was the result of strategic and aggressive government support for both R&D and manufacturing from both central and subnational governments. No other economy has <u>devoted a similar level of resources</u> to the expansion of production capacity and manufacturing R&D in clean energy sectors central to reducing greenhouse gas emissions.

This has especially been the case since 2006, when the central government began encouraging "indigenous innovation" to reduce dependence on foreign technologies through increased domestic R&D efforts. Efforts further accelerated under President Xi's <u>Made in China 2025</u> <u>initiative</u>, which designated the development of domestic low-carbon emitting technology sectors as a strategic national priority. Such programs offered generous R&D funding to firms, which they in turn used to focus on manufacturing innovation. R&D teams in Chinese clean energy firms resemble those in firms in other parts of the world, but, importantly, frequently focusing on making technologies more manufacturable at lower costs.

The development of these skills was also dependent on support from China's provincial and municipal governments, which brokered <u>bank loans and provided land, facilities, and tax</u> <u>incentives to manufacturers</u> in wind, solar, and battery industries. It is estimated that between 2010 and 2012 alone, <u>wind and solar firms received credit lines</u> of USD 47 billion by Chinese banks; the China Development Bank, one of three state-owned policy banks, reportedly extended USD 29 billion in credit to the 15 largest wind and solar firms. At a time when financial markets and public sector financial institutions in other parts of the world were unwilling to fund large-scale investments in manufacturing, these loans allowed Chinese manufacturers to build the physical plants on which these advanced manufacturing capabilities could be developed, improved, and applied. Many manufacturers were able to fund the construction of so-called Golden Lines, designated manufacturing facilities for research and development efforts on which R&D teams could work without competing with production operations.

To compete with these efforts, the United States could establish a public lending institution to finance clean energy firms that the U.S. financial system has been unwilling to fund. A key reason for the lack of domestic clean tech manufacturing in particular has been the scarcity of capital among clean technology firms. Clean energy <u>startups have struggled</u> to raise <u>sufficient</u> <u>funds</u> to invest in domestic manufacturing capacity, as American financial institutions have

prioritized industrial sectors—including software—that have historically yielded higher and faster returns.

A <u>government-owned lending institution</u> tasked with providing capital to manufacturing businesses in critical industries such as clean energy would address a financing problem that the private sector has been unable to solve. Although the United States has historically led in the development of new technologies as a result of large injections of public and private capital, long investment horizons, large upfront investment costs, and technological risks associated with the commercialization of new technologies have prevented private investors from supporting domestic manufacturing. This is particularly the case for technologies central to reducing greenhouse gas emissions, including renewable energy, batteries, and high-voltage transmission.

While the United States has long been a leader in funding R&D efforts in clean energy sectors, the results of such research must eventually be brought to production, scaled, and deployed. A public lending institution, such as an industrial finance corporation, could help fill gaps in domestic supply chains that have historically not been well supported.

Response from Nikos Tsafos, James R. Schlesinger Chair for Energy and Geopolitics, Center for Strategic and International Studies

Hearing on "China's Energy Plans and Practices" | Thursday, March 17, 2022 Question for the record

Nikos Tsafos James R. Schlesinger Chair for Energy and Geopolitics Center for Strategic and International Studies

What factors have contributed to China's success in mass manufacturing clean energy technologies, and in particular its ability to innovate manufacturing processes in this sector? How could the United States employ similar strategies to support domestic manufacturing of clean energy technologies?

The Chinese success in manufacturing will be hard to replicate. But the United States can support domestic manufacturing for clean energy technologies in several ways. To do, the United States must connect deployment objectives to manufacturing, rather than focus on deployment alone with no regard to supply chains and local manufacturing. The United States should also recognize that domestic manufacturing is not primarily an innovation but a scaling challenge—the U.S. innovation system excels at innovating, but new technologies go overseas to be scaled up. Additional resources for research and development, or even for demonstration, are not enough to solve the country's manufacturing in the following ways.

General purpose tax credits. There are a number of initiatives that have supported or can support clean energy manufacturing. The most prominent general purpose support system was the 48C advanced manufacturing tax credit that passed with the American Recovery and Reinvestment Act of 2009. This credit supported investments in clean energy manufacturing across the board—especially solar, wind, industrial processes and vehicles. Reinstituting such a program would make a lot of sense in building up the domestic manufacturing base.

Broad-based federal financial support. Several loan programs exist to scale up new technologies, with the Loan Program Office at the Department of Energy being the most prominent example. In April 2022, the Export Import of the United States announced its "Made in America" initiative to support domestic manufacturers with an export focus.¹ These programs can help support domestic manufacturers; they should be supported and expanded as needed.

Targeted federal financial support. Alongside general purpose initiatives, there are targeted support systems for technologies or sectors. Examples include the Advanced Technology Vehicles Manufacturing (ATVM) Loan Program, by the Department of Energy, or the proposed Solar Energy Manufacturing for America (SEMA) Act. Such initiatives help U.S. industry innovate and remain competitive. These are the kind of programs that can support domestic manufacturing.

¹ "EXIM Board of Directors Unanimously Approves Make More in America Initiative," Export-Import Bank of the United States Press Release, April 14, 2022, <u>https://www.exim.gov/news/exim-board-directors-unanimously-approves-make-more-america-initiative</u>.

State-level initiatives. States want to create economic opportunities in clean energy. These initiatives are sometimes driven by climate ambition, but they are often rooted in the domestic industrial base of each state, and the opportunities that the state sees in the energy transition.² A number of East Coast states, for example, are looking to create supply chains related to the deployment of offshore wind.³ Other states see opportunities around batteries for electric vehicles and stationary storage.⁴ Federal support could complement such initiatives.

Smart trade policy. Support for domestic manufacturing has often been undercut by imports—and often, those imports are made possible due to government subsidies. This was an acute problem for the solar industry, and it undercut the investments made in the 48C tax credit. The United States did impose tariffs on Chinese solar imports, but Chinese industry merely shifted its imports to Southeast Asia. A more agile trade policy would have responded to this shift. Instead, the U.S. solar industry was largely decimated, requiring a much greater investment at present to support its recovery. A strong domestic manufacturing industry requires a sensible trade policy.

Differentiated support. Tax credits that offer different support for products made in the United States can be a powerful tool for supporting domestic manufacturing, but they can also contravene the rules of the World Trade Organization (except in public procurement, where governments have more discretion for local content provisions). The United States, however, could find other ways to support domestic industry. It could, for example, offer higher tax credits to technologies that the United States has a competitive advantage in (e.g., thin film solar). Or it could write product rules that favor certain manufacturing processes (e.g., solar cells with a lower carbon content in the production process).⁵ These could be powerful tools to target support to industries where the United States has an advantage.

² Morgan Higman, Nikos Tsafos, Stephen J. Naimoli, "State Strategies for Expanding Economic Opportunity in Clean Energy," Center for Strategic and International Studies, December 7, 2021, <u>https://www.csis.org/analysis/state-strategies-expanding-economic-opportunity-clean-energy</u>.

³ Shields, Matt, Ruth Marsh, Jeremy Stefek, Frank Oteri, Ross Gould, Noé Rouxel, Katherine Diaz, Javier Molinero, Abigayle Moser, Courtney Malvik, and Sam Tirone. 2022. The Demand for a Domestic Offshore Wind Energy Supply Chain. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5000-81602, https://www.nrel.gov/docs/fy22osti/81602.pdf.

⁴ Nikos Tsafos and Lachlan Carey, "The United States' Industrial Strategy for the Battery Supply Chain," Center for Strategic and International Studies, December 14, 2021, <u>https://www.csis.org/analysis/united-states-industrial-strategy-battery-supply-chain</u>.

⁵ The United States Needs a Solar Manufacturing Strategy, Center for Strategic and International Studies, August 12, 2021, <u>https://www.csis.org/analysis/united-states-needs-solar-manufacturing-strategy</u>.