Foreward

Jennifer L. Turner, Editor

Over the past year, cooperation and dialogue between the United States and China on environmental issues has grown. A delegation from the U.S. National Oceanic and Atmospheric Administration (NOAA) visited China in September 1999, not only to attend working group meetings and workshops, but also to commemorate twenty years of Sino-U.S. scientific cooperation in oceans and atmosphere. The U.S. China Forum on Environment and Development held a third meeting in Hawaii, in January 2000, which has led to new cooperative agreements on renewable energy, atmospheric contaminants, and green chemistry. At this January meeting, the United States/China Water Resources Management Program was also formally established as a working group of the U.S.-China Joint Commission Meeting on Science and Technology. In terms of nongovernmental (NGO) activities, the first NGO Forum on U.S.-China Environmental Cooperation was held in Bethesda, Maryland, in September 1999. As the inventory in this issue of the *China Environment Series* reveals, cooperative environmental activities between U.S. and Chinese nongovernmental organizations have increased over the past year.

This third issue of the *Series* opens with an article by Chris Nielsen, the executive director of the Harvard University Committee on Environment China Project. He argues that the linkage between global and local environmental issues has been highly under-emphasized in the environmental dialogue with China. The environmental studies being undertaken jointly by researchers at Harvard University and various Chinese institutions clearly embody this concern for understanding the local environmental challenges in China and linking them to global concerns. The other four articles in the *Series* explore changes and challenges in the Chinese transportation sector. While vehicle emissions and decisions on land-use for transportation raise local environmental and health concerns in China, they also have regional and global environmental effects. The first of these articles is by Robert E. Paaswell, the Director of the Region II University Transportation Center at the City College in New York. Paaswell highlights some potential lessons from the United States to help China mitigate problems of urban sprawl and traffic congestion. Furthermore, D. Tilly Chang, a Transport Operations Officer with the World Bank, describes the policy evolution of public transport in China. She also provides insights into the institutional and political challenges facing mass transit development in Chinese cities. Michael P. Walsh, a technical consultant specializing in motor vehicle pollution control issues, discusses policy recommendations made in a recent study of vehicular pollution in Chinese cities. Lastly, our authors from Tsinghua University, He Kebin and Chang Cheng, provide an evaluation of current and proposed policies to mitigate vehicular air pollution in China.

The first two issues of the *China Environment Series* featured an inventory of U.S. government and NGO environmental projects and activities taking place in China. In this issue we have broadened the coverage of the inventory to include current and recently completed environmental projects in China undertaken by other countries as well. The inventory also includes a sample of environmental activities funded by multilateral organizations. We will continue to expand the breath and depth of this inventory and will soon convert it into a searchable database on our Internet site (http://ecsp.si.edu). Countless people have contributed to this inventory and I am grateful to all the people in the U.S. government agencies and NGOs who generously gave their time to compile and summarize the information on activities their organizations undertake in China. A large portion of the more recent bilateral and multilateral entries have been made possible by Read Vanderbilt through his work in China as the Project Leader for the Project on Sino-Foreign Environmental Cooperation. Chris Adams and Justin Harris at the U.S. Embassy in Beijing and Jim Stover from EMS were also generous in sharing information for this inventory. Considerable assistance in compiling, formatting, and proofreading this information was done by Clair Twigg (Assistant Editor) and Aaron Sundsmo (Research Assistant) here at the Woodrow Wilson Center. Any updates, corrections, or inquiries regarding the inventory should be directed to me at chinaenv@erols.com.

Lastly, I would like to thank our funder, the National Oceanic and Atmospheric Administration for their support of the Working Group meetings and this publication. I began my work as Editor of the *China Environment Series* and as Coordinator of the Working Group in September 1999. I wish to thank my colleagues at the Woodrow Wilson Center and the members of the Working Group who have welcomed me with enthusiasm. I also wish to tip my hat to Aaron Frank, the first coordinator of this project, whose energy and creativity produced this dynamic discussion forum and the *China Environment Series* publication.

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Perspectives on Global and Chinese Environment: Overview of the Harvard University Committee on Environment in China

by Chris Nielsen

In many respects, the People's Republic of China (PRC) is following a time-honored, familiar path in its development. The primary goal of the PRC's steady and swift economic growth over the last two decades has been delivering to its people a relative prosperity that is largely defined in immediate material terms. While one may question the success of this material transformation as to its equity across the Chinese population, it is difficult to doubt its success in an aggregate, national sense.

What is familiar to observers of development including observers of now-wealthy nations like the United States is that this transformation is taking place at great cost to China's natural environment. Also familiar are most of the specific forms of China's environmental degradation. The PRC's rivers, reservoirs, and other water resources are largely fouled. Its urban air is laden with harmful particulates, gases, and toxins. Households in rural China are often choked with dangerous cookstove smoke. The PRC's solid and hazardous wastes are often dumped untreated. Serious deforestation and overuse of other natural resources have fueled economic growth, but have also diminished biodiversity and endangered many forms of wildlife.

China has a small environmental protection bureaucracy mounting ambitious policy responses to each of these and other complex challenges, but it clearly suffers from insufficient human, technological, and budgetary resources for the tasks at hand. More problematical is the fact that its efforts are undermined by a raft of confounding societal, economic, political, and legal factors rooted far afield from mere environmental concerns, with the myriad of transitions taking place across China as a society, economy, and nation as a whole.[1]

While the above environmental problems and many others are severe and harmful to human and/or ecological health, it is fair to observe that nearly all nations went through, or are going through, similar environmental degradation when at economic stages like China's current one. The time-honored course of national development is to pollute at low and medium stages of economic development, and to embrace aggressive environmental protection only when a nation reaches a comparatively high economic status. While we are learning that treating environmental protection as a societal luxury good can be challenged easily on a multitude of counts, it is nevertheless an understandable national response because it approximates the course previously taken by most countries.

Instead of narrowly focusing on the rapid economic development of China and concomitant environmental problems, we should consider expanding our focus to the development of the planetary population and global environmental problems. For example the rise of an anthropogenic environmental risk on the comprehensive scale of global climate change. Driven by historical means of meeting the material, agricultural, and energy demands of an ever-larger global population pursuing conventional development, there is no doubt that humankind is fundamentally transforming the planetary biosphere and atmosphere.[2] Legitimate scientific debate continues on the precise risks these transformations will pose to human societies and to ecological systems, but the evidence continues to mount that resulting hazards might reach scales heretofore unforeseen in human history. Humankind is essentially conducting a geophysical experiment with the planet that sustains it. We possess limited means, however, to predict the results of this experiment or even to ensure that conclusive tools of prediction will be developed in time to head off what could be ahistoric human and ecological impacts. The uncertainties inherent in understanding systems as immense and complex as the human interaction with the global biogeosphere themselves counsel, at minimum, precautionary measures.

The United States is by far the leading contributor of anthropogenic gases raising the risks of climate change. China is the fast-rising, second-ranking contributor and is likely to surpass the United States in the coming decades. In raw emission terms, these two nations are linchpins to the global response to the greenhouse effect. Given the drastic economic disparities of the two countries, however, their responsibilities in this strategy are "common but differentiated" in the parlance of the United Nations Framework Convention on Climate Change (UNFCCC). "Accordingly, the developed country parties should take the lead in combating climate change and the adverse effects thereof."[3]

It takes little insight to recognize

that the politics—both international and domestic—of determining the practical nature of such "differentiated" responsibilities are enormous and nearly overwhelming. The Kyoto Protocol of 1997 represents a first, halting step toward defining them. Whether the Protocol will ever enter into force, dependent as it is on a U.S. Senate ratification that currently appears nowhere on the horizon, remains to be seen.

China, for its part, is meeting its lesser UNFCCC commitments and carefully playing a role of self-protection in the ongoing convention negotiating processes. Like all but a handful of developing countries, China is devoting its limited resources to what it sees as more immediate priorities, including some of its domestic environmental woes. On climate change, it is awaiting the leadership of the developed world that was laid out in principle, and subsequently ratified—including by the U.S. Senate—the original Rio agreement.[4]

Surmounting the political barriers to effective, precautionary, global action on climate change is an enormous policy challenge, and its confluence with bilateral Sino-American relations could prove pivotal. The short-term political impediments to the Kyoto Protocol's entry-into-force, or its replacement with a more viable alternative, are issues that merit serious attention. For observers decrying the current inaction of the United States, the one nation that must lead the way to viable solutions by its own example, to begin with one need not be overly pessimistic. Mounting scientific evidence and pressure from more proactive allies, and perhaps from a citizenry that at least in the abstract framing of public opinion polls expresses pervasive greenhouse concern, may in time alter the American domestic political landscape now impeding such movement.

All does not depend, however, on these eventualities. Many other strides toward politically acceptable policy solutions can and should take place. One essential step is correcting the typical myopia of viewing climate change in isolation from other environmental problems. In the Sino-American context, there is a great tendency to view the pressing domestic environmental priorities of China described at the outset of this article in opposition to the global environmental priorities described in the paragraphs immediately above. Actors on all sides often accept that a key roadblock to greenhouse headway is that there are far more pressing concerns than climate change, including other environmental ones, that face nations like China in the coming decades.

The lost opportunity of simple acceptance of this priority discordance, whether by American actors lamenting a protracted greenhouse stalemate or by Chinese viewing the climate negotiations as an attempted transfer of responsibility for a problem the West created, is gigantic. It is rooted in an overly narrow conceptualization of the issues at hand, or, in academic terms, the hazard of single-issue, single-disciplinary assessment. A refutation of this argument, moreover, does not even depend on demonstrating the prospective impacts of climatic change on China itself, as large and ultimately priority-altering as they may prove to be. This is fortunate, because local and regional impact assessment of climate change is the most imprecise component of the scientific story.

The linkage of global and local environmental issues has been highly under-emphasized in the environmental dialogue with China. One of the most vital components of China's domestic environmental agenda, as judged by a comparative health risk assessment, is the need to mitigate local air pollution. Addressing local air pollution can converge powerfully with a well-structured international strategy to mitigate climate change. The predominant cause of both sets of problems is the combustion of fossil and other fuels to meet energy demands. A multitude of solutions to both problems is thus coincident. In the short-run these include incremental but potent and feasible options in improved end-use and combustion energy efficiencies, and the switch to cleaner fossil fuels. In the longer term, these solutions include prospects in large-scale leapfrogging to alternative and renewable energy sources and to modes of sectoral development in which energy demand might diverge from conventional trajectories.

Asserting this confluence of problems and solutions rests on an integration of natural, medical, and applied scientific assessments. While difficult, this is in fact the more straightforward part of the analytical equation. The much tougher challenge is creating international and domestic policy mechanisms informed by this confluence that can be implemented in a cost-effective way. The international context returns one to consideration of UNFCCC processes, such as the evolution of the complex and politically sensitive "flexibility mechanisms" of the Kyoto Protocol. Connecting these to effective domestic policy in places like China is still more challenging, because of the confounding social, economic, political, and legal factors in implementation mentioned earlier in this article. The development of global environmental prescriptions unshaped by central participation of experts and policy actors from China and other developing countries is, in the end, worse than a recipe for ineffectiveness. It is a recipe for polariza-

tion. To address such complex hazards effectively, there is no choice but comprehensive analytical and international inclusion.

Ultimately, a reconciliation of global and Chinese domestic environmental priorities may be more feasible than most realize. Indeed if industrialized countries like the United States better acknowledge the unfamiliar conditions and needs of the developing world, and if nations like China respond carefully but openly, there may be opportunity for most in a well-designed, equitable greenhouse strategy. For China these prospects include real technological, financial, and expert assistance for its own domestic requirements, and avoidance of health and economic damages of the environmental mistakes of other nations. For developed nations like the United States, the opportunities include lowered costs of meeting their own "differentiated" responsibilities on climate. Perhaps most importantly for all countries, of course, the prospects also include lowered risk of direct greenhouse impacts in the future.

The Harvard University Committee on Environment China Project

The need to explore intellectual and policy linkages of global and local environmental degradation motivated Harvard's university-wide Committee on Environment (UCE) in 1993 to begin building a program of Harvard-China collaborative research, the University Committee on Environment (UCE) China Project. Its central aim is to investigate a reconciliation of rising international concern about climate change with the immediate Chinese domestic concern for worsening urban and rural air pollution. The program has long-term, institutional objectives that are related to, but distinct from, the specific topical goals described in the introductory section above. It is also driven by two aims of Harvard as a university, one internal and one external, both responding to the limitations of narrow scholarship when assessing real-world environmental choice in an international context.

The linkage of global and local environmental issues has been highly under-emphasized in the environmental dialogue with China.

Recognizing the fundamental multidisciplinary character of environmental degradation and its solutions, the internal aim of the program pursues the mandate of Harvard President Neil Rudenstine to engage the varied schools and departments of the university in internal collaboration on environmental topics. The complex interplay of natural, applied, and medical science, economics, politics, law, culture, and ethics in the reconciliation of climate change and local and regional air pollution abatement are a natural fit for such an interdisciplinary mandate. Given our attention to these issues in a U.S.-China context, the program broadened the mandate for intellectual cross-fertilization beyond the university's diverse network of environmental scholars, to include members of its equally expansive community of specialists in China studies.

On issues of international import, Harvard University possesses the external aim to foster external, cross-national collaboration. The program is explicitly dedicated to facilitating the confluence of Chinese and American environmental scholarship through exchange and joint research of Harvard and PRC counterparts. The UCE China Project has so far developed its strongest such relationships to institutes and departments of Tsinghua University, Beijing Medical University, the Academy of Social Sciences, the environment committee of the National People's Congress, the State Environmental Protection Administration, the Ministry of Science and Technology, and more recently, the Development Research Center of the State Council.

To date, the research has been conducted in three phases. Phase I tasked participants with taking stock of what was already understood about the general topics of interest. It consisted of exploratory review studies and preliminary analyses, which solicited contributions by open invitation to a range of faculty in the natural, applied, and medical sciences, as well as economics, business, political science, law, cultural anthropology, and history. Contributors came from Harvard, other western universities, and a variety of Chinese institutions. These first studies were published in 1998 in *Energizing China: Reconciling Environmental Protection and Economic Growth*, distributed by Harvard University Press.[5]

Building on these preliminary assessments, Phase II consisted of larger, externally funded, multi-year studies. Some retained a single-disciplinary thrust, strengthened by periodic research reviews by those in other fields. Others were launched with more integrated interdisciplinary aims; the three most ambitious ones were initiated as pilot studies to test their feasibility. The program is now initiating its Phase III, in which most

of the prior projects are concluding pilot or intermediate activities and will embark on new stages of research. A couple of new projects, including two major interdisciplinary ones, are also being launched. Funders of research have included the U.S. and PRC governments, multilateral agencies, and a variety of private foundations, organizations, corporations, and individuals.

Space in this article naturally does not permit full representation of each research initiative and its results. To provide a sampling of the work underway, however, we turn next to brief sketches of a number of the studies, and notes on the topics and status of the others.

University Committee on Environment China Project Studies

Dynamic Economy-Energy-Environment Model

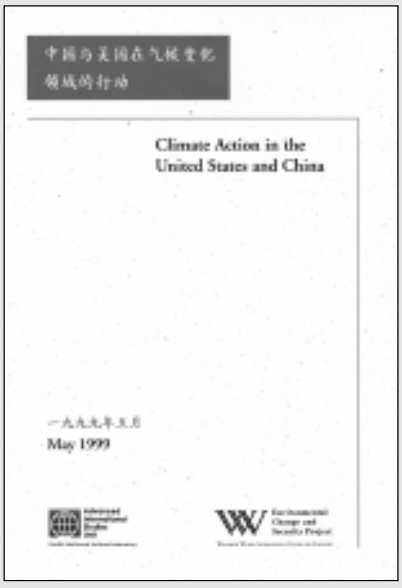
A central effort under the program has been the development of a dynamic computable general equilibrium model of the Chinese economy. In addition to accounting for the effects of population growth, capital accumulation, technological change, and changing patterns of demand, the model also incorporates elements of the dual nature of China's economy in which both plan and market institutions continue to exist side-by-side. The model was developed by a group of Harvard economists, led by Dale Jorgenson, with the collaboration of scholars at China's Academy of Social Sciences and the Development Research Center of the State Council.

The model has been used for a number of environmental policy and economic analyses. One model explores the possible use of carbon taxes to reduce emissions of carbon dioxide in China.[6] The team conducted policy simulations in which carbon emissions were reduced by five, ten, and fifteen percent from their baseline. These carbon taxes were offset by reductions in enterprise taxes to maintain revenue neutrality. After initial declines, in all simulations the gross domestic product (GDP) and consumption rapidly exceeded baseline levels as the reduced enterprise taxes left producers with more retained earnings. Although subject to caveats, the team found evidence of a potential "double dividend," a decrease in emissions of CO_2 along with a long-run increase in GDP and consumption.

In a second analysis, the team also investigated why China's energy use per unit of GDP has fallen so dramatically in recent decades.[7] A long debate has existed in the literature over the relative roles of lower energy use in individual industries versus the sectoral reallocation of total output in this change. At the same time, concerns have been raised about the accuracy of Chinese output data. The team has developed a simple adjustment to produce more plausible output estimates, and has used the most recent input-output data to decompose the overall reduction of energy use into technology and structural changes. Despite finding a serious source of error in the data series definition, the team considers a fair conclusion to be that most of the fall in energy use during 1987-1992 was due to a fall in real energy intensity (at the two-digit industrial classification level) with changes in demand patterns contributing to a small rise in energy use. The changing composition of imports also is playing a role in this fall of energy use. Further research is needed to show if these conclusions also hold at finer levels of industrial classification.

The Future of the Chinese Electric Power Sector: Implications for Emissions of Local and Regional Air Pollution and Carbon Dioxide

This project explores the most cost-effective investment, technology, and policy choices to meet the increasing demand for electricity in China, and their resulting effects on air pollution and carbon dioxide emissions.[8] The study is centered on



Climate Action in the United States and China—Published in May 1999, this thirty-page pamphlet in English and Chinese is designed to provide objective information on climate change projects and policies in the respective countries. A joint publication of the Environmental Change and Security Project and Batelle/Pacific Northwest National Laboratory, over 3,000 copies have been distributed to a broad range of international policymakers and climate experts.

If you would like a copy, please visit our website at http://ecsp.si.edu/Climate-brochure or contact ECSP at chinaenv@erols.com.

a nonlinear optimization model that is designed with a user-friendly graphical interface and runs on a desktop or laptop computer so that the model can be readily used as a decision support tool by policymakers. Led by environmental engineer Peter Rogers, the study has incrementally refined and updated the model over several years in collaboration with colleagues at Tsinghua University and the Energy Research Institute.

The model divides China into six regions characterized by their fuel supplies and other energy resources, interregional transport and transmission capacities, current power production, and projected future electricity demands. It calculates the optimal technology mix by minimizing the total cost to meet this assumed demand for each region. The study evaluates sixteen technological options for five-year periods over twenty-five years. The latest version has added several new technologies and alternative energy sources, physical and chemical coal washing, and six new coal categories based on ash and sulfur content. The total cost being minimized includes fuel costs, transportation and transmission costs, fixed and variable operating costs, coal washing costs, and investment costs for new capacity, all discounted to the present. Outputs of the model include emissions of sulfur dioxide and carbon dioxide and deposition of sulfur. The optimization can be run with limits on any or all three of these factors, to explore implications of environmental policies on power sector development.

The Human Dimensions of Environmental Policy Implementation: Air Quality in Rural China (the "Anqing Project")

Balancing the macro-scale studies in the program, this ambitiously comprehensive initiative has as its research focus environmental policy implementation and the health effects of air pollution on the community- and household-level. The study focuses on the largely rural jurisdiction of Anqing, which lies on the Yangzi River in southern Anhui province.

Working with the local Bureau of Public Health, the initiative capitalizes on a pre-existing, large-scale epidemiological survey of Anqing residents' respiratory health, including lung function, asthma, and bronchitis. The centerpiece of the study includes a new household survey of the subjects' knowledge of environmental protection, perceptions of environmental quality, sources of knowledge about the environment, methods of addressing environmental problems, as well as household energy use, economic situation, and demographics. It also adds household-level air pollution monitoring, interviews of local cadres and enterprise managers, and an archival newspaper review for gaining environmental, economic, and political background of the region.

The goal is to learn when and how local citizens become environmentally aware—especially regarding air pollution problems—and to draw appropriate lessons for policy. This roughly includes two broad topics. The first is how people get basic environmental knowledge through schools, the news media, local meetings, or personal experience, with special emphasis on actual air pollution-related respiratory health problems. The second is whether people are able to act on that knowledge through their own behavioral and economic choices or their political and legal options.

The multidisciplinary team (including public health officials, air pollution epidemiologists, political scientists, legal scholars, cultural anthropologists, and an economist) has completed a pilot study and is currently drafting its initial papers.[9] The team initiated the first full wave of field research in summer of 1999, although completion of the field research has been delayed by Yangzi flooding in the district. Under consideration for the future of the study is a comparative extension of a part of the research strategy to a more economically vibrant and urban locality in coastal China.

The Harvard-Tsinghua Joint Working Group on the Clean Development Mechanism of the Kyoto Protocol

The Kyoto Protocol's primary transnational policy instrument to limit greenhouse gas emissions in developing countries is the "Clean Development Mechanism" (CDM).[10] The CDM takes advantage of the fact that a ton of greenhouse gas (GHG) abated in China, for instance, has the same climate benefit as one saved in the United States, because the greenhouse effect takes place in the global atmospheric commons. It also seeks to capitalize on projected lower marginal costs of GHG abatement in developing economies. The structure of the CDM is not specified in the Protocol and is the subject of ongoing debate, but it is designed in principle to create incentives for firms in developed nations to invest in GHG-abating activities in developing ones. In return, through still-to-be-devised systems, abatement credits would be transferred and counted toward attainment of the firm's home country GHG commitments under the Protocol.

Bringing CDM into practical application, however, depends on overcoming a score of imposing analytical and political challenges. To date, the vast majority of CDM studies have been limited to broad theoretical surveys of issues, with little

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"You have really put together a first-rate piece. The layout is crisp, clean, highly readable…You have a fine assortment of articles, all at just the right length for all-in-one-sitting readability. I loved the book review you solicited…it was refreshing to read a true critique, with both positive and constructive comments… I also especially liked the report highlights and project news sections—they really give the reader a sense of the breadth of your work at a glance."

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consideration of real project conditions and site data. Following a set of preliminary papers,[11] an interdisciplinary Harvard-Tsinghua Joint Working Group on CDM is focusing on one cross-cutting requirement of such investments: the viability of determining acceptable emission baselines. Baselines are the linchpin of the concept, as they are the necessary reference case against which the abatement benefits of a project are measured.[12] Calculating baselines, however, even on the most bounded, project-level basis, is neither a straightforward task nor one likely to yield strictly accurate results. The main analytical challenge is that the baseline is generally hypothetical in nature, and some uncertainty is unavoidable. Emission reductions are intended to be additional to those that would occur in the entire economy in the absence of the project. A vexing challenge un-

der the environmental "additionality" requirement is to assess indirect emission effects of a specific CDM investment, i.e., those emissions occurring outside of the process targeted in the project.

The team, led on the Harvard side by environmental engineer Peter Rogers and international law scholar Abram Chayes, and by a diverse faculty group at Tsinghua led by Vice President He Jiankun and energy system scholar Liu Deshun, is now conducting a series of case studies of Chinese CDM opportunities. These emphasize actual field assessments in applications as diverse as electric power,[13] coke-making,[14] district heating, vehicle stocks, and renewable energy. From the completed case studies, the team's integrative objective is to draw a neutral comparative analysis of the practical viability of baseline determination for CDM. A mid-term version of this assessment has now been drafted in support of an initiative of the Asian Development Bank.

Valuation of the Health Damages of Air Pollution in China

A newer multidisciplinary project is growing out of the economic, atmospheric, and epidemiological research of several Phase II studies described above and below. Its aim is to estimate the aggregate economic value of health damages due to major forms of air pollution in China. Chinese colleagues have projected that such valuations, if they can be estimated within reasonable uncertainty bounds, could potentially have major policy influence in the PRC.

This effort, led by economist Dale Jorgenson and including Harvard public health faculty Xiping Xu and James Hammitt, and Tsinghua environmental engineer Hao Jiming, consists of four components of research in a coordinated strategy: 1) an economics team generating economic output, energy use, and emission levels; 2) an air transport group estimating concentrations of pollutants; 3) an epidemiological team translating concentrations and exposures into health impacts; and 4) a contingent valuation group estimating the costs of such health damages in local currency, Renminbi. The team is trying to improve incrementally on the analytical components of an earlier, related assessment conducted by the World Bank.[15] Following a couple of exploratory pilot efforts in the study's planning stage,[16] contingent valuation field surveys were started in 1999 and a modeling simplification covering the topics addressed by the air transport and epidemiological groups (2 and 3 above) is being developed for the current phase.

Policy and Strategy Studies on Reducing CO_2 and SO_2 Emissions in Chongqing Municipality

This multi-component pilot project was conducted on the PRC side, with principal investigators at the State Environmental Protection Administration (SEPA), Tsinghua University, Beijing Medical University, and the Academy of Social Sciences, as well as with support from the Ministry of Science and Technology and municipal authorities in Chongqing. Harvard UCE researchers chiefly served a periodic advisory role, and facilitated a portion of the study's funding. The lead investigators at SEPA subsequently used the results to inform a U.S. $1 billion, low-interest loan made by Japan to reduce severe air pollution conditions in Chongqing, along with two other Chinese cities.

Based on an application of the Long-Range Energy Alternatives Planning (LEAP) model to Chongqing, the group sought strategies to reduce sulfur dioxide emissions in ways that might also meet eventual pressures to limit emissions of carbon dioxide, the leading greenhouse gas.[17] Among the recommendations of the team's "enhanced environment scenario" were: 1) accelerating the Sichuan Basin's natural gas development for energy use rather than as chemical feedstocks; 2) averting all new coal-fired power plant construction by increasing the proportion of hydroelectricity, gas-fired power, and imported electricity; 3) installing fluidized gas desulfurization (FGD) on existing plants that lack them; 4) creating incentives for coal washing; and 5) capitalizing on new rail links to import higher quality coal from northwest China for small- and medium-scale enterprise use.

The team made a lengthy list of incentive-oriented policy recommendations to achieve these aims. Among them were deepening local industrial reform, notably privatizing natural gas and coal distribution, and subjecting these fuels to market pricing. To target small-scale, disaggregated users of coal, the team recommended pollution taxes based on sulfur, ash, and even carbon content. They advised giving priority on natural gas and hydropower in government energy-sector investment, customs abatement for import of clean technologies, and pass-through of FGD operational costs in electricity pricing. To target small and medium-scale enterprises, the team also proposed greater central government support for dissemination of information, technical support, and training on energy conservation. The recommendations conclude with a more general aspiration for law-based environmental oversight, and enhancement of the institutional capacities of local environmental protection bureaus for inspection and management.

Other Studies

- **Growth of Greenhouse Gases.** Assessing the Contributions of East Asia and North America. Michael McElroy of Harvard's Earth and Planetary Sciences, chairman of the UCE China Project, has led development of a three dimensional chemical tracer model of the atmosphere to explore net contributions of a range of important greenhouse gases in East Asia and North America. This approach takes into account both anthropogenic and natural sources and sinks of GHGs. The researchers, having constructed the model, are currently analyzing mid-term results from its early runs.
- **Environmental Law Drafting in the PRC.** William Alford, Director of Harvard Law School's East Asian Legal Studies Program, is leading a study of the environmental law drafting process in China, focusing in the current phase on the air pollution law and its revisions. An anticipated law review article reporting findings of this stage of the research is now in final revisions.
- **Management Teaching Cases.** Harvard Business School researchers led by Richard Vietor have developed several teaching cases on foreign investment and trade in China, and their environmental implications. The latest case examines the efficiency gains of Honeywell digital control systems installed in a Beijing district heating system and in a petrochemical plant in Anqing, Anhui, the locality of the "Human Dimensions" study described above.[18]
- **Air Pollution Epidemiology.** Xiping Xu of the Harvard School of Public Health, also co-Chair of the UCE China Project, has a long-standing research program on air pollution epidemiology in China in collaboration with Beijing Medical University and others. The China Project has provided supplementary support to several large studies investigating such relationships as the effect of particulates and sulfur dioxide on pulmonary function in Chongqing[19] and air pollution on daily mortality in Shenyang.[20]
- **The Future of the Chinese Transport Sector: Emission Implications.** Peter Rogers of Harvard and Hao Jiming and He Kebin of Tsinghua are directing a next phase of modeling research to another sector with great local, regional, and global environmental effects: transportation. The team has initiated a study with two linked components. The first investigates emissions from urban mobile sources, starting with a now-completed pilot effort to develop a spreadsheet-based vehicle pollution information system for Beijing. The second component, exploring interregional freight and passenger transport flows, will be based on and linked to the optimization model used in the China Project's power sector study described above. In subsequent work the team plans development of an optimization model that can assess an array of options in urban transport—from new technologies to traffic management strategies—subject to pollutant exposure, emission, and/or cost constraints.

Chris Nielsen is the executive director of the Harvard UCE China Project. He was co-editor of Energizing China: Reconciling Environmental Protection and Economic Growth *(McElroy, Nielsen, and Lydon 1998) and co-author of its lead chapter. He was also co-author of an environmental chapter in* Living With China: U.S.-China Relations in the Twenty-First Century *(Vogel 1997).*

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Transportation Infrastructure and Land Use in China

Hu Muqin, sixty-three, was the third winner the other morning of a gleaming new $15,000 Citroen—the top prize in the public lotteries that Beijing and many other Chinese Cities are holding all this week to raise money for victims of last years floods. "I'm so happy…I'll give my car to my thirty-year old daughter, who is just learning to drive," said Mr. Hu. "Everyone who comes here has just one goal, to win a car," said Ling Xiaoping, a migrant from Southern China.

New York Times, *18 February 1999*

Atlanta [Georgia, U.S.A.], 1999. Once a wilderness, it is now a thirteen-county eruption, one that has been called the fastest spreading human settlement in history...It consumes 500 acres of field and farmland every week. What it leaves behind is tract houses, access roads, strip malls, off ramps, industrial parks and billboards advertising more tract houses where the peach trees used to be.

Time Magazine, *22 March 1999*

by Robert E. Paaswell, Ph.D., P.E.

That land use and transportation are inexorably linked is well known. Less well documented is the quantifiable nature of that link.[1] Land use concerns the distribution of activities, while transportation is the spatial link among these activities. The transportation links are characterized by costs including travel time, trip reliability, and the price of the trip to the user. The attractiveness of the activities and the costs of gaining access to them define the transportation—land-use interaction. What seems a simple relationship, has been for planners quite complex. For example, enhancing the attractiveness of a shopping area might increase the demand for such development but it simultaneously creates a crowded area. Conversely, increasing the cost of travel might decrease the attractiveness of an important development. Motorization has a great impact on the perceived costs of travel to the traveler, as well as to the developer. These costs shape the overall accessibility, which is a concept fundamental to land-use and transportation discussions. Accessibility is the cost, usually figured as travel time, in reaching a variety of locations. The greater time it takes to reach a location, the lower the accessibility. Accessibility to an area is increased as the number of activities increases at a given location. To translate this term into a concrete example, imagine if an individual has thirty minutes to shop and there is a choice of using public transport or a car. In a car the individual can visit more stores more quickly than on public transport. A car therefore increases the individual's accessibility to more locations.

The desire to travel quickly to many places (e.g., create greater accessibility) has shaped land-use and transportation decision-making and planning in the United States and other countries. The subsidization of housing costs combined with government subsidies for highway construction has, for example, dramatically changed the nature of American cities within two short decades. In 1940, most U.S. citizens resided in rural areas, but by the 1960s the majority of the population lived within urban areas. Since 1980, most of the urban population has moved to the suburbs with many commuting by auto to work. Households in the United States own, on average, more than one motor vehicle and in large states such as California there are actually more motor vehicles than licensed drivers. To support these motor vehicles, the U.S. government has built more than 3.5 million miles of paved roadway—more than one paved mile per square mile of land area.[2] The United States started its process of motorization early in this century[3] and institutionalized it by establishing the federal Bureau of Public Roads to deal with roads in 1916.

Car ownership and land-use trends in other industrialized countries have replicated those in the United States. For example, in both Western Europe and Japan car ownership and miles traveled have increased at a faster rate than population growth. In Europe, growing battles are being waged over the proliferation of mega-stores in suburban and rural areas. Similar to the developments in the United States, these new mega-stores are changing the patterns of shopping from town center to peripheral shopping center. The personal automobile is also being embraced as a symbol of wealth in developing countries with rapidly growing economies such as the People's Republic of China.

While comparisons between countries are often difficult, examining the development of transportation in the United States could provide insights for countries like China that are in the earlier stages of developing this infrastructure. First, China and the United States are similar in size, but differ widely in terms of population size and concentrations. Each country has a contiguous land area of approximately 3.7 million square miles. The population of China, 1.2 billion people, is nearly five times the U.S. population of 272 million. The urbanized population of China (28.85 percent of the total population) is 346 million, which is greater than the entire population of the United States. Table 1 shows the

comparisons of several large urban areas in the United States and China and illustrates the great difference in density.

Second, the history of travel has been significantly different in the two countries. In the United States, mobility of people and the rate of trip making have always been high because of significant government infrastructure development. In contrast, prior to the economic reform era that began in 1978, mobility was not encouraged in China. In fact, Chinese citizens were required to obtain permission from their place of work to travel outside the area where they were registered. Third, and finally, there is the issue of differing levels of development of transportation infrastructure and motorization. In the United States, the preferred mode of travel has been the car and the structure of U.S. urban areas has changed significantly since 1950 to reflect these preferences. As noted, the U.S. population is predominantly suburban, but it has taken infrastructure investments over eighty years to create that situation. It is this investment which created the 833,600 miles (1,342,000 kilometers) of urban roads,[4] which serve an urban population of 203 million people.[5] In China, 65,100 miles (104,900 kilometers) of urban road serves a population of 346 million.[6] In the United States there are now 206 million motor vehicles (with over two-thirds in urban areas) and nearly one private car for every two persons. In China, there are over five million motor vehicles in urban areas which translates to one motor vehicle for every seventy persons. In comparing the two countries, it is important to keep these differences in mind.

This paper will discuss three general themes: (1) the transportation and land-use issues arising in major Chinese urban areas; (2) how the United States addresses land-use and transportation issues; and (3) lessons learned in the United States that may be used to inform future development in China.

Table 1. Population Density and Urban Population in the United States and China

City	Population Density Persons per sq. km. (Data for built-up or central area)	Population of Urbanized Area
Beijing	13,200	10,510,000
Shanghai	20,700	12,950,000
Guangzhou	15,900	6,240,000
National Average	11,100	
New York	9,264	19,100,000
Los Angeles	843	14,621,000
Chicago	2,082	8,238,000
National Average	109	

Source for China: *China's Urban Transport Development Strategy*, S. Stares and Liu Zhi, eds., World Bank: Washington, D.C., 1996. Source for United States: R. Paaswell and J. Zupan, "Transportation Infrastructure and New York's Competitiveness," *Citizen's Budget Commission*, New York, 1999.

China: The Influence of Accessibility on Land Use and Transportation

Data from Chinese cities show that congestion has made non-motorized modes—cycling and walking—as competitive as public transport for distances under ten kilometers (six miles).[7] In the United States, average travel speeds by auto of 33.6 miles per hour allow the driver in eleven minutes to travel the same ten kilometers that take a Beijing resident fifty minutes.[8] In fifty minutes a U.S. driver can gain access to more than twenty times the activities of her Beijing cohort—or have the same number of activities dispersed over twenty times the land area. In the United States, it is this accessibility by auto that has allowed and encouraged urban areas to become dispersed. When travel modes were slower, or more onerous, workers lived closer to their work and cities were denser and more compact. Urban cores were the heart of commercial activities. Today, with the exception of four or five cities, the concentration of activities at urban centers has decreased. More Americans commute between a suburban home and a suburban job than into the core, because the cost of travel, which includes time, reliability, convenience, and price, encourages it. Even in around New York City—world famous because of its Manhattan core of activities—more commutes are suburb to suburb than to the core.[9] This dispersion occurs at high cost with potentially negative impacts on economic stability and environmental quality.

Understanding causes and impact of the decreased accessibility in

Table 2. Areas of Major Cities in China and the United States

City	Metropolitan Area (square kilometers)	Metropolitan Area compared to New York
Beijing	16,808	.78
Shanghai	6,341	.29
Guangzhou	7,434	.34
New York	21,551	1.0
Los Angeles	87,972	4.1
Chicago	17,174	.80

Source for China: S. Stares and Liu Zhi, eds. *China's Urban Transport Development Strategy*. Washington, D.C.: World Bank, 1996. Source for United States: R. Paaswell and J. Zupan. "Transportation Infrastructure and New York's Competitiveness." *Citizen's Budget Commission.* New York, 1999.

Chinese urban areas is important for it underlines the challenges China faces in balancing land-use and transportation issues. The first fact on accessibility is that Chinese cities are already dense (see Table 1) and have, compared to the United States, slow commute times under congested conditions. Even with extremely high densities of the central cities, extremely slow travel speed decreases accessibility, which in turn impedes the economic growth potential in Chinese cities.

Second, over the last two decades, China has undergone unprecedented economic growth, which has spurred growth in urban areas. Economic reforms freed many from work in the agricultural sector and these rural people have flocked to cities to seek employment. This has resulted in a massive increase in the number of "floating" populations in the large cities.[10] For example, in Beijing, there are over three million floating workers—people with no permanent residence in Beijing—who must make the journey to work along with resident workers everyday. The daily influx and egress of these workers exacerbate the congestion that is already present.

Third, the success of economic reforms has led to the growth in the number of large Chinese cities, with forty cities now larger than one million people. The primary modes of transportation in Chinese cities have been biking or walking. In Beijing, these modes encompass sixty-eight percent of trips; in Shanghai, sixty percent. The average distance traveled by bicycle is 3.9 kilometers. Because of the heavy dependence on bicycles, it has been more efficient in China to locate businesses near residences or vice-versa. Not surprisingly, these highly populated Chinese cities all have land areas that are small compared to large U.S. cities (See Table 2). Accessibility linked to slow travel speeds stimulates high densities; conversely, the ability to travel much further at speeds several times higher than their Chinese cohorts has led Americans to suburbanize and develop immense amounts of land. Suburbanization in the United States has been followed by demands for more highway building, which, by decreasing travel times, has increased accessibility.

Over the past twenty years, large Chinese cities, already congested from bicycle traffic and a growing fleet of motorized vehicles, have become even more congested. Simply stated, the accessibility within these cities has decreased considerably. Two phenomena have emerged simultaneously. The first is the growth of congestion that creates the demand for relief. Two methods used to alleviate congestion are to either improve transportation by adding more capacity or to relocate activities to less congested areas, usually in the periphery. The second phenomenon is the quest for more luxury. As workers becomes more affluent, they have less tolerance for inconveniences such as buses crowded at more than eight persons per square meter; bicycle collisions; and the inability to walk freely in the streets. This desire for comfort has led to a tremendous growth of the taxi industry in China with more than 400,000 now in use. Because accessibility is cost, as the affluent workforce grows, they will create more demand for transport which is less costly in terms of time and comfort, reliability, and convenience, but are financially more personally expensive.

Transport and Congestion

A great cause of congestion in Chinese cities is the inadequate capacity of the road network. A number of reasons explain this inadequacy. First, there are, by international comparison, too few kilometers of roadway per capita. Second, these roads are used by an incompatible mix of vehicular and non-vehicular traffic.[11] The inadequacy of the basic infrastructure and roads makes it difficult for public transit to serve the commuters any better than walking or bicycling. In Beijing, a bicycle trip of ten kilometers takes fifty-one minutes. The same distance is covered by bus in 48-51.5 minutes.[12] Increased road congestion has led to declines in both bus average speeds and over-

all motor vehicle average speeds in the Chinese cities in the last decade.

Building rail transit, an extremely expensive alternative to bus transit, is unlikely to ease current patterns of urban congestion. While rail is fast, it has a limited area of coverage, unless built as a dense network as in New York, Chicago, or London. All of these systems, now over 100 years old, were built as the cities grew and not imposed on existing development. Even if rail transit had room to be constructed, the demand for street space in Chinese cities is so high and their travel needs so great, that any traffic diverted to rail would quickly be replaced by other street traffic.

Adding to the congestion is the increasing rate of motorization in Chinese cities. The annual growth of the motor vehicle fleet is over fifteen percent, while road building to accommodate this growth increases at twelve percent per year.[13] Trucks make up more than fifty percent of this motor fleet. These trucks serve businesses and distribute most goods because the over-taxed rail system cannot meet all the needs of moving products to market. As economic expansion continues, there will be great pressure for more trucks and for a greater reliability (e.g., just-in-time delivery) in these movements. New roads are needed to provide additional capacity for these expanded needs. With the increases in business and personally-owned motor vehicles in China there is simultaneously a great pressure on land development to decentralize and move both housing and businesses to suburban rings.

Planning in Chinese Cities

Chinese cities are currently engaged in a formal planning process that should help alleviate the congestion problems discussed in the above section. However, the growing wealth of individuals leads to an increase in demand for personal cars, which in turn creates constraints on the ability of government planners to achieve plan objectives.

Land use and transportation are issues "joined at the hip." Yet planners have had a difficult time in constructing plans that lead to the implementation of transportation infrastructure and land development that totally complement each other. This is true in the United States, Europe, and without a shift in thinking, soon, it will be true in China. While planning in most countries starts with the establishment of long-term goals and objectives, political realities and investment needs often shift planning from these far-sighted ideals to planning and building to take care of immediate problems. Certainly, high on the list of these immediate problems in China are the growing costs of congestion, such as decreases in accessibility and declines in economic productivity as delivery of goods is slowed. It is the declining accessibility in the core of urban areas, due often to declining bus service, that leads to pressures to decentralize development. Currently, housing and businesses are rapidly moving to suburban rings outside Chinese cities. Below are several key planning objectives Chinese cities must meet to address urban congestion.

- Provide more road capacity to meet the tremendous need.
- Sustain and balance a transport system that includes bicycles as well as a growing motor vehicle fleet.
- Provide increased access to jobs and to homes (permanent or temporary). This need will often lead to finding new land on which to build.
- Decentralize activities away from the core.
- Maintain strict zoning control over land in order to control development.

The national government in China has put in place a planning process intended to address these issues.[14] There remains, however, some obstacles to effectively execute these plans. For example, in urban areas, planners must deal with a number of conflicting situations simultaneously. They must address how major infrastructure improvements or land-use changes will impact current system behavior, accessibility, and the costs associated with travel. Urban planners must also examine how to make both needed capacity additions (e.g., new roadways, bus routes, and rail lines) and how to improve the capacity of the existing system (e.g., new signal controls, intersection capacity, bicycle streets, and parking controls).

At the national level, the State Council and the State Planning Commission set mandates for planning, including national economic policies and strategies. These planning mandates also may address motorization policy or conditions for new urban rail systems. These broad planning mandates are handed down to the Provincial Planning Bureaus and to the municipalities, where officials are more knowledgable of local needs. Following the general central guidelines, concrete five-year plans are established by municipalities. The actual parameters for the plans originate from the agencies at the lowest levels—in townships and cities—and these plans work their way up to the municipal government, where balance among the various planning and implementing agencies should be found. After approval, the appropriate bureaus, in theory, carry out the plans. One significant gap in this planning process is that the central

government lacks significant financial power to impose sanctions or to create incentives to enforce these plans at the lower levels.

The planning function for public transport and road construction in Chinese urban areas falls under the auspices of the Municipal Construction Bureaus. The Municipal Bureaus of Public Security address safety and traffic control. Conflicting objectives among departments of these and other bureaus and problems of overlapping responsibility have hindered the optimal implementation of the plans. Moreover, once planning has been carried out and implementation of road and transit programs begin, there are no assurances that any coordination will take place between those bureaus responsible for street and road construction, traffic operations, transit operations, and bicycle and pedestrian circulation.

Another obstacle to effective planning is the lack of uniform regional planning in China. For example, in large municipal areas such as Shanghai and its surrounding environs, there might be a number of communities that carry out this planning process. There exists no requirement for a coordinated regional plan. This may lead to further conflict in infrastructure development and in land use. As the current momentum in Chinese cities is to add road capacity, undesired or unanticipated impacts on land, including undesired rates of decentralization, or difficult-to-support suburbanization might result. Throughout China many municipalities are now implementing road plans that impose ring roads, grid, or other road networks over the urban structure in an attempt to improve accessibility within the urban area and to stimulate motorization. These roads demand considerable land space and change the relationship between activity centers and the roadways, much as they have in the United States. This parallel stems from the fact that the Chinese planners are borrowing pages from the U.S. practice of road building. The basic assumption is that accessibility increases will improve both the quality of urban life and the economic structure of the region. While levels of motorization are low—compared to European and U.S. levels—there might be some success in this effort. But, local planners are not having success controlling local land uses, ceding them to private economic markets, which tend to promote unregulated sprawl development outside of cities. This situation now arising in China is similar to the growth in sprawl development in the United States immediately after World War II. The United States has spent over eighty years addressing these concerns of planning and implementation; therefore, some overview of current transportation planning in the United States and its rationale will be explored below. Such experience may contain valuable lessons relevant to the development in China.

Transportation and Land-Use Policy in the United States

The United States has evolved from a primarily rural country at the beginning of the century to a predominately urban one as we approach the year 2000. As noted above, nearly three-quarters of the U.S. population lives in urban areas, but more than one-half of this population lives in suburbs. As workers moved to the suburbs, so did their jobs, and the services that supported them. The primary commute in the United States today is single occupant vehicles travelling between suburbs instead of into the city centers. Public transit captures only four to five percent of the transportation market; however, as Americans are extremely mobile, this market share is still nearly nine million trips per day.[15]

Over the last two decades, the impacts of motorization and suburban sprawl on the environment and on traffic congestion have become major concerns of city planners and citizens. Congestion is no longer a concern only of the peak hour commute to the city center, but an all-day concern on suburban roads that no longer have the capacity to met the demand. Work trips, in fact, represent only eighteen percent of person trips taken and twenty-two percent of the miles traveled. Americans travel 4.2 trips per day, which is nearly double that of their Chinese urban counterpart. Americans make only six percent of their trips by walking or bicycling.

By the late 1980s, planners and government officials in the United States began to realize that the costs of suburbanization and the support infrastructure might be too great. The following list illustrates the broad range of these costly problems and provides insights for other countries such as China in the process of suburbanization.

- Suburban sprawl created housing at extremely low densities, which in turn demanded increases in road building and suburban road capacity.
- The costs of maintaining the existing transportation infrastructure were often more than could be managed by local governments. Rapid deterioration of roads and bridges occurred because of poor maintenance and high loadings—both in volume and weight. The roads had not been designed for such high loadings.
- Public transit was losing market share, which exacerbated suburb-

anization, for as transit service worsened more people in urban cores relocated to suburban areas.
- Highways built for inter-city access were becoming congested due to increased use from suburb-to-suburb travel. Moreover, the percentage of major highways with severe congestion continued to increase.
- Suburbs were being constructed without consideration of densities to support public transit and often without a concern for activity centers that could be reached on foot or by bicycle.
- The increased congestion led to sub-standard air quality in most urban areas.

In a 1991 attempt to remedy these concerns, the federal government passed the Inter-modal Surface Transportation Efficiency Act (ISTEA). In 1998, a subsequent version of this Act became law—the Transportation Efficiency Act for the Twenty-first Century (TEA21). TEA21 continues the major elements of ISTEA. Notably, these two acts reintroduced previous federal planning and road support programs. Since 1916, the U.S. federal government has traditionally provided significant capital support for highways and transit systems. Beginning in the late 1970s, the federal government also created laws and regulations that mandated a formal regional planning process. Specifically, cities were required to set up a Metropolitan Planning Organization (MPO) to carry out long-range transportation planning. Moreover, the MPO was responsible for developing an annual list of projects to be carried out to accomplish the long-range plan. This annual plan, the Transportation Improvement Program (TIP) required federal government certification and had to meet six major planning criteria, including land-use planning. These mandated Metropolitan Planning Organizations and Transportation Improvement Programs fell into disuse in the 1980s, but with the passage of the ISTEA and the TEA21 in the 1990s both the MPO and TIP were re-energized. TEA21 aims to ensure proper consideration of land use as transportation improvements and investments are made. For example, TEA21 demands that:
- no new capacity be developed to support single occupant vehicles;
- more powerful transit alternatives be developed;
- non-motorized vehicle alternatives must be considered;
- communities consider public transit- oriented design;
- transportation investments are to be designed to build sustainable communities; and,
- all transportation improvements must make positive improvements in air quality and relieve congestion.

To simplify program development, the federally-run TEA21 also provides flexibility by allowing funds to be shifted between highway construction and public transit projects. The ultimate success of land-use and transportation planning lies with the local-level government. However, there exist two factors that perpetuate the inability of local areas, unless they choose as part of expressed local policy, to achieve the national objectives concerning sustainable land-use and transportation planning mandated in the TEA21. The first factor is the fragmentation of transportation planning bodies and operating bodies throughout various local government agencies.[16] The second factor hindering sustainable transportation development is that all land use is controlled at the local level, down to the smallest town. The fact that development is often controlled by local zoning often means a community will not have to consider the impact of major development—such as a shopping plaza—on traffic generation away from the site, and certainly not on the next community.

The crucial question is whether China can avoid the kind of sprawl and environmental damage that has been created by motor vehicles in the United States.

ISTEA and TEA21 have changed transportation planning in the United States from highway-oriented to multi-modal planning. Yet, growing congestion during the period 1991-1998 have led to pressures to continue to improve roads, especially in suburban areas. In a study of U.S. urban growth patterns, Chinitz showed that no matter how much effort officials in central cities make in increasing their population, suburbs continue to grow at faster rates.[17] During the period between 1980-1990, the average growth in U.S. central cities was 0.64 percent while growth in suburban areas was double that rate at 1.42 percent. Sustaining this move of population to the suburbs is the continued movement of jobs to the suburbs. Three-quarters of the New York region jobs are outside the five boroughs, even though work in New York is associated with the core of Manhattan. Rail transit in New York

makes it possible to achieve employment densities in excess of 200,000 persons per square mile in the core of Manhattan, yet a sophisticated network of 37,000 miles of roadway is necessary to support travel outside the core. New York, which has developed suburban satellites, must support highway infrastructure similar to most large U.S. cities; yet, to sustain its economic vitality, city officials must support a public transit infrastructure similar to Paris, London, and Tokyo. The cost to New Yorkers for this kind of support is $72 per year/person for highways and $81 per person per year for transit.[18]

Transportation development in New York holds insights for densely populated cities such as those in China, for New York has, as have London, Tokyo, and Paris, made a commitment to sustain high densities of employment at the core. This means that primary jobs and services to support the jobs (e.g., financial and legal) and workers (e.g., food, druggists, personal care shops, and gyms) must also be located in the core. Public transit, walking, and telecommuting represent options to deliver people to primary jobs and support services. This dependence on public transport and walking underlines the continued need for high density development in urban areas.

Actions to Slow Sprawl

In suburban areas workers face challenges of sprawl and more trips in the auto than their urban counterparts. Many communities in the United States, TEA21 notwithstanding, do not know how to cope with sprawl or are unwilling to address the issues of sprawl. In some progressive areas, however, actions to address the inefficiencies of land use and the environmental impacts of high levels of auto use are being taken. In MPOs in California these planning bodies are charged with making transportation investments and land use development compatible. In Portland, Oregon, the MPO has the responsibility to insure that its transportation plans are compatible with its long-range growth plans. Portland also encourages in-fill, namely, building in denser areas of the urban core that are abandoned or unused. Growth limits create demands for smaller amounts of available land. Zoning at higher densities, however, must accompany these limits and transit must be put in place to support the higher densities. The decision of families to move to a higher density area means more trips can be satisfied without a car, and in ideal circumstances, household purchases of additional cars are delayed or put off altogether.

A recent and promising aggressive approach to address land use through transportation has occurred in Atlanta, Georgia where a regional transportation agency has been established by the state government to mitigate the urban-suburban problem of sprawl-related congestion. This agency has the power to deny infrastructure connections to new developments, to plan and build rail transit and bus lanes, and withhold local funding unless projects get appropriate approvals and meet congestion and air quality requirements. Despite the potential benefits, such state-wide initiatives are still few in the United States. Data suggest the traditional patterns of suburbanization are continuing, but in response to congestion and poor land use the national and local governments are taking actions to slow sprawl. Incentives and new services to relieve congestion are outlined below.

- Transit-oriented design. Suburban communities and activity centers are built at densities that support transit between activity centers and walking within activity centers. Transit-oriented design can also be part of less dense urban areas. Here employment and residential areas can be mixed, access to transit can be made more direct, and corridors can be developed that support busways or light rail. In suburban transit-oriented design, the ability to do personal tasks, such as shopping, by walking in the neighborhood of the work site encourages transit use.
- Improved access to commuter rail. Local areas are being encouraged to provide bike access to commuter rail, as well as better transit access and park-and-ride facilities.
- Value-pricing. While not getting rid of the car, peak-period or demand-based pricing on highways can be used to mitigate congestion or stimulate mode switches.
- Reduced parking standards. Parking standards should be reduced in high-density areas in order to discourage car use. Parking should be priced to discourage using cars in congested urban areas.[19]
- Financial incentives. Subsidies to discourage private auto driving include transit passes or fare subsidies and ridesharing subsidies.
- Sustainable zoning. Zoning should be developed that examines land use and transportation simultaneously. For a proposed transit corridor, minimum density standards and mixed land uses could be specified.

These are just some of the initiatives being examined in the United States as planners begin to gain some control over land use, using transportation investment as the stimulus. The

pricing and zoning criteria work best in a community predisposed to put high values on environment and a quality of life based upon environmental considerations.

Lessons Learned

The Chinese government is now investing heavily in motorization, particularly the building of highways to support the growing fleet of cars and trucks. In light of this policy priority, the crucial question is whether China can avoid the kind of sprawl and environmental damage that has been created by motor vehicles in the United States. Through trial and error, planners in the United States have learned some lessons on how to prevent and correct such problems. These institutional and technical actions outlined below may contain some insight for land-use and transportation planning in China. These points are then followed by a brief discussion of factors that potentially hinder the transferability of these lessons learned in the United States.

Institutional actions. There are two major institutional actions that can potentially be transferred from the United States to China: regional coordination and funding capability.

1. The first institutional action deals with overall regional coordination. In the United States, urban regions must establish Metropolitan Planning Organizations (MPO). These organizations cut across all local governments and agencies providing transportation within an urban area. The MPO demands coordination among these agencies as one of the basic tenets of planning. It also requires that regional projects be coordinated with long-term regional objectives—including land-use and environmental objectives. Thus, a suburban government must coordinate road or transit projects with other suburbs and the major central city they serve. Such an organization would provide for more efficiency of project planning and implementation, plus address impacts of motorization and suburbanization within the context of a regional growth strategy.

2. The second institutional action encompasses institutional funding capability. The U.S. federal government provides a significant share of capital funding for urban highway and transit projects. Knowing the projected levels of financial support allows for a continuity of planning and enables state and county governments to set planning targets to available resources. In China, local areas, after they get the "green light" to build, must raise the currency themselves—often in competition with other regional projects. By keeping funding—although the major concern—aloof from the regional planning process, projects can be developed as part of regional systems, to which they eventually will belong. A project-by-project basis leads to competition among development sites and competition between road and transit. We have learned in the United States that this is not the most effective way to plan. One source of funding at the national government level can be an infrastructure bank. Here capital can be given as loans to be repaid. Repayment would come from economic value added to the region based on the infrastructure investment.

Technical actions. These actions, which include aspects of design as well as implementation, address the types of facilities that could be created in China.

1. Transit-oriented design. The push for motorization is creating a demand for suburbanization in Chinese urban areas that will only grow with time. However, many mitigating designs can be applied in China. One is to make more extensive use of buses and bus connections through exclusive bus streets and busways. As new highways are built, bus lanes should be added, insuring that rapid transit access will follow communities designed for motor car access. To maximize use of busways, suburban communities should be designed at moderate densities, linked to activity centers easily reached by foot or bicycle. Transit terminals and transfer stations should be part of new community design.
2. Rail transit. Activities along rail corridors should be carefully planned. Rail provides high accessibility and affords the opportunity to cluster the highest densities near the stations. A variety of land uses can be integrated with the stations, including housing development. Access to a rail line by foot will keep both bicycles and motor vehicles off the road and will not add to poor air quality. It must be noted that while rail adds accessibility it does not reduce congestion.
3. Parking policies. Street space is a very valuable commodity and in American cities planners have learned how limiting spaces and increasing prices can discourage auto use. However, when auto use is restricted, adequate public

transit, including available taxis, must be provided. The auto user will look for a higher quality substitute for the current crowded buses. Rethinking the quality of public transit, an exercise now taking place in the United States, would be appropriate as a planning strategy to accompany new road construction. See Tilly Chang's article in this publication for current experimentation with public transit reforms in China.

4. Pricing. Road pricing has been, to date, very unpopular in the United States, but it can be used to differentiate among classes of vehicles and system use over selected periods of time. Correct pricing is a powerful tool and one that will become a standard part of regulating motor vehicles.

In addition to challenges in the existing urban infrastructure, there are financial and political factors that also potentially hinder the application of the above strategies in China. In terms of infrastructure, Chinese cities are much denser than those in the United States—only New York is comparable to the density of large Chinese cities. These densities in Chinese cities—which have historically occurred because work and travel were close together—pose challenges to incorporating new rail transit systems. This dense pattern of urban development has created broad networks of very small streets with only a small amount of roadway suitable for motor vehicles. Another complication for planners is that with the exception of the ring roads, most urban streets have to contend with mixes of motorized and non-motorized travel, which creates the worst of conditions for both types of travel. The speed at which ringroads and suburbs are expanding outside of cities also challenges Chinese planners in designing transit and parking infrastructure.

Although Chinese planners are well trained and foreign experts are often brought in to provide advice, it is often the hindrances created by local governments that obstruct efficient execution of land-use and transportation plans. The decentralization of financial and administrative authority over the past twenty years in China has decreased the incentives for local governments to cooperate in regional planning issues. The central and provincial governments have lowered subsidies to local governments, which has reduced a key means to leverage cooperation from lower levels.

While the United States may provide useful lessons for Chinese planners, it is possible that the successful land–use and transportation development in Hong Kong could also be a valuable and more accessible model. The Hong Kong Regional government has been aggressive in pushing a balance between development and transportation infrastructure. Their main strategy has been to make the region attractive for development and push developers to finance infrastructure. For example, to accommodate the growing population they have planned new cities that will be located at new stops on a developing commuter rail line in the New Territories. This integrated planning will minimize the need for cars and maximize accessibility to the employment centers. There are conferences on development, environment, and infrastructure sponsored at the highest government levels in Hong Kong and such conferences could be repeated in dynamic growing cities in Mainland China such as Shanghai and Shenyang.

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Endnotes

[1]A recent study provided an attempt to quantify some aspects of accessibility with land use and density. See Shunk, G. et al., *Land Use Modeling Conference Proceedings, Final Report*, United States Department of Transportation, DOT-T-96-09, Washington, D.C., February 1995.

[2] With the exception of Alaska and Hawaii.

[3]The U.S. Congress started formal support of the roads program as early as 1916 when it created the Bureau of Public Roads. Shortly thereafter (1918-1921) it began funding roads throughout the United States and required each state to begin a Department of Highways to receive and allocate funds. These programs, albeit in altered form are still in place today.

[4]"*Highway Statistics 1996,*" U.S. Department of Transportation, FHWA-PL-98-003, 1998

[5]"Statistical Abstract of the United states, 1994." U.S. Department. Of Commerce, Bureau of the Census, 1994.

[6]Zhou Ganshi, "Urban Transport Problems in Chinese Cities," in *China's Urban Transport Development Strategy*, S. Stares and Liu Zhi, eds., Washington, D.C.: World Bank, 1996.

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[13]Zhou Ganshi, "Urban Transport Problems in Chinese Cities," in *China's Urban Transport Development Strategy*, S. Stares and Liu Zhi, eds., World Bank, Washington, D.C., 1996.

[14]L. Xiaojiang and Yu Li, " Land Use and Transport Planning in China," in *China's Urban Transport Development Strategy*, S. Stares and Liu Zhi, eds., World Bank, Washington, D.C., 1996. In addition, the author had a number of discussions with Eva Lerner-Lam, who provided great insight into the planning process.

[15] Travel times to work on these commutes, driving at thirty miles per hour, average less than twenty-five minutes, with longer commutes in the largest urban areas. For example, travel time in New York averages more than thirty minutes.

[16] New York City (e.g., the five Boroughs) provides a classic example of this fragmentation of authority in that local roads are the concern of the City Department of Transportation while major roads are under the State Department of Planning. Although the responsibility for transport services falls under the jurisdiction of the Metropolitan Transit Authority (MTA) the management for different areas of transport are separated into different units. For example, under the MTA the NYC Transit operates the subways and buses while the commuter rail is managed by the Long Island Railroad. The bridges and tunnels are under separate authorities and each possesses the power to set tolls. Lastly, it is the Police Department that oversees adherence to traffic laws. Coordinating land-use and transportation planning among all of these agencies is a challenging task.

[17]B. Chinitz, "Urban Growth Patterns," in *The Land Use, Transportation, Air Quality Connection. Resource Manual*, Lincoln Institute of Land Policy, Cambridge, MA, 1994.

[18]R. Paaswell and J. Zupan, "*Transportation Infrastructure and New York's Competitiveness*", Citizen's Budget Commission, New York, 1999.

[19] Both of these strategies—value pricing and parking pricing—illustrate that pricing can be an incentive influencing mode choice.

CHINABRIEF

The publication *Chinabrief* was founded in 1996 and its goal is to improve information flows to and between international agencies funding or implementing development projects in China, with particular emphasis on the work of nongovernmental organizations. The *Chinabrief* aims to share this information with Chinese government agencies and non-profit organizations, as well as promote the development of a more independent communications culture in China. Issues of *Chinabrief* (zhongguo fazhan jianbao) are twin publications in English and Chinese, reporting from Mainland China on international aid to the country—international aid to China currently totals U.S. $5 billion per annum. The publications include regular coverage of environmental projects, with an emphasis on sustainable community development and rural livelihoods. Examples of specific publications include:

- A thirty-six page, quarterly English language publication containing sectoral analyses, project digests, news, and features covering social development, rural development, poverty alleviation, and environmental protection projects in China
- A sixteen page, quarterly Chinese language companion to each English edition, distributed free on request to mainland Chinese organizations. This contains original articles and information, tailored to the information needs of a Chinese readership.
- A *Directory of International NGOs Supporting Work in China* was compiled and published October 1999.

The founder of *Chinabrief,* Nick Young, has lived in China since 1996, having previously worked in Latin America and Africa for a variety of internationally recognized media, including *The Scotsman, The Financial Times, The Economist*, and BBC World Service. There are currently three Chinese and one other international member on the *Chinabrief* staff. Subscription sales and grants from ActionAid India, Kadoorie Charitable Foundations, the Ford Foundation, Save the Children (UK) and the Trace Foundation support *Chinabrief.*

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A New Era for Public Transport Development in China

by D. Tilly Chang

The urbanization and motorization which fueled China's economic growth since the mid-1980s brought unprecedented demand for land, road space, and other urban infrastructure and services. As China's cities were being positioned as the new engines of growth, transport development between and within urban areas received high national priority. Government resources at state, provincial, and local levels focused on increasing infrastructure capacity and on expressways in particular, while industrial policy nurtured the nascent automotive industry. Some early policy and investment support was directed at public transport; however, these efforts were not deep enough to address structural weaknesses in management and operations. Thus, transit development lagged behind the growing demand for, and supply of, private modes of transport as China's economy boomed. As a result, traditional public transport services—mainly large buses—suffered significant ridership losses in the late 1980s and early 1990s.

This article surveys China's public transport experience over the past decade and a half, as China's environmental, energy, and economic development objectives have come into sharper focus. While the earlier industrial policy commitment to the "household car" has not been abandoned, there is growing recognition in cities that, even if private vehicle ownership is encouraged, this must be accompanied by prudent policies curtailing auto use. Moreover, the need to develop suitable alternatives to private auto travel motivates renewed interest in raising the efficiency, quality, and quantity of public transport services in urban areas.

Policy Evolution

In the mid-1980s, the government of China established a policy that public transport should be the dominant mode of urban passenger transport in urban areas.[1] The policy emphasized development of public transport systems and containment of the growth of privately-owned vehicles. For large cities, this included support for the gradual development of rail transit. The need for continuation of such a policy is reflected in the words of one Chinese scholar: "Rapid rail transit with large capacities (including metro) must be put into our agenda for development and constructed with careful planning to meet the needs of large traffic flows."[2]

Due to the large capital investment and foreign exchange required, however, authorities at the State Planning Commission responsible for macro-economic investment were cautious about approving rail transit projects in all but the largest cities. Today, metros only operate in four cities: Beijing (43.5 km), Tianjin (7.4 km), Shanghai (16.1 km), and most recently in Guangzhou where the 18.5 kilometer Line 1 was open for full service in 1999. Light rail or trams built pre-liberalization (e.g., before economic reforms were initiated in 1978) operate in Changchun, Dalian, and Anshan. For most cities, however, regular gasoline and diesel-engine buses and mini-buses and electric trolley-buses remain the dominant form of public transport in China.

Among its top priorities, the Chinese government investment in the transport sector was heavily targeted toward development of the nation's trunk highway system and other transport infrastructure. In urban areas, construction programs supported Master Plans which typically called for development of Beijing-style urban "ring roads." Public transit programs provided investment in vehicles to open new routes. For example, from 1985 to 1995, standard bus equivalent operating units nearly doubled and total route length increased eighty-nine percent. However, due to a variety of factors, this investment was met with disappointing results, as public transport ridership grew by only nine percent over the same period.[3]

As Figure 1 shows (next page), though route length and vehicles increased and vehicle load factors decreased slightly (implying service improvements), passenger density fell between 1985-1995 in China, in part reflecting broader service coverage but also anemic ridership growth.[4] Meanwhile, the growth of premium modes such as taxis and mini-buses exploded and traditional bus transit mode share steadily lost ground, with absolute ridership losses occurring in some cities.

Trends Affecting Public Transport

Several factors contributed to the gradual decline of China's traditional, state-owned public transport companies starting around the mid-1980s. Primary among them was the rising demand for private passenger transport and premium public transport modes, made possible by rapid economic growth and wealth creation following economic liberalization. By

the end of "the Eighth- Five Year Plan" (1991-1995), China's minibus and taxi industries had grown from insignificant numbers to fleets of approximately 100,000 minibuses and 585,000 taxis.[5] During this time, central government authorities were also eager to develop the domestic automotive industry as a means to exploit the forward and backward economic linkages of motorization. In 1994, the central government promulgated industrial policy establishing the automotive industry as a "pillar industry." Moreover, officials at the State Planning Commission began to promote the notion of the "household car."[6]

Although China is in the early stages of motorization (see Figure 2), the growth of motor vehicle ownership and use has the potential to create massive problems in urban areas.[7] Nation wide, passenger vehicle growth rates averaged eighteen percent per annum between 1985-1995. By 1995, motor vehicle ownership had reached ten vehicles per 1000 population, every two of which was a passenger car. The national average of two vehicles per thousand belies the high concentration of car ownership in urban areas. Of the 600 or so cities in China, thirty-four cities account for fifty percent of the national ownership of motor vehicles.[8]

Prior to motorization, buses carried about a third of all trips in most cities, with bicycles and walking comprising the balance. With more vehicles on the road, poor traffic management, and little protection from congestion in the form of priority treatments, bus speeds fell. Inadequate service coverage, low route efficiency, vehicle breakdowns, and poor passenger facilities worsened service levels and added to travel times. As a result, traditional bus services became very unattractive. For cities with a population of one million or greater, it is estimated that public transport journey times averaged almost twice (fifty minutes) the average for all other modes (twenty to thirty minutes) in 1995.[9]

Figure 1. China Public Transport Trends

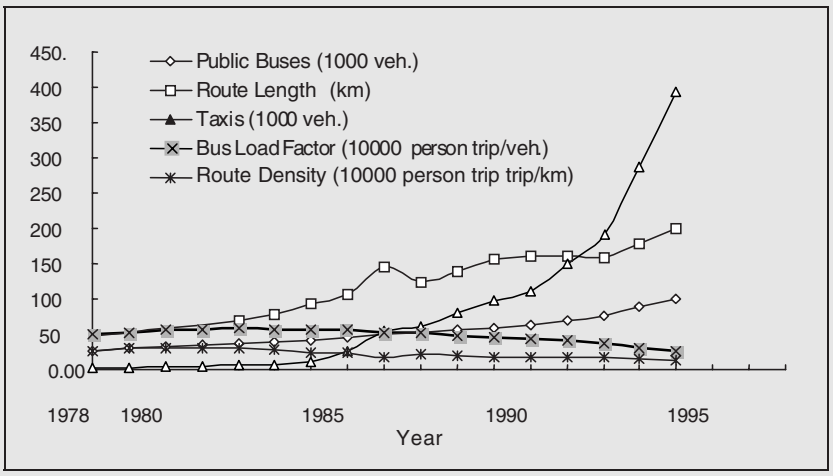
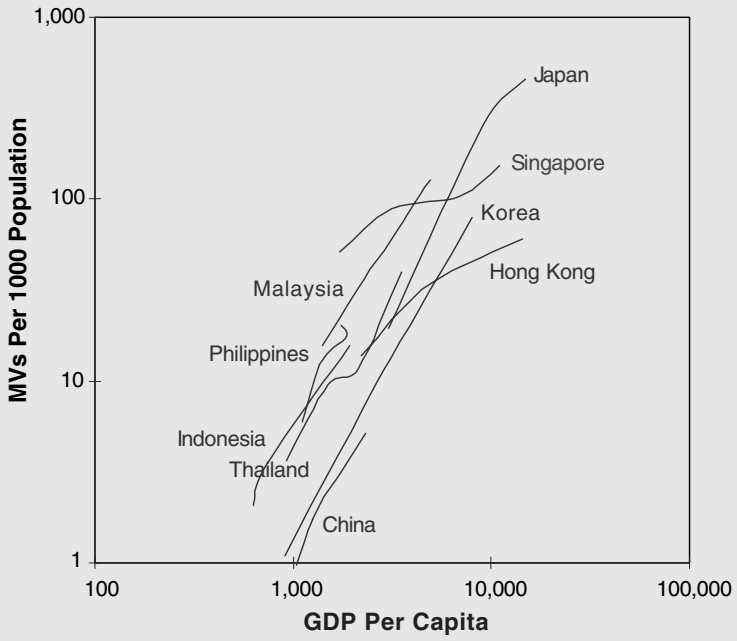


Figure 2. Motorization In Asia (1960-1990)



Unsurprisingly, bus riders left for other modes. Those able to afford and willing to pay for premium modes chose motorcycles, minibuses, and taxis; while others shifted back to bicycles—especially lower-income passengers—as bicycles began to offer competitive door-to-door journey times compared with old, slow buses, which required too many transfers, long waits, and inconvenient stop locations.

Thus, despite stated government policy support for public transport backed by some investment in vehicles and services, the effectiveness of increased capacity in public transport was eroded by a decrease in public transport efficiency and quality of

services, relative to other modes. Table 3 shows the mode shifts over time for Shanghai (urban population 12 million) and Shijiazhaung, the capital city of Hebei Province (urban population 1.5 million) over this period.[10] Note that transit appears to lose mode share to bicycles and autos in Shanghai, and to other motorized modes in Shijiazhuang.

Ridership loss created a revenue crisis for many public transport operators who were already experiencing cost shocks as price controls for certain inputs were lifted with the transition to a market economy. Constrained by employment policies protecting labor, management tended to look to lower fuel quality or deferred maintenance for cost savings. These measures, at times instituted in combination with fare increases, caused many transit enterprises to enter the classic "vicious cycle" whereby loss of ridership and revenue fed on themselves, leading to the steady decline of public transport.

Public Transport Enterprise Reform

During the early 1990s, China was tackling hyperinflation in the economy and managed to achieve a "soft-landing" following the imposition of economic austerity measures. These measures included restriction of government investment only to those projects warranting the highest priority. As a result, in late 1995, China's State Council issued orders to shut down subway and light rail projects in Qingdao, Nanjing, Shenyang, and Tianjin, as well as put on hold the applications from seventeen other cities.[11]

Policy attention in the public transport sector therefore concentrated on reform of public transport enterprises. This policy shift was consistent with general state-owned enterprise (SOE) reform, but was mainly instituted as a matter of fiscal and transport policy. China's municipal coffers were hemorrhaging from the provision of large and growing operating subsidies to transit. By 1994, operating losses in urban public transport totaled Y1.0 billion (1 Yuan = U.S. $8.50 in 1994) and total government assistance to public transport reached Y2.9 billion nationally.[12]

As with reform of SOEs in other sectors, corporatization emerged as a major strategy to commercialize bus operations, manage subsidy relationships with government, and attract private investment. In parallel, under the principle of "comprehensive planning, unified management, and coordinated development" *(zonghe jihua, tongyi guanli, xietiao fazhan*), fair and reasonable competition was declared beneficial to the development of public transport. As a result, supply of municipal transport services was liberalized to expose bus companies to competition from other modes, primarily mini-buses and taxis.[13] However, lack of experience with economic regulation would hamper realization of a "level playing field" within public transport and among urban transport modes in general.

Various reform models exist in China, ranging from less to more aggressive deregulation of the public transport sector.[14] The most common arrangement is the "three-tiered contract responsibility system," (*sanji zeren xitong*) which sets performance targets for each layer of the organization (company, sub-company, and vehicle team). In Shanghai, there has been deregulation of the municipal bus company with the result that operating companies are much more independent and actually compete for operating concessions as they come

Figure 3. Transit Mode Share Loss in Shanghai and Shijiazhuang

	Shanghai	Shanghai	Shijiazhuang	Shijiazhuang
Year	1986	1995	1986	1998
Non-motorized	73%	78%	92%	88%
Walk	41%	33%	34%	34%
Bicycle	31%	45%	58%	54%
Motorized	27%	22%	8%	13%
Auto/Motorcycles	3%	7%	2%	5%
Taxi				2%
Company Car			1%	2%
Transit	24%	15%	5%	3%
Other				2%
Total	100%	100%	100%	101%

up for tender. In addition, in Shanghai and Guangzhou, the public transport companies exhibit diversified ownership arrangements. For example, in Shanghai the Pudong Bus Company—one of the thirteen new companies established after deregulation—is a joint-stock company. Five joint-venture companies have been operating in Guangzhou since 1994.

Municipalities are also engaging various forms of concessioning in an effort to manage subsidies and expand services with minimum public finance. Examples include "joint-operations" arrangements, as found in Shijiazhuang (Hebei Province) in which the municipal public transport company (PTC) contracts with former staff to lease and operate its vehicles on a three-year net-cost basis. Also, in Shenyang (Liaoning Province), the PTC contracts with owner-operators and transport enterprises for public transport services to supplement its own services. In the Liaoning cities of Anshan and Fushun, these strategies are employed in combination with negotiated concessions for scheduled, route-based premium bus services involving private Hong Kong-based operators. Route-based concessions are also being implemented in Beijing and Shenzhen. Finally, as mentioned above, Shanghai has been the most aggressive in terms of deregulating the public transport industry and establishing competitive tender of operating rights for new routes and services.

These reforms are already yielding benefits to municipalities in terms of reducing public operating subsidies and to public transport users in the form of more and better public transport choices. The promise of reform is the redirection of public investment to public transport infrastructure such as passenger terminals, bus priority measures, and fixed rail transit, with the goal of increasing the number of attractive choices for users. The private sector can participate in this arena as well, and not only in the fixed-rail market. For example, Beijing Public Transport Company is actively studying joint development of bus terminals in the city center area with the private sector.

Although China is in the early stages of motorization, the growth of motor vehicle ownership and use has the potential to create massive problems in urban areas.

A New Era for Public Transport

China has twenty cities with a population exceeding five million, creating a huge demand for efficient transport networks. In recognition of the need to manage this demand well, many medium-sized and large cities are leading in the adoption and implementation of urban transport policies favoring public transport. Examples include the auction of motorcycle and car licenses in Shanghai, minibus controls in Beijing and Shenzhen, and the establishment of bus priority measures in Kunming, Shenyang, and Beijing.

National policy emphasizing sustainable development is also causing public transport to be viewed not only as an important strategy for efficient urban transport but also for environmental protection. Broader efforts to target mobile-source air pollution in China include: the removal of lead from fuel; conversion to cleaner fuels (pilots are on-going in ten cities); and—though not directly passed to meet environmental objectives—a recent amendment to the national Highway Law authorizing the levy of a motor fuel tax which could facilitate various policy-based user charges. It remains to be seen how this tax is to be implemented, especially in urban areas.[15] Bus transit is at the forefront of current pilots in natural gas, as companies experiment with dual-mode and natural gas (CNG)-powered engines. Electric-powered trolley buses are already in operation, and central government agencies, such as the State Science and Technology Commission, are sponsoring research and development of electric fuel-cell powered vehicles.[16]

Very recently, China lifted the moratorium on rail projects and began approving more subway projects to support urban infrastructure construction. In March 1999, China's State Council approved the first phase of the Shenzhen metro project and revived the Nanjing light rail project begun earlier. Approvals for work to begin on subway systems in Chongqing, and to resume studies in Qingdao and Shenyang quickly followed. Several other cities have already submitted applications to the State Development Planning Commission for new rail lines. The length of the proposed subway lines totals 430 kilometers, with investment estimated at 140 billion yuan (U.S. $16.8 billion).[17] However, prerequisites for approval—including demonstration of adequate financing—will likely temper the pace of additional new projects going forward in the near future.

Despite these new and encouraging developments, China faces a number of challenges if public trans-

port, and mass transit in particular, is to play a significant role in cities on a sustainable basis. Chief among these is the fragmented nature of policy and institutional capacity in the urban transport sector. Responsibility for policymaking, planning, and finance of urban transport (and especially public transport) is highly decentralized to the cities, where institutions mirror the stove-pipe structure found in central government. Within most cities in China there are several agencies with an interest in urban transport planning and operation. The most significant agency is the urban construction commission that is responsible for construction and maintenance of transportation infrastructure. Organized beneath this commission are usually found the public utilities commission—responsible for public transport provision and regulation—and the transport department—responsible for motor vehicle licensing, including long-distance buses. Municipal planning bureaus are responsible for Master Plans; the public security department work encompasses traffic management and enforcement, and the environment bureau regulates and monitors vehicle emission controls. Lastly, regulating user charges such as bus and taxi fares falls under the jurisdiction of the municipal price bureaus.

This fragmentation of authority limits the ability of local governments to effectively promote a high degree of coordination among policies, planning, finance, and traffic management activities. For example, at the operational level, implementation of bus priority measures on a wide-scale requires better technical coordination among public transport operators, city engineering design units, and traffic police. Also, while institutional mechanisms for the coordination of urban land use and transportation development exist through the "master planning" process, the relationship between these two systems is not well understood. Consequently, while cities are improving their ability to do route and service planning, coverage is not keeping pace with city development. This reflects several factors having to do with the need to coordinate better land-use and transpor-

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tation planning, (de)-regulation of peri-urban transport services, and relative inexperience with complex user charge and cross-subsidy arrangements that can be critical to financing arrangements for new infrastructure and services.

Indeed, financing is perhaps the most difficult aspect of public transport development for city officials. Although rail transit is popular and becoming a reality in some larger cities, bus transit will remain the mainstay of the public transport system for most Chinese cities. In both cases, if the public transport system is not well managed and structured, capital and ongoing costs can potentially bleed a city of resources. Viable fares and an appropriate regulatory framework for private participation are essential to the provision of sustainable finance for the sector. Fortunately, the decentralized nature of urban management is breeding innovation—especially among the more affluent and sophisticated coastal cities as mentioned above—which is being modeled in other cities. Through these incremental initiatives, it can be observed that public transport reform is liberalizing the provision of transit services across China, albeit slowly. These efforts, together with the promotion of increased competition and the capacity to regulate it, are the challenges of the coming era.

Conclusion

It will take time for China to navigate the all-too-common pitfalls of motorization and urban development. Facing a number of strategic choices, China is confronting dilemmas that have plagued many countries before it, though with the added complexities of its huge population and the transition to a market economy. Yet, as reforms take hold and efficient urban transport increasingly is increasingly recognized as critical to sustaining the productivity and quality of life in urban areas, support for public transport is growing. Advances in enterprise reform, decentralization, and finance suggest that China's public transport sector is on the precipice of a new era.

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All views, findings, interpretations, and conclusions expressed in this article are entirely those of the author and should not be attributed in any way to the World Bank, its affiliated organizations, members of the Board of Executive Directors, or the countries they represent.

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[4] Zhao Boping et al. "Prospect and Characteristics of Urban Public Transport in China," in *Proceedings of ASCE 1st International Conference on Public Transport*, 2000.

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Transportation and the Environment in China

by Michael P. Walsh

At first glance, concerns regarding motor vehicle pollution in China seem misplaced. With a population more than four times as large as the United States (1.22 billion versus 268 million) the number of cars, trucks, and buses in China is a mere fraction of that in the United States (less than fourteen million in China versus 210 million in the United States). On a per capita basis, China has one of the lowest vehicle populations in the world, as illustrated in Table 1.

According to Table 1, it is clear that among these countries only India has a lower vehicle ownership density than China. However, to stop at this superficial overview would be very misleading. In recent years, the vehicle population in China has been increasing sharply, with much of this growth taking place in cities. Nationally, the annual growth of vehicles has averaged approximately fourteen percent per year. One result of this rapid growth has been the emergence of serious air pollution problems, especially in cities. Furthermore, the growth in vehicles in China is expected to continue and perhaps even accelerate in coming decades, increasing concerns regarding further environmental degradation. Chinese policymakers have begun to respond to the growing problem of air pollution. For example the government has initiated a public reporting system whereby a growing number of Chinese cities are now routinely reporting their current air quality, as illustrated by the most recent data summarized in Table 2 (following page). As Table 2 shows, several cities have an air pollution index above 400 for total suspended particulates (TSP), which means these cities measured TSP levels above 875 mg/m^3 (micrograms per cubic meter).

Table B illustrates that most Chinese cities already have serious air pollution problems particularly with TSP and nitrogen oxides (NO_x). As this information has become publicly available, citizen pressure has been building to push the government to take action to lower the pollution levels. Strategies are therefore being developed and implemented at both the national and local levels to counteract this problem. Most notably, at the national level, China has completed an environmental technical assistance project, sponsored by a World Bank loan, to develop an Action Plan with the objective of assuring that by 2010 the air quality levels in China's major cities meet the second class of national standards.[1] One trend which could help China attain these national air quality standards has been actions by large cities, particularly Beijing, to develop local pollution control strategies. The purpose of this article is to review and analyze the proposed national Action Plan and recent municipal government actions to alleviate pollution problems in China. To place the Action Plan and local actions in context, I will first outline current information on vehicle use, air quality, and infrastructure investment.

Table 1. Vehicle Ownership Density

Country	Vehicles/ 1000 People
United States	785
Australia	591
Japan	560
Germany	553
Austria	513
Portugal	395
Greece	290
Bulgaria	235
Romania	135
Mexico	135
Chile	105
Venezuela	95
Thailand	73
Egypt	29
China	10
India	8

Source: Data: "World Vehicle Demographics." *Financial Times Automotive World.* (April 1999.)

The Current Situation in China

Vehicle Growth and Roads

The total number of motorized vehicles in China, although very low by Western standards, is growing rapidly and has already risen to about 1.4 million in Beijing and over one million in Guangzhou. For the country as a whole, the number of vehicles in 1998 climbed to about fourteen million cars and trucks and twenty million motorcycles. Much of the growth has been in private passenger cars, especially in recent years. The demand for personal cars in China rose by an average of 28.1 percent over the past five years and is expected to hit one million cars annually by the year 2000.[2] In spite of an almost doubling

in the number of public transit vehicles from 1993 to 1997 (see Table 3, following page), the total passengers carried has remained constant across the country's cities, with many actually showing declines.[3]

With regard to driving patterns and average speeds, many existing roads have already reached their maximum capacity and are saturated during long periods of each day. Substantial road building is underway in all large cities and over the past five years, the investment for road infrastructure in the large cities has doubled.[4] The results of this investment are clear in Shanghai, which boasts an impressive improvement in increasing road length, road area, and road area per capita by nineteen percent, forty-two percent, and thirty-nine percent, respectively, between 1991-1997 (See Table 4, following page). However, the expansion in the city's road infrastructure pales in comparison to the vehicle growth that has averaged fifteen percent per year since the mid-1980s.[5]

Table 2. Compilation of Air Pollution Data for Chinese Cities

City	Air Pollution Index	Chief Pollutant
Beijing	500	TSP
Tianjing	424	TSP
Shijiazhuang	201	TSP
Qinhuangdao	136	TSP
Taiyuan	311	TSP
Huhehaotei	408	TSP
Shenyang	184	TSP
Dalian	70	TSP
Changchun	369	TSP
Haerbin	118	TSP
Shanghai	128	NOx
Nanjing	108	TSP
Suzhou	138	TSP
Nantong	228	TSP
Lianyungang	178	TSP
Hangzhou	152	NOx
Ningbo	82	TSP
Wenzhou	77	TSP
Hefei	82	TSP
Fuzhou	59	TSP
Xiamen	38	-
Nanchang	113	TSP
Jinan	328	TSP

Source: http://www.usembassy-china.org.cn/english/sandt/index.html, which is the webpage for the Environment, Science, and Technology Section of the U.S. Embassy in Beijing.

Air Quality and Pollution from Mobile Sources

One of the challenges for policymakers in China is that air quality monitoring data in Chinese cities are limited, especially in high traffic areas. Based on the available data, however, it is clear that national NO_x air quality standards are currently exceeded across large areas, including, but not limited to, high traffic areas. Before 1992, the annual average concentration of NO_x in Shanghai was lower than 0.05 mg/m^3, which complies with the Class II air quality standards in the People's Republic of China (PRC). But since 1995, the NO_x concentration in Shanghai has increased slowly, from 0.051 mg/m^3 in 1995 to 0.059 mg/m^3 in 1997.[6]

In Beijing, NO_x concentrations within the Second Ring Road that encircles the city center increased from 99 mg/m^3 in 1986 to 205 mg/m^3 in 1997, more than doubling in a decade. Moreover, carbon monoxide (CO) and NO_x concentrations on Beijing's trunk traffic roads and interchanges exceed national environmental quality standards all year round.[7] Recent data also indicate that standards for ozone, formed by the photochemical reaction of NO_x and hydrocarbons (HC), have been exceeded in several metropolitan areas during the last decade.

On average, mobile sources are currently contributing approximately forty-five to sixty percent of the NO_x emissions and about eighty-five percent of the CO emissions in typical Chinese cities.[8] Recent data collected in Shanghai, for example, show that

in 1996, vehicles emitted eighty-six percent of the CO, fifty-six percent of the NO_x, and ninety-six percent of the non-methane hydrocarbons (NMHC) of the total air pollution load in the downtown area.[9] In Beijing in recent years, the NO_x concentration shows a clear increasing trend. Annual average NO_x concentrations, average concentrations during the heating season, and those during the non-heating season in 1997 were 133 mg/m^3, 191 mg/m^3, and 99 mg/m^3, respectively. These emissions were seventy-three percent, sixty-six percent, and eighty percent higher than those ten years ago. The annual daily average NO_x concentration in 1998 was 14.3 percent higher than in 1997. Since the amount of coal burned has remained stable for many years, Beijing local authorities attribute the increases in these pollutants to vehicular emissions.[10] Poor vehicle maintenance is one leading cause of mobile source pollution problems. This deficiency in vehicle maintenance is reflected in the high failure rate in the existing, relatively lenient Inspection and Maintenance (I/M) programs. Poor training of inspectors has meant repair workers lack the necessary professional knowledge and expertise in repair and maintenance service of emission equipment.[11] Many vehicles seem to be

Table 3. Public Transit in Chinese Cities

City	Number of Public Transit Vehicles (Standardized Vehicle Equivalents)		Total Passengers Carried (Millions)	
	1993	1997	1993	1997
Beijing	4890	8548	2863	3374
Tianjin	2193	2896	397	536
Shenyang	2406	2359	537	625
Changchun	1031	2249	310	341
Harbin	1344	3139	612	543
Shanghai	8521	16237	5627	2637
Nanjing	2412	2360	500	499
Wuhan	1971	4355	1251	943
Ghangzhou	2338	4611	664	1074
Chongqing	2090	2479	753	502
Chengdu	1408	1618	288	293
Xian	871	1418	355	299
Total of 12 Cities	31,475	52,269	14,156	11,667
Average of 12 Cities	2623	4356	1180	972
Total of 666 Cities	88,606	168,566	27,259	27,348

Source: Wu Yong, "Targeting Sustainable Development for Urban Transport," Urban Construction Department of the Ministry of Construction, and Li Xiaojiang, unpublished paper, Chinese Academy of Urban Planning and Design, April 1999.

operating with a rich air fuel mixture, which while producing relatively good drivability and low NO_x emissions, leads to high fuel consumption and excessive CO and HC emissions. Furthermore, the vehicle technology being produced tends to be primarily carburetor-equipped with mechanical rather than electronic controls. Recently collected emissions data in China show that current vehicles are typical of the cars used in the United States in the late 1960/early 1970s.[12]

In light of the above information on car trends in China, it appears likely that the growth in the overall vehicle population will continue at a high rate for the foreseeable future. As noted in a recent study,

> Credit facilities and installment payments, which China's commercial banks have promised to introduce, are expected to push forward the car-buying momentum. A survey conducted among 600 urban families in Beijing by the China Economic Climate Monitoring Center says that well-to-do families account for eleven percent of the population, families that enjoy a relatively comfortable standard of living represent fifty-three percent, and those that have adequate food and clothing, thirty-four percent. The first category has put car purchases high on their consumer agenda, and the second is expected to have similar lifestyles and hopes within five to ten years. This will spur on the private car sector.[13]

On average, mobile sources are currently contributing approximately forty-five to sixty percent of the NO_x emissions and about eighty-five percent of the CO emissions in typical Chinese cities.

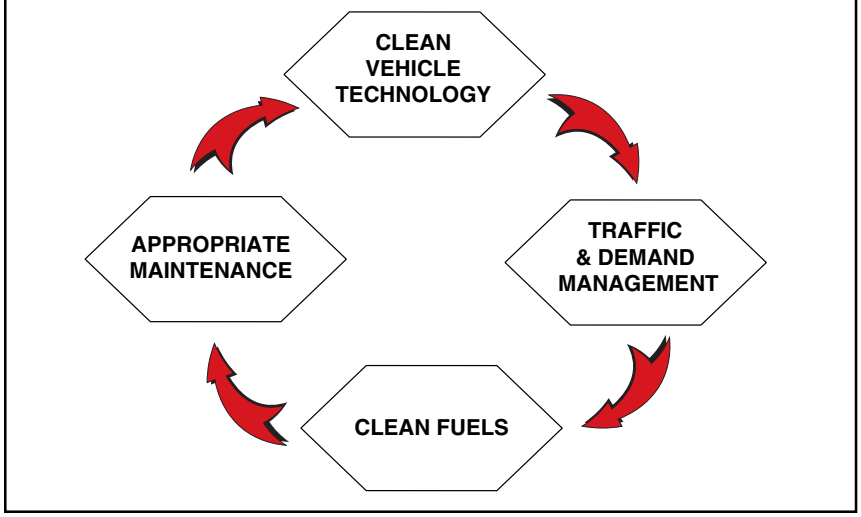
Economic growth and consumers' desires are pushing the growth of vehicle population at a much faster rate than roads are being constructed. The number of roads approaching saturation will likely increase and the period of time when these roads will be overloaded will lengthen, which will result in more frequent and severe air quality peaks in localized areas. This congestion means that national air quality standards for NO_x, CO, and ozone will increasingly be exceeded in many cities. In addition, roadside particulate problems will likely increase, leading to serious health problems. Based on data collected in the World Bank project, it is clear that with the increase in diesel vehicles particulate matter (PM)

Table 4. Paved Road Length and Per Capita Paved Road Area of Shanghai (1991-1997)

Year	Length of Paved Road (Km)	Area of Paved Road (10^4 m^2)	Per Capita Road Area (m^2)
1991	4817.6	6004.8	4.67
1992	5043.2	6386.7	4.95
1993	5105.3	6569.2	5.07
1994	5192.3	6862.2	5.28
1995	5420.3	7399.9	5.69
1996	5599.3	8058.5	6.17
1997	5712.7	8503.2	6.51

"Strategy for Sustainable Development of Urban Transportation and Environment—for a Metropolis with Coordinating Development of Transportation and Environment toward the 21st Century," Shanghai Municipal Government, January 10, 1999.

Figure 1. Elements of a Comprehensive Vehicle Pollution Control Strategy



and NO_x will also rise. Since diesel particulates have been identified as a likely human carcinogen, this risk will increase as well. The World Bank data stress that based on the vehicle growth projections, it can be concluded that a successful program to reduce air pollution and its local and regional effects will depend on the success in controlling mobile emissions sources.[14] In light of these dangerous pollution trends, the National Environmental Protection Administration—now upgraded to the State Environmental Protection Administration (SEPA)—undertook a study of national and local plans, which could help alleviate the growing emissions from mobile sources. The SEPA study and its conclusions are presented below. This article then concludes with examples of recent municipal government actions to control vehicle emissions.

SEPA Technical Plan To Address Vehicle Pollution

Generally, the goal of a motor vehicle pollution control program is to reduce emissions from motor vehicles in-use to the degree necessary to achieve healthy air quality as rapidly as possible or, failing that for reasons of impracticality, to the practical limits of effective technological, economic, and social feasibility. Achievement of this goal generally requires a comprehensive strategy encompassing emissions standards for new vehicles, clean fuels, and programs designed to assure that vehicles are maintained in a manner that minimizes their emissions. Finally, to complete this comprehensive strategy, an effective program for traffic and demand management that limits the demand for and use of all vehicles must be formulated. Ideally, to be politically feasible, these emission reduction goals should be achieved in the least costly manner. Figure 1 illustrates the elements of a comprehensive vehicle pollution control strategy.

Standards for permissible levels of exhaust and evaporative emissions from motor vehicles should be based on a realistic assessment of costs and benefits keeping in view the technical and administrative feasibility of proposed countermeasures. Technological approaches to achieve the desired emission standards may include fitting new vehicles with emission control devices, such as catalytic converters or particulate traps, requiring such devices to be retrofitted to existing vehicles, and modifying fuels or requiring the use of alternative fuels in certain vehicles. Emissions may also be reduced through traffic and demand management strategies and policy instruments, such as higher taxes for vehicles that will be driven in high pollution areas during rush hours. However, many of the potential benefits of these countermeasures will be squandered if regulatory and economic instruments do not create the incentives for vehicle owners, manufacturers, and fuel suppliers to comply with the standards and change their behavior to achieve the desired goals. A key element of the overall strategy, therefore, must be effective enforcement to ensure maximum compliance with standards.

To develop a national strategy for addressing vehicle pollution, SEPA, with support from the World Bank, pulled together a team of experts from a variety of government agencies and technical institutes and universities to study the vehicle pollution issues. Taking Beijing and Guangzhou as typical cities, the study analyzed the main reasons for the serious vehicular pollution in China. The study determined the average emission rates for the existing vehicle fleet and its contribution to urban air pollution and predicted the future vehicular development and pollution. Another important component of the study was a comparative analysis of foreign experiences on controlling vehicle emission pollution and evaluated the feasibility and cost-effectiveness of implementing the internationally-advanced technologies and management systems in China. Finally, the study defined the vehicular emission control targets and corresponding

technology and management strategy.

Emissions Standards for New Vehicles

To determine the appropriate national emissions standards to adopt in China, estimates were made by World Bank and SEPA analysts regarding the potential emissions reductions that such standards could achieve. The costs and cost-effectiveness of these standards were evaluated and compared. The costs of various standards to reduce NO_x are presented in Table 5. Most of the strategies considered for new vehicles were based on European regulations, for China had previously adopted the first generation of European emissions standards. Moreover, the largest car manufacturer in China is a European company—Volkswagen. The important exception was the inclusion of Japanese and Taiwanese strategies for motorcycles. These strategies were considered, because most motorcycles in China are manufactured in Japan and Taiwan.

It can be seen that all but the last three strategies considered would cost less than U.S. $2000 per ton of NO_x reduced. Keeping emission costs below U.S. $2000 indicates a very cost-effective level based on international experience. From this broad analysis, several potential scenarios were developed in the World Bank/SEPA study to represent packages of measures for all categories of new vehicles. In selecting strategies to be adopted, several factors were taken into account, including the following:

- Air quality need;
- Potential effectiveness of the measure;
- Cost of the measure, including

Table 5. Cost Effectiveness of Various New Vehicle Emission Strategies

Vehicle Type	Strategy	Tons NO_x Reduced[a]	Cost	Cost Effectiveness[b] (US$/Ton)
HDDV	EU2	2.2487	$946	$421
Jeep	96/69	0.8602	$42	$49
LDDV	94/12	0.7694	$396	$515
LDGV	94/12	0.704	$382	$543
Jeep	93/59	0.6993	$139	$199
LDDV	91/441	0.6239	$100	$160
LDGT2	96/69	0.5859	$370	$632
LDGV	91/441	0.5714	$394	$690
LDDT	96/69	0.5037	$370	$734
HDDV	EU1	0.4814	$721	$1,498
Mini Vehicle	96/69	0.4468	$316	$706
LDGT2	93/59	0.4449	$385	$866
LDDT	93/59	0.4061	$100	$246
Mini Vehicle	93/59	0.347	$344	$992
MC	Japan	0.1893	$216	$1,142
MC	Taiwan 91	0.1884	$224	$1,190
HDGV	EU2	0.1183	$322	$2,726
MC	Taiwan 94	0.0658	$309	$4,699
HDGV	EU1	0.0219	$416	$18,995

Source: "China's Strategies for Controlling Motor Vehicle Emissions," Summary Report, December 1997.
[a]Relative to current requirements. [b] In making this estimate, all other benefits of the standards were ignored. The entire costs were ascribed to NO_x control even though in most cases, substantial CO and/or HC reductions would also occur. HD-Heavy Duty, LD-Light Duty, DV-Diesel Vehicle, GV-Gas Vehicle, GT2-Heavy Duty Gas Vehicle; MC-Motorcycle

hardware, maintenance, and fuel economy;
- Overall cost effectiveness; and,
- Technical feasibility.

Considering each of the above factors, the choice of standards that promote the lowest emissions in new vehicles were narrowed down to the two scenarios summarized in Table 6. The options for final consideration were:

• **Scenario 2:** Adopting the standards which were introduced in Europe in 1992 followed four years later by the new 1996 European standards and completing enforcement by 2000.

• **Scenario 4:** Adopting the standards introduced in Europe in 1996 and completing enforcement by 2002.

Analysts at SEPA determined that both scenarios are very cost effective (See Table 7). After considering all these factors, as well as the technological capability of the domestic vehicle industry, SEPA and its support team recommended Scenario 2 as the minimum requirement for new vehicles. However, SEPA will consider Scenario 4 as an alternative and provide fiscal incentives to encourage Scenario 4 vehicles and engines. In addition to these emission regulations for new vehicles, the report specified some regulations that SEPA should issue for limiting emissions in existing vehicles.

Table 6. Proposed Scenarios for New Vehicles in China

Scenario	Vehicle Type	2000	2002	2005
2	Passenger Cars	91/441		94/12
	Light Duty Vehicles	93/59		96/69
	Heavy Duty Vehicles	Euro 1		Euro 2
	Motorcycles	ECE 40.01		Japan
4	Passenger Cars		94/12	
	Light Duty Vehicles		96/69	
	Heavy Duty Vehicles		Euro 2	
	Motorcycles		Japan	

Source: "China's Strategies for Controlling Motor Vehicle Emissions," World Bank Summary Report, December 1997.

Proposed Measures for In-Use Vehicles

In addition to setting emission standards for new cars, the World Bank/SEPA study highlighted four main areas for controlling emissions in existing vehicles:

• **Inspection and Maintenance** (I/M): Analysis indicated that creating a well-functioning I/M program could be one of the most cost-effective options considered and one that could have a rapid impact. After 2002, a loaded mode test procedure, the ASM test, will be adopted for catalyst-equipped vehicles and 100 percent of the vehicles will be required to be tested and 100 percent will need to pass the test in order to be driven. In combination with new vehicle standards, this I/M program will better enable the national NO_x targets to be met.

• **Retrofit Programs:** The study also concluded that national retrofit regulations should be issued for two primary reasons: 1) to assure that retrofit programs being introduced around the country are adequately considering important factors such as fuel quality and vehicle maintenance; and 2) to assure that retrofits actually achieve the claims made by retrofit companies. The final report recommends that a performance standard be used as a basis for approving systems.

• **Fuel Programs:** The study team also recommended that SEPA should issue regulations regarding the quality of fuels and fuel additives and enforce these standards and specifications in the fuel distribution system.

• **Non-Technical Measures:** In addition to technical measures outlined above, cost-effective, non-technical measures, such as traffic controls or tax incentives for cleaner vehicles or fuels should also be developed. These types of measures should be implemented locally. However, national support through technical investigations, financing, and necessary legislation will be needed to facilitate cooperation at the local level. Notably, local representatives from Guangzhou and Beijing were very involved in designing this component.

Table 7. Cost Effectiveness of the Scenarios

Scenario	Cumulative NO_x Reduction (10^4 tons)	Cumulative Costs (10^6 $)	Cost-Effectiveness ($/Ton)
2	97	441	450
4	120	389	320

Source: "China's Strategies for Controlling Motor Vehicle Emissions," World Bank Summary Report, December 1997.

Table 8. Projected Overall Vehicle Emissions in 2010

Vehicle Category	HC	CO	NO_x
LDGV	36.8%	52.1%	47.1%
LDGT1	13.5%	17.2%	15.3%
LDGT2	10.7%	13.5%	13.4%
HDGV	2.9%	3.3%	6.6%
HDDV	1.8%	1.0%	11.9%
MC	30.4%	7.9%	0.8%
JEEP	3.8%	5.0%	4.8%

Source: "China's Strategies for Controlling Motor Vehicle Emissions," World Bank Summary Report, December 1997.

Potential Impact of Proposed Standards and Programs

Even after adoption of the new and in-use management and technical measures noted above, the air pollution problems in China's major cities will not be completely solved. While emissions would be much lower without controls, ambient NO_x levels are still projected to remain higher than the targets. Specifically, while area-wide CO problems should be eliminated, it is expected that even with the implementation of emission standards, levels near roadways will still be unhealthy. Furthermore, ozone and PM levels will likely worsen from today's levels without focused efforts to address their emissions and precursors. In the future, to address these remaining problems it will be important to focus on those vehicle categories for which additional control measures appear feasible and potentially effective. In this regard, it is useful to understand the relative importance of the various vehicle categories to projected overall vehicle emissions in 2010 as summarized in Table 8 above.

Based on the data presented in Table 8, it is clear that light duty gasoline fueled cars and trucks will need to remain a primary focus of control efforts in the future. In this regard, it is important for Chinese planners to remain abreast of technological advances and other developments around the world. Therefore, after the standards contained in the Action Plan are implemented, it will be valuable for SEPA to analyze the potential feasibility and cost effectiveness of utilizing the even more stringent Euro 3 requirements in China. Notably, these Euro 3 requirements are going to be introduced in Europe in the year 2000.

Progress on Implementing the Action Plan—Municipal Government Leadership

China has moved rapidly and aggressively to implement the Action Plan strategy. What is striking has been the strong push by large municipal governments to implement these strategies ahead of schedule and at times adopt standards stricter than those in the Action Plan. Below is an overview of five areas in which progress is being made at both the national and municipal level.

• **Unleaded Gasoline:** In March 1997, the decision was made to phase out the production and sale of leaded gasoline across the entire country by 1 July 2000. By July 1997, Beijing had already stopped sales of leaded fuel in the city center and by October the ban had spread to Shanghai and Guangzhou.

• **New Vehicle Standards:** In 1998, the State Council decided to introduce Euro 1, catalyst-based emission standards for all new cars

sold in the country as of 1 April 2000. Beijing again took the lead by phasing in these European auto standards that require all new cars to be equipped with catalysts as of 1 January 1999, one year ahead of the national schedule. Of the 64,000 new vehicles sold in Beijing since the beginning of 1999, 46,000 cars comply with the Euro 1 standards and the remaining 18,000 vehicles not meeting these standards are motorcycles, agricultural tractors, and trucks. To regulate these vehicles, Beijing will implement more stringent exhaust standards (Euro 1) for both Heavy Duty Gas Engines (HDGE)[15] and Heavy Duty Diesel Engines (HDDE) with steady state mode test methods, and to agricultural transport vehicles using the free acceleration mode. The standards were put in force by 1 June 1999.

Furthermore, the government of Beijing has a plan to retrofit 14,000 taxis to become dual fuel vehicles gasoline (Liquefied Petroleum Gas—LPG). Among them, 10,000 taxis should be finished before the middle of September 1999 and the remainder by the end 1999. The city government also requires taxi companies with more than 300 taxis must build their own LPG refueling stations. Notably, some public buses will also be changed to use dual fuel. The government wants to change the diesel buses in downtown—inside the second circle road—into gasoline buses, because some national leaders consider the diesel engine to be the worst pollutant source. Notably, the Shanghai municipal government and numerous other large cities are pursuing retrofit strategies as well. This rapid and progressive work by city governments on emission control standards is linked to the publicizing of air quality data in Chinese cities, which has led to public pressure on local authorities to address the problem.

Table 9. SEPA Proposed Schedule for Heavy Duty Standards

	Certification	Production
Euro 1 Standards	July 1, 2000	July 1, 2001
Euro 2 Standards	January 1, 2003	July 1, 2004

Nationally, SEPA is planning to introduce heavy duty standards according to the data presented in Table 9. It should be noted that the State Supervision Bureau (SSB) is in a dispute with SEPA over which organization has authority to issue new vehicle standards. The SSB would most likely delay the introduction of Euro 2 standards until 2005 for certification and delay production standards until 2006.

• **Vehicle Retrofit:** In early March 1999, the Beijing Environmental Protection Bureau (EPB) had a meeting with car manufacturers from all around the country and informed them that all manufacturers whose vehicles had been sold in Beijing should be responsible for the pollution of these vehicles. As a result of the discussions, all domestically produced cars sold in Beijing, which were manufactured between 1995 and 1998, must be retrofitted with a vehicles manufacturer developed kit designed to meet the Euro 1 standards. For cars with carburetors, this means installing a three-way catalyst, an oxygen sensor, an air injector, and an electronic control unit to manage the air-fuel ration at a cost of approximately $375 per vehicle. The scope of the cars needing to be retrofitted, will be the total cars registered between 1 January 1995 and 31 December 1998. Manufacturers were required to finish the work by December 1999. Approximately 80,000 vehicles have been retrofitted to date in Beijing with estimated emissions reductions averaging about seventy percent. When completed, approximately 200,000 vehicles will be retrofitted. Similar programs are going on in other cities.

• **Fuel Conversions:** Orders have been placed for 300 new Cummins Compressed Natural Gas (CNG) engines to be installed in existing buses, replacing diesel engines. No more buses with diesel engines are planned to be purchased and new regulations will require that new buses and taxicabs are fueled by CNG or have the capacity to be dual-fueled (LPG and unleaded gasoline). Approximately 15,000 vehicles have been converted to CNG or dual-fuel as of November 1999 and it is expected that this exceeded 17,000 by the end of 1999. Diesel to CNG conversions are estimated to result in about ten to twenty percent less CO and HC emissions. The Beijing Environmental Protection Bureau has also apparently decided to ban the sale of diesel vehicles altogether in Beijing.

• **Other:** The Beijing Environmental Protection Bureau is actively pursuing loaded emission testing capability for the I/M program, as are other cities in China. The I/M program is the primary enforcement tool for vehicle retrofits and alternate fuel conversions, as well as for the overall maintenance of the vehicle fleet. Another new policy recently introduced by the Beijing Environmental Protection Bureau (EPB) is the requirement to force the retirement of vehicles that have accumulated more than 500,000

kilometers in use. This policy led to the scrapping of approximately 58,000 vehicles, mainly taxis, by the end of 1999.

On 1 June 1999, SEPA issued new control standards for motor vehicle gasoline designed to minimize hazardous risks of benzene, olefins, aromatics, lead, and other chemicals. In addition, detergents which could clean deposits effectively will be required to be added to motor vehicle gasoline. For olefins, the requirements were implemented in Beijing, Shanghai, and Guangzhou as of 1 July 1999 and will be mandatory for the entire country after 1 January 2003. The Beijing EPB is also trying to work with the Petroleum Ministry on further improvements of fuel quality, especially as it pertains to detergents. Currently the Beijing EPB and the Petroleum Ministry are developing Stage I vapor controls at service stations. In the year 2000, a pilot program to raise money to fund pollution control work has been set up in approximately thirty major cities. This pilot project requires the levy of a 300 to 600 Renminbi pollution fee on all vehicles and the funds will be dispersed to local governments to use as they see fit to remedy vehicle pollution in their area.

Conclusion

The vehicle population in China has been growing rapidly over the past decade and will likely continue to do so for the foreseeable future. Without significant effort to constrain the environmental damage that these vehicles can cause, already serious air pollution problems will become critical. To prevent further severe air pollution, the Chinese government—with funding provided by the World Bank—has developed a national strategy for reducing motor vehicle pollution. Key components of the strategy include unleaded gasoline, tight standards on all categories of new vehicles, and a substantially upgraded I/M program. Institutional improvements to enable the strategy to be implemented have also been developed. A great deal of additional work will be needed but it is believed that the work carried out to date under this project provides a good basis upon which to build in the future. Several important elements of the strategy have now been implemented and most notably have been the additional controls that municipal governments are introducing to complement the national strategy.

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[13] *China Auto*.

[14] "China's Strategies for Controlling Motor Vehicle Emissions, "World Bank Summary Report", December 1997.

[15] Since all heavy-duty engines in Europe are diesel, the gasoline-fueled engine standards will be set to United States 1982 requirements.

Present and Future Pollution from Urban Transport in China

By He Kebin and Cheng Chang

For the past twenty years, as China has shifted away from a planned economy, free market reforms have created dynamic economic growth and produced a more mobile and affluent society. China is now a country with a population on the move. The economic reforms have not only prompted a huge migration of people from rural to urban areas, but have also stimulated trade and movement of goods within and outside China's borders. From the late 1980s to the late 1990s, overall travelling distances (person/kilometer) of citizens increased by more than 100 percent and average travelling times and distances per capita increased by fifteen to thirty percent.[1]

The number of vehicles nationwide has grown considerably over the past decade and by 1998 the national vehicle population grew to over thirteen million, with Beijing and Shanghai accounting for approximately 14.4 percent of total vehicles nationwide. In Beijing City, the growth rate of motor vehicles has averaged between fifteen and twenty percent per year in the past decade. Current trends indicate that ten to twenty percent of this vehicle growth in China is in private cars, which not only threaten to replace the bicycle as primary means of transport, but are also competing strongly with public transport.[2] Policymakers and citizens in China have become concerned as the massive growth of vehicles in the large cities has considerably exacerbated air pollution and traffic congestion.

In this article we will first outline the current trends of vehicle growth and pollution in Chinese urban areas. We then examine recent research linking vehicular pollution to growing health problems in China. The article concludes with a discussion of how the national and municipal government policies are responding to this pollution problem and we outline some proposals for necessary future policies.

Vehicle Production and Transport Infrastructure in China

Compared with industrialized countries, the total pollutant emissions from automobiles in typical cities in China is alarming. Tokyo had four million vehicles in the 1990s, but the vehicle emission level remained at 100,000 tons and 50,000 tons of carbon monoxide (CO) and nitrogen oxides (NO_x), respectively. In 1998, a mere 1.31 million motor vehicles in Beijing emitted 129,000 tons and 115,000 tons of CO and NO_x, respectively.

While China's vehicle fleet is not very large, the average emission factor per vehicle is very high; in fact it is several times higher than vehicle emissions in industrialized countries. China's vehicle emission levels are comparable with the emission levels that existed in Europe and the United States in the 1960s and 1970s. This high level of pollution emissions from vehicles is mainly due to the underdeveloped manufacturing technologies utilized in the Chinese automobile industry and poor maintenance of automobiles. For example, the Beijing Jeep 212 consumes thirteen to fifteen liters of fuel per 100 kilometers and overall has a weak power performance. This fuel consumption rate is between fifty and100 percent greater than the same type of jeep manufactured in industrialized countries. The Red Flag Auto, produced by the First Automobile Works Company, represents another example of inefficient and out-dated engine types. The most highly polluting types of vehicle in China, particularly in terms of CO emissions, are heavy

Table 1. Comparison of Urban Road Density

City	Road Density (km/km^2)	Percent of Road Area	Road Area Per Capita (m^2)
Beijing (China)	6.8	7.1	4.7
Shanghai (China)	7.6	12.6	5.4
Guangzhou (China)	7.0	7.7	5.2
Dalian (China)	12.6	6.46	5.7
Tokyo (Japan)	18.9	14.9	10.9
Osaka (Japan)	18.0	17.5	14.4
London (U.K.)	18.1	24.1	28.0
New York (U.S.A)	8.0	16.6	26.3

Sources: China International Cooperation Committee of Environment and Development, *Proceedings of Symposium of Urban Transportation and Environment,* (April 1999): 48-58; and *China Statistical Yearbooks,* 1978-1998, Beijing.

and middle duty gas trucks, which emit 200 grams of CO per kilometer, compared to European cars which emit fifty grams of CO per kilometer. Because China is in the process of moving from a planned to a free market economy, many large auto manufacturers cannot afford to obtain the technology to build more advanced and cleaner vehicles. Compounding the already low quality automobiles is the fact that drivers tend to ignore maintenance, which would help their vehicles run cleaners.[3]

Despite recent investment increases in transportation infrastructure in Chinese cities, the average speed of vehicles has actually decreased, especially for public vehicles. In rush hour the speed of public vehicles on many lines approaches walking speed. The punctuality rate for public transport vehicles has decreased from seventy percent in 1990 to 8.4 percent in 1996. The greater number of private vehicles is creating more traffic congestion, which has led to the cancellation of thousands of public transportation routes in cities across China. This decrease in public transport has spurred an increase in private vehicle purchases and taxi services, which, in turn, has increased traffic congestion; a vicious cycle.

Road construction has not been able to keep up with the significant growth in the number of public and private vehicles. Over the past decade, the average road area per capita has remained comparatively low—less than six square meters per capita. Table 1 compares urban road density and road area per capita in cities in China and industrialized countries. The explosion of car purchases and lack of new roads has meant that in cities such as Beijing, the average velocity of vehicles on main roads at rush hour was only thirteen to nineteen kilometers per hour in 1998. Over the past few years, the rush hour road load in Beijing has increased from 700 vehicles to 918 vehicles per

Table 2. Transportation Information for Seven Chinese Cities (1997)

	Beijing	Shanghai	Chongqing	Guangzhou	Shenzhen	Dalian	Guiyang
Urban resident population in 1997 (in ten thousands)	646.2	860	250	392.38	379.64	259.7	100.34
Specialized public bus lanes (km)	54	None	9.49	None	80	26.58	4.4
Length of subway in use (km)	42	21.3	None	12.7	None	None	None
Length of subway currently under construction (km)	11	None	None	None	14.8	None	None
Average rush hour speeds (km/h)	13-19	< 25	20	18-20.5	20	15-20	25
Number of clean fuel motor vehicles	809	1231	n.a.	136	1000	225	None
Average daily value of CO emissions (mg/m^3) on urban roads	5.2	n.a.	10.4	2.54	n.a.	2.47	n.a.
Average daily value of No_x emissions (mg/m^3) on urban roads	0.133	0.059	0.068	0.141	0.054	0.056	0.033

kilometer. To summarize, because large and medium-sized cities have inadequate and congested roads, vehicles must drive at low speeds and low driving speeds increase the emissions of CO and NO_x. In order to paint a picture of transportation challenges in China, Table 2 presents information on public transportation, subways, and NO_x emissions in seven major Chinese cities.

Urban Air Pollution

In 1995, the United Nations ranked three Chinese cities—Beijing, Lanzhou, and Taiyuan—among the top ten most severely polluted cities in the world. The concentration of NO_x exceeds national ambient air quality standards (NAAQS) in most of China's largest cities. As Table 3 illustrates, eighty-one percent of cities with a population over two million exceed the NAAQS for NO_x concentration. Slightly over half of China's cities with a population between one and two million also exceed NAAQS for NO_x. Currently, weekly air quality reports for thirty-two cities indicate that NO_x has became the main pollutant in eight major cities (Beijing, Guangzhou, Shanghai, Wuhan, Hefei, Dalian, Shenzhen, and Zhuhai). Statistical data show that there is drastic growth in the number of respiratory health problems due to vehicular pollution.[4] We will discuss more on the air pollution-health nexus below.

The capital city, Beijing, is one of the most polluted cities in China with vehicle emissions as the leading source of air pollution (See Table 4). In 1997, the concentrations of vehicular pollutants in central Beijing exceeded the second class NAAQS many times. In 1997, emissions of CO, lead, and NO_x in Beijing were exceeded four, twenty-two, and thirty-five times, respectively. In order to control and mitigate the severe situation of vehicle pollution, the Beijing municipal government announced new emission standards for new cars in August 1998 and put these standards into effect in 1 January 1999. These new standards are stricter than the current national standard. Despite enforcement of these standards, the number of vehicles continues to grow in Beijing, so it is too early to know the efficacy of the new standards on decreasing pollution. Beijing and other municipal governments will need to create and enforce even stricter emission standards in the future.

In 1997, the CO and NO_x emissions from motor vehicles in Shanghai rose to 380 thousand tons and

Table 3. NO_x Pollution in Chinese Cities by Population

City Population (in 1000's)	Number of Cities		NO_x			
			Average Concentration (mg/m^3)		Percentage of Cities Exceeding Second Class National Ambient Air Quality Standards	
	Year 1994	Year 1998	Year 1994	Year 1998	Year 1994	Year 1998
> 2000	9	11	0.074	0.077	19.5	81.82
1000-2000	19	23	0.065	0.056	17.9	52.17
500-1000	14	44	0.039	0.037	3.3	11.36
200~500	27	133	0.038	0.035	3.4	13.53
< 200	16	111	0.031	0.030	1.3	12.61

Table 4. Vehicle Emissions in Beijing

Pollutant	Emission (10 thousand tons)		Percentage of Total Emissions	
	Year 1995	Year 1998	Year 1995	Year 1998
CO	107.5	129	76.8	82.7
NO_x	9.38	11.59	40.2	42.9

Department of Environmental Science and Engineering, Tsinghua University, et al. *Research Report of Planning of Vehicle Emission Pollution Control in Beijing City*, 1999 (12):105-144.

81.5 thousand tons, respectively.[5] The emission and contribution of pollutant concentration from vehicles in downtown Shanghai City are listed in Table 5. In the city of Guangzhou, the pollutant emission and the contribution from vehicles have also steadily increased. Seventy percent of vehicles in Guangzhou cannot meet the mandated emission standard, which explains why the concentration of NO_x has increased since the mid-1980s.[6] Table 6 is a summary of pollution of NO_x and CO from 1990 to 1996, from which the gradually aggravated situation of air quality from vehicles in Guangzhou could be concluded.

While the CO emission problems are well acknowledged more attention should also be devoted to the problem of fine particulate matter. Although the particle emissions from vehicles have a mean diameter of 1 mm and constitute only a small amount of total suspended particles (TSP), they pose severe hazards to human health. Research on the harmful health effects from fine particles, however, is only at a nascent stage in China. In 1998, the concentrations of particulate in Beijing and Guangzhou were 379 and 205 g/m^3, respectively, which exceeded second class national ambient air quality standards. Furthermore, if compared with the WHO standards for particulates—60-90 g/m^3, the two cities exceed the standards by three to five times. Unfortunately current Chinese standards are not as strict as the World Health Organization standards.

The number of days that Ozone ($O_{3)}$ concentration exceeds National Ambient Air Quality Standards in Chinese cities has increased from an average of forty days in 1988 to seventy-five days in 1994. The HC and NO_x emissions from vehicle sources can further react in the air and form secondary pollutants such as O_3 and Peroxyacetyl Nitrate (PAN). The combination of these pollutants will lead to the formation of photochemical smog, which not only obscures visibility, but also can be very detrimental to human health. Numerous large Chinese cities—such as Lanzhou, Chongqing, and Guangzhou—are already blanketed with smog as a result of the increase of HC and NO_x emissions from vehicles. In May 1995, photochemical smog appeared in Chengdu City for the first time, and in June of the same year, it occurred in Shanghai City.[7]

Table 5. Vehicle Emissions in Shanghai

Pollutant	Emissions (10 thousand tons)		Percentage of Total Emissions	
	Year 1995	Year 1996	Year 1995	Year 1996
CO	10.40	19.7	76	86
NO_x	3.04	4.9	44	56
NMHC	2.41	4.32	93	96

Sources: Lu Shuyu, "Vehicular Pollution Control Strategies in City Shanghai, Shanghai," *Environmental Sciences*, 17:3 (1998):1-3 and Chen Changhong et al., *Pollution Load of Vehicular Exhaust in City Shanghai, Shanghai Environmental Sciences,* 16:6 (1997):26-29.

Health Effects of Vehicular Air Pollution

In 1997, the Institute of Environmental Health Monitoring at the Chinese Academy of Preventive Medicine conducted a study on the exposure levels of vehicular emissions on human health, particularly on the immune system.[8] Passive personal samplers on the road measured the exposure levels of traffic policemen,

Table 6. Vehicular Pollutant Concentration and Pollution Index in Guangzhou (1990-1996)

	1990	1991	1992	1993	1994	1995	1996
Concentration of NOx (mg/m^3)	0.137	0.112	0.107	0.115	0.116	0.123	0.151
Contribution of NOx (%)	36.1	33.5	33.0	35.9	35.4	36.0	42.9
Pollution index of NOx	2.60	2.24	2.14	2.30	2.32	2.46	3.20
Concentration of CO (mg/m^3)	3.16	2.91	2.89	2.71	2.89	2.91	2.96
Contribution of CO (%)	10.9	10.8	11.1	10.9	11.1	10.6	9.90
Pollution index of CO	0.79	0.72	0.72	0.69	0.72	0.73	0.74

Source: Department of Environmental Science and Engineering, Tsinghua University et al., *China's Strategies for Controlling Motor Vehicle Emissions—Summary Report,* 1997.

bicyclists, and riders. The results showed that nitrogen dioxide and carbon monoxide exposures ranged from 0.219-0.349 mg/m^3 and 9.17-41.10 mg/m^3, respectively, for traffic policemen at eight crossroads. Nitrogen dioxide exposures ranged from 0.208-0.377 mg/m^3 for nineteen bicyclists who bicycled on the road to and from work. The level of pollutant exposure on the streets where the study took place exceeded the NAAQS.

In 1995, Ye Shunhua and others investigated and monitored the immune systems of bus drivers and conductors on the Yuejiang tunnel bus line in Shanghai. Their study found that the levels of peripheral blood lymphocytes, T-cyto rosette formation, IgA (Immunoglobulin A), and fibro-mucoprotein are much lower in the bus drivers than in the control group—workers at an arboretum.[9] These enzymes provide protective mechanisms for cells. Another study conducted in Xian showed that the Superoxide Dismutase (SOD), Glutathione (GSH), and Glutathione Peroxidase (GSH-px) levels in bus drivers and conductors were lower than the control group, while the level of Malondialdehyde (MDA) was higher. It was concluded that exposure to vehicular exhaust changed levels of these enzymes which can be detrimental to human immune defenses. Another study analyzed the movement of spermatozoon and blood-lead concentration in traffic policemen's semen. The results revealed lower semen mobility, higher blood-lead concentration, and repressed activity of semen succinate dehydrogenase.[10]

A survey investigating health effect determinates was carried out by the Department of Environmental Science and Engineering, Tsinghua University, Beijing.[11] The results and conclusions are the following.

1) In the peripheral blood of the on-duty traffic policemen in the four areas of Beijing, both carboxhemoglobin (COHb) saturation and blood-lead concentration are remarkably higher than control group. Saturated COHb will cause chronic oxygen deficiency and potentially lead to heart and brain illnesses. The differences have statistical significance. Furthermore, the results show good negative correlation ($r=0.8862$, $P<0.05$) between COHb and blood-lead concentration. The dynamics of absorption mechanisms in the human body and the mutual influences of CO and lead should be further researched.

2) Determination of Peak Expiratory Flow (PEF) is a common index used to assess lung function and measure chronic lung congestion. The average PEF in urban areas in China appears to be lower than in suburban areas. This is potentially caused by the heavier vehicular air pollution in urban areas. However, the results in this particular study showed no remarkable statistical significance in the differences of urban and suburban PEF levels. This was most likely due to the small sample size and highlights the need to conduct more studies with larger samples in the future.

3) The analyses of health conditions of traffic policemen in Beijing highlighted that the degree of self-reported symptoms of discomfort (breathing, eyes, and feelings of overall fatigue) is increasing for the street duty professionals. The study also reported that the rate of respiratory illnesses in traffic policemen is five percent higher than the city average.

One study carried out in twenty-eight provinces and autonomous regions in 1990s revealed that, while the average lead level in blood in the overall population does not appear to increase, spot checks in several provinces revealed that the lead level in forty percent of the children exceeded safe thresholds.[12] Not surprisingly, the blood-lead content of children in towns is higher than in rural areas, which indicates that children are increasingly vulnerable to lead emissions from vehicles. The study also reported that the blood-lead concentration of children who lived in industrial areas is between 200 and 400 g/L, which greatly exceeds the international standard of 100 g/L. In the city of Guangzhou, the blood-lead concentration of the children living near roads is between 142-167 g/L and the blood-lead concentration in traffic policemen is approximately 116 g/L. Overall, these recent health studies in China have helped to communicate the harmful impact of vehicular emissions on human health to Chinese policymakers.

Recent Vehicular Emission Control Policies in China

Over the past few years, as pollution in urban areas has significantly worsened in China, the national and municipal governments have passed vehicle emission policies and regulations. Below, we outline some of the more recent policy developments at the national and municipal levels.

National Policies in 1999

1. The *Emission Standard for Exhaust Pollutants from Light-Duty Vehicles* (GWPB1-1999) was issued by SEPA and went into effect on 1 January 2000. This policy sets emission standards for Light-Duty Vehicles equivalent to EURO1 standards. These new emission standards also establish acceptable emission values after a cold start; emission values from the crankcase of the spark-ignition engine; evaporative emission values from the spark-ignition engine; as

well as several engine durability criteria.

2. *Standard for Hazardous Contents in Gasoline* (GWPB001-1999) was issued by SEPA and went into effect on 1 January 2000. These standards place stricter limitations on the hazardous contents of gasoline than previous Chinese standards. The regulated hazardous contents include: benzene, olefin, aromatics, manganese, iron, copper, lead, phosphorous, and sulfur.

3. Technical Policy on Vehicular Emission Control was issued by SEPA on 8 December 1999. This policy focuses on emission and fuel technology requirements, such as emission reduction technologies for new vehicles, emission reduction technologies for in-use vehicles, fuel quality requirements, exhaust purification equipment, and testing devices.

Municipal-Level Policies

1. Beijing: The Beijing Technical Inspection Bureau (effective 1 January 1999) issued *Emission Standard for Exhaust Pollutants from Light-Duty Vehicles* and these standards are equivalent to EURO1 standards.

2. Shanghai: *Emission Standard for Exhaust Pollutants from Light-Duty Vehicles* was issued by the Shanghai Technical Inspection Bureau—effective 1 July 1999. These standards equal EURO1 emission standards.

3. *Emission Standard for Pollutants at Dual-Idle Speed from Vehicle with Petrol Engines* was issued by Beijing Technical Inspection Bureau—effective 1 July 1999. These standards established idle and high-idle testing methods for CO and HC emissions for in-use vehicles. By regulating high-idle emissions, high-emitting vehicles can be better identified.

4. *Emergency Measures for Improving Air Quality in Beijing* were initiated in December 1998. The measures were designed to be implemented in three phases.

i. Phase1—from December 1998 to February 1999—included measures to promote scrapping of old vehicles and inspection for in-use vehicles. The first phase was limited to in-use trucks and also required that manufacturers take the responsibility for required retrofitting. During this phase light engine vehicles need to meet new standards for LPG and CNG in order to be granted green labels.

ii. Phase 2—from March 1999 to September 1999—included the limited use of heavy engine vehicles, new management rules for maintaining mini-buses and taxis; requirements to construct CNG and LPG gas stations in order to improve the infrastructure for CNG and LPG vehicles.

iii. Phase 3—from October 1999 to March 2000—includes requirements for visual inspections of diesel vehicle emissions; limitations on the use of diesel vehicles; rules for retrofitting taxis into dual-fuel engines; fuel quality controls; and, rules to mitigate the emissions from petrol stations.

Proposed Standards for New Vehicle

As a whole, the recently amended NAAQS in China now regulate many pollutants—such as nitrogen dioxide, carbon monoxide, ozone, particulate matter (PM_{10})—stricter than most other countries. Standards for total suspended particles (TSP) are, however, not nearly as strict as those of the other pollutants/in other countries.[13] In most areas of North China, the concentration of total suspended particulate (TSP) often greatly exceeds the standard.

Using shorter time periods to measure average emissions could strengthen the future amendments to the NAAQS. For example, second class sulfur dioxide (SO_2) standards are currently measured by a yearly average and twenty-four hour average concentration. It would be useful in future amendments if an eight-hour average concentration standard for O_3 was added. In order to meet future vehicle emission control goals, stricter standards for new vehicles will be adopted over the next decade. In the next two years, the emission standards for new cars will reach the level of those in Europe in the 1990s. By 2010 the standards will be completely phased-in and China's emission standards will match that of industrialized countries.[14]

Standards vary according to the type of vehicle; for example, vehicles lighter than 3.5 tons will be required to meet the more stringent standards and when fully implemented in new cars, the CO emissions should decrease by sixty-six percent. HC and NO_x will be forty-three percent lower than current new cars. Vehicles heavier than 3.5 tons will be required to decrease CO emissions by ninety-four percent and emissions of HC and NO_x by eighty-nine percent. Targeted reductions in emissions from heavy-duty diesel vehicles will be lowered in three stages over the next five years. One goal of the NAAQS is by 2004 to decrease CO, HC, and NO_x emissions by seventy-one, sixty-nine, and sixty-one percent, respectively.

Lead-Free Gasoline Program

There exist many problems in the quality of fuels available on the Chinese market. Moreover, the dangers of leaded gasoline have recently become a major policy focus. After studying the many lead-removal programs in industrialized countries, the Chinese leadership has decided to implement its own lead-removal policies. The State Council issued the regulation on forbidding the production, distribution and utilization of leaded gasoline by September 1998,

requesting that the forty-seven key cities must stop selling leaded gasoline by 1 July 1999. The State Council decided to consolidate the fuel market and close down small refineries that could not meet these lead-free regulations and adopt the best available technologies. Lastly, the whole country must cease producing leaded gasoline by 1 January 2000, and stop selling it by 1 July 2000. Accomplishing this target on schedule is one of the most important tasks in motor vehicle pollution control in recent years.

Broader Strategies for Lowering Vehicular Emissions

While the vehicular emission standards outlined above will be key to improving urban air quality in China, a broader mix of policies targeting vehicular pollution will be needed to meet these standards. In this final section we present and critique Chinese policies that focus on infrastructure, public transport, new technologies, and inspection and maintenance (I/M) programs.

Construction and Utilization of Infrastructure

Although the urban road infrastructures in China has been greatly enhanced over the past two decades, the overall investment into transport construction is much lower than that in developed countries. China is many years away from building high-efficiency and sustainable cities with quick transport systems. Since 1978, the growth rate of the vehicle population has been much higher than that of road length. Moreover, due to limitations in municipal funding and lack of areas within cities, the construction of urban roads can not meet the demand of increasing transport. Two major infrastructure priorities should be stressed in the future. First, the total capacity of roads should be steadily enhanced. Second, the layout and construction of road networks utilize space wisely and allow traffic to move faster. These goals can be accomplished by targeting the construction of cloverleaf junctions, overhead roads, tunnels, and supplementary roads. Enhancing public transport will also relieve some of the stress and congestion on roadways.

Current trends indicate that ten to twenty percent of vehicle growth in China is in private cars.

Development of Urban Public Transport

Municipal governments are beginning to emphasize the improvement of public transport, which is a trend not only reflected in finance budgets, but also in the continually increasing public services, such as the number of buses and usage priority lanes. In 1996, the Beijing municipal government was the first city to adopt special public transport lanes on Chang An Road and this model has been replicated in many more cities.

With the deepening of reform in the public transport industry, many large cities have begun to allow privatization of public transport operations, which relieves the city of subsidy programs and has decreased municipal deficits. It should be noted that passenger flow on public transport has increased slowly and has even decreased in a few cities. In addition to public buses, many Chinese municipal governments wish to build subways as an effective and clean public transport system. While urban railway transport is a high-capacity and fast transport system, few Chinese cities have railway transport, due to the fact that subway and light rail are much more expensive than other kinds of transport systems. Currently only four Chinese cities have built subways.[15] Even in these cities with subways, not all of these subways have become the main means of transport for commuters because of the high-ticket prices. Currently, nearly twenty cities are applying for the permits from the China National Planning Committee and Ministry of Construction to build subways. Even with permits, however, subway construction will be slow in these cities due to the necessary large investment and maintenance costs. For smaller cities and the areas outside the center large metropolises, the alternative programs of closed special roads for buses, overhead roads, or trolley cars are other potential options to consider. Table 7 shows the magnitude of railway transport in the four metropolises of China.[16]

Application of Intelligent Transportation System (ITS)

At present, China witnesses the most rapid development of road construction in the world. It is anticipated that it will take another twenty years of construction for China to create a complete road network, at which time most developed countries in the world will be utilizing intelligent transportation systems (ITS). China should strive to develop and coordinate both road infrastructure and ITS simultaneously in order to enhance public transport efficiency and traffic safety to mitigate the environmental impacts of transport. Internationally, ITS has grown from the applications of electronic and information technologies to road transport. Throughout the 1980s, the Chinese Ministry of Communications carried out various research pro-

grams for expressway monitoring systems, tolling systems, and traffic safety security systems.[17] These completed studies represent the beginning foundation for developing ITS in China.

Monitoring Network for Vehicular Air Pollution

Most large cities in industrialized countries have dozens of environmental monitoring stations, which take measurements of general air quality and specific traffic pollution. Currently, only a few Chinese cities, most notably, Beijing, Shanghai, Shenzhen, Guangzhou, Wuhan, and Yantai have installed auto-monitoring systems. In China, the monitoring networks for vehicular air quality are very weak, therefore, the data on urban air quality from the monitoring stations only reveals the general status of air quality such as levels of SO_2, NO_x, particulate matter (PM), and settled dust. Tokyo has seventy-six monitoring stations, in which thirty-two traffic environmental monitoring stations provide data of CO, NO_x, NO_2, HC, and O_3. Carbon Monoxide is measured in a small number of Chinese cities, but the pollutants of hydrocarbon and ozone, which are related to motor vehicles, are not included in the routine monitoring. In addition to expanding the number and scope of monitoring stations, Chinese monitors should also more work to gather sufficient and more concise data. The U.S. Environmental Protection Agency has been working to set up air quality monitoring stations in China and this type of cooperation should continue.

Scrapping of Old Vehicles

China is a developing country with many old automobiles running on the roads, which are a major source of urban air pollution. In 1997, a newly amended *Vehicle Elimination Standard* on scrapping old vehicles was formulated and mandated by the State Environmental Protection Administration and other government agencies in China.[18] The new standard specifies that vehicles with emissions exceeding the National Emission Standards after repairs or the installation of filtering devices should be scrapped. In 1996 and 1997, the planned number of scrapped vehicles nationwide was 300,000 per year. Surprisingly, the actual numbers were 340,000 and 347,000, respectively. Between 1998 and 2000 China planned to increase the number of scrapped vehicles by 50,000 vehicles each year.

Catalytic Converter Requirements

As was discussed earlier in this article, alternative fuels—compressed natural gas (CNG) and liquefied petroleum gas (LPG)—have been introduced in twelve Chinese cities. While these alternative fuels could decrease the emissions of hydrocarbon (HC) and carbon monoxide (CO), they do not lower emissions of nitrogen oxides (NO_x), which are major pollutants in Chinese cities. With the phase-out of leaded petroleum, more additives containing oxygen may be added into gasoline, such as MTBE, which could lower the emission of NO_x.

Based on the experiences in several industrialized countries, the utilization of the three-way catalytic converter represents an ideal option for controlling NO_x as well as HC and CO emissions. After evaluating the performance of catalytic converters produced in China after driving 50,000 kilometers, some researchers concluded that Chinese-made catalytic converters are only twenty to thirty percent as effective as those made in foreign countries.[19] This highlights the need to devote more research and development into Chinese-made three-way catalytic converters. In China the percentage of vehicles with carburetors is very high, but the contents of sulfur and lead in fuel are also very high. Although the pace of the lead phase-out for automobile gasoline has sped up and will be introduced nationwide on 1 July 2000, in actuality leaded petroleum will still exist in the market for a long

Table 7. Railway Transport in Four Urban Centers

City	Subway Established	Subway Length (km)	Planned Subway Construction	Planned Light Rail Construction
Beijing	1969	40.3 (1987)	12.3 km	44.3 km
Shanghai	1993	16.1 (1994)	284 km	179 km
Tianjin	1980	7.4 (1984)	2nd & 3rd line	44 km
Guangzhou[a]	1998	12.7 (1998)	23.21 km (2nd line)	

[a] Source for Guangzhou information: www.gzmtr.com/html

time. Therefore, research and production of sulfur-proof and lead-proof three-way catalytic converters to filter out lead emissions is greatly needed.[20]

National Clean Vehicle Action

With the goal of significantly lowering pollution from vehicular emissions and cleaning air by developing advanced and new technologies, twelve Chinese cities began the implementation of the "Clean Vehicles Action" in 1999. This policy aims to promote linking the current science and technology industries with experiments in cities. The Clean Vehicles Action includes several goals:

• To speed up the production of clean fuel motor vehicles.

• To expedite the matching application of closed-loop electronic fuel injection system and three-way catalytic converters.

• To emphasize the spread of high-efficiency and low emission gas-fired technology buses and taxis.

• To enhance the construction of adding-gas stations and other necessary infrastructures.

• To build up satisfactory service system for clean fuel vehicles.

• To reinforce research and development of electric and hybrid vehicles, which will be the basis of a new automobile industry of China.

Even before this National Clean Vehicle Action policy, China had already begun to introduce clean technology vehicles. By the late 1990s, the number of clean natural gas (CNG) and liquefied petroleum gas (LPG) vehicles rose to more than 10,000 and approximately seventy gas stations to fuel such vehicles were built.[21] Beginning in November 1998, twelve cities in China began experiments in developing and using CNG and LPG vehicles and gas stations. Throughout the year, clean gas engine vehicles developed at a steady pace and Table 8 provides some comparisons of LPG and CNG vehicles in these demonstration cities.[22] Table 9 shows the magnitude of LPG and CNG vehicle increase in seven of these cities. Clearly, the number of gas stations lags behind the increase in vehicles. Although the number of CNG and LPG buses and taxis account for only ten percent of the total vehicles in use, they account for forty to fifty percent of the miles driven on Chinese urban roads. Cleaner fuels will help all cars to run clean and this policy could be easier to implement than vehicle inspection and maintenance programs.

Advanced Vehicle Technologies

Development and application of vehicles using clean alternative fuels will open up new methods to prevent and control vehicular pollution in

Table 8. Number of CNG/LPG Vehicles and Gas Stations in Twelve Demonstration Cities (1998)

City/Province	Classified Capacity of Gas-Vehicle		Gas Stations		Supply Capacity of Gas	
	CNG	LPG	CNG	LPG	CNG ($x10^8 m^3/a$)	LPG ($x10^4$ t/a)
Shanghai	None	300	None	None	None	Imported as needed
Xian	78	None	1	None	3.67	None
Wulumuqi	400	100	2	2	1.8	3.06
Guangzhou	None	210	None	1	None	Imported as needed
Shenzhen	None	1800	None	1	None	Imported as needed
Chongqing	300	None	3	None	1.0	None
Hainan Province	3	52	1	2	5.24	30
Sichuan Province	3500	None	34	None	5.13	None
Beijing	300	600	2	4	15.0	10
Tianjin	None	80	None	3	4.0	105
Changchun	None	40	None	1	3.6	30-40
Ha'erbin	None	350	None	3	0.18	56
Total	4581	6232	43	24	n.a.	n.a.

China. In order to meet the increasingly strict emission standards, the main manufacturers in the world are trying to develop diversified low-pollution vehicles using alternative power, such as vehicles that run on natural gas, liquefied petroleum gas, methanol, ethanol, biological fuels, hybrid fuels, hydrogen, electricity, and solar energy. Among this long laundry list of alternatives, natural gas vehicles and liquefied petroleum gas vehicle are currently the most practical and popular clean energy vehicles. As discussed above, twelve cities in China are experimenting with CNG and LPG public transport. Hybrid fuel and electric vehicles represent other promising clean vehicle technologies in the future.

Fuel cell vehicles are viewed as one of cleanest future technologies, but the technology for marketing fuel cells in China is not yet mature. Nevertheless, because of China's severe pollution problems, the Chinese government should promote fuel cell technology so that it could be put into use, which in turn will help to create a market for it.[23] In light of the currently available electric vehicle technology, a Chinese Ministry of Science and Technology study has outlined the future potential of for developing electric vehicles in China.[24] The study identified the following goals:

• To develop electric vehicles driven by storage battery for buses and other public transportation vehicles. Nickel-hydrogen battery and lithium battery should be applied as soon as possible to ensure the performance and reliability.

• To encourage the production of hybrid vehicles and promote the use of such vehicles on buses in cities to improve the urban air quality.

• To promote the innovation of fuel cell vehicles as a long-term strategy. China should strive for commercial use of fuel cell vehicles by 2010.

• To establish the production and supply system for methanol to complement the industrialization of fuel cell vehicles.

Municipal Inspection and Maintenance (I/M) Programs

The extant municipal I/M programs generally include yearly inspections, first-class maintenance, second-class maintenance, and vehicle overhaul. I/M programs also mandate that buses and taxis be inspected and repaired regularly. Beijing City has adopted and systematically carried out the policy of compelling inspections and vehicle maintenance.[25] Although I/M programs are only a few years old, studies of the I/M policies in several large cities, such as Beijing, Shanghai, and Guangzhou, reveal that they have been fairly effective in lowering vehicle emissions.[26] For example, in Beijing, the emissions from vehicles have been cut down by an average of thirty-seven to sixty percent in the operating mode of dual idling, and lowered by a total of twenty-eight to forty-eight percent. In Shanghai City, the emission concentrations of CO and HC have been decreased on average by thirty-nine percent. However, more reductions could be accomplished with stronger maintenance programs and stricter supervision. Cost-benefit analyses show that the implementation of I/M program is inexpensive and effective in lowering polluting emissions.

The experience of Shenzhen City in mandating yearly emission inspections of vehicles is representative of the challenges Chinese cities face in effectively implementing I/M programs. From 1991 to 1995, the yearly emission inspections in Shenzhen City were performed at inspection stations, which were established by five enterprises overseen by the police and transportation departments of Shenzhen. Due to the lack of coordination and limited knowledge of government regulations and laws, the enterprises responsible for the inspections were not reliable in the I/M work and No_x emissions continued to grow in Shenzhen City. Notably,

Table 9. Growth in Liquefied Petroleum Gas (LPG) and Clean Natural Gas Vehicles (CNG) and Stations

City/Province	Number of LPG/CNG Vehicles		LPG/CNG Gas Station	
	12/1998	11/1999	12/1998	11/1999
Shanghai	300	10000	7	17
Shenzhen	1800	2800	1	2
Chongqing	300	430	3	6
Beijing	900	12000	6	19
Changchun	40	326	1	1
Ha'erbin	350	1200	3	10
Sichuan Province	3500	5000	34	n/a

the city's Environmental Protection Bureau (EPB) was not permitted to take part in the I/M program's supervision, due to historically poor institutional cooperation between the EPB and the city traffic administration. The enterprises performing the yearly inspection of vehicles increased to eleven in 1997 and because air quality continued to worsen, the city government decided to allow the Shenzhen Environmental Protection Bureau to assign experts to emission stations. These EPB representatives now actively supervise the inspections according to national regulations and NO_x emissions have begun to drop.[27] In Shenzhen and other cities the lack of cooperation between various city departments on controlling local emissions will hinder the effectiveness of I/M program and other pollution control policies. The empowerment of EPBs in this area is a promising trend.

It will take time and considerable investment to strengthen the existing regulations, to develop technologies of internal-combustion engine, to improve fuel quality, and to adopt other measures to mitigate vehicle emissions. Inspection and maintenance (I/M) programs offer an inexpensive and effective means to lower emissions in the short term. Without proper maintenance even vehicles with advanced pollution control devices can exceed emission. Therefore, I/M systems clearly should be part of a long-term effective policy tool in China's pollution control strategy. Comprehensive cooperation and more stringent supervision have to be reinforced. The settings of major characteristic parameters for future projects on the system of inspection and monitoring could be similar to the following:

- To adopt concentrated I/M systems and maintain yearly inspections.
- To adopt ASM method in testing electronic fuel injection vehicles ($HC/CO/NO_x$).
- To adopt dual-idle method in testing carburetor vehicles (HC/CO).
- To adopt free acceleration smoke monitoring measurement in testing diesel vehicles.
- To institutionalize inspections within existing government transportation bureaus.

Moreover, there exist some shortcomings of I/M programs that must quickly be addressed. For example, the data in road inspections should be more detailed and exact, including running mileage of vehicles, classification of vehicle type, and exhaust volume. Databases of I/M information should be updated regularly so as to monitor and understand the scope of vehicles lacking maintenance. The current emission standards were mainly referenced singly from Europe, so the future standards will need to be more comprehensive. Training programs for workers in repair shops should be expanded, for the current quality of workers is very low.

Conclusion

Since China is facing severe pollution from urban transportation, Chinese leaders must formulate comprehensive technology, economic, and transport policies to encourage the development of clean emissions technology and create incentives for producers and consumers to meet air quality standards. Below we integrate various policies and programs discussed in the previous section into three policy areas—technology, economic, and transport.

- **Technology Policy.** Technology policy should mainly focus on the advanced technologies in combustion, super low emission, and alternative power. In manufacturing conventional vehicles, the Chinese auto industry is somewhat outdated and only in nascent research stage for electric automobiles and hybrid vehicles. In order to catch up with the developed countries in future, China must target specific advanced technologies in certain areas, for example, developing engines specifically for using CNG or LPG; producing catalytic converters to remove NO_x; and promoting particulate-capturing emission technology.
- **Economic Policy.** In order to decrease and prevent vehicular pollution, economic policy can be used to guide production and consumption towards cleaner emissions technology and cleaners fuels. For instance, considering the relation between engine displacement and pollutant emission, Chinese policymakers should create economic policies to encourage the manufacturing of vehicles with small cylinder volume. Thus, if the number of automobiles were equal, the exhaust emission would be much lower. The Clean Vehicles Action, which was discussed above, was begun less than a year ago, but it is encouraging that many cities have been actively adjusting their economic policies to promote its implementation. In 1998, the national government successfully adopted the measures to tax leaded oil more steeply than lead-free oil, which helped create incentives to speed up the phase-out of lead gasoline.
- **Transport Policy.** Transport policies, such as limiting the use of high-polluting vehicles, creating incentives for commuters to choose public transport, improving the traffic management equipment and methods, and adopting ITS, could considerably decrease traffic congestion and pollution in urban areas. In some metropolises such as Beijing and

Shanghai, instituting high-occupancy vehicle lanes has helped to mediate traffic congestion to some extent.

Vehicle emissions pose considerable threats to human health and quality of life in Chinese cities. Policymakers in China have made great progress in setting standards for emissions and fuels. However, in order to meet these standards, national and municipal governments will need to emphasize policies to strengthen infrastructure, expand public transport, and promote the development of clean vehicle technology.

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Environmental Change and Security Project Report, Issue 5

The Environmental Change and Security Project (ECSP) published its fifth issue of the *Environmental Change and Security Project Report*. A tool for researchers, policymakers, and educators, the ECSP Report examines the various aspects of linkages between environment, population, and security.

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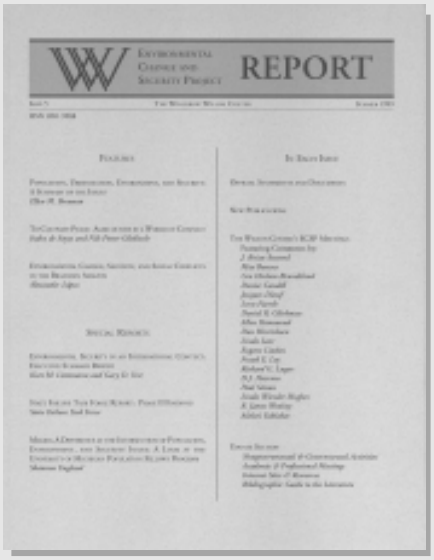

Since October 1994, the Woodrow Wilson Center's ECSP has provided specialists and other interested individuals with a "road map" to the myriad views, activities, and policy initiatives falling under the rubric of "environment, population, and security." Through meetings, publications, and the activities of the staff, ECSP explores a wide range of academic and policy-related topics. The *ECSP Report* can be obtained by email at ecspwwic@wwic.si.edu or online at http://ecsp.si.edu/ECSP-Report5.

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Forest Issues in China

3 June 1998

Ecologically, China's forests are extremely diverse, ranging from tropical moist forest to boreal taiga on permafrost. China's natural forest ecosystems span a wider array of environmental conditions than any other country on earth. Moreover, China is one of the world's most biologically diverse countries and ranks fifth in the world in total forest area (See Table 1). Despite this high ranking, China has had some of the most extensive historic forest losses in the world and is a relatively forest-poor country with only fourteen percent forest coverage. Overall, China has the highest or second highest rate (after Indonesia or India) of threatened species for each major group—e.g., mammals, birds, plants, amphibians, reptiles, and snakes. China's most important biodiversity hotspots are found in the forests of southern and central China. The most intact natural forest areas are concentrated in Yunnan and Sichuan provinces and in the Autonomous Region of Tibet. These forest areas are all considered highly threatened by agriculture, fuel wood collection, and logging by small-scale private timber companies.

On one hand, the degradation of forestry resources in China parallels trends in other developing countries. For example, the loss of natural forests stems from a large use of fuel wood and agricultural encroachment into forests. China's forest sector, however, differs from some trends in developing countries in that the Chinese government has organized mobilization campaigns of public and private resources for forestry and has promoted a high proportion of forestry cover in plantations (See Table 2). These policy actions have led to a reversal of overall forest loss in China, but, as will be discussed below, trends in consumption and production indicate that these past trends in afforestation will not continue.

Table 1. Comparative Forest Coverage Facts

	Percentage of World Forest Area	Percentage of Forested Land in Each Country	Natural Forest (Million Ha.)	Annual Change Rate (%) in Natural Forest (1990-1995)	Plantation (Million Ha.)	Percentage of Annual Increase in Plantations (1990-1995)
Russia	22.1	45	763[a]	n.a.	n.a.	n.a.
Brazil	15.9	65	546	-0.6[b]	4.9	7
Canada	7.1	27	244[a]	+0.1[b]	n.a.	n.a.
USA	6.2	26	212[a]	+0.3	n.a.	n.a.
China	3.9	14	99.5	-0.5	31	5
Indonesia	3.2	55	103	-1	6.1	8
Congo Dem. Rep.	3.1	48	109	-0.7	.04	10

[a]Indicates total forested area. [b]Indicates annual change in total forest.
Source: FAO. *State of World's Forests 1997*. Rome: United Nations Food and Agriculture Organization. 1997.

Table 2. Comparison of Forest Ecosystem and Protected Forest Areas

	Forests as Percentage of Original Forest	Percentage Intact Natural Forest Ecosystem Remaining	Percentage of Non-Tropical Forest Area Protected (Tropical Forests)
Russia	69	29	2 (0[a])
Brazil	66	42	7 (6.9)
Canada	91	57	7 (0[a])
USA	60	6.3	10 (6.7)
China	22	1.8	4 (13)
Indonesia	65	29	21 (21)
Congo Dem. Rep.	61	16	0[a] (7)

Source: World Resources Institute, UNEP, UNDP, and World Bank. *World Resources 1998-99: A Guide to the Global Environment*. New York: Oxford University Press. 1998.
[a]No such forests exist in this country.

Forestry Production and Consumption in China

The economic reforms introduced in 1978 have moved China towards a market economy and opened the country to foreign investment. Following these reforms, China has enjoyed one of the highest economic growth rates in the world with an average 8.9 percent annual GDP growth between 1983-1993. Throughout the reform era, international trade has become a major feature shaping China's forest sector. By 1995, China was the tenth largest importer of forest products and is currently a net importer for nearly all categories of forest products. However, China's overall influence on international forest product markets is still very modest. China's role is largely limited to a buyer in international markets. Currently, China imports less than two percent of its wood requirements, but as demand grows China will increasingly become dependent on imports for all categories of industrial wood products, particularly if the Chinese government drops import quotas on wood, pulp, and plywood if it is admitted to the World Trade Organization.

Although China is now the world's third largest paper producer after the United States and Japan, local production has been unable to keep up with demand. Therefore, paper and pulp board imports increased by 255 percent between 1981 and 1992. These imports come principally from the United States, Canada, and Japan. A majority of Chinese paper comes from non-wood fiber sources (eighty-five percent in 1992), however, higher incomes and recent changes in government trade policy are most likely going to lead to a sharp increase in demand for high quality paper from wood pulp.

Some estimates indicate that by 2010 China will consume as much wood fiber as the United States, although at much lower per capita levels. Paper and paperboard consumption have grown at twelve percent annually for the past forty years. China will have to import approximately one quarter of its wood to meet this growth in paper consumption and industrial wood demand. Nevertheless, China's per capita consumption is and will remain a small fraction of that of the OECD countries. For example, per capita consumption of paper in China in 1995 was about fifteen kilograms, which is approximately five percent of per capita consumption in the United States (285 kilograms). Per capita consumption of paper and wood-based panels in China is expected to increase by as much as seventy-five kilograms by 2010. It is the potential growth in industrial wood demand beyond 2010 that holds significant implications for international timber markets.

Key Forest-Related Environmental Issues in China

Natural forest habitat loss in China is approximately four to eight percent per year. Moreover, as Table 2 indicates, there is little protected forest area in China. The growing problem of deforestation is causing some notably serious environmental problems. For example, deforestation is creating growing problems of soil erosion that

degrades water quality and increases water siltation problems. Dams in China have a 1.5 percent sedimentation rate per year, which is due in great part to the lack of forest cover. High rates of species endangerment is also a directly linked to forest loss.

Like many developing economies, fuel wood and charcoal dominate wood use—China ranks first in the world just ahead of Brazil in this kind of wood consumption. The trends in fuel wood and charcoal use will have a major impact on how much of these products China will need to import to meet future demands. Aggressive plans to increase electricity generation from coal will likely lead to a decline in the use of fuel wood, but with significant adverse impacts on air pollution and greenhouse gas emissions.

Government Forestry and Biodiversity Policies

The Chinese government is taking a number of steps to expand supply and manage the demand of forest products, including extensive investment in a wide variety of afforestation programs and the promulgation of new regulations encouraging conservation and substitution. The PRC has a long history of tree-planting and is the world leader in investment in afforestation.

During the Mao era (1949-1976), short-term tree-planting campaigns "by the masses" was the dominant forestry policy strategy. Such campaigns led to a large number of trees planted, but most died due to lack of care and maintenance. In a similar vein, the post-Mao regime established the Obligatory Tree Planting Program in 1981, which calls on citizens to plant three to five trees per year. In 1994, 490 million people planted 2.5 billion trees, but survival rates are thought to be quite low. A more organized and better maintained tree planting campaign has been the Three Norths Shelterbelt Project. This project, also referred to as the Great Green Wall, is a vast network of shelterbelts designed to combat soil erosion and desertification from Heilongjiang to Xinjiang. This ecological screen against desertification in northwestern and north central China has led to the planting of approximately twenty-three million hectares of trees. Under another related project—the Desert Protection Project—2.2 million hectares of forest has been planted since 1992 in twenty-nine provinces. While these shelterbelts have stopped severe erosion problems, they are susceptible to insect infestation, for only one species of tree was used.

While the relative success of these programs is widely debated in the policy literature, in the reform era, the central Ministry for Forestry and the provincial forestry departments are increasingly effective technical agencies that have successfully implemented large-scale, complicated afforestation programs. The Chinese government expects to increase the forest cover from 13.6 percent to 15.3 percent of total land area by 2000. The current Chinese government development program for forestry is supported by a relatively sound policy framework—including more secure land tenure, market-based resource pricing for about ninety-five percent of all timber, and increased an emphasis on private sector activity. Much of the previously communal forests have been given to households with a fifty-year lease for land-use rights. Policies to encourage the substitution of metal and concrete for scarce wood resources combined with the official goals of planting an additional sixty million hectares of forest over the next twenty years may succeed in increasing the number of plantations, but would most likely be unable to keep up with consumption growth.

On a biophysical basis, there is considerable capacity to increase forest area in China. However, given that China already has one of the lowest agricultural land base per capita of any country, it is questionable whether expansion of forest areas accomplished during the past forty years can be sustained. Moreover, the overall positive trends in forest cover in tree plantations mask the continuing loss and degradation of rich natural forest ecosystems. Tree plantations cannot replace the biodiversity and ecosystem processes and functions of the natural forests. The rapid increase in demand for wood products has led to a decline in standing stock (timber volume) as mature trees are intensively harvested.

In light of these forestry losses and the huge demand for wild animal derived aphrodisiacs and pharmaceuticals, especially in southern China, a strong biodiversity policy is needed. In the international arena, China has not played a major role in shaping international forest-related policies such as the Convention on Biodiversity, CITES, and the International Panel on Forests. On such international accords, China tends to support the views of many developing countries, namely that industrialized countries should provide technology and financial support to developing countries in order to promote forestry conservation and biodiversity policies. Domestically, China has taken the Convention on Sustainable Development seriously and has already completed their Action Plan. While forestry policies fall clearly under the jurisdiction of the Ministry of Forestry, a clear mandate for a national biodiversity strategy does not yet exist, for State Environmental Protection Administration (SEPA), the National Academy of Sciences and other ministries have

all proposed competing biodiversity strategies.

In response to massive flooding problems, the Central government has periodically banned logging in various provinces. The increase in financial and administrative authority at the provincial level, however, limits the central government's power to enforce such bans. The provincial government in Heilongjiang has been apparently very strict in the forestry ban, for they have relocated 55,000 people who previously relied on these forests. Instead of totally banning logging, the central and provincial governments need to push better harvesting techniques on its forest industry and allow more non-governmental organizations to help monitor in this area.

World Bank Programs

The World Bank has provided five loans/credits totaling $804 million, one GEF grant of $18 million, and one Institutional Development Fund Grant over the 1990s to enhance forest productivity, resource-use efficiency, and institutional capacity for sustainable sectoral management. The China forestry program is the largest in the World Bank. It is also the largest forestry investment by any donor in one country. The specific World Bank operations during the 1980s-1990s include:

- The Forestry Development Project ($47 million IDA credit) approved in 1985 and closed in 1991;
- the Daxianganling Forest Fire Rehabilitation Project ($57 million IDA credit) approved in 1988 and closed in 1994;
- the National Afforestation Project ($300 million IDA credit) approved in 1990;
- the Forest Resource Development and Protection Project ($200 million IDA credit) approved in 1994;
- the Nature Reserves Management Project ($18 million GEF grant) approved in 1995; and,
- the Forestry Development in the Poor Areas Project ($100 million IDA credit and $100 million IBRD loan).

By the late 1990s the World Bank began to shift its lending rates for China's forestry sector to the commercial rate of seven percent with a twenty-year repayment period. Such terms will be very difficult for the Chinese government to finance and most likely signals a marked decrease in World Bank funded forestry projects in China. The Food and Agriculture Organization has been involved in a regional fuel wood project in China that is promoting higher efficiency fuel wood stoves.

There is a growing investment in wood processing by foreign private investment, mainly by overseas Chinese. Most of the $30-75 million in private wood processing investment has been done along the coasts, but it may not be promoting sound environmental techniques or new technology transfer.

New Conference Proceedings Volume from ECSP

Protecting Regional Seas: Developing Capacity and Fostering Environmental Cooperation in Europe

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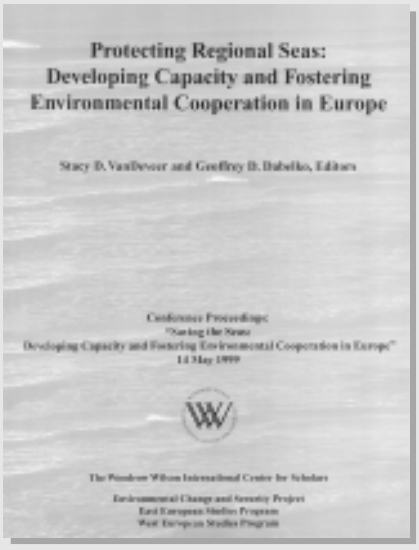

On 14 May 1999, the Woodrow Wilson International Center for Scholars assembled a group of scholars and practitioners to discuss the similar challenges of pollution that undercut the marine ecosystems and the economic potential and health of surrounding human populations of the Baltic, Mediterranean, and Black Seas of Europe. Entitled "Saving the Seas: Developing Capacity and Fostering Environmental Cooperation in Europe," the conference was held at the Center in Washington, D.C. This conference proceedings volume reflects the scholarship and debate featured at that conference and contains chapters that compare and analyze the state of environmental management in each of the three regions including the structure, funding, and effectiveness of each sea's protection program.

For more information or to obtain a copy of the conference proceedings volume, please contact the Project at (202) 691-4130 or by email at ecspwwic@wwic.si.edu.

China's Food Security

1 July 1998

Food security has long been a central concern of the Chinese government and citizens. To strengthen food security, the Chinese government has stressed the need to be self-sufficient in grain. Some western researchers, although hindered by a lack of data, have predicted that water scarcities in China represent a major obstacle to maintaining grain self-sufficiency. Scenarios for water scarcity range from predictions of a grain hungry China importing massive quantities of grain and causing world food prices to soar to predictions of China altering its food production patterns and importing moderately from the world grain market. Other challenges to expanding grain production include the diminishing returns and pollution from fertilizers and the government's inability to maintain grain subsidies. Gathering additional data on China's water consumption, land, and fertilizer use will help improve predictions of Chinese food security as well as highlight opportunities for U.S. cooperation.

Water scarcities in Northern China are the greatest in the country. For example, groundwater on the North China Plain has been dropping 1.5 meters for the last few years and if this speed of extraction continues, water conflicts will become a potentially explosive problem. In the Yellow River Basin a potential political conflict among provinces is also unfolding. The Yellow River, which flows through eight provinces as it winds to the sea, ran dry in 1972 and since 1985 it has been running dry for part of each year. The situation worsened in the 1990s and in 1997, the river failed to reach the sea for seven out of twelve months of the year. The long unresolved question has been how this river's water will be allocated among the provinces. Upriver provinces have plans to divert water for hydroelectric power and for fueling city growth. Building huge reservoirs for hydroelectric generation leads to a significant loss of water through evaporation. Beijing has decided to allow the upstream provinces to divert more water to enable them to develop industry in the country's interior and create as much employment as possible. The logic for this decision most likely stems from the fact that the central government no longer transfers as many resources from east coast provinces to fund development in the interior. This decision to favor upstream urban growth, however, has meant a sacrifice of irrigated agriculture in the lower reaches of the basin. It was a logical decision to make this choice to create jobs, but notably this action contradicts the government's longstanding "agriculture first" policy. The growing water shortages in the north have also led to a serious reconsideration for the construction of a gigantic water transfer project to bring water from the Yangtze River in Southern China.

In addition to regional water shortages, rapid economic growth in China over the past twenty years has increased competition for water among sectors. Specifically, the urban and industrial sectors are pulling water away from the agricultural sector. This trend will continue as China industrializes further, for it is increasingly uneconomic to use scarce water on agriculture. A hypothetical example illustrates this point: with 1000 tons of water one can produce one ton of wheat which can be sold for $200. If this same amount of water is used to expand industrial production one could earn $14,000. With a 70:1 ratio, it is clear that if a country is concerned about job creation and profits, water should not be put into agriculture.

Since economic reform began in 1978, agricultural production teams were broken apart and farmers were given long-term leases on their land. These institutional changes combined with chemical fertilizer use led to a rapid growth in grain productivity. Between 1978 and 1984, grain production grew from 199 million to 306 million tons, but in the 1990s this rise in land productivity slowed. When economically dynamic, water-scarce countries, such as Israel, Jordan, and Saudi Arabia, surpassed the limits of water supply necessary to produce self-sufficient agriculture and industrial growth, these countries began to import seventy to eighty percent of their grain. These imports allowed water to fuel the growth of cities and industry. Nonetheless, the size of China's population prevents it from following this model, for there is not sufficient grain on world markets to feed China.

While fertilizer has been an important factor in raising grain harvests, Chinese farmers are now reaching a point of diminishing returns in fertilizer use. Farmers in the United States hit this limit in the mid-1980s and since the mid-1990s, U.S. farmers have been using less fertilizer. China is using the same area of cropland as the United States, but significantly more land is irrigated in China. Every year, Chinese farmers use thirty-three million tons of fertilizer, while farmers in the United States use twenty-one million tons annually. In the United States each kilogram of fertilizer produces fourteen kilograms of grain, while Chinese farmers produce twelve kilograms for each

kilogram of fertilizer. Currently, most farmers in China use nitrogen-bicarbonate, which is a very inefficient fertilizer. Increasing effectiveness of fertilizer use in China is therefore quite limited. The principle gains in crop production will be achieved if China attains a better balance in chemical nutrients in fertilizer as opposed to simply putting more fertilizers on the crops.

Monsoon rain cycles have lessened even the most agriculturally productive areas. For example, Shandong Province has a very productive multi-cropping system with winter wheat followed by summer corn. In Shandong, wheat stays in the ground until June and corn is planted in July in order to be fed by monsoon rains. With such later planting of the second crop, it is difficult to produce large amounts of corn. In theory, crop yields could be increased by irrigating more areas, but this would be difficult, for in the water-rich south almost all available land has been irrigated and in the north there is insufficient water to expand irrigated area. In fact, without considerable conservation actions, there will be dramatic drops in irrigated area in some northern river basins, such as the Hai River Basin. Water from precipitation and ground water resources no longer meets demands in the Hai and the Yellow River Basins, which include some of China's most fertile wheat-growing lands.

Grain pricing is another key issue that will impact domestic grain yields in China. The central question is: what price level will be required to keep people on the land and to keep marginal lands in production? Grain prices were raised in late 1994 by forty-two percent in an effort to encourage production, which it succeeded in doing. These price supports, however, exacerbated the central government's fiscal debt. This led Beijing to create a tax law demanding more money from the provinces, as well as a push by the central government for provinces to support the grain prices. In an examination of Taiwan and Japan, the strain on state coffers is phenomenally high. Price supports in Taiwan have succeeded in keeping a balance between urban and rural incomes, but had occurred at a high cost to the state. The reform movement in China to cut subsidies and devolve fiscal authority raises the question whether the Chinese central government could even come close to sustaining such price supports.

The inability to maintain higher grain supports and the loss of irrigation levels caused by water scarcity are factors that will directly affect future grain productions in China. Some calculations by the U.S. government indicate that China will need to import 175-365 million metric tons by 2030. It is doubtful that China will ever import anywhere near that scale, for such a magnitude of grain will not be available on the world market. The principle grain exporting countries and regions (e.g., the United States, Argentina, and the European Union) exported sixty million tons in 1960 up to 200 million metric tons in 1980. Export rates have remained at approximately 200 million tons per year since 1980.This leveling of exports stems both from the fact that no strong growth in demand for grain has occurred in the 1990s and the inability for exporting countries to increase grain yields. The United States, for example, has not been able to increase their exports even during the last two years when U.S. farmers brought back into production land that been set aside. Some conservation land could be farmed sustainably to increase grain production, but there are no foreseeable technological changes that could increase these yields. In an examination of India and other countries facing severe limits on water supply, it is clear that projected growth on imported grain will increase considerably in the coming decades. It remains unclear, however, whether exporting nations can raise their exports to meet this potential demand from China. The last half century was dominated by falling grain prices and the next half century will most likely be dominated by scarcity of grain and falling grain supply.

Can China Feed Itself?

Lester Brown's 1995 book, *Who Will Feed China* (W.W. Norton 1995) was one of the catalysts for a group of U.S. federal agencies and the Harvard University China Project to conduct a study of the agricultural sector in China. The study examined only grain, so village gardens, forest agriculture and aquaculture, which are significant contributors to China's food supply, were not included. This study included work to estimate the quantity of arable land and freshwater availability and employed a United States Department of Agriculture (USDA) model to make projections and examine seven scenarios of agricultural supply and price in China. The analysis of these estimates and modeling highlighted some potential policy recommendations.

The major implication from this study was that there does not exist fundamental resource and technological constraints on China's ability to feed itself. Moreover, the study indicates that China's demand for grain will stretch, but not completely overwhelm the world grain markets. All the scenarios indicate that world food prices for grain will go up approximately five percent in real terms, which is not as great as some western analysts had originally assumed. Imaging satellites have estimated that China's

cultivated land area was between 133-147 million hectares (.95 confidence interval). This mean of 140 million hectares is forty-seven percent greater than the official Chinese statistics, which, notably, have been the statistics used previously by western analysts to apprise China's food security. This information underlines that yield per hectare in China is even lower than previously assumed.

The study also indicated that the need for additional grain to feed livestock may not be as great as initially predicted, for official Chinese government data on livestock appears to be overstated by twenty to forty percent. This has occurred because local government officials overstate their numbers to appear more successful than they actually are in order to receive awards from the central government. In light of the fact that fewer animals exist, the estimates for corn needs in China should be reduced significantly.

Implications of the Study for the United States and China

One recommendation from the study suggests that China shift its current requirement of achieving ninety-five percent grain self-sufficiency to one of food self-sufficiency. This could then lead to farmers who use more land to grow high value, labor intensive crops such as fruits and vegetables to sell on the world market and earn sufficient money to buy grain. Grain prices would then be lower and China would have sufficient food, which would promote social stability. Such a food strategy would be better for China's environment as well, for marginal lands would not have to be used for grain, which would decrease some erosion problems. Moreover, fruit and vegetable crops would conserve water, for they are less water intensive.

Every year, China and the United States consume 390 million and 240 million tons of grain, respectively. Both of these countries have the potential to effect the world food balance. Agriculture production can be a productive area for dialogue between the United States and China. Both the United States and China face similar agricultural problems, which means the two countries could hold a dialogue on this topic as equals. Discussions of research and development to solve agricultural problems in both countries could emerge as a building block in the U.S.-China relations. The food debate in China is changing, for there is an increasing openness and acceptance of foreign information and advice on this issue. For example, three years ago *Who Will Feed China* could not be legally sold in China and now it is being advertised on television. While agriculture is not as sensitive as topics such as human rights and carbon emissions, the Chinese government is sensitive about certain food issues. For example, suggestions for the central government to lower subsidies to grain markets and import our cheaper grain will raise tensions. The Chinese are concerned about the use of food as a weapon. Conversely, the United States also has a concern that Chinese demands on the world grain market would cause large fluctuations from year to year. Cooperation on water management issues could be one mutually beneficial area of cooperation, for both countries could improve their efficiency in water use. In China, water pricing policy reforms could produce significant savings in water, particularly in the dry north. Another common challenge for both countries is the loss of some of the most valuable cropland to urbanization.

Cooperation on agricultural research is another promising area for cooperation. In the United States, research is examining how to use biotechnology to increase yields and decrease the use of pesticides. For example, one solution might be breeding seeds with genes that enable plants to defend themselves. Chinese researchers and policymakers are interested in using non-pesticide necessary crops in order to lower the demand for pesticides, but the quality of Chinese research equipment is lacking in this area and they will need investment in order to make progress in using biotechnology to increase yields. China has one of the lowest agricultural research intensities in the world, below the quality of many less developed countries. If research and development in biotechnology and other areas could be increased, significant improvements in food yields in China could be made.

Conservation and Pollution of Water Resources in China

9 July 1998

The uneven distribution of water resources in China—a dry north and water-rich south—combined with growing water pollution problems are posing significant threats to economic development and quality of life in some regions of the country. Estimates by the Chinese Academy of Sciences place economic losses from water shortages in urban areas in northern China to be as high as U.S. $24 billion in 1997, which equals three percent of China's GDP. In light of these problems, Chinese policymakers are exploring a variety of conservation and pollution control strategies.

Water Shortages

In 1985, 236 cities in China had a daily shortage of twelve million cubic meters a day. A mere six years later in 1991, 300 of the existing 622 cities in China were suffering from water shortages by a total of sixteen million cubic meters a day. Although construction of water supply infrastructure to cities has grown considerably in the 1980s and 1990s, it is expected that by the year 2000 water shortages of twenty million cubic meters a day will be experienced in 450 cities. The current water shortages in urban areas adversely impact forty million city dwellers.

Exploitation and Conservation of Water Resources

Similar to early water development projects in the United States, the People's Republic of China has pursued a water supply strategy by building dams, particularly in the 1950s and 1960s. In the 1980s and 1990s, numerous water diversion projects have been constructed to provide water to the expanding northern cities, such as Tianjin, Qingdao (Shandong Province), and Shijiazhuang (Hebei Province). These water diversion projects, which divert water from rivers up to 200-300 kilometers away, were undertaken in order to halt the over pumping of local groundwater resources. Notably, the long-debated South Waters Northward diversion project, which would divert water from the Yangtze River in southern China to the dry north, has been recently approved.

Despite the continuing dependence on projects to increase water supply, demand management measures are increasingly being adopted in China, because new water resources have become more difficult to find. The fact that groundwater sources around cities have become severely depleted—groundwater sources near northern cities fell ten to thirty meters in the 1980s—has also prompted the push for water conservation and demand management. One very promising area for water conservation has been to improve water-use technology and equipment in certain high-use industries, such as steel, paper, and crude oil refining. These industries use 500-700 percent more water per ton of product produced than similar industries in developed countries. For example, steel industries in China use thirty to seventy cubic meters of water for every ton of steel while the rate is five to ten cubic meters per ton in developed countries. Efforts in the area of water recycling also represents a large potential saving of water. Currently, the average rate of water recycling in Chinese industries is only thirty percent nation-wide. Notably, some cities in the north have enforced a much higher rate (e.g., fifty percent in Beijing, Tianjin, and Xian; seventy percent in Qingdao; and seventy-five percent in Dalian). Efforts to increase wastewater recycling have also decreased wastewater discharge significantly. For example, in 1980 the production of 10,000 RMB worth of goods used to generate 470 m^3 of wastewater, while in 1995 this level of production only generated 130 m^3 of wastewater.

Water consumption in urban areas has grown as a result of growing population and prosperity. Some cities have also begun to install water meters and institute water charges for domestic water use. Not surprisingly, water consumption greatly drops in metered homes. Some cities, such as Beijing have instituted heavy water pricing and quota systems for industries and other organizations, for the city is so water short that the annual average water reserve per person is merely 460 cubic meters per person, which is one-fifth of the country's average. Per capita water resources available in Beijing are one-thirtieth of the world average for cities in the world. Since 1980, more cities have constructed water saving or water recycling projects and the water discharge rate has been reduced from 470 cubic meters in 1980 to 130 cubic meters in 1995.

Pollution of Water Resources

A survey conducted in 1984 indicated that of 1,200

rivers, 850 (seventy percent) were polluted. A total of 230 of these rivers were heavily polluted and unable to be used for irrigation, drinking or fishing. A more recent survey reveals even more serious pollution levels. In 1995, more than one-third of all rivers and over ninety percent of rivers surrounding urban areas were polluted. More than fifty percent of water sources did not meet the standards of potable source water quality. Table 1 presents an overview of low water quality of six major river systems in China. Levels I and II represent the cleanest quality of water sufficient for human consumption. Notably, fifty-eight percent of rivers near urban areas are severely polluted (level V and greater). Groundwater sources surrounding cities are also severely polluted. In addition to river pollution, groundwater pollution has also become quite severe. As early as 1983, a survey of eight cities found that all groundwater sources were polluted to some degree.

Strategies and Policies for Drinking Water in China

In light of the severe pollution of water and groundwater resources, the Chinese government has adopted a broad policy strategy to improve water quality. These strategies include:

- Expanding number and capacity of municipal wastewater treatment facilities;
- Controlling industrial pollution sources;
- Utilizing sewage irrigation projects, fish farming ponds, and wetland filtration systems;
- Developing effective river basin management; and,
- Controlling non-point pollution sources.

Municipal Wastewater Treatment Facilities

To protect drinking water sources, it is imperative for China to speed up the construction and operation of new municipal and industrial wastewater treatment plants. Chinese municipal planners have been focusing on the development of large-scale municipal wastewater treatment plants, which are more economic and efficient than the construction of many small treatment plants. The number of municipal waste treatment plants in China has grown from thirty-seven in 1978 to 135 in 1996. Despite the significant increase in the number of treatment plants, most municipal wastewater still is not treated—1.4 percent of wastewater was treated in 1978 and only 13.1 percent was treated in 1996.

Industrial Wastewater Treatment

Rules promoting industrial wastewater management strategies have increasingly been enforced in urban areas in order to eliminate wastes before entering municipal water treatment plants. The industries being targeted for wastewater management include food processing, textile

Table 1. Pollution Data of Surface Water Systems in China—1996

Class of Surface Water Quality	Yangtze River	Yellow River	Pearl River	Huai River	Hai River	Liao River	River Reaches in Urban Areas
I or II	32.2%	8.2%	49.5%	17.6%	39.7%	2.9%	0% (I)
III	28.9%	26.4%	31.2%	31.2%	19.2%	24.3%	23.3% (II and III)
IV or V	38.9%	65.4%	19.3%	51.2%	41.1%	72.8%	18.8% (IV), 19.6% (V)
Over V							38.4% (>V)
Main Pollutants	NH_4–N COD_{MN} Phenol	NH_4–N COD_{MN} BOD Phenol	NH_4–N COD_{MN} Arsenic	NH_4–N COD_{MN}	NH_4–N COD_{MN} BOD Phenol	NH_4–N COD_{MN} Phenol Cyanide Copper Mercury	Petroleum COD_{MN} TSS

Source: Wang Baozhen and Wang Lin. 1998. *Conservation and Pollution Control of Water Resources in China*. Unpublished Manuscript. Water Pollution Control Research Center, Harbin University of Architecture and Engineering. Harbin, China.

dying, printing, iron, steel, chemical, pulp, and paper plants. Approximately 40,000 industrial wastewater treatment facilities have been built and put into operation in the late 1990s. Most of these facilities have been constructed without foreign technology and equipment.

Natural Filtration Systems

Sewage irrigation projects have been increasing rapidly in China since the 1960s. In 1963, a total of 42,000 hectares were supplied by sewage irrigation projects, but by 1988 the amount of land irrigated by such projects leapt to 2.8 million hectares. Such projects use irrigated fields as a filter for wastes, which can improve soil quality and increase grain yields. As the amount of industrial wastewater has increased, however, sewage irrigation projects have increasingly led to the deterioration of farmland from toxins and to the contamination of groundwater resources. For non-industrial wastes, such as manure, China has used fish farming ponds and duck and geese ponds to process these wastes. There are approximately 100,000 such ponds in rural areas that receive and treat manure and sewage from nearby villages and towns. In urban areas and industrial districts there exist nearly 1,500 natural or artificial ponds to receive and treat municipal and industrial wastewater. Such ponds are used in conjunction with modern wastewater treatment plants or irrigation farmlands.

Because construction of wastewater treatment plants cannot keep pace with the growth of pollution, in the 1990s various municipalities and provinces have experimented with utilizing natural wetlands as sewage filtration systems. Such wetland systems (both natural and constructed) have proven effective in removing Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), as well as heavy metals, phenol, and cyanide. These wetlands are viewed as a promising and appropriate type of wastewater technology in China. Some examples include:

- Tianjin City uses a natural wetland area of 150,000 hectares, which should expand, for the Tianjin Environmental Protection Research Center has been conducting pilot studies on various types of wetland filtration systems.
- Heilongjiang Province contains a total natural wetland area of six million hectares.
- Shenzhen City (Guangdong Province) has built and operates a 140-hectare wetland system for treating domestic wastewater.
- Rongcheng City (Shandong Province) has been successful in utilizing a 200-hectare of semi-constructed wetland system to treat municipal sewage and pulp and paper mill effluent.
- Shouguang City (Shandong Province) built a 150-hectare wetland in 1996.
- Jiaonan City (Shandong Province) built a 120-hectare wetland in 1997 and has reached a capacity to treat 50,000 m^3 of municipal wastewater per day.

River Basin Management and Non-point Pollution Control

Since the 1980s, the Chinese Ministry of Water Resources has been expanding the administrative power of river basin commissions in order to better coordinate water conservation and pollution control work. The main functions of river basin management commissions has been to assess current and future water quality and resources, as well as set the priorities for comprehensive planning to manage water resources within the river basin. These commissions focus on the development of regional wastewater treatment plants, and large treatment and storage ponds to filter pollution within the basin. The greater empowerment of river basin commissions has led to the cleanup of ninety-nine rivers over the past decade.

In order to prevent non-point pollution, regulations, subsidies, and education programs have attempted to promote the controlled application of chemical fertilizers and pesticides and substitute low toxic pesticides for the highly toxic pesticides more commonly used.

Briefing on U.S.-PRC Environmental Initiatives

9 September 1998

One year after the creation of the U.S.-China Environment and Development Forum, questions regarding the results and benefits of environmental cooperation merit evaluation and discussion. The energy initiatives and water initiatives have been created to promote benefits for both countries. For example, access to U.S. expertise and technology could enable China to leapfrog into cleaner energy development. Conversely, China offers the United States huge markets for remediation, pollution control, and processed technology markets.

U.S.-China Energy Initiatives

The U.S.-PRC Environment and Energy Initiative owes its origin to the trip by Vice President Gore to China in 1997. After the visit, the Office of the Vice President convened an interagency group to examine ways in which the United States could connect the environment with key financial decisions in the energy sector. The details on the Environment and Energy Initiative were completed in October 1997. This initiative contains three central themes: 1) bringing clean energy technology to China, particularly focusing on clean coal and sulfur reduction technology; 2) rural electrification; and 3) air pollution.

In November 1997, an Oil and Gas Forum was also initiated to focus on the development of nitrogen monoxide (NO) policy, offshore and onshore drilling and joint venture oil and gas projects. Both of these energy initiatives are creating interagency cooperation both within and between the two countries. In China, the State Environmental Protection Agency, the State Development and Planning Commission, and the Ministry of Science and Technology are the main agencies engaged in the cooperative energy activities. On the U.S. side, the Department of Commerce, Department of State, Department of Energy, the White House Office of Science and Technology Policy and the Environmental Protection Agency are the key agencies participating in these energy initiatives.

To make progress in the focus areas of these energy initiatives, Chinese policymakers will need to make changes in financial markets and infrastructure planning in order to enhance China as an attractive market for energy investment. Nuclear agreement is mentioned in the Environment and Energy Initiative, but nuclear energy became a separate agreement, specifically a "letter of intent" for future cooperation. The Energy and Environment Initiative Forum is viewed as quite successful as a means for continuing engagement between the two countries. Moreover, the Oil and Gas Forum is attracting a high level of attention from U.S. companies.

China needs at least U.S. $50 billion a year in investment to meet its need for clean energy infrastructure. Ideally, to mitigate energy shortages and improve pollution problems, China will need considerable investment to leapfrog into high quality energy technology. One of China's greatest challenges in the energy sector will be to develop ways to bring capital from the private sector for new energy technology and renewable energy development. One opportunity for joint public and private investment would be in the development of coal bed methane and liquefied natural gas (LNG), for there exists considerable development potential for these energy types in China. Notably, in October of 1997 ARCO signed three contracts worth U.S. $30 million with the Chinese to explore for coal bed methane in Shanxi Province. The goal of the investment is to bring coal bed methane from this western province via pipeline to Beijing in order to replace urban coal burning.

In terms of financing, the Environment and Energy Initiative is setting up the financing seminars for Chinese administrators in the energy sector. Moreover, a U.S. government initiative to promote clean energy technology in China is being undertaken by the U.S. Export Import Bank. The Export Import Bank is in the process of creating a U.S. $50 million credit facility for renewable energy technologies with a goal to target small companies.

A working group on climate change met for the first time in August of 1998 and had productive discussions. An expansion in climate change discussions would create even greater opportunities for the United States and China to work together on energy issues. Although these talks and initiatives are promising, the United States must avoid becoming too naive about U.S.-China environmental relations, for there still exists the possibility of discord, especially over climate change. To continue the momentum in environmental agreements, the United States should avoid pressuring China and instead focus on creating mechanisms in which the Chinese are genuinely interested and which can solve severe local pollution and

Table 1. Framework for U.S.-China Joint Water Management Program

Discussion Areas	Infrastructure	Management	Assessment/Prediction
Agriculture/Forestry	Storage, distribution, erosion, pollution, quality and quantity (irrigation), crop production	Land use, pollution (non-point source), erosion, distribution, economics, water quality and quantity	Data sources, data archives, database management, remote sensing, prediction, modeling and simulation
Ecological Support	Availability of water, ecosystem health, quality and quantity of water, natural resource management	Biodiversity, technology and engineering, instream flow requirements, water availability	Data interpretation, satellite imagery, prediction, modeling and simulation
Domestic and Industrial Water Supply and Use	Treatment facilities, supply, industrial production, quantity and quality of water	Quantity and quality of water, human health, cost/price of water	Data-sharing systems, sensors, prediction, modeling and simulation
Flood and Drought Planning Mitigation	Hydropower development, instream flow	Economic and environmental impact of event	Remote sensing, prediction, modeling and simulation

energy problems. One ideal example of an initiative that has generated interest in both countries was the air quality monitoring agreement signed in June 1998. It must be acknowledged that the efforts by the United States to assist China in its energy goals continue to be hindered by the restrictions on U.S. Agency for International Development and Trade Development Agency funding.

The Water Resources Management Initiative

The Water Resources Management Initiative, which was begun in 1998, stemmed from an idea developed at the 1997 Environment and Development Forum held in Beijing. At this meeting, each of the Forum's four working groups addressed some aspect of water. For example, the Energy Working Group discussed small hydropower; the Science and Technology Working Group addressed water in its discussions on ecosystem protection; the Environment Working Group explored watershed research; and the Commerce Working Group explored the issue of water conservation and wastewater treatment. There was clearly a need to bring these interests together into a more holistic approach to water resources management and a more coordinated approach was needed to maximize the efficiency of the different efforts by the working groups. Since that meeting, a dedicated interagency group has been working to develop a proposal for the U.S. and Chinese governments to undertake a more coordinated approach to water management. A large workshop on Water Resource Management, which will include U.S. and Chinese government agencies and nongovernmental organizations, is being planned for early 1999. This workshop will examine issues related to assessment/prediction, infrastructure, and management using two different river basins in the United States and China. The framework that will guide the formation of this U.S.-China joint water management program is outlined in Table 1. This framework is the product of extensive consultations both inside and outside government.

[Editors Note: The Water Resource Management Workshop did take place in April 1999 and the workshop led to the creation of a U.S.-China Water Resource Management Program. Information on the program available at: http://www.lanl.gov/chinawater/procpres.html.]

Environmental Law in China

7 October 1998

In 1979, the first major environmental statute—the Environmental Protection Law—was enacted in the People's Republic of China. The nascent environmental law regime in China faces many challenges, for it is taking place in a country undergoing rapid economic, legal, and social reform. After nearly twenty years of development one can begin to systematically appraise the progress of China's emerging environmental law regime. In order to formulate strategies to strengthen the compliance of environmental laws, there are two key areas of the Chinese environmental law regime that merit examination: access to information and enforcement trends.

Access to Information

Information on the environment and environmental legislation in the developing world is rarely the quality necessary for making management decisions and promoting effective implementation. These problems are very acute in China, where resources devoted to environmental information are low due to financial limitations and the relatively recent focus on environmental issues. In addition to the paucity of information, institutional obstacles within the government and legal system in China also have created a very unequal distribution of information on laws, regulations, and enforcement mechanisms. This lack of information has led local governments to misinterpret laws and regulations and has prevented public comment on the content and implementation of environmental laws. Without clarity and transparency, environmental laws will not be effectively implemented.

Demands by local governments and citizens for better information on environmental quality and laws have been spurred by the growing severity of environmental damage in China. Roughly forty percent of river waters in China are completely unusable. Pollution damages—particularly from water and air pollution—cost China roughly $54 billion each year. The rising instances of pollution and disaster-related deaths have also heightened public concern and there is a notable increase in grassroots environmental organization activities. In addition, over the past decade, interaction among grassroots environmental groups in Hong Kong, Taiwan, and mainland China has flourished. These environmental groups are not necessarily playing an advocacy role in China, but they are giving citizens a way to voice their concerns and demand better information on environmental quality and implementation of environmental laws. This growing crisis orientation of citizens about environmental quality has pushed the central government to promulgate a wide range of environmental laws. Examples of key national statues include:

- Marine Environmental Protection Law (1982)
- Water and Soil Conservation Law (1991)
- Air Pollution Prevention and Control Law (1995)
- Solid Waste Law (1995)
- Mineral Resources Law (1996)
- Environmental Noise Pollution Law (1996)
- Water Pollution Prevention and Control Law (1996)
- Energy Conservation Law (1997)
- Criminal Law Amendment—includes section on environmental crimes (1997)
- Land Administration Law (1998)

Despite the wide range of new laws, there is no national requirement that these environmental laws be published or compiled in any one place. Therefore, at the sub-national level, many local agencies have difficulties gaining access to these laws and subsequent implementation regulations. Moreover, many of these laws place contradictory demands on local regulators. To overcome this problem, there is currently a proposal within the National People's Congress to integrate all the separate conservation laws into a single National Conservation Law. Alternately, the Congress is discussing whether to simply amend the separate conservation laws to eliminate contradictions. Other planned pieces of legislation for the next five-year period (1998-2003) include Clean Production Law, Environmental Impact Assessment Law, Renewable Energy Law, and Radioactive Pollution Prevention and Control Law. Planned laws that will complement the 1995 Solid Waste Law include laws for toxic chemicals management and industrial waste utilization. While this list for planned legislation may seem lengthy, it is significantly shorter than environmental laws proposed in the previous five-year plan, which highlighted fourteen environmental statutes to be created or revised. Li Peng, the head of the National People's Congress, has demanded that the Congress be realistic in its planning goals and promulgate fewer, higher quality laws.

One mechanism to promote information dissemination is the environmental impact assessment (EIA), which can engage the public and put pressure on polluters and developers. China's EIA law (1979) requires individual projects to conduct an EIA and have it approved by the local Environmental Protection Bureau. With this approval the builder can then take the project to the local planning commission for a permit. The main shortcoming of EIAs in China is that they only focus on individual projects, and EIAs are not applied to regional planning or government land-use and industrial policies. For example, in the early 1980s, the national government passed a policy that allocated forestland to individual farmers based on the assumption that those granted the right to use the forests would take care of them. Because farmers did not believe these land-use rights were secure, they quickly cut down most of the trees; an EIA could have helped better shape this land-use policy. Another shortcoming is that environmental impact assessments are not readily available for public viewing, which limits the possibilities of public input on land and industrial development.

To expand information access on environmental laws, China will need to promote and protect the freedom of information to its citizens. Newer environmental laws have notably included rules for notice and comment on regulations in order to encourage public participation. Greater internet access in China also represents another means for promoting greater circulation of environmental and legal information. The Asia Development Bank has been funding work to analyze existing environmental laws and disseminate this information to all regulators.

Enforcement Trends

Enforcement of environmental laws in China is much more difficult than in the United States, not only because of a lower amount of environmental awareness and economic development, but also due to a lack of enforcement capacity within the State Environmental Protection Agency (SEPA). In addition to the severe dearth of financial resources and personnel training within SEPA, the staff is very small, with only 200 people. As a comparison, the U.S. EPA has approximately 17,000 people in its agency.

Environmental laws, like most laws in China, tend to be very general and brief, which in practice grants considerable discretion to local governments. For example the Chinese Air Pollution Control Law is a mere ten pages long and allows local governments to adjust the law to fit local conditions. This has led to very inconsistent enforcement of air pollution control standards. More detailed and clearer environmental laws could help improve their implementation and enforcement.

The growing use of criminal law in environmental law enforcement is one major attempt to improve compliance. Notably, the Criminal Law, which was amended in 1997, now includes some environmental crimes, such as unauthorized waste import. Some new environmental laws also include criminal punishments and the death penalty is a possible punishment for extreme violations. Another change in new legislation meant to promote better enforcement, has been rules requiring more open reporting of waste generation and public access to implementation activities.

A considerable number of projects funded by the World Bank have been aimed at environmental education and capacity building, particularly to fund training programs for the drafters of laws. However, not many education or financing programs have been directed towards implementation and enforcement training of local officials. Training of judges is also an area that merits more attention and investment, for many judges are former military personnel who lack a substantive legal background. One promising trend for improving enforcement of environmental laws has been the work by nongovernmental organizations in China to raise public awareness of environmental problems and existing laws.

Policy Options for the 1999 U.S.—China Forum on Environment and Sustainable Development

30 October 1998

In preparation for the April 1999 U.S.-China Forum on Environment and Sustainable Development, a subset of the Working Group on Environment in U.S.-China Relations has developed the following ideas for cooperation between the two countries. These ideas and strategies are designed to be proposed at the Vice Presidential/Prime Ministerial level, and implemented by lower-level government agencies and/or nongovernmental institutions. The ideas listed below reflect the individual opinions of Working Group members, and do not represent the opinions of the Woodrow Wilson Center, a non-partisan, non-advocacy institute.

General Engagement Strategies

- Assistance and proposals for environmental activities should fit within the overall framework of the Chinese economic reform. Chinese Prime Minister Zhu Rongji is under heavy pressure to reform China's state owned enterprises (SOEs), financial markets, and government bureaucracy. Prime Minister Zhu is most interested in U.S. assistance on economic reform; U.S. support for his reform plans will provide him with renewed strength in China and a greater ability to press for environmental improvements both within and outside state owned enterprises.
- Mutual benefit in educational and scientific exchanges should be prioritized. Initiatives should not only consider Chinese environmental conditions, but also invite and create a mechanism for Chinese assessment of U.S. environmental performance and practices. Joint exchanges and research centers that emphasize the sharing of knowledge, information, and expertise will help develop U.S. and Chinese environmental improvements.
- Trade and investment opportunities for U.S. firms should be incorporated, as much as possible, into environmental improvement efforts. Emphasis should be placed on areas that are of high interest to the Chinese and to U.S. firms. Water conservation and treatment are potentially strong markets for U.S. firms in China, and the World Bank has demonstrated that commercial reforestation projects in China can be profitable.
- Local education efforts should be emphasized to improve overall environmental awareness and local-level environmental regulation implementation. Similar to the United States, local level environmental awareness in China increases pressure on local governments to enforce environmental regulations. Efforts to broaden the knowledge of Chinese citizens on environmental issues will play a large role in determining the success of China's environmental initiatives in the decades to come.
- Whenever possible, agreements and projects should be fashioned in such a way that they demonstrate China's willingness to combat climate change. A major barrier to support for global climate change action in the United States is the belief that developing countries, and especially China, are not taking action to reduce greenhouse gas emissions. If viewed in a different manner, energy efficiency, reforestation, and wetlands restoration projects, among others, can all be considered carbon reduction projects. Joint efforts in these areas would provide examples of Chinese action on climate change, and would demonstrate to the Chinese that the United States government is willing to move forward together on climate change issues.
- Efforts should be made to coordinate the initiatives of various U.S. and Chinese groups working on environmental issues in China. Many Chinese scholarly institutions and environmental NGOs are approached by various U.S. actors seeking partnerships on environmental issues in China. New initiatives should focus on coordinating the efforts of U.S. actors through umbrella agreements or consortia.

Optimal Areas for Engagement

- Energy Efficiency. In both production and consumption, China can vastly improve its already impressive energy efficiency efforts. Clean and efficient energy production and consumption decreases costs, improves ambient air quality, and reduces sulfur and greenhouse gas emissions.
- Wetlands Restoration and Protection. The loss of wetlands is a problem in both the United States and

China. Wetlands can reduce the severity of floods, decrease pollution from agricultural runoff into lakes and rivers, and maintain biodiversity. The wetlands issue is critical in many areas of the United States and China, and joint benefits could be gained from cooperation on this issue.

- The Energy-Climate-Health Nexus. Increased research on the health impacts of China's energy consumption—and the resulting health care costs of environment-related illnesses—would help demonstrate the social and economic need to address these issues. Reductions in total suspended particulates can create ancillary reductions in sulfur and greenhouse gas emissions.
- The Reforestation-Climate-Water Nexus. The connections between water, climate, and forests should be emphasized. China's planned reforestation efforts will create carbon sequestration benefits and improve flood control.
- Joint Research and Educational Consortia. Efforts to increase mutual understanding and knowledge about environmental issues will benefit both countries, while developing strengthened ties in the nongovernmental (NGO) and scientific sectors.
- Rule of Law and Environmental Enforcement. There are significant connections between the establishment of rule of law and environmental enforcement. Connections between these two issues will be imperative to improving compliance with environmental regulations at the township and village levels.
- Post-Disaster Ecological Restoration. Massive floods and storms in both the United States and China have caused the destruction of environmentally sensitive areas. Many opportunities exist for the joint study of the ecological restoration of these areas, and the methods by which restoration efforts can help reduce the severity of future natural disasters.

Specific Ideas for Proposals and Projects

Many of the ideas for specific proposals and projects cut across the four categories: acid rain, climate change, land use, and water resources. These four areas of emphasis have been grouped by focus rather than by environmental category.

Joint Research and Educational Initiatives

- Establishment of a loose consortium of universities to foster policy-linked research and educational exchange consistent with the Environment and Sustainable Development Forum's chosen themes. The aim of this government-sponsored consortium would be to provide high-level political impetus for expanding the existing abilities of U.S. universities to sponsor students, senior scholars, and visiting policymakers from China in pertinent areas. Hopefully, the high-level government involvement would also encourage Chinese universities and NGOs to sponsor a similar exchange of Americans to China to better understand Chinese policy conditions. Universities currently undertaking research projects in China (such as Harvard, Stanford, MIT, Yale, Berkeley, and others) could be joined in the consortium by equally prestigious Chinese universities (such as Tsinghua and Beijing University in the north, and Shanghai's Jiaotong and Fudan Universities). The governmental members of the Forum could shape the areas of focus for research activities conducted by the consortium members, perhaps resulting in a series of Sino-American conferences with both academic sessions and "executive summary" sessions for policymakers.
- Designation of at least one large and critical wetland site in each country to study the role of wetlands in water purification and flood relief. Wetland issues in China are critical in many areas, including the central/Yangtze region, the south (Pearl River delta), the southwest (headwaters of the Mekong and Irrawady), and the northeast (Three Rivers Plain along the two China-Russia border rivers). Many areas in the United States are facing similar wetland crises. Capitalizing on China's recently announced plans to restore wetlands in the upper Yangtze, a bi-national team could study wetlands restoration to help increase knowledge on the role of wetlands in flood protection and water pollution control, and in ecological restoration strategies. Bi-national teams could also study a sister U.S. site. Such sites could be managed jointly by government research laboratories, universities, or NGOs.
- Establishment of a U.S.-China Joint Center on Human Health. This Center, located within China, would provide an opportunity for U.S. scientists and researchers to work with their Chinese counterparts to increase knowledge in both countries about the effects of air and water pollution on human health. The Center could be jointly managed by government-sponsored research centers (such as the National Institutes of Health), or U.S. and Chinese medical

schools.

- Creation of a joint project to share environmental education materials and information via the Internet. There is a great need in China for improved environmental education materials for teachers. Chinese NGOs have developed environmental textbooks, but are facing difficulty in securing funding to print and distribute the millions of books it would take to educate the Chinese public on environmental issues. While Internet access in China is still very limited, it is growing rapidly. Environmental information placed on the Internet in both Chinese and English would help raise American understanding of China, as well as offering materials for Chinese teachers and students. Such an initiative could perhaps find support from U.S. computer and telecommunications firms.
- Creation of a bi-national working group to study post-disaster planning for ecological restoration. This working group would examine ecological restoration strategies and practices in the two countries and would establish a long-term policy research process to study the importance of ecological restoration in the aftermath of natural disasters.
- Creation of a joint task force, with participation from European countries and other developing nations, to study emissions trading. This task force would examine methods for establishing trading systems, how such systems work, and solutions to problems of parity within trading systems.
- Establishment of local environmental educational centers that specifically target village bureaucrats and local level officials. These centers could focus on agricultural extension, energy efficiency, green accounting, and environmental management systems. Centers could be established through sister city agreements that focus on common environmental problems and/or industries.
- Assistance in developing Chinese-language television shows and videos that describe U.S. environmental history, practices, and successes. These programs could be developed jointly between U.S. and Chinese NGOs, and broadcast on Chinese television. Such television shows would increase Chinese understanding of environmental issues, and of successful approaches to environmental problems in the United States.
- Joint support for the NGO Forum on U.S.-China Environmental Cooperation. This Forum, being planned for Fall 1999, will bring together environmental NGOs in China and the United States to discuss NGO development, management, and technical environmental issues. The goal of the NGO Forum is to increase cooperation and develop lasting partnerships between U.S. and Chinese NGOs.

Economic Reform and Sustainable Business Practices

- Creation of a U.S.-China Joint Center on Business Training and Sustainable Enterprise Development. This center could be established at the business school of Tsinghua University (headed by Zhu Rongji) in cooperation with a U.S. university. This business center would focus on increasing knowledge in China about environmental business practices such as environmental economics, risk assessment, environmental impact assessment, green accounting, tradable permits, and environmental management systems, while also providing expertise on more general financial and business topics such as mergers, privatization, and financial market restructuring. There is a strong need in China for assistance on enterprise and financial market reform. Packaging such information with expertise on sustainable business development and practices would most likely be very attractive to the Chinese.
- Establishment of a U.S.-China Joint Center on Environmental Technology Development and Management. In order to promote the development of its environmental industry, China is likely to relax regulations on joint ventures and foreign investment. The creation of a joint center on environmental technology development could give U.S. firms an advantage, especially in water conservation, treatment, and energy-saving agricultural technology in which the United States is a leader. Specific cooperation on water management and quality in paired regions of both countries—such as central California and the North China Plain—could potentially open doors for U.S. technologies and technical expertise.

Climate Change-Related Initiatives

- Expanding, a currently proposed, internal U.S. carbon emissions trading system to include projects undertaken in China could provide mutual benefits to the United States and China. Separate from the Kyoto Protocol and its Clean Development Mechanism, this program would reward U.S. firms with early credit for investing in Chinese carbon offset or reduction

projects. The program would demonstrate to the Chinese that the United States does not want to entrap them in future commitments, but rather is interested in creating a market for carbon emissions trading and in improving China's environmental conditions. Expanding the trading system to include Chinese projects would also provide an example of Chinese action on climate change issues.

- Assisting in developing sustainable forestry projects in the upper Yangtze region of China could become a promising climate-related initiative. The Chinese have announced extensive reforestation plans for a large portion of the upper Yangtze region to prevent soil erosion, assist with flood control, and achieve ecological restoration. The World Bank has demonstrated that forestry in parts of China can be profitable. For many commercial forestry projects, the cost of carbon sequestration is zero. Training on sustainable forestry in these regions of China could provide large carbon offsets for U.S. firms while also helping China meet its reforestation objectives.

Green Voice Environmental Solutions

Green Voice Environmental Solutions is a newly founded Chinese nongovernmental organization based in Beijing. The mission of Green Voice is to coordinate technically proficient teams of environmental professionals to bring sustainable solutions to complex environmental challenges. Operating as an autonomous NGO, Green Voice is able to constructively build partnerships among different Chinese government units for collaborative environmental initiatives, provide volunteer opportunities for environmental professionals to join multi-disciplinary teams, strengthen communications among China's growing environmental sector, and facilitate the involvement of international partners in model environmental projects.

Specific work areas for Green Voice include: 1) analysis and promotion of investment policies and procedures to stimulate the development of pollution prevention and energy conservation projects; 2) ecosystem management programs to conserve globally significant biodiversity in China's Yunnan, Sichuan, and Qinghai Provinces, the Tibet Autonomous Region, and the Tumen River region; 3) capacity building programs for national park management and publication of interpretive materials; 4) experiential environmental education program for Chinese youth, including development of vocational training on source reduction strategies and material handling protocols for hazardous materials; 5) strategic communications services to refine and amplify environmental messages to target audiences, from simple brochures to new streaming technologies via the Internet; 6) facilitation of environmental technology transfer to strengthen China's growing environmental protection industry; 7) building a coalition of government agencies, environmental organizations, industry associations, universities, and medical centers to reduce the public health threat of childhood lead poisoning; and 8) coordination of diverse training programs to build environmental management capacity of Chinese organizations.

Green Voice was founded by Mr. Leon Chen, who has supervised scores of environmental programs over the last ten years. In 1991, Mr. Chen was a consultant to U.S. EPA on China's country program of ozone protection and helped implement the U.S.-China Environmental Cooperation Protocol, including the evaluation of China's coal based energy sector. Since 1993, he has worked for the World Bank to help China implement the Montreal Protocol for ozone protection and most recently on the Bank's Iodine Deficiency Disorder Control project. Throughout his environmental career, Mr. Chen has compiled an impressive range of environmental experiences working for TRI (a U.S. environmental consulting firm), Waste Management International, U.S. Foreign Commercial Service, UNDP, UNEP, Getty Conservation Institute, EarthVoice, The Humane Society of the U.S., Fauna and Flora International, Phillips Petroleum Company, and the U.S.-China Environmental Fund. Mr. Leon Chen is also an author of *China Environment and Sustainable Development Resources Book* published by UNDP in August 1996.

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Population, Migration, and the Environment in China

4 November 1998

China constitutes the world's largest population with approximately 1.2 billion people. Today, one out of every five people in the world lives in China. This large population inevitably places intense demands on the natural environment and raises concern about sustainable development in China. It is not only the size of the population that causes concern, but the changing distribution of this population also poses great challenges to the Chinese government as the country strives to improve its economic growth. The interaction between environment and population occurs in a cyclical pattern with demographic behavior. For example, the destruction or depletion of natural resources in rural areas spurs urban migration, which increases the demand for natural resources by urbanites. This greater demand for natural resources is drawn from rural areas, which in turn increases rural poverty and induces more migration to urban areas.

Population Trends

The population in China is currently growing at a rate of about 1.4 percent annually. Through continuing efforts of family planning and enforcement of the one-child policy in urban areas, China has succeeded in slowing its rate of growth, which is predicted to level off at 1.5 billion by the year 2050. One notable population dynamic in China is the growing elderly proportion of the population. Since many of these elderly in rural areas do not have retirement pensions, their children will bear the burden of their care. This in turn will naturally impact growth and income patterns in China.

Migration Trends

The trickle of migration to cities in the 1980s has turned into a flood and Chinese demographers estimate that the country's floating population may be as high as 100 million, a population the size of Mexico's. Heavy migration continues despite attempts by interior provinces to limit the number of peasants heading for the coastal cities.

The speed and scale of change in the population movement from rural to urban areas in China is one that no country has ever dealt with before. Since 1990, the movement of millions of rural people into urban areas in China has become a growing problem for city governments. The overwhelming majority of migrants head the coastal cities and special economic zones which are the urban areas with the fastest economic growth rates. Most large coastal cities now have one to three million migrants living in shantytowns, overcrowded makeshift dormitories or public places, particularly railroad stations. Every night the main railway stations in Beijing, Shanghai, and Guangzhou are filled with poor migrants seeking work. Shanghai's population of seventeen million is now augmented by three million migrants attracted from all over the Yangtze River valley to the city's mammoth construction sites. One sign of the city's construction boom is the fact that Shanghai's new special tax-free zone on the east bank of the Huangpu River has eleven percent of the world's largest construction cranes.

Despite the country's encouraging economic prospects, China's State Planning Commission (SPC) has predicted massive unemployment problems in urban areas. According to its predictions, approximately forty-four million young people will enter the job market over the next five years and some twenty million workers in unprofitable state-run enterprises will lose their "iron rice bowl" jobs. Simultaneously, approximately 120 million surplus rural workers will head for coastal cities and other newly industrialized zones to seek work. The SPC has calculated that 180 million new urban jobs will have to be created to absorb all of these workers. If the economy continues to grow as it has since 1980, job creation may not be a problem. However, if China's explosive growth begins to slow, as it has over the past two years, millions of unemployed or underemployed people could be wandering the urban landscape.

Environmental Concerns

In addition to the joblessness and stability concerns created by a growing wave of migration, the larger population in cities has dramatically increased urban pollution problems. For example, urban wastewater pollution problems have been worsening throughout the reform era and scientists have estimated that along China's 18,000 kilometer-long continental coastline, municipal wastes flow into coastal waters at the rate of fifty to sixty million

metric tons per day, which amounts to seventeen to twenty-one billion metric tons a year. As of 1993, only sixteen percent of the total amount of wastes discharged received any form of treatment. That same year, the country's industries collectively pumped thirty-six billion tons of industrial effluents into rivers, streams, and coastal waters.

Over 100 million people live along China's Bo Hai Sea coast at a density of up to 1200 people per square kilometer, which has led to a significant increase in wastes dumped into coastal waters. Shanghai dumps 4.5 million metric tons of untreated wastes into coastal waters everyday. China's provinces along the Yellow Sea dump 744 million metric tons of untreated wastes into it every year. The industrial waste emissions from the thirteen large port cities flowing into the coastal waters total 200 million a year.

Untreated sewage is contaminating China's rivers severely as well. The fact that many of China's rivers are drying out on a regular basis due to overdrafts has exacerbated this pollution problem. For example, since the mid-1980s the Yellow River does not reach the sea for nearly 200 days a year.

The Liao River in northern China carries 1.3 billion tons of untreated industrial effluents into coastal waters annually. In the summer of 1986, nearly every aquatic organism was killed for hundreds of kilometers along the Liao River due to the massive amounts of pollution. This was the first instance of China's, now notorious, "stink rivers." In 1986, the Xiao River was overwhelmed with untreated sewage water, killing 100,000 metric tons of shellfish in the lower reaches of the river. The economic loss was estimated at 2.5 million dollars.

The high density of population in the urban areas raises not only concerns of pollution, but also increases in infectious diseases and social disorder. The difficulties in acquiring resources such as electricity and clean water have already led to the theft of these resources.

Environmental Impact and Population Density

There is no inherent relationship between population density and environmental impact. Thirty million people spread through small towns and villages can do as much damage to the natural environment through deforestation, as thirty million concentrated in one or two cities. Negative or unmanaged impacts are however more visible and *potentially* more harmful to human health when concentrated. It is possible that some technologies for treating wastes may be more effective in large cities where economies of scale are available.

Migration trends in China are creating the largest concentration of urban dwellers the world has ever known. The impact of such densely populated cities will depend on the kind of urban management that is put in place. To conquer the challenges of quickly growing and high-density cities, the urban management will have to be better than any other cities in the world have previously done. There are, however, no convenient technological or managerial fixes to China's urban population problems, for no other country has faced an urban migration at such a scale and speed. Chinese policymakers appear to favor high-tech, mega-project solutions to fulfill its growing demand for energy and other resources (e.g., the construction of large water diversion projects to bring water to northern China, the building of huge dams to mitigate flooding and supply electricity, the construction of large ring roads around cities to help alleviate traffic problems). The United States and other western countries could positively influence the urban environmental quality in China by promoting:

1) Mass transportation technology that offers a credible alternative to the automobile;
2) Water resource management that encourages efficiency for all uses, applying demand management through pricing policies that reflect costs for production and re-use;
3) The development of a "safety culture" for industry and urban service delivery. For example, safety standards that are linked with environmental standards;
4) The development of an effective insurance industry to raise standards in every sector—transportation, industry, housing, and health;
5) Training in environmental management;
6) Sister-City arrangements with foreign cities that contain an environmental agenda.
7) The growing greenbelt movement that designates tree planting in urban areas.

United States Environmental Priorities in China

10 February 1999

Purposes and Plans for the Second U.S.-China Forum on Environment and Development

In Vice President Gore's 1997 trip to Beijing, the simple objective was to pave the way for President Clinton's trip and work out a venue for discussion and cooperation on environmental issues at the most senior political level. The visit resulted in the creation of The U.S.-China Forum on Environment and Development (hereafter, the Forum). The Forum is co-chaired by the Vice President and the Premier of China—initially, Premier Li Peng.

The Forum's work is divided into four working groups: energy policy, environmental policy, science for sustainable development, and commercial cooperation. These groups are co-chaired by representatives of various government agencies and act as coordinating mechanisms for activities that take place under the Forum. The upcoming visit of Premier Zhu Rongji provides the first real opportunity for U.S. government agencies to focus energy on this Forum and to turn it into a productive working institution. Below is an outline of the four working groups of the Forum.

- The *Energy Policy Working Group* discusses issues of energy generation—including conventional, nuclear, renewable, and alternative energy sources—and major energy consumption activities in industrial, transportation, building, and utility sectors.
- The *Environmental Policy Working Group* focuses on two separate tracks. First, it consults and coordinates on multilateral environmental issues and negotiations. Second, it addresses pollution prevention and control, health impacts of pollution, as well as waste management and remediation, which includes hazardous waste.
- The *Science for Sustainable Development Working Group* examines the application of science and technology to better understand and foster sustainable development in China.
- The *Commercial Cooperation Working Group* examines trade, energy, environment, agriculture, and other aspects of U.S.-China environmental relations that pertain to sustainable development. This group has worked to identify areas in which opportunities for U.S. firms and China's environmental technology needs intersect.

Since the Forum was created, the participating Chinese officials have increased their interest in cooperation with the United States on environmental issues. At the early Forum meetings, the Chinese participants spoke supportively about the environment, but there was no clear indication that they truly intended to locate the resources to take action or make the tradeoffs in which the environment would be the driving factor. The Chinese government's change in attitude and more concrete actions on environmental protection stem from several sources:

- The massive flooding in China has demonstrated to senior political leaders how deforestation can severely impact river systems, as well as the economic, social, and health costs of land degradation.
- Acid rain and related health problems have also begun to impel the Chinese leadership to look for the sources of air pollution and to consider alternatives to the widespread use of coal for heating and industrial use.
- Air pollution and energy self-sufficiency concerns have propelled the Chinese leadership to explore such issues as the development of natural gas infrastructure, thus, opening up new avenues for U.S.-China cooperation.
- Growing demands by the Chinese public to mitigate pollution problems.

To elaborate on this last point, the general public in China is taking a greater interest in environmental issues along with politicians and bureaucrats. Evidence of this rising interest is apparent in a study conducted by the Chinese State Environmental Protection Agency, in which local hotlines were set up to allow citizens to identify the most serious problems in their communities. During the six-week period of the phone study, eighty to ninety percent of the calls cited urban air pollution as the largest problem. Information on air pollution levels is becoming more accessible in China, which in turn has increased people's awareness of the magnitude and possible health risks of air pollution. This rising public awareness could explain why Chinese officials have been talking more intensively with the U.S. Environmental Protection Agency on how China should address environmental problems, such as the impact of pollution on children's health. Cleaning up urban air pollution would not only solve a serious

local problem, but would mark another major step for China in addressing global climate change.

China's Energy Demand

Although the energy growth rate is increasing eight percent per year, China, with a population more than four times as large as the United States, still consumes only one-third the amount of energy that the United States does. More striking is the fact that per capita energy consumption in China is one-fifth that of the United States. Most of China's energy consumption has been driven by coal, which is a major source for local air pollution. Coal generates carbon dioxide, so decreasing coal use in China will have immense implications for lowering greenhouse gas emissions. There exist, however, numerous challenges to "greening" China's energy policy. For example, China shows accelerating rates of electrical energy consumption, as well as other forms of energy consumption. While China currently has sufficient energy, the country's needs will pick up quickly. In terms of clean energy possibilities, the Chinese leadership has initiated the development of natural gas resources in northern China. Through both bilateral and domestic investment, China is also pursuing the development of small-scale hydroelectric, wind power, and other alternative energy technologies. These technologies could create a network of scientific and commercial possibilities for cooperation between the United States and China.

One trillion dollars will need to be spent over the next twenty years in developing energy technology for China to meet the proper relationship between energy management and growth. How to mobilize capital, restructure energy pricing, and utilize existing technology are some of the major challenges China faces in its task of developing new energy technology. Some energy developments that represent opportunities for increased U.S.-China cooperation are listed below.

- Over the last two years there has been a shift in thinking in China over the relationship between the energy sector and economic growth. The Chinese recognize that their energy efficiency is much too low.
- The U.S.-China Oil and Gas Forum held in 1997 in Beijing opened the possibility of an inter-exchange of U.S. and Chinese companies and could result in symmetrical access to oil and gas resources.
- Chinese policymakers have agreed to import liquefied natural gas (LNG) to south China, for broader cost-benefit analyses have indicated that the costs of importing LNG are nearly equal to importing coal from northern China.
- The Chinese have directly asked the United States to help develop a natural gas policy.
- The United States and China signed a nuclear agreement regarding the procurement of U.S. nuclear reactors.
- For the past two years, China has tried unsuccessfully to obtain clean coal technology.
- The Chinese leadership has decided to actively develop the use of natural gas in public transport.

Government to government cooperation has increased, especially between the U.S. Environmental Protection Agency and the Chinese State Environmental Protection Agency. Work between the two countries on energy issues has focused predominantly on the following areas: 1) China's air quality monitoring network; 2) agreements on cooperation regarding wildlife and national park management; 3) energy finance seminars; 4) the Oil and Gas Forum; and 5) commercial contracts in the energy sector.

The Energy and Environment Cooperation Initiative

During President Jiang Zemin's 1997 visit to the United States, former U.S. Department of Energy Secretary Fredrico Peña and Chinese State Planning Commission Vice President Zeng Peiyan signed the Energy and Environment Cooperation Initiative. This Initiative expanded cooperative efforts between the two countries at the point where energy, environmental science, technology, and trade intersect. The Initiative has four focus areas: urban air quality, rural electrification, clean energy sources, and energy efficiency.

Future Prospects for U.S.-China Cooperation on Air Pollution

Pollution, particularly air pollution, is causing China to lose $50 billion per year due to environmental damage and human health problems. Overall, air pollution levels in China are well above the World Health Organization's acceptable emission standards. The long-term costs of pollution on economic growth are becoming clearer to Chinese policymakers. United States cooperation with China on sustainable development projects could help mitigate some of these pressing local pollu-

tion problems. Highlighting the nexus between air quality and human health should be central in U.S-China talks on cooperation on air pollution mitigation. A key question, however, is how should the common tools and approaches used in the United States for pollution control be translated into the Chinese political and economic system? Moreover, how can this newfound U.S.-China dialogue help improve the environment in both countries? Some specific areas for joint cooperation to alleviate air pollution problems in China are listed below.

- Sulfur dioxide (SO_2) emissions trading.
- Co-benefits studies taking steps to reduce emissions and to increase efficiency that produce both health and economic benefits.
- Air quality monitoring—China now has a network for air quality monitoring in eleven cities.
- Cleaner production, including zero waste and energy efficiency.
- Improved understanding of the private sector's role in bringing funding to energy efficiency projects.
- Clean coal technology.

Future Prospects for Cooperation on Climate Change

No global environmental problem can be solved without China's engagement and cooperation, whether the issue is deforestation, land degradation, biodiversity loss, or pollution. Climate change is one global environmental problem in which U.S.-China cooperation is critical. While the United States is the largest emitter of greenhouse gases, China is the second largest and fastest growing. It is imperative to recognize that if all the Kyoto Protocol targets were implemented and the fifty-two countries that assumed targets at Kyoto stayed on track over the next fifty years to reduce emissions, these actions would be insufficient if China and other developing countries do not also act to lower greenhouse gas emissions. The Chinese position in the global arena makes it critical for them to ratify the Kyoto Protocol, for its support of the Kyoto agreement will impact the positions of other developing countries. The United States must improve its dialogue with China on the issue of climate change in an incremental way. One climate change related issue that the United States could stress is the market approach to decreasing greenhouse gas emissions. For example, the flexible market-based mechanisms adopted in the Kyoto agreement are constructed so as to provide incentives for private investment and private sector solutions. Many countries in the world do see the Chinese market as an opportunity for long-term sales of clean energy technology. Despite the promise of foreign investment in this area, it will not occur unless the Chinese government considers a full-scale investment in a variety of new energy technologies and related infrastructure.

Future Prospects for Cooperation on Water Resources and Land Use

The U.S.–China Water Resources Management Program was initiated as a result of the U.S.-China Environment and Development Forum. Water resources management was identified as a critical issue that crossed the core interests of the different working areas of the Forum (Energy, Environment, Science and Technology, and Commerce). It was recognized that water resources management is among the most difficult of all sustainable development problems yet one that crosses the interests of a variety of governmental and nongovernmental organizations. Thus, the initial focus was to identify and prioritize common problems associated with water resources, both quantity and quality. Four activities regarding water are currently underway: 1) identifying programs for bilateral cooperation; 2) reaching out to the private sector; 3) finding common problems; and 4) developing a joint framework.

The water, energy, and other cooperative initiatives created under the umbrella of the Forum hold promise for mutual benefit on environmental activities in both countries. The U.S. government could improve its environmental work with China by understanding the experience and extent of environmental work done by major aid organizations (e.g., UNDP), multilateral financial institutions (e.g., World Bank and the Asian Development Bank), and other countries. Examining these multilateral and bilateral environmental projects could inform the U.S. approach to environmental cooperation in China. Foundation support and activities by nongovernmental organizations in China also hold lessons for U.S. government environmental work. To date, activities and funding by foundations and nongovernmental organizations in China have centered on sustainable agriculture, green building and ecological design, organic fertilizers, environmental conservation, renewable energy programs, low carbon development paths, and transportation. Ultimately, for the United States to expand and deepen its cooperation with China on environmental issues, the U.S. government will need support from Congress, particularly backed by the financing of bilateral initiatives.

Twenty Years of U.S.-China Cooperation in Atmospheric and Oceanic Science

29 October 1999

A delegation from the U.S. National Oceanic and Atmospheric Administration (NOAA) visited China 12-30 September 1999, to attend two working group meetings and a special symposium and workshop on climate change. The delegation included scientists from NOAA, NASA, and several U.S. universities. During their time in China, members of the delegation also attended various meetings to sign new cooperative scientific work plans between the United States and China. The Chinese and U.S. scientists and officials also held celebrations to commemorate twenty years of Sino-U.S. scientific cooperation in oceans and atmosphere.

In 1979, Jimmy Carter and Deng Xiaoping signed the first Sino-U.S. cooperative scientific agreement. This umbrella agreement was based on mutual benefit for the two countries and led to the signing of thirty protocols on scientific cooperation between NOAA and the two corresponding agencies in China: the Chinese Meteorological Administration and the State Oceanic Administration. The most significant protocols for NOAA include the Atmospheric Science and Technology Protocol and the Marine and Fishery Science and Technology Protocol. During the past twenty years, scientists from both countries have held thirteen working conferences on oceanic and atmospheric research. This long-term science and technology partnership has also led to regular workshops and an ever-growing number of cooperative projects between the two countries.

The NOAA delegation's trip, co-hosted by the Chinese Meteorological Administration (CMA) and the State Oceanic Administration, began with meetings in Beijing, where the new agreement on Climate, Oceans, and Atmosphere was signed. In attendance at the conference were one hundred high-ranking officials, as well as top scientists from both countries—including Chinese Vice-Minister of Science and Technology, Deng Nan, and U.S. Under-Secretary of Commerce, Dr. James Baker. Agreements on Marine and Fishery Science and Technology Protocols were signed later in Hangzhou City, Zhejiang Province. At the ceremony celebrating twenty years of cooperation, Jack Kelly, Assistant Administrator for NOAA's National Weather Service, and Wen Kegang, Administrator of the CMA, signed the Twelfth Atmospheric Science Joint Working Group Report, which is a work plan for the next two years. In each of these formal signing ceremonies, the two sides agreed they would continue joint projects and exchange of scientists and data. The atmospheric agreement promotes cooperation in the following areas:

- Research on climate and monsoons;
- Mesoscale meteorology;
- Satellite meteorology;
- Atmospheric chemistry;
- Meteorological modernization; and,
- Training and participation.

After the first signing ceremony a regular meeting of the Joint Working Group—created by the Atmosphere and Science and Technology Protocol—took place in Beijing on September 15-16. The twelfth meeting of the Atmospheric Protocol's Joint Working Group took place in Beijing on September 15-16. Signing of the two-year work plan and celebration of the Atmospheric Protocols twentieth year Anniversary took place at the Great Hall of the People.

This meeting was followed by another event on September 23 celebrating the twentieth anniversary of the signing of the Protocol of Sino-U.S. Marine and Fishery Science and Technology Cooperation. This Protocol has encompassed cooperation in five broad areas:

- Data and information exchange;
- Marine environmental services—tides and currents;
- Role of oceans in global climate change;
- Living marine resources; and,
- Integrated coastal management.

These areas of cooperation cover topics that hold considerable practical application in China. For example, integrated coastal management is one topic that particularly concerns Chinese scientists and policymakers, for much of China's population lives along the coast, approximately 520 million people. Cooperation on such scientific agreements is strongly supported in China, for they promote sustainable development and improvements in technology to monitor potentially dangerous natural disasters. Notably, the Marine and Fishery Science and Tech-

nology Agreement has been one of the most successful data exchange agreements that NOAA has signed with any country. Many valuable data have been exchanged and NOAA has gained access to rich, long-term data sets, particularly on climate. For example, some Chinese records on climate and temperature fluctuation extend back 5000 years, which scientists in the United States view as invaluable in climate change studies. In Hangzhou, NOAA officials also signed the Fourteenth Joint Working Group Report to the Marine and Fishery Protocol that outlined cooperative activities for the 1999-2001 period. The Joint Working Group for this Protocol, which meets every two years, met most recently in Hangzhou September 26-27.

In addition to the anniversary and signing ceremonies, the U.S. and Chinese participants held two meetings: a symposium addressing climate and environmental change and a workshop focusing on the role of oceans in climate change.

The PRC-U.S.A Symposium on Climate, Environmental Change and Regional Impacts (21-22 September 1999) was co-hosted by the Chinese Meteorological Administration and the U.S. National Oceanic and Atmospheric Administration. The participants provided overviews of national climate programs in the United States and China, which represent efforts in our two countries to improve understanding of how the climate system works. One key goal of this exchange is to create a shared understanding on predicting El Niño and monsoons. Of particular interest to U.S. scientists has been exploring the complex impacts the Asian monsoons have on El Niño and Chinese data are invaluable in this pursuit. At this meeting they also discussed the impact of climate on weather.

At **The Symposium and Workshop on Climate Change and the Ocean's Role** the Chinese and U.S. participants shared data from their own studies and agreed to protocols to continue exchanging climate and ocean data and modeling results. Moreover they decided to explore establishing a jointly-managed virtual laboratory. This virtual co-laboratory would enable Chinese and American scientists to exchange data and ideas over the Internet in real time. It should be noted that both U.S. and Chinese scientists have been engaged in climate change and assessment of impacts of climate change for many years. The Chinese Meteorological Administration has been a principal agency in developing a Chinese response to the Kyoto Protocol.

The China-U.S. Workshop on the Impacts of Ocean Variability on Climate (23-24 September 1999) was a meeting co-sponsored by the Chinese State Oceanic Administration and the U.S. National Oceanic and Atmospheric Administration. In this workshop the Chinese scientists discussed the results of their South China Sea Monsoon Experiment, which aims to predict rainfall over the Yangtze River basin—the highly populated, breadbasket region in south-central China. The participants also discussed the following topics:

- Oceans as drivers of climate variability;
- Ocean monitoring and application of satellite remote sensing data;
- Prediction modeling and real time forecasting;
- Theoretical study on the interaction of monsoon and El Niño;
- Global ocean observations for the next 20 years; and,
- Impact of a dipole mode in the Indian Ocean on climate in Asia and Africa.

During the workshop, U.S. and Chinese scientists examined ways to coordinate efforts in improved ocean observations as a key to advancing climate forecasting services. U.S. scientists presented an overview of the developing ARGO program to deploy new technologies and improve climate data integration and management. The ARGO program promises to be an important multilateral, global effort to develop a new generation of reliable climate services. The Chinese interests in participating in this program are being pursued in light of the discussions at the Workshop.

The U.S. delegation ended their visit with tours of numerous key atmospheric and marine research centers, such as the National Marine Data and Information Service in Tianjin, which is one of the three world data centers for oceanography. The other two such centers are located in Washington, D.C., and Moscow. All three of these centers were set up the 1960s. This center in China maintains a very active Website (http://www.nmdis.gov.cn/eindex.html) that provides tide and current data.

Other site visits included various centers operated by the Chinese Meteorological Administration (CMA), specifically the operational forecasting center, the climate center, a television broadcasting center, and a modeling center. In contrasting the United States and China in terms of atmospheric agencies, it is notable that while the NOAA has 5000 employees engaged in atmospheric work, its sister organization in China has 63,000 employees. Moreover, while NOAA is a federal agency, the CMA is administered under a dual leadership arrangement between central and provincial governments. The CMA has offices in all thirty provinces and works directly with local governments.

The China-U.S. Center for Sustainable Development

On the occasion of Premier Zhu Rongji's visit to the United States on 9 April 1999, China's Ministry of Science and Technology and the State of Oregon, USA signed a Memorandum of Understanding to form the *China—U.S. Center for Sustainable Development* (the *Center*). The National Academy of Sciences graciously hosted the signing ceremony at their headquarters in Washington, D.C, immediately following the Second U.S.—China Forum on Environment and Development chaired by Premier Zhu Rongji and Vice President Gore. China's Ambassador Li Zhaoxing and the office of the Vice President were instrumental in bringing all parties together for the event.

The mission of the *Center* is to advance new forms of sustainable development cooperation between China and the United States in "land use planning; sustainable agriculture and rural development; sustainable forestry; environmental technology and cleaner production practices; sustainable cities; energy; marine environment; water resources; and capacity building for sustainable development." The Ministry of Science and Technology has a central role in coordinating China's sustainable development agenda. The state of Oregon is a leader in the United States in the application of sustainable development practices both in government and with the private sector. The organization of the *Center* is moving forward on several fronts.

Co-secretariats have been designated to administer the activities of the *Center*. China's Secretariat is the Administrative Center for China's Agenda 21 (ACCA21). The ACCA21 is responsible for coordinating the implementation of China's Agenda 21 and provides technical and advisory services related to sustainable development in China. The United States Secretariat is the International Sustainable Development Foundation (ISDF). The ISDF is a 501(c) 3 non-profit corporation with its headquarters in Portland, Oregon. Oregon's Governor John Kitzhaber approved start-up funding for the operations of the U.S. Secretariat.

China and the United States agree that the *Center* will focus its resources on demonstration projects and breakthrough opportunities to demonstrate the feasibility and benefits of sustainable development. A key objective of the *Center* is to engage the business sector in trade and investment activities that advance sustainable development practices and generate market return. The *Center* will work closely with China and U.S. government agencies and will forge partnerships with the private sector, higher education, nongovernmental and multi-lateral organizations. The explicit goals of the *Center* are to leverage resources, steadily accelerate the pace of sustainable development cooperation and achieve innovative results.

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Another tour took the U.S. delegates through a satellite briefing. The CMA operates polar orbit satellites, and in 1997 it launched its first geo-stationary satellites. Chinese satellites capture pictures of typhoons, monitor floods and forest fires, and provide mud and river outflow information in large coastal bays, such as Bohai Bay. The three receiving stations for satellite data are located in Beijing, Urumqi, and Guangzhou. With a larger number of functioning satellites the current satellite programs have been very successful. In the 1960s, Chinese satellite programs benefited a great deal from access to meteorological satellite data provided by the United States. Consistent with the United States, China has always maintained a policy of sharing meteorological satellite data, the Chinese Meteorological Satellite Program is now also sharing its data and contributing to global environmental satellite systems. Sharing such information with the international community is a significant shift from past policy in China. In fact, Chinese satellite data are now available on the Internet.

NOAA and the Chinese Meteorological Administration administrators also discussed the possibility of a joint modernization of radar systems. In the past year NOAA has completed a modernization of the National Weather Service with new radar, satellite, and communication systems. In a move to upgrade their system, the CMA has recently signed a joint venture agreement with Lockheed Martin. Under this agreement they developed an improved Doppler meteorological radar system. Over the next few years a 103 Doppler radar system will be deployed. Under the new atmospheric science and technology work plan, NOAA will interact with the Chinese as

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As an important step to achieve these goals, Oregon's Governor John Kitzhaber is pleased to announce that the renowned architect and sustainable development leader, William McDonough, has agreed to be the founding Chair of the U.S. Board of Directors for the *Center*. In 1992 the city of Hannover, Germany selected him to write *The Hannover Principles/Design for Sustainability* to guide the design of EXPO 2000, the World's Fair. In 1996, Mr. McDonough received the Presidential Award for Sustainable Development, the nation's highest environmental honor, presented in a White House ceremony. He is founding principal of William McDonough and Partners, an internationally recognized firm practicing ecologically, socially, and economically intelligent architecture and planning in the U.S. and abroad. He is also a founder of McDonough Braungart Design Chemistry, a product and systems development firm which assists companies to profitably implement their unique sustaining design protocol. Mr. McDonough is the former dean of the School of Architecture at the University of Virginia where he is now professor of architecture and professor of business administration at the Darden School of Business Administration. He is also the founder of the University's Institute for Sustainable Design and Commerce. Mr. McDonough has been called a "hero for the planet" by *Time Magazine*, which hailed his "unified theory that, in demonstrable and practical ways, is changing the design of the world." He is currently engaged in breakthrough initiatives to advance sustainable practices for such global corporations as Ford and Nike. Mr. McDonough was born and raised in Asia.

The other members of the U.S. Board of Directors are now in the process of being appointed. China's Board of Directors is being formed and a search for the Executive Director of the U.S. Secretariat is now underway. For additional information on the Board or U.S. Executive Director search, please contact the International Sustainable Development Foundation.

Even as the Board is being formed, initial delegations have been exchanged between China and the U.S. to chart the future course of the *Center.* The *Center* was also called upon to lead a discussion on state and provincial level land use cooperation at the third U.S.—China Forum on the Environment and Development held in January 2000. Several potential projects are currently being considered for early implementation. The International Sustainable Development Foundation welcomes inquiries, expressions of interest, and support for the work of the *China—U.S. Center for Sustainable Development*.

For further information, please contact: Todd Parker, International Sustainable Development Foundation, One World Trade Center, 121 SW Salmon St., Suite 210, Portland, Oregon USA 97204. Telephone: (1) 503-279-9383; Fax: (1) 503-279-9381; E-mail: tparker@apecnetwork.org.

they upgrade their radar system NOAA and collaborate on technology and data analysis.

In addition to the direct agreements under protocols negotiated with its sister organizations in China, NOAA has also increased its cooperative activities in China under *The U.S.–China Forum on Environment and Development*. This Forum was established by Vice President Gore and Premier Li Peng in 1997 and is currently co-chaired by the Vice President and Premier Zhu Rongji. The most recent meeting was held in April 1999 and the next meeting will be held in January 2000. The approach taken by the both parties on this Forum has changed significantly over the course of two years since its inception. Specifically, in the first Forum on Environment and Development, the U.S. side spoke predominantly about the environment, while the Chinese delegation stressed issues of development and economic growth. In the April 1999 meeting the two sides became more unified in the goals of the Forum. Notably, Zhu Rongji spent considerable time at the April meeting talking about environmental issues and problems that China faces and stressed areas in which the United States and China could cooperate to promote environmental concerns. Issues concerning NOAA that are encompassed by this Forum include cooperation on natural disaster reduction and seasonal-to-inter-annual climate variability (El Niño), and integrated coastal management. Additional projects undertaken by NOAA in China are listed in the Inventory of this publication.

Inventory of Environmental Work in China

In this third issue of the *China Environment Series*, the Inventory of Environmental Work in China has been greatly expanded, both in breadth and in depth. We have enlarged the inventory coverage beyond U.S. government and nongovernmental activities to include the projects and investment of multilateral organizations and other governments. We highlight a total of seventy-two organizations and agencies in this inventory and provide information on 479 projects. This larger inventory helps to paint a clearer picture of the patterns of aid and investment in environmental protection and energy efficiency in the People's Republic of China. In the spring of 2000 this inventory and later updates will be made available as a searchable database on the Environmental Change and Security (ECSP) website (http://ecsp.si.edu). The four categories of the inventory are listed below:

Part I. United States Government Activities (20 agencies and 125 projects)..... p. 78
Part II. Bilateral Government Activities (13 agencies and 176 projects)..... p. 105
Part III. Nongovernmental & Academic Activities (34 organizations, 110 projects)..... p. 142
Part IV. Multilateral Organization Activities (5 organizations and 68 projects)..... p. 169

Part I. United States Government Activities

Battelle-Advanced International Studies Unit (AISU)

Web address: http://www.battelle.org/
Web address: http://www.pnl.gov/china
Web address: http://www.pnl.gov/aisu

Beijing Energy Efficiency Center (BECon)

Partners: Energy Research Institute, Lawrence Berkeley National Laboratory, U.S. Environmental Protection Agency, World Wildlife Fund, Department of Energy

BECon was established in 1993 in cooperation with three organizations—Battelle, Lawrence Berkeley National Laboratory, and the World Wildlife Fund. Today, it has a full-time staff of twelve professionals and many consultants. BECon is leading high-level projects for the World Bank and United Nations Development Programme, and has contributed to many world-class reports on China's energy options. Work with BECon is an on-going collaboration.

Business Plan Training

Partners: Beijing Energy Efficiency Center, China Energy Conservation Investment Corporation, others TBD.
Status/Schedule: Targeted completion date December 2001

Energy efficiency can not only help China become more economically competitive, but also improve the quality of life of ordinary people and reduce growth in greenhouse gas emissions. Despite these advantages, financing energy efficiency projects in China is very difficult. Vendors and potential partners for efficiency projects often complain they do not know who can approve a project and who can provide security for the financing. Energy managers at the provincial level and below are also not prepared to function in the newly emerging system to replace command and control regulation with market forces. They need training to learn the latest ideas in energy efficiency technology, financing, and management. This project will provide experience for both Chinese and foreign partners that will help make the Chinese market more transparent and influential. It will also equip Chinese entrepreneurs and energy planners to take full advantage of the market forces that have such a high potential to reduce energy use. A fundamental barrier is the lack of knowledge to prepare business plans that address and provide solutions to these prob-

lems. Business plans are important in any market economy, but particularly so in a country like China where risks are high, macroeconomic problems are pervasive, and managers with experience in business planning and project finance are rare. China offers many attractive energy-efficiency opportunities, but Chinese managers do not know how to develop them into "bankable" projects. Disciplined preparation of business plans will become even more critical in the wake of recent financial crises in Asia. This project is funded by the W. Alton Jones Foundation and the U.S. Environmental Protection Agency.

Climate Action Update

Partner: Woodrow Wilson Center

The United States and China together produce almost forty percent of the greenhouse gas emissions that now threaten to alter the global climate. Negotiations between the two greenhouse leaders over how and when to mitigate carbon emissions suffer from a lack of awareness regarding what the other has accomplished. The bilingual update from Battelle and the Wilson Center will help policymakers in each country understand what each county has done in an effort to improve negotiating mutually acceptable climate change protection policies. The bilingual pamphlet *Climate Action in the United States and China* was published in May 1999 and is available on-line at http://ecsp.si.edu. Hardcopies may be obtained by contacting the Environmental Change and Security Project at the Woodrow Wilson Center.

Developing Countries and Global Climate Change: Electric Power Options for China

Partners: The Beijing Energy Efficiency Center and the Energy Research Institute
Status/Schedule: Completion date 2000

This Project is funded by the Pew Center on Global Climate Change and will analyze the impact of different power

Glossary

ACIAR	Australian Centre for International Agricultural Research
BMZ	Federal Ministry for Economic Cooperation (Germany)
CICETE	China International Center for Economic and Technical Exchanges
CIDA	Canadian International Development Agency
COFERT	Council on Foreign Economic Relations and Trade
ESCOs	Energy Service Companies
FY	Fiscal Year
GEF	Global Environment Facility
GHG	Greenhouse Gases
GTZ	German Technical Cooperation (Germany)
JICA	Japan International Cooperation Agency
MOFTEC	Ministry of Foreign Trade and Economic Cooperation
MOST	Ministry of Science and Technology (China)
OCR	Ordinary Capital Resources
OECF	Overseas Economic Cooperation Fund (Japan)
OPCV	Overseas Projects Corporation of Victoria (Australia)
SEPA	State Environmental Protection Administration (China)
SETC	State Economic and Trade Commission (China)
SMEs	Small and Medium Enterprises
SSTC	State Science and Technology Commission (Chinese Ministry of Science and Technology)
TASF	Technical Assistance Support Funds
TVEs	Township Village Enterprises
UNDDSMS	United Nations Department for Development Support and Management Services
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific, and Cultural Organization

supply pathways in five rapidly developing countries, including China. It will build on our previous China sector study by focusing on how decisions to add new capacity are reached. The team will simulate a number of least-cost policy scenarios and make recommendations on promising options.

Economic and Environmental Modeling

Partners: Beijing Energy Efficiency Center, Energy Research Institute
Status and Schedule: Completion date December 2000

Economic, energy, and environmental modeling will become increasingly important in China as market reforms continue to reshape the economy. Policymakers will need realistic models to explore energy and climate change policy options and to minimize total development expenditures. The U.S. EPA is supporting a series of modeling workshops to share information on computable general equilibrium (CGE), optimization, and hybrid models, analyze potential scenarios aimed at reducing mitigation costs, and build the community of Chinese and international experts.

Least-cost Power Options for China: The Next 75,000 Megawatts

Partners: Energy Research Institute and the Beijing Energy Efficiency Center
Status/Schedule: The final report should be complete by October 1999

This Project is funded by the Pew Center on Global Climate Change and will analyze the impact of different power supply pathways in five rapidly developing countries, including China. It will build on our previous China sector study by focusing on how decisions to add new capacity are reached. Modelers will account for the full environmental costs of power supply options. The team will simulate a number of least-cost policy scenarios and make recommendations on promising options.

Natural Gas Development

Partners: U.S. Environmental Protection Agency, BECon, University of Petroleum-Beijing, Chinese and U.S. natural gas companies
Status/Schedule: Targeted completion date October 2001

Natural gas has many advantages over coal, yet historically it has played a minor role in China's energy sector. Chinese policymakers are developing a renewed interest in natural gas as a way to fuel economic growth without the environmental and health impacts of coal combustion. To boost natural gas availability, a number of barriers must be removed to make it more competitive. This study—one of the ten agreements reached between EPA Secretary Carol Browner and her Chinese colleagues last spring—will explore supply, transmission and distribution, environmental, pricing, and regulatory issues to accelerate the development of China's natural gas system.

DEPARTMENT OF AGRICULTURE

Web address: http: //www.usda.gov

Agricultural Technology

Focus: Agriculture

This research agreement covers exchanges on: 1) U.S. dry land mechanized production technology; 2) remote sensing technology for crop yield projection; 3) U.S. food safety systems; 4) biological control of plant pests; and 5) botanical/germplasm information.

Biological Control

Partners: Chinese Academy of Agricultural Sciences (CAAS)
Focus: Biological Research

This is a ten-year research agreement with CAAS to collect, evaluate, and exchange biological control agents and natural enemies for integrated pest management of crop diseases, forest pests, range land, and aquatic weeds to reduce pesticide inputs. The work will be performed at the joint Sino-American Biological Control Laboratory in Beijing.

Biological Control of the Asian Long-Horned Beetle (Anoplophora glabripennis) in China

Focus: Pest Control

The U.S. Forest Service is developing cooperative research to control the Asian long-horned beetle. This very aggressive pest has Chinese origins, but has been found in the United States. Currently, eradication efforts have been undertaken in the United States and preliminary information is being gathered through Chinese counterparts at various academies and universities.

Biological Control of Hemlock Wooley Adelges (Adelges tsugae)

Partners: Academy of Forestry, and Provincial Forestry Bureaus of Yunnan and Sichuan
Focus: Forestry, Pest Control

The U.S. Forest Service has engaged in cooperative research with the Chinese Academy of Forestry and Provincial Forestry Bureaus of Yunnan and Sichuan to find biological control agents, primarily other insects, to control the hemlock wooley adelges which have been introduced to the United States. This pest is causing significant mortality to hemlock trees in eastern forests. Preliminary screening has been completed and collections are being made to test the efficacy of the insects in controlling the adelges.

Biological Control of Kudzu (Pueraria lobata)

Focus: Weed Control

The U.S. Forest Service is working to develop cooperative research in the biological control of kudzu. This weedy plant species is causing significant damage to forested, agricultural, and other lands in the southern portions of the United States. There are expensive chemical control options, but they can not be used in sensitive situations such as riparian, wetland, and residential areas. Identification of collaborators and exploratory studies are currently underway.

Biological Control of the Pine Mealybug (Oracella acuta) in China

Partners: Chinese Forestry Administration, Academy of Forestry, and the Provincial Forestry Bureau in Guangzhou
Focus: Pest Control

The U.S. Forest Service is assisting the Chinese Forestry Administration through the Academy of Forestry and the Provincial Forestry Bureau in Guangzhou to find natural enemies to control the mealybug, which was introduced into China from the United States. The pest is severely affecting the growth of forest plantations in China. Several insects from the United States have been collected, tested, and released into plantations in China to control the mealybug. The released insects have appeared to be established and are spreading to other areas.

Biological Control of the Mile-a-Minute Weed (Polygonum perfoliatum)

Focus: Weed Control

The Forest Service is researching strategies to control the mile-a-minute weed with several Chinese partners. This

weedy plant species is invading many parts of the United States. Exploratory studies are underway to find natural enemies to this weed.

Cochran Fellowship Program

Focus: Agricultural Trade
Status/Schedule: Ongoing into 2000

This program provides training opportunities in the United States or in country for senior and mid-level specialists and administrators involved in agricultural trade and agribusiness. Since 1989, 214 participants have received training in wood product use, flour milling, agricultural policy, grain and soybean marketing, and study tours related to dairy, livestock, poultry, and seeds.

Emerging Market Program

Focus: Agricultural Technical Assistance
Status/Schedule: Ongoing into 2000

This program promotes U.S. agricultural exports to emerging markets by providing technical assistance. Examples of recent projects conducted in China include livestock genetics and artificial insemination; grain storage management; daily cattle nutritional supplements using agriculture forage by-products; and marketing of seeds in China.

Forest Management

Focus: Pest Control

This research agreement promotes collaborative research on finding natural enemies of the insect pest oracella acuta. This pest severely reduces the growth and form of U.S. Southern pines in Chinese industrial forest plantations in the United States.

Genetic Resource Conservation

Partners: Chinese Academy of Agricultural Sciences (CAAS)
Focus: Botany

This research agreement is a ten-year research project with CAAS to collect, evaluate, and exchange native, unique or primitive plant varieties for plant genetic resource conservation in international germplasm repositories.

Letter of Discussion Between the Chinese Ministry of Forestry and the USDA Forest Service

Partner: Chinese Ministry of Forestry
Focus: Forestry

The Chinese Ministry of Forestry (now the Chinese Forestry Administration) and the U.S. Department of Agriculture/Forest Service in 1993 signed a Letter of Discussion to express their mutual interest in cooperating in all areas of forestry, including sustainable forest management, germplasm exchange, remote sensing, and fire management. Discussions are currently underway to sign a Memorandum of Understanding to strengthen cooperation between the two agencies.

Long-Term Research Programs

Partners: USDA's Agriculture Research Service, Natural Resources Conservation Service, Forest Service, Economic Research Service
Focus: Botanical Research
Status/ Schedule: Ongoing into 2000

Project to conduct long-term research programs in such fields as plant genetic resource studies; conservation of

germplasm; exchange of biological control agents; restoration and conservation of grasslands; reforestation; and agricultural economic studies and statistical surveys.

Reforestation

Focus: Forestry

The cooperation agreement headed by Department of Agriculture/Forest Service has worked in cooperation for more than ten years on China's reforestation program. This program has included the establishment, monitoring and genetic screening of North American tree species plantations in China.

Restoration and Conservation of Grasslands

Partners: Chinese Academy of Agricultural Sciences (CAAS)
Focus: Conservation Research

Ten-year research agreement with the CAAS for restoration and conservation of grassland plant ecosystems in China's Inner Mongolian region and the U.S. Great Plains area.

Soil Stabilization

Focus: Soil Conservation

Cooperative agreement to collect, evaluate and exchange tree, shrub and plant species suitable for soil stabilization, windbreaks and erosion control to conserve and maintain valuable land areas.

Sustainable Agriculture Videos

Partner: Global Village of Beijing
Focus: Agricultural Education
Status/Schedule: Ongoing into 2000

Project is producing ten twelve-minute video segments on sustainable agriculture practices in the United States. By highlighting key issues in the success of U.S. agricultural sustainability, the series will serve as an educational model for the development of sustainable agriculture in China.

Sustainable Forest Management in Northern Yunnan Province

Partners: Yunnan Provincial Government, and The Nature Conservancy
Focus: Forestry

The U.S. Forest Service will provide focused technical support to a sustainable forest management project in Northern Yunnan Province. The project, which is being developed by the Yunnan Provincial Government, has the support of the central government, The Nature Conservancy, and a Thai development company. The aim of the project is to provide a balance of conservation and development in this area of China. Currently, the project is in the planning stages. The Forest Service has assisted in the conceptual planning of the multiple resource management project and may provide further technical assistance as the project progresses.

Transfer of Forest Health Monitoring Technology

Focus: Pest Control, Pest Monitoring

The Forest Service is providing current forest health monitoring technologies to the Chinese Forestry Administration and the Anhui Forest Bio-control Station. Activities include assisting the Administration and Station to acquire aerial videography systems, training in the use of the equipment, training in the development of ground based forest pest monitoring, and integrating monitoring data into a geographic information system (GIS).

U.S./PRC Scientific Cooperation in Agriculture

Partners: Ministry of Agriculture
Focus: Agricultural research
Status/Schedule: Initiated 1978

This ongoing project is intended to promote U.S. agricultural priorities, encourage long-term cooperation in science and technology, and promote agricultural trade with China.

Water and Soil Quality

Focus: Water and Soil Quality Improvement
Status/Schedule: Meeting Held 20-21 April 1999

A breakout session on agriculture and forestry was held in Tucson, Arizona at the U.S.-China Water Management Conference. Panels of experts from both countries gained a better understanding of agriculture and water management problems and practices.

U.S.-China Agreement On Agricultural Cooperation

This three-part agreement was worked out in April of 1999 between the United States and China. The three areas of cooperation are outlined below.

Increased Technical Cooperation and Scientific Exchange

Under this objective, China and the United States will encourage research institutes and agricultural enterprises to collaborate on high-tech research and development, including education symposiums in cooperation with U.S. land grant universities, opportunities for Chinese leaders to visit the United States to observe and study management systems, and production technology.

Specific Technical Exchanges to Develop the Agricultural Sectors of Both U.S. and China

China and the United States will participate in a wide range of technical cooperation and assistance initiatives that span a variety of commodities, such as field and horticulture products, meat, dairy, and livestock, as well as such disciplines aquaculture, biotechnology, and natural resources and environment.

Resolution of Trade Disputes

Under this objective, the United States and China agree to accelerate the removal of all non-tariff measures restricting trade in a gricultural products that cannot be justified under World Trade Organization (WTO) rules. The agreement removed longstanding technical barriers to trade in wheat, citrus, and meat. The two countries agreed that disagreements should be settled scientifically. This moved both countries closer toward rational two-way trade in agricultural products.

Department Of Commerce/International Trade Administration

Web address: http://www.ita.doc.gov/
Web address: http://www.ita.doc.gov/uscs/
Web address: http://infoserv2.ita.doc.gov/ete/eteinfo.nsf

Department Of Commerce Role In U.S.-China Bilateral Environmental Fora

U.S. Joint Commission on Commerce and Trade (JCCT)

Established in 1992, the mission of the JCCT is to facilitate development of commercial relations and related

economic matters between the U.S. and China with the direct objective of promoting advancing bilateral commercial agendas. The JCCT is led by the U.S. Secretary of Commerce and the Chinese Ministry of Foreign Trade and Economic Cooperation (MOFTEC). They meet annually in a Plenary Session. The JCCT's Environment Subgroup identifies, organizes, and supports events and programs such as technology demonstrations, training workshops, trade missions, exhibitions, conferences, and seminars that foster environmental and commercial cooperation between the two countries. The American USG Agency co-chairs are USDOC's Office of Environmental Technology Exports and the EPA's Office of International Activities. The Chinese Co-chair is SEPA. For information about the 1999-2000 Work Plan activities of the Environment Subgroup, contact: Susan Simon, Office of Environmental Technologies Exports (ETE), USDOC; Phone: 202-482-0713; E-mail: Susan_Simon@ita.doc.gov.

U.S. China Forum on Environment and Development

The inter-agency U.S.-China Forum was established in March 1997 with the expressed mission to address environmental and development issues in water resources/treatment, climate change, SO_2 emissions, and energy efficiency. The four working groups and the U.S. and Chinese lead agency implementers are (China agencies noted in bold):

- Energy Policy-U.S. Department of Energy and the Chinese State Development and Planning Commission;
- Environmental Policy-U.S. Environmental Protection Agency, State Department; Chinese Ministry of Foreign Affairs and the Chinese State Environmental Protection Agency;
- Science for Sustainable Development-White House Office of Science and Technology Policy; Chinese Ministry of Science and Technology; and,
- Commercial Cooperation-U.S. Department of Commerce; Chinese Ministry of Foreign Trade and Economic Cooperation.

The Commercial Cooperation Working Group is chaired by USDOC and covers environmental trade promotions aspects in a broad range of industry sectors, including, energy, automotive, housing, environmental technologies, agriculture, and other areas of sustainable development. For information about the CCWG, Contact: Susan Simon, Environmental Technologies Exports (ETE), USDOC; Phone: 202-482-0713; E-mail: Susan_Simon@ita.doc.gov or Kathryn Hollander, Basic Industries (BI), USDOC, phone: 202-482-0385, E-mail Kathryn_Hollander@ita.doc.gov

Export Assistance Services

Environmental Technologies Exports (ETE)

The Environmental Technologies Exports (ETE) office is the principal resource and key contact point within the U.S. Department of Commerce for U.S. environmental technology companies. ETE's goal is to facilitate and increase exports of environmental technologies, goods, and services by providing support and guidance to U.S. exporters. ETE's staff covers key countries, with an emphasis on the designated emerging markets, including China. ETE and EPA are the American co-chairs of the bilateral U.S.-China Joint Commission on Commerce and Trade (JCCT) Environment Subgroup. The ETE published an Export Market Plan for China and plans an updated version for Fall 2000. Contact: Phone: Susan Simon at 202-482-0713; E-mail: Susan_Simon@ita.doc.gov.

Market Access and Compliance

The Market Access and Compliance(MAC) country desk officer at the U.S. Department of Commerce helps U.S. companies overcome trade and investment barriers. The China country desk officer informs American companies of rights and benefits under existing trade agreements, and provides comprehensive, up-to-the-minute information and analysis on market barriers. Working with other U.S. Government agencies, the MAC officer can help a company devise strategies to overcome market access barriers in such areas as import policies, lack of intellectual property protection, standards, testing, labeling, and certification, services barriers, government procurement, investment barriers, export subsidies, and bribery and corruption. The USDOC Market Access and Compliance China Desk officer is Cheryl McQueen, Phone: 202-482-3932; E-mail: Cheryl_McQueen@ita.doc.gov.

The U.S. and Foreign Commercial Service (U.S. & FCS)

The U.S. and Foreign Commercial Service (FCS) at the Department of Commerce is a global network of offices strategically located in more than 220 cities worldwide, offering U.S. exporters a comprehensive range of export facilitation services. FCS officers and foreign national staff serve American companies in Hong Kong and five cities in the People's Republic of China: Beijing, Shanghai, Guangzhou, Chengdu, and Shenyang. Mainland China services include market analyses, business counseling, market and policy information, and introductions to Chinese government officials and business contacts. In Hong Kong, U.S. Asian Environmental Partnership (USAEP), which is affiliated with the USAID, is active and a source for grant support, trade leads, exchange programs, information distribution, and trade events sponsorship. US FCS Contacts:

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Department Of Commerce/National Oceanic And Atmospheric Administration (NOAA)

Web Address: http://www.noaa.gov

Major Agreements And Protocols

U.S.-China Forum on Environment and Development

NOAA participates actively in the Vice Presidential U.S.-China Forum on Environment and Development. The Forum is an overarching policy dialogue led by Vice President Gore and the Chinese Premiere and has four working groups: Commercial Cooperation; Energy Cooperation; Environmental Policy; and Science for Sustainable Development. NOAA is primarily involved in the latter two working groups. NOAA was responsible for co-sponsoring the first concrete result of this Forum: the U.S./China Workshop on Natural Disaster Reduction and Mitigation, which was held 19-22 November 1997. Moreover, NOAA has taken a leadership role in other responsive activities, including the Workshop on Water Resource Management and new activities on Marine and Coastal Management. The third meeting of the Forum was held in January 2000 in Hawaii and resulted among its other accomplishments, in renewed enthusiasm for cooperation in the areas of natural disasters, water resources, coastal management, and climate science.

U.S.-China Science and Technology Agreement

The year 1999 marked the twentieth anniversary of the signing of the U.S.-China Science and Technology Agreement, one of the most prominent successes of U.S.-China relations. This umbrella agreement contains over thirty

individual protocols for science and technology cooperation based on mutual benefit. Two of these protocols—also signed in 1979—are administered on behalf of the United States government by the National Oceanic and Atmospheric Administration: the Marine and Fishery (M&F) Science and Technology Protocol and the Protocol for Cooperation in Atmospheric Sciences. In celebration of this important anniversary, Dr. James Baker traveled to China in September 1999 to participate in celebratory events for these two Protocols and to participate in a Workshop and Symposium on Climate, Environmental Change and Regional Impacts and the Impacts of Ocean Variability on Climate Change.

The umbrella Science and Technology Agreement, combined with the two protocols, represent an important cornerstone in U.S.-China scientific and environmental relations. These agreements have supported innumerable activities encompassing the sharing of data and information, exchange of technical experts and expertise, and direct scientific collaboration, and have spawned groundbreaking new collaborative activities that form the basis for future policy exchanges.

The Protocol on Cooperation in the Field of Atmospheric Science and Technology

The Protocol on Cooperation in the Field of Atmospheric Science and Technology was renewed on 7 May 1999 without change for another five years. The Protocol has been in effect since 8 May 1979. Activities under the Protocol are divided into six major areas as follows: 1) Climate and Monsoon Studies; 2) Mesoscale Meteorology-such as typhoons, thunderstorms and tornadoes; 3) Satellite Meteorology; 4) Atmosphere Chemistry; 5) Meteorological Modernization; and 6) Training and Participation.

U.S.-China Marine and Fishery Science and Technology Protocol

Partners: Chinese State Oceanic Administration, the Ministry of Agriculture, and the Chinese Academy of Sciences

The NOAA Office of Oceanic and Atmospheric Research administers the Marine and Fishery Protocol, whose activities span the following five scientific areas: 1) Data and Information Exchange; 2) Marine Environmental Services; 3) Understanding the Role of the Oceans in Climate Change; 4) Living Marine Resources; and 5) Marine and Coastal Management. In China, NOAA's counterpart organizations for this agreement are the State Oceanic Administration, the Ministry of Agriculture, and the Chinese Academy of Sciences.

Marine and Coastal Management has become a major area of cooperation under the Marine and Fishery Protocol. In response to recommendations of the U.S.-China Environment and Development Forum co-chaired by Vice President Gore and the Chinese Premier, the U.S.-China Marine and Coastal Management Joint Coordination Panel was established in May 1998. The program supports activities in developing and operating an integrated coastal management framework, developing coastal use legislation, management and research of marine protected areas (corals, wetlands, and mangrove ecosystems), use of information technology to facilitate effective resource decision-making, marine pollution and mitigation, and comparative case studies. China and the United States have agreed to the following projects, which are scheduled for implementation in the year 2000 (pending funding): Twenty Year Assessment of Marine Environmental Monitoring (pollution), U.S.-China Partner Reserves Management Planning, Mooring Buoy Project Demonstration Project, Mariculture Management Study, Mangrove Restoration, Training in Application of GIS Information Systems, Comparative Case Study of GIS and MPA Management, Application of U.S. Monitoring Technology to Forecast Pollution Discharge, and a U.S.-China Water Quality Workshop, as well as a new effort to expand cooperation to include a bilateral workshop in coastal water quality in the year 2000.

U.S.-China Cooperation On Fisheries

High Seas Drift Net (HSDN) SHIPRIDER Program
U.S.-China Cooperation to Discourage High Seas Driftnet Fishing

On 3 December 1993, the United States and China signed the Memorandum of Understanding Between the Government of the United States of America and the Government of the People's Republic of China on Effective Coop-

eration and Implementation of the United Nations General Assembly Resolution 46/215 of 20 December 1991. This Memorandum of Understanding (MOU) established boarding procedures for law enforcement officials of either country to board and inspect U.S. or PRC flagged vessels suspected of driftnet fishing on the high seas. The MOU also established a shiprider program that allows PRC fisheries enforcement officials to embark on U.S. Coast Guard cutters during each driftnet fishing season. This program is implemented in part by NOAA Fisheries Office of Law Enforcement. As a bilateral enforcement agreement, the MOU negates the requirement for the United States and the People's Republic of China to enter into lengthy diplomatic discussions to obtain flag state authorization to conduct a fisheries enforcement boarding on the high seas.

International Convention for the Conservation of Atlantic Tunas (ICCAT)

The first year that a scientist from PRC attended the International Convention for the Conservation of Atlantic Tunas (ICCAT) Standing Committee on Research and Statistics was 1999. Chinese had participated in meetings since the PRC became a member, but until this year those individuals did not possess a scientific background. Through ICCAT, the United States and China are cooperating, along with other ICCAT members and participating entities, on fishery stock assessments and the provision of scientific advice for management of Atlantic tunas and tuna-like species.

PICES

China and the United States are founding members of PICES (the other members are Canada, Japan, the Republic of Korea, and Russia) and participate in all its scientific discussions. NOAA Fisheries scientists and scientists from other U.S. institutions interact with their Chinese counterparts according to the scientific agenda of PICES which addresses the entire range of current marine science issues. The next PICES annual meeting will take place in Hakodate, Japan, during October 2000.

Shellfish Aquaculture

The aquaculture program at NOAA Fisheries Milford Laboratory has had periodic consultations with China on scallop aquaculture techniques. China has used a genetic strain of bay scallop developed at this laboratory as the basis for developing their scallop aquaculture industry.

TED-Technology Transfer

P.L. 101-162, Section 609 requires the United States to embargo shrimp harvested with commercial fishing technology which may adversely affect sea turtles. The import ban does not apply to nations that have adopted sea turtle protection programs (e.g., requirements to use TEDS) comparable to those utilized in the United States or those nations whose fishing environment does not pose a threat of incidental take of sea turtles. The Department of State (DOS) is the principal implementing agency of this law, with NMFS serving as technical advisor, providing extensive TED training throughout the world.

In recent years China has been certified as not posing a threat of incidental sea turtle take due to their use of beam-type trawls. However, the most recent certification visit by U.S. personnel in 1997 revealed that some segment of the Chinese fishing fleet is using more conventional otter-type trawling gear, similar to that used in the United States, and which poses a significant threat to sea turtles. Therefore, the United States may consider working with China to transfer appropriate TED technology to that segment of the shrimp fleet fishing with otter-type trawls, and to evaluate the impact of beam trawls on sea turtles.

The Third World Fishery Congress in Beijing 31 October - 3 November 2000

The Third World Fisheries Congress will take place from 31 October to 3 November 2000 in Beijing. The Chinese Fisheries Society of its National Academy of Sciences is the organizer. NMFS is a financial sponsor of the Congress. The World Fishery Congress meetings are held approximately every four years. The Beijing Congress is particularly

noteworthy since China is the world's largest fishing and aquaculture producing nation. The Congress will focus on the factors that have lead to the rapid expansion of Chinese capture fisheries and aquaculture, and examine the sustainability of future development. The Beijing meeting is also significant because it is intended to be the venue for the first meeting of the World Fisheries Council, which is an international union of national professional societies dealing with fisheries. This newly formed Council has four members—societies from North America, the United Kingdom, Japan, and Australia—and the goal is to have China join before the Congress. The plan also calls for a "Beijing Declaration" marking the first meeting of the Council and calling for others to join to promote international cooperation.

U.S.-China Fisheries Consultations

In early 1999, the United States and China held their first wide-ranging consultation on fisheries matters in Washington, D.C. China's policy of continuing to expand its high seas fishing capacity is of concern to the United States and may serve as a basis for further bilateral interactions.

The Yellow Sea Large Marine Ecosystem Project

The NOAA Fisheries Office helped China seek funding from the Global Environmental Facility (GEF) to develop a monitoring and assessment project for the Yellow Sea Large Marine Ecosystem (YSLME). In 1998, the GEF made $350K available to plan the project, and a NOAA Large Marine Ecosystem expert is now serving on a five-member UNDP team to plan the YSLME project. NOAA is expected to provide further expert consultation to assist in its program implementation and review when research projects get underway.

Other Areas Of Cooperation With Noaa

Environmental Data

The NOAA National Geophysical Data Center (NGDC) and the State Key Laboratory for Environmental Information Systems agreed to cooperate on the CD-ROM release of a collection of environmental data (e.g., vegetation and soils) developed by the State Key Laboratory. Release of the data is anticipated in the third quarter of FY 2000. This database is likely to be the most extensive unrestricted scientific-environmental database of China in existence.

Exports of Captive Marine Mammals

There have been several exports over the past few years of captive marine mammals to zoos and marine parks in China under provisions of the Marine Mammal Protection Act. There is no current information of any exports planned or pending. No permit is required for exports, providing the government of China assures that standards for animal care will be met comparable to those that apply in the United States.

GLOBE

China joined the NOAA-led GLOBE Program on 18 October 1995, when U.S. Secretary of Commerce Ronald H. Brown and Chinese National Environmental Protection Agency Administrator Xie Zhenhua signed the GLOBE Agreement in Beijing. China has developed a very active GLOBE Program over the years and has been involved in many GLOBE environmental education activities inside and outside of China. Currently, there are twenty-eight GLOBE schools in China and twenty-nine trained GLOBE teachers. GLOBE students in China have reported over 52,500 scientific measurements to scientists through the GLOBE Website comprising the Hydrology, Soils, and Landcover Biology investigations. Chinese GLOBE Country Coordinator Jia Feng's goal is to build on GLOBE's presence in each province, growing to 100 schools in each of China's thirty-three provinces participating in GLOBE within the next few years. GLOBE China conducts an Annual GLOBE China Conference each year, followed directly by a teacher training workshop to train more teachers throughout the provinces. Their last annual conference and teacher training workshop was in March 2000.

GLOBE China has also been a successful example of implementation in seeking support from the private sector.

Sponsorship for equipment and activities for the first five years of the GLOBE Program in China was provided by Ameritech International Inc., beginning 18 October 1995. In April 1998, Mobil Oil established a fund called Mobil China Environmental Education Fund, of which a significant portion is being used to support GLOBE activities in China.

Technologies Specific to the Next Generation Radar (NEXRAD) System

In October 1999, the Director General of the People's Republic of China (PRC) National Meteorological Center (NMC), Dr. Qiu Guoqing, invited representatives of the National Climatic Data Center (NCDC) to visit China to provide briefings and discuss data processing, archiving, and servicing procedures and associated technologies specific to the Next Generation Radar (NEXRAD) system. A secondary purpose was to discuss activities and information technologies used to manage other types of climate data at the NCDC. The Director of the Chinese National Meteorological Center (NMC) and the Director of the Climate Data Center, both in Beijing, expressed a strong desire to establish a closer relationship with NOAA and the NCDC. In particular, they asked to increase the exchange of historical climate data between the United States and China. Over the next twelve to thirty months the NMC expects to place into orbit a geostationary weather satellite and deploy at least one hundred weather radars (U.S. NEXRAD) throughout China. The NMC is also considering the purchase of the Wind Profiler system for the Shanghai area and an automated tape library system for the Climate Data Center in Beijing.

Department Of Commerce/National Weather Service (NWS)

Web address: http://www.nws.noaa.gov

Cooperation Agreement: Hydrology

Partners: Ministry of Water Resources

The Ministry of Water Resources and NWS agreed in August 1994 to develop a prototype flood forecasting system for the Huai River Basin which will then be expanded and applied to the seven major rivers in China as part of a central flood control dispatching system. This project has been completed in China and the Ministry of Water Resources will be receiving special recognition by the Chinese central government for successful performance during the 1995 floods, which was based on this cooperation.

Department Of Energy (DOE)

Web address: http://www.doe.gov/
Web address: http://www.fe.doe.gov/int/china.html
Web address: http://www.eia.doe.gov/emeu/cabs/china.html

Asia-Pacific Economic Cooperation (APEC): Energy Working Group
Energy Efficiency and Renewable Energy (EERE) Project

Partners: Multiple

Under the APEC's Energy Working Group the EERE Project seeks to promote sustainable development in the Asia-Pacific region. APEC distributes information on the economies of member states regarding energy efficiency and renewable energy projects, and plans, technologies, and practices. APEC facilitates private sector interaction among member economies to expand the delivery of environmental technologies regionally. Cooperative programs include: 1) conducting workshops and seminars on technology development; 2) developing industrial energy efficiency best practices and measures manuals; 3) implementing energy-technology greenhouse gas mitigation projects; 4) developing an APEC energy efficiency information system database; and 5) forming expert groups to coordinate and monitor APEC's programs.

Asia-Pacific Economic Cooperation-Energy Working Group
Clean Fossil Energy Experts Group

Focus: Clean Energy, Coal, Oil and Gas
Partners: Multiple

This Clean Fossil Energy Group conducts studies, technical seminars and conferences and carry out projects such as coal-mine gas recovery and utilization projects in China.

Protocol for Cooperation in the Fields of Energy Efficiency and Renewable Energy Technology Development and Utilization

Partner in the Energy Efficiency Area: State Development Planning Commission

Under the energy efficiency segment of the Protocol action plans are underway in ten priority areas (energy efficiency policy, information exchange and business outreach, electric motor systems, district heating, cogeneration, lighting, buildings, transformers, industrial process, and finance), with significant progress being made in electric motor systems, buildings, finance, and policy. Workshops on DoE's Motor Challenge program on electric motor pumping systems and on international motor standards and testing procedures have been held in Beijing over the last two years. Also, plans are underway to implement a motor system pilot program in two provinces. Significant progress has also been made in the building's area. A technical feasibility design study for an energy efficient demonstration building in Beijing has been completed and a workshop was held to exchange information on U.S. and Chinese building technologies.

Partners in the Renewables Area: Chinese Ministry of Science and Technology, Chinese Ministry of Agriculture, State Economic and Trade Commission, and State Power Corporation

Under the renewables segment of the Protocol progress has taken place in the following areas: 1) installation of 125 solar home systems in Inner Mongolia; 2) development of an island wind/diesel village power project off the coast of Shandong Province; 3) technical assistance and training for rural electrification; 4) wind energy workshop in Beijing; 5) U.S.-China Business Development Workshop in Xian; and 6) three general agreements to pursue geothermal heat pump (GHP) demonstration projects in China.

Protocol on Fossil Energy Research and Development for Cooperation-Atmospheric Trace Gases

Partners: Chinese Academy of Sciences

The DoE and the Chinese Academy of Sciences established a joint research and information exchange activity exploring the relationship of climate changes and atmospheric levels of CO_2. Current activities include: 1) the study of the relationship among large-scale and regional-scale climate features and casual mechanisms; 2) analysis of general circulation models (primary models used to study and predict climate change); 3) analyses of instrumental data; and 4) measuring and analyzing methane emissions from rice paddy fields in China. DoE is currently negotiating a new fossil energy protocol with China's Ministry of Science and Technology, as a result, current activities could conceivably be modified under the new protocol.

Protocol on Fossil Energy Research and Development for Cooperation-Regional Climate Research

Partners: China Meteorological Administration

The objective of this protocol is to promote joint research and information exchange, to document regional climate and climate change, to predict regional climate and climate change, and to identify regional impacts of climate change. Current activities include: 1) updating of instrumental data and visitor exchange; 2) development and improved regional climate models necessary to quantitatively predict regional features of potential climate change; and 3) development of data sets to test for climate change and improve and verify regional and global climate models. DoE is currently negotiating a new fossil energy protocol with China's Ministry of Science and Technology,

as a result, current activities could conceivably be modified under the new protocol.

Protocol on Fossil Energy Research and Development
Cooperation on Clean Coal Technology (Two Initiatives)

Partners: Ministry of Science and Technology (MOST) with some funding from EPA (under the U.S. Technologies for International Environmental Solutions-USTIES-Program)

DoE provided MOST and the China State Power Corporation with technical and economic information on Integrated Gasification Combined Cycle (IGCC) technology to support China's efforts to do a demonstration project for which they have now received approval to proceed. DoE is currently negotiating a new fossil energy protocol with China's Ministry of Science and Technology, as a result, current activities could conceivably be modified under the new protocol.

Partners: Ministry of Coal Industry/Central Coal Research Institute

Joint Program on Market Issues Related to the Introduction of Clean Coal Technology in China.

U.S.-China Energy and Environment Technology Center

Partners: U.S. Environmental Protection Agency (USTIES Program), Chinese Ministry of Science and Technology, Private industry, and Academic institutions

The purpose of the Center is: 1) training and education on technical and financial issues; 2) project development in conjunction with Agenda 21, Green Program and Provincial Governments, and opportunities for U.S. investors and technology suppliers; and 3) to work with the Chinese in policy development. DoE supported activities under the Yixing Environment Industry Partnership will be folded into the Center.

U.S. Country Studies Program

Partners: Ministry of Science and Technology

The China Climate Change Country Study Program (CCSP), started in 1994, has been an integrated part of the U.S. Country Studies Program (USCSP), which is a Presidential Initiative for Climate Change Studies. This Study Program is part of the U.S. contribution to support UN Framework Convention on Climate Change (FCCC) which provides financial and technical assistance to developing and transition countries. The CCSP has been completed and the final report (English version) submitted to the USCSP in March 1999 and was published in December 1999. The CCSP is China's first nationwide comprehensive, systematic study to deal with challenge issues and mitigation strategies for climate change. The study involves the highest level of PRC Government, overseen by a State Councilor and directly reported to the China State Council. A national Climate Committee and a Climate Change Coordination Group were set up to coordinate and carry out this inter-agency study with a technical team consisting of more than 120 scientists and analysts from more than twenty-one government ministries and commissions as well academic institutions. China is now continuously working on its Climate Change Action Plan, with additional U.S. support, emphasizing upon various climate-friendly technology assessments for mitigation measures suitable for China's current sustainable development. The U.S. is also assisting China in developing socioeconomic modeling capabilities to facilitate China's evaluations on climate change policy adaptations for its active participation in Activities Implemented Jointly (AIJ) and Clean Development Mechanism (CDM) activities in the future. Therefore, the CCSP was further extended in 1999 with additional funding to help China develop an analytical framework to ascertain carbon mitigation technology options in the setting of a dynamic growth economy. The work includes the development of a technology database and the building of a dynamic liner-programming model, MARKAL. USDOE plans to use the China MARKAL to conduct a research project on the Clean Development Mechanism and permit trading. The expected completion for this work is the spring of 2001.

Department Of Health And Human Services/National Cancer Institute

Web address: http://www.os.dhhs.gov/
Web address: http://www.nci.nih.gov/

Research Agreement: Cancer

NCI is involved in collaborative epidemiological studies with Chinese scientists to identify the dietary and environmental determinants of esophageal, lung, and stomach cancers and choriocarcinoma in China.

Department Of Health And Human Services

Web address: http://www.hhs.gov/progorg

Research Agreements: Disease

The National Institute of Health supports collaborative research into several infectious and parasitic diseases with potential environmental links, including cryptosporidium, rotavirus, hantavirus, hemorrhagic virus, lyme disease, and hepatitis.

Department Of Interior/Bureau Of Reclamation

Web address: http://www.usbr.gov/
Web address: http://www.doi.gov/

Memorandum of Understanding: Water

Partner: Ministry of Water Resources

The Bureau of Reclamation and the Chinese Ministry of Water Resources have a two-pronged Memorandum of Understanding (MOU): 1) the exchange of ideas, information, skills, and techniques on water resources management and conservation, and 2) the exchange of information and technology for preserving and enhancing the environment. Under Annex I, Reclamation helped facilitate U.S. irrigation equipment manufacturers (through the Irrigation Association) to set up three demonstration projects around the city of Zhaoyuan in Shandong Province of China. The object of the demonstration program is to compare the effectiveness of different types of irrigation equipment, and the water savings achieved by the various pieces of equipment. A three-year demonstration program was begun after equipment installation was completed in the spring of 1997.

Reclamation and the Ministry of Water Resources are presently negotiating Annex II to the MOU. This annex would establish a Cooperative Training Program, with the following objectives: 1) further cooperative relations between the two organizations; 2) promote exchange of technical personnel and ideas between the countries; and 3) train administrative and technical personnel in all aspects of water resources management.

Department Of The Interior/Fish And Wildlife Service (FWS)

Web address: http://www.fws.gov/
Web address: http://www.fws.gov/index.html

Cooperation Agreement: U.S.-China Nature Conservation Protocol

Partners: Ministry of Forestry, Ministry of Agriculture, and the U.S. Geological Survey

The Fish and Wildlife Service (FSW) administers exchanges with China under the bilateral Nature Conservation Protocol. Exchanges carried out in 1997-1998 emphasized wetland and river ecosystem health, including studies of

factors affecting the reproduction and survival of sturgeon and other species in the Yangtze River. Training for Chinese specialists in wildlife forensic identification and in proper identification of live animals/plants and their parts and products at ports of entry is also a priority.

Department Of Interior/National Biological Service (NBS)

Web address: http://www.doi.gov/pfm/ar4nbs.html

Cooperation Agreement: Habitat Conservation

Partner: Fish and Wildlife Service (FWS)

The U.S.-China Nature Conservation Protocol is co-led by the NBS and the FWS. NBS activities in China include studies of the distribution and habitat requirements of migratory birds, spawning requirements of sturgeon species in rivers, propagation of freshwater mussels, research to support conservation of special status species such as the snow leopard and polecats, and training in biological monitoring and wildlife.

Department Of The Interior/U.S. Geological Survey (USGS)

Web address: http://www.nbs.gov/
Web address: http://www.usgs.gov/

Cooperation Agreement: U.S.-China Nature Conservation Protocol

Partners: U.S. Fish and Wildlife Service, and various Chinese government agencies

The U.S. Geological Survey (USGS), Biological Resources Division, along with the Fish and Wildlife Service lead the U.S.-China Nature Conservation Protocol. USGS activities in China include the design and deployment of telemetry for radio-tracking mammals, studies of special status species, research on the spawning requirements for sturgeon in major rivers, and training in biological monitoring and methodologies of wildlife research and management.

Protocol for Scientific and Technical Cooperation in Surveying and Mapping Studies

Active since 1985, this Protocol focuses on technology transfer and cooperation in the areas of digital cartography, spatial database design, geographical information system applications, remote sensing applications, and geodetic studies.

Protocol on Surface Water Hydrology

Under the 1981 Protocol on Surface Water Hydrology, there have been recent exchanges with Chinese individuals and scholars for water quality assessment studies.

Environmental Protection Agency (EPA)

Web address: http://www.epa.gov/
Web address: http://www.epa.gov/oia/prchina.htm

Assessment of the Chinese Air Quality Management Process

Partner: State Environmental Protection Administration

The year-long project calls for a collaborative assessment of China's air quality management process and potential for applying U.S. techniques within that process.

Automotive Technologies/Leaded Gasoline Phase-out

Partners: Office of International Activities, EPA Office of Air and Radiation (OAR)

A conference/workshop in Beijing held in October 1995, recommended that the Chinese government phase-out leaded gasoline, create tighter emissions restrictions, and improve transportation planning. EPA was an integral part of the adoption of legislation requiring the phase-out of leaded gasoline. EPA is still working with the Chinese government for the adoption of the other recommendations.

Beijing Energy Efficient Center (BECon)

Partners: Office of International Activities, Office of Policy

BECon is a quasi-nongovernmental center established to recommend policies for energy reform; encourage business ventures for upgraded technologies; sponsor demonstration projects; and implement public education programs. Recent work focused on energy efficient lighting, motors, transportation, and demand side management.

CFC Phaseout Program

Partners: United States Navy, Ministry of Public Security, United Nations Development Program and SEPA

The first project under this program, which is now completed, trained Chinese fire protection experts on operation of halon 1211 recovery/recharge machines, and improved fire extinguisher service, and maintenance practices to prevent unnecessary halon emissions. An initial assessment of halon use in major halon manufacturing provinces was completed. Additional work is underway on mobile air conditioning units. Funding was provided from bilateral contributions to the Montreal Protocol Fund.

Children's Lung Function Study

Partners: National Center for Environmental Assessment and the Chinese National Monitoring Center of SEPA

This is an epidemiological study of the effects of air pollution on childrens' lungs. Health surveys were sent out twice a year to children in four Chinese cities: Wuhan, Chongqing, Guangzhou, and Langzhou. The project yields extremely valuable data for use in U.S. standard setting, especially for particles (fine and PM10). This study was begun in 1988 and is currently in the final stage of data analysis.

China Room Air Conditioner Monitoring Study

Partner: The American Council for an Energy Efficient Economy (ACEEE)
Status/Schedule: Targeted Completion August 1999

ACEEE led efforts to monitor room air conditioners in 150 households in three Chinese cities-Beijing, Shanghai, and Guangzhou. Data collected on room air conditioner energy use and operating patterns in various climates in China will establish the basis for identifying cost-effective measures for improving air conditioner efficiency.

Cleaner Air and Cleaner Energy Technology Cooperation

Partner: State Development and Planning Commission

This project will expand work under the Technology Cooperation Agreement Pilot Project (TCAPP) by developing and implementing investment and commercial market strategies and clean energy technology projects in four key areas: 1) efficiency improvements in industrial coal-fired boilers; 2) clean coal technology-integrated gasification combined cycle power generation; 3) high efficiency electric motors; and 4) grid-connected wind electric power. The project will also be expanded to include additional key technologies based on China's priorities.

Climate Change Country Study

Partners: Multiple agencies

Since 1994, EPA and DoE have been actively engaged with the PRC on the issue of global climate change through the U.S. Country Studies Program. The country study involves the highest levels of the PRC, including more than fifteen State Commissions and Ministries. This study is an interagency effort to assist China in the development of a national action plan for climate change. More than one hundred Chinese analysts and technical experts have been involved in this study, which is the largest climate change analysis ever conducted in China. The China Climate Change Country Study includes four major elements: 1) an inventory of greenhouse gas emission sources and sinks; 2) an assessment of China's vulnerability to climate change, including sea level rise; 3) a technical assessment of adaptation and mitigation measures such as public education; and 4) a socioeconomic evaluation of climate change policy options. The study was completed and in late 1999 an English version was published by Tsinghua University Press (See Climate Change section of bibliography). The U.S. Country Studies Program is also providing financial and technical support for the development of a National Action Plan, building on the results of the country study. This effort includes: 1) coordination of State Commissions and Ministries by the National Climate Committee; 2) public consultation; 3) technology assessments; 4) review and selection of options by the National Climate Committee; and 5) preparation of a future National Communication to the UNFCCC. The national action plan is expected to be completed in approximately one year.

Climate Change Research

Partner: EPA Office of Policy, Department of Energy

The EPA is working in conjunction with China on three areas of research: 1) quantification of local environmental and health co-control benefits of green house gas (GHG) mitigation; 2) national economic modeling and analysis of costs of alternative strategies and levels of GHG commitments including flexibility mechanisms; and 3) Technology Cooperation Agreements Pilot Project (TCAPP). The first local-environmental and health co-benefit analysis is being carried out in Shanghai. The second effort included a joint workshop on economic modeling in January 1999. The third area, TCAPP, has been co-founded by DoE and is part of a multi-country USG effort.

Coalbed Methane Recovery and Utilization

Partners: Chinese Ministry of Forestry, United Nations Development Programme (UNDP), GEF

The EPA and the UNDP manage a Global Environmental Facility project to demonstrate advanced methane recovery technologies at three sites in China. Cooperation principles were signed in 1991 to launch various projects, including a comprehensive assessment, country program development, feasibility studies, and model site development for coalbed methane recovery and use. This environmental management project also aims to establish technical support and staff training for a Coalbed Methane Clearinghouse at the former China Ministry of Coal. In 1995 an International Coalbed Methane Conference was held and led to the publication in 1996 of a joint report entitled Reduced Methane Emissions from Coal Mines in China: The Potential for Coalbed Methane Development. The EPA is also providing technical cooperation to an APEC coalbed methane scoping effort in China.

Coal Mine Methane Market Development Plan

Partner: State Administration of Coal Industry

Project would develop a market development plan for methane which is released from active coal mines. Methane, a potent greenhouse gas, is released into the atmosphere in the process of coal mining.

Cooperation on Development of Energy Efficient Buildings

Partner: State Environmental Protection Administration

Project will assist the Chinese in collecting data and developing program designs for the preparation of a proposal for international funding (e.g., the Global Environmental Facility) to promote the construction and operation of energy-efficient buildings.

Cooperation to Assess Benefits of Programs to Reduce Air Pollution and Protect Public Health in China

Partner: State Environmental Protection Administration

Cooperation will continue to evaluate the air pollution and public health benefits of technologies and policies that reduce greenhouse gas emissions in Shanghai. Research will be extended under the project to Beijing and one other city and then to a preliminary national assessment by the end of 2001.

Cooperative Study of Natural Gas Utilization in China

Partner: State Development and Planning Commission

A team of experts from government and key technical institutes in China and the United States will assess the potential for expanding natural gas production and imports; appropriate applications across the economy; the climate, environmental, and health benefits of increased gas use; and policies and programs needed to achieve the desired levels of natural gas use. The assessment may also identify opportunities for which credits certified under the Clean Development Mechanism could help finance natural gas projects in various sectors.

Energy Efficient Buildings Project

Partners: Department of Commerce, U.S.-Asia Environmental Partnership, Hong Kong Polytechnic, Hong Kong EMSD, and Megawatts Company

This Hong Kong project will demonstrate energy efficiency measures for buildings.

Energy Efficient and CFC-free Refrigerators

Partners: National Council of Light Industry, Beijing Household Electrical Appliance Research Institute through SEPA

This project, which is now completed, worked at the regulatory and factory levels to assist with the conversion of refrigerator factories to produce models which use fifty percent less energy and are non-ozone depleting. The project was funded in phases by U.S. bilateral contributions to the Montreal Protocol Fund, and additional GEF funding. Additional work was done through an EPA grant to the University of Maryland in FY 1994 for design and testing of domestic Chinese refrigerators and to the Lawrence Berkeley National Laboratory for market transformation of the refrigerator industry.

Energy Efficient Lighting

Partner: Lawrence Berkeley National Laboratory (LBNL)

LBNL is assisting China to develop product quality standards and a testing, certification, and labeling program to ensure consistency in results among testing labs in China and to support lighting products confidence among Chinese consumers. LBNL is also assisting China in documenting barriers to lighting efficiency and successes in overcoming these barriers as a way of monitoring and evaluating the Chinese Green Lights Project.

Energy Futures Study

Partners: U.S. National Academy of Sciences (NAS), and the Chinese Academy of Sciences
Status/Schedule: Completed late 1998

NAS and the Chinese Academy of Sciences/Chinese Academy of Engineering are undertaking this study to examine energy growth scenarios in China under several different policy paths. This study is co-funded by EPA,

the Department of Energy, and the National Research Council (NRC).

Feasibility Study on the Use of Market Mechanisms to Achieve Sulfur Dioxide Emissions Reduction in China

Partner: State Environmental Protection Administration

Cooperate on examining the possibilities for using market-based mechanisms for sulfur dioxide emissions control in three phases: 1) an educational workshop on how the U.S. developed its SO_2 emissions trading program and the fundamental features of the program; 2) a pre-design study of the nature and effects of the SO_2 problem in China, available control technologies and costs, and regulatory and institutional issues relevant to the design of an effective emissions trading program; and 3) the design of a pilot program for SO_2 emissions trading in China.

Health Effects of Coal Combustion in Xuan Wei County, Yunnan Province

Partners: National Health and Environmental Effects Research Lab and NEPA

This study is a multidisciplinary project that uses epidemiology, chemical analyses, and bioassays to determine the impact of domestic coal burning, ambient air pollution, and other factors on lung cancer incidence. Results from this study have been presented in several international conferences and were published in *Science* magazine. The study is now focusing on the development of human health bio-markers.

Integrated Gasification Combined Cycle (IGCC) Power Generation Deployment to China to Achieve Emissions Reduction

Partners: Department of Energy and Texaco

This project's goal is to construct an IGCC demonstration power plant that uses one-third less water and produces less CO_2 and toxic emissions than other coal-burning technologies. The project includes cost efficiency studies, research and identification of manufacturing capabilities in China, and workshops and training.

Membrane Drinking Water Treatment

Partners: Department of Agriculture (USDA), Shandong Province Water Resources Management Office, Zibo City, Ministry of Geology and Mineral Services, and the Institute of Hydrology

This project's goal is to demonstrate cost-effective technologies for the control of toxic chemicals and pathogenic microorganisms in drinking water in China.

Pollution Prevention and Control for China's River Basins

Partner: Office of International Activities

This project involves technical cooperation with China to utilize U.S. environmental pollution-control technology and management approaches in solving a water pollution problem labeled as a top priority by the Chinese government. In addition, technology workshops have also been held in several provinces as part of this project.

Pollution Prevention and Control in the Huai River Basins

Partners: World Bank and the Delaware River Basin Commission

The project will bring U.S. technologies and approaches to work on the vast environmental damage in the Huai River Basin in China and the Delaware River Basin in the United States. Working closely with the World Bank, the EPA has sponsored a technology seminar, as well as U.S. private sector monitoring work and training.

Pollution Prevention and Environmental Education

Partners: EPA Office of International Activities, Air and Waste Management Association, Tianjin City, Anhui Province, Global Village Institute

This project, coordinated by the Air and Waste Management Association through an EPA grant, will work with Tianjin City and Anhui Province on improving the capacity of pollution prevention centers. The EPA will also work with the Global Village Institute on environmental education programs.

Room Air Conditioner Energy-Efficiency Standards

Partners: Lawrence Berkley National Laboratory and the U.S. Department of Energy

The market for room air conditioners has skyrocketed in the 1990s, from 241,000 in 1990 to 10,000,000 in 1998. This expanded use of air conditioners has caused an immense energy drain in China. The EPA has worked with Chinese State Bureau of Quality and Technical Supervision to improve efficiency. They have developed a new standard scheduled to apply to all units manufactured after 1999, thereby reducing energy consumption by fifteen percent.

Room Air Conditioner Market Transformation

Partners: State Economic and Trade Commission (SETC)

This project included the collection and analysis of hourly air-conditioner energy use data from 150 households in three cities over twelve months. This study provided key information for a SETC proposal to the Global Environmental Facility (GEF). The GEF project is a multi-year effort to increase consumer purchases of highly energy-efficient air conditioners. Implementation is expected to start in October 2000.

Sectoral Energy Efficiency Studies

Partner: Lawrence Berkeley National Laboratory

Through the Lawrence Berkeley National Laboratory and various Chinese partners, this project will assess alternative energy utilization scenarios for particular sectors. The first sector of interest will be building materials and buildings, which are major contributors to greenhouse gas emissions. The final outcome will be a detailed roadmap of technologies, environmental benefits, and costs for these sectors.

Study of the Effect of Particulate Matter on Children's Lung Function

Partner: State Environmental Protection Administration

This project extends and expands an existing project on children's lung function by studying the effect of particulate matter on children.

Study of the Relation of Air Pollution to Asthma and Other Respiratory Health Problems

Partner: State Environmental Protection Administration

Under this project, the U.S. and China will cooperate to initiate detailed measurements of particulate matter in Wuhan and Beijing. Data would be analyzed by U.S. and Chinese experts and related to data on asthma and other respiratory health problems.

Technical Assistance for Energy-Efficient Lighting in China

Partner: Office of Air and Radiation

This project provides training at China's State Bureau of Technical Supervision and the Beijing Energy Efficient Center in the development of standards for energy-efficient lighting in China and in test procedures to improve production in China of energy efficient fluorescent lamps.

Technology Seed Grant Program through the National Association of State Development Agencies

Partner: Office of International Activities

This project consists of technical cooperation with China to transfer U.S. environmental technologies to areas that are most dire need in China. The National Association of State Development Agencies provides assistance to state development agencies, which fund demonstrations of U.S. environmental technologies in China.

U.S.-China Energy and Environment Technology Center

Partners: Department of Energy, Tulane University, State Science and Technology Commission (SSTC)

The goal of this three-year project is to facilitate the development of U.S.-China relations in energy and environmental technology related to electric power. It will also provide a forum for information exchange, demonstrations, and research on energy and environmental technologies such as clean coal, oil, and gas.

U.S.-China Partnership for Industrial Pollution Prevention and Energy Efficiency

Partner: State Environmental Protection Administration

This initiative will significantly expand EPA's cooperative program with China on promoting cleaner production and pollution prevention. This initiative will focus on three main areas: 1) sharing experience on applying public policy and regulatory approaches that encourage pollution prevention; 2) capacity building for technical and compliance assistance programs that promote pollution prevention and energy efficiency through government industry partnerships and "beyond compliance" incentive programs; and 3) information networking and exchange to improve access in China to U.S. technical materials, tools, and training resources, and to improve EPA understanding of China's cleaner production activities and regulatory system.

USEPA/NASDA Program for Environmental Technology Transfer-China

Partners: National Association of State Development Agencies (NASDA)

EPA funds a program run by NASDA to provide small seed grants of up to $20,000 to private companies and their non-profit sponsor to gain access to the Chinese environmental technology market. Eight proposals approved by a panel in a competitive solicitation are now underway. No further grants are available.

Vehicle Emissions/Leaded Gasoline Phase-out

Partner: National Environmental Protection Administration (now SEPA)

EPA has cooperated with SEPA to assist in China's adoption of legislation calling for the nationwide phaseout of lead in gasoline by 2000. Such legislation has already been implemented in Beijing, Guangzhou, and Shanghai. In addition, a SEPA official spent three months at the U.S. EPA, and EPA is working closely with SEPA and other organizations on implementing regulations, including training at national and local levels, on mobile source air pollution control, and lead phase-out. EPA is also funding technical and public information materials development.

Wind Energy Mapping

The objective of this project is to show Chinese officials potential sites in China that are economically and environmentally viable for U.S. wind energy equipment.

EPA Projects Conducted Outside Of Environmental Protocols

The following eight projects fall under the U.S. TIES Initiative. This initiative was terminated due to lack of funding

in FY 1996, but was continued using FY 1995 funding. The combination of all projects falling under this rubric represent a commitment of U.S. $3,225,000 in public funds. This commitment was leveraged against other sources of support from participating partners to accomplish projects valued at U.S. $9 million.

Asia Pacific Initiative for Renewable Energy and Energy Efficiency

Partners: Office of International Activities, Department of Energy

This project was completed utilizing technical cooperation with China to increase the acceptance and understanding of renewable energy technologies in Asia through training workshops, development of model regulations, and technology demonstrations.

Demonstration of Combined NOx/SOx Control Technology

This is an ongoing project testing low-cost NO_x and SO_x removal technologies that could reduce SO_x and NO_x emissions by up to seventy percent, as well as remove mercury. This project will encompass mercury measurement in coal, training Chinese in stack mercury management, provision of sampling hardware, and selected stack measurements.

Hazardous Waste and Toxic Disposal

Partners: State of New York, Office of International Activities, Office of Solid Waste and Energy Responses

This project through technical cooperation sought to strengthen China's waste regulations, provide demonstration facilities, and sample technical specifications for hazardous waste treatment technologies for China. This project has been completed.

Integrated Gasification Combined Cycle (IGCC) Power Generation

Partners: Office of International Activities, Department of Energy

This is an ongoing project involving technical cooperation with China to construct an IGCC demonstration power plant, which uses one-third less water and produces less CO_2 and toxic emissions than other coal burning technologies. The project include cost efficiency studies, research and identification of manufacturing capabilities in China, and workshops, and training on IGCC technology and benefits.

Membrane Drinking Water Treatment

Partners: Office of Research and Development and the Department of Agriculture (USDA)

This is an ongoing project involving technical cooperation with China to demonstrate cost-effective technologies for the control of toxic chemicals and pathogenic microorganisms in the drinking water in China.

Pollution Prevention in the Petrochemical, Pharmaceutical, and Metal Finishing Industries of China

Partners: State of Illinois, Office of International Activities, Office of Research and Development

This project involving technical cooperation with China on pollution prevention technologies and practices through workshops, assessments, and technology demonstrations has been completed.

U.S. - China Energy and Environment Technology Center

Partners: Office of International Activities, the Department of Energy

This is an on-going project involving technical cooperation with China to disseminate information on energy and environmental technology related to electric power. The project also encompasses information exchange, demonstrations, and research on energy and environmental technologies such as clean coal, oil, and gas.

Wind Energy Mapping

This project was completed utilizing cooperation with China to compile information on wind resources in the People's Republic of China. This mapping project is expected to facilitate greater U.S. private sector involvement in wind energy projects in China. The end result was greater wind technology sales by one U.S. company.

Lawrence Livermore National Laboratory (LLNL)

Web address: http://www.llnl.gov/

Cost Effective Desalinization Using Capacitive Deionization

Partners: Various Asian countries

Discussions and contracts are currently being discussed with China and other Asia-Pacific states.

Environmental Technologies and Evaluation Methodologies

Partners: Tulane University, USA/China Institute and the Center for Energy and Environmental Technologies at the China Academy located at Tsinghua University.

With the U.S. Department of Energy, the LLNL is establishing models for various regions of China that are in need of energy and environmental analysis along with economic evaluation of new technologies for implementation. LLNL is also collaborating with the Fossil Energy group within U.S. DoE to assist in planning for new clean energy and renewable sources of energy for China.

Regional Water Resource Planning and Infrastructure Building

Partners: World Bank and Asian Development Fund Infrastructure Building

This is sponsored by the World Bank and Asian Development Fund and includes a new water project in Sichuan Province.

National Aeronautic And Space Administration (NASA)

Web address: http://www.nasa.gov/

Research Agreement: Mapping

Partner: Chinese Academy of Sciences (CAS)

Under a 1992 agreement between NASA and the CAS, a Chinese Principal Investigator is participating in the NASA Dynamics of the Solid Earth (DOSE) program. Through this agreement, NASA and CAS are cooperating in exchange of data from Satellite Laser Ranging Stations, Very Long Baseline Interferometry, and Global Positioning Systems.

National Park Service (NPS)

Web address: http://www.nps.gov/

March for Parks

Bilateral meetings were held between Chinese and U.S. parks officials in 1996. The aim of these meetings was to discuss park management strategies and techniques. High level meetings with the Chinese and officials from the

Department of Interior and National Park Service were also held in 1996. These meetings discussed the possibility of formalizing a relationship among the National Park Service, Peace Corps, and the Chinese Ministry of Construction.

National Park Service/Office of International Affairs

United States National Park Service-People's Republic of China Cooperation

Partners: Peace Corps, Republic of China Cooperation

In 1988, the NPS developed an agreement with the Sichuan Provincial Construction Commission to allow cooperative technical exchanges, as well as joint planning and scientific research activities between these two agencies.

Nuclear Regulatory Commission (NRC)

Web address: http://www.nrc.gov/

Cooperative Agreement: Nuclear Safety

Partner: China's National Nuclear Safety Administration

The NRC has an active program of cooperation with China's National Nuclear Safety Administration and works within the framework of the U.S. Congressional sanctions that limit cooperation to publicly available safety information. Current and future cooperation will focus on power reactor operating performance, material safety, and emergency preparedness.

United States Army Corps of Engineers

Web address: http://www.usace.army.mil/

Research Agreement: Dams

Partner: National Science Foundation

Jointly with the National Science Foundation, the Corps of Engineers is studying the dynamic behavior of arch dams including effects of interaction of the dam with the impounded water and foundation rock.

United States Export-Import Bank

Web Address: http://www.exim.gov/

Clean Energy Program

Partners: China Development Bank, Department of Energy
Funding: U.S. $100 million
Status/Schedule: Approved December 1999

This Clean Energy Program provides financing to Chinese enterprises for the purchase of U.S. equipment and services for clean energy projects, which include wind, solar, geothermal, clean coal, and industrial cogeneration projects. The program has been designed to bring in projects with high rates of return and small projects that fall below the threshold of conventional loans. The Chinese Development Bank will be the borrower under the program, however, final loan applications will be accepted only after approval of the State Development Planning Commission. The China Development Bank can apply for either a direct loan or a guaranteed loan. The program will provide the most favorable terms allowed under OECD guidelines including maximum repayment terms, capitalization of interest during construction, and financing of eligible local costs up to fifteen percent of the value of the eligible U.S.

export contract. The Eximbank can make enhancements to the program by offering yen financing at a reduced rate, but the borrower would bear the foreign exchange risk. The Department of Energy will provide expert assistance in project identification and review.

United States Peace Corps

Web address: http://www.peacecorps.gov/

Teaching English as a Foreign Language (TEFL) Project, Including Development of Several Environmental English Classes

Partners: Chinese Education Association for International Exchange, and the Sichuan Educational Association for International Exchange

Peace Corps/China (in China, Peace Corps is known as the U.S.-China Friendship Volunteers) is presently exploring development of expanded environmental activities in China. There is considerable interest in enlarging the existing TEFL project to enhance the English skills of Chinese working in the environmental area. Possibilities include providing Peace Corps English teachers to nature reserves, forestry colleges, and specific offices focusing on environmental protection activities. In addition, the potential exists to develop an environmental project utilizing parks and wildlife, environmental education, and forestry volunteers. Exploratory meetings are underway in Beijing and Chengdu.

ASIA PROGRAM

Below is a selection of recent Asia Program meetings at the Woodrow Wilson Center. For additional information on these meetings please refer to the Woodrow Wilson Center website (http://wwics.si.edu).

9 May 2000

Conference on U.S.-China Relations Since the End of the Cold War

This conference includes panel sessions on the following themes:

- The Impact of Tiananmen and the End of the Cold War
- Human Rights and MFN, 1993-2000
- The Taiwan Dilemma
- Convergences and Divergences of U.S.-China Strategic Interests in the 21st Century

Speakers: Nancy Pelosi, U.S. Representative; Stanley Roth, Assistant Secretary, Bureau of East Asian and Pacific Affairs, U.S. Department of State; Richard Solomon, President, United States Institute of Peace; Mann, James, Columnist, Los Angeles Times; Xing Qu, Xing, Associate Dean, Foreign Affairs College (Beijing), and others.

16 May 2000

Censoring History: Citizenship and Memory in Japan, Germany, and the United States

Speaker: Laura Hein, Fellow, Woodrow Wilson Center and Associate Professor of History, Northwestern University; and Commentator: Louise Young, Assistant Professor of History, New York University

24 May 2000

India and the U.S. Congress

Speaker: Arthur Rubinoff, Public Policy Scholar, Woodrow Wilson Center, and Professor of Political Science, University of Toronto.

Part II. Bilateral Government Activities

Australia

Note: All Grant and loan values are converted from Australian dollars to U.S. dollars using the exchange rate of A $1 = U.S. $0.6493, the market rate on October 14, 1999 at 2:31 PM EDT.

Australian Government

Action Program for Water Sector

Partners: World Bank, Chinese Ministry of Water Resources, Chinese Ministry of Finance, Chinese Ministry of Foreign Trade and Economic Cooperation (MOFTEC)
Focus: Water Pollution, Floods, Water Supply
Funding: U.S. $1.3 million (Grant)
Status/Schedule: Initiated September 1998, Completed August 1999

This project aimed to assist the Chinese Ministry of Water Resources in addressing fundamental water resource problems such as floods, pollution, environmental degradation, and water shortages. This water sector project also worked towards developing solutions to fragmented water management at both the national and provincial levels. The project's activities encompassed solution-oriented studies addressing topics such as flood damage prevention and mitigation, water pollution management, water supply augmentation, water demand management, water conflict resolution, and integrated basin management (Source: *Chinabrief*, November 1998).

Renewable Energy Project

Partners: MOFTEC, State Council, State Development and Planning Commission, State Economic and Trade Commission, Ministry of Science and Technology, State Environmental Protection Agency
Focus: Renewable Energy
Funding: U.S. $2.9 million (Grant)
Status/Schedule: Initiated 1998, Targeted for Completion 2003

The project aims to remove barriers that currently impede the widespread adoption of renewable energy technologies. The project hopes to strengthen the capacity of China to shift from supply-oriented technology deployment to demand-driven investment and consumer-friendly approaches. In order to accomplish these goals, the project will develop market-based institutions and instruments for renewable energy industry and investors. It supports pilot projects for five renewable technologies: solar and wind hybrid power systems for rural electrification, wind farms, biogas production, biogas co-generation, and solar hot water heaters.

AusAid

Web Address: http://www.ausaid.gov.au/

Automation of Hydrological Data Collection Project

Partners: China Ministry of Water Resources, Data Electronics
Focus: Flood Control
Funding: U.S. $909,000 (Grant portion of soft loan)
Status/Schedule: Initiated September 1997

This project has been helping China to construct an automatic hydrological data collection system so that approximately half of the rain gauges and water control stations in China could log data automatically. The goal is to provide

more accurate hydrological data, which is essential for making accurate flood control forecasts. Foreign assistance is needed because China can not manufacture solid-state data loggers to the necessary degree of accuracy.

Beijing Natural Gas Distribution Project

Partners: Beijing Natural Gas Company, Premier Controls
Focus: Gas
Funding: U.S. $840,000 (Grant portion of soft loan)
Status/Schedule: Initiated 1997, Completed 1998

This soft loan supported the supply of equipment and technical expertise for rebuilding part of the Beijing natural gas distribution network and for reconstructing the high-pressure feeder main from Wang Si Ying to Zhong Guan Cun. The feeder main was having serious problems and required complete rebuilding.

Development of Ecological Environment, Changtou River Valley, Shanxi Province

Partner: Shanxi Council on Foreign Economic Relations and Trade (COFERT)
Focus: Soil Erosion, Animal Husbandry
Funding: U.S. $63,000
Status/Schedule: Initiated June 1995, Completed June 1996

The goal was to reduce soil erosion and to increase opportunities for animal husbandry and self-sufficiency in four pre-existing experimental areas in the Changtou River Valley. Funds were used to provide technical equipment for the existing Ecological and Agricultural Supervision Station and to purchase goats, grass, seeds, and tree saplings.

Firewood Replacement Project, Du An County

Partner: CARE Australia
Focus: Deforestation, Erosion
Funding: U.S. $49,000 (Grant)
Status/Schedule: AusAid funding Initiated 1994, Completed 1995; CARE Funding Initiated September 1997

This project supplies firewood to the poorest and most remote communities in Du An county, by planting an improved mix of tree species, introducing the cultivation of fruit trees for income, and supporting the purchase of more efficient stoves. The goal of these efforts is to slow the erosion of steep hillsides and the rate of related environmental damage in the county. The project encompasses 1,000 households in seven villages.

Guangxi Urban Environment Project

Partners: Guangxi Regional Environmental Protection Bureau, World Bank, Australian consultants CMPS&F Pty. Ltd. and Sinclair Knight Merz
Focus: Water Pollution, Industrial Waste
Funding: U.S. $666,000 (2 grants combined)
Status/Schedule: Initiated July 1995

The project has helped to improve wastewater management and treatment and municipal and industrial waste management in Nanning and Guangxi Provinces. Its goal is to protect and improve the health of natural waterways.

Hainan Land Resource Fundamental Information System

Partners: China National Bureau of Surveying and Mapping, Hassall & Associates
Focus: Surveying, Regional Planning
Funding: U.S. $3.2 million (Grant)
Status/Schedule: Initiated 1995, Completed 1998

The project addressed the critical shortage of information regarding the land and natural resources of Hainan Island. This information was needed for planning sustainable development on the island. In particular, the project developed a Land-Resource Fundamental Information System and applied it to development planning. The project helped to prepare local development plans for Sanya City and a regional plan for Hainan Island as a whole.

Hefei Sewage Treatment Project

Partners: Hefei Provincial Construction Authority, Blohm and Voss (Australia) Pty. Ltd.
Focus: Sewage Treatment
Funding: U.S. $1.9 million (Grant portion of soft loan)
Status/Schedule: Initiated 1995, Targeted Completion 2001

The project designed and constructed a 150 million liters per day sewage treatment plant in Hefei City. The Australian supplier provided equipment, design expertise, supervision, and training for the construction and commissioning of the plant. Constructing the plant was the first stage of the sewage master plan for Hefei City. Although the project's construction ran behind schedule because of unfavorable weather and design flaws, the Asian Development Bank nevertheless agreed to provide U.S. $21 million in loans to construct a second treatment facility, which as of September 1997 was scheduled to be completed in 2001.

Hubei Urban Environment Project

Partners: Hubei Environmental Protection Bureau, World Bank, Overseas Projects Corporation of Victoria (OPCV) in association with Canal Wagner Pty., Kinhill Engineering PL, and Gippsland Water
Focus: Sewage, Municipal Waste, Industrial Pollution Control
Funding: U.S. $935,000 (Grant)
Status/Schedule: Initiated 1994, Completed 1995

The Australian grant funded the preparation phase for a U.S. $125 million dollar World Bank project, which focuses on capacity building, policy formation, and institution building in the fields of night soil utilization, municipal solid waste management, industrial pollution control, water quality monitoring, and sewage and sanitation.

Inner Mongolia Grasslands Conservation Project

Partner: Inner Mongolia Department of Foreign Economic Relations and Trade
Focus: Grasslands Conservation
Funding: U.S. $4.0 million (Grant)
Status/Schedule: Initiated 1996, Targeted for Completion 2000

The project has multiple objectives: to establish a variety of profitable village level enterprises—especially those run by women, to improve animal control and grasslands utilization standards and policies, to improve animal husbandry standards, to build the breed base of flocks and herds, and to help build the capacity and strength of the Xingan Animal Husbandry Bureau.

Jingdezhen Refrigerator Compressor Plant Project

Partners: Huayi General Electric Company, Kirkby Engineering (Australia)
Focus: CFC-free Compressors
Funding: U.S. $9.5 million (Grant portion of soft loan)
Status/Schedule: Completed 1996

This project supported the construction of China's first CFC-free refrigerator/freezer air compressor plant, which was designed to produce one million energy-efficient, non-CFC refrigeration and freezer compressors per year. Kirkby Engineering provided expertise, technology, machine tools, and equipment to help the Huayi General Electric Company complete the plant.

Kunming Sewage Treatment Project

Partners: Kunming Municipal and Public Utility Bureau, BHP Engineering
Focus: Sewage Treatment
Funding: U.S. $1.6 million (Grant portion of soft loan)
Status/Schedule: Initiated 1995

The project designs and builds the Kunming Sewage Treatment Plant in Yunnan Province, which will boost capacity to 100 million liters per day. This project is a part of the larger Kunming Sewage Master Plan, which aims to control water pollution and related problems in and around Dianchi Lake. Through these efforts, the plan hopes to revive the area's tourist value and decrease the health risks for the people of Kunming City, who depend on the lake for drinking water, seafood, irrigation, and recreation.

Local Coal Gasification Projects

Partners: Yingkou Municipal Gas Company, Henan Provincial Coal Industry Bureau, Huangshi Gas Company, Various Australian Suppliers
Focus: Coal Gasification
Funding: U.S. $27.5 million (Grant portion of soft loan)
Status/Schedule: Initiated 1994, Completed 1998

AusAID provided this soft loan to support the purchase of equipment from Warren Engineering Pty. Ltd. (Yingkou), Energy Equipment Pty./CMPS (Henan), F Pty. Ltd. Joint Venture (Henan), and Warman International (Huang Shi). The project's objective is to reduce indoor and outdoor air pollution emissions by supplying coal gas to households, hospitals, and possibly industrial facilities. Before the project, the households typically burned coal for domestic heating and cooking.

Mine Waste Management

Partners: Beijing General Research Institute for Mining and Metallurgy, China National Non-Ferrous Metals Corporation, ACIL/AGC Woodward-Clyde Consortium
Focus: Mining
Funding: U.S. $4.4 million (Grant)
Status/Schedule: Initiated 1993, Completed 1997

The goal of this project was to reduce environmental damage from the disposal of mine waste. The project established an Institute for Mine Waste Management Research, developed and tested research methods and guidelines for the rehabilitation of damaged areas, designed and implemented a mine waste management policy for the China National Non-Ferrous Metals Corporation, and wrote plans for the rehabilitation of existing tailing reservoirs.

More Energy Efficient Boiler Manufacture

Partners: Taiyuan Number 2 Boiler Works, Maxitherm Australia Pty. Ltd.
Focus: Boilers
Funding: U.S. $2.5 million (Grant portion of soft loan)
Status/Schedule: Initiated 1996, Completed 1997

The soft loan supported the manufacture of relatively fuel-efficient packaged boilers, by providing technology, training, machinery, and ongoing support.

Nationwide Environmental Education Course Number 2

Partner: China Environment Protection Foundation
Focus: Environmental Education

Funding: U.S. $1,950 (Grant)
Status/Schedule: Initiated 1996, Completed 1997

Funds were used to purchase training materials for this environmental education training course, which targets primary and middle school students. The course is nonprofit and is run by volunteer environmental experts.

Second Shanghai Sewerage Technical Review Panel

Partner: Shanghai Municipal Government
Focus: Wastewater
Funding: U.S. $115,000 (Grant)
Status/Schedule: Initiated December 1995, Completed March 1996

The World Bank was in the process of providing loans for a new wastewater outfall in Shanghai, which would be the largest in the world. This panel reviewed the design and construction of the project to help ensure that it would be carried out safely and effectively.

Shanghai Battery Recycling

Partners: Minproc (Australia)
Focus: Battery Recycling
Funding: U.S. $910,000 (Grant portion of soft loan)
Status/Schedule: Initiated April 1996, Targeted Completion 2000

The loan is for a new plant that recovers lead and some plastics from spent vehicle batteries. The plant, which is located in Shanghai, will process batteries from six provinces in eastern China.

Shanghai Environmental Master Plan Study

Partners: Shanghai Research Institute for Environmental Protection, World Bank, Kinhill-PPK SEMP Joint Venture
Focus: Urban Planning, Urban Management, Institutional Strengthening
Funding: U.S. $844,000 (Grant)
Status/Schedule: Initiated 1992, Completed 1996

The grant funded technical assistance and project management components of the World Bank's U.S. $527 million environmental project in Shanghai. The project included financial and policy initiatives and planning and management reforms, which were supported by an investment program for environmentally-oriented capital works and institutional strengthening.

Sichuan Urban Environmental Project and Chongqing Urban Environment Project

Partners: Sichuan Environmental Protection Bureau, World Bank, Ausino Engineering
Focus: Water Supply, Wastewater Management, Solid Waste
Funding: U.S. $147,000 (Grant)
Status/Schedule: Initiated 1995

This grant assists the design of a U.S. $800 million loan project by providing a sector review. The initial sector review examined water supply and wastewater management in a number of cities in Sichuan. Goals included: 1) enabling Sichuan municipalities to recover from past degradation of water and land resources; and 2) putting in place policies, practices, and institutions to facilitate and sustain the cost-effective provision of essential services. The sector review activities then were extended to fund an initial sector review in the Chongqing municipality. This sector review was required to identify key issues in the water, wastewater, and solid waste sectors, with the objective of working with local agencies to produce some provisional development strategies for these sectors.

Tarim Basin II

Partners: World Bank, Tarim Basin Water Resources Commission, MOFTEC, Chinese Ministry of Finance
Focus: Integrated Pest Management, Water Resources
Funding: U.S. $1.9 million (Grant)
Status/Schedule: Initiated 1998, Targeted Completion 2000

This project follows up on an earlier one. The project has three main goals: 1) to help poor minority farmers increase their incomes through sustainable irrigated agriculture development; 2) to introduce systems and mechanisms to help promote sustainable development and the sustainable management of water resources in the Tarim Basin; and 3) to partially restore the forests and pastures of the lower reaches of the Tarim River. The Australian portion of the project will support three sub-components: institutional development at the Tarim Basin Water Resources Commission; the preparation of a master plan for development in the lake catchment; and the implementation of integrated pest management practices (Source: *Chinabrief*, November 1998).

21st Century Urban Water Management Project

Partners: Chinese Ministry of Construction and United Nations Development Programme (UNDP)
Focus: Water Management
Funding: U.S. $600,000 (AusAid grant), U.S. $500,000 (UNDP grant)
Status/Schedule: Initiated 1997, Targeted Completion 1999

The project assists the Ministry of Construction in launching a National Program for Sustainable Urban Water Management in China and in developing the institutional capacity to implement it. The overall objective is to improve water and wastewater management by developing and demonstrating an effective process for institutional reform and the implementation of a water demand management strategy.

Wei Hai Sewage Treatment Plant

Partners: Environmental Protection Bureau of Wei Hai City, Overseas Projects Corporation of Victoria (Australia)
Focus: Sewage Treatment, Offshore Disposal
Funding: U.S. $1.4 million (Grant portion of soft loan)
Status/Schedule: Initiated 1992

This project has supported the construction of a sewage treatment plant that pre-treats water from the town and then disposes of it offshore, where the deep water and strong ocean currents are supposed to keep the environmental effects minimal. Planners have hoped that the project would improve human living conditions in the area and enable the aquatic ecosystems in the bay to rebound, which in turn would benefit the region's economy.

Xingtai Waste Water Treatment

Partners: Urban and Rural Construction Commission of Xingtai City, Hebei Construction Authority
Focus: Wastewater Treatment
Funding: U.S. $1.5 million (Grant portion of soft loan)
Status/Schedule: Initiated 1995, Completed 1999

The project constructed a wastewater treatment plant with a mean throughput capacity of 150,000 cubic meters per day. The city of Xingtai, Hebei Province (population 400,000) previously discharged its wastewater directly into the waterways in and around the city, which severely polluted the city's water source.

Zhangzhou Waste Water Treatment

Partners: Zhangzhou Public Utility Bureau, Overseas Projects Corporation of Victoria (OPCV, Australia)

Focus: Wastewater Treatment
Funding: U.S. $1.4 million (Grant portion of soft loan)
Status/Schedule: Completed early 1998

The project built a secondary sewage treatment plant with a capacity of 100,000 cubic meters per day, which treats partly-treated industrial waste flows that are released mainly from a sugar factory.

Zunyi Waste Water Treatment Plant

Partners: Zunyi Water Supply Company, OPCV (Australia)
Focus: Wastewater Treatment
Funding: U.S. $1.4 million (Grant portion of soft loan)
Status/Schedule: Initiated 1997, Targeted for Completion 2002

The project provides equipment and related services for a wastewater treatment plant to supply drinking water to Zunyi City.

Australian Centre for International Agricultural Research (ACIAR)

Web Address: http://www.aciar.gov.au/

Eucalypts and Groundwater: Managing Plantations to Avoid Resource Depletion and Environmental Detriment in China and Australia

Partners: Department of Natural Resources & Environment, Centre for Forest Tree Technology, Australia; University of Melbourne; CSIRO Land and Water; Research Institute of Tropical Forestry, China; South China Institute of Botany; and China Eucalypt Research Centre.
Focus: Forestry, Groundwater Resources
Status/Schedule: Initiated late 1990s

This project aims to gather crucial quantitative information for predicting the productivity and sustainability of eucalyptus plantations in southern China or northeastern Victoria. With the view that site hydrology and productivity are inseparably linked, this project will gather data from eucalyptus stands in southern China. Activities will include measuring stand water use under a range of site conditions and management options. The data gathered will be analyzed with the aid of stand growth and hydrological models developed from data arising from other sources. This study strategy will be applied to plantations in northeastern Victoria.

Integrated Control of Citrus Pests in China and Southeast Asia

Partners: University of Western Sydney, Hawkesbury; Guangdong Entomological Institute, China; Department of Agriculture, Agriculture Research Centre, Semongsk, Malaysia; Department of Agriculture, Entomology & Zoology Division, Thailand; National Institute of Plant Protection, Biological Control Research Center, Vietnam.
Focus: Pest Management
Status/Schedule: Initiated late 1990s

This project aims to reduce the use of broad spectrum pesticides in China and Southeast Asia by implementing sustainable integrated pest management (IPM) programs based on the use of petroleum spray oils. IPM focuses on minimizing the use of pesticides and maximizing the use of natural enemies while optimizing production yields and fruit quality. The researchers on this project will conduct experiments in seventeen locations throughout Southeast Asia to establish the efficacy and cost effectiveness of implementing IPM programs. Workshops will also be held in China. This current project is based on earlier trials in China and Australia that utilized petroleum spray oils to effectively control citrus pests.

Impact of Water Saving Irrigation Techniques in China

Partners: International Rice Research Institute (IRRI); International Water Management Institute (IWMI), Sri Lanka; Zhejiang Agricultural University, Department of Soil Science and Agricultural Chemistry, China; Wuhan University of Hydraulic and Electric Engineering, China
Focus: Water Conservation
Status/Schedule: Initiated late 1990s

Within the framework of the System Wide Initiative on Water Management (SWIM), scientists from IWMI and IRRI are collaborating with Chinese scientists to find ways to increase rice yields with less water by utilizing Water Saving Irrigation (WSI) techniques. Water conservation in rice production is particularly important for China, where level of access to fresh water is one of the lowest in Asia and still declining. In an effort to optimize the use of valuable water resources, this project will address some of the technical issues underlying the successful application of WSI techniques. These issues include the impact on fertilizer use, the financial costs and benefits to farmers, the implications of the eventual large-scale adoption of these techniques on water savings, and water productivity increases.

Improved Orchard Productivity and Water Use Efficiency Using Modern Irrigation and Tree Management Techniques in Northern China

Partners: Institute of Sustainable Irrigated Agriculture, Victoria; China Agricultural University; Beijing; Horticultural Research Institute
Focus: Forestry, Water Use, Irrigation
State/Status: Initiated late 1990s

ACIAR has supported research into irrigation and orchard tree management in northern China for nine years. Outcomes of these projects were highly relevant to many parts of northern China, and researchers recommended that a more comprehensive development project be undertaken. This project aims to promote the adoption of the outcomes of the previous irrigation research both within China and other countries. The project will demonstrate through commercial scale in four major fruit growing areas and conduct training programs for farm managers and extension staff. Australian scientists will produce and test a computer-based model of tree and fruit development, irrigation, salinity, and nutrient losses that will form the basis of an expert system that will address a multitude of complex problems confronting Australia's orchard industry.

Improvement of IPM of Brassica Vegetable Crops in China and Australia

Focus: Pest Management
Partners: University of Queensland, Department of Entomology, Australia; Queensland Department of Primary Industries, Australia; Zhejiang University, Department of Plant Protection, China; Hunan Agricultural University, China; Zhejiang Academy of Agricultural Sciences, China; Zhejiang Department of Agriculture, China
Status/Schedule: Initiated late 1990s

Brassica crops are highly susceptible to insect damage and growers have attempted to control the pests with large amounts of chemical sprays. In this project, a continuation of earlier ACIAR research, scientists will further refine regimes of integrated pest management that significantly reduce the need to spray by studying the major factors affecting pest numbers in brassica crops and the role of beneficial organisms (parasitoids, predators, and pathogens) in suppressing pest numbers. Project activities include the measuring the impact of major pests on crop yield and quality loss; investigating how to modify insecticide regimes to promote the use of 'soft' insecticides; and minimizing the amounts applied. In order to promote wider acceptance of IPM in brassica production, the project will also evaluate different pest management regimes.

Priorities for Public Investment in Chinese Agriculture

Partners: Australian National University, National Centre for Development Studies, University of Adelaide, Department of Economics, Australia; Chinese Academy of Agricultural Sciences, Institute of Agricultural Economics; State Planning Commission, Economic Research Institute, China; International Food Policy Research Institute, USA. (Commissioned organization)
Focus: Investment
Status/Schedule: Initiated late 1990s

This project will undertake a series of policy research reports to provide national and regional policy makers in China with information to evaluate the impact of public investment in different sector, and future priorities for investment. The goal of this research is to help guide the Chinese government in determining appropriate levels of investment in agricultural research, particularly to determine which sub-sectors (cereal crops, cash crops, animals, or freshwater fisheries) deserve the greatest investment. Moreover, the study will identify which agro-ecological zones hold the most promising investment for both production increases and poverty alleviation. These studies will also help Chinese officials set the levels of investment in agriculture in relation to other sectors of the economy.

Canada

Note: All grant values are converted from Canadian dollars to U.S. dollars using the exchange rate of C $1 = U.S. $0.675, the market rate on October 14, 1999 at 2:30 PM EDT.

Canadian International Development Agency (CIDA)

Web Address: http://www.acdi-cida.gc.ca/index.htm

Applying Economic Research Institute Linkages

Partner: International Trade Research Institute
Focus: Economic Reform
Funding: U.S. $3.3 million (Grant)
Status/Schedule: Initiated 1992, Targeted Completion 1997

The project supported cooperative research between selected Canadian and Chinese applied economic research institutes. The research focused on areas of mutual interest, including environmental protection.

Assistance to Open Cities—Phase II

Partners: Special Economic Zones Office (China), Federation of Canadian Municipalities
Focus: Urban Management
Funding: U.S. $5.4 million (Grant)
Status/Schedule: Initiated 1993, Completed 1999

This program consists of two phases. Phase one trained Chinese bureaucrats and policymakers in urban management and environmental issues. Phase two of this project focused on urban management issues related to environmental protection and trade/investment. Training programs included seminars in China and Canada, study tours in Canada, and courses conducted at Nankai University (Tianjin) and the Minhang Cadre Training Center (near Shanghai).

Canada-China Cooperation Project in Cleaner Production

Partners: State Economic and Trade Commission (SETC), National Environmental Protection Agency (now SEPA), Coopers and Lybrand Consulting, SNC Lavalin Environment, ESSA Technologies
Focus: Cleaner Production

Funding: U.S. $7.1 million (Grant)
Status/Schedule: Initiated 1996, Targeted Completion 2001

This project attempts to help position Canadian firms for participation in World Bank environmental protection and industrial restructuring investments in the Huai River Basin. It does so by helping Chinese authorities and companies to apply cleaner production techniques at two locations in the Huai River basin. The project also aims to help improve the capacity of SETC and SEPA to promote the use of cleaner production technologies in the chemical and light industry sectors.

China Council for International Cooperation on Environment and Development (CCICED)

Partners: National Environmental Protection Agency (now SEPA), Simon Fraser University
Focus: Policy
Grant: U.S. $6.7 million
Status/Schedule: Initiated 1992

This project attempts to help China formulate policies that recognize the crucial linkages between environmental sustainability and economic and social development. It supports the CCICED, which brings together high-level experts and policymakers from China and abroad. The group drafts policy recommendations that are given directly to a senior representative of China's State Council. To help formulate these policy recommendations, the council has seven working groups that explore specific issues more in-depth. The Working Group categories include: Energy Strategy and Technology, Pollution Control, Environmental Economics, Protection of Biodiversity, Trade and Environment, Sustainable Agriculture, Cleaner Industrial Protection, and Transportation and Environment. For more information, please visit the website at: http://www.harbour.sfu.ca/dlam/ is the web address for CCICED.

Clean Coal Technology Transfer

Partners: Chinese Ministry of Coal Industry (now State Coal Industry Bureau)
Focus: Coal
Grant: U.S. $7.4 million
Status/Schedule: Initiated 1998

This CIDA project aims to help China's State Coal Industry Bureau accelerate the use of power generation technologies that pollute far less than traditional coal fired plants. The project activities to attain this goal include building a training center, constructing a pilot project, offering technical assistance, and funding training, seminars, workshops, study tours, and practical attachments in Canada and China.

Dam Safety Monitoring and Management Project

Partners: Chinese Ministry of Water Resources, S.M. Group International Inc.
Focus: Dams
Funding: U.S. $5.4 million (Grant)
Status/Schedule: Initiated 1996, Completed 1999

This CIDA project attempts to enable its Chinese partner organizations to develop the ability to implement a comprehensive dam safety program. The project helps to bring dam safety policies and standards up to a level of consistency with international norms. Moreover, the project activities attempt to give Chinese oversight institutions the ability to enforce dam safety and design monitoring systems for ten dams in China.

Electric Power Research Institutes, Phase II

Partners: Chinese Ministry of Electric Power, British Columbia Hydro International
Focus: Electric Power

Funding: U.S. $3 million (Grant)
Status/Schedule: Initiated 1994, Completed 1997

The project aimed to improve the capacity of the Ministry of Electric Power's research institutes. The institutes received state-of-the-art technology and training in all elements of electric power systems research, a portion of which addresses mitigating the environmental effects of energy generation and transmission. The principal activities were seminars in China, technical missions to Canada, training courses in Canada, and specific high-technology technical assistance and cooperative research.

Energy Efficiency in Buildings Project

Partners: Chinese Ministry of Construction, Soprin/ADS International
Focus: Energy Efficiency
Funding: U.S. $5.7 million (Grant)
Status/Schedule: Initiated 1996, Targeted Completion 2001

The project uses Canadian technologies to help China's Ministry of Construction develop energy efficiency standards for buildings. The project supports energy efficiency pilot projects for selected building types and climates. It also introduces a comprehensive management system and incentive program to promote energy conservation. The project's overall goal is to help the civilian building sector achieve an energy saving rate of fifty percent by the year 2000 in the cities of Beijing and Shanghai and in Liaoning and Guangzhou Provinces. If achieved, this actually would lower carbon dioxide emissions despite these areas' steady increase in developed land, according to project planners. For this project Canada is providing technical assistance, training, workshops, seminars, study tours, "practical attachments" in China and Canada, collaborative research, and other unspecified activities.

Hebei Dryland Project

Partners: Ministry of Agriculture, Hebei Academy of Agriculture and Forestry Science
Focus: Agriculture
Funding: U.S. $6.6 million (Grant)
Status/Schedule: Initiated 1989, Targeted Completion 2001

The project sends agricultural scientists, training, and equipment to China and gives selected Chinese scientists the opportunity to work in Canada for a short time. The goal is to improve dry-land agricultural management in the Hebei Lowland Plain and thus to increase the efficiency of water use, improve soil and water quality, and build farming profitability.

As of April 1997, the project had put in place new irrigation methods that reduce water consumption by thirty percent without decreasing yields. It also introduced balanced fertilization practices that significantly decrease fertilizer use and the quantity of excess nitrates in the soil and groundwater. In addition, by April 1997, GIS applications and the economic analysis of land-use planning and community development had been completed, minimum tillage applications had been introduced, and twenty scientific publications had been completed.

Jiangsu Applied Managerial Training and Protection for Small and Medium Enterprises (SMEs)

Partners: Ministry of Foreign Trade and Economic Cooperation (MOFTEC), Foundation of International Training, and the following agencies in Jiangsu Province: Council on Foreign Trade and Technology (COFTEC), Environmental Protection Bureaus, and the Bureau of Township Village Enterprises
Focus: Policy, Enterprise Management
Funding: U.S. $3.4 million (Grant)
Status/Schedule: Initiated March 1998, Targeted Completion 2003

Jiangsu's Small and Medium Enterprises (SMEs) are positioned for growth and will damage the environment seri-

ously if they expand unregulated. In response, this CIDA project has three goals. First, to work directly with both SMEs and the provincial government to improve the management and economic performance of SMEs. The second goal is to help provincial authorities bring these enterprises under their jurisdiction with regard to environmental protection. The third goal is to develop pilot programs that will propagate improved environmental compliance among SMEs in the province.

Kunming Horticulture Exhibition—Trees for Life Canada

Partners: International Co-operation for Children—Trees for Life Canada, Trees for Life China
Focus: Environment
Funding: U.S. $52,872 (Grant)
Status/Schedule: Initiated 1998, Completed 1999

The purpose of this project was to support reforestation and enhanced awareness of the importance of trees in order to contribute to environmentally sustainable development in China. It involved the establishment of a booth during the opening weeks of the Kunming International Horticulture Exposition to promote environmental awareness; the planting of 100,000 trees; and the launching of the 1999 Trees for Life "Grow a Tree" Program with schoolchildren in Yunnan Province.

Oil and Gas Technology Transfer Program

Partners: China National Petroleum Corporation, Nova Gas/D&S International
Focus: Oil, Gas
Funding: U.S. $19.6 million (Grant)
Status/Schedule: Initiated 1994, Targeted Completion 2000

The project helps China to optimize the recovery of its oil and gas resources. The project has two objectives. The first is to help selected petroleum institutions and research centers improve their analysis and research capabilities in the fields of oil and natural gas development. The second objective is to enhance CIDA's long term planning and programming ability in China by conducting a petroleum sector review.

Public Sector Reform Program

Partner: Ministry of Foreign Trade and Economic Cooperation (MOFTEC)
Focus: Economic Development and Reform
Funding: U.S. $2.7 million (Grant)
Status/Schedule: Initiated 1998, Targeted Completion 2003

The purpose of this project is to enable key Chinese public sector decision-makers to be directly exposed in a timely fashion to a broad range of Canadian expertise, ideas, and experience in social, trade, financial, and other strategic policy areas, including the environment. This will be accomplished by bringing Canadian experts to China or by bringing Chinese decision-makers to Canada.

South China Power Studies, Phase II

Partners: Chinese Electric Power Planning and Engineering Institute, Canada China Electric Power Consultants
Focus: Electric Power
Funding: U.S. $5.3 million (Grant)
Status/Schedule: Initiated 1994, Completed 1999

This second phase of studies utilized the power planning techniques that were transferred in the first phase. Its studies focused on power planning up to the year 2015 for Yunnan, Guangxi, Guizhou, Guangdong, and Sichuan Provinces. The project included hands-on training, seminars, and workshops for local personnel. These activities

focused on planning and implementing major electricity developments, system transmission networks, and regional interconnections. Some portion of the project also focused on mitigating environmental damage from energy generation and transmission.

Strategic Energy Planning for Southern China

Partners: Chinese Ministry of Electric Power, Canada China Electric Power Consultants
Focus: Electric Power
Funding: U.S. $9.7 million (Grant)
Status/Schedule: Initiated 1995, Completed 1999

This project focused on technology transfer to help China import appropriate processes for the development of power and coal in South China. It introduced a market-based approach and according to its architects will operate in an economically, environmentally, and socially sustainable energy management framework. Canada helped China with planning and research, providing China and Canada-based training, furnishing some equipment and materials, and offering management services, monitoring, and evaluation.

Sustainable Resource Development in the Tarim Basin

Partners: China National Petroleum Corporation, Xinjiang Uygur Autonomous Region
Focus: Petroleum, Water Resources
Status/Schedule: Initiated fall of 1997

The goal of the project is to help its two partners develop a regional strategy for developing the petroleum resources of the Tarim Basin in an ecologically sustainable manner. The optimum allocation and use of water resources is a particular focus of the project. The project has two primary objectives: First, to help protect the environment in areas exploited for petroleum exploration and development and second, to improve the Xinjiang region's water and hydro-environmental resources and to develop a strategic plan for water supply to the petroleum industry, while taking into account the regional macro economy.

Denmark

Danish Government

Wastewater Treatment and Wind Energy

Focus: Wastewater Treatment, Wind Energy
Funding: U.S. $50 million (Loan)
Status/Schedule: Initiated sixteen projects in 1994; Completed ten projects in 1998; Six projects continue

Denmark has completed ten projects focusing on wastewater treatment and wind energy. The projects were conducted in various locations, notably in Inner Mongolia and Xinjiang and Guangdong Provinces. Six additional wastewater treatment and wind energy projects were ongoing as of November 1998 (Source: *Chinabrief*, November 1998).

Wastewater Treatment and Wind Energy

Focus: Wastewater Treatment, Wind Energy
Funding: U.S. $10 million (Loan)
Status/Schedule: Awaiting final approval as of November 1998

Four Danish projects focusing on wastewater treatment and wind energy were awaiting approval as of November 1998 (Source: *Chinabrief*, November 1998).

Wind Energy

Partner: Danida (Danish bilateral aid agency)
Focus: Wind Energy
Funding: Up to U.S. $100 million (Loan)
Status/Schedule: Initiated 1998, Targeted Completion 2002

In April 1998, Denmark and China agreed to develop a comprehensive program of wind energy projects, with a total loan value of up to U.S. $100 million. Some limited technical assistance grants also were offered by Danida, the Danish bilateral aid agency (Source: *Chinabrief*, November 1998).

European Union

Note: All grant values are converted from European to U.S. currency using the exchange rate of 1 Euro = U.S. $1.078, the market rate on October 14, 1999 at 7:19 PM EDT.

European Union-China Environmental Management Cooperation Program

Partners: China International Center for Sustainable Development (Beijing), Ministry of Foreign Trade and Economic Cooperation, State Science and Technology Commission (now Ministry of Science and Technology)
Focus: Policy, Environmental Management, Planning, and Enforcement
Funding: U.S. $14 million (Grant)
Status/Schedule: Initiated 1998

The project attempts to build capacity and influence local and municipal governments to adopt more sustainable development practices. These goals will be done in project activities by raising awareness, conducting forums, providing management and planning tools, and breaking down barriers and building networks between cities and government institutions in China. This EU funded project also attempts to influence industry by organizing conferences, providing training workshops on environmental management systems, conducting training courses, and implementing pilot programs for the implementation of environmental management techniques and environmental protection technologies. The funding for this project was still being negotiated as of February 1998.

The project has four salient objectives: 1) to help integrate environmental protection into sectoral policies, private industry, and public sector investment; 2) to further integrate environmental and sustainability considerations into public sector planning decisions and private industry; 3) to develop China's environmental management, planning, and enforcement capacity; and 4) to build cooperation between China and the European Union.

European Union-China Honghe Environment Protection and Poverty Alleviation Project, Pilot Phase

Partners: Yunnan Provincial Bureau of Foreign Trade and Economic Cooperation, Yunnan Poverty Alleviation Office, Yunnan Environmental Protection Bureau
Focus: Poverty, Agriculture, Micro-finance
Funding: U.S. $1.1 million (Grant)
Status/Schedule: Initiated October 1997, Completed 1999

The project had three objectives: 1) to reduce poverty and improve environmental protection in Yunnan Province; 2) to encourage the use of participatory and people-centered techniques to reduce poverty and protect the environment; and 3) to help minority communities develop entrepreneurial activities and work with government agencies on an equal footing. The project was designed to fund technical assistance from the Center For Integrated Agricultural Development, provide training, develop area plans, and provide topographical equipment and vehicles. It also

furnished micro-credit for chicken and pig raising, tree plantations, cash crop production projects, and numerous other types of projects.

Liaoning Integrated Environmental Program

Focus: Clean Production, Waste Minimization, Recycling, Energy Efficiency, Alternative Energy
Funding: U.S. $40 million (Grant)
Status/Schedule: Initiated 1998, Targeted Completion 2003

This large project in Liaoning Province has three objectives: 1) to build environmental awareness and improve environmental planning, management, enforcement; 2) to promote cleaner production, waste reduction, recycling, energy efficiency, and alternative energy; and 3) to support economic and social restructuring.

The EU funded project includes eight core activities: 1) establishing a program office that is responsible for raising awareness and sharing information with the public and government institutions; 2) preparing an integrated master plan for the municipality of Shenyang; 3) improving the management of water resources and control of water pollution emissions in the Liao River basin; 4) improving air quality monitoring and management; 5) promoting the use of gas and formulating an improved energy policy; 6) promoting cleaner production through training, seminars, a Cleaner Production Center, and a previously established cleaner production revolving fund; 7) assisting industrial restructuring at the enterprise and sector level; and 8) promoting investment by surveying enterprises, providing policy advice, identifying constraints to investment, and fostering contacts with EU industry.

Federal Republic of Germany

Note: All Grant and loan values are converted from Deutsche Marks to U.S. dollars using the exchange rate of 1 DM = U.S. $0.5513, the market rate on October 14, 1999 at 2:30 PM EDT.

Federal Ministry for Economic Cooperation (Bundesministerium für Wirtschaftlich Zusammenarbeit und Entwicklung—BMZ)

Web Address: http://www.bmz.de/

Advisory Inputs for the Longkou and Lanzhou Coal-fired Power Plants

Focus: Power, Coal
Funding: U.S. $1.3 million (Loan)
Status/Schedule: Initiated June 1997

This Federal Ministry for Economic Cooperation (BMZ) technical cooperation project involves the disposal of coal ash, a waste product of heat generation. It uses the ash as a raw material to produce building blocks, and utilizes relatively low-impact dumping.

Advisory Services for the Introduction of International Environmental Standards

Partner: National Environmental Protection Agency (now SEPA)
Focus: Environmental Management
Funding: U.S. $1.4 million (Grant)
Status/Schedule: Initiated June 1997

This technical cooperation project pays for advisory services for the staff of government environmental institutions and consulting businesses that are involved in using ISO 14,000 management practices to reduce industrial environmental protection.

Afforestation with Fast-growing Tree Species

Focus: Forestry
Funding: U.S. $4.2 million (Grant)
Status/Schedule: Initiated June 1997

This technical cooperation project helps to produce ecologically stable forests. This BMZ funded project is part of China's national afforestation program.

Basic and Advanced Training in the Forestry Sector

Focus: Forestry
Funding: U.S. $2.8 million (Grant)
Status/Schedule: Initiated June 1997

This technical cooperation project aims to improve basic and advanced training in the forestry sector.

Biological Control of Forest-based Pests

Focus: Forestry, Pest Management
Funding: U.S. $3.4 million (Grant)
Status/Schedule: Initiated June 1997

According to a document furnished by the BMZ, this technical cooperation project develops mature methods to control forest-based pests.

Center for Power Station Technology and Energy Management in Xian

Focus: Power, Energy Management
Funding: U.S. $2.2 million (Grant)
Status/Schedule: Initiated June 1997

This BMZ technical cooperation project funds power engineering and energy management-related seminars and training activities.

CFC-free Technologies for the Refrigerator Industry

Focus: Ozone Depleting Substitutes
Funding: U.S. $550,000 (Grant)
Status/Schedule: Initiated June 1997

This technical cooperation project conducts conversion studies for up to ten refrigerator producers.

CIB III

Focus: Environmental Industry
Funding: U.S. $19 million (Loan)
Status/Schedule: Initiated 1997

This project extends a cash line of credit for financing environment-related investment. The target group is private sector enterprises and state-owned companies that have become incorporated. The project began accepting investor applications as of June 1997.

Coal-fired Power Plant in Tianjin (Yang Liu Qing)

Focus: Power, Coal
Funding: U.S. $72.8 million (Loan)

Status/Schedule: Initiated June 1997

This financial cooperation project involves two 300 MW units with slag tap-fired boiler firing systems. These units use slag as a material additive.

Coke-gas Purification in Beijing

Focus: Coke-gas Purification
Funding: U.S. $14.1 million (Loan)
Status/Schedule: Initiated June 1997

This financial cooperation project expanded the coke-gas purification facilities at the Beijing coking plant. This project increased gas supply to the area and reduced air pollution by lowering the combustion of coal.

Credit Program I

Partners: Export-Import Bank of China, Agricultural Bank of China
Focus: Environmental Industry
Funding: U.S. $36 million (Loan)
Status/Schedule: Initiated 1997

This loan extends a cash line of credit for financing environment-related investment. The target group is private-sector enterprises and state-owned companies that have become incorporated. The project began accepting loan applications as of June 1997.

Development and Implementation of Participatory Approaches in Agriculture and Forestry

Focus: Agriculture, Forestry
Funding: U.S. $2.2 million (Grant)
Status/Schedule: Initiated June 1997

This technical cooperation project includes local people in agricultural and forestry planning. The participatory planning approaches employed in this BMZ project also consider both ecological and economic principles.

Development of Concepts for the Appropriate Supply of Energy

Focus: Ozone, Energy
Funding: U.S. $400,000 (Grant)
Status/Schedule: Initiated June 1997

This technical assistance project provides support for the implementation of the Montreal Protocol in China.

Forest Fire Protection

Focus: Forestry
Funding: U.S. $2.2 million (Grant)
Status/Schedule: Initiated June 1997

This technical cooperation project gives foresters fire-fighting training and provides for the transfer of fire-fighting technologies.

Gasifiable Coal Briquetting

Focus: Coal
Funding: U.S. $300,000 (Grant)
Status/Schedule: Initiated June 1997

This technical assistance project is a preparatory study on gasifiable coal briquetting, which the BMZ calls "environ-

mentally friendly energy generation."

Greenhouse-effect Reduction Study

Focus: Climate Change
Funding: U.S. $390,000 (Grant)
Status/Schedule: Initiated June 1997

This technical cooperation project identifies options for carbon dioxide reduction. It is part of a larger DM 5 million (U.S. $2.8 million) project that is being carried out in several countries. The project is related to the UN Convention on Climate Change.

Heat Technology and Environmental Protection for Thermal Power Stations in Xian

Focus: Power, Coal
Funding: U.S. $3.6 million (Grant)
Status/Schedule: Completed December 1995

This technical cooperation project improved combustion control so that the power stations in Xian use less coal and emit a smaller quantity of pollutants.

Lhasa Leather Factory

Focus: Sewage, Recycling
Funding: U.S. $8.5 million (Grant)
Status/Schedule: Initiated June 1997

This BMZ technical cooperation project based in Tibet has targets in three areas: 1) enhancing economic efficiency in an environmentally and socially compatible manner; 2) constructing a sewage treatment facility; and 3) constructing a chromium recycling plant.

Modern-Technology Power Plant

Focus: Power, Coal
Funding: U.S. $78.2 million (Loan)
Status/Schedule: Initiated 1997

This financial cooperation project constructs a coal-fired power plant that is to be highly efficient and lowers emissions. The site of the plant was to be selected as of June 1997.

Production and Management of the Miyun Lake Watershed, Hebei/Beijing

Focus: Water
Funding: U.S. $2.2 million (Grant)
Status/Schedule: Initiated June 1997

This technical cooperation project focuses on conserving soil and water resources and improving rural income within the Miyun lake watershed.

Promoting the Dongying Environmental Agency

Focus: Monitoring
Funding: U.S. $2.8 million (Grant)
Status/Schedule: Initiated June 1997

This technical cooperation project helps the Dongying environmental protection office to systematically register

environmental burdens in their area. It also funds a pilot pollution reduction program for three polluters.

Promoting the International Environmental Protection Agency within the State Council, Beijing

Partners: International Environmental Protection Agency, State Council, Beijing
Focus: Planning
Funding: U.S. $300,000 (Grant)
Status/Schedule: Initiated June 1997

This technical cooperation project attempts to encourage Chinese authorities in Beijing to consider environmental protection and environmental impacts more strongly when formulating plans for future development.

Promoting the National Environmental Protection Agency in Beijing

Partner: National Environmental Protection Agency (now SEPA)
Focus: Capacity Building, Industrial Pollution
Funding: U.S. $1.4 million (Grant)
Status/Schedule: Initiated June 1997

This technical cooperation project supports the consolidation of industrial environmental protection concepts, information systems, and training curricula.

Promotion of the Tianjin Environmental Agency

Focus: Environmental Management
Funding: U.S. $1.7 million (Grant)
Status/Schedule: Initiated June 1997

This technical cooperation project supports the development of corporate an environmental management system that meets ISO 14,000 standards.

Reducing Harmful Emissions from Thermal Power Stations

Focus: Power, Coal
Funding: U.S. $3.0 million (Grant)
Status/Schedule: Initiated June 1997

This grant purchases a mobile laboratory for the Chinese power utilities and provides training for power plant personnel. Financing of the mobile laboratory van is provided by Germany's Credit Agency for Reconstruction (Kreditanstalt für Wiederaufbau).

Refuse Disposal in Beijing

Focus: Municipal Waste
Funding: U.S. $21.5 million (Loan)
Status/Schedule: Initiated June 1997
The loan is for the construction of two sanitary landfills, two transfer stations, and one composting facility for Beijing Municipality.

Rehabilitation of the Banshan Power Station

Focus: Power, Desulfurization
Funding: U.S. $33.1 million (Loan)
Status/Schedule: Initiated 1996

This financial cooperation project retrofits the Banshan power plant with a desulfurization system that reduces sulfur dioxide emissions. Competitive bidding on this project was ongoing as of 1996.

Rehabilitation of the Beijing Power Station

Focus: Power, Desulfurization
Funding: U.S. $23.9 million (Loan)
Status/Schedule: Initiated 1997

This financial cooperation project retrofits the power plant with a desulfurization system that reduces sulfur dioxide emissions. Competitive bidding on this project was ongoing as of 1997.

Rehabilitation of the Chongqing Power Station

Focus: Power, Desulfurization
Funding: U.S. $35.8 million (Loan)
Status/Schedule: Initiated 1996

This financial cooperation project retrofits the power plant with a desulfurization system that reduces sulfur dioxide emissions. Competitive bidding on this project was ongoing as of 1996.

Rehabilitation of Forest-fire Areas

Focus: Forestry
Funding: U.S. $2.2 million (Grant)
Status/Schedule: Initiated June 1997

This technical cooperation project focuses on the creation of a silvicultural basis to promote ecologically-oriented reforestation.

Rehabilitation of Micro-hydropower Plants in Tibet

Focus: Micro Hydropower
Funding: U.S. $2.8 million (Grant)
Status/Schedule: Initiated June 1997

This technical cooperation project funded by BMZ rehabilitates existing micro-hydropower installations and helps to establish self-sustaining producer/consumer associations.

Resource Protection in Sichuan Province Nature Reserves (Giant Panda Protection)

Focus: Nature Reserves
Funding: U.S. $2.4 million (Grant)
Status/Schedule: Initiated June 1997

This technical cooperation project helps to protect the habitat of the Giant Panda by improving nature reserve security.

Sewage Disposal in Guangzhou City

Focus: Sewage
Funding: U.S. $10.2 million (Loan)
Status/Schedule: Initiated June 1997

Funds are for the construction of a municipal sewage treatment facility with a capacity of 220,000 cubic meters per day.

Sewage Disposal in Hangzhou City

Focus: Sewage
Funding: U.S. $12.7 million (Loan)
Status/Schedule: Initiated 1997

This project, which focuses on the rapidly growing capital city of Zhejiang Province, expands the existing municipal sewage treatment facility's mechanical treatment from a capacity of 400,000 cubic meters per day to 600,000 cubic meters per day. It also expands the plant's biological treatment capacity to 400,000 cubic meters per day. Competitive bidding on this project was ongoing as of June 1997.

Sewage Disposal along the Huai River

Focus: Sewage
Funding: U.S. $33.1 million (Loan)
Status/Schedule: Initiated June 1997

The loan supports the construction of municipal sewage treatment facilities within the Huai watershed.

Sewage Disposal in Qingdao City

Focus: Sewage, Water Supply
Funding: U.S. $16.0 million (Loan)
Status/Schedule: Initiated 1997

Expands the existing drinking water supply system from 75,000 cubic meters per day to a capacity of 250,000 cubic meters per day. Moreover, this BMZ loan funds the construction of a municipal sewage treatment facility that can treat 300,000 cubic meters per day. Competitive bidding on this project was ongoing as of June 1997.

Sewage Disposal in Qingdao City

Focus: Sewage
Funding: U.S. $13.8 million (Loan)
Status/Schedule: Initiated June 1997

This project builds a municipal sewage treatment facility with a capacity of 100,000 cubic meters per day and a fractional industrial water treatment capacity of 40,000 cubic meters per day.

Sewage Disposal in Qingdao City

Focus: Water Supply
Funding: U.S. $5.8 million (Loan)
Status/Schedule: Initiated June 1997

This third BMZ sewage project in Qingdao City expands the drinking water supply by 50,000 cubic meters per day.

Sewage Disposal for Towns in Shandong Province

Focus: Sewage
Funding: U.S. $26.2 million (Loan)
Status/Schedule: Initiated 1996

This project builds four municipal sewage treatment facilities that possess capacities of 200,000 cubic meters per day, 80,000 cubic meters per day, and 2 x 40,000 cubic meters per day. Competitive bidding on this project was taking place as of mid-1996.

Sewage Disposal in Yangtai City

Focus: Sewage
Funding: U.S. $12.7 million (Loan)
Status/Schedule: Initiated June 1997

Funds are provided for the construction of a municipal sewage treatment facility with a capacity of 250,000 cubic meters per day. Its fractional industrial water treatment capacity is 40,000 cubic meters per day.

Special Energy Program

Focus: Renewable Energy
Funding: U.S. $3.0 million (Grant)
Status/Schedule: Initiated June 1997

This program helps to promote the use of renewable energy sources in China.

Substitution of CFC/FC in the Refrigeration Sector

Partner: National Environmental Protection Agency (now SEPA)
Focus: ODS Substitutes
Funding: U.S. $2 million (Grant)
Status/Schedule: Completed January 1996

This technical cooperation project initiated CFC/FC substitution in China's refrigeration industry and supported a conversion study.

Sustainable Development in the Mountain Region of Jiangxi Province

Focus: Deforestation
Funding: U.S. $3.3 million (Grant)
Status/Schedule: Initiated June 1997

This technical cooperation project protects natural resources that have been degraded by massive deforestation and inappropriate land-use techniques.

Town-gas Supply in Harbin

Focus: Gas
Funding: U.S. $13 million (Loan)
Status/Schedule: Initiated June 1997

This financial cooperation project improves air quality by substituting gas for the burning of coal. The gas is produced via the pressure-assisted gasification of coal.

Training Center for Industrial Pollution Control

Focus: Industrial Pollution
Funding: U.S. $2.2 million (Grant)
Status/Schedule: Initiated June 1997

This technical cooperation project supports a joint German-Chinese environmental technology center.

Tropical Forest Protection in Hainan Province

Focus: Forest Protection
Funding: U.S. $2.9 million (Grant)
Status/Schedule: Initiated June 1997

This technical cooperation project demonstrates systems for the protection and sustainable management of tropical forests on Hainan Island.

Tropical Forest Protection, Yunnan Province

Focus: Forest Protection
Funding: U.S. $3.6 million (Grant)
Status/Schedule: Initiated June 1997

This technical cooperation project establishes an integrated system for protecting and managing the tropical forests in southern Yunnan Province in a sustainable manner.

Turbine Modernization

Focus: Coal, Turbines, Power
Funding: U.S. $33.1 million (Loan)
Status/Schedule: Initiated 1996

This financial cooperation project modernizes turbines and boiler plants to improve performance and efficiency, which in turn reduces coal consumption and pollution emissions. Competitive bidding on this project was ongoing in 1996.

Water Supply in Zunyi

Focus: Water Supply
Funding: U.S. $4.4 million (Loan)
Status/Schedule: Initiated June 1997

This project expands Zunyi's drinking water supply from 80,000 cubic meters per day to 150,000 cubic meters per day.

Wind Park I

Focus: Wind Energy
Funding: U.S. $6.3 million (Loan)
Status/Schedule: Initiated 1996

This financial cooperation project expands energy supply in an emission-free manner by building wind power plants in Hainan and Zhejiang Provinces. The project began in Hainan in 1996 but is still in the process of taking competitive bids in Zhejiang Province.

Wind Park II

Focus: Wind Energy
Funding: U.S. $10.5 million (Loan)
Status/Schedule: Initiated 1997

This financial cooperation project builds a wind park for power production. Competitive bidding was underway for this project as of 1997.

Wind Park III

Focus: Wind Energy
Funding: U.S. $8.3 million (Loan)
Status/Schedule: Initiated June 1997

This financial cooperation project builds a wind park for power production.

Wind and Solar-Energy Usage in Central Mongolia

Focus: Wind Energy, Solar
Funding: U.S. $6.9 million (Grant)
Status/Schedule: Completed July 1997

This BMZ financed technical cooperation project helped to electricity design systems that use renewable energy sources.

Yang Shu Pu Cogenerating Facility

Focus: Power, Heat
Funding: U.S. $59.5 million (Loan)
Status/Schedule: Initiated June 1997

This financial cooperation project involves the substitution and expansion of combined heat and power generation.

GERMAN TECHNICAL COOPERATION (DEUTSCHE GESELLSCHAFT FÜR TECHNISCHE ZUSAMMENARBEIT—GTZ)

Web Address: http://www.gtz.de/

Environment-oriented Advisory Services for Enterprises

Focus: Cleaner Production, Hazardous Waste Management
Funding: U.S. $5 million (Grant)
Status/Schedule: Initiated 1999

This German Technical Cooperation (GTZ) technical assistance project targets production processes, hazardous waste management, and environment related advisory services in Zhejiang Province (Source: *Chinabrief*, August-November 1999).

Environmental and Resource Protection

Focus: Agriculture
Funding: U.S. $5.5 million (Grant)
Status/Schedule: Initiated 1999

This GTZ funded technical assistance project provides research and training in environmentally sound nitrogen fixing and for other topics on which agreement had not been reached as of summer 1999 (Source: *Chinabrief*, August-November 1999).

Rural Infrastructure and Vocational Training in Tibet

Focus: Micro-Hydropower, Agriculture
Funding: U.S. $4.4 million (Grant)
Status/Schedule: Initiated 1999

A detailed plan for this technical assistance project had not been finalized as of summer 1999, but the project is expected to focus on 1) providing vocational training in agriculture and crafts and 2) repairing and improving irrigation systems and micro-hydropower plants (Source: *Chinabrief*, August-November).

Japan

Note: All Grant and loan values are converted from Japanese Yen to U.S. dollars using the exchange rate of 1 Japanese Yen = U.S. $0.009316, the market rate on October 14, 1999 at 2:30 PM EDT.

Japan International Cooperation Agency (JICA)

Web Address: http://www.jica.go.jp/Index.html

Beijing Research Center for Water Pollution and Reuse

Partner: State Science and Technology Commission (now Ministry of Science and Technology)
Focus: Water Pollution
Status/Schedule: Initiated 1992, Completed 1997

The project provided technical assistance regarding the filtration and removal of chemical contaminants in water (Source: *China Development Briefing*, January 1997).

China Energy Conservation Training Center, Dalian City

Partners: Dalian Economic Commission, State Economic and Trade Commission
Focus: Energy Conservation
Status/Schedule: Initiated 1992, Completed 1997

The training center focuses its work on energy conservation technologies for industrial enterprises and power stations in the northeastern coastal city Dalian (Source: *China Development Briefing*, January 1997).

Environmental Model City Project

Focus: Air Pollution, Water Pollution, Energy Conservation, Recycling
Status/Schedule: Initiated September 1997

Chongqing, Dalian, and Guiyang are the three cities selected for participation in this JICA funded project. In these cities efforts will be made to strengthen environmental regulations and to provide Japanese technical assistance grants and soft loans. The two nations hope that introducing advanced technologies and systems in these cities will inspire other Chinese cities to adopt them as well. Primary efforts involve preventing air pollution, improving water quality, combating global warming by conserving energy, and building industries and local support systems for the recycling of gypsum, fertilizer, and other by-products of emissions desulfurization.

Environmental Protection Center, Beijing

Partner: National Environmental Protection Agency (now SEPA)
Focus: Monitoring
Status/Schedule: Initiated 1996, Targeted Completion 2001

This technical assistance grant provides training in environmental monitoring. The training will take place at the Japan-China Friendship Environmental Conservation Center in Beijing.

Forest Tree Improvement, Hubei

Partner: Chinese Ministry of Forestry (now State Forestry Bureau)

Focus: Forestry
Status/Schedule: Initiated 1996, Targeted Completion 2001

This technical assistance program focuses on genetic preservation and propagation to aid reforestation in Northwest Hubei (Source: *China Development Briefing*, January 1997).

Forestry Development, Fujian Province

Partner: Fujian Forestry Department
Focus: Forestry
Status/Schedule: Initiated 1991, Targeted Completion 1998

This JICA project focused on reforestation technologies and on forestry research and management (Source: *China Development Briefing*, January 1997).

Japan-China Comprehensive Forum on Environmental Cooperation

Partners: Unspecified Japanese and Chinese Government Agencies, Local Municipalities, NGOs, and Specialists
Focus: Air Pollution, Water Pollution, Technology, Public Education
Status/Schedule: Initiated 1995

This project, which is co-sponsored by China and Japan, brings together individuals from the public and private sector to foster a heightened, far-reaching exchange of views and opinions on themes in environmental cooperation. As of 1998, two forums had taken place. The second, in Tokyo in November 1997, targeted the topics of environmental pollution, pollution prevention, environmental technology, and public awareness programs.

Japan-China Friendship Environmental Protection Center

Partners: Japan's Ministry of International Trade and Industry, Japan's Environment Agency, National Environmental Protection Agency of China (now SEPA)
Focus: Research, International Cooperation, Information Dissemination
Funding: U.S. $97.8 million (Grant)
Status/Schedule: Completed 1996

This joint Chinese-Japanese financed project led to the construction of the Japan-China Friendship Environmental Protection Center in Beijing. According to Zhang Kun, the Center's General Director, the Japan-Friendship Environmental Protection Center was built to promote effective environmental protection in China and to improve implementation of sustainable development. Moreover, this center aims to promote the friendship between Japan and China and international environmental cooperation. The eleven-story building is located on the Fourth Ring Road in Beijing. It houses environmental monitoring equipment, offices for government and non-governmental agencies, research facilities, a television production studio, research laboratories, conference facilities, and a residential building for visiting scholars and professionals.

Nationwide Environmental Information Network

Partner: Japan-China Friendship Environmental Conservation Center
Focus: Monitoring
Status/Schedule: Initiated September 1997

This project will attempt to establish a nationwide environmental information network. This network will be comprised of 100 installations, all of which will have a set of computers that are dedicated to the processing of environmental information. The hub of the network will be the Japan-China Friendship Environmental Conservation

Center in Beijing, which was built from 1992-1996 with JICA grant aid.

Ningxia Forest Protection Research

Partners: Ningxia Science and Technology Commission, Ningxia Forestry Bureau
Focus: Forest Protection
Status/Schedule: Initiated 1994, Completed 1999

This technical assistance project targets pest control and other forest protection-related research in a desert located in Ningxia Province (Source: *China Development Briefing*, January 1997).

The Overseas Economic Cooperation Fund (OECF)

Web Address: http://www.oecf.go.jp/index.htm

Beijing Sewage Treatment Plant Construction Project

Partners: Beijing Municipal Engineering Bureau
Focus: Sewage
Funding: U.S. $24.6 million (Loan)
Status/Schedule: Initiated 1988

The OECF loan supported the expansion of a pre-existing sewage treatment plant in Beijing and led to an increased capacity by 500,000 cubic meters per day.

Benxi Environmental Improvement Project I

Partners: Benxi Municipal People's Government
Focus: Air Pollution, Water Pollution, Water Supply, Monitoring
Funding: U.S. $38.3 million (Loan)
Status/Schedule: Initiated 1997

The project involved the construction of gas/heat/electricity plants and water supply facilities. It also enabled factories to purchase pollution control and monitoring equipment.

Benxi Environmental Improvement Project II

Partner: Benxi Municipal People's Government
Focus: Urban Environment, Air Pollution
Funding: U.S. $39.1 million (Loan)
Status/Schedule: Loan committed to the project in September 1997

This project, which is funded by the second such OECF loan to the region, is to construct gas supply facilities and to equip factories with pollution-control equipment in order to improve the environment in Benxi, Liaoning Province.

Dalian Water Supply System Rehabilitation Project

Partner: Ministry of Construction
Focus: Water Supply
Funding: U.S. $52.3 million

The project funds the construction of water supply facilities in Dalian City, Liaoning Province. These facilities will expand and improve the city's water supply system in order to meet the increasing demand for water. The capacity of the pumping station is 350,000 cubic meters/day.

Heilongjiang Songhua River Basin Environmental Improvement Project

Partner: Heilongjiang Provincial People's Government
Funding: U.S. $100.3 million (OECF loan)

This project is to construct sewage facilities and to take pollution control measures in factories in the major cities in the Heilongjiang Province in order to reduce pollution. Also, this project is to prevent air pollution, which can contribute to more effective utilization of resources.

Henan Panshitou Reservoir Construction Project

Partner: Henan Provincial Department of Water Resources
Funding: U.S. $64.1 million (OECF loan)

This project is to construct a multi-purpose rock-fill dam in the Panshitou area, located fifteen kilometers northwest of Hebei City, Henan Province.

Hohhot and Baotou Environmental Improvement Project

Partner: National Environmental Protection Agency (now SEPA)
Focus: Air Pollution, Monitoring, Gas, Investment
Funding: U.S. $145.6 million (OECF loan)
Status/Schedule: Initiated 1996, Completed 1997

This very large project was comprised of three parts. One portion of the loan supported the procurement of machinery and equipment for the expansion of the gas and heat supply systems in the two cities. The second portion of the loan was for environmental monitoring and research equipment for Baotou City. The third portion of the loan enabled the Export-Import Bank of China to extend long-term loans to non-public entities in either city that request funds to make environmental improvements to their facilities.

Huai River Henan Water Pollution Control Project II

Partner: Henan Provincial People's Government
Focus: Water Treatment
Funding: U.S. $47.1 million (Loan)
Status/Schedule: Loan committed in September 1997

The goal of the project is to construct sewage treatment plants and sewage pipeline networks in the major cities in the Henan Province and to implement water pollution control countermeasures in factories currently discharging pollutants, which violate environmental standards. The loan for this project represents OECF's second commitment in this region.

Hunan Yuanshui River Basin Hydropower Development Project

Partner: State Power Corporation of China
Funding: U.S. $168.1 million (OECF loan)

The aim of this project is to accelerate development of hydropower resources in Hunan Province by means of the construction of two concrete-gravity dam systems with power-generating capacities of 225MW and 240MW, respectively.

Jilin Song Liao River Basin Environmental Improvement Project

Partner: People's Government of Jilin Province
Funding: U.S. $121.8 million (OECF loan)

The goal of this project is to construct sewerage facilities and to take water pollution control measures in factories in the Songhua and Liao River basins located in Jilin Province in order to improve water quality.

Lanzhou Environmental Improvement Project

Partner: State Environmental Protection Agency (SEPA)
Funding: U.S. $71.7 million (OECF loan)
Status/Schedule: Initiated 1996

The purpose of the OECF-funded project is to abate air pollution from coal burning, to improve the water quality of the Yellow River, and to ensure a safe drinking water supply in Lanzhou City, Gansu Province. The project extended a gas pipeline, constructed more efficient heat-supply lines, built a wastewater treatment plant, and expanded the existing water treatment plants. The loan was also used to procure machinery and equipment for the project.

Liuzhou Environmental Improvement Projects I and II

Partner: National Environmental Protection Agency (now SEPA)
Focus: Air Pollution, Water Pollution, Urban Sanitation
Funding: U.S. $55.7 million (OECF loan)
Status/Schedule: Initiated 1996, Completed 1997

The first part of this loan funded the purchase of machinery and equipment for the construction of a gas supply facility and a fill-cover-up garbage yard. A second part of the loan enabled the Export-Import Bank of China to extend long-term loans to non-public entities for the purpose of investing capital in projects that improve the environment.

Liuzhou Environment Improvement Project III

Partner: Liuzhou Municipal People's Government
Focus: Air Pollution
Funding: U.S. $ 21.9 million (first loan) and U.S. $35 million (second loan)
Status/Schedule: First loan committed in December 1996, Second loan committed in September 1997

This project is to construct a flue gas desulfurization system at the Liuzhou Power Plant in order to improve the environment in Liuzhou, Guangxi Province. This loan represents OECF's third commitment in this region.

Qingdao Development Project

Partner: Qingdao Municipal Government
Focus: Water Supply, Sewerage
Funding: U.S. $23.4 million (OECF loan)
Status/Schedule: Initiated 1993

This dual-purpose project has constructed water supply facilities to meet the quickly increasing demand for water in the Qingdao Economic and Technical Development Zone. This OECF loan has also funded the construction of sewer facilities to improve sanitation for humans and to reduce sea pollution.

Shandong Yantai Water Supply and Water Induced Disaster Management Project

Partner: Yantai Municipal People's Government
Focus: Water Supply
Funding: U.S. $57.2 million

The project is comprised of construction of water supply facilities, reservoirs, and tidal embankments in Yantai City, Shandong Province. These new water facilities will improve the water supply system in the city as well as help Yantai

City overcome water shortages and meet the increasing demand for water.

Shanxi Wangqu Thermal Power Plant Construction Project

Partner: Ministry of Electric Power
Focus: Energy, Air pollution
Funding: U.S. $543.2 million

The project is leading to the construction of the Shanxi Hejin Thermal Power Plant with the capacity of 600MW x 2 in Lucheng City of Shanxi Province. This power plant will help to meet the increasing demand for electricity and to assure stable electricity supply in Shanxi Province.

Shaanxi Hancheng No. 2 Thermal Power Plant Construction Project II

Partner: State Power Corporation of China
Funding: U.S. $32.6 million (OECF loan)
Status/Schedule: Loan committed in September 1997

This goal of this project is to construct a thermal power plant with a capacity of 600MW x 2 in Hancheng City in Shaanxi Province in order to meet the increasing demand for electric power in Shaanxi Province and the Northwest Power Grid. This loan is OECF's second commitment in this region.

Shenyang Environmental Improvement Project

Partner: Chinese National Environmental Protection Agency (now SEPA)
Focus: Air Pollution, Water Pollution
Funding: U.S. $46.6 million (Loan)
Status/Schedule: Initiated 1996

This project's primary goal is to improve air and water quality in the city of Shenyang, Liaoning Province. The project should reduce pollution from the copper smelting and acid making system of the Shenyang Smelter, which is the largest single source of pollution emissions in Shenyang. The project also attempted to reduce the number of small and inefficient boilers used in the city by expanding the quantity of heat and electricity supplied by centralized power stations in the city. The OECF loan was used to purchase machinery and equipment for the project.

Urban Gas Project

Partner: Ministry of Construction
Focus: Gas
Funding: U.S. $139.6 million (Loan)
Status/Schedule: Initiated 1988, Completed 1989

The project aimed to satisfy the increasing demand for coal gas in Harbin, Fuzhou, and Guiyang Provinces.

Xian Water Supply Project

Partner: Chinese Ministry of Construction
Focus: Water Supply, Land Subsidence
Funding: U.S. $66.5 million (Loan)
Status/Schedule: Initiated 1993, Completed 1995

The project expanded and improved the water supply system that serves the urban part of Xian City. The goal is to meet the area's increasing demand for water and consequently to combat the land subsidence and other negative environmental impacts that are being caused by the over-pumping of underground water.

Xiang River Basin Hunan Environmental Improvement Project II

Partner: Hunan Provincial People's Government
Focus: Sewerage, Gas, Municipal Waste
Funding: U.S. $54 million (Loan)
Status/Schedule: Initiated 1997

This project constructed sewage treatment plants and sewage pipeline networks in major cities along the Xiang River. The goal was to reduce the overall pollution load in the portion of the river that is located in Hunan Province. A portion of the OECF loan supported the purchase of machinery and equipment for these purposes. To attack local air pollution and lower acid rain-causing emissions, a second portion of the loan funded the expansion of urban gas supplies in the area. The third portion of the loan supported the construction of garbage disposal facilities, which should reduce the impact of municipal waste on water quality in the region. This loan represents OECF's second commitment to this area.

The Netherlands

Dutch Government

Cleaner Production in Township and Village Enterprises

Partners: University of Amsterdam, China National Cleaner Production Center, provincial Environmental Protection Bureaus
Focus: Cleaner Production
Funding: U.S. $1 million
Status/Schedule: Initiated 1999, Targeted Completion 2002

This Dutch initiative focuses on promoting cleaner production by township village enterprises in Yunnan and Anhua Provinces (Source: *Chinabrief*, May 1999).

CO_2 Mitigation Policy

Partner: China International Council on Environment and Development
Focus: Climate Change
Status/Schedule: Initiated 1999, Targeted Completion 2001

This project supports the Council's advisory role in developing policies for the gradual reduction of CO_2 emissions in China (Source: *Chinabrief*, May 1999).

Efficient Technology in Huai River Tanneries, Anhui Province

Partners: Netherlands Applied Technology Research Institute, Chinese Ministry of Agriculture and Department of Township Enterprises in Anhui Province
Focus: Water Pollution
Funding: U.S. $2.4 million
Status/Schedule: Initiated 1999, Targeted Completion 2002

This project introduces Dutch integrated clean chrome leather technology for effluent treatment in tanneries located in Anhui Province. The project attempts to induce Chinese tanneries to up their environment-related investment (Source: *Chinabrief*, May 1999).

Environment and Economic Self Sufficiency Program

Focus: Pollution
Status/Schedule: Initiated 1997

This program encourages the introduction of pollution abatement and treatment technologies, by offering financing that provides an effective subsidy of sixty-five percent. Feed mills, cattle and chicken slaughter houses, drinking water supply projects, and power stations all had taken advantage of this financing as of 1997 (Source: *China Development Briefing*, April 1997).

Forestry Management

Partner: Yunnan Forestry Department
Focus: Forestry
Funding: U.S. $14 million (Grant)
Status/Schedule: Initiated 1997

This project provides technical support funds to the Yunnan Forestry Department, with the goal of helping them to improve resource management and implement community forestry practices (Source: *China Development Briefing*, April 1997).

Improved Process Instrumentation for Environment and Energy Management in Anhui

Partners: University of Amsterdam, Chinese Center for Environmentally Sound Technology Transfer
Focus: Industrial Process Instrumentation
Funding: U.S. $1.5 million (Grant)
Status/Schedule: Initiated 1999, Targeted Completion 2003

This project aims to help Chinese manufactures produce process instrumentation equipment of higher quality and better design by introducing Norwegian technology and know-how. In addition, selected industrial sectors in Anhui Province will be encouraged to utilize process instrumentation, so that they can produce products in a more efficient manner that uses less water, energy, and other materials (Source: *Chinabrief*, May 1999).

Industrial Policy Evaluation

Partners: UN Industrial Development Organization, Netherlands Economic Institute (University of Rotterdam), Chinese State Development and Planning Commission
Focus: Policy
Funding: U.S. $1.7 million (Grant)
Status/Schedule: Initiated 1999, Targeted Completion 2002

The project attempts to improve the ninth five-year plan by helping the State Development and Planning Commission to conduct environmentally sustainable policy modeling (Source: *Chinabrief*, May 1999).

Integrated Pest Management

Partners: National Agro-technical Extension Service Center (China), Provincial Agricultural Departments, County level Plant Protection Stations, Township Agro-technical Extension Stations
Focus: Pest Management
Funding: U.S. $2 million (Grant)
Status/Schedule: Initiated 1993, Targeted Completion 2003

The main goal of this nationwide project is to promote the use of environmentally sound integrated pest management techniques for controlling pests in rice fields. The grant supports the construction of a network of 500 field schools, where farmers can go to receive hands-on training in integrated pest management (Source: *Chinabrief*, May 1999).

Nature Reserve Protection

Partners: Department of Wildlife Conservation, Chinese Forestry Department, Forestry Design Institute, and other local institutions in China
Focus: Forestry
Funding: U.S. $14 million
Status/Schedule: Initiated 1998, Targeted Completion 2003

The multifaceted project involves four Yunnan Province prefectures: Simao, Baoshan, Nujiang, and Dehong which together contain seven nature preserves. The project aims to build capacity at the Chinese Forestry Department and to help it better conserve primary forest. Secondly, the project seeks to enhance livelihoods in the communities in and around the prefecture's nature reserves. Thirdly, the project supports the following conservation activities: developing a biodiversity resources inventory, establishing biodiversity monitoring systems, controlling caterpillars, improving fire prevention, and better mapping the reserves (Source: *Chinabrief*, August-November 1999).

Qomalangma Reserve Management

Focus: Biodiversity, Community Development
Funding: U.S. $2.5 million (Grant)
Status/Schedule: Initiated 2000, Targeted Completion 2004

This project aims to protect the wildlife and bio-diversity of Tibet's Qomalangma (Mount Everest) Nature Reserve. Main activities include supporting community-based development and strengthening the park's environmental management (Source: *Chinabrief*, May 1999).

Strengthening the Production of Environmental Technology

Focus: Wastewater, Solid Waste
Funding U.S. $2.5 million (technical assistance grant) and U.S. $12.5 million (technology transfer loan)
Status/Schedule: Initiated 1999, Targeted Completion 2004

This project, which still is in the planning stages, aims to help Chinese environmental technology manufacturers produce products of higher quality and efficiency. The project will focus on wastewater technology and also on solid waste treatment (Source: *Chinabrief,* May 1999).

New Zealand

New Zealand Government

Community Forestry in Fujian Province

Partner: Groome Poyry Ltd.
Focus: Community Forestry
Funding: U.S. $1.1 million (Grant)
Status/Schedule: Initiated 1991, Completed 1997

The project aimed to help local citizens in Shouning County improve tree crops and increase their supply of timber and firewood. The project consisted of two parts. The first provided technical assistance, which focused on nursery and plantation management and post-harvest techniques. The second part provided a revolving micro-credit fund (Source: *China Development Briefing,* April 1997).

Geothermal Power in Tibet

Partner: Industrial Research Ltd.
Focus: Geothermal Power

Funding: U.S. $175,000 (grant total as of April 1997)
Status/Schedule: Initiated 1995

The project provides training and technical support for the construction and installation of an on-stream geothermal plant in Tibet (Source: *China Development Briefing,* April 1997).

Norway

Note: All Grant and loan values are converted from Norway Kroner to U.S. dollars using the exchange rate of 7.81984 NOK = U.S. $1, the market rate on October 31, 1999 at 6:11 PM EST.

Norwegian Government

Air Quality Management and Planning System for Guangzhou

Partners: Guangzhou Science and Technology Commission, Norwegian Institute for Air Research
Focus: Air Pollution, Policy
Funding: U.S. $1.9 million (Grant)
Status/Schedule: Initiated 1996, Completed 1999

The project aimed to develop and implement an air quality management and air quality planning system for Guangzhou City and to develop an air quality action plan for the city. The action plan will become part of a larger master plan to reduce air pollution throughout Guangzhou.

Bei Dou Fisheries Research and Management Project

Partners: CAR Bureau of Cultural Relics, Central Office for Cultural Heritage (Norway)
Focus: Fisheries
Funding: U.S. $870,000 (Grant)
Status/Schedule: Initiated 1998, Completed 1999

The goal of the project was to implement competence enhancing and institution building activities in the fields of fisheries management and fisheries research.

Biodiversity Projects

Partner: State Environmental Protection Agency (China)
Focus: Energy, Biodiversity, and Environmental Management
Status/Schedule: Initiated 1999

A series of new energy, biodiversity, and environmental management projects financed by the Norwegian government is planned (Source: *Chinabrief*, May 1999).

Capacity Building for Environmental Monitoring Network for River Basins and Regions

Focus: Water Quality Monitoring and Assessment
Funding: U.S. $63,900 (Grant)
Status/Schedule: Initiated March 1998

The grant supports a feasibility study for a larger project. The main project, if implemented, would provide a monitoring and quality assessment system that is comprehensive and consistent enough to provide a basis for re-

gional water pollution control in the Three Lake District.

China Council for Environment and Development

Partner: China Environment Project Society
Focus: Research
Funding: U.S. $1.1 million (Grant)
Status/Schedule: Initiated March 1998, Targeted Completion 2003

The grant supports scientific work on selected environmental issues.

Chinese Television Team

Partners: Norwegian Ministry of Environment, China Central TV
Focus: Television Programming, Policy, Technology
Funding: U.S. $28,500 (Grant)
Status/Schedule: Initiated March 1998

This grant pays a Chinese television team to produce a television program about environmental policy and environmental technology in Norway.

Cleaner Production, Phase 2

Partners: Beijing Science and Technology Commission, World Cleaner Reduction Society
Focus: Cleaner Production
Funding: U.S. $235,000 (Grant)
Status/Schedule: Initiated 1998, Completed 1999

The project planned to introduce cleaner production methods in Chinese factories.

Environmental Project in Zhuzhou and Jiaxing Cities

Partners: Municipal governments of Zhuzhou (Zhejiang) and Jiaxing (Hunan) cities, Interconsult
Focus: Sewerage, Water Supply, Cleaner Production
Funding: U.S. $1.3 million (Phase one grant); U.S. $400,000 (Phase two grant)
Status/Schedule: Initiated 1996, Phase one completed 1998; Phase two initiated 1999

The project built a purification system to provide clean and healthy drinking water for both cities. This project also led to the construction of sewage treatment systems and implemented cleaner production methods to reduce industrial contributions to air, water, and soil pollution. A March 1999 agreement extended wastewater projects in Jiaxing, Zhejiang Province and Zhuzhou, Hunan Province (Source: *Chinabrief*, May 1999).

Environmental Statistics and Analysis

Partners: State Statistical Bureau of China, State Statistical Bureau of Norway
Focus: Environmental Statistics
Funding: U.S. $1 million (Grant)
Status/Schedule: Initiated 1998, Targeted Completion 2001

The project has four goals: 1) to build natural resources accounting capacity; 2) to improve the ability to compile environmental statistics; 3) to implement tools to link natural resources use to both economic activity and environmental impacts; and 4) to provide better methods of statistical presentation and encourage their use.

Environmental Surveillance and Information System for Yantai

Partners: Yantai Science and Technology Commission, Norwegian Institute for Air Research
Focus: Monitoring, Air Pollution, Water Pollution

Funding: U.S. $1.4 million (Grant)
Status/Schedule: Initiated 1996, Completed 1999

The first goal of the project was to evaluate and improve Yantai's monitoring system for air and water quality. The second goal was to develop and implement a new environmental surveillance system for Yantai.

Establishment of an Indicator-based Electronic State of the Environment Report

Partners: UNEP/GRID Arendal, National Environmental Protection Agency (now SEPA)
Focus: Statistics, Policy
Funding: U.S. $89,500 (Grant)
Status/Schedule: Initiated April 1997

This project aims to produce a user-friendly *State of the Environment Report* for China. The content of this report, based upon quantitative indicators, will be published in both Mandarin Chinese and English.

Evaluation of Strategies to Control the Environmental Effects of Energy Technologies

Partners: Norwegian School of Management, Beijing Institute of Technology, Tsinghua University, Beijing Municipal Research Academy
Focus: Energy
Funding: U.S. $485,000 (Grant)
Status/Schedule: Initiated 1998, Targeted Completion 2001

The project will finance two doctoral programs, with the goal of increasing indigenous Chinese knowledge and expertise with regard to the environmental impacts of energy technologies.

Handbook and Training Program for Economic and Financial Analysis of Projects Under the Trans-Century Green Project Program

Partners: ECON, National Environmental Protection Agency (now SEPA)
Focus: Policy, Project Analysis
Funding: U.S. $83,100 (Grant)
Status/Schedule: Completed 1998

The Chinese Trans-Century Green Project Program lists hundreds of projects for which the SEPA would like to attract foreign aid. This grant supported the development of a handbook for the evaluation of these projects.

Integrated Management of Industrial and Municipal Wastewater in Jiaxing, Zhejiang Province

Focus: Wastewater
Funding: U.S. $625,000 (Grant)
Status/Schedule: Initiated 1996, Completed 1998

The project had three goals: 1) to build an action plan for the integrated management of municipal and industrial wastewater in a Chinese city; 2) to demonstrate inexpensive and efficient wastewater treatment processes; and 3) to write a master plan for comprehensive wastewater management in Jiaxing City.

Master Plan Against Air Pollution in Shanxi Province

Partners: Nordic Consulting Group, Shanxi Environmental Protection Bureau
Focus: Air Pollution
Funding: U.S. $62,800 (Grant)
Status/Schedule: Completed February 1998

This feasibility study was for a project to develop a comprehensive master plan to combat air pollution in Shanxi Province. The feasibility study included a proposal for founding a new Shanxi Center for Energy and Environment.

Rehabilitation Plan for Suzhou Creek, Shanghai

Partners: Shanghai Academy of Environmental Sciences
Focus: Water Pollution
Funding: U.S. $20,000 (Grant)
Status/Schedule: Initiated 1998, Completed 1999

The project aims to develop a plan for the rehabilitation of Suzhou Creek.

Soga Ecomuseum

Partner: Chinese Society of Museums
Focus: Environmental Education
Funding: U.S. $89,500 (Grant)
Status/Schedule: Initiated 1997, Completed 1998

The grant supported the establishment of an Ecomuseum in Soga.

Surveillance of Water Quality in the Songhua River, Heilongjiang Province

Partners: Heilongjiang Environmental Protection Bureau, Norwegian Institute for Water Research
Focus: Monitoring
Funding: U.S. $1.5 million (Grant)
Status/Schedule: Initiated 1996, Completed 1999

The project sought to design and to implement an environmental surveillance system for the Songhua River. The project also aimed to build a system for environmental monitoring and planning in Heilongjiang Province.

Translation of Green Global Yearbook

Partners: Fridtjof Nansen Institute, National Environmental Protection Agency (now SEPA)
Focus: Translation
Funding: U.S. $190,000 (Grant)
Status/Schedule: Initiated 1996, Completed 1998

This project funded the translation of the Green Globe Yearbook's 1996, 1997, and 1998 editions into Mandarin Chinese.

Water and Air Pollution Projects

Partner: Ministry of Science and Technology (China)
Focus: Water Pollution, Air Pollution
Status/Schedule: Initiated March 1999

During a visit to China by the Norwegian Minister for the Environment in March of 1999, agreements for eight new projects in the fields of air and water pollution abatement were signed with the Ministry of Science and Technology (Source: *Chinabrief*, May 1999).

BEIJING ENERGY EFFICIENCY CENTER (BECON)

Web address: http://www.gcinfo.com/becon/

China Green Lighting Program

Partners: UNDP, State Economic and Trade Commission (SETC), State Science and Technology Commission (SSTC), National Council of Lighting Industry, Ministry of Construction, and Ministry of Electronics
Funding: U.S. $1 million (Grant)
Status/Schedule: Initiated 1996

The China Green Lighting Program, specifically authorized in the Ninth Five-Year Plan (1996-2000), is funded through BECon with a $1 million grant from the United Nations Development Programme (UNDP). The program's purpose is to improve consumers' awareness of "green lighting," which implies educating and training of large-scale buyers, such as operators of buildings and public facilities. BECon has held two international symposia on green lights. The first, in October 1996, hosted over 250 participants and at a subsequent symposium BECon opened a China Green Lights Center in Beijing—a permanent exhibition of the products of over sixty manufacturers. BECon has also created TV spots and magazine advertising for high-quality compact fluorescent products and will soon develop standards for lighting products and for building design.

BECon will also be organizing demonstration projects and guiding major investments made by the Chinese government. They will provide recommendations for the use over the next five years of 250 million RMB in soft loans provided by the SETC through the Commercial and Industrial Bank. The subsidized investment will help improve the technical quality of lighting manufacturing.

Demand Side Management and Integrated Resource Planning

Partners: Department of Energy, Electric Power Research Institute (ERI), Battelle, and the Environmental Defense Fund
Funding: U.S. $60,000

BECon is designing an Integrated Resource Planning (IRP) effort for the "closed system" of the Shen Li Oil fields. The customer is the Chinese Natural Gas and Petroleum Company (CNPC), and BECon is working jointly with the Research and Planning Academy under the CNPC and with ERI. BECon's team is developing a least-cost energy plan for the oil field, which is "closed" in the sense that it provides all its own electricity for oil pumping and for the homes and community for its workers who, with their families, number some 100,000 people. The Asian Development Bank is providing $30,000 for this project and the Chinese government is matching this amount.

Demonstration and Information Center

Partners: World Bank, European Union, Global Environment Facility (GEF)

The Demonstration and Information Center will be a world-class, $200+ million dollar effort to introduce energy service companies (ESCOs) to China. The Center grew out of a 1994 World Bank study on greenhouse gas emissions and now includes four components. First, is an energy management company demonstration effort to show how ESCOs can deliver efficiency services though market-oriented mechanisms. The project will create three companies located in Beijing, Liaoning, and Shandong. These companies are former state-owned energy centers that will be privatized. A $35 million GEF grant will provide the basis for the establishment of these companies by providing for demonstration projects. Second, the funding will also support technical and economic analysis that will be provided through an information dissemination center. The Center will manage $5 million of this GEF grant. The third component is technical assistance, the main work of which is developing institutional capacity in the government and in the project office. The project office will provide oversight, technical assistance, and develop ESCO

guidelines. The fourth component is ESCO promotion. The funding breakdown for components one through four is $15 million, $5 million, $2 million, and $13 million, respectively. The funding was made available in 1998. A European Union grant of $4.5 million was made available from April 1997 to maintain momentum in the project.

A World Bank loan of $65 million will provide customer finance for the ESCOs. The SETC will provide $37 million of loans, with subsidized rates. There will also be a SETC grant of $7 million. Domestic banks are expected to provide an additional $41 million. Each of the three provinces will provide 20-40 million RMB of capital investment. Each project must have three parts: a feasibility study; a performance contract; and specifications for the equipment.

Energy Efficiency and Renewables in Town and Village Enterprises (TVEs)

Partners: World Wildlife Fund (WWF), Center for Renewable Energy Development

BECon has been collaborating with WWF to develop energy efficiency and renewables in TVEs. Construction and development in TVEs is a main component of national development. The level of energy efficiency in the small town industries is relatively low compared to those in urban areas. An objective of the project is to develop two to three full-scale proposals for obtaining external financial support.

Beijing Environment and Development Institute (BEDI)

Web address: http://www.cceia.org/teams.html#china

Development and Wetlands Conservation in the Sanjiang Plain in Northeast China

Partners: Resources for the Future (RFF), Henry M. Jackson Foundation
Focus: Wetlands
Status/Schedule: Initiated 1994

The Sanjiang plain, which is located at the Northeast corner of China, contains the largest area of freshwater wetlands in China. The wetlands in the plain provide habitat for numerous wildlife species, including over 1000 plant species, at least 150 species of birds and thirty-five species of mammals. However, until the mid-1990s the wetlands were treated as land resources for agricultural development. In response, this project evaluated the cost and benefit of agricultural development versus natural resource conservation. The project found areas that were slated for agricultural development actually were not suitable for profitable agriculture. It suggests that resources in this area are better used for ecological livestock husbandry, fisheries and, tourism. The project was funded by the Henry M. Jackson Foundation.

Forum on International Investment and China's Sustainable Development

Partner: Resources for the Future (RFF)
Focus: Investment
Status/Schedule: Held November 1995

The main topics at the form were the missions of the BEDI/RFF Collaborative Program (BRCP), the involvement of international investment in China's sustainable development, and the development of collaboration between BRCP and foreign companies.

Identification of Obstacles to Complying with Environmental Regulations

Partner: Resources for the Future (RFF)
Focus: Policy
Status/Schedule: Initiated July 1994, Completed January 1995

This study was conducted as part of the much larger World Bank Chongqing Industrial Reform and Pollution

Control Project. The project identified obstacles to complying with environmental regulations and to achieving environmental goals and targets, with the assumption that the Chongqing Environmental Protection Bureau has the capacity to monitor omissions and effluents and to enforce environmental regulations. Examples of obstacles that were identified by the BEDI team are the shortage of capital for upgrading industrial production processes that reduce the generation of wastes, a shortage of capital for pollution control infrastructure, and the lack of an alternative social security system to provide housing and compensation for laid-off and retired workers.

Study of Regulatory Programs for Water Pollution Control and Water Quality Management in the Xiaoqing River Basin

Partner: Resources for the Future (RFF)
Focus: Water Pollution, Policy
Status/Schedule: Initiated July 1995, Completed March 1996

This study was part of the Environmental Priorities Sub-component of the World Bank's Shandong Environmental Project. This study had three main objectives. First, was to assess the effectiveness of the regulatory framework for water pollution control in the Xiaoqing River Basin, using Jinan as a case study. Second, it identified changes needed for the improvement of the pollution levy system and the discharge permit system, in order to support the implementation of mass based pollution control regulations. The third objective was to provide information that would be needed for the preparation of the terms of reference for an action plan for water quality management in the Xiaoqing River Basin.

Center for International Earth Science and Information Network (CIESIN)

Web address: http://www.ciesin.org/
Web address: http://sedac.ciesin.org/china

China Dimensions Data Collection

Partners: The China in Time and Space Project at the University of Washington, the Chinese Academy of Surveying and Mapping, and Others.

The China Dimensions Data Collection includes a variety of data sets on China, covering such topics as population, agriculture, land use, economic development, and public health. The Collection includes China Administrative Regions Data, the Fundamental GIS: Digital Chart of China, China County-Level Data on Population (Census) and Agriculture, China County-Level Data on Provincial Economic Yearbooks, Chinese County-Level Data on Hospitals and Epidemiology Stations, Agriculture Statistics of People's Republic of China, and Priority Programme for China's Agenda 21. The China Administrative Regions Data provide accurate and highly reliable spatial data on the country. Included are two unique Geographic Information System (GIS) databases that cover the administrative regions of China, presented at a scale of one to one million, as of 1 July 1990 and 31 December 1990. Also available is a data set of GB (Guo Biao) Codes for the Administrative Regions of the People's Republic of China for 1982-1992. County-level data in the Collection may be linked directly to the GIS coverages using the GB codes. URL: http://sedac.ciesin.org/china/

Environmental Treaties and Resource Indicators

Partners: Multiple

The Environmental Treaties and Resource Indicators (ENTRI) system provides access to data on the content and status of international environmental treaties and to related national resource indicators and other socioeconomic and environmental information. It permits interactive, relational queries by country (including China), treaty, keyword, and indicator. ENTRI currently provides access to information on approximately 435 environmental treaties

(and the full text of about 170 treaties) related to nine global environmental issues, including global climate change, stratospheric ozone depletion, transboundary pollution, desertification and drought, conservation of biological diversity, deforestation, oceans and their living resources, trade and the environment, and population. It includes more than 145 national-level variables drawn from the World Resources Institute dataset and other sources.
URL: http://sedac.ciesin.org.entri

Gridded Population of the World

Partners: World Resources Institute (WRI), International Food Policy Research Institute (IFPRI)

Gridded Population of the World (GPW), version 2, is a unique global demographic dataset that provides consistent population estimates referenced to a 2.5 minute grid. This recently updated data set provides estimates of the population counts and densities for 227 countries of the world, including China, in 1990 and 1995. National estimates have been reconciled with the United Nations (UN) population estimates for those years; both the UN-adjusted and unadjusted data are available. GPW may be used in studies of greenhouse gas emissions, land use and land cover change, vulnerability to environmental change, and other aspects of human interactions with the environment.
URL: http://sedac.ciesin.org/gpw

World Data Center for Human Interactions in the Environment

CIESIN's World Data Center (WDC) for Human Interactions in the Environment serves the scientific community by archiving and disseminating interdisciplinary data and information concerning human interactions with the environment. This WDC focuses in particular on geo-referenced data on population and administrative boundaries that are needed for a wide range of interdisciplinary research. It also provides access to a Data and Information Catalog Service that can simultaneously search a wide range of national and international data catalogs and other information resources. The CIESIN WDC is one of more than forty centers comprising the World Data Center System of the International Council of Scientific Unions. URL: http://www.gateway.ciesin.org/wdc/

World Wide Website for the IPCC Special Report on Emission Scenarios (SRES)

Partners: Intergovernmental Panel on Climate Change Working Group III and Others.

In 1997, the Intergovernmental Panel on Climate Change (IPCC) charged its Working Group III with developing a Special Report on Emissions Scenarios (SRES) to provide a basis for analysis of potential future climatic changes and associated impacts and a reference for socioeconomic analysis of long-term mitigation options. Working closely with an international team of scientists from some twenty-five countries, CIESIN developed a World Wide Website to facilitate an "open process" aimed at obtaining inputs from the broad, international scientific community and ensuring a comprehensive, up-to-date, and balanced report. The SRES website includes descriptions of SRES activities and methods, detailed information on scenarios and associated integrated assessment models and "storylines," and an interactive system for visualizing scenario data. SRES scenarios provide both global and regional detail on a number of variables relevant to future greenhouse gas emissions, including data on population, economic growth, land use, and energy consumption. URL: http://sres.ciesin.org

East-West Center

Web address: http://www.ewc.hawaii.edu/

The East-West Center Research Program

The East-West Center Research Program (EWCRP) conducts multidisciplinary research on issues of contemporary significance with a view to promoting understanding and mutually beneficial relations between the United States and countries of Asia and the Pacific. The EWCRP aims to contribute to the long-term goal of building a just and prosperous regional community that eschews violence in the conduct of international relations. Current research themes include "Urban and Transnational Air Pollution" and "Ecosystems and Governance." Within the latter theme, the two research projects—*Civil Society and Resource Management in Asia* and *Developing National Institutions for Upland Development*—include activities in China.

Environmental Defense Fund (EDF)

Web address: http://www.edf.org/

Environmental Management Project

Partner: Beijing Environment and Development Institute

The Environmental Defense Fund (EDF) is currently undertaking a project, in partnership with the Beijing Environment and Development Institute (BEDI), to develop strategies for implementing China's total emissions control policy. It is the goal of Chinese State Environmental Protection Agency (SEPA) to control the emissions of some pollutants by 2000 at their 1995 levels on average throughout the country. EDF is working closely with the Planning Department of SEPA to examine implementation policy alternatives to help SEPA achieve this goal, with emphasis on the application of market-based solutions. Currently the EDF project has two pilot cities, Benxi and Nantong. At least one new city will be added this year. Capacity building in both institutions and personnel for local environmental authorities will also be provided through this project.

ELFIN Computer Modeling Training

Partner: Beijing Energy Efficiency Center

EDF is working with the Beijing Energy Efficiency Center in the training of China's energy planners in the use of ELFIN, a computer model developed by EDF to plan capacity potential from a full range of options (including renewable and demand side management).

Ford Foundation

Web address: http://www.fordfoundation.org

Sustainable Forestry at Lugu Lake

Partners: Yunnan Academy of Social Sciences, Yunnan Provincial Forestry Bureau
Focus: Sustainable Forestry

In this area of Yunnan Province the local Yi people live adjacent to a state nature reserve. Because the local nature reserve staff do not permit the Yi to engage in selective cutting in the state forest, the primary goals of this project were to help the Yi reduce soil erosion and increase income from on the land on which they live. The Ford Foundation and its partner, the Yunnan Academy of Social Sciences, successfully impelled the local government to work more closely with the Yi. The primary technique used was training local nature reserve staff in participatory rural appraisal—interviewing local people and integrating their views into the processes of project selection and design.

Friends of Nature, Beijing

Contact Information: cjliang@mail.ied.ac.cn Telephone/Fax (8610) 65252560

Environmental Summer Camp

Focus: Education
Status/Schedule: Initiated 1996

These camps were organized to give schoolchildren a deeper appreciation and fuller understanding of nature. The first, held in northeast China in July 1996, included sixty schoolchildren, ten teachers, and twenty journalists. The second camp took place in 1996 in the old-growth forests of Yunnan Province.

Free the Caged Wild Birds Campaign

Partner: Green Weekend (Environmental Publication)

Focus: Education
Status/Schedule: Initiated 1996

This campaign targeted the Chinese tradition of capturing wild birds and keeping them in cages. The campaign, during which several volunteers set free their caged birds, received a wide media response. To provide an alternative to caging birds and to give citizens the opportunity to see birds in a natural setting, Friends of Nature set up and continues a bird watching group that takes regular trips outside of Beijing.

Green Campus

Focus: Education
Status/Schedule: Initiated 1995

Friends of Nature assists student environmental groups throughout China by providing technical help and educational outreach for their on-campus activities. Friends of Nature works to attract and include students of all ages to all activities.

Green Forums

Focus: Education, Public Participation
Status/Schedule: Initiated 1993

This project consists of holding forums focused on environmental issues, which include environmental activists, citizens, and schoolteachers. They focus upon specific conservation issues that currently affect China and shortcomings in environmental education.

Information Resource Center

Focus: Education
Status/Schedule: Initiated 1996

Friends of Nature has worked to create a center that provides the public with environmental literature, reference works, visual materials, and up-to-date environmental information. The center is geared to serve the general public with regard to both education and research.

Respect for Animals

Partner: Beijing Zoo
Focus: Education
Status/Schedule: Initiated 1996

Friends of Nature helped the Beijing Zoo to replace the informational signs that describe the animals. The old signs discussed which animals could be eaten and how the parts of various animals could be utilized. The new signs emphasize the need to respect and protect animals.

Survey on Environmental Reporting in Chinese Newspapers

Focus: Environmental Reporting
Status/Schedule: Initiated 1995 to be held annually

This survey, the first of its kind in China, is compiled by scanning approximately eighty local, national, and industry-focused newspapers for environmental content. Both quantity and quality of reporting are measured, using measures such as the number of articles, the length of articles, and the placement of articles within the paper. Using these measures, trends are analyzed and individual papers are ranked from best to worst. Awards are given both to reporters and to newspapers for exceptional merit in the reporting of environmental issues.

Friends of the Earth (FoE)

Web address: http://www.foe.co.uk/
Web address: http://www.foe.co.uk/foei.html

Three Gorges Dam Activism

Friends of the Earth has played a significant role in convincing the U.S. Export-Import Bank to refuse to provide financing to U.S. companies hoping to receive contracts for the Three Gorges Dam project and has been fighting the project for over ten years. In addition, FoE has hosted Chinese opponents to the project, gained national publicity for the environmental and social problems of the project, and briefed government officials on the potential environmental impacts of the dam.

Global Village of Beijing

Web Address: http://www.ifce.org/gvb/index.html

Agenda 21 and Me

Focus: Education
Status/Schedule: Initiated 1997

This educational program for children includes a television series that is hosted by children and has children reporters, lectures at schools, training courses for teachers, and other environment-related activities.

Environmental Media Network

Focus: Education
Status/Schedule: Initiated 1997

This is an educational web for journalists, which includes training courses, workshops, forums, informational databases and program exchanges.

Environmental Newspaper Columns

Focus: Newspaper Reports
Status/Schedule: Initiated 1997

The Global Village of Beijing, as of 1997, was regularly writing environmental columns for three national newspapers (*China Consumers Daily, China Women's Daily* and *China Youth Daily*) and one magazine (*Middle School Student Magazine*). Cumulatively, the four publications had a circulation of almost two million.

Environmental 30 Minutes

Partner: China Central Radio
Focus: Radio Program
Status/Schedule: Initiated 1997

The program, which is co-produced with the China Central Radio station (CCR), is broadcast nationwide in China every other week.

Green Civilization and China

Partner: China Education Television (CETV)
Focus: Television Program
Status/Schedule: Initiated 1997

The show is produced independently by the Global Village of Beijing. *Green Civilization and China* is a thirty-

minute television program that is broadcast on an irregular basis by China Education Television, which is overseen by the State Education Commission and reaches 100 million viewers. The program is divided into four sections that provide domestic and international news, a discussion of possible solutions to China's environmental problems, information and advocacy regarding more environmentally friendly lifestyles and consumption patterns, and stories documenting individuals who are concerned about protecting the earth.

Recycling Campaign

Focus: Recycling
Status/Schedule: Initiated 1997

The Global Village of Beijing for years has conducted a variety of activities to encourage citizens to recycle. Activities include public education and advocacy, setting up pilot projects for waste sorting and recycling, and working with related government departments to spur action.

Time for Environment

Partner: China Central Television 7 (CCTV 7)
Focus: Television Program
Status/Schedule: Initiated 1997

The Global Village of Beijing produces the program independently. It is broadcast nationwide each week on Fridays and Saturdays on CCTV 7, which is the channel specializing in Science and Technology and Children's Education.

Institute for Human Ecology

Web address: http://www.ihe.org

1997 China Environment Forum

Partners: Chinese Society for Environmental Sciences, National Environmental Protection Agency (now SEPA)
Focus: Policy, Education, Energy, Technology
Status/Schedule: Held 1997

On 18-21 November 1997 in Beijing, The China Environment Forum was held. This event, which helped to bring the relatively young Institute for Human Ecology to prominence, brought together 100 delegates for two days of large meetings and one day of small workgroups. A relatively even mix was sought between Chinese and foreign delegates, with government officials, corporate officers, and authorities on environment-related issues were invited. The forum' s main goal was to put in place "practical measures" to achieve its four goals: promoting international awareness of China's situation; providing practical guidance to China on a host of environment-related issues; linking international corporations with Chinese government officials; and, launching a program of environmental education and awareness within China.

International Crane Foundation (ICF)

Web address: http://www.savingcranes.org/

Integrating Conservation with Rural Development at Cao Hai Nature Reserve

Partners: Cao Hai Nature Reserve, Guizhou Environment Protection Agency, and Trickle Up Program
Status/Schedule: Initiated 1993

Since 1993, ICF has been working at Cao Hai Nature Reserve, a wetland area supporting 400 wintering black-neck cranes and numerous other waterbirds. As a response to severe human pressure on the wetland and its watershed, this project involves local farmers in creating economic alternatives that protect the resource base on which both human and avian communities depend. The project relies on two micro-finance mechanisms (small grants and revolving

loan funds) and emphasizes farmer participation in decision-making and conservation.

Integrating Wetland Conservation with Agricultural Development in Sanjiang Plain

Partners: Heilongjiang State Farm Bureau, Heilongjiang Bureau of Water Conservation, Chinese Ministry of Agriculture, Wild Bird Society of Japan, Overseas Economic Cooperation Fund (Japan)

This project has developed guidelines for the protection of wetlands and wildlife in what was formerly the largest wetland in China, as part of preparations for farmland improvement and water management activities. They created a conservation plan to ensure the viability of wetlands protected or proposed for protection and are now negotiating with counterpart agencies about implementation of this plan during the upcoming year.

Protection of Black-necked Cranes in Agricultural Areas of South-Central Tibet

Partners: Tibet Plateau Institute of Biology, Agro-Environmental Protection Institute, Tibet Agricultural Bureau

Since 1990, ICF has been studying a wintering population of about 3,900 black-necked cranes (two-thirds of the world's known population). As this population is dependent on waste grain of fallow croplands in winter, the IFC has worked with agricultural authorities to develop strategies that will maintain cropland and roost-site conditions needed by cranes. ICF is currently considering mechanisms for initiating pilot activities at one or more additional locations.

Publication of China Crane News

Partners: Crane and Waterbird Specialist Group of the China Ornithological Society, Cracid Breeding and Conservation Center (Belgium)

Crane and Waterbird Specialist Group publishes its newsletter twice each year. China Crane News reports on research and conservation related to cranes, waterbirds, and their habitats in China. The newsletter is distributed among scientists, reserve managers, and officials interested in cranes, in order to enhance communication and cooperation. The newsletter includes full texts in both Chinese and English to promote international collaborations.

Studies of Waterbirds, Water Levels, and Aquatic Food Plants as a Basis for Conservation of Threatened Wetlands at Poyang Lake, China

Partners: Poyang Lake Nature Reserve, Jiangxi Nature Reserve Management Office

The International Crane Foundation is working with managers and technical staff at Poyang Lake Natural Reserve to study key aspects of crane and wetland ecology. Research will guide development of programs to mitigate impacts of wetland destruction and to expand protected areas in response to expected fluctuations in hydrology and aquatic vegetation.

International Fund for Animal Welfare (IFAW)

Web Address: http://www.ifaw.org/

China Bears Campaign

Partners: China Wildlife Conservation Association, Chinese Association of Medicine and Philosophy, Earthcare
Focus: Animal Cruelty, Black Bear Conservation
Status/Schedule: Initiated 1993, Targeted Completion 1996

The International Fund for Animal Welfare is headquartered in the United States and currently maintains a Beijing

office. IFAW initiated this project by investigating China's bear farms and publicizing the terrible conditions in which over 10,000 individual Asiatic black bears were incarcerated for the production of bile. They are caged in constricting wire cages and subject to barbaric surgeries. This kicked off a worldwide campaign that brought mounting pressure from within and without China to solve the problem. In 1994, IFAW granted U.S. $75,000 to fund a research program to produce an herbal alternative to bear bile, which was carried out by Beijing's State Administration for Traditional Chinese Medicine. Research and lobbying efforts continued as of 1996.

International Fund for China's Environment (IFCE)

Web address: http://www.ifce.org/

The First NGO Forum on U.S.-China Environmental Cooperation

Partners: Professional Association for China's Environment, Woodrow Wilson Center, Global Village of Beijing, Overseas Chinese Environmental Engineers and Scientists Association

The first NGO Forum on U.S.-China Environmental Cooperation was held in Bethesda, Maryland on 2-3 September 1999. In attendance were approximately 100 people from more than sixty organizations representing environmental NGOs from both the U.S. and China. The Forum provided a unique opportunity for practitioners and experts concerned about China environmental protection to become acquainted, exchange ideas on issues such as NGO development, fundraising, public education and outreach as well as conservation technologies. The goal is to strengthen communication among U.S. and Chinese environmental NGOs. The URL http://uschinango.org/ provides a summary of the meeting.

Publication of the Environmental Series Reading

Partner: Chinese Population and Environment Association and the European Union
Status/Schedule: The Series will be Published by the End of 2000

IFCE will be compiling and publishing a series of environmental readings for children and students in China. The series includes two parts: 1) "Children Version-Letters from Aunt Zhenzhen" to cover concepts of environmental elements; and 2) "Student Version-Reports and Essays from Young Environmental Protection Guardians" to teach how air and water are polluted and how to keep them clean. More than three thousands of essays and articles have been received nationwide through announcements in the *Chinese Children Newspaper* and *Chinese Young-Student Newspaper*.

Training Center in Northeast Forestry University and Assessment of Tiger Habitats in Northeast China

Partner: Northeast Forestry University, China

A natural resource management-training center will be established in Northeast Forestry University. The first training course was held in September 1999. Meanwhile, the remaining habitats for the Siberian Tigers in northeast China were assessed.

Training Center in Zhejiang University

Partner: Zhejiang University, China and Environmental Research Science Institute (ESRI), Inc

A natural resource management-training center will be established at Zhejiang University in Hangzhou City. The objectives of this center are to provide GIS, remote sensing and other resource management technologies for professionals in natural resources management areas; to enhance academic exchanges among IFCE, Zhejiang University and ESRI; and to provide a platform to develop cooperative projects in technological applications.

Young Scientists Forum "Conservation Biology"

Partner: Chinese Association of Science and Technologies

IFCE is working on a "Young Scientists Forum" to discuss conservation biology which will be held in Beijing in October 1999. The forum will bring thirty scientists, primarily from China and the United States, together to address issues in conservation biology.

International Institute for Energy Conservation (IIEC)

Web address: http://www.cerf.org/iiec

Compressed Natural Gas Transportation Project

IIEC has completed developing a proposal for a transportation project that will convert fleet vehicles in Beijing from gasoline to compressed natural gas.

Energy Efficient Transformers

Partners: Multiple Chinese Agencies and Enterprises

IIEC worked with several Chinese agencies and enterprises to promote the use of energy-efficient transformers in China. The focus of this project was to develop policies that encourage Chinese electric utilities to purchase transformers based on total life-cycle cost analysis.

Market Development/Technology Transfer in China for Energy-Efficient Industrial Motors and Motor Systems

Partners: Multiple Chinese and U.S. Government Agencies, Private Sector Companies and Research Organizations

The International Institute for Energy Conservation (IIEC) is engaged in a three-year project to facilitate the development of a market for energy-efficient industrial motors and motor systems in China. The project includes a study tour in the United States in February 2000 for IIEC's Chinese partners to meet with their counterparts in government that formulate energy efficiency policies and standards, motor manufactures, motor repair and maintenance companies, end-user associations and individual end-users (e.g., utilities, industrial plants), and research institutes. The first objective of the study tour is to provide technical support, information and training to help the delegation draft energy efficiency standards. The second objective is to partner Chinese end-users and motor manufacturers with their U.S. counterparts to help educate and promote the economic value and other benefits to China of energy-efficient motors and motor systems. For more information starting 8 February 2000 call Project Manager Denise Knight at (202) 326-5170 or email dknight@iiec.cerf.org.

Xiamen Sustainable Transport Project

Partners: City of Xiamen, U.S. Environmental Protection Agency
Status/Schedule: Completed

IIEC has completed work with the City of Xiamen to undertake an integrated transport services planning activity. The purpose of the project was to analyze the most cost-effective and least polluting way to improve Xiamen's transportation system.

International Institute for Environment and Development (IIED)

Web address: http://www.oneworld.org/iied/index.html

An Interdisciplinary Approach to Reduce Nutrient Losses by Erosion in Sichuan Province, China

by Combined Use of Participatory and Modeling Techniques

Partners: Winand Staring Center for Integrated Land, Soil and Water Research (The Netherlands), the Swedish University of Agricultural Sciences, and Several Partners in China
Status/Schedule: Initiated 1998

This joint project aims to find alternative land and water management systems to reduce the loss of soil, water, and nutrients by combined use of soil erosion and nutrient modeling, and participatory research and planning techniques in the Hilly Purple Agricultural Area of the Sichuan Province of China. The project, which began in mid-1998, involves: 1) development of a standardized method for measuring nutrients in sediment and runoff at different scales; 2) performance of a field survey in a selected watershed to determine the flows of soil, water, and nutrients and deliver the necessary model input; 3) extension of a state-of-the-art soil and water erosion model with a nutrient sub-model; 4) calibration and validation of the model for conditions met in the study area; 5) participatory appraisal of local social and environmental problems and opportunities; 6) capacity strengthening of Chinese research organizations to conduct soil erosion modeling and participatory appraisals; 7) selection of conservation alternatives and translation into model parameters; 8) formulation of methodology to find conservation alternatives using participation of local actors and the extended model; 9) testing the methodology in the watershed; and 10) implementation of a participatory monitoring and evaluation system.

The project expects to produce: 1) a standardized method of measuring nutrient concentrations in sediment and runoff at different scales; 2) an extended state-of-the-art water erosion model, able to predict and simulate transport of soil, water, and nutrients on the field and watershed scale; 3) a new methodology using a soil erosion model in a participatory planning process; and, 4) a participatory monitoring and evaluation system to ensure prolonged use of the results.

International Rivers Network (IRN)

Web address: http://www.irn.org/

Three Gorges Project

By using the Three Gorges Project as a case study, IRN is working to increase public awareness regarding the environmental, social, cultural, and economic impacts of unsustainable river management practices in China. Accomplishments of this campaign have included: a National Security Council recommendation that the U.S. government should stay clear of the project; and a May 1996 U.S. Export-Import Bank announcement that they would not guarantee loans to U.S. companies seeking contracts for the Three Gorges Project. This announcement impeded private-sector capital flows to the project by mobilizing public pressure on existing and potential investors and documented the immediate technical problems and social and cultural impacts that were being covered up by project officials.

International Snow Leopard Trust (ISLT)

Web address: http://www.snowleopard.org/

Conservation of the Snow Leopard and its Mountain Habitat

ISLT is dedicated to the conservation of the endangered snow leopard and its mountain ecosystem through a balanced approach that considers the needs of the local people and the environment. ISLT's activities in China have focused on three main areas: 1) ISLT held the 7th International Snow Leopard Symposium in Xining, Qinghai Province in 1992; 2) ISLT convened a training workshop on Snow Leopard Information Management Systems (SLIMS) and conducted "hands-on" field surveys in Gansu Province in 1993; 3) ISLT has translated and distributed snow leopard captive management techniques for eight Chinese zoos; and 4) ISLT has hired a Snow Leopard Conservationist in China to implement research activities and conservation projects throughout the snow leopard's range.

IUCN—The World Conservation Union

Web address: http://www.iucn.org/

IUCN's work in China primarily focuses upon a broader range of mechanisms and is concentrated at two levels, the provision of policy input to high-level agencies and the development and strengthening of technical networks. In due course a third mechanism—selected training and field projects—will be developed. Currently the most important policy mechanism used by IUCN is the China Council for International Co-operation on Environment and Development (For information on the Council, see entry under the Canadian International Development Agency in this inventory).

Joint Institute for Energy and Environment (JIEE)

Web address: http://www.jiee.org

Biomass in China

Partner: Yunnan Environmental Research Institute

JIEE has worked since 1989 with researchers from the Yunnan Environmental Research Institute in Yunnan Province, China to carry out extensive feasibility studies on biomass-to-electricity. The goal has been to identify sites suitable for the development of electricity production using biomass as a fuel. As a result of this work JIEE held a workshop in Knoxville, Tennessee linking energy and policy officials from Yunnan with American energy companies interested in the possibility of investing in biomass energy in China.

Memorandum of Understanding

Partner: Chinese Research Academy of Environmental Sciences

In October 1995, JIEE and the Chinese Research Academy of Environmental Sciences signed a Memorandum of Understanding. Preparation has begun for joint research in two areas: effects of greenhouse gas and exchange of information on environmental labeling.

Reform of the Pollution Levy System

Partners: State Environmental Protection Administration, Chinese Research Academy of Environmental Sciences

JIEE staff has worked with Chinese counterparts on development of incentive-based regulation of environmental pollutants since 1991 when they helped organize the first Chinese national workshop on the issue. JIEE has hosted scholars and study groups, provided consultants, and participated in decision meetings and other activities in China. They are now working with Chinese authorities and researchers on evaluation of ongoing pilot projects for pollution levy system reform and publishing and communicating results of previous work.

Renewable Energy for Rural China

Partners: Winrock International, Asia Development Bank, State Economic and Trade Commission, and other PRC Government Agencies

JIEE staff members are following up on previous projects on renewable energy in a program to determine the most effective ways in which renewable energy can be used to meet economic development, poverty reduction, and environmental goals in China.

Global Climate Change

Partners: U.S. Department of Energy, Resources for the Future, Various Chinese Scholars and Government Agencies

JIEE staff has analyzed technology transfer as one mechanism for limiting growth in greenhouse gases. Other activities have included analysis of joint implementation, both in general and as a mechanism for cooperation with China. Continuing activities are expected.

Missouri Botanical Garden

Web address: http://flora.harvard.edu/china/ [Flora of China Project website]
Web address: http://www.mobot.org/ [Missouri Botanical Garden website]

Flora of China Project

Partners: Harvard University; the California Academy of Sciences; the Botanical Institutes of Beijing, Guangzhou, Kunming, and Nanjing; the Smithsonian Institution; Missouri Botanical Garden: The Coordinating Center; and the Royal Botanic Garden, Edinburgh and Kew
Status/Schedule: Targeted Completion 2010

The Flora of China Project is a collaborative effort among a variety of institutions that seeks to create partnerships between Chinese, U.K., and U.S. research institutions to catalogue the flora of China and produce an up-to-date English version of China's *Flora Reipublicae Popularis Sinicae*, which contains eighty volumes. The project consists of four main areas: 1) publication of text and illustration volumes; 2) creation of a database; 3) maintenance of a species checklist; 4) specimen purchase; and 5) maintenance of up-to-date websites.

The major thrust of the project is to update and publish for the first time in English a comprehensive work on Chinese plants. The project is expected to be completed by the year 2010, ten years after the completion date of the Chinese version. The data from the Flora of China project will also be entered into a comprehensive Missouri Botanical Garden database that will be accessible on-line. Additional efforts include completing and updating a checklist on the plants of China of which nearly seventy percent is available on-line, and the purchase of about 600,000 Chinese plant specimens for the Garden's herbarium. Four volumes of text and one of illustrations have already been published. The fifth volume of text and second of illustration are scheduled for publication this year.

National Committee on U.S.-China Relations

Web address: http://www.ncuscr.org/

Administrative Decentralization and Environmental Protection

Partners: Heilongjiang Province Environmental Protection Bureau, Chinese Academy of Sciences, Institute of Geography, Changchun Branch

The goal of this project is to examine the impact of recent reforms in the field of environmental protection and to draw lessons from comparative experiences of the two countries in solving local problems through local initiatives. Programmatic activities related to decentralization and environmental protection involve local institutions in China's Northeast interior provinces of Jilin and Heilongjiang. The National Committee created a working group comprised of Chinese and American specialists/practitioners to identify priority needs and devise plans for an integrated set of activities to meet those needs, to be implemented over several years. Two joint working group meetings have been held and a series of training sessions and exchange activities are planned to take place in 2000. Activities focus on local water resource management related to wetlands conservation, lake pollution prevention, and community awareness raising.

Exchanges

Partners: Various Government Agencies and NGOs

Over the past decade, the National Committee has carried out delegation exchanges focusing on aspects of sustainable development and environmental protection. These exchanges (both Chinese visits to the United States and

American visits to the People's Republic of China) have included: 1) a Citizen Involvement in Environmental Protection Delegation to the United States, which examined how American environmental organizations involve citizens in environmental protection activities; 2) a Growth Management Workshop in the People's Republic of China, which focused on methods of managing urban growth in order to protect agricultural lands; 3) a Sustainable Agriculture Delegation to the United States, which examined practices and government policies related to agriculture; and 4) an Environmental Education Leadership study tour to the United States which explored curriculum development, community activism, public-private collaboration, and environmental awareness efforts. Delegation exchanges scheduled for 1999 included: 5) Energy and Transportation, which focused on energy efficiency, alternative fuels, and transportation management; and 6) Local Environmental Protection Leadership, which addressed local environmental management concerns, including laws, regulations, and enforcement.

Grassroots Environmentalism

The National Committee expects to send five American environmental education specialists to China for twelve days later this year to lead two-day workshops in several Chinese cities. Cities with significant environmental problems will be chosen and could likely include Beijing, Harbin, Changchun, Lanzhou, or Fuzhou. The workshop will examine American efforts in environmental education, including strategies for building awareness of environmental issues, establishing public-private partnerships, mobilizing public participation, and making effective use of the media. The workshops will include lectures at local schools or community organizations to demonstrate sample environmental education lessons and teaching techniques. American participants might include an environmental education teacher, a private sector representative responsible for community outreach, a park ranger specializing in public programs, an environmental NGO leader, and a professor of environmental science with a broad understanding of the field. Chinese participants in the workshops would be drawn from NGOs, the media, environmental protection bureaus, the scientific community, industry, and the education system.

Natural Disaster Preparedness, Response and Community Involvement

The National Committee is planning to bring together participants from the PRC, Taiwan, and Hong Kong to foster cooperation among them when responding to natural disasters. As the recent earthquake in Taiwan demonstrates, valuable time can be lost and flexibility in devising responses can be limited if inter-regional cooperation plans are not in place prior to the occurrence of a natural disaster. This project offers an opportunity to encourage collaboration, attempt to de-politicize the disaster response process and develop effective inter-regional policies. The study tour to the United States would include visits to the Federal Emergency Management Agency (FEMA), the Army Corps of Engineers, the Red Cross, and other national government agencies and NGOs that anticipate and respond to natural disasters. The delegation would also visit areas of the United States that have recently experienced or are particularly vulnerable to natural disasters, such as the Virginia/North Carolina coast (tidal floods), Des Moines (river floods), Oklahoma City (tornadoes) or Los Angeles (earthquakes, fires). The program would address themes such as: central versus local initiatives, intergovernmental coordination, public/private cooperation, financial incentives to encourage disaster mitigation measures, recovery efforts, and establishing effective organizational systems that anticipate and predict disasters.

Post-Flood Eco-System Recovery Workshop along the Songhua and Nen Rivers

Partner: Heilongjiang Province Environmental Protection Bureau

In collaboration with the Heilongjiang Province Environmental Protection Bureau, the National Committee on U.S.-China Relations sent a team of American specialists for a week-long visit and workshop in May 1999 to provide expert advice on post-flood ecosystem restoration. The agenda included sessions on: managing restoration and land use in the region; protecting riverbanks, bottomlands, and reservoirs; restoring forests and grasslands after emergencies as well as during non-disaster conditions; and coordinating the natural river environment with local economic development.

Sustainable Land Use and Allocation Program for the Ussuri River Watershed

Partners: Heilongjiang Territory Society, two institutes of the Russian Academy of Sciences—Far East Branch, Ecologically Sustainable Development, Inc., and Russian and Chinese Government Agencies

This project convened scientists, policy-makers, and government officials from China, Russia, and the United States to develop a sustainable land-use plan for the Ussuri River watershed, a region roughly the size of New England of which two-thirds is in Russia and one-third in China. Significant aspects of the project included: negotiating a multi-lateral agreement among the participating organizations; organizing and coordinating trilateral scientific teams; collecting and synthesizing their findings; coordinating public meetings throughout the region; and editing a 300-page final report that was published in three languages.

The recommendations outlined in the final report include: the establishment of four international peace parks; the establishment of a bilateral (Chinese and Russian) steering committee to oversee the implementation of the report's recommendations; and, specific investment opportunities in the region that are sustainable in nature. The planning stage of the project concluded in May 1998 when the Vice Governors of both regions met in Khabarovsk to sign a memorandum of understanding which included the designation of "secretariats" in each of the three territories to coordinate implementation efforts.

U.S. Environmental Priorities in China: A Dialogue with American Foundations

On 10 February 1999, the National Committee and the Woodrow Wilson International Center for Scholars co-sponsored a one-day meeting in Washington, D.C. on Sino-American cooperation in the field of environment and sustainable development for representatives of American foundations and international donor agencies. The purpose was to help shape the U.S.-China Environmental Agenda for Chinese Premier Zhu Rongji's visit to Washington in April 1999.

Natural Resources Defense Council (NRDC)

Web address: http://www.nrdc.org/

Demonstration of a Model Energy Efficiency Project

Partner: AES Corporation

NRDC met in January, 1998 with the President of AES China Generating Co. Ltd., an American independent power company currently operating with power plants in China. AES Corporation is very interested in joining with NRDC to develop a model energy efficiency project that would combine demand-side energy efficiency measures with new investments in power supply, in order to maximize the economic and environmental benefits of new power investment. AES is seeking approval from the Chinese government to begin construction of a co-generation plant in Tianjin, a major municipality north of Beijing. AES and NRDC believe that expanding this project into a first-of-a-kind pilot project, that would not only provide power but also finance energy efficiency improvements by major end-users, would attract the critical support of the central government and enable the project to proceed. NRDC has already been able to gain initial support from the Administrative Center for China's Agenda 21, which is backed by the State Science and Technology Commission.

Three pilot projects are being considered. First is a co-generation plant in Tianjin which will focus on energy efficiency mainly for end-users. Second is a power plant in the Henan province, managed by AES, that provides energy to an aluminum plant. AES is currently working on an agreement with the aluminum plant in which AES will fund expansion of the plant in an energy efficient manner and be reimbursed by savings the plant will make in energy costs. Finally, there is a proposed energy efficient power plant that AES wants to build in the independent municipality of Chongqing. This effort hopes to build upon environmental accords between the mayor in Chongqing and the Center for Strategic and International Studies and the National Center for Asia Research in Seattle.

Energy Efficient Buildings

Partners: Multiple Partners

NRDC's program to promote energy-efficient building construction in China combines a three-city demonstration project, development of more comprehensive building codes, and a new financing mechanism for energy-efficient housing.

NRDC's Three-Cities demonstration project is modeled after the Three-Cities fuel cell transportation demonstration project sponsored by the W. Alton Jones Foundation, and will include a 650,000 square foot, $70 million Chongqing Guesthouse project now in the design phase. On regulatory mechanisms, NRDC has begun a collaboration with the Ministry of Constructions' new Office of Energy Efficiency. Efforts in this area will most likely include real-world pilot projects to first determine what level of standards are achievable in practice, and then demonstrate to local governments and the market that achieving the standards is both practical and economical. NRDC's China Clean Energy Project is working to develop market transformation and financing mechanisms that will help to overcome existing barriers to energy efficiency. NRDC has proposed to work with a Chinese bank that would dedicate a share of its lending to projects that conform with certain sustainable development criteria, including at least a twenty percent net return on investment when the costs of external environmental factors and lower lending costs are considered.

Environmental and Energy Policy Development

Partner: Fudan University

NRDC met in January 1997 with the Deputy Director of Fudan University's Center of American Studies and the Director of the University's Research Center of Environmental Science. NRDC and the representatives of Fudan University agreed to establish a Fudan University-NRDC Environmental Seminar Program that will bring together experts from China and the United States on a variety of environmental and energy policy issues. This program will seek the participation of environmental policy leaders in Beijing and Shanghai as well as university students. Because of the University's close relationship with the Shanghai Municipal Bureau of Environmental Protection, NRDC was able to meet with officials from the agency, who expressed great interest in the program and provided a number of suggested topics. NRDC will also seek opportunities to use this program as an unofficial forum to further constructive dialogue between the United States and China on environmental issues.

Industrial Energy Efficiency

Partners: Multiple

NRDC's program to promote industrial energy efficiency in China consists of a demonstration project evaluating the potential for combined power and chemical production in Chongqing, and a pilot program for utility-funded demand side management in the aluminum industry. NRDC has developed a partnership with the Chongqing Municipal Economic Commission and the U.S. Department of Energy to evaluate the use of natural gas, coalbed methane, hydrogen, and coal gasification in combined technologies to produce both power and chemical fertilizer while minimizing carbon dioxide emissions. The feasibility study for this project will be carried out by a team of NRDC policy analysts and technical experts from the U.S.-China Energy and Environment Technology Center (EETC) in Beijing, and the Lawrence Livermore National Laboratory. NRDC is also working with the Chinese partners to develop a pilot utility program designed to improve energy efficiency in the aluminum industry. This program would link power production and energy conservation for what may be the first time in China, and provide a model for utility financing of demand side management programs.

Promotion of Gaseous Fuels in China

Partners: Battelle, Pacific Northwest National Laboratory

NRDC will continue to work with Battelle, Pacific Northwest National Laboratory to promote the use of domestic and imported natural gas, coalbed methane, and hydrogen as a large-scale alternative to coal and nuclear power in China. These groups will also work together on a White Paper analyzing the potential for an increased use of gaseous fuels in power production and the resultant impact upon global carbon emissions.

Technology Development and Climate Change Modeling

Partners: China Academy of Engineering Physics (CAEP)

NRDC has signed an Agreement for Cooperation with the CAEP, a complex of ten major institutes and laboratories in Beijing and Sichuan province, whose major responsibilities include the research, development and testing of Chinese nuclear weapons. Because of advances in nuclear weapons arms control and China's signing of the Comprehensive Test Ban Treaty last September, CAEP is redirecting some of its substantial research capabilities to work on the country's pressing environmental problems. Based on its long-standing working relationship with NRDC on arms control issues, CAEP has asked NRDC to help with the development of CAEP's newly created Research Center on Environmental Protection Engineering (the "Environmental Research Center").

NRDC met in Beijing in January 1997 with representatives of the Environmental Research Center, which employs 1,000 highly skilled scientists and has perhaps the most advanced computing and modeling capabilities in China. NRDC reached agreement on several priority projects of mutual interest including climate change modeling, the development of energy-efficient lighting and hydrogen fuel cells, and the formulation of lower-polluting gasoline. NRDC will assist the Center in its research and development efforts through a series of technology exchanges with experts in the United States and other countries.

Pacific Environment and Resources Center

Web address: http://www.pacenv.org/

China Biodiversity Conservation Project

Partner: Chinese Ministry of Forestry

The Pacific Environmental Resources Center has several projects under the China Biodiversity Conservation Project, the majority of which are grassroots projects. These projects include: wetlands conservation; migratory bird protection in Southwest Asia; NGO and grassroots capacity building and technical support; wetland action plan development; nature preserve management, particularly in the Tumen River basin; development of a natural resources database on the Tumen River basin; Ecological Information Centers in Beijing and the Yunnan province; and a proposed project to promote renewable energy in the rural Southwest.

Renewable Energy Project

Partners: Linglan County, China Exploration Research Society, Yunnan Geography Institute, staff and students at Yunnan University

The Renewable Energy Project will include an energy audit to assess options and barriers for future clean, sustainable energy development for local needs (e.g., cooking, heating, and lighting). The project will involve work with villagers in the Lugu Lake area of Linglan County, as well as the China Exploration Research Society, the Yunnan Geography Institute, and staff and students at the Yunnan University (Kunming). The project will involve meetings with local agencies involved in energy planning and research, such as the Yunnan Department of Agriculture. In subsequent stages of this project, the energy audits will serve as the basis for further work to bring together international and local individuals, agencies and businesses to meet rural energy needs in Linglan and other areas in China. The

ultimate goal of the project is to implement an appropriate renewable energy project at Lugu Lake over the next several years.

Tumen Environmental Initiative

The Tumen Environmental Initiative has four basic components: 1) to create and distribute a comprehensive directory of environmental advocates working in Tumen; 2) to provide direct funding for Russian, Chinese, and North Korean individuals and environmental organizations working on scientific, policy and education efforts in Tumen; 3) to establish a Russian-Chinese-North Korean exchange program for environmental advocates; and 4) to improve public participation in national and international agency decision-making.

Smithsonian Institution

Web address: http://www.si.edu/

Biological Diversity Program

Partner: UNESCO

This program fosters international cooperation in the management and conservation of protected areas through research and training. Previous training sessions have included a biodiversity measuring and monitoring program with the Chinese Academy of Sciences and methodology courses in Guangzhou City.

Flora of China

Partners: Missouri Botanical Garden, Harvard University, California Academy of Sciences, and National Science Foundation

This project, funded by the National Science Foundation and coordinated by the National Museum of Natural History, will study and document the plants of China, and translate and revise Chinese efforts in works on the plants of China.

Giant Panda Conservation

Coordinated by the National Zoo, this project documents the biology and behavior of the giant panda for purposes of developing and maintaining a captive self-sustaining population.

Global Change Program - Deltas

Partners: National Geographic Society, Multiple Universities

This project will examine the recent geological evolution of Mediterranean and other world deltas in light of natural factors (sea level, paleoclimates, subsidence) and humans. Initial studies have focused on the Holocene geology of the Yangtze Delta.

Mass Extinctions (International Geological Correlation Program)

Partners: UNESCO, International Union of Geological Sciences

This project will study worldwide patterns of biotic recovery following mass extinctions over geologic time and develop predictive theories of extinction. Initial study has been conducted with the Nanjing Institute of Geology and Paleontology.

Wildlife Conservation and Management Training Program

Partner: North American Association for Environmental Education

Begun in 1981, this extensive program trains wildlife professionals from developing countries in the techniques and theories of conservation biology and wildlife management. Over seventeen of these training courses have been undertaken in China since 1987.

Television Trust for the Environment (TVE International)

Web address: http://www.eetpc.org/

Environment Education Television Project for China

Partners: The Centre for Environmental Education and Communications of the State Environmental Protection Administration, the Institute of Science and Technical Information of China, the Chinese Academy of Science, Friends of Nature, Global Village, and the WWF China Programme Office
Focus: Education, television programming
Status/Schedule: Initiated 1997

The Environmental Education Television Project for China was officially launched on 13 March 1997 with an agreement signed between the Television Trust for the Environment (TVE International) and the Centre for Environmental Education and Communications of the State Environmental Protection Administration. The aim of this project is to import high-quality documentary films with environmental content to China and translate them for Chinese language transmission. The films will be brought into China in the form of broadcast master tapes, which are of high enough quality to be duplicated. Then, after import, copies of the films will be available to anyone who wishes to screen or broadcast them for a nominal fee.

The China Environment and Sustainable Development Reference and Research Center

Partners: Center for Environmental Education and Communications, State Environmental Protection Agency
Focus: Education
Status/Schedule: Initiated 1997

The Center aims to provide information and services to the growing number of concerned environmentalists in China and to scholars from around the world. It is open to the whole community, including government agencies, nonprofit organizations, Chinese and international scholars, scientists, communicators, development workers and international assistance agencies. It houses a library of books, periodicals and officially published data, has computer and reference resources, contains meeting space, and provides office space.

U.S.-China Environmental Fund (USCEF)

Contact Information: mail@uscef.org; Tel: 608-767-3888, Fax: 608-767-3887

Biodiversity Conservation and Forest Management

Partners: SEPA, State Forestry Administration, Provincial Bureaus for respective sites, University of Wisconsin-Madison, Fauna and Flora International

A range of capacity building programs are being developed in Yunnan, Sichuan, Qinghai Provinces, and in the Tibet Autonomous Region with local agencies to conserve biodiversity and sustainably manage critical forest resources. The first major program is the Wuliangshan Mountains in Yunnan Province with funding from the Global Environment Facility. In general, all programs will involve local stakeholders in project design and implementation, which will include alternative agricultural practices and livelihoods to reduce development pressures on sensitive ecosystems. Key priorities focus on long term planning, development of funding mechanisms, and facilitation of multi-agency and multi-disciplinary cooperation for resource management.

The Great Wall at Badaling

Partners: Beijing Municipal Government, Badaling Special Zone Administration

This project integrates environmental planning with economic development by balancing conservation and tourism at Badaling. In partnership with the Beijing Municipal Government, USCEF is preserving the cultural integrity of this section of The Great Wall though the design and development of the International Friendship Forest, a 100-acre natural park along the western edge of The Great Wall at Badaling. A master plan for Badaling, the most popular Great Wall site, is being designed and implemented to accommodate increased tourism from the newly completed Beijing-Badaling expressway.

High School Environmental Education Program

Partner: China State Environmental Protection Administration (SEPA)

After initiating an environmental education exchange between eighteen U.S. and Chinese sister cities in 1996, USCEF is now working with SEPA on an experiential environmental education program for high school students in China's largest cities. A major product of the program is the publication of municipal Environmental Handbooks (for Beijing, Shanghai, Tianjin, Shenzhen, and Lanzhou to date), which serve as a hands-on, practical guide on local environmental conditions. The Handbooks are linked to a field studies program that turns a city's environmental management systems into a laboratory for study, including suggestions for monitoring exercises and environmental community service activities. In 2000, in cooperation with International Awareness Community Theater (I-ACT) USCEF will launch Theater for Environmental Awareness (TEA) that will use storytelling, dance, song, and drama as powerful and compelling methods to engage audiences on a range of environmental issues.

National Parks, World Heritage Sites

Partner: Chinese Ministry of Construction

In cooperation with the Ministry of Construction's National Park Administration, USCEF is helping build the institutional capacity of China's national park system. The technical assistance program will publish interpretive literature, strengthen policies and laws for park administration and concessions, create design standards for construction within parks, address economic development needs of communities surrounding parks, and conserve threatened cultural and natural resources. Specific activities include policy research and development, training, strategic planning utilizing GIS, interpretive signage, visitor programs and publication of educational materials, and ongoing exchanges with U.S. park professionals.

Lead Poisoning Prevention in China

Partners: China State Environmental Protection Administration, Beijing University, Shanghai Children's Medical Center, Alliance To End Childhood Lead Poisoning

The project will assist key Chinese institutions in developing and implementing effective education and prevention programs to control and eliminate environmental sources of childhood lead poisoning. USCEF, working with the Alliance To End Childhood Lead Poisoning (a U.S. NGO) and Chinese partners, will help build coalitions of government agencies, environmental organizations, industry associations, universities, and medical centers to provide technical and policy assistance at the national and local levels and help conduct community-based pilot projects. Currently, coalitions are being built in Beijing and Shanghai, and one more city will be identified by Earth Day 2000. Partnerships are being sought with Chinese, U.S., and international entities who can support these lead prevention initiatives.

Wetlands International, Asia-Pacific

Web Address: http://www.wetlands.agro.nl/

National Wetland Conservation Action Plan

Partners: WWF, Ministry of Forestry (now State Forestry Administration)
Focus: Wetlands Conservation, Policy
Status/Schedule: Initiated May 1996

China's extensive wetlands currently are over-exploited. This cooperative effort brings together 15 national level ministries in a process that identifies and begins to resolve conflicts regarding the use, exploitation and conservation of China's wetlands.

Mangrove Forest Management

Partner: Euroconsult (Netherlands)
Focus: Wetlands
Grant: U.S. $3 million
Status/Schedule: Funding anticipated in 2000

The project focuses on enhancing the management and restoration of mangrove forests in Guangdong Province's Leizhou Peninsula, which is the largest mangrove area left in China. In recent years, some of the area has been destroyed and the health of much of the rest has been harmed by human activity, especially aquaculture fish farming (Source: *Chinabrief*, August-November 1999).

Newsletter for Wetlands

Partners: WWF, CITES, Qiniuangdao Safari Park
Focus: Wetlands conservation, Education, Policy
Status/Schedule: Initiated

This biannual publication is written and produced by Wetlands International and distributed to citizens, researchers, professionals and Chinese government officials. The magazine-format newsletter is in Mandarin Chinese, with selected articles and a table of contents in English. Its contents include special sections and articles on topics that relate to wetlands conservation, reports on wetland-related research, reports on wetland-related organizations, meeting summaries, and lists of new English and Chinese language wetland-related publications.

Winrock International Focus: Agriculture

Web address: http://www.winrock.org/

LEAD21 Program

Partners: Starr Foundation, Chinese Education Authority, and Chinese Agricultural Universities
Status/Schedule: Initiated 1996, Target Completion 1998

The LEAD21 program brings instruction in agricultural economics, agribusiness principals, and policy reform to China, as well as training farmers in economics. LEAD21 students are being trained to become policy makers and instructors in the hope that they will help ensure China a place in the world food market.

World Resources Institute (WRI)

Web address: http://www.wri.org/

Climate Policy, Air Pollution and Public Health: Estimating Mortality and Morbidity from Fossil Fuel Consumption in Major Urban Areas in China

Partners: USEPA, China Council's Pollution Working Group, Tsinghua University, Beijing Medical University, Shanghai Environmental Protection Bureau

This project focuses on conducting studies in Beijing and Shanghai and other major urban areas of China to document the benefits that would follow from adopting less carbon-intensive energy and urban transportation policies. This would lessen the impact of greenhouse gases from fossil fuel consumption, and significantly reduce current and future public health impacts from exposure to combustion-related air pollutants.

China Energy Future Project

Partners: Energy Research Institute, China State Environmental Protection Administration

This project has two overarching objectives. The first is to support a process within China to compare several studies on energy, environment, and climate change as they relate to China's economy. Several such studies have been undertaken in recent years, and they are essential to developing a broad-based, well-informed discussion of China's energy options and their environmental ramifications. The second objective is to improve international understanding of the energy challenges facing China and to encourage effective, international cooperation on energy and environment issues.

China Environment and Health Project

Partners: Policy Research Center for Environment and Economy, Chinese Academy of Science's National Conditions Analysis Group

The primary goal of this project is to improve the quality and type of information available on the relationship between environmental degradation and human health. To assist in this effort, WRI is working with its partners to develop the Environment and Health Profile of China. This profile will pull together in one place the key indicators and studies that link environmental conditions to public health and will attempt to identify the direct and underlying causes for these conditions and what is being done to address the problems.

World Wildlife Fund (WWF)

Web address: http://www.panda.org/

Web address: http://www.panda.org/resources/countryprofiles/china/page1.htm

Beijing Energy Efficiency Center (BECon)

Partners: Battelle, ERI, and Lawrence Berkeley National Laboratory

WWF is working with BECon to help implement its energy policy analysis in China. WWF is moving forward in its efforts to help create a strong domestic market for energy efficient and renewable energy technologies in China and build capacity at a local government level to implement efficiency and renewable based energy solutions. WWF is also promoting a shift to economic growth at low CO_2 emissions in China, with an overall goal to promote a domestic market for priority applications, which integrate available energy efficiency and renewable energy technologies into the sustainable growth of the local rural economy while reducing or eliminating CO_2 emissions sources. The objective is to identify and develop market and policy incentives to promote a domestic market for a set of specific end-user applications with wide applications in local townships and rural economies.

National Wetland Conservation Action Plan

Partner: Asian Wetland Bureau

WWF and the Asian Wetland Bureau are helping the Chinese government to formulate a comprehensive national action plan, in consultation with the various agencies involved in wetland conservation, and those whose activities affect wetlands, to ensure support at all levels. The project was initiated in response to a realization by the Ministry of Forestry, the National Environmental Protection Agency, and other agencies, that the lack of a comprehensive national action plan is a major impediment to wetland conservation in China.

Giant Panda Conservation, Management Plan for the Giant Panda and Its Habitat

Partners: Ministry of Forestry, Chinese Zoos
Status/Schedule: Initiated 1992, Targeted Completion 2002

Known in China as "The National Conservation Program for the Giant Panda and its Habitat," the ten-year program, which gained approval in China in 1992, is focused on setting up fourteen new panda reserves, improving the management and protection of these panda reserves, and maintaining or re-establishing "bamboo corridors." These corridors allow the otherwise isolated groups of pandas to communicate and to interbreed.

Development of Environmental Education

Partners: State Environmental Protection Agency (SEPA), State Education Commission (SEC)

In 1993, the Chinese embassy in Switzerland approached WWF for help in furthering environmental education in China. In cooperation with SEPA and SEC, WWF helped devise an action plan for teacher training, resources, and curriculum development on environmental issues. WWF is currently providing institutional support for these plans.

Capacity Building

Focus: Capacity Building

WWF emphasizes the need to help build knowledge and expertise among the government officers, scientists and environmental managers who are involved in China's conservation initiatives. For example, at Hong Kong's Mai Po Marshes Nature Reserve WWF has developed training materials and run training courses in wetland protection for the staff of numerous Chinese governmental agencies. WWF also has sponsored the staff of the China Giant Panda Research and Captive Breeding Center in Sichuan to attend numerous training programs, including wildlife management and postgraduate courses overseas.

Conservation in the Baimaxueshan Nature Reserve, Yunnan Province

Focus: Reserve Management, Sustainable Livelihood
Status/Schedule: Initiated 1998

The project aims to strengthen the management capacity of the 1,900 square kilometer Baimaxueshan Nature Reserve. The reserve is remote and mountainous, and supports important habitats for the snub nosed golden monkey. The project also aims to reduce pressure on the reserve from poor communities adjacent to the reserve, by implementing demonstration projects focusing on sustainable livelihoods (Source: *Chinabrief*, November 1998).

Conservation in Sichuan's Wanlang Reserve

Focus: Wildlife Conservation, Watershed Protection

WWF is helping to improve and strengthen management in the reserve, which provides habitat for the Giant Panda, Clouded Leopard, Takin, golden monkey, and the Chinese monal partridge. Improved reserve management also should provide additional protection for vital watersheds, which in turn would help to prevent flooding and soil erosion and to improve agricultural productivity.

Conservation in Xishuangbanna Prefecture, Yunnan Province

Partners: Yunnan Forest Department, Chinese Academy of Sciences (various institutions), Unnamed Local Authorities in and around Xishuangbanna Nature Reserve
Focus: Tropical Forest Conservation

Xishuangbanna prefecture contains part of China's single largest area of tropical rain forest. This wide-ranging project's primary goal is to develop and promote methods of producing food and fuel that are relatively environmentally sensitive. WWF activities attempt to simultaneously protect the area's tremendous biodiversity and promote the livelihood of the 200,000 people living there. Participatory development planning techniques are included, with cooperation from a number of institutions under the Chinese Academy of Sciences that have expertise in this field.

Environmental Education Training Center

Partner: Beijing Normal University
Focus: Education
Status/Schedule: Initiated 1997

In its early months, the center sponsored two pairs of Chinese professionals to attend training courses abroad. The first pair attended a three-month course in environmental education, based in Ahmedabad, India. The second pair of Chinese professionals attended a three-month course on environmental education at Strathclyde University, Scotland (Source: *China Development Briefing*, July 1997).

Environmental Education Workshop and Teacher Training and Support

Partners: National Environmental Protection Agency (now SEPA), State Education Commission (SEC)
Focus: Education
Status/Schedule: Initiated May 1996

WWF, in partnership with NEPA and the SEC, ran an environmental education workshop for selected education officials and schoolteachers prior to May 1996. As of May 1996, WWF planned to help implement the teacher training plans that were developed at the workshop. WWF also committed to help both the NEPA and the SEC further promote environmental education in China.

Numerous projects

Focus: Conservation, Wetlands, Energy, Climate Change, Education
Status/Schedule: Initiated 1980

WWF, which was the first international nonprofit conservation organization to be invited to work in China, initially focused on protecting the Giant Panda and its Sichuan Province habitat. Today WWF maintains a significant staff in China, who work on Giant Panda conservation and a wide variety of other topics that include wetland and tropical forest conservation, energy, climate change, and environmental education. Overall, WWF expenditures in China have totaled more than 10 million Swiss francs (U.S. $6.6 million dollars based on the market rate of 31 October 1999). To find out about other WWF work in China, please contact WWF China directly.

Universities

Massachusetts Institute of Technology (MIT)

Web address: http://web.mit.edu/

Clean and Efficient Utilization of Coal in China: Environmental Aid and Coal Combustion

Partners: Tsinghua University, Tokyo University, Environmental Aid and Coal Combustion Swiss Federal Institutes of Technology, and Taiyuan University

The goal of this project is to determine how coal use in China can be made cleaner and more efficient. Coal combustion engineers and social scientists from MIT, Tsinghua University, Tokyo University, the Swiss Federal Institutes of Technology, and Taiyuan University are all members of the research team. The group is examining coal use in industrial boilers, utilities, and households.

One group is examining: 1) energy efficiency and environmental performance measures for firms in five provinces; 2) engineering factors including hardware, mode of operation and fuel types that affect energy efficiency and environmental performance; and 3) economic and social factors such as price systems, incentives, ownership, and domestic and international environmental programs that affect the choice of hardware, operational methods, and fuel. Another group is examining household coal use and ways of encouraging cleaner and more efficient cooking and heating and how combustion processes may affect human health at the household level.

Stanford University/Department of Civil and Environmental Engineering

Web address: http://www-seep-server.standord.edu/seepweb/ews/ewsbroch/research.html#enviornmental

Stanford's Department of Civil and Environmental Engineering has several research projects related to air and water quality management in China. Some projects focus on the transfer and diffusion of technologies and methods to increase "cleaner production" in certain industrial sectors. Work is also being done on the implementation of Chinese environmental regulations by enterprises and on what China is doing to implement the Montreal Protocol. One recent topic of research, funded by NSF and the UPS Foundation, is the Role of Japan in Clean Technology Transfer to China.

Stanford University/Institute for International Studies (IIS)

Web address: http://www-iis.stanford.edu/

Energy Development Conference

Partners: NITO, Japan; Tsinghua University, Beijing

IIS cosponsored an energy development conference that explored issues of reducing acid rain, transferring clean energy technology, and developing compliance monitoring systems for potential enforcement.

Montreal Protocol Research

IIS graduate students have been working on projects aimed at keeping China in compliance with the Montreal Protocol.

Tulane University

Web address: http://www.tulane.edu/~uschina/

U.S.-China Energy and Environment Technology Center

Partners: U.S. Department of Energy, Tsinghua University, and Multiple Other U.S. and Chinese Governmental Agencies.

The U.S.-China Energy and Environment Technology Center (EETC) was established in Beijing in 1997 to enhance the competitiveness and adoption of U.S. clean energy and environmental technology in China. The center is implemented jointly by the U.S. and Chinese governments, Tulane and Tsinghua Universities and is overseen by a

Board of Directors and Steering Committee. Both the Memorandum of Understanding between Tulane and Tsinghua, and the Center's charter are in place. Over the past year, the Center has conducted education and training programs, and information seminars that support policy development. It has worked to develop policy initiatives in the energy and environmental sectors, and matched U.S. business interests with China's needs.

University of Wisconsin

Web address: http://www.wisc.edu/

Community-Based Management of Natural Resources

Partners: University of Cheng Mai, Yunnan Province

This project focuses on local community-based management of natural resources. In addition, work is being performed to examine the use of local, traditional knowledge systems for environmental management, as is a project to promote the formation of local watershed councils.

University of Wisconsin/Institute for Environmental Studies

Web address: http://www.ies.wisc.edu/

Natural Resource Management in the Upland of Asia: Developing Tools for Local Policy

Partners: Chiang Mai University, Thailand of Asia: Developing Tools for Local Policy and Yunnan Academy of Social Sciences, China

The goal of this project is to link rural communities in selected watersheds to: 1) national institutions in China, Thailand and Vietnam for research; 2) training and networking activities for policy makers; and 3) researchers and officials from government institutions, non-government organizations and private sector institutions.

Part IV. Multilateral Organization Activities

Asian Development Bank (ADB)

(Pre-project Technical Assistance)

Web Address: http://www.adb.org/

Chengdu General Des Eaux-Marubeni Waterworks Company Limited

Partners: Vivendi of France (sixty percent), Marubeni Corporation of Japan (Marubeni) (forty percent)
Focus: Water Supply
Funding: U.S. $48 million (ADB Complementary Financing Scheme U.S. $21.5 million; European Investment Bank U.S. $26.5 million)
Status/Schedule: Initiated February 1999

The project will be the first Build-Operate-Transfer (BOT) urban water supply project in People's Republic of China. This project will finance the following activities:1) water intake facilities, and a two-kilometer transmission line to the water treatment plant; 2) a water treatment plant; and 3) twenty-seven kilometers of transmission pipelines to the city. The project will supply treated water to Chengdu Municipal Waterworks General Company (CWGC) in Chengdu City, Sichuan under a take-or-pay off-take agreement. Commercial production is scheduled to begin in September 2001.

Fuzhou Water Supply and Wastewater Treatment

Partner: Fuzhou ADB project Office
Focus: Social Infrastructure/Water Supply and Sanitation
Funding: U.S. $192.2 million (ADB loan: U.S. $102 million Ordinary Capital Resources [OCR]; Local investment: U.S. $90.2 million)
Status/Schedule: Initiated 1998, Targeted Completion 2002

The project will help resolve an acute shortage of potable water and address severe water pollution problems in Fuzhou City. Part A of the project consists of constructing a new water supply source from the Ao River, water treatment facilities, and feeder mains. Part B consists of a sewerage system including collection, interceptors and pumping facilities, and a wastewater treatment plant at Yang Li. The objectives of the project are to improve the quality and quantity of water supplied to Fuzhou City in Fujian Province and to improve the urban environment by reducing contamination of local water courses in Fuzhou City and the Min River.

Heilongjiang Water Supply

Partners: Harbin Municipal Water Supply Construction Company and Mudanjiang Linhai General Water Supply Company
Focus: Social Infrastructure, Water Supply and Sanitation
Funding: U.S. $1 million (ADB loan)
Status/Schedule: Initiated 1999

The objective of this technical assistance is to update the feasibility studies to help formulate an investment project for water supply in Harbin and Mudanjiang cities. The ensuing project is expected to include the following components: 1) two multipurpose dams with a small-scale hydroelectric plant; 2) raw water conveyance; 3) construction of water treatment plants and expansion of distribution systems; and 4) capacity building of the water supply companies.

Market-based Energy Conservation

Partner: State Economic and Trade Commission
Focus: Energy, Cleaner Production

Funding: U.S. $300 million (ADB loan: U.S. $150 million; Local financing: U.S. $150 million)
Status/Schedule: Initiated 1999, Targeted Completion 2004

The project will promote modification of existing production processes, installation of energy-saving equipment, recovery of waste materials, elimination of hazardous wastes, and establishment of energy management systems throughout China. Sub-project enterprises will be the respective implementing agencies; the Industrial and Chemical Bank of China, the Construction Bank of China, and the China Energy Conservation Investment Corporation will be the intermediaries.

North China Flood Protection

Partner: Chinese Ministry of Water Resources
Focus: Agriculture, Natural Resources
Funding: U.S. $1 million (ADB Loans: U.S. $1 million Technical Assistance Support Funds [TASF])
Status/Schedule: Initiated May 1999

The objective of the technical assistance is to prepare a follow-on sector project which aims at longer-term flood protection in North China, including the Songhua and Liao River basins as well as part of Yellow River basin. The technical assistance will identify the necessary structural and non-structural flood protection measures that are needed in these river basins, as well as identify candidate sub-projects to be included in the project and prepare feasibility studies for some representative sub-projects.

North China Marine Culture and Coastal Resources Management Project

Partner: Chinese Ministry of Agriculture
Focus: Environment
Funding: U.S. $70 million (OCR)
Status/Schedule: Initiated 1996, Targeted Completion 2000

The main objectives of the project are: 1) to enhance sustainable marine culture production in line with increasing demand for fish products; 2) to contribute to coastal and marine resource conservation and environmental management in the Bohai Sea; 3) improve economic and social conditions in coastal communities in the project area through economic diversification and expansion of income generating opportunities; and 4) to strengthen human resource capabilities in the investment, management, and operation of aquatic product processing activities.

Northeast Flood Damage Rehabilitation Project

Partner: Heilongjiang Province
Focus: Agriculture and Natural Resources
Funding: U.S. $110 million (ABD loan: U.S. $57.33 million OCR; Local investment: U.S. $52.67 million)
Status/Schedule: Initiated 1999, Targeted Completion 2002

The project is given high priority by the Chinese central government. The project will reinstate essential infrastructure in key sectors that were damaged by the 1998 floods in Heilongjiang Province and their after-effects in the Songhua and Liao river basins in northeast China. The project will finance the rehabilitation of flood-damaged facilities in three key sectors: 1) water resources infrastructure; 2) urban facilities; and 3) roads and bridges. The project scope includes surveys and design, civil works, supervision, materials, equipment, and consulting services for project coordination, monitoring, and evaluation.

Power Rehabilitation and Environment Improvement

Partner: State Power Corporation
Focus: Energy, Electric Power

Funding: U.S. $400 million (ADB loan: U.S. $200 million; Local investment: U.S. $200 million)
Status/Schedule: Initiated 1999, Targeted Completion 2004

This project is a continuation of an earlier advisory technical assistance. The potential for this project to expand its scope nation-wide is great. Based on previous technical assistance work, the bank has identified 200 potential 100-300MW sized coal fired power plants for renovation and six areas have been identified as priorities: turbines and generators; boilers; environmental protections equipment; control instruments; fans/pumps; and valves. Loans will subsequently be made to smaller subprojects in a suitable "Sector Loan" approach.

Power Rehabilitation and Environmental Improvement Project

Partner: State Power Corporation
Focus: Energy, Power Transmission
Funding: U.S. $1.23 million (ADB loan: U.S. $765,000; Local loans: U.S. $235,000; Central government loan: U.S. $230,000)
Status/Schedule: Initiated Late 1998

The objective of this technical assistance study is to help the People's Republic of China prepare the proposed Power Rehabilitation and Environmental Improvement project for external financing. Fifteen 125MW - 300MW facilities will be eventually selected country-wide for rehabilitation or upgrade based on the results. Consultant services and equipment was procured for the work beginning in late 1998.

Shanxi Environmental Improvement

Partner: Shanxi Environmental Protection Bureau
Focus: Energy Efficiency, Air Pollution
Funding: U.S. $102 million (ADB loans: U.S. $102 OCR)
Status/Schedule: Initiated 1999

The ADB-financed project aims to improve the environmental condition in Shanxi Province. The project will introduce policies to mitigate the environmental pollution and to encourage environmentally friendly technologies that will conserve energy and raw materials. These goals will be achieved by:1) supporting market-oriented price reforms; 2) promoting institutional improvements of environmental protection agencies for sustainable environmental management and compliance with environmental standards; and 3) financing a portion of the environmental investments for expanding the district heating and gas distribution systems to reduce direct coal burning and improve energy efficiency. The scope of the project includes three sub-projects: a) Datong District Heating Plant; b) Taiyuan Coal Gasification Plant; and c) Yangquan Coal-bed Methane Collection Plant. Piggybacked onto this loan is technical assistance from the Shanxi Environmental Protection Bureau.

Suzhou Creek Rehabilitation

Partner: Shanghai Suzhou Creek Rehabilitation and Construction Co., Ltd.
Focus: Social Infrastructure, Water Supply and Sanitation
Funding: U.S. $912.2 million (ADB loan: U.S. $300 million OCR; Foreign investment: U.S. $373.50 million, Local investment: U.S. $542.7 million)
Status/Schedule: Initiated 1999, Targeted Completion 2004

The project is the first phase of a twelve-year program to take place from 1998 to 2010, to rehabilitate the Suzhou Creek. Phase I in Shanghai will be implemented over a five-year period from 1999 to 2004, and will include components aimed at: 1) improving wastewater management, including sewage treatment and disposal; 2) introducing water resource management and quality control methods; and 3) providing environmental sanitation and urban renewal. The long-term water quality objectives for the section of Suzhou Creek within the Shanghai Municipal Government administrative area are to achieve Class IV water quality standards in the lower twenty-four kilometers of the creek and Class III standards in the upper twenty-nine kilometers by 2010.

Tianjin Wastewater Treatment and Water Resource Protection

Partner: Tianjin Municipal Government
Focus: Social Infrastructure, Water Supply and Sanitation
Funding: U.S. $8 million (ADB loan)
Status/Schedule: Initiated April 1999

Under the Hai River Pollution Prevention and Control Plan, approved by the State Council in April 1999, the central government has designated Tianjin as one of the four major cities requiring urgent intervention in pollution control on a priority basis. The technical assistance would help formulate a project suitable for ADB financing including construction of the Baicang wastewater treatment facilities and implementation of a water resources protection scheme in the existing Luan-Tianjin water diversion system.

West Henan Agricultural Development

Partner: Henan Provincial Government State Development Bank
Focus: Agriculture, Natural Resources, Rural Development
Funding: U.S. $216.1 million (ADB loan: U.S. $100 OCR; Foreign investment: U.S. $14.4 million; Local investment: U.S. $101.7 million)
Status/Schedule: Initiated 1999, Targeted Completion 2005

This initiative is a top government priority. Technical advice and training will be provided to improve the quality of produce, and environmentally sound agronomic practices and land development techniques will be introduced to prevent soil erosion and pollution in Henan Province. The project will integrate agricultural production, agro-processing, and marketing in the province.

Wind Power Development Project

Partner: State Power Corporation
Focus: Energy, Electric Power
Location: Xinjiang Autonomous Region, Liaoning and Heilongjiang Provinces
Funding: U.S. $65 million (ADB loan: U.S. $45 million; Local co-financing: U.S. $20 million)
Status/Schedule: Initiated 1999

The project promotes the development of commercial grid-connected, wind-based electricity generation by expanding one existing wind farm in the Xinjiang Autonomous Region, and developing new wind farms in Liaoning and Heilongjiang Provinces.

Xian-Xianyang-Tongchuan Environment Improvement

Partner: Shaanxi Provincial Planning Commission
Focus: Energy Efficiency, Air Pollution
Funding: U.S. $298 million (Loan: $156.0 million OCR; Local costs: U.S. $142 million)
Status/Schedule: Initiated 1998, Targeted Completion 2001

This ADB-financed project in Shaanxi Province will institute reforms for sustainable environmental management and continued progress towards market-based energy pricing, while at the same time financing investments for improving air quality. Air pollution will be reduced by: 1) the replacement of old, small, inefficient boilers and domestic stoves by modern efficient cogeneration plants and district heating systems fitted with pollution control devices; 2) the substitution of natural gas for coal burning by end users; and 3) the reduction of particulate emissions from a large cement plant.

Zhejiang-Shanxi Water Supply Project (Phase II)

Partner: Wenzhou Water Supply Investment Development Company
Focus: Social Infrastructure, Water Supply and Sanitation
Funding: U.S. $250 million (loan OCR)
Status/Schedule: Initiated 1999, Targeted Completion 2004

The project includes construction of raw water mains, pumping stations, wastewater treatment, and water transmission network in Wenzhou City, Ruian City, and Pingyang County. The project will also involve extensive capacity building and training to facilitate implementation and to convert the implementing agency into an efficient operating company following the completion of project construction.

United Nations Development Programme (UNDP)

Web Address: http://www.undp.org/

Barrier Removal for the Widespread Commercialization of Energy-Efficient CFC-Free Refrigerators in China

Partners: Global Environment Facility (GEF), United Nations Office of Project Services and Chinese manufacturers of refrigerators
Focus: Climate Change
Funding: U.S. $41.5 million (GEF: U.S. $9.860 million and Chinese government co-financing: $31.290 million)
Status/Schedule: Initiated March 1998, Targeted Completion September 2003

This project aims to reduce greenhouse gas (GHG) emissions in China by removing barriers to widespread commercialization of energy-efficient refrigerators. The project activities focus on key market, technological, social, and commercial barriers to the adoption of high-efficiency refrigerator technology. Another component of the project addresses acceptance of these refrigerators by Chinese consumers as well. Activities include technical assistance and training for compressor and refrigerator manufacturers, incentives for energy efficient production design, national efficiency standards, a national labeling program and a consumer buyback/recycling program.

Beijing Municipality: Addressing Key Agenda 21 Sustainable Development Issues

Partner: Executing Agency: Ministry of Foreign Trade and Economic Cooperation (MOFTEC); Implementing Agency: China International Center for Economic and Technical Exchanges (CICETE)
Focus: Sustainable Development
Funding: U.S. $1,275,000 (UNDP Budget: U.S. $1,100,000; Government cost-sharing: U.S. $175,000)
Status/Schedule: Initiated July 1996.

The development objective of this project is to assist Beijing in implementing China's Agenda 21 at the local level in several urgent areas by technical transfer and capacity building.

Capacity Development for Acid Rain and Air Pollution Control in Guiyang Province

Partner: Executing Agency: MOFTEC; Implementing Agency: CICETE; Cooperating Agency: United Nations Department for Development Support and Management Services (UNDDSMS)
Focus: Air Pollution
Funding: U.S. $969,000 (UNDP budget: U.S. $609,000; Government cost-sharing: U.S. $360,000)
Status/Schedule: Initiated January 1997

The project has the following three immediate objectives: 1) assessing air pollution in Guiyang and obtaining an expanded and updated SO_2 emissions inventory; 2) developing a control strategy and associated regulatory framework for sulfur dioxide emissions; and 3) strengthening the commitment of municipal authorities to implement a control strategy and revising the regulatory program for SO_2 emissions and acid deposition.

Capacity Development for Ambient Particulate Emissions Control in Xian

Partners: Executing Agency: MOFTEC; Implementing Agency: CICETE; Cooperating Agency: UNDDSMS
Focus: Air Pollution
Funding: U.S. $855,000 (UNDP Budget: U.S. $470,000; Government cost-sharing: U.S. $385,000)
Status/Schedule: Initiated January 1997

The project located in Xian and Shaanxi Provinces has the following three immediate objectives: 1) conduct in-depth investigation and analysis about the types and sources of atmospheric particulate in Xian; 2) develop a particulate control strategy; and 3) strengthen municipal capacity for particulate atmospheric pollution control in Xian.

Capacity Development for NOx Pollution Control in Guangzhou City

Partner: Executing Agency: MOFTEC; Implementing Agency: CICETE; Cooperating Agency: UNDDSMS
Focus: Air Pollution
Funding: U.S. $ 960,000 (UNDP Budget: U.S. $600,000; Government cost-sharing: U.S. $360,000)
Status/Schedule: Initiated January 1997

The project has the following two immediate objectives: 1) to assess the impact of vehicular and NO_x emissions on air quality in Guangzhou and 2) to provide integrated policy guidance to the Guangzhou Municipal Government on the control of vehicular NO_x emissions.

Capacity Building for the Rapid Commercialization of Renewable Energy

Partner: Global Environment Facility (GEF)
Focus: Energy Efficiency, Renewable Energy
Funding: U.S. $28 million (GEF: U.S. $9 million)
Status/Schedule: Initiated 1997

This project aims to promote the widespread adoption of renewable energy sources in China by strengthening the capacity of Chinese government agencies to implement policies that support the removal of barriers to solar and wind hybrid systems, wind farms, biogas, and other forms of renewable energy. Some activities include: 1) conducting workshops to focus on market penetration, foreign investment, and power purchase agreements; 2) establishing a renewable energy center for training and facilitation programs; 3) training policymakers, renewable energy professionals, and business community in market-based renewable energy development and best practices; and 4) installing 200 pilot solar heating systems and several biogas digestion plants.

Capacity Building for Widespread Adoption of Clean Production for Air Pollution Control in Benxi

Partner: Executing Agency: MOFTEC; Implementing Agency: CICETE; Cooperating Agency: UNDDSMS
Focus: Clean Production
Funding: U.S. $969,000 (UNDP budget: U.S. $530,000; Government cost-sharing: U.S. $500,000)
Status/Schedule: Initiated January 1997

The project has the following immediate objectives: 1) to identify possible production modifications and industrial restructuring options and 2) to strengthen the municipal capacity for clean technology promotion in Benxi, Liaoning Province.

China Wetlands Project

Partners: Global Environment Facility, Australian Government, Wetlands International
Focus: Water Conservation
Grant: U.S. $14.7 million (GEF U.S. $12 million; Australia U.S. $2.4 million; UNDP U.S. $0.3 million)

Duration: Initiated 1999

The project initially focuses on four significant wetland areas: Sanjiang in Heilongjiang, Yanchen in Jiangsu, Dongting Lake in Hunan, and Ruogai on the border between Sichuan and Gansu (Source: *Chinabrief*, August-November 1999).

Energy Conservation and GHG Emission Reduction in Chinese Township and Village Enterprises

Partners: GEF and United Nations Industrial Development Organization (UNIDO)
Focus: Climate Change
Funding: U.S. $18.55 million (GEF: U.S. $8.000 million; UNDP and others: U.S. $10.550 million)
Status/Schedule: Initiated 1999, Targeted Completion June 2003

UNDP is the implementing agency and UNIDO is the executing agency of this project. This project will focus on Township-Village Enterprises (TVEs) which constitute a significant share of Chinese economic production. The project seeks to reduce GHG emissions in China from the TVE sector by increasing the utilization of energy efficient technologies and products in brick, cement, metal casting, and coking industries. The project will encourage the removal of key market, regulatory, technological, management, and commercial barriers in order to promote the production, marketing, and utilization of energy efficient technologies in these major TVE industries.

Prevention and Management of Marine Pollution in East Asian Seas

Partners: Global Environment Facility, International Marine Organization, Coastal Management Center, Asian Fisheries Society, Marine Environmental Resource Foundation, UP Marine Science, local universities and oceanographic institutions.
Focus: International Water
Funding: U.S. $11.4 million (GEF: U.S. $8.000 million; Co-financing by international organizations and recipient governments: U.S. $3.400 million)
Status/Schedule: Initiated July 1997, Targeted Completion October 2000

In addition to China, other participating countries are Cambodia, Indonesia, Korea DPR, Malaysia, Philippines, Thailand, and Vietnam. The goal of this project is to promote the development of policies and plans to control marine pollution for land and sea-based sources; upgrade national and regional infrastructures and technical skills; and establish financing instruments to promote continuation of the project. Demonstration sites have been selected and regional monitoring and information networks will be established. A regional association of marine legal experts is involved in the project to help improve the capacity to implement relevant marine conventions. One of the earliest selected sites was Xiamen City in Fujian Province in southern China. This demonstration project has been particularly successful.

Programme Support Project for Air Pollution Control in China

Partner: Executing Agency: The Ministry of Foreign Trade and Economic Cooperation (MOFTEC) Implementing Agency: China International Center for Economic and Technical Exchanges (CICETE) Cooperating Agency: United Nations Department for Development Support and Management Services (UNDDSMS)
Focus: Air Pollution
Funding: U.S. $570,000 (UNDP budget)
Status/Schedule: Seeking additional investment

The project is intended to be the coordination and policy component of a broader national program for air pollution that will include four projects directed at separate, but complementary aspects of air pollution in China. Four cities—Benxi (Liaoning), Guiyang (Guizhou), Xian (Shaanxi), and Guangzhou (Guangdong)—have agreed to work within the framework of a national program of air pollution control activities in order to enhance the country's ability to effectively improve air quality at the local and regional levels.

Renewable Energy Technologies in China

Partner: State Economic and Trade Commission with assistance from SEPA
Focus: Renewable Energy
Funding: U.S. $25.83 million (GEF: U.S. $8.8 million; the Government of Australia: U.S. $3 million; the Government of Netherlands: U.S. $2.53 million: and the Government of China: U.S. $11.5 million)
Status/Schedule: Seeking additional investment

This project will assist China in developing market-based institutions and instruments to attract new players in the renewable energy industry and increase investments in renewable energy technologies. To provide first-hand knowledge of a particular instrument/institution, the project will support pilot activities for five promising technologies, namely: 1) rural electrification by solar and wind hybrids; 2) wind farm development; 3) industrial scale biogas production; 4) bagasse cogeneration; and 5) solar-water heaters. The selection of technologies was made on the basis of recent assessments of market conditions and potential for future greenhouse gas reductions. Project activities include supporting the formation of a China Renewable Energy Industries Association, international training for policymakers and professionals, development of standards, and technology demonstration. The project is jointly financed by the Global Environment Facility through UNDP.

Wetland Biodiversity Conservation and Sustainable Use

Partners: Global Environment Facility, State Forestry Administration of the PRC
Focus: Biodiversity
Funding: U.S. $35.1 million (GEF: U.S. $12 million; UNDP and other co-financing: U.S. $23 million)
Status/Schedule: Initiated November 1998, Targeted Completion January 2004

The Biodiversity Conservation Action Plan, Agenda 21, and the draft National Wetland Conservation Action Plan provide the foundation for conservation and sustainable management of China's wetland resources. Nevertheless, in China, as well as in other countries, barriers to effective conservation of wetland biodiversity remain. Challenges facing wetland conservation include: 1) lack of integration of wetland management and biodiversity conservation into development planning; 2) paucity of institutional mechanisms and technical capacity at national and local level to manage and conserve wetlands for their biodiversity and to undertake multi-sector wetland management; 3) limited awareness within government and society of wetland values and functions; and 4) insufficient examples of sustainable development of wetland resources that include involvement of local communities. This project aims to remove these barriers at four demonstration project sites—Sanjiang Plain, Ruoergai Marshes, Yancheng Coast and Dongting Lakes. Each represents a different ecosystem and is of high global biodiversity importance. A national coordination component will ensure that lessons learned will be transferred throughout the country. The UNDP and the GEF are the implementing agencies and the Chinese State Forestry Administration is the executing agency for this proposed project. GEF support will be closely tied with new Chinese government programs that promote biodiversity and sustainable development at the local level.

United Nations Educational, Scientific, and Cultural Organization (UNESCO) Man and The Biosphere Program

Web address: http://www.unesco.org/

Biodiversity Conservation and Sustainable Development in Xishuangbanna Biosphere Reserve

Partners: Canadian International Development Research Center (IDRC), Yunnan University, Xishuangbanna Biosphere Reserve Management Bureau
Focus: Conservation
Grant: U.S. $250,000 (IDRC)
Status/Schedule: Initiated 1995, Targeted Completion 1997

This UNESCO project aimed to promote sustainable forestry practices in the sub-tropical forests of Xishuangbanna in southern Yunnan Province.

Cooperative Ecological Research Project

Partners: German Federal Ministry for Education, Science, Research and Technology (GFMESRT)
Focus: Research
Grant: U.S. $4.0 million (GFMESRT)
Status/Schedule: Initiated 1987, Targeted Completion 1995

This multilateral research project brought together 100 scientists from Germany and China to study forest, aquatic and urban ecosystems in China.

United Nations Environment Programme (UNEP)

Web Address: http://www.unep.org

Biodiversity Enabling Activity

Partners: GEF; the Department of International Cooperation and the Chinese State Environmental Protection Agency
Focus: Biodiversity
Funding: U.S. $59,000 (GEF allocation)
Status/Schedule: Approved in February 1997, Completed April 1998

The aim of this project was to assist China with the preparation of the first national report pursuant to Article 26 of the Convention on Biodiversity. The National Report was finalized in March 1998.

Lop Nur Nature Sanctuary Biodiversity Conservation

Partners: Global Environment Facility and the Chinese National Environmental Protection Agency
Focus: Biodiversity
Funding: U.S. $1.507 million (GEF: U.S. $725,000; Chinese government co-financing U.S. $782,000)
Status/Schedule: Approved November 1998

The Lop Nur region of Gashun Gobi desert was formally a nuclear testing site, but in 1998 was declared a Nature Sanctuary by the Chinese government. This new sanctuary is home to the last surviving genetically pure herd of wild Bactrian camels (Camelus bactranus ferus) in the world. This project is aimed at developing management and monitoring to help protect this dry-land ecosystem from damaging human encroachment—particularly from illegal miners and hunters.

People, Land Management, and Environmental Change (PLEC)

Partners: Global Environment Facility, United Nations University, and domestic universities
Focus: Biodiversity
Funding: U.S. $11.1 million (GEF: U.S. $6.3 million; Recipient governments co-financing: U.S. $4.8 million)
Status/Schedule: Approved 1997, Targeted Completion April 2001

PLEC is a global project on agrodiversity of different ecosystems in the tropics and subtropics. The goal of the project is to establish how sustainable and conservationist development can be achieved by participatory methods integrating expertise of local farmers and knowledge of scientists. Central activities include demonstration sites, biodiversity assessments and participatory rural appraisals, as well as cross-country workshops to promote training and information dissemination. Demonstration sites have been established and data have been gathered by villagers and scientists in China, as well as in the other participating countries—Brazil, Ghana, Guinea, Kenya, Papua New Guinea, Tanzania, and Uganda.

World Bank

Web Address: http://www.worldbank.org/

Anning Valley Agricultural Development Project

Focus: Agriculture, Irrigation
Funding: U.S. $120 million (IDA credit: U.S. $30 million equivalent; IBRD loan U.S. $90 million)
Status/Schedule: Initiated January 21, 1999

This project will increase the incomes of more than 250,000 poor families in China's Anning Valley, Sichuan Province including many minority Yi families, by improving the potential for production of large areas of marginal land through better irrigation, improved crop varieties, and extension work. It will also help farmers develop hilly land for orchard production, boosting incomes and productivity while preventing soil erosion and flooding in China. The project includes all areas of production, ranging from better irrigation and improved seed varieties to better processing and more training and research. All of these project activities are focused on producing products suitable for sale in other parts of China and increasing the income and standard of living in this poor area of Sichuan Province.

China-Beijing Environment Project II

Partner: Beijing Environmental Protection Bureau (EPB)
Focus: Air pollution, Urban Development
Funding: U.S. $670 million (Local beneficiaries: U.S. $240 million; Beijing municipal government: U.S. $230 million; IBRD loan: U.S. $200 million)

This project in Beijing will support facilities and work to reduce emissions from coal-burning boilers and to collect and treat municipal sewage around the Liangshui river basin. In addition, it will also strengthen the city's environmental management institutions and policies with upgraded monitoring capabilities and policy and regulatory tools. There are five main components to this project: 1) conversion or improvement of coal burning devices (total estimated cost approximately U.S. $300 million); 2) power plant pollution abatement (U.S. $25 million), which includes installation of a flue gas desulfurization facility at the Shijingshan power plant and will effectively reduce its overall sulfur dioxide emissions by twenty-five percent; 3) vehicle conversion to liquefied petroleum gas (U.S. $20 million). This pilot project aims to demonstrate the feasibility of liquefied petroleum gas vehicles as a practical means of reducing nitrogen oxides, hydrocarbon, and carbon monoxide emissions; 4) waste water management (U.S. $315 million) which encompasses the construction of a set of secondary and possibly tertiary wastewater treatment plants with total capacity of about 650,000 m^3/day to improve the quality of the Liangshui river basin; and 5) institutional strengthening (U.S. $10 million), which encompasses technical assistance programs and equipment upgrading to improve the capacity of municipal agencies responsible for managing the environment, energy, and sewage.

China-Chongqing Urban Environment Project

Partner: Municipality of Chongqing
Focus: Urban Environment
Funding: U.S. $500 million (World Bank Loan: U.S. $250 million; Local government investment U.S. $250 million)
Status/Schedule: Projected Board Date January 1999

Targeted investments would support the expansion of urban environmental infrastructure in Chongqing, primarily in the water sector. This project would also finance technical assistance to strengthen the financial and operational management of municipal services providers, as well as the capacity for region-wide environmental water resource management of the Environmental Protection Bureau.

China-Development

Partner: State Economic and Trade Commission
Focus: Renewable Energy

Funding: U.S. $408 million (IBRD loan: U.S. $100 million; GEF grant: U.S. $35 million; Central government: U.S. $15 million; Local equity: U.S. $140 million; Local debt U.S. $118 million)
Status/Schedule: Projected Board Date March 1999

The proposed project aims to develop state-of-the-art wind and solar photovoltaic technologies to increase electricity supply in an environmentally sustainable way and improve access of dispersed rural households and institutions to modern energy. The project would include: 1) installation of 190 MW of grid-connected wind farms in four provinces; 2) a supply of about 200,000 photovoltaic systems to households and institutions in remote areas of four Northwestern Provinces; 3) support for technology upgrading to improve the performance and reduce the costs of wind farm and solar PV technologies in China; and 4) assistance to strengthen institutional capacity and market infrastructure for large-scale commercialization of wind farms and solar PV. The wind farm development component would develop 190 MW of wind farms at up to five sites. Proposed sites include: Huitingxile, Inner Mongolia; Zhangbei, Jiangsu Province; Pingtan, Fujian Province, and; Chongming Island, and Nanhui, Shanghai Municipality. Each wind farm will be developed using a commercial framework that includes power purchase agreements and other legal documentation (to be developed during the project) that will encourage private sector participation in future wind power projects.

China-Fourth Rural Water Supply and Sanitation Project

Partners: National Patriotic Health Campaign Committee, China Water Supply and Sanitation National Project Office
Focus: Water Supply
Funding: U.S. $92 million (Central government: U.S. $23 million; IBRD: U.S. $16 million; IDA: U.S. $30 million;
Local beneficiaries: U.S. $23 million)
Status/Schedule: Board Date June 3, 1999

The country-wide project will comprise of the following three main components: water supply, sanitation and health, and management. The water supply project activities include the provision of safe water suitably financed to poor communities currently lacking such supplies. This will include both piped as well as non-piped systems (e.g., hand pumps and rain catchments). Users will be expected to pay for the full cost of the water, net of government investment. The sanitation and health education component would support demonstration programs to increase use of improved latrines. Finally, the project for management would increase project office capacity to provide services to beneficiary villages.

China Guangxi Urban Environment Project

Focus: Urban Environment, Water supply
Funding: U.S. $92 million (IDA credit: U.S. $20 million; IBRD equivalent loan: U.S. $72 million)
Status/Schedule: Initiated June 1998

This project will help improve the environment of Nanning and Guilin municipalities and support sustainable economic growth and poverty alleviation in the Guangxi region. Specifically, the project will:1) improve the quality of major water bodies; 2) regulate the flow of the Lijiang river; 3) improve institutional and financial capacity for environmental protection, environmental services, and water resource management; 4) pilot a participatory approach to environmental improvement in poor neighborhoods; and 5) implement pilot schemes for control of sugar refinery pollution.

China Irrigated Agriculture Intensification Project II

Partners: State Office for Comprehensive Agriculture Development, Ministry of Finance; and the provinces of Hebei, Henan, Shandong, Jiangsu and Anhui
Focus: Agriculture, Water Resources
Funding: U.S. $300 million (IBRD loan)
Status/Schedule: Initiated June 1998

This project will: 1) increase agricultural production; 2) increase farmers' incomes; and 3) establish mechanisms for sustainable use, development, and management of water and land resources in irrigated areas in the Huang-Huai-Hai Plain, the most important agricultural production region in China. The project will benefit some low-income areas that suffer from lack of water or partial irrigation by providing facilities for full irrigation, improved agriculture support services, and forest produce production, which will raise incomes substantially.

China-Liaoning Environment Project

Partner: Liaoning Provincial Government (LPG)
Focus: Environment, Urban Development
Funding: U.S. $338.1million (IBRD: U.S. $150 million; Foreign investment: U.S. $29.3 million; Local investment: U.S.
$158.8 million)
Status/Schedule: Projected Board Date June 1994

The project would provide physical works and technical assistance for institutional development in water supply, wastewater treatment, air pollution control, waste management, water conservation and process improvements, and cultural asset management in the province of Liaoning. The project objectives are to: 1) protect the main water resources in Liaoning Province including the Hun-Taizi River Basin to allow their sustained economic and safe use for drinking, industrial, and agricultural purposes; 2) strengthen pricing policies and institutional arrangements for environment protection, water pollution control, wastewater, and municipal solid waste management; and 3) institute measures for air pollution and cultural heritage asset management.

China Liaoning Urban Transport Project

Focus: Urban Development, Air pollution
Funding: U.S. $150 million (IBRD loan)
Status/Schedule: Project Board Date March 30, 1999

This project will ease the flow of traffic through three cities of the Liaoning Province in China—Shenyang, Fushun, and Anshan—as well as improve the urban air quality through the use of unleaded fuel and catalytic converters. The benefits of this project include reduced travel time for passengers and freight transport, lower transport costs, and increased reliability and safety of the urban transport system. The project will also strengthen the policy-making, regulatory, and implementation capacity of transport institutions. Additionally, the three project cities recognize that unchecked growth in motor vehicles will gradually erode the benefits of the project. The cities therefore recognize the need to implement controls on vehicle emissions.

China Renewable Energy Promotion

Partner: Global Environment Fund
Focus: Renewable Energy
Funding: U.S. $408 million (GEF: U.S. $36 million)
Status/Schedule: Initiated 1998

This project aims to develop commercial markets for wind farms and photovoltaic (PV) systems in China. The project will finance the installation of 190 MW of wind farms and install 200,000 solar heating systems in rural households, as well as establish a PV test center and national PV system standards. Consumer awareness campaigns will also be conducted.

China Second Inland Waterways Project

Partners: Guangdong and Jiangsu Provincial Waterway Bureaus
Focus: Water
Funding: U.S. $123 million (IBRD)

Status/Schedule: Project Board Date May 1998

This project, located in Guangdong and Jiangsu Provinces, will provide more efficient and productive inland waterway transport services that would be more competitive than the current services. This will be achieved through reduction of unit cost and transit time by: 1) upgrading inland waterways infrastructure to allow navigation of larger size vessels; 2) increasing ship lock capacity to reduce waiting time; and 3) increasing financial and organizational capacity of inland waterways transport agencies.

China Second Loess Plateau Watershed Project

Partners: The provinces of Shanxi, Shaanxi, and Gansu, Inner Mongolia
Focus: Water resources, Agriculture
Funding: U.S. $250 million; (World Bank loan: U.S. $150 million)
Status/Schedule: Initiated 1998

This project will help achieve sustainable development in the Loess Plateau by increasing agricultural production and incomes and improving ecological conditions in tributary watersheds of the Yellow River. This will be accomplished through the introduction of more efficient and sustainable uses of land and water resources and reducing erosion and sediment flow into the Yellow River. The feasibility of the project's components, the institutional arrangements, and the participatory process have been confirmed by the highly successful implementation of the First Loess Plateau Watershed Rehabilitation project over the last five years.

China Sustainable Coastal Resource Development Project

Partners: Fishery Department, Chinese Ministry of Agriculture
Focus: Coastal Development
Funding: U.S. $100 million (IBRD loan)
Status/Schedule: Initiated 19 May 1998

This project will support the Chinese government's commitment to sustainable development of China's coastal resources, as well as reduce pressure on coastal fishery resources. The project will also help improve aquatic product quality. Without environmental safeguards, agriculture investments may carry environmental risks. The project will put in place environmental practices and systems at the local level to ensure that private investment operates under environmentally sound criteria.

China-Tarim Basin Project II

Partners: Xinjiang Uygur Autonomous Region; Prefectures of Bayingol, Aksu, Kashgar, Kizilsu; and Hotan
Focus: Agriculture, Water Resources
Funding: U.S. $276 million (IBRD loan: U.S. $90 million; IDA credit: U.S. $60 million; Local investment: U.S. $126 million)
Status/Schedule: Tentative Board Date June 9, 1998

The project would be implemented in five prefectures and twenty-two counties in southern Xinjiang Uygur Autonomous Region in the Tarim River Basin. The project's objectives are to: 1) increase incomes of poor farmers through irrigated agriculture development and improvement; 2) establish mechanisms for sustainable use, development, and management of water resources in the Tarim Basin; and 3) partially restore and preserve the "green corridor" in the lower reaches of the Tarim River.

China Tuoketuo Thermal Power Project

Focus: Energy Efficiency, Air Pollution
Funding: U.S. $400 million (IBRD loan)
Status/Schedule: Board Date May 1997

The project will increase electricity supply and electricity trade in North China through creation of an independent

power company to develop a mine-mouth power plant in Tuoketuo. This power company will improve the efficiency of energy supply and use in the region by introducing modern technologies and reducing losses in transmission and distribution in Beijing.

China—Wanjiazhai Water Transfer Project

Partners: Yellow River Diversion Project Corporation, Shanxi Provincial Government
Focus: Water
Funding: U.S.$ 1.268 billion (Foreign investment—Italian co-financing: U.S. $30 million; Yangtze River Development Planning Commission: U.S. $838 million; World Bank: U.S. $400 million)
Status/Schedule: Project Board Date September 1996

The objectives of this project located in Wanjiazhai, Shanxi Province include: 1) reducing the severe water supply infrastructure bottlenecks that impede economic growth; 2) increasing employment and thereby reducing poverty, by eliminating constraints to development; 3) reducing the distress of the urban population caused by insufficient and intermittent water supplies that are barely enough to meet their basic needs; 4) improving the environment by ending the over-extraction of groundwater and the subsequent drying of surface streams and land subsidence, as well as by treating all waste, so as to reduce water pollution downstream; and 5) creating a system to rationalize water use, by sector, and reducing water shortages by managing demand. The project would provide the physical works needed to transfer water from the Yellow River through a system of tunnels, aqueduct pipelines, and reservoirs. It would also support policy and institutional reform for economic water pricing and water marketing.

China Yangtze Flood Emergency Rehabilitation Project

Focus: Flood Rehabilitation
Funding: U.S. $80 million (IDA Credit: U.S. $40 million equivalent; IBRD loan: U.S. $40 million)
Status/Schedule: Board Date February 1999

This project, which covers areas in the Yangtze river basin—Hubei, Hunan and Jiangxi Provinces—will rebuild schools, roads, water systems, hospitals, and clinics to restore basic services to poor communities devastated by the 1998 and 1999 Yangtze floods. Eighty-four county and rural roads covering 945 kilometers will be restored and reconstructed with project funds. Water supply systems, fifty-five in all, providing almost 2.5 million people with safe drinking water, will be restored or reconstructed as will 146 county and township hospitals, health centers, clinics, and 194 secondary and primary schools.

Chongqing Industrial Pollution Control and Reform Project

Focus: Cleaner Production, Energy Efficiency
Funding: U.S. $170 million (IBRD loan)
Status/Schedule: Approved 18 June 1996

This project will combat environmental pollution in Chongqing, Sichuan by integrating environmental protection objectives into economic policies. The project will assist in the development of an integrated economic reform policy by linking industrial pollution control and environmental regulation with industrial enterprise reform, particularly of inefficient state-owned enterprises. This will be achieved by: 1) eliminating key sources of pollution in Chongqing's worst polluting industries, iron and steel, with investments in modern production and energy-efficient technologies; 2) improving environmental management and enforcement of regulations, as well as restructuring and commercializing local industries through reform initiatives; and 3) and reducing greenhouse gas and SO_2 emissions through an associated Efficient Industrial Boilers project.

Efficient Industrial Boilers Project

Partner: State Machine-Building Industry Bureau

Focus: Energy Efficiency, Air Pollution
Funding: U.S. $32.8 million (GEF Grant),
Status/Schedule: Initiated 26 December 1996

The project aims to introduce combustion systems and equipment needed to upgrade heating and power boilers in China; introduce modern manufacturing techniques and new boiler designs; and support technical assistance and project management. This project is associated with the Chongqing Industrial Pollution Control and Reform project.

Ertan II Hydroelectric Project

Partner: Ertan Hydroelectric Development Corporation (EHDC)
Focus: Hydropower
Funding: U.S. $2.383 billion (World Bank loan: U.S. $400 million; Foreign investment: U.S. $100 million; Local investment: U.S. $1883 billion)
Status/Schedule: Projected Board Date June 1995

The proposed project would comprise the completion of the construction of the Ertan hydroelectric project in Chengdu, Sichuan Province. The Ertan project, appraised in 1991 and supported by World Bank loan 3387-CHA, includes the construction of a 240 meter high dam and an underground powerhouse complex with an installed capacity of 3,300 MW, resettlement of about 30,000 people, an environmental management program, consulting services, studies, and training.

Forest Protection

Partner: Global Environment Facility
Focus: Forestry
Funding: U.S. $217.9 million (World Bank loan: U.S. $200 million; GEF allocation: U.S. $17.9 million)
Status/Schedule: Initiated 1994, Targeted Completion 2002

The project, which targets sixteen provinces, aims to establish 735,000 hectares of plantations and 280,000 hectares of multipurpose protection forests. The GEF portion of the project supports nature reserve management in five provinces (Source: *Chinabrief,* November 1998).

Guangzhou City Center Transport Project

Partner: Guangzhou City Center Transport Project Leading Group
Focus: Urban Transport
Funding: U.S. $200 million (IBRD loan)
Status/Schedule: Initiated 29 May 1998

This project will improve the accessibility of the city center of Guangzhou, Guangdong Province, by promoting efficient use of the urban transport system in an environmentally sustainable way. This will be achieved through: 1) improved level of service and reduced congestion on the city center road network; 2) increased output of public transport corridors within the city center; 3) reduction in the relative levels of air pollution and accidents; 4) improved effectiveness and efficiency of road maintenance; and 5) strengthened management capacity of municipal agencies responsible for urban transport.

Guanzhong Irrigation Improvement Project

Partner: Shaanxi Water Conservancy Bureau, Government of Shaanxi Province
Focus: Irrigation
Funding: U.S. $100 million (IBRD loan: U.S. $80 million)
Status/Schedule: Board Date May 1999

This project will improve the performance of existing irrigation systems in the Guanzhong Plain of Shaanxi Province

and thereby raise agricultural production, in particular of grains. This project will support reforms of Shaanxi's irrigation sector that are aimed at strengthening the organizational, technical, and financial aspects of Irrigation Districts and at transferring water management below the branch canals to the farming communities.

Hebei Urban Environment Project

Partner: Hebei Finance Bureau
Focus: Urban Development, Water Supply and Treatment
Funding: U.S. $330 million (Chinese government: U.S. $180 million; IBRD: U.S. $150 million)
Status/Schedule: Projected Board Date 15 February 2000

The project, implemented in various cities in Hebei Province would include three main components: water supply, wastewater management, and water conservation control. Water supply projects in Tangshan City include the construction of a water treatment plant with a capacity of 150,000 m^3/d. This treatment plant includes an intake pumping station, a nineteen kilometer raw water transmission main; and eleven kilometer distribution trunk mains. Water supply projects in Handan City include the construction of a water treatment plant with a capacity of 100,000 m^3/d, a fifty-six kilometer raw water transmission main, and some sixty kilometers of water distribution network. Qinhuangdao City's waters supply projects will build a bulk water transmission system with a capacity of 150,000 m^3/d, consisting of twenty-nine kilometers of pipelines, and a booster pumping station (1.7 m^3/s). Wastewater Management projects in Shijiazhuang City include the construction of a wastewater treatment plant with a capacity of 250,000 m^3/d, including some 100 kilometers of trunk sewer, rehabilitation, and expansion. Tangshan City wastewater management includes the construction of a treatment plant at Xijiao with a capacity of 160,000 m^3/d and associated lateral and trunk sewer infrastructure. Handan City's wastewater treatment plant will have a capacity of 100,000 m^3/d with a forty kilometer trunk sewer infrastructure. Water Conservation and Pollution Control projects will take place in all of these cities and include: a) industrial counseling program for process adjustments to promote water conservation and pollution reduction; and b) public awareness campaign for water conservation at households. Provincial Environmental Protection Bureaus will create a credit facility for lending to small and medium industries to finance water pollution abatement. The project also has an institutional strengthening component that would finance the design and equipment for setting up GIS based decision support systems and provide training to staff. Technical assistance would also support construction management services and future investment project preparation.

Huai River Basin Pollution Control Project

Partner: Anhui Provincial Finance Bureau
Focus: Water Pollution
Funding: U.S. $100 million (World Bank loans: U.S. $50 million; Local investment: U.S. $50 million)
Status/Schedule: Project Board Date September 1997

This project environmental regulation and enforcement project would comprise support for the Anhui provincial government plans for improved enforcement of surface water pollution regulations in the Huai River Basin. Key indicators of successful implementation of government plans would be chosen as benchmarks to be tracked during project implementation. Loan support for improved enforcement would be considered. Based on World Bank experience and discussions with the provincial project office, various provincial, municipal, and county leaders and agencies, enterprises, and the Huai River Basin Commission, a potential project has been identified with the objective of speeding environmental recovery in the Anhui section of the Huai River Basin. A secondary objective is to foster environmental monitoring and investment planning at the Basin level, in order to develop a more efficient alternative to existing plans.

Hunan Power Development Project

Focus: Energy efficiency, Air pollution
Funding: U.S. $747.2 million (IBRD: U.S. $300 million; Hunan Electric and Power Commission: U.S. $149.7

million; China Construction Bank: U.S. $148.8 million; State Development Bank: U.S. $148.7 million)
Status/Schedule: Initiated 18 June 1998

This project will alleviate power shortages in the Hunan region by providing efficient, reliable, and environmentally sound power supply. The project will have a marked impact on the economic development of the Hunan Province, specifically through three targeted activities. These activities include: 1) a reduction in the value of lost production; 2) improvements in quality of supply in terms of reduced interruptions and recognized but difficult to quantify service parameters, such as more stable frequency and voltage; and 3) improvements in local air quality, with retirement of older pollution-generating units, which tend to be located in urban and populated areas.

Shandong Environment Project

Partner: Shandong World Bank Environmental Protection
Focus: Water supply and treatment, Urban Air pollution
Funding: U.S. $215.1 million (Proposed World Bank loan: U.S. $110 million; Foreign investment: U.S. $69.1 million; Local investment: U.S. $ 36 million)
Status/Schedule: Projected Board Date May 1997

Specific objectives of the project to improve the environment in Shandong Province are to:1) strengthen policies, regulations, and institutional arrangements for municipal water, wastewater, and district heating management, and environmental pollution control; 2) support the improvement of the waters of the Xiaoqing River Basin in order to allow the waters to be used for potable supply, industry or agriculture, as appropriate; 3) expand surface water supply to Jinan to prevent further depletion of ground water aquifers; 4) facilitate complementary sustainable investments in pollution control and municipally-provided urban environmental services; 5) reduce air pollution in Weihai and Yantai; and, 6) introduce a comprehensive approach to planning, prioritization, management, and financing of urban environmental infrastructure investments.

Shenyang Engineering Industry Project

Partners: Shenyang Municipal Government, Shenyang Machine Tools Corporation, Ltd.; Participating Financial Institutions
Focus: Waste and Wastewater Treatment, Cleaner Production
Funding: U.S. $ 175 million
Status/Schedule: Initiated 15 January 1994

While focusing on the engineering industry as a major demonstration effort, the proposed project would further support Shenyang's overall industrial restructuring through reforms and investments. The project would include an environment component that would support Shenyang's policy of improving the enforcement of existing environmental regulation, extending coverage to pollution centers not adequately covered, and strengthening the capabilities of Shenyang Environment Planning Board. The sub-components would include a Hazardous Waste Treatment Facility, Water Quality Monitoring Network, and technical assistance for necessary training, computerization, and analytical capabilities. The funding will be divided between industrial restructuring (U.S. $160 million) and environmental protection (U.S. $10 million). The last known status of this project was that the plan had been prepared 15 January 1994.

Sichuan Urban Development Project

Focus: Urban Development
Funding: U.S. $152 million (IBRD loan: U.S. $150 million; Local investment: U.S. $2 million)
Status/Schedule: Board Date June 1999

The objective of this project is to provide a safe environmental setting for the sustainable long-term economic growth of urban areas in Sichuan Province. The project will: 1) support the first phase of a long-term urban environmental services improvement program to recover from past environmental degradation of its water and land re-

Protecting the Oriental White Stork & Other Endangered Migratory Birds of North East Asia Earth Island Institute's Russian-Chinese Wetlands Exchange Program

In December 1999, Earth Island Institute launched a long-term, Russian-Chinese wetland exchange program. This exchange breaks new ground and brings together a number of leading environmental professionals from throughout Northeast Asia. This exchange includes the directors of many national parks and nature reserves, wetlands scientists, nongovernmental activists, and key government policymakers. Their aim in coming together is simple: to preserve and to restore habitat for the numerous endangered bird species that migrate between the Amur and Yangtze River Basins. The coordinators for this exchange are the China Biodiversity Network Baikal Watch, and SAVE projects at Earth Island. Late last year they invited fourteen wetland managers from China, Russia, and Taiwan to survey wetlands issues in the western United States and to meet with related management agencies and citizens groups. In the end, a stronger Russian/Chinese partnership was inspired by this first exchange-and the inspiration came from the many success stories where wetlands have been protected or restored in other parts of the world.

The participants in this exchange are now committed to planning for an integrative wetland-management regime in Northeast Asia. In taking advantage of this opportunity to collaborate, the participants have now begun to develop a conservation strategy specifically for the endangered Oriental White Stork and other migratory species, such as the Crested Ibis and the Blackface Spoonbill. Less than 800 Oriental White Storks survive in the wild. This species breeds only in the Amur Basin in Russia and China, and over winters at key wetlands in the Yangtze River Basin. The habitats for these birds have suffered greatly from recent flooding, pesticide use, the draining of wetlands, and the conversion of additional areas for agricultural usage. Only in recent decades has wetlands conservation come to the fore as an issue of global significance and has become prominent in East Asia only in the last few years. Therefore, the first accomplishments of this exchange were, importantly, to:

1) Introduce Chinese/Russian colleagues to sustainable and collaborative ways for using wetlands and protecting wild bird populations.
2) Familiarize them with laws related to biodiversity protection, and show how federal, regional, and local agencies interact to enforce these laws in other parts of the world.
3) Help them discover the economic advantages derived from biodiversity protection.
4) Introduce them to institutions whose mandate is to protect biodiversity on an international level.
5) Help them assess methods both of environmental education and promoting public involvement in decision-making processes that affect biodiversity management.
6) Present them with basic methodologies for biodiversity protection, such as possible means for: a) the creation and management of protected territories; b) setting up anti-poaching and anti-encroaching programs; c) developing biological monitoring stations; d) restoring habitats for endangered species; and e) other innovative technical methods for protecting biodiversity.

The next phase of this long-term program will bring the Chinese and Russian colleagues together again for follow-on work in Northeast Asia in the summer of 2000. Some twenty to twenty-five wetlands specialists will exchange trips across the border regions of Russia and China. Special focus on these trips will be paid to the coordination of management and research projects at reserves in the Amur Basin and to programs that support the breeding of storks and other key migratory species. Information on the exchange partners and their wetland reserves, regional resources, and future ecotourism opportunities will become available in the near future through the Earth Island web page. Funding provided for this exchange program is derived from the Trust for Mutual Understanding and members of Earth Island Institute.

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sources; 2) provide an adequate supply of safe water to its growing urban population and economy; and 3) maintain water quality at levels compatible with the needs of the basins of the Min and Tuo Rivers, protecting the water quality of the Yangtze River while protecting public health, especially of lower income groups.

Sustainable Forestry Practice

Focus: Forestry
Funding: U.S. $200 million (World Bank loan $100 million)
Status/Schedule: Initiated 1998

The project aims to establish, on a sustainable and participatory basis, a timber plantation of 315,000 hectares and 230,000 hectares of economic forest crops. The areas involved are in impoverished areas of central and western China. This loan was made on commercial terms (Source: *Chinabrief,* November 1998).

Waigaoqiao Thermal Power Project

Partner: Shanghai Municipal Electric Power Company
Focus: Energy Efficiency, Air pollution
Funding: U.S. $2144.3 million (IBRD: U.S. $400 million; Shanghai Municipal Electric Power Co.: U.S. $216.2 million; East China Electric Power Group Co.: U.S. $ 108.1 million; Shanghai Energy Company Limited: U.S.

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About Earth Island Institute

Earth Island Institute has been confronting ecological threats in Russia, China, and around the world by working with local citizens and communities to protect endangered ecosystems, especially forests, wildlife, and biodiversity. As an umbrella organization for over twenty-five individual projects, Earth Island educates and empowers citizens to protect natural resources and prevent environmentally destructive development. Projects include forestry, clean energy, marine mammals, tree-free paper, environmental education, and ecotourism/sustainable economies. Earth Island focuses on those regions where there are major environmental crises, potential for citizen activism, possibilities to develop ecologically sustainable economic alternatives, opportunities for governmental reform, and a desire and need for Earth Island's expertise.

Earth Island's China Biodiversity Network

Earth Island's China Biodiversity Network has been working since 1995 to strengthen biodiversity protection in China by educating the Chinese public and community leaders, and by building the long-term capacity of the nascent Chinese environmental movement. The Network has especially focused on the Tumen Environmental Initiative, where it promoted biodiversity protection by facilitating international cooperation and advocating for designation of the Tumen River wetlands as a RAMSAR site. The Network has also worked to increase local involvement and awareness of the environmental importance of the UNDP Tuman River program. The Network was under the umbrella of the Pacific Environment and Resources Center as the China Biodiversity Conservation Program until 1998, and is now a project of Earth Island. The wetland exchange is the first collaborative project of the Chinese and Russian programs at Earth Island.

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$216.2 million; Local banks: U.S. $703.8 million; Co-financing: U.S. $ 500 million)
Status/Schedule: Initiated June 25, 1997

This project will finance the building of two 900-1,000 megawatt coal-fired supercritical thermal power units in Shanghai and the installation of flue-gas desulfurization equipment (to offset anticipated SO_2 emissions) at Shanghai's Shidongkou Power Plant. This World Bank project will also lead to the construction of two 500 Kilovolt power lines to connect electricity users to the Shanghai power grid.

Xiaolangdi Multipurpose Project II

Partner: Xiaolangdi Construction and Management Bureau
Focus: Water
Funding: U.S.$ 430 million equivalent (IBRD loan)
Status/Schedule: Initiated June 25, 1997

This project will expand on massive flood protection, hydropower, sediment control, and irrigation infrastructure works begun in 1993. The project will finance the second construction stage of a dam and hydroelectric power plant on the Yellow River and will invest in water resource schemes and in flood control and water storage.

Yangtze Basin Water Resources Project

Partners: Foreign Investment Management Office, Chinese Ministry of Water Resources
Focus: Agriculture, Water Resources
Funding: U.S. $613 million (Bank/IDA loan/credit: U.S. $210 million; Local investment: U.S. $403 million)
Status/Schedule: Projected Board Date March 1995

The project areas lie to the north and south of the middle reaches of the Yangtze River in Hubei and Hunan Provinces. The project's objectives are to support the implementation of high priority improvements in water control in the two large Yangtze River Provinces of Hubei and Hunan Provinces while simultaneously promoting advances in project planning, procurement and independent review. The project work represent a cross-section of the highest priority water control investments in the two provinces and will alleviate poverty among several million rural dwellers through a combination of irrigation, drainage, flood protection, and power benefits. In addition, safety from flood hazards for millions more of the Yangtze Basin's residents will be improved through improved flood forecasting and warning in the mid-Yangtze region.

Yunnan Environment Project

Partner: Yunnan Provincial Government, Yunnan Environment Project Office
Focus: Urban Development, Pollution Control
Funding: U.S. $150 million (IBRD loan: U.S. $125 million; IDA credit: U.S. $25 million equivalent)
Status/Schedule: Initiated June 25, 1996

The project will set the stage for Yunnan Province's long-term economic and social development by designing a system of urban management that includes a sustainable environmental framework with strategies for urban environmental improvement and industrial pollution control. The project will support formulation of improved pollution control policies and regulations; support improvements in the water quality of lakes within the province; facilitate complementary investments in pollution control and municipal environmental services; and support the introduction of a comprehensive approach to planning and financing investments in urban environmental infrastructure.

Bibliographic Guide to the Literature

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