Testimony of

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Thank you, Co-Chairs and fellow Commissioners, for the opportunity to offer testimony before this Commission about China's energy policies and their environmental impacts. I am a Fellow at Resources for the Future (RFF), a 56-year-old research institution, headquartered here in Washington, DC, that focuses on energy, environmental, and natural resource issues and I serve as the Co-Director of the Harvard Project on International Climate Agreements.

RFF is both independent and nonpartisan, and shares the results of its economic and policy analyses with members of both parties, environmental and business advocates, academics, members of the press, and interested citizens. RFF neither lobbies nor takes positions on specific legislative or regulatory proposals, although individual researchers are encouraged to express their individual opinions, which may differ from those of other RFF scholars, officers, and directors. The Harvard Project on International Climate Agreements works to help identify key design elements of a scientifically sound, economically rational, and politically pragmatic post-2012 international policy architecture for global climate change. The Harvard Project draws upon leading thinkers from academia, private industry, government, and non-governmental organizations from around the world to construct a small set of promising policy frameworks, and then disseminates and discusses the design elements and frameworks with decision makers. The views I present today are mine alone, and do not reflect the positions of RFF, the Harvard Project on International Climate Agreements, or Harvard University.

The use of energy and its associated environmental impacts in China reflects remarkable economic development over the past three decades. China's economic growth has resulted in per capita income in excess of $5000 (on a purchasing power parity basis) thereby lifting several hundred million people out of poverty since 1978 (UNDP 2005), probably the most successful poverty-reduction program in history. As the country has developed, it has become a major producer of energy-intensive goods. China today manufactures one out of every three tons of steel produced globally, and the Chinese domestic market consumes approximately 90 percent of that production (Houser et al. 2008). The emerging middle class in China drives a rapid increase in automobile ownership, as the Chinese car market now exceeds the German and Japanese markets and will likely pass domestic sales in the United States by 2015 (IEA 2007).

This phenomenal economic growth has required substantial investments in the Chinese energy infrastructure. In the past twenty years, power generation has increased ten-fold, and the rate of growth in installed capacity continues to increase: in 2006 alone, China installed 105 gigawatts of new capacity, 90 percent of which was coal-fired (IEA 2007). The amount of coal-fired generating capacity installed in China in 2006 exceeds more than a quarter of all U.S. coal-fired generating capacity (EIA 2007). China has now become the second largest consumer of petroleum, and third largest net importer in the world. Total energy demand has increased substantially as the economy has expanded, although through two distinct phases in recent years. The energy intensity of economic output declined significantly from 1980 through 2001 – the energy to GDP ratio falling approximately 5 percent per year. This trend reversed over the 2001 to 2005 period, with energy intensity increasing nearly 4 percent per year.

The development in China has brought substantial economic gains, but has adversely affected the local and global environment. The daily discussion of air quality in the lead-up to the Beijing Olympics this month illustrates the seriousness of the pollution problem in China and the growing concern Chinese officials share about the environment. Vice-Minister Pan Yue of the Ministry of Environmental Protection has noted that the "global environmental crisis is most prominently revealed in the contradictions between traditional industrial economic growth and environmental protection" (Yue 2007, p. 10).

While American athletes and tourists may experience first-hand elevated smog levels and concentrations of fine particulates during the Olympics, the most pressing effects of Chinese economic activity on the U.S. (and global) environment result from the emissions of carbon dioxide and other greenhouse gases. I will focus on the impact China has on the global climate through past, current, and forecast greenhouse gas emissions. Then I will discuss the prospects for Chinese participation in international efforts to confront global climate change, with attention to ways to integrate recent domestic policy goals and efforts in China in a global regime.

China's Greenhouse Gas Emissions

Current Emissions

China's rapid development and reliance on coal to power their economy has caused a dramatic increase in carbon dioxide emissions. In 1980, China's carbon dioxide emissions from fossil fuel combustion comprised 8 percent of global emissions. China's share increased to 10 percent by 1990, and advanced to 12 percent by 2000. With the accelerated economic growth in this decade, and the reversal of the trend in improving energy efficiency, China's carbon dioxide emissions have taken off and passed U.S. emissions in 2006. In 2007, China's emissions of 1.83 gigatons of carbon alone comprised 23 percent of global carbon dioxide emissions, and these emissions exceeded U.S. emissions by more than 15 percent in that year (Netherlands Environmental Assessment Agency 2008).

The recent acceleration in China's emissions growth reflects a variety of factors already enumerated above. China's increasing role in international trade has also contributed to the growth in carbon dioxide emissions. The energy- and carbon-intensity of Chinese imports, and their volume, dwarf the emission-intensity of Chinese imports. Chinese scholars have estimated that the embedded energy in net exports exceeded more than a quarter of all energy consumed in 2006 (Jiahua et al. 2007). If the United States accounted for the carbon content of net imports, our emissions could be 10 to 30 percent higher than current estimates (Weber and Matthews 2007), reflecting U.S. specialization in carbon-lean goods for export and imports of carbon-intensive goods. This distinction between the location of where carbon-intensive goods are produced and where they are consumed will likely play a larger role in the design of domestic and international climate policy.

Historic Contribution to Emissions

Climate change does not reflect the flow of emissions in any one year, however; it is the product of the accumulation of greenhouse gases that reside in the atmosphere for hundreds to thousands of years. Many developing countries have pointed to the historic contribution of wealthier countries that achieved their development during the 19th and 20th centuries as a result of burning fossil fuels as a leading rationale for why the developed countries should take the lead in mitigating climate change. Recent analysis of greenhouse gas emissions across the world dating back to 1890 casts some light on this issue. When accounting for all sources of greenhouse gas emissions, the industrialized countries classified as Annex I under the Framework Convention on Climate Change are responsible for 54 percent of the atmospheric accumulation of greenhouse gases and all non-Annex I countries are responsible for the remaining 46 percent (Muller et al. 2007).[1] While nearly one out of five tons of greenhouse gases in the atmosphere reflects economic activity in the United States, China is second in terms of its contribution at 11 percent of the global share. While these historic contributions on a per capita basis differ substantially between developed and developing countries, they show how the damages from climate change – which depend on the accumulation of gross, not per capita, emissions – exist as a by-product of economic activity in a number of large economies in both the industrialized and developing world.

Per Capita Emissions

Developing countries, including China, have focused on the significant variation in per capita emissions around the world. During the 1997 Kyoto Conference, a Chinese negotiator reportedly said "In the developed world, only two people ride in a car, and yet you want us to give up riding on a bus" (Climate Action Network 1997). In 1980, carbon dioxide emissions per capita in the United States exceeded China's per capita level 14 times over. By 1990, the average American was associated with ten times as much

[1] All Annex I countries except for Turkey and Belarus have legally-binding quantitative emission targets inscribed in Annex B of the Kyoto Protocol.

carbon dioxide emissions as the average Chinese. By 2005, this ratio had declined to less than five times, and if China's emissions continue to grow fast, per capita emissions will converge quickly.

Forecasting Emissions

Will China's emissions continue to grow fast? Export forecasters at the Energy Information Administration and the International Energy Agency did not anticipate China's rapid increase in carbon dioxide emissions. In 2000, the EIA forecast China's 2010 carbon dioxide emissions to be 1.15 gigatons of carbon and the IEA forecast China's emissions to be 1.32 gigatons of carbon in that year. China passed the EIA forecast in 2003 and the IEA forecast in 2004. The Intergovernmental Panel on Climate Change effort in 2000 to forecast long-term global emissions did not anticipate the fast growth of emissions in China or globally this decade. The IPCC published 40 emissions scenarios through 2100, but they all appear to have underestimated emissions through the first decade of this century: realized 2006 global emissions exceeded even the worst-case scenario (Canadell et al. 2008), largely reflecting the growth in China. It is important to note that even if China's emissions grow at the slower rates previously forecast by the IPCC, IEA, and EIA, they would now grow from a much higher base than initial expected. For example, the *Stern Review on the Economics of Climate Change* employed the IPCC's A2 emissions scenario to forecast the long-term damages from climate change. If we use the A2 scenario's long-term emission growth rate, but grow global emissions from the realized 2006 level (instead of the 1990 level in the IPCC work), then global carbon dioxide emissions would be some 40 percent higher in 2100 than assumed in the *Stern Review*. Forecasting emissions, especially for a country like China, is very difficult, but can have very serious implications for our long-term assessments of climate change.

Several recent analyses have provided emission forecasts for China that account for the most recent experience in the Chinese energy-economy. Researchers at the University of California evaluated historic provincial-level carbon dioxide emission data to forecast exceptionally rapid emissions growth in China (Auffhammer and Carson 2008). Extrapolating their 2010 forecast growth for China to 2012, the close of the Kyoto Protocol commitment period, shows that Chinese emissions could grow to as much as 3.32 gigatons of carbon. Or drawing from a much simpler analysis, if China's emissions grow as fast over the next five years as they did over the past five years, then they will effectively reach this same forecast level in 2012. To put this figure in context, the Energy Information Administration (2008) forecasts U.S. 2012 fossil fuel carbon dioxide emissions to be 1.68 gigatons of carbon, or almost exactly half of China's emissions in 2012! If China's emissions grow this fast, then its per capita carbon dioxide emissions will exceed the current per capita levels of 15 Annex I nations and be roughly on par with much of Western Europe by 2012.

The variation in forecasts of China's carbon dioxide emissions is represented well by Figure 1, drawn from recent work by Blanford, Richels, and Rutherford. The lower shaded section shows the slower growth forecasts from the International Energy Agency

and by the modeling teams participating in the 2006-7 scenarios work under the purview of the U.S. Climate Change Science Program (CCSP). The higher shaded section demonstrates the much faster growth expected in the MERGE model, one of the models that participated in the U.S. CCSP exercise, with its updated assessment of Chinese growth and energy system. In the highest growth case in their model, China's emissions in 2030 could be triple current U.S. emissions.

The prospect of such growth in carbon dioxide emissions in China raises critical questions for the effort to tackle global climate change. A number of scientists have raised concerns about atmospheric concentrations of greenhouse gases exceeding 450 parts per million (and even recently expressed concerns about going beyond 350 parts per million). The current concentration is about 385 parts per million carbon dioxide, and when accounting for all greenhouse gases, the atmospheric concentration is roughly equivalent to 450 parts per million. This suggests that long-term goals to stabilize the atmosphere at these levels may not be feasible without dramatic action. If emissions in China do not slow soon and reverse and if emissions in the United States do not slow and reverse soon, then we will effectively close the doors on some of the policy goals advocated by some in the scientific and policy communities.

The Potential Role for China in International Climate Policy

Graduation

In 1992 at the Earth Summit in Rio de Janeiro, the UN Framework Convention on Climate Change effectively divided the world into two: Annex I countries – the industrialized nations in the OECD and much of the former Soviet bloc – and Non-Annex I countries – everybody else. Much has changed since then, and the emergence of some countries, including China, suggests the need to re-evaluate the division of effort under international climate policy and find ways to "graduate" emerging economies into taking more effort to mitigate climate change. China's current per capita income exceeds that of several Annex I countries at the time they signed the Framework Convention on Climate Change. If China's emissions grow as the same rate as they have over the past five years, then their per capita emissions will be on par with the median country with target under the Kyoto Protocol in 2012. China has the second largest economy in the world and has made substantial investments in human capital to indicate that it has the resources to alter the carbon-intensity of its development.

This is not to say that China should take on emission targets like Annex I countries, but to note that China and some other emerging economies have the means to do more and should not necessarily be lumped in with the least developed countries. The Government of Bangladesh recently framed this issue well:

> "At the same time while the differing national circumstances between developed and developing countries have been acknowledged in Article 1(a), it must be acknowledged that similar vast differences exist between many of the developing countries, particularly the large ones among them

> and the Least Developed Countries (LDCs). Such large developing countries with large economies and resource and institutional capability to take mitigation, adaptation and technology-related actions can not and should not be equated with those of LDCs even when all nations are required to lower GHG emission" (UNFCCC. Views Regarding the Work Programme of the Ad Hoc Working Group on Long-Term Cooperative Action under the Convention, March 3, 2008).

What Is China Doing Now?

Some may infer that China is not doing much to combat climate change as evidenced by its recent run-up in carbon dioxide emissions and lack of quantitative emission commitment under the Kyoto Protocol. China has set goals and begun to pursue policies that can lower its carbon dioxide emissions. The most recent five-year plan set an ambitious goal of lowering the energy intensity of economic output by 20 percent over five years. While the first several years showed an increasing energy intensity of output, preliminary data for 2007 suggest that China may have reversed the trend again with a modest improvement. China's National Climate Change Programme also calls for a variety of actions, from promoting more small-scale hydropower in western regions to coalbed methane capture to producing biofuels (NDRC 2007). The Programme calls for expanding reforestation efforts to increase forest coverage to 20 percent of land mass, thereby increasing biological sequestration of carbon. In total, China estimates that these efforts would lower emissions by 300 million tons of carbon by 2010.

China has also actively participated in the Clean Development Mechanism (CDM) under the Kyoto Protocol. The CDM allows for the industrialized countries with emission targets under Kyoto to meet their commitments in part by financing projects that lower greenhouse gas emissions in developing countries. China hosts more than twenty percent of all registered CDM projects, but these tend to be larger than average projects since China is expected to generate more than half of all certified emission reduction credits under the CDM.[2]

What Can China Do in an International Climate Policy Regime?

China is not a developed country, like the United States and members of the European Union, so international commitments appropriate for the wealthiest economies in the world may not be appropriate for China. China is not like many developing countries, as noted by the Government of Bangladesh, and so it may be appropriate to ask China to do more than the least developed countries of the world. This suggests that the international climate policy regime should become more flexible to incorporate efforts and

[2] Refer to http://cdm.unfccc.int/Statistics/Registration/AmountOfReductRegisteredProjPieChart.html and http://cdm.unfccc.int/Statistics/Registration/NumOfRegisteredProjByHostPartiesPieChart.html for more information.

commitments by emerging economies that may differ from those taken in the Kyoto Protocol.

Commitments do not have to be quantitative emission targets. Given the poor track record in forecasting Chinese carbon dioxide emissions and the fast but potentially volatile growth in emissions expected under continued economic development, it does not seem plausible that China could reasonably negotiate a quantitative cap on its emissions with the rest of the world. Instead, China should focus on policies and measures that can lower the carbon-intensity of its development. Only after further economic growth, institutional development, and experience with mitigation policies, would it be practical to consider an emissions cap for China.

The policy commitments China could undertake should start with what China has already started to do under its National Climate Change Programme. This is consistent with some notions of so-called "pledge and review" approaches to international climate policy (e.g., Pizer 2007). China's experience with the Clean Development Mechanism suggests that many more opportunities exist for low-cost mitigation. Several policies could help drive substantial, low cost emission abatement. First, China can continue and accelerate the reform of subsidies in the consumption of energy. China's energy subsidies amounted to about $11 billion in 2006 (IEA 2007), but may be much higher this year as the Government of China has subsidized petrol during the run-up in crude oil prices (although the government did allow petrol prices to increase recently). Reducing subsidies can free up fiscal resources to address other important social objectives, promote more efficient allocation of private sector resources, facilitate energy security by reducing demand for fuels for which China is a net importer, and lower carbon dioxide emissions.

Second, China could implement a carbon tax. This could provide the incentive for households and firms to invest in more energy-efficient and carbon-lean technologies. The revenues could also benefit the government as it attempts to finance more research and development, and consider ways to address the concerns of the lowest-income citizens who would face higher energy prices. These ideas constitute rational economic policy to address the environment, and they may have some salience among environmental leaders in China. Vice-Minister Pan Yue of the Ministry for Environmental Protection has called for both policy instruments: "By introducing environmental tax, we can achieve the 'triple win' of revenue increases, environmental protection, and fairness in society. …As the first step, eliminate subsidies and preferential taxation policies not in favor of environmental protection" (Yue 2007, p. 329). The Vice-Minister has suggested that after further research on environmental taxation, China will "design various carbon tax policies in due course" (Yue 2007, p. 330).

This fiscal instrument approach to climate change may make more sense in China than it would here or in other developed countries. First, China has institutional experience with subsidy reform and taxation, but very little experience in the design of environmental policy instruments for carbon dioxide emissions, like emission cap-and-trade favored by

many in the United States. Second, a carbon tax and subsidy reform also takes advantage of the strength of the leading ministries in Beijing, including the Ministry of Finance and the National Development and Reform Commission. Third, this may also play to the interests of those in Beijing who would like to re-assert more control over the provinces. Centralized tax policy provides a better way to do this than cap-and-trade (Yue 2007).

From the U.S. perspective, Chinese efforts to step forward in the international community and commit to policies that will mitigate their emissions will deliver several important benefits. First, these policies will lower Chinese carbon dioxide emissions and help address the risks posed by climate change. Second, policies that remove subsidies and impose taxes on the carbon content of fuel will minimize the potential incentive that American firms may face to relocate their manufacturing activities to China. This will ensure the level playing field as the United States moves forward with its domestic emission mitigation efforts. Third, this leadership by China will show other emerging economies how they can contribute to the global effort to confront climate change. Finally, taking serious efforts to mitigate carbon dioxide emissions in the United States and China can complement other opportunities for cooperation. This could include coordinated research and development on carbon capture and storage technologies, which could ensure that both countries could continue to use their vast coal resources while sequestering the associated carbon dioxide emissions underground.

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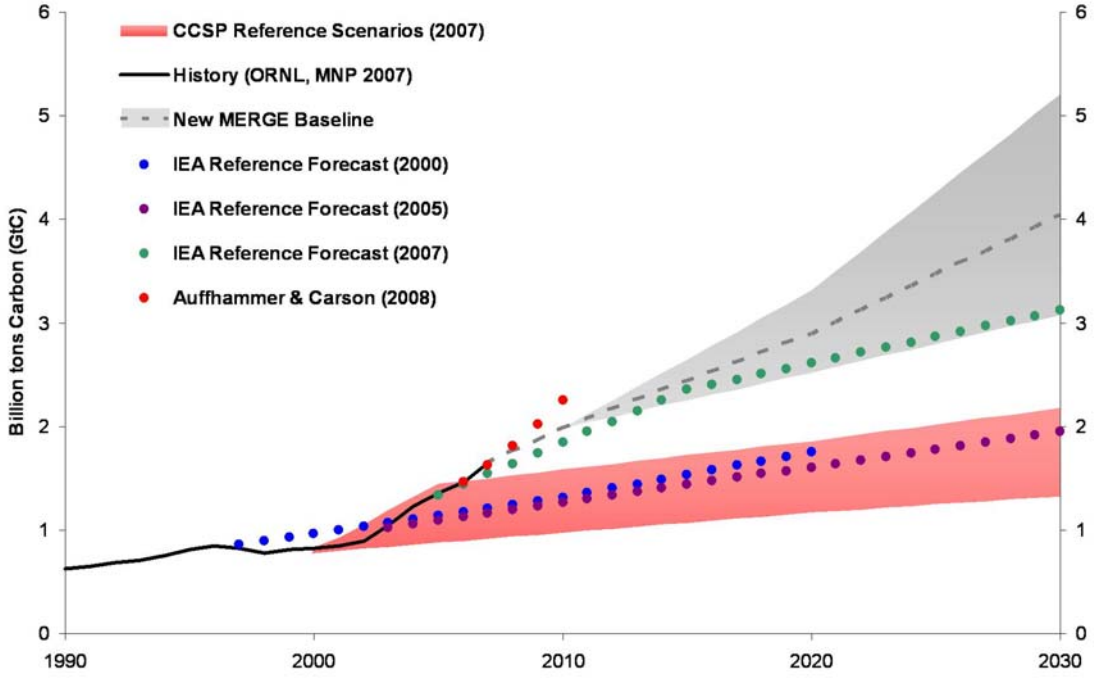
Figure 1. Fossil Fuel Carbon Dioxide Emissions, China, 1990-2030



Source: Blanford et al. 2008.