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China's Energy Consumption and Opportunities for U.S.-China Cooperation to Address the Effects of China's Energy Use

I. What We Need to Know about China for a Post-Kyoto Accord

In both the United States and China, officials are fond of saying that the arena of energy and the environment offers the best opportunity for Sino-American cooperation, far better certainly than currency revaluation, human rights, or Darfur. Moreover, the increasingly high profile issues of climate change and energy security have prompted senior officials in both countries to raise energy and the environment to near the top of their bilateral agenda. The result is that strategic cooperation on energy and the environment is already well underway. The two countries work with the world's other large energy consumers through the Carbon Sequestration Leadership Forum and the Asia Pacific Partnership on Clean Development and Climate. On the bilateral level, the U.S. Department of Energy is involved in over a dozen areas of cooperative research and development with Chinese counterparts, including a recently announced set of efforts on methane capture in Chinese coal mines.

Yet dialogue and demonstration projects fall far short of addressing the challenge at hand. Real cooperation on climate change and energy and the environment is every bit as difficult as that on arms proliferation, market access or human rights. In fact, many of the same issues that complicate the bilateral agenda more broadly are present in the energy and environmental realm: will China provide market access for foreign environmental technologies? Will the intellectual property rights of American companies be protected? Can China actually implement its ambitious energy and environmental targets? How will both the United States and China balance their strong beliefs in sovereignty with the need to meet a global challenge? How can the United States encourage China to strengthen its climate change policy until the U.S. has assumed a significant leadership role?

In order for the United States to begin to think about a climate strategy that engages China in a serious post-Kyoto regime, there are perhaps two things to consider: the conditions under which China has traditionally signed on to international environmental agreements and the reality of China's energy-related environmental challenges.

Historically, four conditions have driven China to sign on to international environmental accords. First, consensus exists among Chinese scientific experts and other elites concerning the science and the seriousness of the problem. Second, China pays very little

to nothing of the costs engendered by adhering to the treaty. Instead, the international community provides much of the technology, financing and policy advice necessary to bring China on board. Third, there is a sanctioning mechanism within the treaty. And fourth, there is a substantial reputational cost to inaction. [1]

As important as putting into place the conditions to make accession to a post-Kyoto accord easy for China is to understand the opportunities and challenges to the implementation of any agreement that are presented by the energy and environmental reality on the ground. During 2000-2020, for example, 300 million Chinese will move to new urban developments. To fuel this growth, China today is building one new coal-fired power plant every 7-10 days. Even with China's participation in the Kyoto Protocol-based carbon market and a raft of new climate change-reduction projects under the auspices of the Protocol's Clean Development Mechanism, China is on track to erase all the gains in reduced carbon emissions achieved by the rest of the world by 2025.

The following discussion only begins to lay the groundwork for understanding the opportunities and challenges in developing a post-Kyoto accord that can transform China from the world's soon-to-be largest contributor to global climate change to an active and successful participant in a global accord designed to limit the impact of climate change.

II. China's Energy-related Environmental Challenges

One important rationale for China's leaders to take more aggressive action to address climate change is the link between energy-related pollution on the domestic front and climate change. China's environment ranks among the most polluted and degraded in the world. Much of this environmental pollution and degradation stems from China's particular mix of energy resources, the rapid growth in energy consumption, and China's efficiency and conservation practices:

- Centuries of deforestation for timber resources—in part to fuel the country's growth—have engendered serious soil erosion and desertification. The country, which is roughly the same size as the United States, is almost ¼ desert, and the desert is expanding at an estimated 1900 square miles annually, affecting the livelihood of some 400 million Chinese. Overall, 40% of China's land is affected by soil erosion.

- Dependence on coal for roughly 70% of the country's energy contributes to serious air, water and soil pollution. China is the largest consumer of coal in the world, and coal consumption is anticipated to more than double during 2000-2020. China boasts 16 of the world's 20 most polluted cities in terms of air quality. Acid rain affects approximately ¼ of China's land and 1/3 of its

[1] For a detailed study of China's accession to international environmental treaties up to and including the Montreal Protocol on Substances that Deplete the Ozone Layer, see Michel Oksenberg and Elizabeth Economy, "China: Implementation Under Economic Growth and Market Reform," in Edith Brown Weiss and Harold K. Jacobson, eds., *Engaging Countries* (Cambridge, MA: MIT Press, 1998), pp.353-394.

agricultural area. As much as 90% of SO2 and 50% of particulate emissions arise from coal use.[2]

Coal mining also pollutes surface and groundwater, which in turn contaminate soil and crops. China's air carries suspended particulate-matter loads that are more than twice the highest levels the WHO regards as safe. According to one report, the coal and iron mines in karst regions of north China (where the bedrock is deteriorating) discharge 1.2 billion tons of waste water every year, of which 70% drains untreated into rivers. In the coal rich but water poor areas of northern China, accessing water to wash coal to reduce emissions has led to severe subsidence in which buildings, roads and croplands have been seriously damaged.[3] Currently, according to China Daily, two-thirds of China's 660-odd cities do not have enough water for their needs and 100 are facing severe water shortages. Moreover, seventy percent of the water that flows through China's seven major rivers and their tributaries is unfit for fishing or drinking, and thirty percent is so polluted that it cannot be used even for agriculture or industry. Only about 45% of the surface water can be cleaned up enough through treatment to be usable in most industries.

- Hydropower, which provides roughly 20% of China's electricity, is increasingly a source of societal friction. Chinese and international NGOs raise issues of biodiversity loss, soil erosion, water pollution, loss of cultural and natural heritage sites, and resettlement and compensation. One recent study in the May 17, 2007 issue of the journal Geophysical Research Letters reported that the Three Gorges Dam has reduced the amount of sediment flowing into the Yangtze River Delta by almost 33% since the dam began operation. As a result, land in the delta region—some of China's most fertile—is losing nutrients that are not being replaced. This may translate into the loss of as much as 20% of China's most fertile land.[4] In an ongoing case, the Yunnan government recently halted plans for construction of a dam in a World Heritage Site, but only after significant pressure from domestic environmental organizations, as well as UNESCO.

- Plans are on the books to increase dramatically the role of nuclear, wind and solar power. Issues of the storage of nuclear waste are likely to become increasingly important in the domestic debate on energy within China. Wind power, while generally well-accepted in China, has engendered some serious protests when local communities believe they are not being properly compensated for their land. Wind farms also contribute to high rates of bird mortality and land degradation.

- An important emerging environmental challenge emanates from China's search for oil and gas abroad. Chinese companies engaged in resource extraction often

[2] Noreddine Berrah, Fei Feng, Roland Priddle, Leiping Wang, "Sustainable Energy in China," in Greening the Energy Sector, (Washington, D.C.: The World Bank, 2007).
[3] Yang Yang, "Coal Mining and Environmental Health in China," A China Environmental Health Project Research Brief (April 2, 2007)
[4] Andrea Thompson, "Huge Yangtze Dam Destroying Delta," *LiveScience* (May 16, 2007)

do not employ best environmental practices. In a recent case in Gabon, the Chinese energy company Sinopec was accused of abusing its oil exploration license in the Loango national park—dynamiting and polluting the park and destroying the forests to create roads. In October 2006, Sinopec was ordered to halt all its prospecting operations in the park.[5]

- Looking toward the future, China is clearly concerned about the impact of climate change on its resources and development potential. In spring 2007, Beijing released its "First National Climate Change Assessment." This study predicted a 37% decline in China's wheat, rice and corn yields in the second half of the century. Precipitation could decline by as much as 30% in three of China's seven major river regions: the Huai, Liao and Hai. The Yellow and Yangtze rivers, which support the richest agricultural regions of the country and derive much of their water from Tibetan glaciers, will initially experience floods and then drought as the glaciers melt. Moreover, a one-meter rise in sea level wills submerge an area the size of Portugal along China's eastern seaboard—home to more than half the country's population and 60% of its economic output.

Public Health Consequences

The human cost of China's energy-related pollution is not yet fully understood. A research institute affiliated with China's State Environmental Protection Administration (SEPA) has reported that 400,000 people die prematurely in China annually from respiratory diseases related to air pollution. In 2002, 70,000 miners became ill and over 2000 died from black lung disease resulting from the inhalation of coal dust. More recently the Ministry of Public Health has blamed worsening air and water pollution for the dramatic increases in rates of cancer: 19% in urban and 23% in rural areas since 2005.[6]

The United States Agency for International Development is sponsoring a China Environmental Health Project in which scientists from Western Kentucky University and Southwest University in China are researching the impact of the pollution of underground streams from coal-burning on public health. The researchers have identified a number of troubling trends: indoor coal burning stoves emit arsenic which poisons food that is drying; pollution from roadsides is seeping into the underground water system, and the underground aquifers are also being contaminated by toxins from steel mills and pesticides and fertilizers.[7]

China's coal use also contributes to soil contamination. According to one estimate 10% of China's soil is seriously contaminated. In Linfen, Shanxi—China's coal heartland and

[5] "Sinopec Accused of Illegal Exploration at Gabon Site," *The Standard* (October 2, 2006).
[6] "Health Expert Blames Pollution for China's Cancer Rise," Reuters (May 16, 2007)
[7] Kristyn Ecochard, "Chinese Pollution a Rising Health Threat," Terradaily
http://www.terradaily.com/reports/Chinese_Pollution_A_Rising_Health_Threat_999.html

reportedly one of the most polluted cities in the world—the crops are "covered in gray dust and considered toxic."[8]

GDP Consequences

China's State Environmental Protection Administration has been working diligently over the past two and a half years to ascertain the costs of environmental pollution and degradation to the Chinese economy in order to update the widely cited statistics from the late 1990s that environmental pollution and degradation cost the Chinese economy the equivalent of 8-12% of GDP annually.

Unfortunately, the agency has received little support from most regional officials, many of whom have worked actively to undermine SEPA's effort. Moreover, the National Bureau of Statistics (NBS), which partnered with SEPA and was primarily responsible for undertaking the statistical work for the Green GDP, reported that it did not have the skill set to do such calculations. The result has been a set of numbers that do not comprehensively or accurately assess the costs. In 2006, NBS and SEPA published an official cost of 3%, acknowledging that the number only partly represented the cost of degradation and pollution to the economy. In June of that year, one SEPA Vice-Minister reported that the costs of environmental degradation and pollution to the economy were 10% of GDP annually. This year, the NBS has declined to release the calculations to the public.

Additional reporting from in and outside China includes the following energy-related pollution costs: In 2006, climate change-related disasters cost China more than $25 billion in damage;[9] air pollution is driving some extreme weather events, which hamper China's economic growth by between 3-6% of GDP, or $70-130 billion annually;[10] health effects from coal pollution will cost China US$39 billion in 2020; and black carbon soot from vehicles, coal stoves and burning crop residues may be lowering crop yields for both wheat and rice in China by 30%.[11]

III. China's Global Environmental Footprint

As a result of China's reliance on coal, the country's emissions of CO2 have tripled over the past thirty years. China is now anticipated to surpass the United States as the largest emitter of CO2 either this year or next, more than a full decade earlier than anticipated. If China does not dramatically reconstitute its energy mix or take advantage of the most advanced clean coal technologies, the increase in global warming gases from China's coal use will likely exceed that for all industrialized countries combined over the next 25

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[8] Yang Yang, "Coal mining and environmental health in China," A China Environmental Health Research Brief, the Woodrow Wilson Center (April 2, 2007).
[9] Elizabeth Economy, "China vs. Earth," *The Nation* (May 7, 2007)
[10] Juli S. Kim, "Transboundary Air Pollution—Will China Choke On Its Success?" A China Environmental Health Project Fact Sheet," Research Brief (February 2, 2007)
[11] Kim, op. cit., "Transboundary Air Pollution," (February 2, 2007)

years, surpassing by five times the reduction in such emissions that the Kyoto Protocol seeks.[12]

Beyond climate change, China's coal burning contributes to a range of regional and global transboundary air pollution issues. Japan and South Korea have long been concerned about the large and growing role of China in their acid rain problem as well as the toxic yellow dust that is dumped on their land each spring.

In California, researchers are carefully tracking a sharp increase in trans-Pacific pollution. According to one UC Davis researcher, about one-third of the pollution from China is dust, and the rest is composed of sulfur, soot and trace metals from the burning of coal, diesel and other fossil fuels. The US EPA estimates that on some days, fully 25% of the particulates in the atmosphere in Los Angeles are from China. The importance of this challenge has increased in recent years given the toxicity of the dust that is being transferred. Mercury emitted into China's air from coal burning is yet another growing public health concern---both in China and abroad. When ingested, mercury can cause birth defects and developmental problems. Reportedly, 25-40% of global mercury emissions emanate from China's coal burning.

IV. The Opportunities and Challenges China Presents

The good news is that in many respects China is already on board with the idea that climate change matters and that for both domestic and international reasons, it needs to take action. China is a very active player in the Kyoto Protocol's Clean Development Mechanism (CDM) and carbon trading market. According to one report, China already accounts for 60% of the carbon credits trading under the CDM,[13] and China already has seventy-odd CDM projects underway.

In addition, the Chinese leadership has announced a series of steps to improve its pattern of energy use, even as it increases overall energy consumption. (Just last year, China added power capacity equal to the entire grids of the UK and Thailand combined,[14] and both in relative and absolute terms, coal use actually increased.) Such initiatives include:

- Renewable energy should provide 10 percent of the nation's power by 2010 and 15% by 2020.
- Key-state-owned enterprises and provincial governors must make 20% reductions in their energy intensity (that is energy consumed per unit of GDP) during 2006-2010.
- Local officials must now sign accountability pacts promising to adhere to energy and environmental goals

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[12] Tom Holland, "Polluting Woes can turn China into Green Industry Leader," *South China Morning Post* (April 3, 2006).
[13] Antoanta Bezlova, "Investors on e-mission to China," Asia Times (November 29, 2009).
[14] Richard McGregor and Jo Johnson, "China and India Face Pollution Timebomb," Financial Times (March 3, 2007)

- Energy-intensive industries such as aluminium, copper, steel, coke and coal, power generation and cement will no longer receive land use, tax and power incentives. [15] (Typically, these industries in China use 20-40% more energy to produce the same amount of output than in developed countries.)
- The Ministry of Construction is pushing tough, new energy efficiency codes for all new buildings. This is critical when 30% of all CO2 emitted in China is related to buildings, and Chinese buildings consume 250% more energy that buildings in other countries with comparable climates, such as Germany.

The bad news is that in its June 4, 2007 Climate Plan, China categorically rejected any targets or timetables for capping or reducing greenhouse gas emissions. Moreover, achieving energy and environment targets domestically has often proved elusive in the past. Contrary to popular wisdom, what Beijing says, does not go:

- The Chinese government pledged to cut SO2 by 10% during 2002-2005; the result was an increase of 27%.[16]
- In 2006, China failed to meet the target of a 2 percent reduction in the emission of key pollutants that it set in 2005: SO2 increased by 1.8% and COD increased by 1.2%.[17] It also failed to meet its target of a 4% reduction in energy intensity, achieving only a 1.23% reduction.
- Despite warnings from Premier Wen Jiabao, electricity, steel, nonferrous metals, construction materials, oil processing and chemical—six industries that account for nearly 70% of energy consumption in the entire industrial sector—grew by 20.6% in the first quarter of 2007, 6.6% more than the same period in 2006.[18] Mainland aluminium smelters reportedly "surprised" analysts with a 38% rise in output during January-May, 2007. As one analyst noted, it is tough to slow down industries when they are profitable.
- Campaigns to increase renewables within China's energy mix may also be encountering difficulties. According to one senior executive with the Indian wind power firm Suzlon, only 37% of wind projects awarded in 2004 in China were ever built. This official noted that "a large chunk of orders handed out in the past two years was given to inexperienced producers who accepted low prices required by project developers." Moreover, he argues that only the smaller local projects are likely to succeed as they have a tariff 20% higher than those given by the central government and thus may be profitable.[19]

The repeated failure of Beijing to reach its stated targets for energy efficiency, pollution control, etc. suggests a serious mismatch between the goals of the government and the political economy of the country. Any effort in the United States to work with China on

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[15] "China to act on pollution, warming gases," Xinhua (April 28, 2007)
[16] Keith Bradsher and David Barboza, "Pollution from Chinese Coal Casts Shadow," *New York Times* (June 11, 2006).
[17] "Polluters Face Automated Monitoring," Reuters (May 11, 2007)
[18] "China to Stick to Strict Energy-Saving, Environment-Protection Plans," Beijing Xinhua in English (June 3, 2007).
[19] Eric Ng, "Winds of Change Cloud Industry Power Game," *South China Morning Post* (May 28, 2007)

addressing climate change should not only begin from an accurate understanding of the incentives and disincentives in place for local officials and businesses to follow Beijing's regulations but also with the understanding that *to make a real difference beyond a set of demonstration projects, the United States will have to get down into the trenches of the Chinese local political system.* How are natural resources and energy priced? What is the penalty for flouting the law for factory managers and local officials? How are regulations enforced and does enforcement vary from one province to the next? If so, why? What is the role played by civil society, the media, and the legal system as an accountability check on local officials and enterprise leaders?

Looking to a post-Kyoto World: Opportunities for U.S.-China Cooperation

In late May 2007, a foreign reporter inquired of a Chinese climate official whether China should be labeled "Mr. No," in part because of Beijing's refusal to accept any targets or timetables for limiting or reducing China's greenhouse gas emissions. The official responded, "We won't be a Mr. No. We want to be a Mr. Cooperation and a Mr. Partnership." [20]

Unfortunately, if cooperation means nothing more than what China already has on the books, it won't be enough. How then to engage China in a more rigorous post-Kyoto accord?

Play to China's Image Concerns
Leadership on the part of the United States is a prerequisite for any change in China's climate change policy. China faces no cost to its reputation from inaction as long as the United States refuses to chart its own aggressive course of emissions reductions. The United States needs to be on board with the European Union and Japan—and critically for China, the developing world—in order to push China (and India) on its climate policy.

A Global Fund for Technology, Financial and Policy Transfer
For China, ensuring access to financial, technological and policy cooperation is the top priority in any global environmental accord. China, along with India, will argue that it is a developing country, with ¼-1/5 the per capita emissions of the United States and far less historical contribution to the problem. The international community, in essence, must pay China to play.

The Clean Development Mechanism already offers one such avenue of technology and financial transfer. A global fund for all developing countries to help access training opportunities and technologies is a necessity. Yet China should not be counted among those most in need of such a fund. China is a global economic power with US$1.3 trillion in foreign currency reserves. It also has NYSE-listed indigenous companies such as Suntech that produce state-of –the-art solar panels for export. China is in a position to be not only a recipient of international technology and policy support but also a provider of

[20] Alan Wheatley, "China's Climate Change Plan Due Ahead of G8 Summit," Reuters (May31, 2007)

such assistance to less-developed countries. It is now in a position to license technologies or even purchase companies that can advance its response to climate change.

A Sectoral Approach

While the United States and China are making progress on joint R&D in areas such as carbon sequestration and capture, the nature of China's political economy suggests that cooperation on policy development and implementation is equally, if not more, important.

Energy efficiency might be one area where the United States and China might jointly set targets and timetables and develop comprehensive programs. Energy efficiency in buildings, greening the energy supply chain in factories, or as CI proposes, a comprehensive system of energy efficiency in industry, buildings and products could all be part of such a sectoral approach.[21]

To help with enforcement, the U.S. can play an important role by

- Encouraging U.S. multinationals to "scorecard" the factories from which they source based on their energy efficiency—rewarding those that meet or exceed energy efficiency targets and punishing those that do not;
- Ranking provinces based on how effectively they meet their energy intensity reduction and pollution targets, much in the same manner that the American Chamber of Commerce in China evaluates provinces on their intellectual property rights protection efforts;
- Supporting the efforts of U.S. NGOs to train local officials and business leaders on the opportunities and economic advantages of energy efficiency; and
- Dramatically increasing assistance to environmental and legal non-governmental organizations within and outside China who are educating and protecting the Chinese citizenry. These organizations are at the forefront of civil society development in China and merit not only rhetorical but also financial support for the critical work they are doing.

[21] See for example, the much under-utilized U.S. Energy Savings Performance Contracting Program, which brings companies such as Johnson Controls, Honeywell and Chevron into government facilities to raise energy efficiency standards. There is no up-front cost to the government; the companies are paid back over a 5-10 year time frame through savings from the energy bills. Similarly, the new program launched by the U.S. Consulate in Hong Kong in which Hong Kong based energy service companies will evaluate factories on the mainland for their potential energy savings, secure a loan through a multilateral institution or bank, and again the factories will pay back the investment over time through energy savings. The World Bank's work with NRDC on its Greenwatch program in Jiangsu Province and Conservations International's efforts to push Integrated Resource Energy Planning, which looks to upgrade entire industrial drive systems—motors, pumps, compressors, and fans--as well as to put into place the most energy efficient appliances, and develop green buildings—are also initiatives that could form the basis of a sectoral approach to climate change.