WRI POLICY BRIEF

WORLD RESOURCES INSTITUTE

China, the United States, and the Climate Change Challenge

DEBORAH SELIGSOHN, ROBERT HEILMAYR, XIAOMEI TAN, LUTZ WEISCHER

EXECUTIVE SUMMARY

As the two largest current global emitters of greenhouse gases (GHGs), it is imperative that the United States and China work together to support effective domestic energy and climate change programs and an effective international climate regime. As China's domestic energy policy has transformed over the last several years to incorporate climate-friendly goals – increased energy efficiency and a greater contribution of non-fossil fuels to its energy mix – this opportunity is already becoming a reality, especially as the United States advances comprehensive climate policy.

This report discusses the successes and challenges to effective regulation in China, outlining the major advances made in implementing effective energy efficiency programs in the past several years. These include targeted programs for both large and small enterprises, specific goals for government officials, and the development of energy statistics infrastructure. It also addresses U.S. competitiveness concerns in relation to the introduction of U.S. cap-and-trade policies, and specific opportunities for enhanced climate change cooperation between the two countries.

China's Energy and Climate Policy

China's energy and climate change policy is based on its own assessment of national interest as outlined both in its 2007 National Climate Change Program and 2008 Climate Change White Paper. China's climate policy meshes with concerns about energy security, pollution abatement and the cost of energy itself, as well as the impacts of climate change and China's international reputation.

Section 1 of *China, the United States and the Climate Change Challenge*, outlines China's National Climate Change Program, the key components of which are:

- Reducing energy intensity per unit GDP by 20 percent between 2006 and the end of 2010,
- Increasing non-fossil fuel-based and renewable energy to 15 percent of the energy mix by 2020, and
- Increasing total forest cover in China to 20 percent by the end of 2010.

China's approach is diverse and includes targets and quotas, industrial and equipment standards, energy taxes and financial incentives and penalties. While China has gained some experience with carbon markets through the Clean Development Mechanism (an offset mechanism under the Kyoto Protocol), given China's institutional strength, as demonstrated by other policies, the country will likely use a variety of tools to continue to implement its climate change policy. Although these policies may not provide the environmental certainty of a cap-and-trade system, they can drive emissions reductions and may be more suited to the current development of China's financial markets and enforcement infrastructure.

U.S.-China Competitiveness Concerns and Cooperation Opportunities

This brief addresses the concern in the United States about potential transfer of carbon-intensive jobs to China. While a carbon cost will not be a major factor in most sectors in the United States, some sectors could be affected. However, this concern can be addressed through adjustments to the United States' domestic allowance system under cap-and-trade legislation, by coordinated action under an international agreement, or by trade measures. Trade measures are unlikely to be an attractive option as they increase costs for downstream users, threaten export markets and potentially damage international negotiations.

Comprehensive U.S. climate legislation could spur further improvements in China's climate change programs and policies. Creating incentives in the United States for clean technologies will help drive down the prices of these technologies, making them much easier for China and other major emitters to adopt. The United States can also collaborate with China in areas ranging from research and development to enforcement infrastructure to help China move its own policies forward. Finally, U.S. legislation can encourage China to do more as it positions itself as a global leader.

10 G Street, NE Washington, DC 20002
Tel: 202-729-7600 Fax: 202-729-7610

www.wri.org

OCTOBER 2009

This brief outlines a number of bilateral and multilateral venues for enhanced cooperation. In the bilateral sphere, the new U.S.-China Memorandum of Understanding to Enhance Cooperation on Climate Change, Energy and the Environment, signed at the first meeting of the revamped Strategic and Economic Dialogue (S&ED) in Washington, D.C. in July 2009, provides a coherent framework for this cooperation.[1] The new MOU incorporates the Ten Year Energy and Environment Framework developed under the previous U.S. presidential administration, provides a framework for cooperative projects and creates a new coordinating committee for both countries' energy and environment agencies. The challenge will be to follow through on coordination and delineate clear goals and timetables. Many of the structures set up under the previous U.S. administration, not just bilaterally, but also multi-laterally, such as the Asia Pacific Partnership (APP) for Clean Development and Climate and the Major Economies Forum (MEF) have real potential to bring together key players, but they need more sharply defined goals and missions, and the United States will need to clarify funding. All of these programs can support domestic policies in each country as well as both countries' efforts to reach a global agreement at Copenhagen in December.

INTRODUCTION

Congressional debate about climate action in the United States often elicits questions about China's domestic and international climate commitments. China's total annual greenhouse gas (GHG) emissions have now surpassed those of the United States,[2] leaving U.S. policymakers to question the impact of passing legislation at home in the face of perceived reluctance to act in China. Congress has also debated the impact of climate policy on U.S. industry and competitiveness if it enacts domestic limits to emissions and China does not.

Together the United States and China account for almost 40 percent of total global emissions. Thus, despite great differences in both historical and per capita emissions, actions by both countries are essential to stabilizing and reducing emissions over the next 40 years.

In fact, China is on a trajectory of change. China's current climate policy, as outlined in its June 2007 China's National Climate Change Program and then presented internationally in its October 2008 White Paper *China's Policies and Actions for Addressing Climate Change*, is real and significant. If successful, it will substantially slow the growth in China's energy use and GHG emissions. This will be achieved through changes in energy policy as well as through long-standing reforestation policy.

Today, each Chinese citizen produces only one fifth the GHG emissions of an average American consumer, and China still has many unmet energy needs (See Figure 1). Most Chinese have a much lower standard of living than the average American. Half the Chinese population has no access to winter heating, and most have limited access to motorized transportation.[3] Therefore, the challenge for China in the short term is to reduce the rate of growth of its GHG emissions as it strives to meet the growing energy demands of its people. In the mid- to long-term, China must take advantage of the policy and technological changes that increased wealth offer to further climate change mitigation.

China and the United States face a common challenge related to their primary source of energy – coal. With development pressures strong and coal resources plentiful, the challenge for China to shift to non-fossil fuel energy sources is significant. With international capacity and policy support and focused national policy, China can develop more efficiently and add a greater variety of non-carbon sources. This would enable it to avoid the trajectory that has led to a high level of per capita emissions in the United States today.

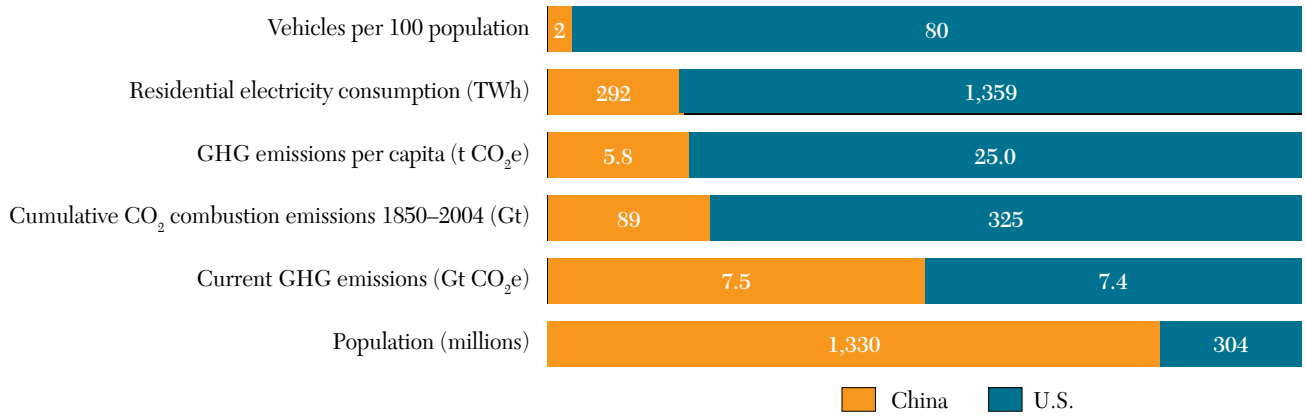
This brief outlines and discusses the actions and policies that China is taking to address climate change. (Section 1). The authors then explain why a cap-and-trade program may be a policy option for China in the future but may not be the first climate policy it chooses to enact. In looking at the programs China can implement the authors address China's current technical capacity and its program implementation strengths and weaknesses, including the ability to monitor and report its outcomes both domestically and within an international agreement. The paper then turns to competitiveness concerns (Section 3) and outlines how the United States can move forward with its own climate program while ensuring climate policy does not adversely affect the trade competitiveness of domestic industry. Finally, the authors examine steps the United States can take to promote swifter progress in China (Section 4) and conclude with the specific mechanisms available for U.S.-China engagement on climate change (Section 5).

SECTION ONE

What action is China taking on climate change?

In the past five years, Chinese leaders have embraced policies to reduce the rate of increase in China's energy demand for a variety of reasons.[4] China has recognized that reducing the amount of energy used per unit of GDP (the concept known as energy intensity) and broadening the range of energy sources to include more renewable and nuclear energy improves energy

Figure 1 **Comparison of Chinese and U.S. Energy Statistics**



Source: Data Sources: CIA Factbook, IEA CO_2 Emissions Report, WRI CAIT, IEA World Energy Statistics, http://www1.eere.energy.gov/vehiclesandfuels/facts/2007_fcvt_fotw474.html

security and local air quality. The Chinese government, along with its leading industrialists and scientists, also believes in a green economic future.[5] They recognize that the world is adopting new energy sources and technologies, and they want to compete in this new energy market. The government has recognized that reductions in fossil fuel combustion can improve China's currently strained ecosystem services by reducing air and water pollution. While there have been significant improvements in air pollution levels, particularly in the past three years, the size of the challenge is enormous with levels still well above U.S. national standards.[6] Its long-standing reforestation efforts,[7] originally designed to improve soil and water quality,[8] also contribute to reducing China's net carbon dioxide emissions.

Chinese leaders now speak openly about the significant risks China faces from the physical impacts of climate change. These include the potential flooding of coastal cities, changes in rainfall patterns that may strain already scarce water resources, costly climate events such as typhoons, and temperature change that could impact millions of people.[9]

China is also interested in protecting its global image by taking action.[10] President Hu Jintao has listed climate change as one of the areas where China must engage with the world community as part of his "peaceful development" approach to international relations.[11] China has previously responded to international public opinion in addressing global environmental protection. For example, when an international consensus on reducing ozone-depleting substances was reached, Beijing responded with policies and programs commended by the United Nations Environment Program.[12]

Since nearly three quarters of China's GHG emissions result from the combustion of fossil fuels for energy (see Figure 2), the new energy policies will have a profound impact on China's contribution to global warming. While China has traditionally avoided policies that explicitly target GHG emissions, its energy and forestry programs have provided the framework for its National Climate Change Program (See Box 1). In addition, the government has recently shown a growing willingness

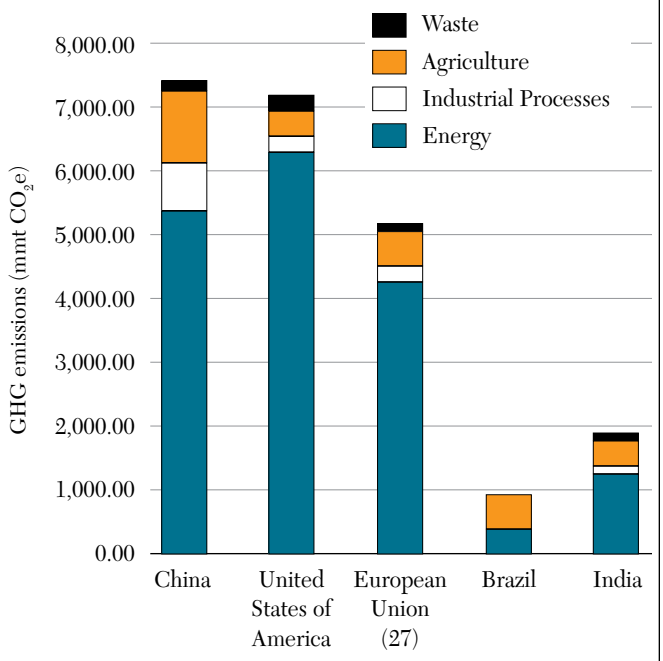
Box 1 **China's National Climate Change Program**

China's National Climate Change Action Program, published in June 2007, provides for three major mitigation efforts that, in combination, reduce greenhouse gas emissions:

- Reducing the energy intensity of GDP by 20 percent over the five years 2006 through the end of 2010.
- Increasing alternative energy in the fuel mix to 15 percent by 2020.
- Increasing forest cover to 20 percent of China's land mass by the end of 2010.

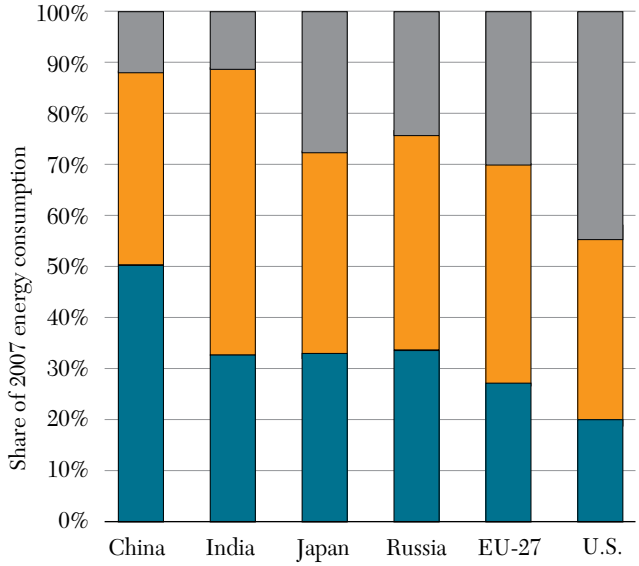
The national program is more than a mitigation program. It also contains support for climate science and for preparedness and adaptation. China's scientists have been active in the global effort to understand climate change and are increasingly involved in developing technical approaches to both mitigation and adaptation.

Figure 2 International Comparison of GHG Emissions by Sector, 2005

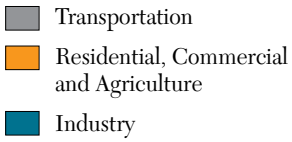


Source: Climate Analysis Indicators Tool (CAIT) Version 6.0. (Washington, DC: World Resources Institute, 2009). Note: Industrial processes refers to GHGs emitted by various industrial processes (chemical reactions). Industrial energy use is included in the energy figure.

Figure 3 Energy Consumption by Sector



Source: IEA World Energy Balances 2009.



to target greenhouse gases directly. On World Environment Day in June 2009, China's Premier Wen Jiabao announced that China would include some form of GHG emissions goals in its 12th five year plan.[13] While there have been few details released on the structure of the goals, National Development and Reform Commission (NDRC) officials have indicated that they will cover all major GHGs.[14]

In seeking to control the increase in energy consumption, the government has set two key policy targets: to reduce national energy intensity by 20 percent by the end of 2010 and to increase renewable energy as part of the national energy mix to 15 percent by 2020. Both of these goals, which contribute to controlling GHG emissions, are ambitious by global standards, especially for a developing country, and China has enacted special policies to put it on track to meet these goals. These policies include some of the same mechanisms used in the United States including energy efficiency standards, building codes and renewable portfolio standards as well as unique policy tools such as performance targets, quotas, and taxes.

Policy Goal #1: Reduce National Energy Intensity by 20 percent by 2011

Concerns about energy security and environmental protection inspired the Chinese government to put a clear and ambitious 20 percent energy intensity reduction goal in the 11th Five Year Plan. The program covers a broad range of efficiency measures in industry, buildings and transportation and has been gaining in effectiveness as the commission and related ministries have developed the regulations, targets and guidelines that push implementation at the local level and in specific industries. China's National Development and Reform Commission (NDRC) has been charged with implementing the energy intensity goal.

The program has been operational for three years. In 2008, China reduced its national energy intensity by 4.59 percent, up from 4.04 percent in 2007,[15] and 1.79 percent in 2006.[16] China thus appears to be approximately on target to make the 20 percent goal by the end of 2010. The figure for the first half of 2009 suggests continuing progress as China's energy intensity improved by 3.35 percent.[17]

Box 2

Will China Be Able to Enforce Its Goals?

The Chinese government's ability to enforce policies, laws and regulations varies considerably, depending both on the complexity of the task and the political commitment to effective enforcement. In some areas, such as the tracking of infectious disease cases, there has been considerable improvement in the past six years as the government absorbed the lessons of the 2003 SARS crisis. It implemented a new national disease detection and reporting system and greatly increased transparency. Cases of infectious disease such as human avian influenza are now reported rapidly to the world.[1] In other areas, such as food safety, where effective enforcement requires monitoring of a complex and dispersed system of small producers, the Chinese government clearly has much work to do.[2] Energy and environment is an area in which there has been significant change over the past five years, beginning with the enunciation of clear goals in the 2006-2010 five year plan, the elevation of the environmental function to ministerial status and the creation of a national energy agency. With the 11th five year plan came new data reporting requirements, and the National Bureau of Statistics (NBS) and the National Development and Reform Commission (NDRC) were tasked with collecting and analyzing the data.

The energy intensity performance requirements were strengthened significantly in early 2007 when President Hu Jintao publicly made energy efficiency one of the government's highest priorities and China's State Council directed industries and provinces to report energy use data semi-annually. This is an uncommonly high level of reporting, and it enables the central government to track performance closely. This 2007 policy shift also created a new standard of accountability; China made the energy efficiency targets a "political goal," which means that individual officials' performance is evaluated and promotions are made in part on successful progress toward achieving targets.

Energy data is relatively easy to track, as China has a limited number of import points for oil and natural gas and production areas for coal. Confidence in this data will be strengthened over time due to a number of simultaneous actions:

1. The Chinese government is engaged in a major effort to improve both the quality and transparency of its data collection effort. Key moves include: criminal sanctions for government officials who misreport data; and the issuing of major economic indicators at newly established monthly National Bureau of Statistics press conferences, where journalists will be able to ask questions about these indicators.[3]
2. The Chinese government collects data from both industries and provinces, so the data can be cross-checked.
3. In addition to supply and usage data, the Chinese government also collects shipment and customs data. Almost all fuel travels by either ship or train, and thus can be monitored on the state-run rail system or when it arrives at an international seaport.
4. Smaller coal mines and power plants are being shut down: the government has been actively closing smaller mines for safety reasons and, as discussed below, smaller power plants and heavy industrial facilities to increase energy efficiency and pollution abatement.[4]
5. Renewable energy is generally attached to the national electric grid, and power generation companies have incentives to build and report facilities.

Thus, energy policy enforcement is relatively straightforward even in comparison to other environmental areas where multiple parameters need to be monitored and controlled. Moreover, unlike air quality, food safety or other regulations where local businesses save money by evading enforcement, NDRC's energy efficiency interests are aligned with those of the major firms – saving energy saves money even if it requires some firms to make institutional changes. Finally, the impacts of energy savings and GHG reductions are cumulative and occur regardless of the distribution of the reductions – if most of China's savings are among large companies rather than among smaller firms in the near to medium term, the program can still succeed as a whole. This contrasts with pollution and health risks, where the smallest players are both the most difficult to control and can cause the greatest harm. In energy efficiency, large players contribute more to the solution.

Notes

1. For a description of how the Chinese public health system has developed over the past 5 years, please see Longde Wang, et al, "Emergence and control of infectious diseases in China," The Lancet, Volume 372, Issue 9649, Pages 1598 - 1605, 1 November 2008: http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(08)61365-3/abstract
2. See Gordon Fairclough, "UN Criticizes China on Food Safety, Wall Street Journal, October 23, 2008: http://online.wsj.com/article/SB122470185058359197.html?mod=googlenews_wsj
3. Andrew Batson, "China's Stats Bureau Boosts Transparency," http://blogs.wsj.com/chinajournal/2009/08/10/chinas-stats-bureau-boosts-transparency/, August 10, 2009.
4. See WRI, Tsinghua "Discussion Paper: Mitigation Actions in China: Measurement, Reporting and Verification," May 2008, for the schedule of closures issued by the National Development and Reform Commission.

Improvements in industrial efficiency have been the major contributors to these energy intensity improvements, but China has also implemented important policy changes for buildings and transportation, smaller but growing parts of the economy and of energy use. As shown in Figure 3 below, China's energy mix is unusually tilted toward industrial uses, and thus improvements in the industrial sector have large overall impacts.

Box 3 **China's Climate Change Leading Group**

One sign of China's growing seriousness in implementing climate change policy is the 2007 formation of a high-level body led by Premier Wen Jiabao to formulate climate policy and coordinate implementation.[1] This group replaced one led by the Chairman of the National Development and Reform Commission (NDRC). In addition to Premier Wen, it has two Vice Chairs at the level of State Council (China's governing body), and 20 ministerial members. In China, inter-ministerial coordination is only effective when it is centered in the State Council. Ministries typically do not coordinate well if they are expected to report directly to other ministries. This is especially true for environmental and social issues, where priority is being substantially elevated and local officials need to learn new approaches. For example, effective management of HIV/AIDS programs and an infusion of funds took place when the State Council Working Group was created in 2004.[2]

At the same time the NDRC set up a climate change department to support both domestic climate change policy and its participation in international relations and greatly increased its staffing above the level of the previous office.[3]

The members of the National Climate Change Leading Group:[4]

Chairman:	Premier Wen Jiabao
Vice Chairman:	Principal Vice Premier Li Keqiang
	State Counselor Dai Binguo
Members:	Deputy Secretary-General of the State Council You Quan
	Foreign Minister Yang Jiechi
	National Development and Reform Commission Chairman Zhang Ping
	Minister of Science and Technology Wan Gang
	Minister of Information Industry Li Yizhong
	Finance Minister Xie Xuren
	Minister of Land and Resources Xu Shaoshi
	Minister of Environmental Protection Zhou Shengxian
Members *(cont)*	Minister of Housing and Urban and Rural Construction Jiang Weixin
	Minister of Transport Li Shenglin
	Minister of Water Resources Chen Lei
	Minister of Agriculture Sun Zhengcai
	Minister of Commerce Chen Deming
	Minister of Health Chen Zhu
	National Bureau of Statistics Administrator Xie Fuzhan
	State Forestry Administrator Jia Zhibang
	President, Chinese Academy of Sciences, Bai Chunli
	China Meteorological Administrator Zheng Guoguang
	National Energy Administrator Zhang Guobao
	China Civil Aviation Administrator Li Jiaxian
	State Oceanic Administrator Sun Zhihui
	NDRC Vice Chairman Xie Zhenhua

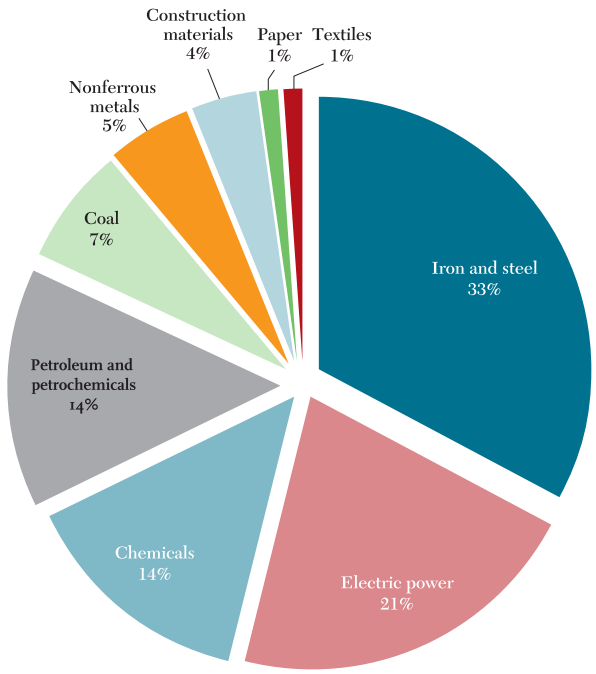
Notes

1. Joanna I. Lewis, "China's Strategic Priorities in International Climate, Negotiations," *The Washington Quarterly*, Winter 07/08, pp. 158-159.
2. Fujie Zhang, et al, "Initiation of the National Free Antiretroviral Program in Rural China," in Kaufman at al, eds., AIDS and Social Policy in China, Harvard University Press, 2006, p. 100. http://www.fas.harvard.edu/~asiactr/publications/pdfs/ AIDS%20volume%20complete.pdf
3. China's White Paper on Climate Change, "Policies and Actions for Addressing Climate Change," http://www.ccchina.gov.cn/WebSite/CCChina/UpFile/File419.pdf, sites the importance of this group on p. 51.
4. The members of the group are listed on the Climate Change Department's website: http://www.ccchina.gov.cn/cn/Column.asp?NewsId=5474

1. Improving Industrial Efficiency

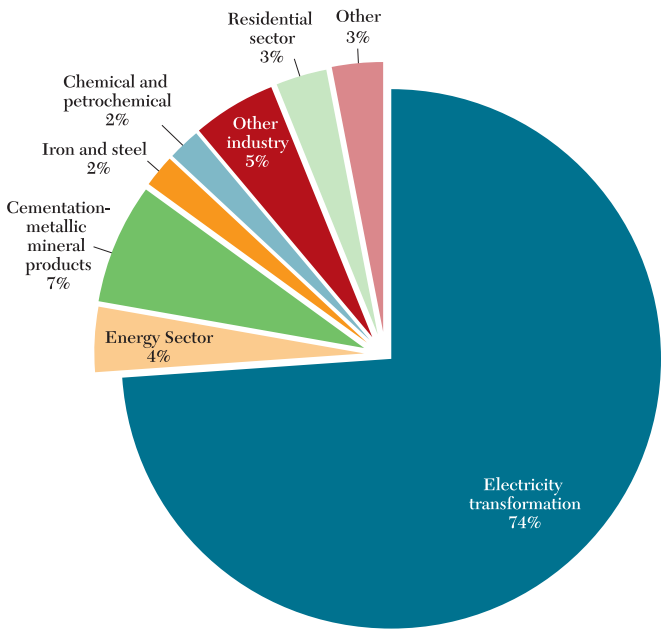
NDRC's "Top 1,000 Enterprises Program" is central to its efforts to reduce energy intensity by 20 percent.[18] Established in its current form in 2006, this program imposes a significant portion of the overall 20 percent energy intensity target directly on China's 1,000 largest state-owned enterprises, most of which are in heavy industry (see Figure 4). In 2005 the enterprises in the program accounted for at least 33 percent of total primary energy demand and 47 percent of industrial energy demand. The program met its goals in the first year, achieving the full 20 percent of its five-year target and actually exceeded its targets in 2007.[19] A team from the Lawrence Berkeley National Laboratory (LBNL) in the United States analyzed the program, finding that its effectiveness has been based on implementation of targeted efficiency measures in these firms. Specific targets were set for the individual companies, which are then required to develop energy efficiency action plans outlining how they will meet the targets.[20]Two keys to success were the deployment of a national government monitoring system and firm-level requirements to create "energy manager" positions in regulated companies. The LBNL team calculated that the program's five year target of 100 million metric tons coal equivalent (MTCE) is equal to about 250 million metric tons of CO_2.

Figure 4 1000 Enterprises' Energy Consumption by Sector, 2006



Source: NDRC and NBS, 2007.

Figure 5 Chinese Coal Use by Sector, 2006



Source: International Energy Agency, World Energy Statistics, 2008.

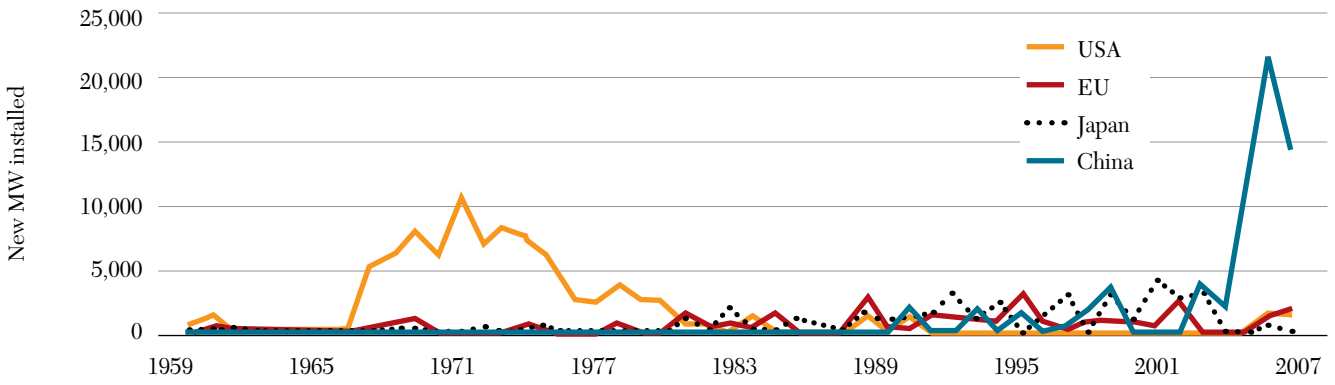
While systematically improving efficiency of the largest energy users, the government is also implementing large-scale closures of inefficient facilities. The number of closures has been significant: in 2007 China closed 1000 cement plants with a total of 50 million tons capacity, 14.4 GW worth of small power plants, and plants producing 35 metric tons of steel production.[21] Plant closures reduce energy consumption and send a strong signal to other plants to improve efficiency.

This approach, combined with a variety of more industry-specific regulations, is paying off. China's Energy Research Institute reports that energy use per unit output dropped by 7.1 percent in 2006 and 1.3 percent in 2007 for steel, by 7.3 percent in the cement industry, 4.7 percent in papermaking and 11.5 percent in the coal industry in 2007.[22] These results are essential to China's progress in reducing greenhouse gas emissions. Industrial energy use constitutes a much greater percentage of China's total energy use than most countries, both developed *and* developing.

Power Sector Improvements

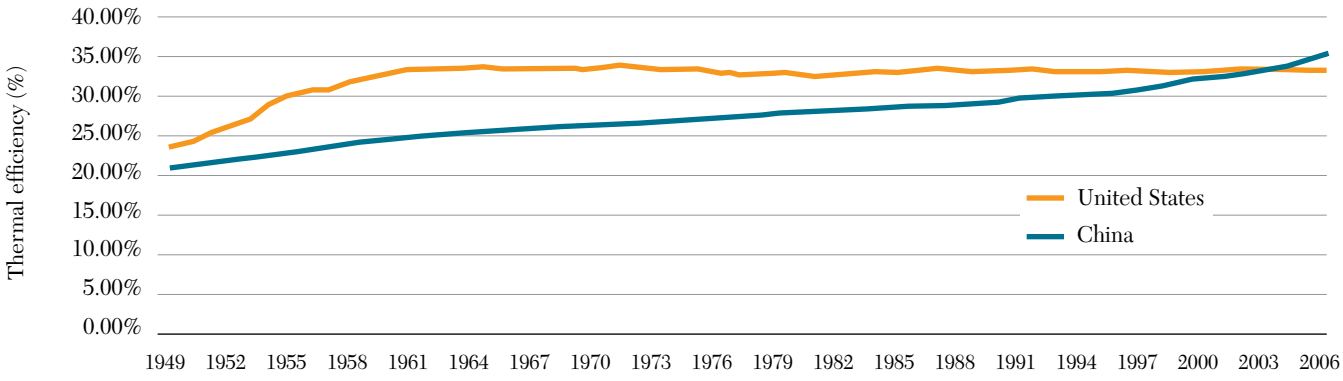
Over 50 percent of all China's coal is used in the electric power industry. This electricity powers mainly industry but also households and the service sector. (See Figure 5). Improving energy efficiency and reducing carbon intensity in the power sector have been major goals for the Chinese government. Last year the NDRC adopted a standard requiring all new coal-fired power plants to be state-of-the-art commercially available or better technology. As a result, today most of the world's most efficient coal-fired power plants are being built in China (See Figures 6 and 7).[23] This trend contrasts with the United States, where new coal-fired power plants built in the 1980s and 1990s were actually less efficient than those built in the 1970s.[24] While China is still increasing its overall electricity output at a rapid rate - slightly more than one power plant per week - new power plants both add to capacity and replace less efficient, smaller power plants and direct (and very dirty) coal-burning at industrial sites.[25] By 2011, China plans to close all plants of below 50 MW of capacity, and old plants below 100 MW. Between 2011 and 2020, many plants between 100 and 200 MW will also be closed. As a result, the International Energy Agency (IEA) estimates that by 2011, 80 percent of China's coal-fired power plants will be modern plants above 300 MW in capacity and this number will rise above 90 percent by 2020.[26] Moreover, coal power is growing much more slowly than in earlier years. Investment in new coal-fired power plants was down 22 percent in 2008 as compared with 2007.[27]

Figure 6 New Supercritical and Ultra-Supercritical Coal-Fired Power Plants Installed Annually, by Capacity



Source: Nalbandian, Hermine. 2008. "Performance and Risks of Advanced Pulverised Coal Plant;" IEA Clean Coal Center.

Figure 7 Average Coal-Fired Power Plant Fleet Efficiency in China and the United States



Source: US Energy Information Administration, Annual Energy Review 2008; China Electricity Council Statistical Data

2. Other Key Efficiency Programs and Efforts

Beyond industrial energy efficiency, China's policies aim to increase efficiency in sectors that are relatively modest energy users today but will inevitably grow as China develops. As noted, China's current energy use is skewed toward industry. However the Chinese, half of whom still have little or no winter heating and most of whom have limited access to motorized transportation, will increase consumption levels of home heating, cooling and electricity as well as more transport-related energy as they become more affluent. Much of the effort to combat this increase is contained in a set of policies the NDRC calls the "10 Key Energy Conservation Priority Programs." Combined with the industrial programs, NDRC estimates that this initiative will reduce greenhouse gas emissions by 550 million metric tons of CO_2.[28] (China's total efficiency gains will actually be greater, because NDRC's estimate does not include any transportation programs). These additional programs include:

- **Local planning.** China's 2007 Energy Conservation Law requires all local governments to submit plans for in-

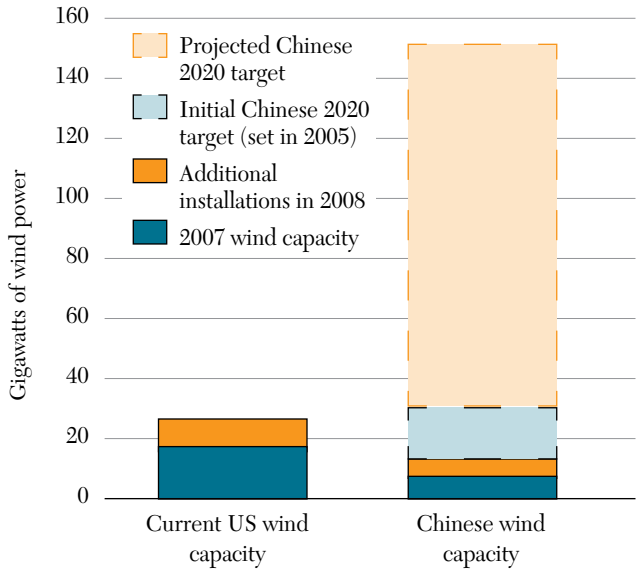
creased urban energy efficiency, including buildings and public transportation, to the central government.

- **New building efficiency regulations.** China's current five year plan mandates a 50 percent reduction in new buildings' total operational energy load, and up to 65 percent for buildings in four major municipalities: Beijing, Shanghai, Tianjin and Chongqing. According to recent government statistics, 97 percent of new buildings in urban areas meet energy saving standards at the design stage and 71 percent at the construction stage, up from 17 percent and 1 percent in 2006, respectively.[29] Improvements in the housing sector also include an aggressive energy efficient lighting program, with a goal of 150 million more compact fluorescent bulbs to be installed by 2010. New subsidies that reduce the cost to consumers by as much as 50 percent[30] have made these lamps commonplace within a few years.
- **Fuel efficiency standards**. Not only does China already have higher fuel economy standards than the United States, Canada and Australia at 36.7 mpg for urban vehicles, but in 2007 it also established an average fuel economy standard of 34 mpg for both on and off road rural vehicles.[31] While vehicle use in China is growing, it is important to note that in China today there is one vehicle for every 70 people, as opposed to one for every single person in the United States.[32]
- **Rapid transit and investments in public transport,** including six efficiency upgrades to China's intercity rail system in the past 10 years. The latest efficiency upgrade covered 9 major routes in 17 provinces and increased railway shipping capacity by 18 percent when the new schedule was launched in June 2007.[33] According to officials from the Ministry of Railways, 6003 km of track from 18 main lines have been approved for high-speed operation. For example, by 2013 travel time from Beijing to Shanghai will drop from 13 to 5 hours. In addition, public transportation in at least 15 major cities is being significantly improved.[34] For example, in preparation for the Olympics, Beijing added three new subway lines, light rail connecting downtown and the airport and bus rapid transit.

Policy Goal #2: 15 Percent Renewable Energy by 2020

In addition to pursuing the world's most efficient coal technologies, China's National Climate Change Program also expects to avert 640 million metric tons of CO_2 through the use of non-fossil fuels including hydropower, nuclear and an ambitious scale up of renewable energy.[35]

Figure 8 Chinese Wind Targets



Source: Global Wind Energy Council, Global Installed Wind Power Capacity (MW) – Regional Distribution, 2009.

While China has developed modern dams only since the 1980s, hydropower is responsible for the biggest share of projected emissions savings through 2010, estimated at 500 million metric tons of CO_2.[36]

The most dramatic changes in China's energy mix in the last several years have been in new renewable energy sources. China is in the process of raising its wind generation capacity goal to as much as 150 GW by 2020.[37] a five-fold increase from the original target of 30 GW by 2020, set in 2005, and more than five times current U.S. wind capacity (see Figure 8). China has raised its target after consistently outpacing early goals - meeting its 2010 goal of 5 GW in 2007, and on track to reach at least double that original goal by 2010. Investment in wind power in 2008 was 72 percent higher than in 2007.[38]

China's solar industry is also growing rapidly. China produced nearly 40 percent of the global supply of solar photovoltaics in 2008, up from less than 20 percent in 2006, most of which were exported to other markets.[39] However, with continuing decreases in solar technology costs, domestic use should start to grow. China already accounts for 70 percent of global production and use of solar hot water heating systems. Ten percent of Chinese homes have solar water heaters installed and the number is growing at 20 percent per year.[40] These heaters save

the equivalent of 20 million metric tons of coal annually, or approximately 45 million metric tons of CO_2, while solar PV and wind power are expected to avert 60 million metric tons of CO_2 by 2010.[41] From the outset, the Chinese wind program focused on the domestic market, but 2009 marks a real turnaround for the solar power market, previously focused on exports. In March 2009, the Chinese government announced a subsidy of RMB 20 (about US$2.92 at that time) per watt for solar PV installations, putting its subsidy at slightly above the current German rate.[42]

Alternative energy sources such as organic and municipal waste and methane gas captured from coal beds and mines are also playing increasingly important roles in energy production in both the public and private sectors. In 2007, the national government added a 0.25 Yuan feed-in tariff[43] to encourage biomass use in power production with a goal of reaching 30 GW of biomass-to-power by 2030. This is in addition to industrial biomass use, with already boasts 1600 plants in operation nationwide, and over 50 cities running waste-to-energy plants. China's national goal is to process 30 percent of total municipal waste into energy by 2030.[44] The national plan estimates savings of 30 million metric tons of CO_2.

SECTION 2

Does China need a cap-and-trade program in order to begin reducing emissions?

Market-based mechanisms to promote GHG emission reduction include both taxes and cap-and-trade systems and can promote cost savings by allowing the potential polluter to choose the least-cost approach to reducing the pollution. These are generally designed as an alternative to regulatory command-and-control approaches that require "best available control technology" or specific technology standards.

In the United States cap-and-trade programs have been designed in the context of the well-developed financial system and its capacity for handling new financial instruments with ease. The sulfur dioxide cap-and-trade system, which became part of U.S. environmental regulation in 1990, was developed to provide a non-tax, market-based pollution reduction mechanism.

In China, however, the current capacity in financial markets and the central regulatory systems is vastly different than in the United States, and, by implication, so are the climate mitigation policies available to Chinese policymakers. The state of China's industries, markets and environmental regulatory agencies indicate that targets and quotas, green taxes and incentives — all tools being used effectively by Beijing today — may be both appropriate and efficient mechanisms for GHG emission abatement in China.

This type of pluralistic approach is actually envisioned in the Bali Action Plan agreed to in 2007 as the roadmap for a new agreement under the United Nations Framework Convention for Climate Change, due to be concluded in Copenhagen in Decmeber 2009. The plan introduced the concept of "measurable, reportable and verifiable" policies, measures and support. Many of the policies that China uses might be considered under this type of framework.[45]

For example:

- **Targets and quotas:** As described previously, China has implemented a wide variety of environmental and energy targets and quotas. This reliance on targets to achieve and measure outcomes is seen in all sectors of Chinese policy. Whether mandating the number of senior centers to be built, university seats to be added or rail lines to be laid, the central government uses targets and quotas to ensure that local and regional officials are held accountable to central policies. The resulting familiarity with simple quantitative policy mechanisms has made the implementation of energy efficiency targets easier than would have otherwise been possible.
- **Taxes:** Several of China's tax structures, including its vehicle and value added taxes, have been designed with energy and environmental outcomes in mind. Although China does not have the necessary emissions tracking mechanisms and infrastructure in place to administer an emissions tax or cap, these taxes have proven the government's ability to track consumption and industrial output. This suggests that straightforward taxes on energy sources may be more appropriate initially than a cap on GHG emissions. Since such taxes can be administered directly to a limited number of energy companies, China can take advantage of existing institutions to enforce its policies. Proving its willingness to encourage changes in energy consumption through taxes, China increased fuel taxes on gasoline and diesel on January 1, 2009.[46]
- **Financial incentives and penalties:** China has had a long history of using financial carrots and sticks to encourage desired outcomes. Due to centralized control of the banking sector, the government has a unique ability to encourage climate-conscious investment practices through a combination of favorable and punitive lending policies. For example, China invested US$12 billion in renewable energy capacity (excluding large hydropower) in 2007, second only to Germany.[47] Conversely, China's

new green credit policy punishes heavy polluters by limiting bank lending to companies with heavy pollution and high energy consumption. Since July 2008, 12 such companies have been banned from obtaining loans. In Jiangsu province alone, more than US$137 million in loans have been called in from companies that failed environmental assessments by the local Environmental Protection Bureau.[48]

In addition, there are technical and market capacity limitations in China that could hinder reliance on a cap-and-trade system in the near term.

- **Technical capacity:** A cap-and-trade system depends on sophisticated monitoring and verification programs that China simply does not have in place today. Even at the most general level of reporting, Chinese GHG data is inadequate. Whereas the United States prepares annual GHG inventories to quantify domestic emissions and China reports quarterly energy use, China has only submitted a single national inventory of its greenhouse gas emissions to the UN Framework Convention on Climate Change.[49] WRI and other organizations are working in China today to build local capacity for undertaking rigorous GHG accounting programs.[50] Chinese industry and government partnerships are now designing emissions calculators and registry programs. Establishing these programs and building the capacity to verify the data will take several years. For example, China has spent the past fifteen years developing its sulfur dioxide emissions monitoring and compliance system, and in recent years conducting experimental sulfur trades. After years of development and some difficult growing pains, there is a push among environmental policy advisors for the Chinese government to establish a national sulfur dioxide cap-and-trade program in the power sector, starting in 2011.[51]
- **Market maturity**: China's financial markets are not as mature as U.S. and European markets, given their short history and limited scope. Cap-and-trade makes sense when underlying market structures already exist. American exchanges will provide a reliable environment for trading allowances, offsets and financial derivatives to hedge compliance and energy costs. In comparison, China's markets may not have the necessary liquidity or maturity to allow companies to benefit from the efficiencies of cap-and-trade regulation. China's stock markets are small and a sideline to the real economy. China's futures market is even more immature. As a result, traders in a new derivative, such as an emissions credit, would not necessarily have the sophistication to identify real from false claims, and the immaturity of the monitoring system suggests there would be many unreliable reports. Finally, in a country with a sophisticated financial system there are real cost savings in relying on it in part to absorb the enforcement costs. Given that China's tax and industrial oversight structures are more developed, the cost savings are likely to be realized by using these structures rather than financial structures.

There is no question that China needs more accurate entity and national level emissions accounting. However, as Section 1 illustrates, the government has demonstrated that it can accomplish a considerable amount of carbon mitigation even as it develops better accounting. Until that accounting is developed, and until its financial markets further develop, China is not in a position to implement an effective national cap-and-trade system. However, it is experimenting with limited local or single sector cap-and-trade programs, which can inform future climate policy options, similar to the experiments in sulfur trading in the past ten years.[52]

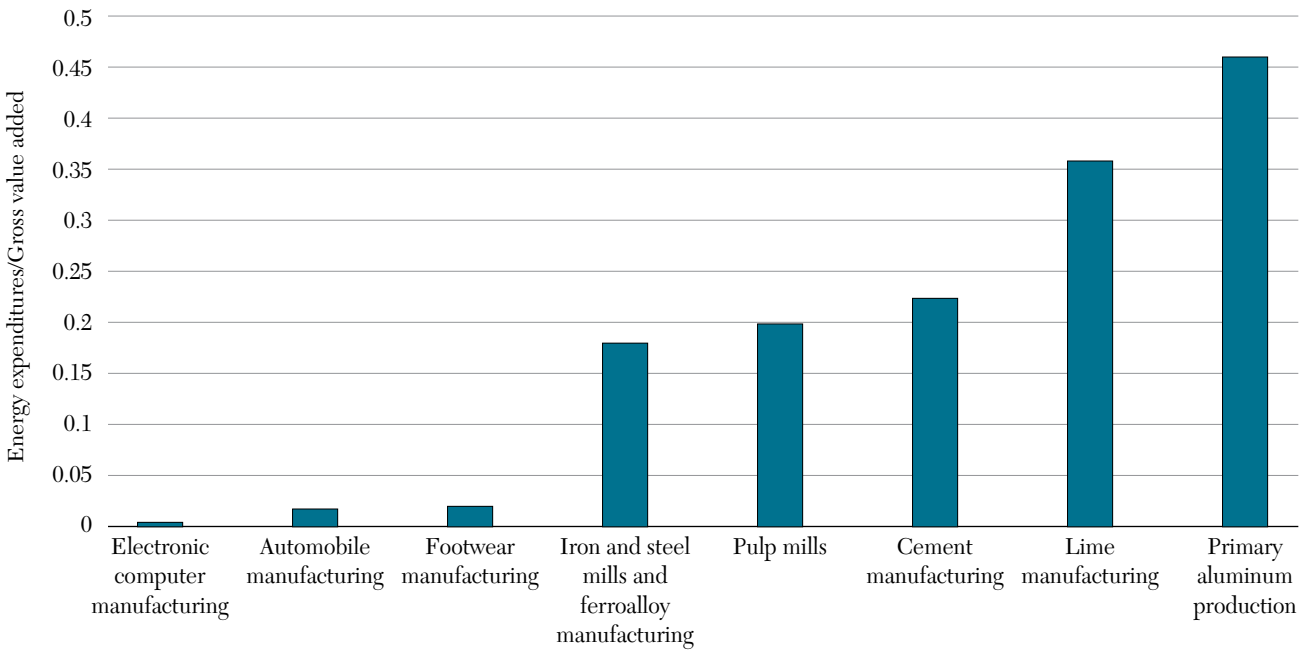
SECTION THREE

Will Climate Legislation in the United States Result in the Transfer of Carbon-Intensive Jobs to China?

International climate negotiations begun in 1992 under the United Nations Framework Convention on Climate Change (UNFCCC) emphasized that countries have "common but differentiated responsibility" to mitigate greenhouse gas emissions. Until recently, this had been interpreted as focused on timing rather than on differential approaches. In other words, the obligations (emission reduction levels and target dates) of different countries would be staggered based on their development levels and historic and current contributions to global emissions. This interpretation resulted in concern voiced by the U.S. Congress that if emerging countries that were also major greenhouse gas emitters were not required to take simultaneous action, would that place undue burdens on the United States?

The "Bali Action Plan" agreed to by the international community in 2007 as the pathway to a new UNFCCC treaty at Copenhagen offered a significant step forward from the 1997 Kyoto Protocol, which it would replace. The essence is to establish "nationally appropriate" measures and actions that can be measured, reported and verified.[53] As the United States, China and other countries worldwide develop such appropriate national approaches to mitigation, the policies they adopt will vary in form and stringency. As a result, the costs they impose

Figure 9 **U.S. Energy Intensity by Industry**



Source: Houser, Heilmayr, Werksman, work under way.

on manufacturers are unlikely to be uniform. American manufacturers fear that the imbalances created by aggressive climate policy in the United States could contribute significantly to the "offshore-ing" of jobs and relocation of industry to countries with lower standards and production costs.

For most U.S. industries, these fears are overstated and limited to industries where energy and fossil fuels are a large portion of their cost structures and where those industries participate in global markets.[54] In industries such as transportation equipment and electronics manufacturing, energy accounts for less than one percent of total production costs (See Figure 9). In fact, industries are more likely to be impacted by fluctuations in currency exchange rates or national differences in tax and transportation costs. Carbon regulation compliance costs are likely to be insignificant to global competitiveness of these industries.

For other sectors, including pulp and paper, chemicals, non-metallic mineral products, and ferrous and non-ferrous metals, energy costs can reach 20 percent of total production costs. Initial observations in Europe and preliminary modeling of American policies indicate that, in the absence of mechanisms to address relative differences in compliance costs, these sectors could potentially face pressure to relocate to nations with less stringent climate change policies.[55]

Since these exposed industries are a discrete portion of the economy, U.S. and European policymakers have reviewed several options to negate potential competitiveness impacts. These policies can be grouped into three categories:

1. *Cost containment mechanisms* aim to reduce the pressure on carbon dioxide-intensive industries by limiting the cost of complying with climate legislation. The most direct methods proposed have sought to use allowance allocations to reimburse exposed sectors for the costs of complying with the legislation. Although such policies could shield industries from newfound competitiveness concerns, they must be carefully structured to maintain incentives for emissions mitigation and avoid overcompensating firms.
2. *Trade measures* do not limit costs on the covered companies but seek to indirectly apply similar costs to competing companies in other countries through the treatment of traded goods at the border. Although this policy mechanism found widespread support in legislation during the 110th Congress, significant flaws have been overlooked.[56]

For example, border price adjustments of imports would negatively impact downstream manufacturers such as the automobile industry by increasing costs of raw materials. Furthermore, these policies would do little to protect important export markets, since adjustments would only apply to the U.S. market. Finally, the confrontational approach represented by trade measures may damage important international negotiations to create a multilateral agreement to address climate change by destroying trust and driving developing countries away from the table.[57]

3. *Coordinated international actions* seek to reduce the pressure on carbon-intensive industries by encouraging major trading partners to impose similar costs or policies. Commonly cited international mechanisms to address competitiveness and leakage concerns include sectoral agreements and the successful negotiation of a global climate agreement under the UNFCCC that would include mandatory action by developing countries. Although China's official negotiating position in climate debates has focused on ensuring that developed countries make reduction commitments, China's support for the Bali Action Plan, and its National Climate Change platform foreshadow possible willingness on China's part to make commitments to regulate specific, heavily polluting industries. Nevertheless, perfect coordination of national actions is unlikely in the immediate future, so the United States is likely to again consider the first two approaches as China phases in its emissions requirements.

Careful application of cost containment mechanisms should enable the domestic policy process to advance in parallel to international negotiations. This combination of domestic mechanisms and international coordination will allow the United States to pursue aggressive mitigation targets without adversely affecting equitable international trade or domestic employment and industry.

SECTION FOUR

How can comprehensive climate change legislation in the United States spur further action in China?

During the debate over climate change legislation in Congress, U.S. policymakers pondered what level of GHG reduction commitment was appropriate for the United States under cap-and-trade legislation. The congressional debate included concerns over the current uncertainty surrounding China's GHG mitigation actions, willingness to compile, monitor and verify data and governance capacity. However, action by the United States is a pre-condition to creating an incentive for China to commit more deeply to international efforts to reduce global emissions.[58] U.S. policy can help precipitate Chinese action in a number of ways:

1. Drive important technological changes that will be needed for China to make its own reductions. As the world's wealthiest nation, the United States is uniquely positioned to spur research, development and capital investment in low-carbon technologies, such as carbon capture and storage, wind and solar energy, and newer vehicle technologies. By setting strong domestic emission limits, the United States would unleash new creativity and drive down prices for new technologies including renewables, highly efficient long-distance transmission lines and plug-in vehicles.
2. Directly engage with China in promoting ambitious new developments to address China's greatest challenge – how to address CO_2 emissions from coal. This could be achieved by conducting joint research in areas ranging from generation and transmission efficiency to carbon, capture and storage, and helping build China's regulatory and implementation capacity. As the major developed country that faces a similar challenge, the United States is uniquely positioned to play this role.
3. Passage of comprehensive U.S. climate policy. This will motivate those in China who worry about China's global reputation and its ability to achieve technology leadership, as well as encourage the reformist voices in China that are already arguing for increased domestic action and international commitments.

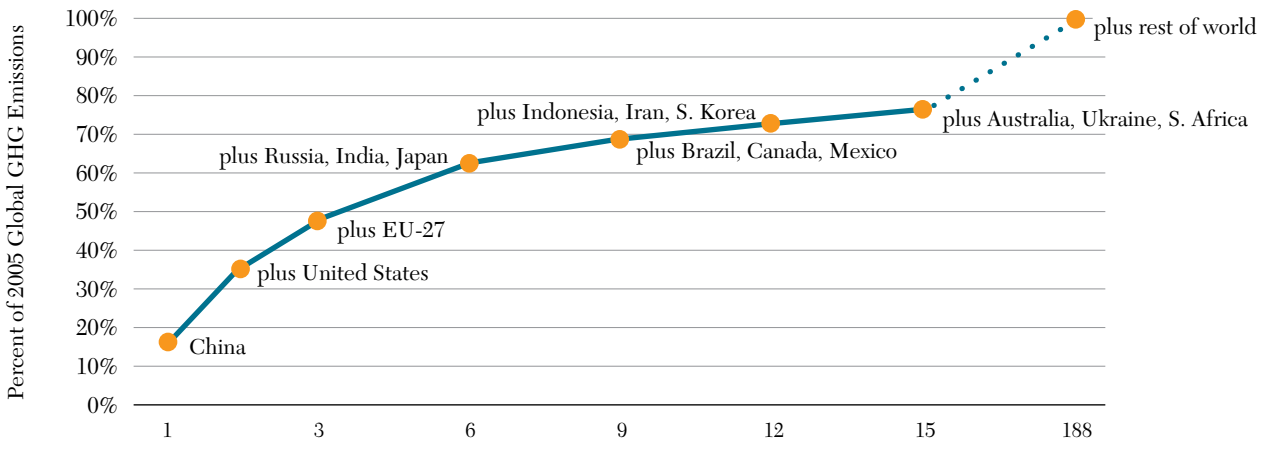
Because the United States failed to ratify and implement the Kyoto Protocol, many in China doubt it is prepared to transform its economy to seriously address climate change. Decisive U.S. leadership and the enactment of climate policy should convince China and the rest of the world that the U.S. is prepared for action and that others have the opportunity to join. Many business and government leaders in both China and the United States agree that those who move decisively on climate policy will be the technology leaders in the new low-carbon economy.

SECTION FIVE

How can the United States and China work collaboratively on climate change action?

Together, China and the United States are responsible for nearly 40 percent of total global emissions (See Figure 10). As a result, it will be crucial for these two countries to cooperate in developing pathways to a low-carbon economy. The structures for collaboration already exist in both the public and private

Figure 10 **Aggregate GHG Emissions by Country, 2005**



Source: WRI, CAIT. Percent contributions are for year 2005 GHG emissions only. Moving from left to right, countries are added in order of their absolute emissions, with the largest being added first. Figures exclude emissions from land-use change and forestry and bunker fuels. Adapted from Figure 2.3 in Baumert et al. (2005)

sectors. For example, most Chinese climate change experts cite the critical importance of assistance from the United States' Department of Energy (DOE) when China was conducting its first National Assessment on climate change in the late 1990s.[59] Since then, a number of the DOE National Laboratories have assisted China in areas ranging from energy efficiency to clean coal, but funding has been highly variable. Similarly, U.S. and international companies have stepped up joint research and development programs with Chinese partners, both on technology applications and in some cases on specific policies, such as sustainable mobility. These programs have played a role and can continue to do so, but would benefit from strong and consistent national U.S. policy focused on clear goals both for U.S. policy development and for how to contribute to the transformation of China.

The challenge for the future is to create a coherent climate partnership program while ensuring that all key government agencies, academics, NGOs and the private sectors in both countries are able to contribute effectively. Most vital will be setting clear goals for the relationship. These goals should include metrics for energy use or carbon dioxide emissions (and could reflect the differences between the countries), but they should also set clear targets for how the two countries want to collaborate, from developing better measuring and regulatory structures to developing clean, advanced coal technology.[60]

For the United States, four key agencies have representation in Beijing (see Table 1). Three opened Beijing offices within the last four years. A number of other key organizations do not have Beijing representation, but have ongoing relationships, many now extending back 30 years. The Chinese situation is similar. Three key ministries are represented at the Chinese Embassy in Washington, while others engage on a less permanent basis. While roles of U.S. agencies in relation to climate change have traditionally been poorly defined and their missions have changed from year to year, clarifications on both roles would yield improved collaborations.

In neither the United States nor China are these lists exhaustive. Government agencies covering agriculture, fisheries, forestry, wildlife, disaster management and others all increasingly play roles in both domestic deliberations and international cooperation. Both countries support rich academic research, and in China a number of academics serve on its international negotiating team. The private sector is also vital. As China has moved forward with climate programs in the past two to three years, the private sector has shown markedly more interest in being engaged, not only in discussions, but actual projects. Both the oil and gas and power industries have renewable energy and carbon capture and storage (CCS) programs. All industries are directly involved in efficiency.

Table 1 **Key Agencies for United States-China Collaboration**

Key U.S. agencies		Key Chinese agencies	
With Beijing representation	**With Chinese ties**	**With Washington DC representation**	**Without direct U.S. representation**
Department of State	Environmental Protection Agency	Ministry of Foreign Affairs	Ministry of Environmental Protection
Department of Energy	National Oceanic and Atmospheric Administration	National Development and Reform Commission	Ministry of Industry and Information Technology
National Science Foundation	National Aeronautic and Space Administration	Ministry of Science and Technology	State Meteorological Administration
U.S. Agency for International Development			Chinese Academy of Sciences
			Chinese Academy of Social Sciences

Enhanced Bilateral Cooperation

In July 2009, the United States and China signed a "Memorandum of Understanding to Enhance Cooperation on Climate Change, Energy and the Environment." This new agreement provides for a bilateral working group to coordinate efforts under two existing structures: The Strategic and Economic Dialogue (S&ED) and the Ten Year Energy and Environment Framework.

The S&ED provides an overarching coordinated approach to the bilateral relationship, and addresses environment as a subset. It is headed at the Vice Premier level in China and is now headed in the United States by the secretaries of State and Treasury, with the Secretary of State responsible for energy, environment and climate change. With ministerial-level meetings twice a year and active working groups, the S&ED has become the major venue for bilateral economic and energy discussions over the last two years. The Energy and Environment Framework creates a structure for this collaboration, but to date the two countries have not established shared goals. The MOU states that Washington and Beijing will implement and expand the ten year framework. Were the framework restructured to focus on the climate change and green job priorities of the new U.S. administration, this structure could play a key role in creating bilateral programs that support both domestic GHG control efforts and the international negotiations.

Using existing structures is an effective approach, because both governments already have organizational structures to support them. Thus, the two governments should now be able to move forward on goal- and policy-setting and project development. At the same time, there is a need to ensure that sufficient resources are mobilized and that these bilateral efforts are focused directly on achieving specific energy and environmental policy objectives.

In addition to the S&ED and the ten year framework, there is also a need to ensure that science and broader environmental cooperation are integrated into climate change cooperation. These areas of joint interest are coordinated through:

- **The U.S.-China Science and Technology (S&T) Cooperation Agreement.** The Joint Commission on Science and Technology (JCST) meets at the ministerial level (White House Science Advisor) every two years and at the Executive Secretary (office director) level in the alternating years. All major agencies doing technical work do so under this agreement, including DOE, EPA, NSF, and NOAA. The Commission offers a venue for research-oriented collaboration. Its working groups have not been developed as much as in other United States-China commissions, but those under the Joint Commission on Commerce and Trade and under the Strategic Economic Dialogue provide models. This group provides the best venue for deepening climate science cooperation.
- **Joint Commission on Environmental Cooperation (JCEC).** This acts as the annual ministerial-level coordinating body for the United States EPA and the Chinese Ministry of Environmental Protection (MEP) in relation to their 2003 MOU on Environmental Cooperation. The MOU is also theoretically part of the S&T Agreement but operates somewhat autonomously, and the two agencies took their own initiative in setting up this Commission. EPA and MEP have separate annexes on air, water and

toxics. On air, they have worked together very closely on continuous emissions monitoring and air pollution regulation, and there is a very sound basis for enhancing this collaboration. This single department discussion is generally held in tandem with the S&ED and is a more technical complement to the ten year framework.

These bilateral institutions operate in tandem with multilateral processes. China and the United States are both members of a number of organizations or treaties which have addressed climate change, including:

- The UNFCCC, the central framework for international climate negotiations and multilateral agreement.
- The Asia Pacific Partnership for Clean Energy and Climate (APP), which has many active public-private partnership projects in key sectors. The APP was the first significant example of Chinese private sector involvement in an international partnership process. The partnership has been effective in running cooperative projects and sharing best practices. However, its impact to date has been limited by a lack of clear goals or fully shared views on how programs should be managed and funded. The United States and China would benefit from strengthening these programs and building them around major targets.
- The Major Economies Forum, a relatively new process initiated under President Bush, recognized the need to expand beyond traditional processes like the UN and the G8 both to ensure consultation among a core group and to ensure large developing countries' involvement. The group still struggles with whether its major goal is to resolve issues for the UNFCCC or to operate in an independent arena. The Chinese have never agreed to formal negotiations outside the UNFCCC process. To make sufficient progress by Copenhagen, the U.S. team will need to seek venues for in-depth discussion with Chinese counterparts.
- The Asia Pacific Economic Cooperation or APEC community has also had some climate change discussions. These have not been as intensive as APP.
- Technology Programs such as:
  - The Methane to Markets Partnership or M2M, a global grouping focused on a single greenhouse gas. It has effectively used capacity-building to create successful large-scale methane business-promotion events.
  - The International Partnership for the Hydrogen Economy (IPHE), where DOE has worked with the Chinese on hydrogen road-mapping.
  - The Carbon Sequestration Leadership Forum.
  - The Committee on Earth Observing Satellites (CEOS). China has been a key player in various earth observation efforts, and these can be used to enhance satellite-based climate and emissions monitoring.

These partnerships could potentially become part of a model for technology cooperation under the UNFCCC. While priorities have changed, and some like the IPHE look likely to be de-emphasized under the Obama administration, the approach has been effective in promoting new technologies and, in the case of M2M, spurring actual investments.

There are tremendous opportunities for the United States and China to collaborate, based on existing mechanisms such as those discussed above. To succeed, they will require common metrics of progress and agreed-upon financial and technical contributions from both sides. China is already active in seeking more international cooperation and has budgeted for collaborative research, for example including an international cooperation fund of US$1 billion for climate change research in the 11th five-year plan (2006-2010).[61]

CONCLUSION: THE ROAD AHEAD

Responding to both its domestic needs and international concerns, China has set goals and is taking actions to reduce its emissions below business as usual and the historical trajectory for developing countries. Chinese policy approaches have both similarities and differences from those taken in the United States and Europe. The relevant question is not whether such approaches and actions are identical, but whether they are measurable, reportable and verifiable. It will be critical to agree, through a global framework, on low carbon emissions strategies and to ensure that we have the metrics and mechanisms necessary for ensuring common understanding and transparency.

China is pursuing international collaboration across a range of climate policies, including measurement and enforcement, modeling and planning, clean coal, energy-efficiency and clean vehicles technologies. For China to "leapfrog" technologically to lower carbon technologies, wealthier countries will have to invest in, and push down the cost curves for, those new technologies.

A clear program for collaboration between the United States and China should:

- Set clear goals and benchmarks, both in energy or carbon terms and in terms of programs, projects, technologies and policies to be developed;

- Be tied to a specific funding mechanism in the United States;
- Involve relatively modest but long-term programs in areas including monitoring, regulatory infrastructure, policy development and start-up research support;
- Involve focused, ambitious programs in technology development and deployment.

The recent bilateral MOU provides a framework for such cooperation. The challenge will be to create specific programs of work with sufficient ambition, as well as clear targets and benchmarks. To succeed such a program will need to involve the ambitions and active engagement of both countries.

The benefits of such engagement will not be limited to the United States and China. It will set the entire world on the path to greatly lowered CO_2 emissions. Moreover, collaborative action will reduce concerns about emissions merely being transferred from one country to another. Collaborative technological engagement between the United States and China leverages the two countries' innovative capacity, increases access to future markets and leads to better technology and more technology winners for both countries. Both the United States and China have an interest today in burnishing their image on this important issue. There is no better way to do so than through real and productive collaborative efforts that lead to solutions for the greatest challenge of our time.

ABOUT THE AUTHORS

Deborah Seligsohn is the Principal Advisor to WRI's China Climate, Energy and Pollution Program. Previously, Deborah served as Science Counselor at the U.S. Embassy in Beijing during twenty years spent mainly in Asia with the United States Foreign Service.

Robert Heilmayr is a doctoral student at Stanford University's Emmett Interdisciplinary Program for Environment and Resources. Previously, Robert worked as a Research Analyst in WRI's Climate and Energy Program.

Xiaomei Tan is the project manager for WRI's China Climate and Energy Program. She leads the technology transfer work in developing countries and supports WRI's expanding climate-related work in China.

Lutz Weischer is a Fellow of the Robert Bosch Postgraduate Program in International Affairs, supporting WRI's Climate and Energy Program. His previous placements as a Bosch Fellow include the United Nations Environment Programme and the World Trade Organization.

ACKNOWLEDGMENTS

The authors gratefully acknowledge the helpful advice of Banning Garret, Angel Hsu, Joanna Lewis and Lynn Price in reviewing drafts of this publication. We would also like to thank WRI colleagues Rob Bradley, Ray Cheung, Christina Deconcini, Jennifer Layke, Janet Ranganathan, Athena Ronquillo-Ballesteros and Hanqian Zhang for their feedback and Polly Ghazi, Stephanie Hanson and Lydia Weiss for their assistance in editing.

WRI gratefully acknowledges the Center for Strategic and International Studies, the Energy Foundation, and the Doris Duke Charitable Foundation for their support of this work.

ABOUT WRI

The World Resources Institute is an environmental think tank that goes beyond research to create practical ways to protect the Earth and improve people's lives. Our mission is to move human society to live in ways that protect Earth's environment for current and future generations.

Our programs meet global challenges by using knowledge to catalyze public and private action:

- *To reverse damage to ecosystems.* We protect the capacity of ecosystems to sustain life and prosperity.
- *To expand participation in environmental decisions.* We collaborate with partners worldwide to increase people's access to information and influence over decisions about natural resources.
- *To avert dangerous climate change.* We promote public and private action to ensure a safe climate and sound world economy.
- *To increase prosperity while improving the environment.* We challenge the private sector to grow by improving environmental and community well-being.

In all of our policy research and work with institutions, WRI tries to build bridges between ideas and actions, meshing the insights of scientific research, economic and institutional analyses, and practical experiences with the need for open and participatory decision-making.

For more information, visit WRI's website at http://www.wri.org.

NOTES

1. http://www.state.gov/r/pa/prs/ps/2009/july/126592.htm
2. EIA, International Energy Annual 2006, Table H.1co2 World Carbon Dioxide Emissions from the Consumption and Flaring of Fossil Fuels, 1980–2006, December 2008. US – 5,903; China – 6,018.
3. China's longstanding policy limiting heat to areas north of the Yangtze River, despite chilly winters in the South, is widely discussed in blogs, such as http://blog.ce.cn/html/16/114716-70924.html, but rarely in the formal literature. Similarly, much recent study relates to China's car ownership, still quite low by world standards. Most Chinese are more affected by crowded urban or inadequate rural mass transportation systems.
4. Carbon intensity refers to the amount of CO_2 emissions per unit GDP. These emissions can come from any source – energy use, industrial processes, deforestation, agriculture, etc., but for a country like China that is actually reforesting, the majority of greenhouse gas emissions come directly from the burning of fossil fuels.
5. "Wen: China gives top priority to meeting challenge of climate change," Xinhua, February 2, 2009, http://news.xinhuanet.com/english/2009-02/02/content_10752897.htm
6. China's "State of the Environment Report, 2008" reports an almost 9% decrease nationwide in sulfur dioxide emissions, in three years, putting China at least a year early in meeting its 5 year goal of 10%. http://english.mep.gov.cn/News_service/news_release/200906/t20090618_152932.htm. However, levels in urban and suburban areas are still well above developed country standards, Yanli Feng, et al., "Characteristics of organic and elemental carbon in PM2.5 samples in Shanghai, China," Atmospheric Research 92 (2009) 434–442.
7. See Yuxing Zhang and Conghe Song, "Impacts of Afforestation, Reforestation and Deforestation on Forest Cover in China, 1949 to 2003," http://www.unc.edu/~csong/Zhang-Song06-JOF.pdf. During that period forest cover in China grew from 8.6 percent to 18.21 percent. China's national goal is to reach 20 percent by 2010.
8. China's forest protection policies operate against a backdrop of continuing economic development and land pressure. Their intended purpose is to increase forest cover and they are explicitly designed to reduce soil erosion and protect water quality. Results thus far on ecosystem protection criteria have been mixed, but the policies have also been adjusted as problems are discovered. Jianguo Liu, et al, "Ecological and socioeconomic effects of China's policies for ecosystem services," Proceedings of the National Academy of Sciences, PNAS July 15, 2008 vol. 105 no. 28 9477-9482, http://www.pnas.org/content/105/28/9477.full and Zhu Chunquan and Feng Guoqiang et al., "The Policy on Conversion of Sloped Farmland into Forests and Grassland in China and the Case Study on Management Techniques," World Wildlife Fund, 2002.
9. See "Whitepaper: China's policies and actions on climate change," October 29, 2008, http://www.china.org.cn/government/news/2008-10/29/content_16681689.htm. The Whitepaper was released by China's State Council Information Office, representing China's governing body.
10. Ibid., the Whitepaper states that China "plays a positive role" in global climate efforts, and whitepapers by definition in China are directed at the international community.
11. President Hu: China to maintain "peaceful development," April 13, 2008, http://english.peopledaily.com.cn/90001/90776/6391501.html
12. See for instance http://www.solutions-site.org/artman/publish/article_334.shtml, outlining China's closure of its last 6 factories producing ozone depleting substances (ODS), putting China 2 ½ years ahead of its Montreal Protocol commitment or http://www.unido.org/fileadmin/media/documents/pdf/UNIDO_Worldwide/UNIDO_Offices/China/Factsheet_POP.pdf outlining China's program for complying with the Stockholm Convention on persistent organic pollutants (POPS), a class of highly harmful pollutants.
13. "Emissions targets set for government schemes," China Daily, June 6th, 2009, http://www.chinadaily.com.cn/world/2009green/2009-06/06/content_8256019.htm
14. WRI private discussions with NDRC climate officials, June 9, 2009.
15. State Council Information Office, Economic Statistical Briefing, January 22, 2009.
16. Ibid.
17. Reuters, http://www.reuters.com/article/latestCrisis/idUSPEK133146
18. A lengthier discussion of these industrial efficiency policies appeared in Deborah Seligsohn, "Doing More Than You Think," China Economic Quarterly, September 2008.
19. National Development and Reform Commission and National Bureau of Statistics, "Report on the State of the Energy Use of the Top-1000 Enterprises (Year 2007)" for 2006 data and Liu Jingru, Yu Cong, Liu Zhiping, "Energy Conservation Moves Forward Steadily with Significant Achievements—A review of 30-years of Open Door Reform," Energy of China, Vol. 31, No. 2, February 2009, pp. 17-22, for 2007 data.
20. Lynn Price, Wang Xuejun and Yun Jiang, "China's Top-1000 Energy-Consuming Enterprises Program: Reducing Energy Consumption of the 1000 Largest Industrial Enterprises in China," LBNL-519E, June 2008, http://ies.lbl.gov/iespubs/LBNL-519E.pdf.
21. Jiang Kejun, et al, "Energy Efficiency Improvement in China: Significant Progress for 11th Five Year Plan," draft.
22. Ibid.
23. *Cleaner Coal in China*, International Energy Agency, 2009.
24. National Energy Technology Laboratory, "Reducing CO_2 Emissions by Improving the Efficiency of the Existing Coal-fired Power Plant Fleet," DOE/NETL-2008/1329, July 23, 2008.
25. Chinese National Bureau of Statistics. China built approximately 2 power plants per week in 2006, but the new construction rate has slowed steadily over 2007 and 2008, and can be expected to slow further as the impact of the global economic downturn is felt. Plants coming on line in 2009 were all ordered well before the fall-off in electricity demand in China.
26. International Energy Agency, Cleaner Coal in China. 2009, pp. 104 and 117.
27. http://www.chinadaily.com.cn/bizchina/2009-02/09/content_7455726.htm
28. National Development and Reform Commission, "China National Climate Change Programme," June 2007.
29. "Press Briefing on China's Energy-efficient Building and Green Building Initiative on February 26, 2008." Online at http://english.gov.cn/2008-02/28/content_904034.htm
30. "One Yuan Energy-efficient Lights Successfully Phase out Market Barriers." People's Daily. August 14, 2008.
31. Green Car Congress. See also http://www.greencarcongress.com/fuel_efficiency/index.html

32. KPMG, Momentum: Driving forces in China's car market, 2007. http://www.kpmg.com/Global/IssuesAndInsights/ArticlesAndPublications/Pages/DrivingforcesinChinascarmarket.aspx
33. http://news.xinhuanet.com/fortune/2007-04/18/content_5990717.htm
34. "China is getting on track with public transportation." Online at http://www.pbs.org/nbr/site/onair/transcripts/070105c/
35. China's National Climate Change Program, June 2007. This calculation is based on reductions from "business as usual" scenarios.
36. Ibid.
37. http://www.chinadaily.com.cn/china/2009-07/02/content_8346480.htm
38. http://www.chinadaily.com.cn/bizchina/2009-02/09/content_7455726.htm
39. Solarbuzz, LLC, http://www.solarbuzz.com/index.asp
40. "Solar hot water soon will save China 20 million metric tons of coal each year" Xinhua news agency, April 28th, 2007. See also http://www.gov.cn/jrzg/2007-04/28/content_600212.htm. Gordon, Brian "China's solar hot water capacity will soon be equivalent to 40 nuclear plants" see also http://www.environmentalgraffiti.com/sciencetech/china-solar-hot-water-capacity-soon-to-be-equivalent-to-40-nuclear-plants/822
41. Gordon, Brian "China's solar hot water capacity will soon be equivalent to 40 nuclear plants" see also http://www.environmentalgraffiti.com/sciencetech/china-solar-hot-water-capacity-soon-to-be-equivalent-to-40-nuclear-plants/822 for the solar water heater estimate. The National Climate Change Program for the power estimate.
42. Melinda Peer, "Solar Sector Radiates Hope For Chinese Subsidy," Forbes, March 26, 2009, http://www.forbes.com/2009/03/26/solar-china-subsidy-markets-equity-trina.html
43. A feed-in tariff is an incentive to encourage use of renewable energy. The policy sets an above-market price at which power utilities are obligated to buy electricity from renewable generators.
44. "Covanta developing waste-to-energy projects in China" International Solid Waste Association. March 2008.
45. For further detail both on how China's national plan might be considered within such a regime and on the negotiating positions of China and other countries, see WRI Working Papers at http://www.wri.org/project/cop-15
46. People's Daily, December 6, 2008, http://english.peopledaily.com.cn/90001/90776/90785/6548233.html
47. Xinhua News Agency, China focus: China takes responsible attitude to climate change and environmental protection, April 2008.
48. More Efforts Needed to Implement Environmentally-Friendly Loan Policy," Xinhua, February 13, 2008.
49. China's Initial National Communication on Climate Change can be found at http://unfccc.int/resource/docs/natc/chnnc1e.pdf. China is currently preparing its second national communication.
50. WRI's efforts involve intensive work in a number of heavy industry sectors and are described at www.ghgprotocol.org. Other organizations working in this area include the Carbon Registry, the World Wildlife Fund, the Innovation Center for Energy and Transportation, and Business for Social Responsibility.
51. Wang Jinnan statement at China Council for International Cooperation and Development Workshop, September 8, 2009.
52. Shai Oster, "China Expands Markets for Emissions Trading, November 11, 2008, http://online.wsj.com/article/SB122636062518315545.html
53. For a more detailed discussion of how Chinese policies fit into this framework, see "Working Paper: Mitigation Actions in China, Measurement, Reporting and Verification," May 2008.
54. *Leveling the Carbon Playing Field, International Competition and U.S. Climate Policy Design*, http://www.wri.org/publication/leveling-the-carbon-playing-field
55. Morgenstern, Richard, et al. Competitiveness Impacts of Carbon Dioxide Pricing Policies on Manufacturing, Resources for the Future, Washington DC, 2007. EU ETS impacts on profitability and trade: A sector by sector analysis. Carbon Trust, London, 2008.
56. See, for example, the American Electric Power/International Brotherhood of Electrical Workers proposal as incorporated into S. 3036, Lieberman-Warner Climate Security Act of 2008, 110th Session of the United States Senate.
57. *Leveling the Carbon Playing Field.*
58. China's Climate Change Whitepaper explicitly calls for developed countries, with higher per capita and cumulative historic emissions, to reduce emissions first.
59. Interviews by Deborah Seligsohn with Chinese policymakers and advisors, 2008.
60. For a detailed discussion of how these goals could be developed, please see Taryn Fransen, Hilary McMahon and Smita Nakhooda, WRI Discussion Paper, "Measuring the Way to a New Global Agreement," December 2008.
61. Wan Gang, "Rely on science and technology to address climate change," speech on the Forum on Climate Change and Science and Technology Innovation, April 24, 2008, http://www.ccchina.gov.cn/cn/NewsInfo.asp?NewsId=12104