SECTION 4: PROSPECTS FOR ADDRESSING THE EFFECTS OF CHINA'S ENERGY CONSUMPTION

"The Commission shall investigate and report on—

"ENERGY—The effect of the large and growing economy of the People's Republic of China on world energy supplies and the role the United States can play (including joint research and development efforts and technological assistance), in influencing the energy policy of the People's Republic of China.

"UNITED STATES-CHINA BILATERAL PROGRAMS—Science and technology programs, the degree of non-compliance by the People's Republic of China with agreements between the United States and the People's Republic of China on prison labor imports and intellectual property rights, and United States enforcement policies with respect to such agreements."

Energy Policymaking Reform

In May 2007 a study by the McKinsey Global Institute concluded, "Developing countries could contribute more to improving energy productivity, largely because they tend to start at a lower base than developed economies. Their faster growth also creates opportunities to adopt the latest, energy-efficiency technologies in a cost effective way. The choices they make will therefore be critical to the future trajectory of energy demand growth. China, as in so many other respects, will be crucial because of its size and rapidly growing weight in the world economy."[221] The environmental consequences and strategic effects of China's energy consumption will have dramatic consequences for China and the world. For this reason it is very important to encourage China to find options that limit demand, and allow China to improve its energy security and environmental quality. Successfully addressing this issue will be crucial not only for the continued health of the Chinese economy but also, given the nature of the globalized economy, for the continued health of the American economy.

To succeed in increasing energy efficiency and conservation, and in adopting cleaner energy technologies, China will need to address the structural weaknesses within its energy policymaking and enforcement apparatus and establish policies that provide economic incentives for choosing cleaner energy alternatives.

U.S. Environmental Protection Agency (EPA) Assistant Administrator for International Affairs Judith Ayres testified to the Commission that "... the heart of a successful regulatory regime is compliance and enforcement. ..."[222] Yet, as mentioned in Chapter 3,

Section 1, China's energy policy structure places responsibility for implementing most energy use policies on local and provincial governments. This decentralization results in a potpourri of approaches rather than a cohesive national policy intended to curb emissions and improve energy efficiency. For example, Ms. Barbara Finamore, Senior Attorney and Director of the China Clean Energy Program at the Natural Resources Defense Council, testified that the 11th Five-Year Plan (2006–2010) calls for the implementation of building efficiency standards that require energy savings of 50 percent for new buildings and 65 percent for buildings in Beijing, Shanghai, Tianjin, and Chongqing. However, only 10 percent of newly constructed commercial buildings and 15 percent of new residential buildings are in compliance.[223]

Assistant Secretary of Energy for Policy and International Affairs Karen Harbert noted in her testimony that the solution to this failure is not "upping the mandate," but rather is clearly delineating responsibilities and providing policy tools that enable officials to implement the law.[224] Mr. Saad Rahim of PFC Energy testified that China currently has an opportunity to put a new framework in place to resolve the existing system's problems, but if China delays, then the political, economic, and environmental costs associated with its existing energy consumption will rise exponentially.[225]

China's State Environmental Protection Administration (SEPA) recognizes this situation and has taken a crucial step to strengthen its capability to prescribe and enforce regulations pertaining to energy use by creating six regional offices. Typically, provincial and local governments in China establish agency structures mirroring the structure of the central government, but the provincial and local agencies do not coordinate directly with the central government counterpart agencies.[226] Also, funding for provincial and local government agencies usually is collected at the local level, establishing a strong incentive for local officials to be responsive to local interests. However, in SEPA's initiative, its regional offices will report directly to it and will not be subservient to local economic interests. SEPA hopes this structure will increase its ability to monitor air pollution and enforce air quality regulations.[227] Importantly, SEPA has sought assistance from the Asian Development Bank and the U.S. Environmental Protection Agency in developing this new regional system and in engaging stakeholders outside the national government.[228] Seeking structural examples from other nations in the process of determining how China will address its internal challenges is a positive step, and offers a reason to be hopeful that China's government also will be willing to engage cooperatively with the United States and other nations to address environmental challenges and to share environmental data.

Along these lines, the Chinese government's recent decision to refuse to release two reports quantifying the impact of air pollution on public health and the cost of China's pollution on its gross domestic product (GDP) is not a fortuitous indicator.[229] Without public information detailing the costs of pollution to China and the Chinese people, it will be more difficult for the government to take the steps necessary to reduce pollution, establish monitoring base-

lines, and motivate the public to participate in energy conservation and environmental awareness efforts.

Assistant Secretary Harbert noted in her testimony that, with an increasingly market-oriented economy, China now is starting to realize that it must incentivize action, rather than mandate it.[230] Policies can provide either positive incentives (to encourage a certain behavior) or negative incentives (to discourage a behavior). For example, pursuing a policy of demand-side management would provide a positive incentive because it would promote consumer conservation of energy by internalizing the costs of energy efficient technologies in power production. Essentially, investment in energy efficient technology by power producers and government administrators would result in "avoided demand."[231] China has tested this policy in Jiangsu Province, and has adopted Jiangsu's program as a national model for other provinces.[232]

Following a large benzene spill in the Songhua River in Heilongjiang Province in 2005, China passed regulations that criminalized failure to report the spill of dangerous pollutants.[233] Attaching criminal penalties to the reporting requirement is an example of a negative incentive—in this case applied to local officials.

To assist it in bringing energy and environmental problems to the public sphere, and thereby enhancing its enforcement capability, SEPA has been encouraging nongovernmental organizations (NGOs) to investigate and report local environmental problems. Dr. Jennifer Turner of the China Environment Forum at the Woodrow Wilson International Center for Scholars testified, "Chinese environmental NGOs have begun to take on more sensitive issues such as [conducting] a national campaign to demand more transparency in dam-building decision-making and assisting pollution victims in class action court cases."[234] Essentially, SEPA is beginning to employ NGOs to help extend the reach of the central government's enforcement capability for environmental laws and regulations to the provincial and local levels.

Stimulating Commercial Investment in Clean Energy Technology

Altering the existing financial incentives pertaining to pollution so that Chinese firms perceive negative economic costs tied to industrial pollution, and see pollution prevention as being in their self-interest, will be key to achieving pollution reduction objectives. Mr. Wayne Rogers, a Partner at Sonnenschein, Nath & Rosenthal, testified, "China recognizes that there are technology choices to protect the environment and to reduce atmospheric pollution; however, these are perceived as 'costs,' not 'benefits.'"[235] Reframing the private sector's perception of costs and benefits in the market will be crucial to persuading businesses to invest in the application of cleaner technologies.

In his testimony to the Commission, Dr. Mun S. Ho, a Visiting Scholar at Resources for the Future, suggested one means of altering market forces to favor reducing pollution: establishing a "green tax."

> *Pollution is a "negative externality," i.e. the factory owner does not bear the cost of the health and material damages*

> *[of pollution] . . . A pollution tax [or "green tax"] would "internalize" this externality, if producers are charged a fee for every ton of SO_2 [sulfur dioxide] they produce: then they would: (a) find ways to reduce SO_2 emissions, (b) raise the price of their output leading consumers to use less of this environmentally-unfriendly good, leading to lower output and lower fuel use. The level of this fee should thus be set in a manner that balances these costs on producers and consumers with the health benefits.*[236]

Chinese firms do not have to bear the environmental costs of producing and consuming energy.[237] A green tax, such as a carbon tax,[238] would encourage energy producers to seek energy production methods that produce the least pollution. Given that producers pass on some of their costs to consumers, energy consumers would be encouraged to choose environmentally friendly energy producers. Consumers of manufactured products would have an incentive to choose products from manufacturers whose processes are the most environmentally friendly, because the cost of their products would be lower. This policy would not necessitate a dramatic decline in national output as it promotes a shift toward environmentally sustainable production and energy use.

Foreign direct investment and venture capital also can be instruments to promote and facilitate the use of clean energy sources and technologies. Dr. Kelly Sims Gallagher, Director of Energy Technology Innovation Policy at Harvard University's Kennedy School of Government, testified that ". . . foreign direct investment can be a highly effective mechanism for the transfer of technology, but technology transfer (especially clean technology transfer) does not happen automatically. . . . There must be incentives in place to elicit clean technology transfer because the private companies do not find it in their interest to develop, transfer, and install cleaner technologies on their own." Such incentives could include requiring private joint ventures to meet higher standards for pollution controls and to transfer clean energy technologies among the venture partners.[239]

Given that China soon will become the world's largest energy market, venture capital can provide seed funding for development of new energy technologies to meet China's demand. Expansion of venture capital in China will be challenged by pervasive violation of intellectual property rights, as venture capitalists will be averse to the risk of losing control to pirates of firms' newly developed technologies.[240] Addressing intellectual property enforcement could facilitate the development and distribution of clean energy and energy efficient technologies.

China is one of the world's largest markets for the Kyoto Protocol's Clean Development Mechanism that allows companies in industrialized nations to invest in clean energy projects in developing countries in order to meet their Kyoto compliance obligations. China's involvement in this mechanism brings international companies into the country and "allows the gap to be closed between higher costs of green energy and the market cost of brown energy."[241] The United States is not a party to the Kyoto Protocol and thus is not engaged in this initiative. However, witnesses recommended establishing bilateral or multilateral mechanisms to encourage private

sector investment—such as the creation of an investment fund to accelerate adoption of low-carbon technology in China.[242]

U.S.-China Cooperation on Energy

Central findings from the Commission's hearings and research this year are that China cannot address its energy and environmental problems adequately without international cooperation, and that the United States, both because it is the world's biggest consumer of energy and because it possesses some of the most advanced energy efficiency and clean energy technologies, should play an active role in providing assistance to China. Assistant Secretary Harbert declared, "It is incumbent upon us to engage much more aggressively with China, to help them understand the benefits of participating in a world market."[243] Dr. Elizabeth Economy of the Council on Foreign Relations warned that "[r]eal cooperation on climate change and energy and the environment is every bit as difficult as that on arms proliferation, market access, or human rights."[244] Nonetheless, the costs of failure would be so high to both nations that the United States needs to do all it can do to help China recognize the benefits of implementing energy efficiency and conservation measures, and removing the manmade causes of global climate change.

The U.S. Department of Energy (DOE), the U.S. EPA, and U.S. universities and nongovernmental organizations have been actively pursuing cooperative activities on a number of levels. Deputy Assistant Secretary of Energy David Pumphrey testified, "DOE engages China in energy policy, energy security, fossil energy, energy efficiency, renewable energy, and nuclear energy and nonproliferation. The primary mechanisms include the U.S.-China Energy Policy Dialogue (EPD), technical cooperation under the auspices of the U.S.-China Science and Technology Agreement, the U.S.-China Peaceful Uses of Nuclear Technology Agreement, the Oil and Gas Industry Forum, and the recently established Strategic Economic Dialogue (SED)."[245] Another mechanism is the Asia Pacific Partnership for Clean Development and Climate that involves Australia, China, India, Japan, the Republic of Korea, and the United States. These partners "have agreed to work together and with private sector partners to meet goals for energy security, national air pollution reduction, and climate change in ways that promote sustainable economic growth and poverty reduction."[246]

In addition, the United States has actively engaged China on the development of nuclear energy technology, as was mentioned in Section 1 of this chapter. However, this cooperation has been expanded beyond only the sale of nuclear technology to China—to include cooperation on nuclear security and the expansion of peaceful nuclear energy. In May 2007 at the fourth meeting of the Joint Coordinating Committee of the Peaceful Uses of Nuclear Technology Agreement, the United States and China created a new working group on "nuclear emergency management; a new sub-group on radiological source security in the nuclear security, emergency management, and safety working group; and the inclusion of export control technical cooperation to jointly develop Chinese language nuclear commodity guides to aid in China's export licensing and en-

forcement."[247] Also, China has expressed interest in joining the Global Nuclear Energy Partnership (GNEP) that seeks to expand access to nuclear energy technology for peaceful purposes while reducing the risk of nuclear proliferation. The State Council in China has not finally determined if China will participate.[248]

The FutureGen project has the greatest potential to curb China's emissions in ways other than requiring China to reduce its coal consumption. FutureGen Alliance Chief Executive Officer Michael Mudd testified, "The FutureGen Project is a global public-private partnership formed to determine the technical and economic feasibilities of generating electricity from coal with near-zero emissions, including carbon dioxide [CO_2]." FutureGen will cost an estimated $1.5 billion when estimated revenue offsets are included.[249] The U.S. Department of Energy is funding 74 percent of the project, and China, India, and South Korea are co-funding it;[250] China is expected to pay $10 million.[251] This project is designed to demonstrate the feasibility of constructing and operating a power plant that will rely on an Integrated Gasification Combined Cycle (IGCC) technology, and then capture and sequester carbon dioxide so it will be nearly free of emissions.[252]

The China Huaneng Group, one of China's largest energy companies, is a private partner in the FutureGen Alliance along with some of the United States' largest power companies. Of note, the Alliance is a non-profit organization and members like Huaneng are not entitled to receive financial gain or intellectual property associated with the FutureGen project.[253] Given the extent of China's coal-related environmental problems, successful development of FutureGen that enables application of this technology to power production elsewhere in China should be warmly welcomed by Beijing.

The U.S. EPA has engaged China in "agency-to-Ministry agreements, multilateral efforts such as the Asian Pacific Partnership on Clean Development and Climate," and SED discussions.[254] Assistant Administrator Ayres testified that many of the EPA's programs are conducted within the framework of a 2003 Memorandum of Understanding with SEPA that allows the two agencies to coordinate activities. Current projects include working with SEPA and Beijing's EPA to retrofit diesel buses in Beijing with emissions control equipment in advance of the 2008 Olympic Games, and working in rural areas to decrease indoor air pollution by providing alternative home heating and cooking energy sources.[255]

The EPA's Integrated Environmental Strategies Program (IES) was identified in testimony before the Commission as a very successful program for U.S.-China cooperation.[256] The IES Program seeks to reduce greenhouse gases on a global level and air pollution on a local level through the implementation of integrated policies and measures. The EPA's China program, initiated in 1999, is composed of three parts: "(1) assessment of energy options and health benefits in Shanghai; (2) analysis of energy and transport programs in Beijing; and (3) a national assessment of GHG [greenhouse gases] mitigation potential and expected health benefits of several air pollution control policies."[257] One of the outcomes of this collaboration is that Shanghai changed its 10th Five-Year Plan (2001–2005) to focus more on energy and investment in cleaner energy alternatives for the city.[258]

The EPA also has engaged China in the work of the multilateral Methane to Markets Partnership that seeks to promote "cost-effective, near-term methane recovery and use as a clean energy source."[259] As China is the world's largest emitter of coal mine methane, its participation in this effort has significant implications for reducing greenhouse gas emissions. Also, China will host the Methane to Markets Expo in 2007 to showcase the partnership.

In addition to activities directly sponsored and implemented by the U.S. government, U.S. universities and NGOs have actively pursued cooperation with China on energy and environmental issues, often with government funding. Two university projects—the U.S./China Energy and Environmental Technology Center (EETC) at Tulane University and the China Environmental Health Project at Western Kentucky University—were examined by the Commission in its hearings.

The EETC works with U.S. government agencies to expand the collaboration and transfer of clean energy technologies, and has centers in the United States at Tulane and in China at Tsinghua University. According to EETC Director Dr. S.T. Hsieh, "[t]he center's major goal is to enhance the competitiveness and adoption of U.S. clean energy and environment technology, especially clean coal technology for power generation, transmission, and emissions reductions supported by DOE [the Department of Energy]."[260] The EETC seeks to accomplish this by enhancing U.S. industry partnerships in China that focus on small- and medium-sized businesses; through involvement of public and private stakeholders; and through industry education and training in China addressing the financial and technical aspects of employing new technology.[261] In practical terms, EETC's projects benefit U.S. businesses by increasing U.S. technology exports—as a function of promoting the transfer of coal gasification technology, coal liquefaction technology, and flue gas desulfurization technology to Chinese companies and organizations. The EETC currently is pursuing projects on nitrogen oxide emissions reduction; retrofitting small industrial boilers in Beijing to make them more efficient; carbon capture and sequestration; and capturing coal mine methane and coal bed methane and supplying it to local townships.[262] All these projects fulfill goals for cooperation identified by the U.S. DOE. They also involve U.S. businesses by matching American technology with energy-related opportunities in China.

At Western Kentucky University, Dr. Wei-Ping Pan leads the clean coal technology component of the China Environmental Health Program, funded by the U.S. Agency for International Development. In this program, Dr. Pan cooperates with Anhui University of Science and Technology in Huainan City. This city has a strong interest in the project because it has coal reserves of 44.4 billion tons or 19 percent of China's total national reserves. The China Environmental Health Program seeks to improve air quality monitoring and control in Huainan City; to train Chinese researchers in the latest environmental protection technologies; and to assist Anhui University researchers in studying the impact of coal emissions on community health.[263] This project combines data collection with environmental impact studies and meets two crucial needs within China: first, compiling accurate emissions data and

information at a local level about how applied technology can reduce emissions; and second, collecting accurate information on how coal emissions are affecting local health and productivity.

Prospects for Future Cooperation

Based upon an analytical review of the testimony before the Commission, three important aspects of U.S.-China energy cooperation emerge. First, Administration witnesses noted that frequent high-level ministerial dialogue on energy and the environment is important for raising consciousness on these issues, demonstrating government commitment to resolving energy security and environmental concerns, and establishing the matters addressed as priorities for the subordinate bureaucracies that must carry out the programs' activities. Assistant Secretary Harbert testified that the Department of Energy has conducted ten senior-level visits to China in the past two years. This interaction signals that energy security and energy cooperation are high priorities for the United States, and that the United States prefers to resolve mutual concerns through cooperation rather than conflict.

The Strategic Economic Dialogue (SED) has been an important mechanism for demonstrating high-level interest in various issues including energy and environmental matters, and for cooperatively addressing mutual concerns. Although the general impression is that the SED has not produced significant accomplishments, it has provided a forum in which both the United States and China have expressed like-minded ideas about a number of energy and related issues. During the December 2006 meeting of the SED, Secretary of Energy Samuel W. Bodman and NDRC Chairman Ma Kai signed the U.S.-China Energy Efficiency and Renewable Energy Protocol. This agreement builds on prior initiatives to advance the use of renewable energy technologies in China and the commercialization of solar, wind, biomass, geothermal, and hydrogen energy.[264] At the SED in May 2007, "Secretary Bodman led discussions on the urgency for investment in the energy sector, the importance of a diversified energy mix, and the power of scientific innovation in addressing climate change issues"—all issues on which China and the United States have similar views. Both countries agreed to develop up to 15 large-scale coal mine methane projects in China, agreed to reduce cost barriers to the full commercialization of advanced coal technologies, and signed a Memorandum of Cooperation on Nuclear Security.[265]

Assistant Administrator Ayres noted that during the SED the U.S. EPA and China agreed to conduct a Joint Economic Study to evaluate the environmental, economic, and health costs of policy approaches for saving energy and controlling emissions. The two nations also agreed to explore harmonizing the U.S. program for energy efficiency labeling for consumer products with China's Standard Certification Center (CSC) to improve the energy efficiency of Chinese products and reduce energy intensity.[266]

The second aspect of U.S.-China energy cooperation brought out in testimony to the Commission is that addressing China's coal consumption will be necessary in order to address U.S. and Chinese energy security and environmental pollution. Without strong

intervention by Beijing, China's dependence on coal likely will not diminish, even as the environmental costs grow. The quantities of pollutants emitted from China's coal combustion affect other portions of the world including the United States, and, of course, the entire planet is subject to the climate change to which China's greenhouse gas emissions now are a major and growing contributor.

As long as coal remains a major energy source for China, development and commercialization of carbon capture and sequestration (CCS) technology will be critically important. Before such technology can be commercially viable, large-scale underground pilot tests must be conducted and the cost of obtaining carbon to conduct such tests must be reduced substantially.[267] Witnesses before the Commission suggested that the U.S. government should support these demonstration projects—both within the United States and in China—and the development of a viable business model for employing this technology.[268] Before CCS can be implemented on a large scale, sites in China that are geologically and geographically suited to be reservoirs must be identified.[269] Ultimately, the technology must be applied both to new power plants that will be constructed and to existing plants that must be retrofitted to capture carbon—an expensive proposition.[270] While the former in most cases will be less expensive, the number and emissions volume of existing plants makes the latter essential, despite the high cost, in any scheme intended to achieve major reductions in China's carbon emissions. Already China is collaborating with other Asia Pacific Partnership nations on CCS under that Partnership's auspices, but Dr. Jeffrey Logan, Senior Associate at the World Resources Institute, argued that the United States should strongly encourage and further assist China to pursue a broader and more aggressive effort.[271]

Finally, witnesses testified that U.S.-China cooperation on energy and the environment should be predicated on U.S. leadership and action on these issues to address U.S. domestic energy and climate concerns. Dr. Logan made the following case:

> *The most important thing the U.S. can do to mitigate the impacts of China's recent enormous growth in energy demand is to lead by example. The U.S. must demonstrate that it can address energy security and climate change simultaneously within a thriving economic context. . . . Without this leadership, no incremental shift in technical assistance or policy dialogue will get the traction it needs to help move China onto a fundamentally different course.*[272]

His testimony, echoed in statements by Governor Brian Schweitzer of Montana, argued that the United States has the ability to encourage and affect change in China's energy strategy and consumption patterns by demonstrating the feasibility of energy conservation and energy efficiency in the United States, moving substantially toward energy independence, and significantly reducing U.S.-generated carbon dioxide emissions. Such steps can yield new ideas, techniques, policies, and technologies that the United States can share with China, and identify new stakeholders to involve in addressing global climate change.[273]

Conclusions

- Success in addressing China's energy challenges will require the Chinese government to focus on correcting the structural weaknesses within its energy policymaking apparatus.
- Cooperative projects that promote and support the collection and reporting of sufficiently detailed energy and environmental data will contribute substantially to China's ability to address challenges in these fields and to the ability of the United States and other nations to provide real encouragement and targeted assistance to those efforts.
- U.S.-China cooperation on energy and the environment is a crucial component for addressing the energy challenges that both countries face.
- China presents an opportunity to develop and apply U.S. energy technologies on a large commercial scale that will increase the viability of these technologies on the market.