

Foreword

Aaron Frank, Editor

In an October 1995 comment to President Jiang Zemin, President Bill Clinton suggested that the greatest threat China presented to American security was environmental, not military. President Clinton's remark raises environmental issues to the priority level of economic interests, human rights concerns, and Asian security issues. China's continual growth — in economic, demographic, and military terms — has already made it an important player in international politics and trade. Due in large part to these changes, the PRC's concurrently increasing environmental problems — with both domestic and global impacts — has made it a major player on global environmental issues and agreements. In this light, the Environmental Change and Security Project has created the Working Group on Environment in U.S.-China Relations and this *China Environment Series*. These fora are designed to facilitate discussion on environmental issues in China, determine how the United States can most fruitfully engage China on the environment, and explore the means by which government agencies, non-governmental organizations (NGOs) and private businesses can best work together to assist the Chinese in addressing future environmental dilemmas.

This first issue of the *Series* opens with an article by Kenneth Lieberthal, which provides the reader with a foundation for understanding Chinese environmental problems: any U.S. or multilateral effort to assist the Chinese on the environment must take into consideration the Chinese political economy and issues of environmental implementation and enforcement. Elizabeth Knup describes environmental NGOs in China and how they work within Lieberthal's political context. Knup's article also provides insight into how the Chinese people are developing a new form of civil society and utilizing close ties to the government to benefit the environment. Building on the working group's concentration on energy issues during its first six months, Michael May and Yingzhong Lu focus on future energy scenarios and Chinese nuclear power development, respectively. May hypothesizes that Chinese energy demand, under a no-surprise scenario, will match U.S. demand by 2050 and analyzes what problems these demands might create for the Chinese. Lu provides an environmental argument in favor of nuclear power expansion in China, focusing on its benefits for carbon dioxide mitigation. The next issue of the *Series* will include a perspective opposing Chinese nuclear power expansion. In an effort to learn more about the accomplishments of international fora on the environment with China, Earl Drake describes the successes and goals of the China Council for International Cooperation on Environment and Development (CCICED) in this inaugural issue.

Several other items will appear in each issue of the *Series*: summaries of working group meetings and small group sessions, an inventory of government and non-governmental work on the environment in China, a listing of upcoming conferences on the environment in China, and a bibliographic guide to the relevant literature. The inventory, conference section and bibliography are all working documents: we would appreciate greatly your contributions to help make these sections as comprehensive as possible. You may use the perforated sheet at the back of this issue to mail us your updates or requests. In addition, I would also like to direct you to our web site at <http://www.ecsp.si.edu>. This site will constantly be updated to include new meeting summaries, conferences and other relevant information.

Lastly, I would like to thank our funders, the National Oceanic and Atmospheric Administration, the Summit Foundation, and the W. Alton Jones Foundation for their support. I would also like to thank working group co-chairs Elizabeth Economy and P.J. Simmons, and the Wilson Center's Asia Program, whose assistance and guidance have been central to working group activities and the publication of this *Series*. I hope you find this issue useful, and we look forward to receiving your comments and suggestions.

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China's Governing System And Its Impact on Environmental Policy Implementation

By Kenneth Lieberthal

THE PEOPLE'S REPUBLIC OF CHINA (PRC) PRESENTS A PARADOX. ITS leaders are aware of its enormous environmental problems; impressive environmental laws and regulations have been adopted; a dedicated environmental bureaucracy extends from Beijing down through the provinces, cities, and counties to the township level; and China participates actively in the global environmental community. Yet, much of the environmental energy generated at the national level dissipates as it diffuses through the multilayered state structure, producing outcomes that have little concrete effect.

To understand how to work with China to improve environmental outcomes, one must appreciate the systemic dynamics that contribute to the disjuncture between the PRC's promise and its performance on environmental issues. Two factors—the distribution of authority and the structure of incentives—are particularly consequential.

I. Distribution of Authority¹

China has a multilevel political system in which the major territorial levels are: the *Center*, covering the entire country; thirty-one *provinces*; more than six hundred *cities*; over two thousand *counties*; nearly one hundred thousand *townships*; and close to a million *villages*. [See Chart #1] Typically, every office in the Chinese system has a bureaucratic rank assigned to it. One territorial level of government² contains within its organs several bureaucratic ranks. For example, in the national government in Beijing the State Council (China's cabinet) is at the top;³ commissions such as the State Planning Commission are one step down; ministries are an-

other step down; bureaus within ministries are yet another step down; and so forth.⁴ Provincial governments are the same bureaucratic rank as ministries, and provincial bureaus share the same rank as their ministerial counterparts. [See Table #1]

One key rule of the Chinese system is that *units of the same rank cannot issue binding orders to each other*. Operationally, this means that no ministry can issue a binding order to a province, even though on an organizational chart it appears that the ministries (which are at the Center) sit above the thirty-one provinces.⁵ The natural consequence of this operating rule is that there often is a tremendous need to build a consensus in order to operate effectively in China, and negotiations aimed at consensus building are a core feature of this system.⁶

Authority is channeled (or fragmented) by function as well as by rank. Chinese officials speak of

their government as being divided into broad functional "systems" (the Chinese term is *xitong*), so that each ministry sits atop a functionally-defined hierarchy of government units that exist at each territorial level of government. The National Environmental Protection Agency (NEPA), for example, is at the top of a hierarchy of EPAs⁷ at, respectively, the township, county, city, and provincial levels. Typically, each of these specialized organs has at least two potential masters: the government at each organ's own territorial level of the system and the office in the same functional sphere one level "up" the territorial hierarchy (e.g., the Hunan Provincial EPA is under both the Hunan Provincial Government and NEPA). [See Chart #2]

There is an obvious potential conflict between the "vertical" lines (in Chinese, *tiao*) of authority (e.g., the EPA at each level of the political system) and the "horizontal" lines (in Chinese, *kuai*) of authority (emanating from the territorial government at the same level as the functional office). The former coordinates according to function (in this example, environment); the latter coordinates according to the needs

Chart 1: Territorial Layers of State Administration

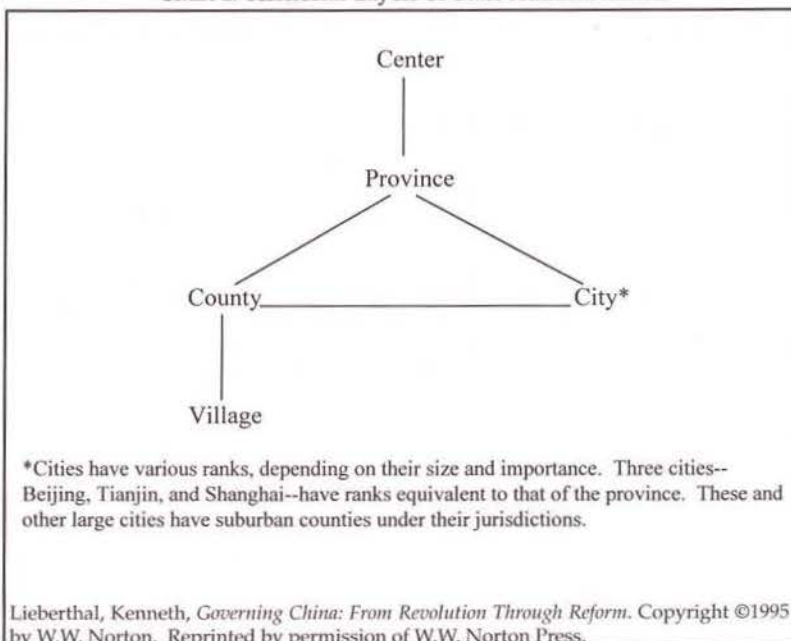


Table 1: Rank Equivalents among Government Organs

CENTER	PROVINCE	COUNTY
State Council		
Ministry	Province	
General bureau	Commission	
Bureau	Provincial department	
	Prefecture	
Division		County
Section		County department

Lieberthal, Kenneth and Michel Oksenberg, *Policy Making in China: Leaders, Structures, and Processes*. Copyright© 1988 by Princeton University Press. Reprinted by permission of Princeton University Press.

of the locality that it governs. While specifics vary, generally one of the most notable thrusts of the reforms since the late 1970s has been to give the horizontal (that is, the territorial coordinating) line of authority priority over its vertical counterpart. The Chinese call this "Making *tiao* serve *kuai*." The result is that, in general, territorial governments have become more powerful and the central-level functional units such as ministries have had their wings clipped. Within each territorial government, moreover, typically there is one top person (called a "governor" at the provincial level) and several deputy heads. Each of

the deputy heads has formal responsibility for a specific array of functional offices, and a deputy head is not allowed to interfere in the affairs of functional offices outside of his/her prescribed jurisdiction.

As even the above simplified review suggests, authority in China is fragmented by function, by territory, and by rank. Specifics may vary, but it is important to "map" the lines of authority that apply to the implementation of any specific environmental policy in any given locality. It is easy, for example, to end up speaking to a vice mayor of a municipality who in fact has no

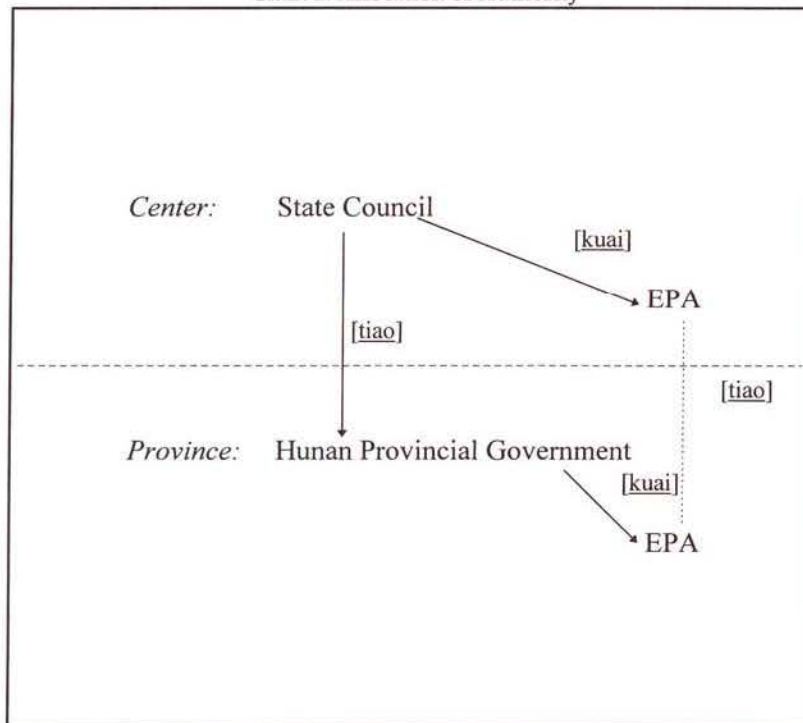
authority over the specific issues that are on the agenda of the foreign visitor.

II. Incentives

Relations among territorial governments are complex and important. Typically, all communications go up and down the national hierarchy level by level; skipping levels (by, for example, having the Center communicate directly with a county) is not the norm. In addition, formally each territorial level of government is permitted to issue binding orders to the territorial governments within its jurisdiction one level "down" the national hierarchy. But an implicit political/economic deal developed under the reforms has vastly complicated this straightforward operational rule.

China's reform leaders recognized early on that they had to find some way to spark the genuine enthusiasm of territorial leaders at all levels if they were to succeed in their quest to jump start the Chinese economy and transform it, over time, into a technologically dynamic, efficient engine of growth. Simply issuing orders from Beijing would inevitably produce huge errors and crushing rigidity in a country as large and complex as China. Yet, leading officials did not want to give up ultimate control. The solution to this quandary, reached through experimentation and never codified in either law or specific documents, is a national political-economic deal which says, essentially: *each level of government will grant the level just below it sufficient*

Chart 2: Allocation of Authority



flexibility to enable the lower level to grow its economy rapidly enough to maintain social and political stability. Rapid economic growth, accompanied by social and political stability, is, in turn, rewarded with promotions and other benefits.

This underlying national political/economic deal has produced dramatic results. It has provided enormous incentives for key officials in each locality to become entrepreneurial — to find opportunities to maximize economic growth in the territory under their jurisdiction. Officials at all levels of the political system have become increasingly adept at negotiating for additional flexibility from those at the next higher level — or of concealing activities that violate restrictions imposed from above.

China has thus become a highly negotiated political system. At each territorial level, officials retain enormous ability to interfere in the affairs of the territorial governments one level down the national hierarchy that are under each officials' direct jurisdiction. The officials can stop almost anything they wish to bring to a halt. Therefore, at every level key officials spend an enormous amount of time negotiating for additional flexibility and trying to devise ways to keep higher levels from becoming overly restrictive. This is a bargaining game in which economic growth and social and political stability are the chips at stake.

This situation has had particularly interesting results at the township level. Townships amount to small cities, and they are absorbing a good deal of the surplus labor that has been leaving the land since the breakup of the rural communes in the early 1980s. Township and village enterprises have been the most dynamically growing sector of the Chinese economy for more than a decade, providing a substantial portion of the impetus for the economic miracle widely associated with China over that period.

Township governments do not

receive a regular budgetary allocation from higher levels of the state apparatus. Rather, they rely primarily on generating their own operating funds, and many township leaders have their remuneration tied more or less directly to the profitability of township enterprises.

Although formally considered collectives, the township enterprises are usually creatures of the township government itself. The local government may appoint the enterprise's managers, specify the business scope, provide the access to credit, facilitate the marketing, determine the size of the labor force, and keep the profits, among other activities, for each of the township enterprises under its jurisdiction. Although government and enterprise appear separate it is more realistic to regard the two as a joint local territorial corporation, with the township government serving as the corporate headquarters and the enterprises serving as the various business arms. [See Chart #3] A major purpose of the local government is to make the territorial economy grow rapidly so as to maximize income, employment, and stability.

The above description of the township level requires various modifications as one shifts either "down" to the village level or "up" to county, city, and higher levels of the political system. But many of the most basic features remain quite

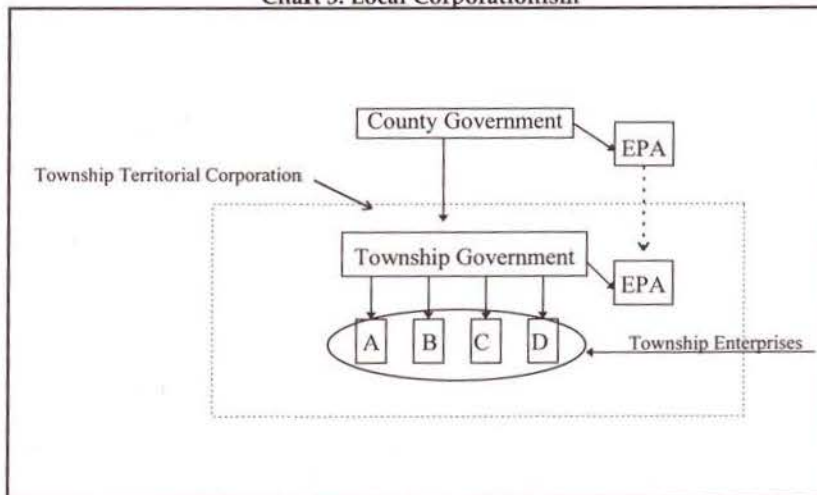
similar, such as:

- Key officials see themselves as both government administrators and entrepreneurs;
- There is massive official involvement in the economy at all levels;
- Enterprises enjoy few secure property rights that protect them from official intervention; and,
- There are pervasive incentives to produce rapid economic growth.

The above characteristics do not bode well for implementation of environmental policy. Given the lines of authority and the incentives in China, the entrepreneurs (local territorial officials) typically control the regulators (local environmental officials). Some entrepreneurs are personally environmentally sensitive, and in some localities tourism or other environment-related activities are crucial to the economy. But in most cases, this combination goes far toward explaining the paradox of good environmental laws and poor environmental performance that is pervasive throughout China.

There are additional ways in which this basic structure and set of incentives inhibit effective implementation of environmental policy. "Local corporationism," the name I am ascribing to the nexus between government and economy at the township level, means that various localities tend to become inward

Chart 3: Local Corporationism



looking and regard each other as competitors. But most environmental problems travel across local boundaries and require the cooperation of various territorial governments to address effectively. Such cooperation is difficult to achieve: indeed, there is some evidence of purposeful activity to benefit a locality at the cost of a neighbor's well being. For example, after China imposed water discharge fees for adding pollutants above permissible levels to rivers and streams, there was noticeable movement of offending enterprises to the downstream boundaries in various townships and counties.

The strong incentives to expand local employment and generate new wealth mean that the local government may conspire to blunt the effectiveness of disciplinary actions initiated by its own environmental organs. There are documented cases, for example, of a local EPA imposing a fine on a large local enterprise and then passing along the amount collected to local government coffers; the government then provided a tax break to the enterprise roughly in proportion to the amount of the fine that had been levied. In this way, the EPA met its responsibilities by imposing the fine and the government met its responsibilities by maintaining the financial health of an important source of local jobs and income. Only the environment lost out in this scenario.

Some research suggests that China's large state-owned enterprises may be more effectively subject to government environmental controls than are the local enterprises under the country's new political economy. But the state-owned enterprises are under increasing pressure to issue stock and to separate themselves from government administrative dictates. This rapidly growing trend may, in turn, mean that increasing numbers of firms are slipping into the "neither state nor private" status that has proven so difficult to subject to

the discipline of environmental regulations.⁸

III. Central Power and Its Limits

The above comments might create the mistaken impression that higher levels of government in China retain little clout in this political system. That is decidedly not the case. China remains an autocracy, albeit one committed to economic reform and increasing interaction with the international arena. Among the levers that the center has available to enforce its priorities, the following are particularly important:

- Appointments to all top positions are made by the leaders one level "up" in the hierarchy. The Center thus appoints all provincial governors, vice governors, and party secretaries, while the provincial leaders make comparable appointments at the next level, and so forth. No leader is secure in office if s/he raises the ire of leaders at the level directly above. Perhaps to highlight this ongoing vulnerability, tenure in top provincial positions typically is shorter than the mandated term of office for those positions.⁹
- The Center must approve loans from all international financial institutions before those funds are made available for local projects.
- The Center establishes the regulatory environment, including granting exemptions from specific regulatory requirements.¹⁰ Even though localities often find ways to soften the edge of regulatory demands, local leaders nevertheless fear adverse regulatory rulings and lobby hard to gain regulatory relief from upper levels.¹¹
- The Center controls investment approvals for large projects, which can have significant economic repercussions for various localities.¹²
- The Center can employ the organs of coercion — the Public Security and State Security forces on the civilian side, plus the military — to bring recalcitrant localities into line.
- The Center can dispatch work

teams (the Chinese term for what in the United States would be termed "strike forces") into localities to investigate irregularities, remove offending officials, and clean up problems. Local leaders work hard to avoid the type of attention that might trigger investigation by a higher level work team.

Given these prerogatives in the hands of the Center (most of which also apply to the ability of each successive level of government to exercise leverage over its immediately subordinate level), how is a balance struck between "top — down" discipline and local flexibility and entrepreneurship? There is no hard-and-fast rule that adequately answers this question. China at this stage in its history is simply highly dynamic, consciously experimental, poorly institutionalized and therefore quite diverse.

In broad terms, though, the Center can generally obtain high levels of reasonably disciplined compliance when three conditions are present:

- All top leaders agree on the issue;
- All top leaders are willing to give the issue priority; and,
- The degree of compliance of lower levels is measurable.

In the presence of these three conditions, lower level authorities know that failure to comply will bring substantial punishment, including the possibility of being fired. In these circumstances, compliance is usually impressive, as witnessed by China's extraordinary birth control effort. But only very few policy issues meet all three of the above conditions. Most environmental policies, for example, are too complex, long term, and deeply enmeshed in competing economic interests to be effective. They do not provide the kind of clear-cut priority at the top, and measurable performance evaluation at lower levels, required in the above explanation.

Where the above conditions are not met, policy implementation is

more uneven. When top leaders turn their attention to the issue and publicize their concern about it, local officials tread more carefully. When the attention of those at the top shifts elsewhere, compliance levels may quickly fall off.

The institutionalization of policy initiatives, therefore, is particularly important. Given the pervasive bureaucratic nature of the Chinese system, new initiatives fare best when specific units are created (or adapted) and concretely tasked with implementing that particular initiative.¹³ This has been done with environmental policy, as attested by the development of a nationwide apparatus of environmen-

Cooperation with authorities at the Center will not be adequate to produce substantial outcomes in environmental efforts.¹⁴ Efforts at the Center are crucial in that central level opposition (or, for that matter, opposition at any higher level) can kill an initiative, but rarely are such efforts in themselves sufficient. Rather, it is also important to cultivate understanding and support in the localities whose actions can make a significant difference. The Center places so many demands on localities that local leaders effectively have some ability to prioritize their compliance. Foreign efforts may move some environmental issues higher up the list of local pri-

sive. In addition, given the Chinese side's short term focus on making money, it is often important to devise approaches that sharply limit any downside risks.

In China, as in many more democratic countries, it is important to develop coalition strategies. China is in most instances a consensus building system. The fragmentation of authority outlined above means that most major initiatives require the cooperation of people in a situation in which no single official has command authority over each of the important participants. Put differently, a winning strategy in China must take account of the various units or individual officials

Most environmental policies are too complex, long term, and deeply enmeshed in competing economic interests to be effective.

tal offices from the top to the bottom of the system.

It is important, though, to ask about reporting lines as well as the mere existence of dedicated offices. In the case of the environment, as noted above, the EPA at each level has a solid line relationship with the territorial government at that level and only a dotted line relationship with the EPA one level up in the national government hierarchy. This structure of authority effectively puts each EPA under the thumb of precisely the officials who have the greatest responsibility for — and interest in — accelerated development of the local economy. Environmental policy implementation inevitably suffers accordingly.

IV. Recommendations for Environmental Assistance

The above analysis has significant implications for foreign approaches to China's environmental problems. Details inevitably must vary according to the specific nature of the issue under consideration and the part of the country in which a remedy is sought. But several broad lessons warrant attention.

orities.

Foreigners must take care to understand the division of responsibility in each location. If talking with a vice governor, for example, it is important to know whether that particular individual actually has responsibility for environmental issues (or for energy or whatever specific project is under discussion).

In most localities, there is overwhelming pressure to expand the local economy rapidly. That pressure comes not only from above (those officials who are successful generally enjoy both higher standards of living and better prospects for promotion), but also from below. For example, research has determined that one of the strongest driving forces of local elections in China's villages has been the desire by peasants to put into place local leaders who are more entrepreneurial and therefore better able to expand the local economy.¹⁵ Approaches to local officials must seek, therefore, to tie environmental improvements to short term economic growth. Promises of long term benefits at the cost of near term growth are unlikely to prove very persua-

whose opposition could effectively stymie an initiative and develop an approach that assures their neutrality, if not their active cooperation.

China's system is one that creates ongoing negotiations among its various officials and offices. Foreign partners do best if they make the effort to understand these behind-the-scenes negotiations and to work out how they can most helpfully contribute to the negotiating effort of their Chinese counterparts.

China's concentration on economic development reflects its still deep-rooted and pervasive poverty. Foreign initiatives backed by foreign funds and technology, especially initiatives that are job-creating, are going to be more successful in general than will potentially more important initiatives that require immediate Chinese outlays or that might reduce local employment.

V. The Future

The above comments lay out pertinent characteristics of the current Chinese system and some of their implications for cooperation on the environment. The overall thrust of the above analysis should

be sobering: China's present political system operates in a rather fluid fashion, with great local variation, considerable opportunity for local initiative, and tremendous pressure on local officials to give priority to rapid economic development. As a consequence, the country's implementation of its extensive environmental regulations is very inadequate, and its environmental offices generally are under the authority of officials whose priority is short term growth rather than long term sustainability. Putting these factors together, China's environmental conditions are likely to continue to deteriorate overall during the coming 5 - 10 years.

However, China's system is in the midst of constant change, and the longer term prognosis is less gloomy. Trends already evident in the system that are likely to become increasingly important include the following:

- Greater circulation of information based on a more relaxed view toward release of data, better communications infrastructure, and more tolerance for a diversity of views on technical issues;¹⁶
- Greater expertise, based in part on increased contacts with the international environmental community, better educational resources within China, and research dedicated to tackling environmental problems;
- Growing concern with quality of life among the increasing number of Chinese who have put poverty behind them. This is accompanied by a gradually increasing willingness by the government to consider the opinions of the population and to try to be responsive to popular sentiment;
- Greater understanding on the part of national political leaders of the real costs of environmental degradation; and,
- Gradual moves away from the "local corporatism" model and toward sharper differentiation of government from enterprises. This may result in greater official willingness

to enforce environmental standards.

Over time, the Chinese system should move in a direction more favorable to responsible environmental stewardship. Increased information and analytical capabilities, structural changes that begin to disentangle the interests of officials from those of entrepreneurs, and greater responsiveness to growing popular sentiment in favor of environmental protection should combine to increase China's desire and ability to move toward sustainable development. Foreign assistance in education, research, technology transfer, and funding can make contributions along, but such contributions are likely to be more effective if they are tailored to the structure and dynamics of the Chinese political system than if they are addressed solely to resolving a specific problem.

Endnotes

¹ For a more detailed treatment of the issues raised in this section, see Kenneth Lieberthal, *Governing China: From Revolution Through Reform* (New York: W.W. Norton, 1995).

² Comments made about the government in this paper generally apply also to the Communist Party's governing structure.

³ The Communist Party's Politburo ranks higher than the government's State Council.

⁴ China's National Environmental Protection Agency has a rank below that of a ministry.

⁵ The same rule means, of course, that ministries cannot issue binding orders to other ministries, provinces cannot issue binding orders to other provinces, and so forth.

⁶ David M. Lampton and Susan Shirk provide additional explanations for this phenomenon in their chapters in Kenneth Lieberthal and David M. Lampton, eds., *Bureaucracy, Politics, and Decision Making in Post-Mao China* (Berkeley: University of California Press, 1992).

⁷ The actual nomenclature changes—from agency, to bureau, to department, to office—as one goes down the national governmental hierarchy.

⁸ Key information for these three points is drawn from Abigail Jahiel's excellent

study, *Policy Implementation Under "Socialist Reform": The Case of Water Pollution Management in the People's Republic of China* (Ann Arbor: University of Michigan Political Science Department Ph.D. Thesis, 1994).

⁹ Yasheng Huang, *Inflation and Investment Controls In China: The Political Economy of Central-Local Relations During the Reform Era* (New York: Cambridge University Press, 1996).

¹⁰ Susan Shirk argues that during the 1980s the Center's leaders followed a very specific political strategy in their granting of regulatory relief to various provincial authorities: Susan Shirk, *The Political Logic of Economic Reform in China* (Berkeley: University of California Press, 1993).

¹¹ Dorothy Solinger documents this phenomenon well for the major central China metropolis of Wuhan: Dorothy Solinger, "Despite Decentralization: Disadvantage, Dependence, and Ongoing Central Power in the Inland—The Case of Wuhan," *China Quarterly* (March 1996), 1-34. See also Paul Schroeder, "Territorial Actors as Competitors For Power: The Case of Hubei and Wuhan," in Lieberthal and Lampton, 283-307.

¹² Cf. Huang.

¹³ Kenneth Lieberthal and Michel Oksenberg, *Policy Making In China: Leaders, Structures, and Processes* (Princeton: Princeton University Press, 1988).

¹⁴ The exception to this rule is large scale projects that are funded basically from the Center. But even here, local cooperation is often vital for success. Cf: Lieberthal and Oksenberg.

¹⁵ Allen C. Choate, "Local Governance in China: An Assessment of Villagers Committees" (The Asia Foundation: Working Paper #1, February 1997).

¹⁶ See, for example, Zhu Hongfei, et al., *Fazhan yu weiji: Changjiang liuyu fazhan zhanlue sikao* (Development and Crisis: Reflections on the Development Strategy for the Yangtze River Basin) (Shanghai: Shanghai renmin chubanshe, 1996), which provides the very skeptical view of current Yangtze River Basin strategy of a research team at the State Council's Development Center.

Kenneth Lieberthal is the Arthur Thurnau Professor of Political Science and William Davidson Professor of Business Administration at the University of Michigan. His most recent book is *Governing China: From Revolution Through Reform* (W.W. Norton, 1995). He is currently writing on the evolution of the Chinese state over the course of the twentieth century.

Environmental NGOs in China: An Overview

By Elizabeth Knup

THE EMERGENCE OF SOCIAL ORGANIZATIONS (*SHEHUI TUANTI*) IN CHINA is commanding considerable attention from observers both outside and inside China.¹ It is viewed with hope by some as the initial sign of nascent civil society and with wariness by others as a potential breeding ground for resistance to the state. Neither depiction is entirely accurate. Social organizations are emerging in China in forms not seen before, and since they are emerging in an economic, social, and political context unique to China, they possess particular “Chinese characteristics” which distinguish them from Western-style NGOs and cause confusion if viewed through a predominantly Western lens. The degree of autonomy Chinese social organizations maintain from the state is one of the characteristics which raises the most concern. There is no question that Chinese social organizations are tied more closely to the government than in many other societies, but as this article will demonstrate, this closeness, while limiting, also allows these groups to operate effectively within the current Chinese context.

The growth of social organizations in China must be viewed in terms of a China which is undergoing rapid economic, social and political change. These conditions simultaneously create the need for non-state organizations, provide the space for their development, and define the constraints within which they operate.

Economic reform has created opportunities for many Chinese citizens, but it has also exacerbated many of China’s increasingly obvious social challenges, including environmental challenges. Tens of

thousands of redundant agricultural workers are leaving the countryside to find employment in the booming cities, but are not included in the urban “social safety net” which historically has provided urban workers with adequate housing, health care, pensions, and other social benefits. As China attempts to keep the economic boom going, it has become increasingly clear that state-owned enterprises (which employ an estimated 110 - 115 million workers, two-thirds of them in urban areas) must be streamlined or shut down, thereby increasing unemployment and social dislocation.² The prospect of urban centers teeming with unemployed workers without previously provided benefits sparks fears of social unrest. At the same time, rising living standards increase demands for better food and more consumer goods, putting pressure on the government to keep the economy moving forward to satisfy rising expectations. Perhaps the key question which preoccupies many Chinese leaders is how to keep the economy growing while addressing new social challenges and preventing unrest.

Another aspect of China’s reform which bears directly on this discussion is the way in which revenues are collected and reallocated across society. A combination of factors, including a weak taxation system and a cumbersome state-owned sector, compounded by increasing demands on the state to address social challenges, creates a situation in which the state is unable to bear the full cost of running the society. Almost all institutions, including local governments, have been called upon to raise higher percentages of their own revenue. This relieves the state of a large financial burden, but also increases political decentraliza-

tion. Decisions about how to raise and allocate revenue are increasingly made at the local level, and local priorities tend to favor economic development. One of the primary mechanisms previously held by the state to compel adherence to central directives and policies, particularly those policies which address broad social concerns, has been significantly weakened — namely the power of the purse.³

One important outgrowth of China’s reforms is a recognized need to address social concerns but a limited state capacity to do so. This situation has compelled the Chinese government to seek alternative ways to address these problems, thereby creating space for the emergence of social organizations or NGOs. As long as these organizations address problems deemed valid by the state, and in a manner deemed appropriate by the state, some public space will continue to exist and perhaps even grow. However, the situation is fluid; NGOs in China must tread warily in a vague and uncertain political climate which keeps a careful eye on potential threats to social stability and emerging challenges to the political elite.⁴

It is particularly useful to examine the development of the NGO sector through the field of environmental protection. Rapid economic development and political decentralization have exacerbated China’s environmental challenges, a condition which affects all Chinese citizens more or less equally. As described elsewhere in this volume, these environmental challenges are well-recognized in both China and throughout the world. A large and growing population with rising expectations for material well-being, fed by a rapidly growing and industrializing economy, all put pressure on China’s natural resources. Increased inputs in agricultural production, competition for land use, a strain on water and other essential resources, and rising air pollu-

tion problems due to heightened energy consumption and increased industrial production (particularly

should instead serve as a guide and a start on a path that needs further exploration.

Social organizations are emerging in China in forms not seen before, and since they are emerging in an economic, social, and political context unique to China, they possess particular “Chinese characteristics” which distinguish them from Western-style NGOs.

among the 10 million township and village enterprises throughout the country),⁵ all contribute to an untenable situation. However, the political structures set up to manage environmental problems are weak and the financial resources available to address the problems are limited.⁶ It is here that rapid economic development — seen as desirable and essential — conflicts directly with other social needs which are recognized as valid by the Chinese government but which it finds difficult to address efficiently on its own. It is at this nexus that the public space for emergent NGOs is being formed. At the same time, Chinese leaders, looking at the Taiwan case, see that environmental NGOs can present challenges to economic development plans and easily become politicized.

Because of the fluid nature of the changes mentioned above, assertions about NGOs in China are subject to equally rapid revision. This article draws on research (both Western and Chinese) on the nature of China’s NGOs as well as personal observation and conversations to provide a picture of a spot on a continuum. Perhaps more usefully, this article identifies some of the important NGOs in the environmental protection field and places them in the overall context of the development of civil society in China. The list is by no means exhaustive; undoubtedly new organizations emerge every day. This article

China’s NGO Sector: The Regulatory Framework

To date there are no laws governing the establishment, management, and activities of the NGO sector in China. The Ministry of Civil Affairs is reportedly working on a number of drafts, but such a law is not expected to be passed until the end of the century. Currently the only legal document pertaining to social organizations in China is the “Regulations on the Registration and Administration of Social Organizations,” promulgated in 1989.⁷ Responsibility for implementation of these regulations resides with the Ministry of Civil Affairs or its local-level departments. The Regulations pertain primarily to registration procedures and are supported by several Ministry of Civil Affairs circulars on financial management, membership fees, income generating activities, and other issues.⁸ The People’s Bank of China also plays an important role in overseeing social organizations in China through financial regulation.

As stipulated by the two-step registration procedures outlined in the Regulations, all social organizations first must obtain a state or Party sponsor (*guakao danwei*), or “mother-in-law,” which is responsible for determining whether or not the organization should be permitted to register. Upon successful registration, the sponsor is to play an important supervisory role over the social organization, and is expected

to carry out annual reviews, approve budgets and staffing plans, and act as an intermediary with the Ministry of Civil Affairs.

The second step in the registration process requires submission of various documents including a mission statement, a list of leading members of the organization, funding sources, organizational structure, and other “necessary information.” The Regulations clearly stipulate that “social organizations must abide by the Constitution, the laws and the regulations, and must protect the unity of the state and the solidarity of the nation and must not harm the interests of the state.” Social organizations must limit their activities to the geographic region covered by the Department of Civil Affairs with which they are registered and are not allowed to establish branch offices. In principle, there can be only one registered organization in a given field of work at each administrative level. The Regulations say nothing about fundraising activities other than to mandate that social organizations may not engage in profit-making business activities.⁹

This regulatory framework is at once limiting and vague. It is difficult to categorize accurately the different types of organizations which currently exist or what organizational forms might emerge. Social organizations generally include associations, societies, federations, research associations, foundations, and friendship groups which focus their activities on a range of topics including culture and arts, medicine and health, social welfare and public service, education and social sciences, and science and technology. It is currently estimated that there are over 200,000 social organizations registered nationwide, of which 1,800 are national-level organizations.¹⁰

Environmental NGOs: Degrees of Autonomy from the State ¹¹

One common standard for evaluating how “genuine” NGOs

are (a standard used by both Western and Chinese observers) is the degree of autonomy any given organization maintains from the state. This can be measured in a few quantitative ways: the percentage of funding received from the government or the number of government officials on the staff or board of directors. The degree to which the activities of any given NGO are initiated without government influence is an important qualitative measure of autonomy — one which is difficult to measure given the limited transparency in China. The requirement for a government or Party sponsor certainly calls into question the ability of any NGO in China to have true autonomy. Yet, despite the required “mother-in-law,” many newly established social organizations have achieved a relatively high degree of autonomy, as long as the organization’s activities support the overall goals and policies of the state. An examination of the environmental protection field shows that, in fact, a wide range of organizations, with varying degrees of autonomy, have found space in which to operate. Moreover, the close relationship between NGOs and the government can be seen as beneficial at this stage of China’s development.

Government-Organized NGOs

The least autonomous social organizations, which are strongly favored by the current regulatory environment, are those initiated from the top down — “government-organized NGOs” or GONGOs. These tend to be associations or foundations established by state agencies or well-known Chinese leaders. Frequently the leadership of the GONGO is the same as the leadership of the sponsoring agency, and the boards of directors and membership are composed of senior officials and scholars with close ties to the government. GONGOs tend to be large, national-level organizations which receive the bulk of their funding from the

government. These are by no means grassroots organizations; their activities focus on an elite audience of scholars, policy-makers, and government officials. A subset of the GONGO is the “quasi-governmental NGO.” These organizations typically come into existence for administrative reasons to facilitate work with foreign NGOs. Chinese government agencies cannot sign cooperative agreements with or raise funds from foreign NGOs, and therefore, they frequently form “NGOs” expressly for this purpose. Some examples of GONGOs in the environmental protection field are listed below.

The China Environmental Protection Foundation (CEPF) was established in 1993 under China’s National Environmental Protection Agency (NEPA) with the donation of United Nations Environmental Prize money awarded to Qu Geping, chair of the Environmental Protection Committee of the National People’s Congress (NPC) and former administrator of NEPA. Its honorary presidents include Wan Li, former chairman of the NPC and Huang Hua, former vice premier and foreign minister. Qu Geping is CEPF’s president. Foundations in China are generally organizations which seek funding and tend to implement programs determined by the government. They rarely have endowments or programmatic autonomy. CEPF’s own literature states its first general principle is “to facilitate the donation of funds and goods in order to help develop environmental protection undertakings in China.” Other activities include the promotion of international exchange activities and honoring outstanding Chinese environmental protection professionals and journalists.

The China Society of Environmental Science (CSES) was established in 1979 with the support of NEPA and the Chinese Association of Science and Technology. The honorary

president is Qu Geping and the president is Xie Zhenhua, administrator of NEPA. The board of directors is equally as prestigious. CSES boasts a membership of 35,000 scientists, teachers, and environmental protection professionals throughout China. Its stated activities include enhancing environmental awareness and scientific knowledge, providing information to policy-making bodies, and assisting the Chinese government in mobilizing public participation in environmental protection. CSES also seeks to promote international cooperation on environmental issues and publishes academic journals and books.

The National Natural Science Foundation (NNSF) was established in 1986 under the Chinese Academy of Sciences and views itself as analogous to the National Science Foundation in the United States. It is a loose association of scholars and intellectuals in the natural sciences with approximately 250 members, 70% of whom are professors. The primary goals of NNSF are to support basic research in the natural sciences at universities, research institutes, and within industries. Some of the work supported by NNSF is directly relevant to the needs of environmental protection.

The Heilongjiang Provincial Territory Society, established in 1994 by the Heilongjiang Provincial Planning Commission is typical of the “quasi-governmental NGO.” In this case, the Heilongjiang Provincial Planning Commission committed to a four-year project with two American NGOs and two branches of the Russian Academy of Sciences to develop a sustainable land use plan for the Ussuri River watershed. In order to sign the agreement with foreign groups and to separate the funds needed to carry out its responsibilities toward the joint project, the Planning Commission created the Territory Society. On the one hand, the staff and offices of the

Territory Society are the staff and offices of the Planning Commission, indicating no autonomy from the government whatsoever. On the other hand, the Territory Society was able to involve scholars and policy-makers from the Forestry Bureau, the Environmental Protection Bureau, a variety of universities, and other administrative units in the project, perhaps more easily due to its "NGO" status. Once the joint project is complete, the parallel Territory Society may or may not continue to exist. This type of shadow organization is quite typical in China as it opens its doors further to the outside world and seeks to engage in cooperative activities with foreign, nongovernmental partners.

The clear advantage of GONGOs is their ability to draw together scholars and officials from a wide range of institutions who normally find it difficult to interact in China's highly vertical bureaucratic structure — something particularly important in the interdisciplinary field of environmental protection. As well, the prestigious leadership and membership of GONGOs draws attention to environmental issues, and provides a channel for the flow of information and ideas from the GONGO membership to policy-making bodies in the government. At this stage in China's development, new challenges require new, interdisciplinary solutions, and the potential role for GONGOs in a more well-informed policy-making process should not be dismissed.

Individual-organized NGOs

The environmental social organizations most analogous to Western-style NGOs tend to be "individual-organized" and although they also are regulated by the Ministry of Civil Affairs, they are far more autonomous than GONGOs. Typically, these groups are organized around a committed individual who — in most cases — establishes the organization, often

with difficulty, and who struggles to keep the organization running with few staff and extremely limited financial resources (often personal savings). The founders/leaders of these organizations usually have some connection to the government, although it is informal — usually through personal connections (*guanxi*) and therefore the political protection provided is less secure than for GONGOs. These organizations tend to be more grassroots in nature, draw their members and volunteers from among the general population, and focus their educational and awareness-building activities "down" as opposed to "up." Funding for these groups is mixed, including small grants from Western foundations or multilateral organizations, personal savings of the leaders and tiny contributions from members, and a "pay as you go" approach to their activities. The founders of this type of organization frequently have ties to the West where they have observed that independent organizations and individuals can make a difference in terms of education about environmental issues. For the most part, however, these "individual-organized" NGOs focus on activities which support the stated environmental protection goals of the state. Some examples of "individual-organized" NGOs in the environmental protection field are listed below.

Friend of Nature (FON) was established in 1994 by the historian Liang Congjie. Liang initially approached NEPA seeking sponsorship for his NGO. When he was turned down, after a ten-month wait, he went to the Academy of Chinese Culture (where Liang is both a professor and vice president) for permission to establish a "green culture" group. Permission was granted, and FON was established as a national-level membership organization. FON's membership includes over 250 individuals, mostly intellectuals, but the activities of the organization focus primarily on raising environ-

mental awareness among China's general population.

FON's activities were initially small, with groups of like-minded intellectuals gathering in secluded parks to commemorate Earth Day or to discuss environmental issues. They soon began to focus on environmental education, particularly at the primary and secondary school level, and sponsored environmental art exhibits in schools and other activities designed to raise the environmental awareness of young people. FON's activities have grown in scope and now focus in two primary areas: environmental education and habitat/wildlife conservation. FON has recently developed and published a primer of environmental readings for school children, organized field trips, and established a "Forest and Kids" summer camp.

FON's wildlife/habitat conservation efforts focus primarily on the Golden Monkey in Yunnan Province where the logging practices of the local people threaten the monkeys' habitat. Importantly, this activity has broadened FON's activities into the realm of advocacy, albeit advocacy with "Chinese characteristics." When the threat to the monkeys' habitat was brought to the attention of FON, the group mobilized its members to write letters and send petitions to central government officials; with additional support of the media, FON has exacted a promise from local officials to reconsider the logging decisions. The significance of this activity lies not in the promise to reconsider the logging decisions,¹² but in the form of advocacy Liang and FON created. They identified a problem which the central government itself recognized but which it was ill-equipped or unwilling to address. They mobilized citizens and the media *in support* of stated government goals for sustainable development practices, and compelled the government to enforce its own policies.

Global-village Environmental Culture Institute of Beijing (GECIB) was established in 1996 by Liao Xiaoyi. Primarily using personal savings supplemented by small grants from Western and multilateral organizations, Liao and her one staff member focus GECIB's activities in two main areas: the production of a series of television programs, including a weekly television program entitled, "Time for Environment," and efforts to popularize reuse and recycling among the households of Beijing. Liao also writes articles on environmental issues for such publications as *China Women's Daily* and *China Youth Magazine*, although it is unclear if these activities are considered part of GECIB or personal contributions to the popularization of environmental issues in general.

Beijing Environment and Development Institute (BEDI) was established in 1995 by Ma Zhong with the support of the People's University's Institute of Environmental Economics, where Ma is a professor. BEDI focuses on applied research on environmental issues and seeks to encourage the use of new approaches to development planning and environmental decision-making among China's environmental protection and development agencies. In one case, research by Ma and colleagues at the Institute of Environmental Economics was instrumental in the reevaluation of development plans in Heilongjiang's Three Rivers Plain region where wetland preservation and agricultural development come into direct conflict. As with FON, such reevaluation may not result in a substantial change in local behavior. The significance lies in the increased ability of relatively independent organizations to insert ideas into the policy development and implementation process.

Center for Biodiversity and Indigenous Knowledge (CBIK) was established in 1995 and is affiliated with the Kunming Institute of Botany under the Chinese Academy of Sciences.

CBIK's activities combine research on conservation and development, work with rural communities to sustainably manage their natural resources, and communication among government officials, scholars, and rural farmers about environment and development. The executive director of CBIK, Xu Jianchu, administers a wide range of projects, including programs to

The clear advantage of GONGOs is their ability to draw together scholars and officials from a wide range of institutions who normally find it difficult to interact in China's highly vertical bureaucratic structure.

rehabilitate degraded ecosystems in upland Yunnan Province and to encourage community participation in biodiversity and conservation efforts. CBIK supports a library accessible to researchers from different institutions, training programs, and workshops. The Center also provides consulting services to the government and to international organizations in the design of environmental projects in southwest China.

Institute of Environment and Development (IED) was established in 1994 with the sponsorship of the Beijing Science and Technology Association by graduates from the Rockefeller Foundation's Leadership for Environment and Development training program. (Ma Zhong, founder of BEDI, is also a graduate of this program.) The director of IED, Li Lailai, plans to develop a database of case studies of sustainable development and research on environmental issues which ideally will be accessible to a range of environmental protection professionals and scholars across China via the Internet. While

pursuing this long-term goal, IED currently provides Internet connections and training.

Voluntary Organizations

The groups described above reflect a range of organizational forms, including membership organizations, applied research institutes and centers, and more narrowly focused "single-issue" organizations. There is, however, one other organizational form emerging which is perhaps the most autonomous of all the voluntary organizations. The author has details of only one of these types of groups, but assumes that there are more and that the number is growing. One reason these groups are difficult to track is that they are not registered with the Ministry of Civil Affairs, and as voluntary groups they do not have formal organizational structures or staff. Rather, individuals with like interests come together voluntarily on an irregular basis to work together towards a common goal. The same individuals may or may not come together in the future, and there is nothing that binds them together institutionally.

Green Earth Volunteers (GEV) co-founded in 1997 by Wang Yongchen, a popular radio personality and board member of FON, is a known example of a volunteer organization. Wang and her co-founder organize activities which are carried out by volunteers who generally pay their own way in order to participate. For example, earlier this year, GEV organized a group of volunteers to travel to the Inner Mongolia Autonomous Region to spend three days planting trees in the Engebie Desert. The 108 volunteers each paid \$78 to cover transportation and other costs associated with the project. Other anticipated activities include training volunteer guides for Beijing's zoo and botanic gardens, and encouraging individuals to volunteer their time in classrooms to share knowledge about the environment.

Conclusion

If held up to the lens of commonly held Western definitions of NGOs, China's social organizations appear flawed, particularly in terms of their relative autonomy from the state. However, viewed in terms of what is currently needed at this stage of China's social development, and seen as growing out of a particular economic, social, and political context, those flaws can be seen as assets, or at the very least as evidence of growing pains.

The need for a sponsor is one of the most important "Chinese characteristics" which defines Chinese NGOs. The sponsor has veto power over the establishment of the nascent NGO which often makes it difficult for NGOs without good political connections to pass the first registration hurdle. This is evidenced by Liang Congjie's initial trials. The result is generally a very close relationship — either formal as in GONGOs or informal as in "individual-organized NGOs" or voluntary organizations — between an NGO and the government. From a Western standpoint this calls into question the autonomy of the social organization, and by extension its genuineness and credibility. However, there are varying (and increasing) degrees of autonomy. Moreover, in the Chinese context where the state has come to depend on social organizations to carry out certain activities, the close relationship creates a bridge between non-state, even grassroots, organizations and the official state agencies over which information, policy ideas, and advocacy can travel. It also allows the NGO to know the priorities of the state, helping it navigate shifting political tides. Of course, the system works because the organizations do not oppose the policies of the state. Most of the NGO leaders recognize this and have determined that it is not worth behaving antagonistically since there are enough state-endorsed projects they can undertake that are beneficial to China's environment.

Challenges lie ahead for China's fledgling environmental NGOs — particularly "individual-organized" NGOs and voluntary organizations. As the organizational momentum comes from the personal authority of the founder/leader, the transition to more sustainable governance and organizational structure is difficult. It is also quite difficult to adequately staff fledgling NGOs since employment is expected to carry with it social benefits such as housing, health care, and pensions, something impossible for these organizations. Funding is a constant difficulty, particularly in the current climate. And, without a clearer legal framework, the political existence of these groups is always in question.

Perhaps the most important achievement of these organizations is that they are changing, in incremental ways, the manner in which average citizens interact with each other and with the state. Individual volunteers and members, loosely affiliated with "individual-organized" NGOs and voluntary organizations, comprise the most autonomous sphere of China's growing environmental movement. Teachers, journalists, scholars, housewives, children, retirees — in short, a diverse range of average citizens — are finding both a space in which to come together and a means by which they can articulate shared concerns.

Endnotes

¹ Social organizations (*shehui tuanti*) are those organizations in China most analogous to Western-style NGOs. For the purposes of this paper the terms will be used interchangeably.

² China's president, Jiang Zemin, opened the 15th Party Congress with a speech in which he stated, "We should encourage mergers of enterprises, standardize bankruptcy procedures, divert laid-off workers, increase efficiency by downsizing staff and encourage re-employment projects." Seth Faison, "China's Leader Announces Sell-off of State Enterprises," *New York Times*, 13 September 1997, 7.

³ For a review of various perspectives on

the effects of China's economic reform, see *The China Quarterly's* special issue on China's Transitional Economy, No. 144 (December 1995).

⁴ For a detailed discussion of the effect of economic and social change on China's emerging NGO sector, see National Committee on U.S.-China Relations, *The Rise of Nongovernmental Organizations in China: Implications for Americans* (National Committee on U.S.-China Relations: New York, 1994), 1-5.

⁵ Abigail R. Jahiel, "The Contradictory Impact of Reform on Environmental Protection in China," *The China Quarterly* 149 (March 1997): 93.

⁶ Local-level Environmental Protection Bureaus (EPBs) are in a difficult position. They are tasked with carrying out environmental protection activities which are often seen as financially onerous by local enterprises. And, the EPBs are subject to local governments which are often more interested in increasing profits in the local economy than in preventing or cleaning up pollution. For a discussion of the structural and financial difficulties faced by local-level EPBs, see Jahiel, 81-103; or, see Lieberthal in this journal.

⁷ This document supersedes the Provisional Measures on the Registration of Social Organizations promulgated in 1950. For a more detailed history of the development of social organizations in China, see Zhang Ye, "Chinese NGOs: A Survey Report," in *Emerging Civil Society in the Asia Pacific Community* (Institute of Southeast Asian Studies, JCIE and The Asia Pacific Philanthropy Consortium, 1995), 94-98.

⁸ National Committee on U.S.-China Relations, 12.

⁹ "Regulations Concerning Registration and Administration of Social Organizations," Decree No. 43 of the State Council of the People's Republic of China (October 1989).

¹⁰ Groups not included in these categories are political parties; the "eight big bodies" (*ba da tuanti*), i.e., women's federations, trade unions, communist youth leagues, etc.; groups established by foreign citizens or Chinese citizens residing abroad; and religious organizations. See, Michaela Raab, "Social Development NGOs in China," Executive Summary of a report commissioned by the Ford Foundation, 1996, 3.

¹¹ The information in this section is drawn from literature and brochures published by the organizations described and from personal conversations held with staff members of the

organizations unless otherwise indicated.

¹² Liang, himself, recognizes that a simple promise will not curtail the logging. Local communities rely on logging for their economic development goals, and a more sustainable relationship between the local people and their environment must be found. This, he admits, will take much more than a letter-writing campaign. For a detailed description of this activity see, Seth Dunn, "Taking a Green Leap Forward," in *The Amicus Journal* (Winter 1997), 12-14.

Elizabeth Knup is program director for the National Committee on U.S.-China Relations, a private, non-profit, educational organization committed to improving mutual understanding between the peoples of China and the United States. Ms. Knup is responsible for developing the Committee's programs in the field of environmental protection and sustainable development.

Energy and Security in East Asia

by Michael May

THERE ARE OPTIMISTIC AND PESSIMISTIC VIEWS OF CHINA, BUT EVEN among the optimists there is an underlying concern. The problem with China is not human rights abuses (which are no greater than in many other countries) nor arms sales (where its \$800 million in sales is less than a quarter of Russia's and less than 7% of U.S. sales — and less than a third of U.S. arms exports to Taiwan alone¹) nor yet its trade surplus with the United States, or its attempts to obtain advanced U.S. technologies, all of which are features of U.S. relations with many other countries.

The problem with China is that it is big. Big and becoming more powerful. Not just China; the same can be said of East Asia. A huge amount of power is shifting from “the West” to Asia. Because of that change, the usual ways the West has dealt with East Asia — trade and evangelism backed by muscle — are obsolete. No one knows what will take their place or at what cost, human and economic, or, for that matter, with what attendant benefits.

The concern takes several forms and dimensions. One dimension is energy. Oil: where is Asia's oil coming from? Nuclear: East Asia has only about seventy of the world's four hundred-plus nuclear power reactors, but it is the only part of the world where nuclear power is growing and expected to continue growing. Global warming: China puts half as much carbon into the atmosphere as we do, but its contribution is growing faster than ours. What can be said about all this?

Future watchers sometimes look at no-surprise scenarios. A no-surprise scenario is what happens

if current trends continue, as affected by foreseen changes: changes in demand caused by satiation or new products, for instance, or foreseen changes in supply. Fluctuations are part of the scenario, but catastrophes are not included: thus, local wars and depressions will come and go in the world, but the world-wide depression and major-power war which have not come in the last sixty years will not come, it is assumed, in the next fifty.

These assumptions could prove wrong. A no-surprise scenario is not a prediction. Its value lies in assembling what most individuals and institutions are forecasting. Combining these forecasts allows us to determine whether future outcomes will be desirable.

What does a no-surprise scenario tell us about energy and pollution, in China, in East Asia, and in the world? Decades are the right time span to examine energy matters: it takes forty years to amortize a modern power plant, thirty to fifty to get a new technology into the power grid, longer than that to stabilize global warming. What will the United States, China and the rest of the world look like in forty or fifty years — assuming we get that far without catastrophes — so far as energy and pollution are concerned?

Fifty years from now, under a no-surprise scenario, the world's population will be twice what it is today. Economic growth between now and then, and all the other factors which affect people's lives, will be determined by a host of important causes — leadership, political stability, the behavior of the rich minority of people in the world, climate, and others — which are assumed in a no-surprise scenario not to change very much. Under that

scenario, most of the new people in the world will be poor. Unfortunately, most of the surprises we can foresee (war, depression) would make them even poorer.

Nevertheless, these people will use about two and a half to three times as much energy as they do now, most of it in now developing countries. A factor three increase in energy consumption of itself is not unprecedented: it is approximately the factor by which world energy consumption has risen in the past fifty years. The actual numbers — of millions of tons of coal and billions of barrels of oil burned, of carbon released into the atmosphere, and of nuclear spent fuel (and plutonium) produced — on the other hand are far higher. Still, we will not run out of fuels. Some real resource costs are likely to increase: coal because of a probable increased tightening in environmental controls, oil and uranium because of a likely gradual rise in extraction cost. But as they are now foreseen, the increases will not be sufficient to interrupt economic growth, at least not in East Asia, with its large rate of savings and investments and its relatively effective economic management.

China under that scenario will have a lower fraction of the world's people than it does now, but a higher fraction of its economic product and of its energy consumption. That consumption, estimated conservatively, with a declining but still healthy economic growth rate and continued energy conservation measures, will increase twice as fast as that of the world as a whole, to a fifth or a sixth of total world consumption, on a par with the U.S. consumption at that time. These growth rates will certainly not be uniform over the period considered. They will fluctuate, but at a relatively high average. For comparison, over the past fifty years, the economy of East Asia as a whole, led by Japan, has grown an average of 4% per year.

Coal will continue to provide

over half of China's energy — China is now the largest coal user in the world — although, if current plans work out, much of this new capacity will be in cleaner burning plants. The Three-Gorges hydroelectric plants will long have been on-line, but hydroelectric power will be hard-pressed to maintain its present 25% share of electrical capacity: China should then have about a thousand gigawatts of installed electric capacity, roughly five times what it has now and two and a half times what the United States has now. Nuclear power could be the largest gainer percentage-wise. Again, if current plans work out, it could provide over 30% of Chinese electricity, comparable to the fraction it provides now for the rest of East Asia. With China's huge prospective electric generating capacity, however, this would constitute over a hundred-fold expansion, and it would mean as much nuclear power in China then as there is now in the world.

All told, China will be on a rough par with the United States in energy use, global pollution and gross domestic product (it is now at a half, a half and a tenth to a fourth of U.S. levels respectively²), but not in per-capita income. The Chinese will still on average be poorer than Westerners, though much wealthier than they are now. Behind China, and behind the rest of East Asia, will be several billion more people who will, one can only hope given the alternatives, be on their way to modernity, including modern energy consumption. Their prospects will depend in good part, as they do now, on the political and economic policies of the richer states.

What's wrong with this scenario? What contradictions does it contain? What unrealistic assumptions does it make? Four points come to mind:

1. Continued Open World Markets

The no-surprise scenario implies continued open world markets. Otherwise, neither China nor

the rest of East Asia will have the wherewithal to buy the needed oil and gas, much of which will still come from the Middle East, the Caspian Sea area and the rest of Russia. China produces about 80%

fluence of the United States, the economic growth of China has an ambiguous impact: it inevitably increases both Chinese national power (including the potential for military investments) and, because

From the standpoint of the relative power and influence of the United States, the economic growth of China has an ambiguous impact: it inevitably increases both Chinese national power and, because it requires participation in international trade, Chinese economic interdependence.

of its oil now, but that percentage is likely to decline, even under optimistic assumptions about the size and availability of the oil resource in Western China. The natural gas outlook within China and offshore is still uncertain, although most estimates lead to an indigenous resource perhaps comparable to that of the United States.³ Large Chinese contracts for oil and gas and for the needed pipelines are being let with Russia and Kazakhstan, albeit the source of their financing has not been made clear. The rest of East Asia is even more highly dependent on world markets for oil and gas, as well as uranium and coal for Japan and Korea. It is important to note that world markets must remain open both to East Asian exports and to fuel imports for economic and energy consumption growth to take place at the rate suggested here.

Continued open world markets are not a contradiction with anything in the rest of the scenario, but their existence implies continued political foresight and wisdom in dealing with the likely ups and downs of international relations, in particular the relations between a growing superpower, China, and an established superpower, the United States.

Will China's economic growth be seen in the United States as serving U.S. interests? From the standpoint of the relative power and in-

fluence of the United States, the economic growth of China has an ambiguous impact: it inevitably increases both Chinese national power and, because it requires participation in international trade, Chinese economic interdependence. For China, as for any country, the development of national prosperity and power requires international economic interdependence. The latter, in turn, serves to further increase domestic development and national power.

Three arguments support the thesis that the United States should support Chinese growth, not only for the welfare of China, but for its own:

- First, by supporting Chinese participation in world markets, the United States is supporting the considerable political forces in China which desire to and would profit from continued economic openings and reforms.⁴ By opposing this participation, or making it contingent on transformations in the Chinese polity and society which are unlikely to be possible in the short run, the United States is strengthening the hand of the political forces that could pose a danger to peace and to the United States.
- Second, a stable world with an open world economy which includes China is what China's neighbors, including U.S. allies, want. The major East Asian and Southeast Asian states (other than China) want the United States as a balancer, in military, economic and political dimensions, but none wants a conflict and none wants to have to

choose between the United States and China.

• Third, and as a result of number two, economic containment policy is not possible for China, as it was for the Soviet Union. China, since the start of the Deng era, has conducted the opposite of the autarchic economic policy which the Soviet Union conducted. As a result, Japan, the Koreas, Taiwan, and the ASEAN states all have a stake in an economic order of which China is an essential part. Russia, for both strategic and economic reasons, has also been improving its ties with China, a trend which it is in both countries' interest to continue. Thus, the preconditions for successful economic containment are absent.

If these arguments prevail, world markets will remain open to East Asian states in general and to China in particular. If they do not, there is little question but that denial of trade with the United States could cause a serious economic setback in China. As Chinese aggregate internal demand expands, the effect of trade with the United States will diminish. The long-term outcome is unclear. U.S. restrictions on trade with China could as easily isolate the United States from the rest of Asia (and Europe, a major Chinese trade partner) as they could succeed in isolating China. This has been exemplified by current U.S. nuclear reactor export policy, where all nuclear reactor exporters but the United States engage in a lively trade with China.

2. No Reduction or Stabilization of Carbon Emissions

The no-surprise scenario does nothing to reduce or stabilize carbon emissions. This is a global, not an Asian problem, one which may, fifty years from now, loom larger than any other. The United States and Europe will continue to be the largest emitters. Without large investments in research and development and even larger ones in new industrial plants and means of

transportation to replace our present fossil fuel-based plants and transportation, the global carbon emission rate will increase two- to three-fold over the present rate. There could be one to a few degrees of global warming well before mid-century, with further increases on the way. We do not know now, and will not know soon, what the economic, societal and political consequences of that amount of warming would be. Thus, as it stands, the no-surprise scenario does not make provision against a possible highly disruptive, perhaps catastrophic contingency.

If action is needed on this score, the terms of the necessary global cooperation promise to be a highly charged political matter, since different countries come to the table with very different interests. Since the scientific basis and regional climatic and economic implications of global warming are very uncertain, and will remain so for some time to come, the situation is even more difficult. Indeed, it is quite possible that global warming will not lend itself to an orderly approach wherein the scientific situation is understood before action is planned and carried out, but rather that signs which indicate that action is needed (such as prolonged regional falloff in food production and increased frequency of severe weather) will appear before the situation is fully understood scientifically. This possibility increases the value of carrying out needed developments of economically acceptable non-fossil sources of energy as a risk-reduction measure, before the cost of these developments is justified by the market at business-as-usual rates of discount.

3. Reliance on Expensive Oil Imports

The scenario uses more expensive oil, possibly by \$10 a barrel of crude oil on average. That in itself would not halt oil imports, though it will be a burden especially on developing economies. On the way to

higher average price, however, there could well be — without adequate investments, there almost surely will be — temporary shortages and price spikes. As an economic matter, these can be dealt with at some cost without breaking down the world's trade and financial order, as the developed world's reaction to the oil crises of the 1970s showed. As a political matter, viewed again through the prism of a worried establishment superpower, or a resentful new one, these shortages could lead to defensive reactions such as exclusive arrangements for supplies, backed by force, which would worsen both the economic and the political situation for all without much benefit to anyone in either area.

4. Maintenance of Current Security Structures

Most importantly, the scenario assumes that the world's major powers continue to support a structure of security under which rivalries and disagreements (which will not go away) can be pursued without striking at the vital interests of any one, and, of increasing importance, within which global problems such as climate change, handling of nuclear power and materials, and maintenance of world markets, can be addressed effectively. So long as this structure holds, solutions are possible for the problems above, though some solutions will no doubt come only after considerable climatic and economic damage has been done. Without this framework of security, no solution to these global problems can be envisaged. Rather the world's major powers, and many others as well, will split, with or without war, and be left to pursue what are bound to be ineffective national or regional solutions.

Economically, a number of major powers need to cooperate. Strategically and militarily, the major powers which must have an understanding that permits a peaceful evolution are the United States,

China and Russia. In particular, it is difficult to envisage anything but the most primitive of holding actions taking place on global warming, oil prices, and continued open world markets without the cooperation on these matters of the two nations which are slated to have the world's largest economies, and be the greatest energy consumers and carbon emitters, the United States and China. Whether they welcome it or not, their cooperation is the most important prerequisite for the no-surprise, or at least no-too-unpleasant-surprise, scenario.

We note that this cooperation will have to take place against a complicated historical background. From the start of its interactions with East Asia two hundred years ago, the United States, following the lead of other Western states, has prominently involved its military power in support of its East Asian objectives. U.S. military forces remain in the region, and are indeed today dominant in certain dimensions of force, such as naval and air forces, combined arms operations, and intelligence. The United States will presumably maintain its traditional U.S. goals of avoiding Asian dominance by another power and improving terms of trade. Will the pursuit of these goals, particularly the first one, be compatible with cooperation on other matters, especially with maintaining open markets, which by their nature will strengthen the economies of potential rivals?

China is not the last billion-strong group of people who will want to participate in the world's economic and energy growth up to near first-world standards or as close to them as they can come. How the existing powers, most of all the United States, engage China is likely to have a profound effect on the perceptions which India, Pakistan, Indonesia, and many other countries in and outside the Asian continent will have of the options open to them and on the assumptions they will make about what the

U.S. role in their growth will be. Conversely, any understanding the United States, China and Japan reach about the factors of growth and energy in particular will affect not only the region, but the world.

As a consequence, a strategic understanding between the United States and the states of East Asia, and China especially, must address the question of how these states can cooperate to lay the groundwork for a peaceful evolution of the rest of the developing world. Otherwise, the understanding will leave out matters that are likely to affect it. All of the items suggested above, energy supplies, environmental impact of energy consumption growth, nuclear issues, long-term investments, will, by mid-century, have to be confronted in the new context.

The U.S. policy establishment itself, and those in other developed major powers, will come to terms with this new global context as a matter of national survival. The process has begun but the outcome remains very much in the balance. At present, major powers including the United States oscillate in their domestic politics and their policy approaches between narrow, predominantly defensive definitions of national interests, leading to a restrictive approach to growth in underdeveloped countries, and a definition of national interests which emphasizes mutually beneficial outcomes. The former is a dead end leading to conflicts no one can win, the latter offers a difficult road to technically and economically reasonable outcomes.

Endnotes

¹ Figures from *World Military Expenditures and Arms Transfers 1995*, U.S. Arms Control and Disarmament Agency, April 1996. The study has been carried out at the Center for International Security and Arms Control (CISAC), in the Institute for International Studies (IIS) at Stanford University, as part of the project on "American Alliances with Japan and Korea in a Changing North East Asia." Professors Dan Okimoto

and Michel Oksenberg of the Institute's Asia-Pacific Research Center (APRC) are the project leaders. The project is supported by a grant from the Smith-Richardson Foundation and the Japan Foundation Center for Global Partnership. The author thanks Ekaterina Drozdova and L. Celeste Johnson of CISAC for their research help.

² China's gross domestic product is about a tenth that of the United States if measured at currency exchange rates, roughly a fourth if measured at purchasing power parity (what the money actually buys for consumers). The right ratio so far as energy investments are concerned is probably somewhere in between.

³ From Jonathan Sinton, ed., *China Energy Databook*, p. I-5, published by the Lawrence Berkeley National Laboratory for the Department of Energy, (1996)

⁴ See Dale C. Copeland, "Economic Interdependence and War: A Theory of Trade Expectations," *International Security*, Vol. 20, No. 4 (Spring 1996), pp. 5-41 for an analysis of the dynamics of expectations from international trade in recent cases. With its large ratio of external trade to GDP and its nationalistic rather than universalistic ideology, China is somewhat closer to pre-World War I Germany and pre-World War II Japan than to the Soviet Union. Its leadership is not dominated by war parties, however, and is at present optimistic on balance rather than pessimistic about how world trade will affect it.

Michael May is Research Professor of Engineering Economic Systems and Operations Research at Stanford University and Co-Director of the Stanford University Center for International Security and Arms Control. He is Director Emeritus of the Lawrence Livermore National Laboratory. From 1965-1971 he served as Director of the Laboratory. Dr. May was an appointed delegate to the Strategic Arms Limitation Talks from 1974 to 1976.

The Role of Nuclear Energy in the CO₂ Mitigation Strategy of the People's Republic of China

By Yingzhong Lu

AS THE MOST POPULOUS COUNTRY IN THE WORLD, THE PEOPLE'S REPUBLIC OF CHINA (PRC) has successfully recovered from its past disastrous economic policies and adopted a novel, "Chinese-Style Socialistic" economic policy. Under this new policy, the economy has achieved unprecedented rapid growth. To the surprise of many domestic and foreign economists, the Chinese GDP has quadrupled within 15 years, almost 5 years ahead of the PRC's original plan. The high inflation rate associated with abrupt economic growth is now under control and the high growth rate of the Chinese economy is expected to continue for decades.

The fast-growing economy of the PRC was successfully fueled by a powerful energy policy. (Lu, 1993 and 1997) Domestic resources have fueled China's huge energy demand: China did not amass foreign debt in the early stages of its energy

This article is the first of two which discusses the environmental implications of nuclear power development in China. A piece in Issue 2 of the Series will describe the negative impacts of nuclear power expansion.

crisis. In the meantime, the PRC has established a sustainable energy conservation and supply system which will support its fast economic growth into the next century. Despite the suspicion of many energy-economists, the ambitious Chinese goal (declared in 1979) of quadrupling GDP while only doubling energy consumption by the year 2000 has been exceeded. This implies that Chinese energy intensity was cut by 50% during the past 15 years; a comprehensive energy conservation policy was successfully implemented.

Various studies — notably those performed by the Institute of Nuclear Energy Technology (INET) and the Institute for Techno-Economics and Energy System Analysis (ITEESA) of Tsinghua University under the sponsorship of the State Planning Commission (SPC) and the State Science and Technology Commission (SSTC) — have forecasted the future of the Chinese economy and Chinese energy supply and demand. Their results are summarized in Table 1.

These forecasts reflect a comprehensive approach. The critical factors considered include: 1) the

effectiveness of population control policy; 2) the change of economic structure; 3) the potential of energy conservation; and, 4) the availability of capital investments. From 1990 to 2030, the GDP is predicted to increase approximately 17 fold, while energy demand is predicted to increase by only 4.47 fold, corresponding to an energy intensity reduction of 26% of its 1990 value. From demonstrated past performance, these goals are believed to be realistic and attainable.

Based on the above forecasts, however, energy-related CO₂ emissions will still increase 4.48 fold from 1990 to 2030. Total annual emissions will correspondingly increase from 2.13 Gt to 7.62 Gt, still 27% higher than the current U.S. level. The per capita emissions in the PRC in 2030, however, will only be one quarter of the U.S. value, i.e., 5.49 tones against 23 tones per person. Given the 2030 per capita GDP in the PRC (only 15% of the present U.S. level), growth of the Chinese economy will continue and as a consequence CO₂ emissions in the PRC will continue to increase unless effective measures are undertaken by the PRC and the world.

I. Is There a Real CO₂ Mitigation Opportunity in the PRC?

Great efforts have been made on CO₂ mitigation technologies all over the world. For example, the Global Environmental Facility

Table 1: Economic Growth and Energy Demand Forecasts in the PRC

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(GEF), jointly sponsored by the World Bank, the United Nations Development Programme, and the United Nations Environment Programme, has established a number of pilot projects to address CO₂ mitigation in various developing countries, including the PRC. These projects include energy conservation, renewable energy, infrastructural development, and the development of local resources.

The outcome of these projects will unquestionably benefit CO₂ mitigation in the PRC. However, given the multi-Gt scale of required mitigation efforts in the PRC, a more comprehensive mitigation strategy must be formulated. Under the joint sponsorship of several international agencies and governments, a Country Climate Change Study has recently been performed in the PRC, the outcome of which has been documented in a draft Final Report submitted to the Asian Development Bank. (Country Climate Change Study Team, 1997) In this study, the priorities for all potential

greenhouse gas (GHG) mitigation measures were established with an Analytic Hierarchy Process (AHP). The set of assessment criteria included: 1) mitigation potentials; 2) local environmental impacts; 3) energy and resource efficiency; 4) economic costs; 5) consistency with national development goals; 6) availability of resources; and, 7) localized manufacturing and infrastructural needs. The areas assessed include energy efficiency improvements, conventional energy supply technology, and new and renewable energy development. The mitigation strategy thus formulated contains the following elements:

- Enhancing energy efficiency improvements;
- Accelerating utilization of new and renewable energy; and,
- Encouraging the energy substitution of coal with hydro power and nuclear power.

The resulting energy mix is listed in Table 2. A summary of the poten-

tial of CO₂ mitigation with all these measures (Policy scenario), in comparison with the Business as Usual (BAU) forecast values, is provided in Table 3.

As shown in the policy scenario of Table 2, the combined share of two CO₂-intensive fossil fuels, coal and oil, is reduced by 14.98% in 2030, while the share of a less CO₂-intensive fossil fuel, natural gas, is increased by 1.5%. The combined share of three non-CO₂ emission fuels, hydro, nuclear and renewables, is increased by 13.48%. Nuclear power will be the most important contributor to CO₂ mitigation in this scenario.

In Table 3, the CO₂ emissions in 2030 under the policy scenario will be reduced by 29% of the BAU scenario value, or about 2.2 Gt annually. This corresponds to more than one third of total current U.S. annual emissions. This is an unprecedented challenge to any country devoted to CO₂ mitigation.

Table 2: The Primary Energy Mix Scenarios

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Table 3: The Potential of CO₂ Mitigation in the PRC (Unit: Gt/year)

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II. Justification of Nuclear Power for CO₂ Mitigation in PRC

According to the results of a comprehensive assessment of various CO₂ mitigation technologies in the PRC, nuclear power will be one of the most important CO₂ mitigation contributors, second only to energy conservation. Nuclear power's effectiveness in CO₂ mitigation exceeds all other non-CO₂ emission energy sources. (Country Climate Change Study Team, 1997) The reasons for this include the large electricity generating capacity of nuclear power, the maturity of nuclear power as an energy technology, and Chinese experience with nuclear technology.

2.1 Nuclear Power: Multi-Megawatt Scale Energy Technology

Given the magnitude of the CO₂ mitigation problem, only those

energy technologies that can provide multi-megawatts per unit can have a significant impact on reaching CO₂ mitigation targets. A currently operating nuclear power plant can provide 600-1350 megawatt (MWe) per unit, and is readily available from both domestic and international markets. In contrast, most other alternative energies, with the exception of hydropower, are much smaller. With only 10-15 nuclear power stations of 2-4 units each, it is feasible to replace about 392 Mtce of coal annually by 2030, corresponding to an annual reduction of more than 1Gt of CO₂ emission.

2.2 Nuclear Power Is a Mature Energy Technology

Nuclear power is a mature, well proven energy source throughout the world. Currently, 433 nuclear power units operate worldwide, with a total capacity of 345.5 gigawatts. The United States still leads in operating nuclear power capability, with 109 units and 100.5 gigawatts, but the construction of new stations has been halted for many years. Both France and Japan rely heavily on nuclear power: nuclear units supply 77% and 34% of their total national electricity consumption, respectively. Table 4 displays the nuclear shares of power generation of various countries in 1996. In spite of some controversies over political and environmental issues,

nuclear power is a technically mature and economically viable option for any country that needs power for rapid economic growth.

2.3 The PRC Has Domestic Capability and Experience in Developing Nuclear Power

The basis of Chinese energy policy is *self-reliance*. The PRC developed its own nuclear technology before this market was opened to foreign interests, and it has established a complete nuclear industry that includes: uranium mining, uranium processing, uranium enrichment, nuclear fuel fabrication, nuclear reactor design and manufacturing, nuclear power plant construction and operation, spent fuel reprocessing, and nuclear waste treatment and disposal. The present Chinese domestic industry, however, is not able to build heavy components for nuclear steam supply systems with a unit power higher than 300 MWe, and must rely on foreign producers for these systems.

The first operating nuclear power station in the PRC was the 300 MWe Qingshan I nuclear power plant (NPP). This Chinese designed and constructed power plant is based on the technologies developed for the Chinese nuclear navy. The Qingshan I NPP was connected to a grid on 15 December 1991, and its annual load factor increased from 68% in the first year of commercial operation (1994) to 84% in the fol-

Abbreviations used in the article

Gt: gigatons (one billion tons)
Mt: megatons (a million tons)
Mtce: megatons of coal equivalent
kgce: kilogram of coal equivalent
Gtc: gigatons of coal
Mtc: megatons of coal
RMB: Renmibi, the name of the Chinese currency
Sv: International radiation dose unit
GWa: gigawatt year (annual)
TWe: Tetravatt electricity
TWe.h: Tetravatt electricity/hour
FBR: Fast Breeder Reactor

Table 4. Nuclear Power Share, 31 December, 1996 (Hu, 1997)

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lowing two years.

The second nuclear power station in operation is the Daya Bay NPP, a twin-900 MWe unit imported from France and jointly owned by Chinese and Hong Kong companies. Currently, four other NPPs are under construction, design, or active planning in China. These include two twin-600 MWe domestic designed Qingshan II NPPs, a twin-700 MWe Qingshan III NPP imported from Canada, a twin-900 MWe Lingao NPP to be imported from France, and a twin-1,000 MWe Lianyungang NPP imported from Russia. In addition, a number of 20-23 GWe nuclear power plants are scheduled to be completed before 2010. (Shen, 1997) The localization of heavy nuclear components manufacturing is also an important element of the Chinese nuclear program. Based on the experience of the Republic of Korea (ROK), the PRC will be able to localize the majority of the key nuclear components within the next two decades.

2.4 Nuclear Power Will Be the Least Cost-Option for Gt-Scale CO₂ Mitigation

Although China has abundant coal resources, serious transportation bottlenecks and local pollution have forced Chinese decision-makers

to pursue a progressive nuclear power program. The implementation of such a program is restricted mainly by the availability of capital. This situation will change when the local supply of heavy nuclear components increases. In 1996, INET, under the sponsorship of IAEA, conducted a detailed techno-economic assessment of nuclear and coal power in China. (Luo et al., 1996) The outcome of this study jus-

tified the techno-economic feasibility of nuclear power development in coastal areas of the PRC. Table 5 summarizes the specific investment comparison of imported NPP with coal-fired and hydropower stations for a 9 GWe Power Program in Guangdong province.

When a fuel supply system is included, the cost of imported nuclear power stations is only slightly higher than that of coal-

Table 5. Investment of a 9 GWe Power Program in Guangdong Using Different Power Units (In US\$M, Load Factor=75%, Discount Rate=10%)

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fired power stations without flue gas desulfurization (FGD), but lower than the hydropower technologies. The findings of the INET report are supported by the analyses of the Country Climate Change Study, which compared the incremental costs of CO₂ mitigation for nuclear power, advanced coal use, wind power, and hydro power. The results of this analysis are summarized in Figures 1 and 2. (Country Climate Change Study Team, 1997)

In Figure 1, imported nuclear power stands as the third highest in incremental cost of CO₂ mitigation. This implies that imported nuclear power is not the most economic option. On the other hand, Figure 2 shows that domestically manufactured nuclear power equipment is the optimal economic choice.

2.5 Nuclear Power Reduces Local Pollution Among Megawatt Power Systems

Nuclear power is considered a clean energy source by most Chinese, even by many environmentalists. This perspective results from the serious level of local pollution caused by extensive coal burning in the PRC. The most well-known air pollutants from coal are particulates, SO₂, and NO_x from flue gas. However, the emissions of radioactive material from coal burning are also more serious than those produced by nuclear power stations. A comparison of estimated collective doses and the associated health risks caused by coal-fired and nuclear plants are summarized in Table 6. (Luo et al., 1996)

As shown in Table 6, annual fatalities resulting from ionized radiation are higher in the case of coal power. If all other pollutants and accidents are also considered, the fatality rate in a coal power system is substantially higher than in a nuclear power system, as shown in Table 7. (Luo et al., 1996) Even with future technical improvements, the fatality risk of coal-fired systems will be three times as high as those of nuclear systems.

Figure 1. Incremental Costs of CO₂ Mitigation with Imported Nuclear Equipment

Figure 2. Incremental Costs of CO₂ Mitigation with Domestically Supplied Equipment

Table 6. Normalized Public Health Risks of Ionizing Radiation from Coal-fired and Nuclear Power Plants

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The local environmental impacts and risk comparisons between nuclear and hydropower are not as straightforward. However, some of the serious environmental impacts of hydro power are obvious. The extremely serious disruptions of ecosystems and human social life by large hydropower stations are unparalleled by any other energy source. For example, the construction of the Shanmenxia Dam across the Yellow River caused serious problems of siltation and other adverse consequences, both upstream and downstream. The Mammoth Shanxia (Great Gorge) Dam under construction is a more risky adventure. The removal of about 1 million residents from their homes is unparalleled. The Shanxia Dam will also have severe impacts on both the ecosystem and the environment in upstream and downstream regions. Accidental fatality from hydropower collapse is another major concern. In an unreported medium-size dam collapse in Henan Province in the mid-1970s, there were over 200,000 fatalities. This accident was deliberately concealed due to political considerations during the era of the Cultural Revolution.

III. Barriers to the Large-Scale Nuclear Power Program in PRC

There are four major barriers for the large-scale nuclear power program in the PRC: 1) the availability of capital investments; 2) radioac-

tive-waste management; 3) domestic anti-nuclear movement; and, 4) international concern over non-proliferation.

3.1 Capital Investments

Nuclear power is a capital-intensive enterprise. As shown in Table 5, the unit investment of an imported nuclear power plant is 50% higher than an imported coal-fired plant. Currently, China cannot manufacture some heavy nuclear components, thus import equipment is indispensable. Foreign investment for NPPs is available, particularly in connection with nuclear equipment exports. However, due to payback capability considerations, China is reluctant to overburden its foreign debt, thereby limiting the potential for nuclear growth.

Another interesting approach to acquiring foreign investment is the potential of CO₂ "quota sales" with developed countries. Per capita CO₂ emissions in the PRC are currently much lower than those of many developed countries; although no emission quota system is currently applicable to the PRC, the rapid increase of CO₂ is a major global concern. If the incremental costs of the development of nuclear power are paid to the PRC, then the reduction of CO₂ will benefit the whole world. The global community should therefore arrange to allow developed countries to purchase the *virtual quota* of CO₂

emissions from the PRC by investing the incremental costs of nuclear development to promote CO₂ mitigation. In fact, this is the only feasible, cost-effective approach to attain global Gt-scale CO₂ mitigation in the near future.

3.2 Waste Management

Nuclear power reactor operations generate radioactive waste. Because China has operated plutonium-production reactors for years, it has some experience in the treatment of similar radioactive wastes. Waste treatment technology for high level radioactive wastes has been developed and commercialized. However, uncertainty still exists regarding the reliability of underground storage of very long-life transuranic radionuclides over millions of years. There has been recent progress with the burning of these radionuclides in a fast reactor: the PRC has a fast reactor program, and a prototype FBR is under construction. In this way, the problem of the storage of high level wastes may be solved in the near future.

3.3 Domestic Anti-Nuclear Movement

Presently, there is virtually no anti-nuclear power movement inside the PRC. The reasons for this are three fold. First, power concerns in a fast growing economy override environmental concerns. Second, according to scientific analysis, nuclear power is a cleaner fuel than

Table 7. Summary of Fatality Risks of Coal and Nuclear Power Systems

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coal. Many Chinese people, including many environmentalists, therefore prefer nuclear to coal. Third, the Chinese people have less opportunity to openly protest against governmental programs. As a consequence, no foreseeable significant anti-nuclear movement will emerge and affect the Chinese nuclear program in the near future.

3.4 Non-Proliferation Concerns

The PRC is a country with nuclear weapon capabilities. Importing nuclear power reactors has nothing to do with the proliferation of weapon technology to the PRC *per se*. This argument — held by some foreign critics — lies in the fact that imported nuclear power technology may enhance China's capability to transfer weapon technology to a third country. This argument has little scientific or political ground. In fact, a nuclear weapon program is based on either uranium enrichment or a non-power plutonium production reactor. A nuclear power reactor is not a practical source of weapons material. Proof of this can be found in the recent agreement signed by the United States, South Korea and North Korea. The United States and South Korea agreed to supply two large PWR nuclear power stations to North Korea and provide significant funding to North Korea in exchange for the termination of North Korea's weapons program. In this instance, cooperation on trade in nuclear power can be seen as a

means of non-proliferation.

IV. Conclusion

Nuclear power is the best practical means for large-scale Chinese CO₂ mitigation: it has the potential to support growing Chinese energy needs. In combination with proven Chinese energy efficiency standards and an increase in the use of hydroelectric power, nuclear power will provide a clean, safe alternative to meeting the demands of a continuously expanding Chinese economy.

The criticisms of nuclear power expansion in China are unfounded: nuclear power is a much cleaner burning fuel than coal, has less radioactive risk potential than coal, and does not incorporate any of the environmental and social disruptions of hydro power. In addition, U.S. concerns over Chinese non-proliferation are unrealistic because civilian nuclear technology is not the key to developing military nuclear capability.

For these reasons, nuclear power should not only be viewed as a viable energy alternative in China, but should be also pursued by the Chinese as an environmentally sustainable energy option and supported by the global community through financing and bilateral CO₂ quota sales. Only with Chinese cooperation can any true progress be made in the substantial reduction of global CO₂ emissions — □ worldwide assistance for Chinese nuclear power development may be the answer to curbing Chinese emissions.

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A member of the first Science and Technology Advisory Panel (STAP) of the Global Environmental Facility (GEF), Yingzhong Lu is the Director for R&D, PAI Corporation. Lu is the author of Fueling the Billion (1993) and several recent articles on energy policy for the mitigation of greenhouse gases.

China Council for International Cooperation on Environment and Development

by Earl Drake

ON THE EVE OF THE UNITED NATIONS CONFERENCE ON ENVIRONMENT and Development held in 1992, the World Bank, in collaboration with Chinese authorities, produced a major study which identified problems, analyzed causes and assessed policies and programs as follows:

“The interrelationship between environmental issues and economic growth and development is central to any discussion of environmental matters. . . . Unlike many developing countries, China has a comprehensive set of laws to guide environmental policy development; a range of command-and-control as well as economic incentive approaches to implement the law; and an impressive network for administering, monitoring and enforcing environmental policy. However, while past efforts have somewhat reduced pollution per unit output, these gains have been mostly canceled by the rapid growth of the economy and the population and by industry’s continued high share in GDP.”

It was in this atmosphere of international and domestic concern about environmental issues that the Chinese Government established the China Council for International Cooperation on Environment and Development (CCICED).

In opening an early session of the CCICED, China’s Vice Premier Qian Qichen challenged the Council with these words:

“How then, can we meet the oppor-

This piece is the first in a series of articles which will describe the work of ongoing cooperative international projects on the environment in China.

tunities and challenges facing human beings and bring our world into a more promising 21st century? Extensive and effective international cooperation is the only sensible alternative. Environment and development is one of the areas where such cooperation is most needed and most vividly manifested. Over two centuries of industrialization has left us a neglected planet, degenerated ecosystem and slowed development. . . . I hope that the Council will continue to act as a bridge between China and other countries in cooperation on environment and development by introducing useful experience of other countries to China and communicating to the world the determination and aspiration of the Chinese Government and people for sustainable development.”

I. Description of Project — Phase I (1992-96)

Organization

The CCICED is a high-level, non-governmental, consultative organization. The stated purpose is “to further strengthen cooperation and exchange between China and the International Community in the field of environment and development.” Its inaugural meeting was held in Beijing in April 1992. The Council was initially given a five-year mandate. Subsequently, it was decided to extend the mandate for another five years until the year 2002.

The Bureau consists of the Chairman and Vice-Chairs of CCICED; it acts as the executive of the organization. The chair is Dr. Song Jian, State Councilor and Chairman of the Environmental Protection Commission of the State Council. The three Vice-Chairs are:

Prof. Qu Geping, Chairman of the Environmental Protection Committee of the National People’s Congress; Mr. Gu Ming, former Chairman of the Legal Committee of the National People’s Congress (he is likely to retire and be replaced soon) and Dr. Huguette Labelle, President of the Canadian International Development Agency (CIDA).

The Council, which meets annually, is composed of approximately fifty Chinese and international members. The members on the Chinese side are of Ministerial or Vice Ministerial rank together with several eminent Chinese experts. The international members are of comparable stature. The members participate as experts in their personal capacities at the invitation of the Chinese Government. They have been chosen for their expert knowledge and experience and come from different fields of expertise: environment, economics, science, technology, energy policy, agriculture, industry, business, finance, and education. The Chinese members come from Ministries and Agencies directly concerned with the central issues of economic development and the environment. Many of the Chinese members are from the Environmental Protection Commission under the State Council, facilitating coordination of domestic and international issues.

Individual membership of the Council fluctuates as people change positions. However, among the 25 Chinese members, there has always been senior representation from the following agencies: National People’s Congress, State Planning Commission, State Economic and Trade Commission, State Commission for Economic Restructuring, State Science and Technology Commission, Development Research Centre of the State Council, the Ministries of: Foreign Trade and Economic Cooperation; Chemical Industry; Construction; Agriculture; Coal Industry; Forestry; Water Conservancy; Electric Power; Geology

and Mineral Resources; Foreign Affairs; and Finance, National Environmental Protection Agency, Chinese Academy of Sciences, Beijing and Qinghua Universities, Chinese Association of Science and Technology, and China Meteorological Administration.

The international members come from a wide range of countries including Japan, Malaysia, India, Indonesia, Italy, Germany, Britain, the Netherlands, Sweden, Norway, Switzerland, Canada, the United States, Guyana and Kenya. Professional backgrounds have included current or former Environment Ministers, Heads of Non-Governmental Organizations, and business

year but occasionally they will hold additional meetings or workshops. These meetings are generally held in China, often far from Beijing where experts can observe environmental problems first hand.

The National Environmental Protection Agency (NEPA) has been designated as the responsible Chinese organization for CCICED. It has established a small Headquarters Secretariat (HS) in Beijing to support the operations of the Council. The Secretary-General is Mr. Xie Zhenhua, the Administrator of NEPA.

A Canadian Secretariat (CS) has been formed at the David See-Chai Lam Centre for International Com-

allocated to Expert Working Groups, \$1.7 million to Council meetings and \$1.9 million to Secretariat and consultant expenses. The contributors were: Canada, \$3.4 million; China, \$.9 million; and others, \$2.2 million. Other forms of support and collaboration were received from the World Bank, UNDP, the Asian Development Bank, the U.S. Environmental Protection Agency and other organizations.

II. Terms of Reference of Expert Working Groups (WG)

Energy Strategies and Technologies WG

The key energy issues ad-

The stated purpose [of the CCICED] is "to further strengthen cooperation and exchange between China and the International Community in the field of environment and development."

leaders.

The Council has established several expert Working Groups (WG), each jointly chaired and staffed by Chinese and international experts. Initially, the following six groups were formed: Energy Strategies and Technologies; Pollution Control; Monitoring and Data Collection; Scientific Research, Technology Development and Training; Resource Accounting, Environmental Economics and Pricing Policies; and Protection of Biodiversity. In 1994, a new WG on Trade and Sustainable Development was created. The WGs analyze important problems that China faces in the field of environment and development, propose strategies based on international experience and China's needs, and prepare preliminary recommendations for the Council. The latter decides what recommendations to forward to the Chinese Government. Council Members present these recommendations in person to a senior Chinese leader at the conclusion of their deliberations. Normally, each WG will meet twice a

year but occasionally they will hold additional meetings or workshops. These meetings are generally held in China, often far from Beijing where experts can observe environmental problems first hand.

International Support

Canada has always been the "lead" donor of CCICED, but the Council is structured to encourage the involvement of other international organizations and agencies. To date, direct financial support has been contributed by the British Overseas Development Administration (ODA), the Ford Foundation, the Rockefeller Foundation, the German Agency for Technical Cooperation, the Netherlands' Environment Ministry, Global Industrial and Social Progress Research Institute of Japan, the Norwegian Agency for Development Cooperation (NORAD) and the European Union. The budget for 1992-1996 was \$6.5 million with \$2.9 million

allocated to Expert Working Groups, \$1.7 million to Council meetings and \$1.9 million to Secretariat and consultant expenses. The contributors were: Canada, \$3.4 million; China, \$.9 million; and others, \$2.2 million. Other forms of support and collaboration were received from the World Bank, UNDP, the Asian Development Bank, the U.S. Environmental Protection Agency and other organizations.

Pollution Control WG

The objectives are: to study and analyze the present pollution situation; to study future trends of environmental pollution in China; to review China's experiences in pollution control while drawing on the practices and lessons of advanced and newly industrializing nations; to undertake in-depth studies on the priorities in combating industrial and urban pollution as well as pol-

lution of major waterways and watersheds; and to offer recommendations to the Chinese Government on the objectives and policy measures of pollution control for the coming decade.

Monitoring and Data Collection WG

This working group started with a systematic approach and standardization to improve the monitoring network. Its objectives are: to set up a new indicator system and develop the information system to support optimal pollution control; to make full use of existing scientific findings and coordinate difficult cross-sector issues; and to learn from the experience of other countries in order to be able to propose realistic programs.

Scientific Research, Technological Development and Training WG

The objectives of this working group are: to carry out research on environment while engaging in technology development; to review the current policies on environment and development from the angle of science; to analyze the current situation, problems and priorities in scientific research, technology development and training; to provide the optional strategies and recommendations required in formulating long-term policies; and, enhance the environmental awareness of the public to help develop the scientific capacity for sustainable development.

Resource Accounting and Environmental Economics WG

China is currently experiencing a massive structural change in its economy, characterized by a rapid shift from an administered system to one which is becoming increasingly reliant upon market forces. It is recognized, however, that the market alone cannot satisfactorily address all development issues. Although rapid changes are taking place, resource prices in China still tend to be unrelated to the true eco-

nomical, social and environmental costs resulting from their production and consumption. Given this, the working group has been established to conduct research on current natural resource pricing in China, and to recommend policy reforms which meet multiple objectives of economic efficiency, social equity, and sustainable development.

Protection of Biodiversity WG

The functions of this working group are: to analyze and review information on China's biological diversity, including information on its use, and to propose surveys and research to remedy deficiencies in this knowledge base; to bring together the relevant government agencies and scientific institutions in China, and appropriate governmental and non-governmental organizations concerned with the conservation and sustainable use of living resources and biological diversity; and to propose strategies and actions for the conservation and sustainable use of the nation's biological diversity and living natural resources.

Trade and Sustainable Development WG

This Working Group assists China in developing and implementing long-term, comprehensive and integrated trade and environmental policies and measures that are supportive of sustainable development. Research subjects include the role of trade in China's Agenda 21; lessons learned from the experience in other countries and regions; the role of Multilateral Environmental Agreements; and the transfer of environmental technologies.

III. First Recommendations to the Chinese Government by CCICED

The heart of the CCICED process is the annual presentation of recommendations by Council Members directly to a Senior Chinese Leader, such as the Premier (who

has met with it three times). These are then considered by the State Council which reports on its follow-up actions to the next meeting of the Council. The first recommendations and the Chinese responses are presented here to illustrate the process.

Recommendations

The Council provided a detailed study to the Premier on the means by which sustainability can be achieved. It identified some priorities and formulated the following recommendations:

1. Energy is critical. At present, dependence on coal is a prime cause of pollution and contributes to global as well as local climate change. It is necessary to promote:

- Energy conservation and efficiency in domestic and industrial use;
- Clean coal technologies; and,
- Alternative renewable sources of energy.

2. China is rich in biodiversity. Its continued destruction could cause enormous damage to the economy by weakening its natural base and depriving China of its potential for future food, medicine and other materials. It is necessary to:

- Strengthen the system of terrestrial and aquatic protected areas; and,
- Restore degraded habitats to ecological productivity.

In order to achieve this, China should:

- Enlist the indispensable help of local communities, and,
- Cooperate with neighboring countries to create regional agreements on the prevention of trade in endangered species. In this respect, China should convene a regional conference on the issue.

3. Food security is a vital issue for China. China should give its highest attention to agricultural growth, especially to proper land use planning, water use planning and ecological agriculture. China has, in

this connection, accumulated valuable experience, which should be emphasized for further practice and popularization.

4. Correct valuation and pricing of resources is the key to a sustainable economy. It is necessary to:

- Develop and adopt resource pricing policies which reflect environmental and social costs;
- Remove inappropriate subsidies;
- Improve the present National Economic Accounting System by incorporating environmental costs into it; and,
- Develop and use economic and fiscal instruments for environmental management and pollution control.

5. Nothing is possible without public understanding, support and participation. Taking this into account, it is necessary to:

- Disseminate environmental information to the public through the media;
- Carry out environmental education at various levels, paying special attention to youth and women;
- Establish mechanisms which will guarantee public participation;
- Consider public choices and wishes; and,
- Encourage the public to exercise supervision of behavior that causes damage to the environment.

6. Allocate adequate funds to support the implementation of environmental laws, standards and regulations.

7. As an important member of the international community, China should play an active role in international efforts to cope with global environmental problems. For example, China should make efforts to reduce atmospheric carbon emissions which are related to international efforts.

Given the traditional Chinese antipathy to horizontal coordination among its own work units and suspicion of foreigners, it is quite remarkable that, in the case of CCICED, China has agreed to some coordination among Chinese Ministries and the involvement of foreigners.

IV. First Chinese Responses to CCICED Recommendations

The Chinese Government presented a detailed response to the Council at its next meeting. I quote its opening words and then summarize the new measures which were announced. "Last year, the Chinese and international members of the Council put forward seven constructive recommendations which won the very high appreciation of President Jiang Zemin. The Chinese Government has shown concern for the areas covered by the recommendations. Following serious study, these recommendations have already been implemented or are being put into practice."

1. Improve energy efficiency

• Major achievements were made in introducing clean combustion technology and increasing the energy utility rate by way of strengthened international cooperation. Such projects included desulphurising boilers and the selection of clean coal in Chongqing, heating power supply from Shijinshan to Beijing, renovation of kilns and boilers with gasification in Tangshan, etc.

• A Power Industry Plan was worked out, focusing on the development of big units and renovation of aged plants, aimed at reduction of coal consumption by 17% by the year 2000.

2. Protect biodiversity

• A Country Program for the protection of biodiversity is being drafted.

• The State Council issued a Circular on Banning Trade of Rhino Horns and Tiger Bones.

• Area of nature reserves will increase from 6.7% of the total territory to 10% in 2000.

3. Protect agricultural environment

• The State Council approved Regulation of Basic Protection of Farmland, further defining rules on prevention and control of farmland pollution and destruction.

• A large number of eco-townships, villages and counties were created.

• Ministries required registration and evaluation of fertilizer to meet environmental standards.

4. Use resource accounting and economic instruments

• 12 provinces started a pilot project to collect eco-environment compensation from resource utilization with a view to establishing an economic mechanism for rational use of resources.

• In order to promote rational use of water, an extra charge was added to every ton of waste water discharge.

• There was discussion on implementing environmental taxes, starting with CFC and lead-petrol products.

5. Enhance public participation in environmental protection

• NEPA and relevant organizations held the first Youth Environmental Forum and the first Women's Conference on Environment.

• A media campaign was organized to expose the public to environmental problems and publicize the need for environmental protection.

6. Enact environmental legislation
• In the next five years, the National People's Congress will promulgate eight laws for environmental protection, covering atmospheric, water, noise, and radioactive pollution and control of marine environment, solid wastes and toxic chemicals.

7. Activate China's global role
• China reported to the CCICED on its implementation of Agenda 21, the Basel Convention, the Biodiversity Convention, the Montreal Protocol, the Convention on the International Trade of Wild Flora and Fauna and the UN Convention on Climate Change.

V. Phase II (1997-2001)

The Chinese & Canadian Secretariats, acting under the direction of the CCICED Bureau, submitted a paper on the future of the Council to its Members at their meeting in September 1995. Members supported the continuation of the Council as proposed and asked that some of their suggestions be incorporated into the work of the Council. The meeting concluded that: CCICED is a unique international experiment in international cooperation. Council Members concluded that the results of Phase I merit extending the mandate of the Council for a further period covering the years 1997-2001. However, they wish to recommend some modifications to the Council in the light of experience and China's changing needs.

Objectives

- The Council should continue to concentrate on its main objectives:
- Advise the Government of China in the definition and implementation of long-term, integrated strategies and policies that promote sustainable development;
- Encourage international cooperation as a means to address environmental and development issues in China; and,

- Advise and assist in efforts to encourage a better public understanding and awareness of environmental issues in China.

Within that broad mandate, the Council should concentrate in Phase II on making its advice and cooperation as practical and as expeditious as possible in addressing China's priority needs. In giving policy advice, the Council and its Working Group's will be asked to go beyond proposing "what to do" and to add concrete proposals on "how to implement the policies." This would not involve funding, designing in detail or implementing any full-scale projects; CCICED would stop at outlining demonstration projects to be financed by donor agencies.

Practical Elements

Chinese decision-makers have asked that, whenever possible, the Council's policy advice should be supplemented by concrete, pilot projects. These projects should demonstrate the implementation of proposed policies by testing them in an affordable way, at a specific location, and within a limited time-frame. This practical approach would affect various levels of CCICED activity: Council Members might set a more pragmatic tone and direction in their Annual Meetings. In addition, some Council Members might be able to help during the year in various ways, e.g., by preparing papers at the request of Council, chairing Working Groups, or helping to attract financial support from donors for Council activities and demonstration projects; and, Working Group experts might be specifically charged by the Council with producing policy recommendations and ideas on how to implement those policies. They could also identify concrete pilot projects which are affordable and implementable within the next five-year plan. In addition, they could be asked to give more emphasis to holding their meetings, seminars and workshops

in the field where they can study acute environmental problems first-hand. Representatives of potential donor agencies could be invited to some of these meetings.

Chinese end-users need to be identified and brought into the policy formulation process. These end-users include National, Provincial and Municipal levels of government and enterprise management in several sectors (e.g., not just Environmental Protection officials but also energy producers and distributors, water authorities, State Planning officials and Finance officials worried about inflation, etc.). Chinese Council Members and Working Group experts would be responsible for identifying relevant end-users and promoting their collaboration with the Council.

Council Membership

The Council should maintain its membership of approximately 50 Chinese and international members of Ministerial rank or comparable stature. Members will continue to participate as experts in their personal capacities at the invitation of the Chinese Government. All current Memberships will terminate at the end of 1996; it is anticipated that China will ask approximately half of the current Members to accept a second term and will invite some new Members to join the Council.

Expert Working Groups

There should continue to be approximately seven Working Groups, jointly staffed by Chinese and international experts. These working groups should draft multi-year work plans and report annually to the Council. It is anticipated that two of the existing Working Groups will complete their work by 1996 and will be retired (Monitoring and Data Collection; and Science and Technology), five existing Groups will be asked to continue their work and two new Groups will be added (Sustainable Agriculture and Cleaner Production).

VI. Coordination and Effectiveness

China is the prime example of a developing country which does not want its economic development program coordinated by any outsider. It has resisted being incorporated into the international network of Consortia and Consultative Groups chaired by the World Bank. It has also resisted the less formal donor coordination groups which the UNDP offers to chair in the capitals of many developing countries. China has been reluctant to accept the good offices of these organizations despite its excellent relations with both of them.

Given the traditional Chinese antipathy to horizontal coordination among its own work units and suspicion of foreigners, it is quite remarkable that, in the case of CCICED, China has agreed to some coordination among Chinese Ministries and the involvement of foreigners. An outsider can only speculate that this unusual degree of coordination may be due to the following factors:

- Control is very firmly in the hands of China. It is a Chinese Council not an international organization. All Members and Working Group Chairs are invited by China and maintain their membership at the discretion of China.
- All Council meetings are chaired and all executive actions are taken by the Bureau, which has one Chinese Chair, two Chinese Vice-Chairs and only one international Vice-Chair;
- Environment is recognized as a special subject that has international significance and where China is a party to several global conventions;
- Environment is a field where China hopes to attract foreign financing and technology;
- The amount of funds being administered is very small;
- The terms of reference are limited to broad policy advice and do not include the coordination of major fund-raising or the implementation of projects in the field;

- Chinese coordination is left to a Chinese agency (NEPA) which has little power and does not pose a threat to any other Ministry. Moreover, NEPA had already been designated as the Secretariat for the Interdepartmental Environmental Protection Commission of the State Council (whose membership is largely the same as the Chinese membership of CCICED); and,
- International coordination is mostly left to a non-threatening and distant country (Canada).

Effective coordination of the CCICED is hampered by the absence of any rules or guidelines on donor roles, burden sharing, or information exchange and by the low-key role of the Chinese Secretariat. While the Chinese are keen on the symbolism of Chinese leadership, they do not in fact play a very assertive role in leading the debates in the Council, in preparing workplans for the Expert Groups or in performing the secretariat function. Much of the initiative and much of the detailed follow-up on these matters comes from the international side. To take successful initiatives without causing the Chinese hosts to "lose face," often requires considerable sensitivity and skill on the part of the foreigners. Some are better at it than others. In retrospect, it is amazing how well all participants have adapted to this unusual way of working.

In conclusion, it can be said that the Council is unique in many ways. It has been successful in engaging the attention of a remarkable collection of senior Chinese officials and leaders at least once a year on major questions of environment and development. Since the Council began, the Chinese Government has regularly produced action plans, budgets, environmental standards and laws consistent with Council recommendations. Taken together, they constitute the world's most impressive response to the 1992 U.N. Conference on the Environment. Regrettably, it is impossible to

measure how much of these splendid words are attributable to the work of the Council and how much to other influences. The biggest question, however, is how effective these paper plans will be in effecting real progress in the many polluted towns and threatened eco-systems of rapidly industrializing China.

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Earl Drake is the Project Director at the China Council for International Cooperation on Environment and Development. He is the Executive Vice President, Canada-China Business Council and Chair of the Executive Committee, Foundation for International Training. Dr. Drake is an adjunct professor at the David Lam Centre for International Communication, Simon Fraser University, and former Canadian ambassador to China and Indonesia.

The Environment in U.S.-China Relations: Themes and Ideas from Working Group Discussion on Energy Issues

by Aaron Frank

The People's Republic of China (PRC) is becoming an increasingly important player in international affairs, given its staggering 1.2 billion population, growing military and economic power, and ability to affect regional stability in Asia and important global issues. The United States recognizes that it needs Beijing's cooperation to achieve key regional and international objectives. Yet, U.S.-China relations continue to be strained. Similarly, America's approach to China on environmental issues has lacked a guiding framework that fits appropriately into an overall approach to China. Such an overall approach has been difficult to achieve — especially given the considerable constraints associated with Beijing's dedication to rapid industrial growth, its stances on climate change and nuclear non-proliferation, and the country's relative absence of non-governmental environmental organizations.

The United States has important interests in developing a more cooperative relationship with the PRC on environmental issues, for these problems will increasingly affect the global environment and could affect China's internal stability. Rapid industrialization combined with population growth is putting enormous strains on China's domestic natural resources while harming the global environment. China is already the second largest contributor to greenhouse gas emissions (the United States is the leader¹), and its emissions are growing; if the global community is to negotiate successfully for binding limits on greenhouse gases to address climate change, China's cooperation will be pivotal. Meanwhile, the health of the Chinese economy and the welfare of Chinese citizens are increasingly being affected by a plethora of domestic environmental problems. These include scarcities of water and arable land, air and water pollution, overcrowding, flooding and other issues — all of which contribute to population movements, health problems, food security problems and rising disparities in income. Beyond the humanitarian concerns involved, the United States cannot ignore these problems since they have the potential to affect China's stability. The U.S. government, however, will have to approach China on these issues in a way that enhances, not hinders, the overall U.S.-PRC relationship.

To address these important concerns and develop strategies for engaging the Chinese on environmental issues, the Environmental Change and Security Project created the Working Group on Environment in U.S.-China Relations. In an effort to concentrate on the Chinese environmental issue of utmost concern to the

United States — climate change — the working group focused on energy issues during its first six monthly meetings. The themes of these meetings included multilateral cooperation, domestic Chinese environmental issues which have ancillary impacts of importance to the United States, and the impediments to cooperation on U.S. led projects within China. In addition, working group members identified specific areas on which U.S. efforts in the Chinese energy sector should concentrate (most notably energy efficiency, pricing reforms, and technology transfer) and areas of debate (such as whether U.S. efforts in China should focus on technology or policy changes). Working group meetings also provided numerous engagement strategies for U.S. policy-makers, and highlighted the context in which these strategies could be implemented.

The themes, lessons, and engagement strategies which emerged from working group discussions on energy can be applied to other environmental concerns with China and to overall U.S.-China relations, including water issues, biodiversity, food security — and even economic development; the overriding sentiment from working group members was that the United States should continue to engage the Chinese in a constructive manner, providing assistance for environmental projects and policy reforms in China, and opening markets for U.S. environmental technologies. Such a policy would provide the framework under which engagement on environmental issues — at the governmental, non-governmental organization (NGO) and private business levels — could take place.

I. The Working Group on Environment in U.S.-China Relations

The Woodrow Wilson Center's Working Group on Environment in U.S.-China Relations, coordinated by the Environmental Change and Security Project in partnership with the Center's Asia Program, is an ongoing multidisciplinary forum for discussion on environmental and foreign policy concerns with regard to China. The aims of the working group are to: (1) identify the most important environmental and sustainable development issues in China and discern how those issues relate to U.S. and Chinese interests; (2) develop creative ideas and opportunities for government and non-government cooperation on environmental projects between the United States and China; and, (3) discuss promising government and non-government strategies for engaging China on these issues.

The working group has had particular success in

drawing upon the expertise of its over forty members, which include government, NGO, academic and private business representatives. Working group speakers also have represented a broad mix of backgrounds. [For a list of working group speakers, please refer to page 39.] Working group meetings are co-chaired by Elizabeth Economy of the Council on Foreign Relations, and P.J. Simmons of the Carnegie Endowment for International Peace, and are held on a not-for-attribution basis.

Small group sessions of the working group concentrate on more specific topics of interest and have included visits by Qu Geping, Chairman, Committee on Environmental Protection and Natural Resources Conservation, National People's Congress; and the Citizen Involvement in Environmental Protection Delegation from the People's Republic of China.

II. Main Themes of Working Group Discussion

The themes of the first six monthly meetings have wide applications for environmental issues and overall U.S.-PRC relations. From trade issues to human

Chinese perception and to enhance domestic credibility on relations with the Chinese, many working group members felt that the primary U.S. government action to enhance U.S.-PRC relations on the environment should be a clearly articulated, coherent China policy with explicit objectives and guidelines by which progress on a variety of issues could be measured. Such a policy was considered to be a means to avoid the public perception that policy changes are the result of economic incentives or 'pandering' to Chinese interests.

The lack of a clearly defined and articulated overall China policy was regarded by many working group members as the major U.S. domestic impediment to cooperation between the two countries on environmental issues. Changes in the status of U.S.-PRC relations not only impact government sponsored and managed programs, but can also cause dramatic shifts in Chinese governmental cooperation with NGOs and U.S. businesses. As one working group member remarked, increased tension between the countries can either slow down or completely halt a proposed U.S. business ven-

The overriding sentiment from working group members was that the United States should continue to engage the Chinese in a constructive manner, providing assistance for environmental projects and policy reforms in China, and opening markets for U.S. environmental technologies.

rights, the lessons learned from working group discussion underscore the basis for overall engagement strategies. Working group members agreed that a useful engagement strategy in the area of environmental protection should include: (1) a clearly defined and articulated overall China policy; (2) constructive engagement with the Chinese; (3) financing mechanisms for environmental projects; (4) multilateral cooperation; (5) a focus on local problems with secondary global impacts; and, (6) close examination of U.S. and Chinese domestic impediments to cooperation on environmental issues.

A Clearly Defined and Articulated Overall China Policy

The relationship between the United States and China is complex and multifaceted; while progress has been achieved on many issues in recent years, others still raise considerable tension. In addition, recent changes in both U.S. and Chinese policy (such as the linking and then delinking of human rights to trade on the United States side, and differing actions towards Taiwan on the Chinese side), have created corresponding shifts in the warmth of U.S.-PRC relations. It is not unreasonable for the Chinese to view U.S. policy as a see-saw which balances itself according to pressures from Congress, the public or the media. To combat this

ture in China. Vacillations in U.S.-PRC relations can also affect NGOs working in China: a stable environment provides the framework within which businesses and NGOs can independently operate in the PRC. Even though the U.S. government may not be able to fund extensive environmental projects in China, its outspoken support for them can be equally as valuable, as can sharing its experiences — good and bad — in formulating and implementing regulatory and market approaches to environmental protection in the United States.

Constructive Engagement with the Chinese

Working group members emphasized the importance of offering technological and policy assistance to the Chinese rather than lecturing them about their missteps. This approach was considered imperative when engaging the Chinese on environmental issues: the Chinese are still very suspicious of U.S. assistance on environmental matters and fear that the United States is pushing sustainable development as a means of keeping Chinese economic growth in check. It should be noted that a non-didactic approach is also important for NGOs when working in China; while the role of a U.S. NGO may be to precipitate policy or attitudinal change, its mission in China should be sensitive to cultural constraints. As one working group member com-

mented, in order for U.S. environmental assistance to succeed in China, the United States must first convince the Chinese that it has a strong interest in China's continued economic growth and that economic growth does not necessarily equate to environmental degradation.

The United States should also be wary of criticizing Chinese development plans to the point that the Chinese are left with no options. One working group member commented that the United States cannot decry China's abundant use of coal, ban all United States involvement in the massive Three Gorges Dam Project, and prohibit U.S. investment and trade in civilian nuclear technology, yet still expect the Chinese to take U.S. offers of assistance on energy matters seriously.

Financing Mechanisms for Environmental Projects

According to working group members, the Chinese are frequently critical of U.S. government offers of assistance because the United States lacks the funding mechanisms to back up its promises. American businesses with environmental technologies hoping to invest in rapidly expanding Chinese markets express similar discontent: they feel as though they are at a disadvantage to Japanese and European competitors who receive more financial assistance from their governments to invest in China. The impact of this lack of financial assistance on Chinese environmental problems is large; U.S. businesses possess the environmental technology and financial capability to significantly improve China's environment, but are deterred by a lack of financing and insufficient government attention.

The solution to this problem, however, is not necessarily increased U.S. federal funding for investment in, or transfer of, environmental technologies to China. Indeed, such a scenario is unrealistic. Instead, working group members suggested a number of approaches to address this issue:

- Establish agreed upon and accepted international environmental guidelines and minimum specifications for projects funded by OECD countries, development agencies or banks. These guidelines would not only halt large, environmentally unsound projects, but would also provide a level playing field for international businesses proposing projects in developing countries;
- Provide high level governmental support for environmental projects and business ventures in China to show the Chinese that these projects are considered a priority by the United States government;
- Explore the possibilities for multilateral or trilateral joint commercialization projects. For example, a project could capitalize on U.S. technological innovation, Taiwanese or Japanese financing, and Chinese labor to create a demonstration project in China; and,

- Develop a 'green' bank within the Export-Import Bank specifically to help finance environmental projects in developing countries, including China.²

Multilateral Cooperation

Working group discussion placed a great deal of emphasis on bilateral approaches and solutions to China's energy problems, but also stressed the importance of multilateral cooperation on energy issues. Multilateral fora and conventions were seen as appropriate venues for discussion of the regional and global impacts of China's increased energy consumption. One mechanism for encouraging international cooperation can be seen through the example of trilateral joint commercialization described above. Multilateral fora were also considered to be a non-threatening, positive way to engage the Chinese on environmental issues and to display international support for sustainable development principles.

Many working group members supported the idea of a multilateral forum to address energy and environmental issues throughout all of Asia. As proposed, this forum would include government representatives from interested countries, non-governmental organizations, and private business representatives. Specialized working groups could operate under the forum and focus on specific areas of interest. Suggested umbrella organizations for such a forum included the World Bank, the Global Environmental Facility, and a combination of multilateral development banks and private foundations.

A Focus on Local Problems with Secondary Global Impacts

While the Chinese are clearly concerned about the environment, it is equally evident that they are much more concerned about domestic environmental problems (such as urban air pollution and water shortages) than global ones (climate change). This prioritization of environmental issues presents a conundrum for the United States, which places its priority on the global impacts of China's environmental problems, most notably CO₂ emissions and global warming. Working group members agreed, however, that ignoring local problems at the expense of global ones would be a last-thing mistake for the United States; the U.S. government and NGOs should therefore concentrate on local environmental problems which have secondary global impacts.

For example, the Chinese will be much more receptive to assistance on reducing urban levels of suspended particulates after studies demonstrate the connection between these pollutants and high rates of urban lung cancer. Once the connection is made, assistance — and investment in the technology to reduce emissions — will be more openly accepted by the Chinese. The secondary impact of such emissions reduc-

tions would be ancillary reductions in sulfur and CO₂ emissions, thereby reducing greenhouse gases and the prevalence of acid rain. Such an approach was viewed as critical when engaging the Chinese: linking domestic health concerns to economic impacts was thought to be a practical alternative method for reducing greenhouse gas emissions.

Close Examination of U.S. and Chinese Domestic Impediments to Cooperation on Environmental Issues

Recognizing that the U.S. government is unwilling to devote substantial financial resources — and political capital — to support extensive environmental projects or initiatives in China, working group discussion often analyzed ways of addressing non-economic impediments to U.S.-PRC cooperation. Examples of these impediments include a lack of market pricing mechanisms in the Chinese energy sector and the absence of international contract standards for natural gas exploration. One suggestion was to create two bilateral groups, each composed of members from public agencies, private industry and NGOs, to specifically address these impediments. The first of these groups would focus on the structural reforms necessary to make private sector investment in China more viable for U.S. companies and to reverse the trend of decreased international investment in China's energy sector. The second group would focus on impediments in the United States to increased cooperation with the Chinese on energy and environmental issues. This group, as envisioned by some working group members, would discuss strategies for encouraging more vocal public and Congressional support for cooperation on environmental issues and attempt to tackle other related topics such as trade in civilian nuclear technology and Export-Import Bank restrictions on loans to China. The group would also explore the means by which efforts on Chinese environmental issues could facilitate dialogue between the Clinton Administration and Congress on China policy. At a low cost, these groups could help establish trust in U.S.-PRC relations, and address the issue most important to U.S. investment in the Chinese energy market: legal and financial reforms.³

Discussion on this topic also centered on the impediments U.S. companies face when looking to invest in Chinese energy markets. Some notable impediments included:

- Policy and enforcement inconsistencies among provinces create high transaction costs for firms doing business in more than one Chinese province; and,
- The lack of transparency in the Chinese governmental and business structure makes it difficult for U.S. firms to determine the appropriate individual to speak with during negotiations.

III. Key Chinese Energy Issues

In addition to the themes listed above, working group members identified key Chinese energy issues and offered a variety of approaches to assist the Chinese in developing a sustainable energy network. Discussion also explored Chinese energy alternatives and the environmental impacts of China's reliance on coal as an energy source [For background information on Chinese energy production and its environmental impacts, please see the working group summaries located on pages 40-66 in this volume].

Working group discussion on energy issues centered on a singular debate: policy reforms versus technological fixes to Chinese energy problems. While both approaches were deemed necessary for sustainable energy growth in China, disagreement focused on which approach the United States should prioritize when working with the Chinese. In the opinion of one working group member, policy will be the driver of environmental change in China and not technology; the Chinese need to make political, legal and institutional changes before technology can have an impact on their energy needs. Other working group members agreed, citing weak environmental enforcement, artificial pricing of environmental goods, and a lack of environmental awareness among Chinese citizens as problems that must be addressed before technology can help lower Chinese energy-related emissions. Other working group members, however, felt that China's first priorities should be technological changes, including limiting current energy-related emissions and exploring alternative energy sources to coal combustion.

Technological Fixes

Technological fixes were seen by many as the best way to assist the Chinese with their energy development. Coal currently accounts for approximately 75% of Chinese energy production, leading to high levels of urban air pollution, acid rain, and transportation bottlenecks due to the rail transport of coal from the north to the economically booming south. Because of the abundance of coal in China, most working group members concurred that the Chinese will continue to rely on coal for the majority of its energy production over the next fifty years. With this in mind, many believed that the United States could best assist China through transfers of coal technology, such as coal scrubbers, more efficient boilers, or developing technologies such as integrated gasification combined cycle technology (IGCC) power plants. These technologies would help reduce carbon and sulfur dioxide emissions, would increase supply-side energy efficiency and would conform to China's continued reliance on coal.

Other working group members remarked that the United States should place emphasis on alternative energy sources and technologies — especially those for which U.S. companies could create a market in China.

Natural gas was thought to be the best alternative energy source, although the extent of China's natural gas resources are largely unknown and often far from areas of high demand. Still, natural gas presents a cleaner and more efficient fuel for China and is an area in which U.S. companies have expertise; U.S. industry is among the world's leaders in natural gas exploration and the construction of natural gas pipelines.

Fuel cells, wind power, IGCC, and small hydro-power projects were all seen as new technologies that could have wide applications for Chinese energy production. These new technologies all have the benefit of low emissions, high rates of efficiency, and high potential as future markets for U.S. firms. They could also serve as a model for Chinese energy efficiency efforts or as the basis for joint commercialization projects.

Technology transfer projects, however, encompass concerns over a lack of trained Chinese personnel to properly maintain and run new equipment, intellectual property rights (IPR) issues, and a lack of U.S. government incentives for private firms to trade and invest capital in energy related activities in China. Joint commercialization projects were suggested as the best way to overcome these concerns while still assisting sustainable Chinese energy growth and obtaining profits for United States companies. Financing mechanisms, such as those described earlier in this paper, were also seen as critical to promoting technology transfers. Multilateral joint commercialization projects were seen as another alternative. Such an agreement, in conjunction with demonstration projects and proper training for Chinese personnel, could open markets for U.S. technologies while also enhancing China's environmental protection efforts. If implemented in a rural Chinese area, it would have the additional benefit of showing the Chinese that the United States is concerned with the development of all of China and not just the booming southeast.

Biomass, hydropower, and nuclear energy were also regarded as areas in which U.S. expertise and technology could assist the Chinese. Although it now seems probable that President Clinton will make the necessary certifications to approve civilian nuclear trade with China, during Working Group sessions U.S. companies were still restricted from trade in this area. United States cooperation on the hydroelectric power project which will have the largest impact on Chinese electricity generation, the Three Gorges Dam, is also currently restricted. Biomass is the main source of fuel in the Chinese countryside, and assistance in increasing its efficiency would greatly improve its current use.

Policy Reforms

While technological fixes are clearly necessary to assisting the Chinese in their energy development — and while the Chinese are more willing to implement and accept new technologies than new policies — some

China's environment is important to the United States not only because of China's increasing greenhouse gas emissions and its growing role as a major player in the global environment, but also because Chinese energy and development choices have the potential to directly impact U.S. interests.

working group members argued that policy changes were a critical first step in meeting future Chinese energy development goals. Discussion focused on two issues: proper pricing of environmental goods, and demand-side energy efficiency measures.

Without market pricing of environmental goods (including electricity and water), many working group members could not foresee any significant efficiency increases in Chinese energy use. Pricing mechanisms were viewed as the key to increasing transmission efficiency, lowering energy use, and creating a shift away from inefficient coal boilers. Many believed such indirect market mechanisms would create an incentive for the use of new technologies and allow these new technologies to be effective.

Demand-side efficiency and education were also considered important Chinese policy measures. More efficient consumer use of electricity would greatly decrease demand, especially as China begins a shift towards heavy industrial production. Education on energy issues is a crucial factor in the implementation of end-use efficiency policies and can raise awareness of the impacts of inefficient energy use and production.

IV. Conclusion

China's environment is important to the United States not only because of China's increasing greenhouse gas emissions and its growing role as a major player in the global environment, but also because Chinese energy and development choices have the potential to directly impact U.S. interests. A stable, economically healthy China increases the likelihood of a stable Asia and is therefore in the best interest of the United States. Such stability and continued economic growth, however, will only be accomplished if done in an environmentally sustainable manner. Without assistance, the Chinese will be unable to meet this goal: China needs support and advanced technology from developed countries to achieve its economic, development and environmental objectives. Multilateral cooperation and a focus on domestic Chinese environmental issues with secondary global impacts will demonstrate to the Chinese the international concern about their environmental problems while also addressing

Chinese environmental priorities. Continued bilateral engagement and cooperation with China on environmental issues will facilitate the transfer of American environmental technologies to China and will further support the work of environmental NGOs establishing partnerships and programs in the PRC.

The meetings of the Working Group on Environment in U.S.-China Relations identified these key themes while also exploring Chinese energy sector choices. Taking into consideration that businesses are best equipped to promote and create environmental change in the Chinese energy sector, Working Group members believed that support for U.S. businesses and technologies should be a priority for the U.S. government. The United States government is currently unwilling to significantly increase its financial commitments to support environmental protection measures or technology transfers to China. It can, however, open doors for those who can — namely private firms. In doing so, the United States will help bring environmental remediation technologies and alternative fuel sources to the Chinese while opening markets for U.S. firms and products.

At the same time, the U.S. government and NGOs should support and assist China in developing policy changes in the energy sector, especially through multilateral mechanisms and bilateral fora on the environment. Working in tandem with private businesses, NGOs and foundations offer the best hope for encouraging Chinese sustainable development.

Through continued engagement and explicit sup-

port for environmental projects, the United States can provide a framework within which businesses, NGOs and foundations can successfully promote Chinese environmental improvements. Such cooperation is vital if the United States aims to effectively assist the Chinese in their economic and energy development. Only under such a scenario can the United States hope to have a positive influence on future Chinese energy choices and on a Chinese development pattern that is environmentally sensitive for China and the world.

Endnotes

¹ It should be noted that U.S. interest in China's greenhouse gas emissions is largely a result of developed countries' energy production and contributions to global climate change. If the United States harbors any hope of successfully reversing global climate change patterns, it must reduce its own emissions in addition to assisting China in the development of a sustainable energy sector.

² The Export-Import Bank has recently established a \$50 million window for energy efficiency and renewable energy loans to China, although China's State Planning Commission (SPC) has yet to identify a corresponding Chinese bank.

³ The SPC agreed in May, 1997 to the creation of a U.S.-China Oil and Gas Forum. The forum held its first organizational meeting in Beijing during October, 1997 in conjunction with the convening of the World Petroleum Congress.

Aaron Frank is a project associate with the Environmental Change and Security Project, and Coordinator of the Working Group on Environment in U.S.-China Relations.

Speakers from the meetings of the Working Group on Environment in U.S.-China Relations, November 1996-July 1997

MARCIA ARONOFF

Environmental Defense Fund

WILLIAM CHANDLER

Battelle Memorial Institute, Advanced International Studies Unit

JEROME ALAN COHEN

Council on Foreign Relations

LOUIS DONATO

General Motors

RICHARD LOUIS EDMONDS

The China Quarterly, University of London

BARBARA FINAMORE

Natural Resources Defense Council

ABRAHAM HASPEL

Department of Energy

TODD JOHNSON

The World Bank

EVA LERNER-LAM

The Palisades Consulting Group, Inc.

KENNETH LIEBERTHAL

University of Michigan

JONATHAN MARGOLIS

Bureau of Oceans and International Environmental and Scientific Affairs, Department of State

WILL MARTIN

National Oceanic and Atmospheric Administration

HU MIN

Peking University

JULIA PHILPOTT

International Institute for Energy Conservation

KAREN R. POLENSKE

Massachusetts Institute of Technology

ROBERT PRICE

Department of Energy

LESTER ROSS

Paul, Weiss, Rifkind, Wharton & Garrison

JOHN SAMMIS

Department of State, Policy Planning Office

MIRANDA SCHREURS

University of Maryland

WILLIAM SPODAK

Strategic Consulting Alliance

ROBERT SUTTER

Congressional Research Service

BARRY TREMBATH

The World Bank

Working Group Co-Chairs

ELIZABETH ECONOMY

Council on Foreign Relations

P.J. SIMMONS

Carnegie Endowment for International Peace

Summary of Working Group Discussions on Energy Issues in China

Beginning in November 1996, the Woodrow Wilson Center's Working Group on Environment in U.S.-China Relations launched a series of monthly meetings on energy issues in China. The monthly meetings will continue through 1998, focusing on a variety of issues, including water scarcity, agriculture and biodiversity.

Background on Chinese Energy Production

- Coal accounts for approximately 75% of Chinese energy production, oil accounts for approximately 19%, hydroelectricity and natural gas 3% each, with nuclear energy contributing slightly over 1%. As currently planned, this breakdown should remain the same over the next 20 years;
- Biomass is the main source of fuel in the Chinese countryside, but its current use can be improved greatly by increasing efficiency;
- Based on an assumed 10% GDP growth rate, China's energy demand will grow at least 15,000 Megawatts per year until 2010; this is roughly equal to adding a Tennessee Valley Authority every two years;
- Chinese energy consumption in the year 2010 could be as much as 50-100% higher than current U.S. energy levels;
- Significant natural gas fields exist in Chinese provinces such as Sichuan. In order for natural gas to become a viable fuel in China, however, the Chinese need to overcome problems with gas storage and supply, and with the cultural perception that natural gas should only be used as a feed stock;
- The transportation of coal from the mines of the north to the centers of demand in the south have caused rail transportation bottlenecks and increased locomotive emissions;
- At the end of 1995, China's total installed capacity of hydroelectric power was 220 gigawatts (GW) per year, generating over 1000 kilowatt (KW) hours of energy;
- Between 1995 and 2000, newly commissioned electric capacities are expected to be between 17-18 GW per year;
- By 2000, hydroelectric power will probably account for 23% of China's generating capacity and 15% of its annual electricity generation. This percentage should remain static until 2003, when the Three Gorges Project begins power generation;
- Installed electricity generation capacity in China was 215 GW in 1995; it is planned to be 300 GW by 2010 and 533 GW by 2020;
- Nuclear energy currently accounts for 1.3% of the total Chinese energy output. This amount is expected to rise to 3.6% by 2010.

The Environmental Impacts of China's Reliance on Coal

From the perspective of the United States govern-

ment, China's greenhouse gas emissions are the most serious concern of the PRC's reliance on coal for energy production. While the United States is the leading producer of greenhouse gases worldwide, the Chinese currently rank second and their emissions are increasing. The Chinese, however, are more concerned with domestic environmental problems and, consequently, the domestic impacts of pollution due to their coal energy production. These impacts include:

- Highly unhealthy air pollution due to coal burning for energy production, household and street vendor use. 500 major cities in China do not meet World Health Organization (WHO) air quality standards, and Beijing, Shenyang and Xian are three of the top ten most polluted cities in the world. Urban coal use accounts for 75% of the total output of pollutants in China. It produces 14.14 million tons of soot, 18.25 million tons of sulfur dioxide, and 11.63 million tons of industrial dust per year;
- Acid rain due to the high sulfur content of a majority of China's coal. Acid rain is problematic south of the Yangtze river, in the regions east of the Qinghai-Tibetan Plateau, and in the Sichuan Basin.

Main Barriers the Chinese Face in Addressing Environmental Issues

Even with the increasing attention the Chinese central government is giving to environmental issues, the Chinese face a number of domestic barriers in addressing environmental issues:

- The central government has little direct influence over township and village enterprises and has difficulty enforcing local implementation of environmental policies;
- The ingenuity of Chinese businesses in circumventing new environmental legislation and the willingness of government officials to allow them to do so if it will increase profitability;
- A dearth of good, reliable data on environmental pollution and other environmental factors;
- A hesitance to accept foreign assistance on energy issues because the Chinese do not see how it will benefit them commercially;
- The tendency of the Chinese central government to emphasize technological fixes and large projects rather than policy changes.

Impediments to U.S.-PRC Cooperation on Energy Issues

Working group discussion on impediments to U.S.-PRC cooperation on energy issues has run the gamut from political considerations to legal problems encountered by U.S. businesses investing in China. Examples of the major impediments hindering cooperation are:

- The Chinese still equate sustainable development with slow growth and feel that the United States is touting sustainable development as a means to keep their economic growth in check;
- The current political climate in China — especially after the death of Deng Xiaoping — makes it difficult for high level Chinese bureaucrats to institute the mechanisms under which a shift to sustainable development could take place;
- Inconsistency between provinces creates high transaction costs for firms doing business in more than one Chinese province;
- U.S. firms feel that European and Asian firms get more export assistance from their governments;
- The lack of transparency in Chinese governmental and business structure makes it difficult for U.S. firms to determine the consumer and the appropriate person to speak with during negotiations;
- When U.S.-PRC bilateral relations are tense, decisions are made at the upper levels of the Chinese government to stop deals for U.S. firms, or to make them go very slowly.

Areas for U.S.-PRC Cooperation on Energy Issues

A main focus of working group discussion has been on areas in which the U.S. and China share a common interest. Discussion has tended to focus on areas in which the United States can assist the Chinese, capitalizing on U.S. expertise or advanced technology in a certain field. There has been an ongoing debate among working group members about the best approach to assisting the Chinese: some members believe that technology transfer would encourage the Chinese to make accompanying policy changes, while others believe that new technology would be ineffective if policy reforms were not emphasized first. A summary of the main areas for cooperation on both sides of this debate follows:

- Help the Chinese increase their energy efficiency and support end-use efficiency, which holds immense potential for energy savings and conservation;
- Assist the Chinese in restructuring their utilities and decentralizing control to local utilities;
- Provide expertise and equipment so that the Chinese can refurbish and renew their coal fired power plants.
- Assist the Chinese in developing natural gas exploration

and in building a modern gas system— technically, economically and politically;

- Assist the Chinese in the development of databases on water, land use and other environmental issues;
- Help the Chinese switch to non-coal electricity for households to significantly reduce coal use;
- Provide technical and policy assistance to the Chinese in implementing indirect market mechanisms in the energy sector;
- Encourage a policy framework that decouples utilities' profits from sales and lets them keep part of any savings achieved.

Engagement Strategies

While there has been a general consensus in working group discussions on the areas in which the United States can best assist the Chinese on energy issues, working group members have offered numerous ideas on *how* the United States should approach the Chinese on these issues. Members have debated whether the United States should take a bilateral or multilateral approach; whether the U.S. government, NGOs or private business should take the lead on Chinese environmental issues; and how to incorporate increased trade into environmental assistance. A list of working group suggestions for engagement strategies follows:

- Create two groups as part of the Sustainable Development Forum, both composed of members from public agencies, private industry and NGOs, to specifically address impediments to U.S.-PRC cooperation on energy issues. The first of these groups would focus on the structural reforms necessary to make private sector investment in China viable for U.S. companies. The second group would focus on impediments in the United States to increased cooperation with the Chinese on energy and environmental issues. The benefits of groups such as these is that they are low cost, will help establish trust in U.S.-PRC relations and will address the issue most important to U.S. investment in the Chinese energy market: legal and financial reforms;
- Create a multilateral group to address energy and environmental issues throughout all of Asia which would include governmental, private business, and NGO representatives from Europe, Asia and North America to discuss technology transfer, policy changes, and energy efficiency strategies. The World Bank and the Global Environmental Facility were mentioned as possible umbrella organizations for such a group;
- Develop sister-city or U.S. state-Chinese province partnerships in which cities/states/provinces would collaborate to share technologies, policies, and energy efficiency strategies. Japan and China have similar arrangements which have been successful and the U.S.-China Environment Fund is starting a program which would link U.S. and Chinese high schools;

- Provide the Chinese with environmental information and data, allow them to analyze the data themselves, show high level governmental support for progress on the issue being researched, and set deadlines by which goals and objectives to address the issue should be met;
 - Encourage joint commercialization projects to build partnerships between U.S. and PRC industry through the research, development and manufacturing phases;
 - Establish contact between the U.S. government and new Chinese government agencies, such as the newly created Ministry of Natural Gas;
 - Provide advice to Chinese think tanks that write and develop Chinese legislation;
 - Reconsider lifting U.S. export controls on nuclear technology to China;
 - Encourage the Chinese to conform to international contract standards for natural gas exploration;
 - Encourage the development of alternative energy sources, such as fuel cells, wind and solar power through demonstration projects, especially in rural areas;
 - Provide high level governmental support for U.S. business ventures in China;
 - Provide high level government access for U.S. businesses in China. U.S. business has the mechanisms to create change in China, but lacks the access that the U.S. government can provide;
 - Use mechanisms such as the Montreal Protocol Fund to engage the Chinese on climate change issues;
 - Be cognizant that there is a whole class of rising 40 year old bureaucrats in China who have an entirely different way of thinking than the 60 year old bureaucrats who are currently in power. The U.S. needs to be aware of the differences in thinking between the two groups and devise innovative ways to satisfy them both while still promoting U.S. objectives;
 - Develop domestic constituencies that have common goals with those in China. These constituencies could combine forces for mutual benefit.
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The Environment in China: An Overview

November 26, 1996

Energy

Coal accounts for 75% of Chinese energy production, oil accounts for 19%, hydroelectricity and natural gas account for 3% each, and nuclear energy represents a very small amount of China's energy production. Biomass, solar and wind power are also contributors to China's energy production, with biomass being the main source of fuel in the countryside. However, biomass and solar systems receive limited funding from the government and currently play a limited role in China's energy system.

Coal is expected to remain China's main energy source due to its vast abundance and the resilience of Chinese authorities to energy alternatives. Domestic oil reserves are low and imports are seen as a domestic threat while natural gas exploration has been historically shunned as too expensive. Hydroelectric power has very high capital costs and long payback periods, as does nuclear power.

Vertically integrated systems of business in China have made domestic oil exploration unprofitable, causing Chinese businesses to move away from the industry. China's oil self-sufficiency is also a possible economic and security problem for the United States.

Any large increase in Chinese nuclear power creates a global environmental concern which should be of high priority to the United States. However, nuclear power is often not economically feasible and the main concern of the Chinese is to get the best return for their investment in energy related fields.

Coal is also problematic for transportation by bottlenecking rail lines throughout the country. Most coal is concentrated in the North while a majority of the Chinese population lives in the South and East. Technical fixes for the negative externalities of coal use are also seen as capital intensive.

There are four possible opportunities for cooperation between the United States and China on energy issues:

- Helping China increase its energy efficiency;
- Helping China restructure its utilities and decentralizing control to local utilities;
- Refurbishing and renewing China's coal fired power plants; and,
- Helping develop natural gas exploration.

Key Environmental Issues and Chinese Institutions

Almost all government agencies and large state owned enterprises in China now have an environmental bureau or department. The key environmental agencies include:

- The National Environmental Protection Agency (NEPA);
- The State Planning Commission (SPC);
- The State Science and Technology Commission (SSTC); and,
- The China Council for International Cooperation on Environment and Development (CCICED).

On any given environmental problem, several ancillary agencies also become involved and should not be ignored in international negotiations with the Chinese.

While NEPA is a well meaning agency, it ranks low in the bureaucratic hierarchy and often is ignored. The SPC is aggressive but not terribly proactive, although some departments are more environmentally inclined than others. The SSTC has many well-educated, articulate, and relatively cosmopolitan officials (especially at the junior level); however, its reputation abroad is much better than its reputation and influence domestically.

Chinese environmental agencies do not have much clout in the Chinese bureaucracy and it is extremely important to know the institutional structure of the organization or person you are approaching.

Chinese NGOs have been focusing on issues such as environmental education and recycling, and have had some initial success with these programs. Perhaps more noticeable is that the Chinese media has latched onto environmental issues recently and there is much more coverage of international environmental conventions, such as the Montreal Protocol, and an increase in environmental investigative reporting.

The main barriers that the Chinese face in addressing environmental issues are:

- Weak local implementation of environmental policies;
- The ingenuity of Chinese business in getting around new legislation; and,
- A lack of good, reliable data.

In order to address these problems, the Chinese government needs to give more power to regulatory agencies and create stronger regulations.

The Chinese are mostly concerned with domestic environmental issues such as water and clean coal technology. Global environmental issues are very much secondary but, for political reasons, of utmost importance among global issues is climate change.

A main area for cooperation regarding the environment should be helping the Chinese improve their statistics. This could take the form of assisting NEPA

in developing databases on water or land use. It is also important to listen to Chinese interests and concerns rather than focus U.S. cooperation efforts solely on the international problems of greatest concern to the U.S.

Legal Framework

Since 1979, a great effort has been made to create a legal system in China from scratch. While significant progress has been made in terms of creating foreign treaties and agreements, the creation of legal institutions has been slow.

Legal problems for China include the enforcement of environmental regulations and policies, and tax collection. Although China is seen as a mostly totalitarian system, it more closely resembles a system of local baronies in which provinces try to avoid central government rule as much as possible. Difficulties in tax collection limit funds which could be used for environmental protection.

Environmental problems are not very prominent in Chinese legal issues, especially in terms of foreign investment. This has hurt foreign investment in China because many U.S. companies are afraid to enter a country in which enforcement of regulations appears to be lax yet they may be held liable should an accident occur.

New Chinese environmental laws and regulations have recently come into effect and over 300 environmental standards are currently in place. Many of these standards are modeled after international environmental standards. China is also preparing to cooperate with ISO 14000 and has implemented an Agenda 21 program. In addition, the legislative process in China has become more open and progressive, even to the point of providing a degree of public participation in the environmental impact assessment process.

Despite changes in the legal system, environmental enforcement is still the most significant legal problem in China.

Items of possible cooperation between the United States and China on this topic are:

- Biodiversity and fisheries protection;
- Greater participation by NGOs in the legal process;
- Cooperative efforts between the EPA, BLM, Forest Service and their counterpart Chinese agencies;
- Cooperation at the customs level to help smooth relations;
- U.S. bank supervisory agency assistance in helping clear up NEPA's problems with Chinese banks; and,
- Assistance by the United States Energy Department or NGOs to help make energy conservation law in China a reality.

U.S. Business Perspective

A key factor towards the success of U.S. business

in China is the need to be patient and understand Chinese culture and thinking. Several large obstacles for U.S. businesses in China are: 1) laws and regulations are enforced differently from region to region or company to company; and, 2) political instability can be problematic. To succeed in China, U.S. business needs the continued support of the United States government. Assistance can come in the form of endorsing improved strategies and learning from our collective experiences, collaborating with industry to develop systems approaches to environmental issues, and decoupling issues like human rights, trade and international property rights (IPR) from environmental issues.

U.S. business can also promote environmental issues in China, such as broad base educational systems on the environment which include education at the kindergarten level, essay contests for school children, technological training programs for Chinese professionals, and promoting Chinese research.

Environmental Priorities in China for the United States

- It is important for the United States to exercise leadership on environmental issues in the Asian arena. The United States is not currently a major environmental force in China — Japan is #1 and Germany #2.
- Trade issues and the trade imbalance with China must be the key concern for the United States. U.S. investment in China's environment, mainly through technology transfer programs, could help reduce the trade imbalance.
- Environmental issues may take the place of human rights in terms of importance in relations between the United States and China.
- Biodiversity is an area of considerable importance to the United States and a prime candidate for U.S.-PRC cooperation. China has over 700 nature preserves and this type of preservation should be supported by the United States.
- Fisheries are an area of high importance due to the global impact of over-fishing in the region.
- Transportation should be seen as an area of environmental concern and one in which there can be cooperation between the United States and China.
- Localism in China may be more of a virtue than a vice in relation to the environment. The central authorities are giving 'go slow' signals while local leaders may be more receptive to change, help and ideas. The United States needs to build on localism while keeping the central agencies informed.
- NGOs have a unique and valuable role to play on environmental issues; NGOs have the benefit of being able to tread into areas in which the U.S. government (USG) would be seen as forcing an agenda, and they can provide reliable data for China that will not be seen

as having a hidden governmental agenda. NGOs can also more forcefully address an especially weak area, such as environmental enforcement. On issues in which the USG would be seen by the Chinese as promoting national interests, NGOs should take the lead.

Environmental Priorities for the PRC

- The most important goal of China's leadership is the country's survival. If the environment gets in the way of any of China's economic or development goals, the Chinese will become uninterested in it. Therefore, a connection must be made between Chinese economic survival and the environment.
- The United States needs to show the Chinese that there will not only be a national benefit due to environmen-

tal changes but also a benefit on a private or individual level. This will gain support at a base level of the Chinese population for new policies.

- China has its own national Agenda 21 and provinces have developed their own individual Agenda 21s. However, China is not funding Agenda 21 programs and it is improbable that they will internally do so. China also seems to be moving away from Agenda 21 and focusing instead on a 'green' plan in its 9th National Plan. This 'green' plan is backed by domestic planning and bilateral loans and has the support of the SPC. China, though, does not have adequate funding to promote this plan and will be reliant on external funding to help solve its environmental problems.

Chinese Energy Production

February 5, 1997

Energy

Background on Chinese Energy Production

Energy demand in China has doubled since 1979, yet China's energy consumption has grown only about half as fast as its economy during this period. This remarkable energy efficiency achievement must continue if China is to avoid economic hardships due to energy shortages and excessive pollution levels in the future.

China's low energy consumption figures can be attributed mainly to rationalized energy prices and a power plant retrofit program instituted after 1979. It is imperative for China to continue their energy efficiency efforts for them to keep energy use at manageable levels; without high priority attention to how energy investments are made in China, they will fail to meet their energy goals.

Based on an assumed 10% GDP growth rate, the best case scenario for China's growth in energy demand is 15,000 megawatts per year until 2010, which is roughly equal to a Tennessee Valley Authority every two years. At this rate of growth, China would reach current U.S. energy consumption levels by the year 2010. If China is unable to meet their energy efficiency standards — and it is increasingly looking as though they will not — energy consumption in the year 2010 could be as much as 50-100% higher than current U.S. energy levels. This could create serious environmental and energy management problems for the Chinese. Thus, energy efficiency should be seen as a high priority for United States assistance.

The bulk of China's energy production comes from coal (75%), with hydroelectricity, oil, natural gas, and biomass all contributing to the overall picture. It is

important to note, however, that China's reliance on coal is more a function of policy decisions in the central government than the abundance of coal in China. This is exemplified by the fact that the United States has twice as much coal as China and Russia has four times as much, but both are much less reliant on coal as an energy source than China.

China is currently experiencing a multitude of problems due to its coal use, including greenhouse gas emissions, air pollution due to the dirty nature of China's coal, acid rain due to the high sulfur content of their coal, and transportation difficulties. Much of China's air pollution, however, does not come from industrial boilers but from household and street vendor coal use. The best opportunities for U.S.-PRC cooperation in this area are through increased trade in coal technology and assistance on reform in the coal sector. However, this type of reform will only be effective if the coal industry in China is privatized.

Of the 75% of energy production that comes from coal, 1/3 is for electricity, 1/3 for boilers and the final third is used for home heating and cooking. These are very different uses of coal than in the United States. Significant progress could be made if the U.S. could simply help the Chinese switch to non-coal electricity for households. The U.S. should also assist the Chinese in getting energy to users in a more efficient manner.

Chinese Energy Alternatives

Alternative energy sources in China include oil, natural gas, hydroelectric power, nuclear power, biomass, wind and solar power. Domestic oil reserves in China are low and oil exploration does not seem to be a priority of the central government. Increased oil im-

ports could lead to increases in the global price of oil and create security concerns for the United States due to a strengthened partnership between China and OPEC countries.

There is very little natural gas exploration in China, but significant gas fields do exist in provinces such as Sichuan. In order for natural gas to become a viable fuel in China, the Chinese need to overcome problems with gas storage and supply, and with the cultural perception that natural gas should only be used as a feed stock. Natural gas is an area in which the United States has a strong competitive advantage: the United States has a great deal of experience with natural gas, especially in storage and supply issues.

Biomass energy has perhaps the best potential of any energy source for rural China, and its current use can be improved greatly by increasing efficiency. However, as with wind and solar power, biomass energy suffers from a lack of infrastructure, demand and expertise on the part of the Chinese.

Increased importation of oil in China will not significantly affect oil prices. The main concern for the United States should be the strengthened partnership between China and OPEC countries that oil imports may create.

Hydroelectric power in China is abundant, underdeveloped, costly and often located in remote areas far from load centers. Large hydroelectric projects also carry environmental and social costs.

Hydroelectricity accounts for 3% of the total primary energy use in China. The Three Gorges Dam will add approximately 18 GW of power — roughly equal to one year's worth of power plant expansion in China. W. Alton Jones is currently undertaking a study to look at the costs of hydroelectric transmission and distribution.

China's growth in the nuclear field is highly dependent on foreign technology. While U.S. firms are restricted in nuclear trade with China due to a Congressional ban, both France and Russia are currently negotiating with the Chinese for the sale of reactors.

Energy efficiency in China has been assisted not only by the price structure, but also by a shift from heavy industry to light industry, and then to agriculture. An increased importance on heavy industries, such as automobile manufacturing, may hurt energy conservation efforts.

The U.S. Business Perspective on Chinese Energy Issues

China presents a challenge to U.S. firms because transactions lack transparency, making it difficult for them to determine the consumer and the appropriate person to speak with during negotiations. Inconsistency between provinces also means that transaction costs are high for firms doing business in more than one Chinese province. In addition, U.S. firms feel that

these difficulties are exacerbated because European and Asian firms get more export assistance from their governments.

U.S. firms say that what they desire most is a level playing field, and increased attention to technical support and issues of supply and demand by the United States government.

There is an unfair perception by U.S. firms that our government does not provide assistance for them in China. The U.S. government not only provides financial support for U.S. firms but also contacts for new business ventures. On the other hand, it is the type of help that the U.S. government provides for businesses in China that is seen as the problem. In order for there to be tangible assistance for U.S. firms, there needs to be more high level involvement.

The main problem facing U.S. firms in China is overall U.S.-PRC bilateral relations. These relations have a definite impact on U.S. firms doing business in China. There are decisions made in the upper levels of the Chinese government to stop deals for U.S. firms, or make them go very slowly, when bilateral relations are tense.

In Poland, a shift to a market economy equated to imports of gas and oil because consumers prefer cleaner burning fuels. China could shift to natural gas under a market economy, and there is also a potential market for biomass fuels.

Funding Environmental Projects in China

- Philanthropic agencies may be the best funding sources for environmental projects in China.
- It is unnecessary for the United States to provide funding for the Chinese on environmental matters; the Chinese are one of the largest holders of United States bonds and reportedly have \$110-120 billion invested worldwide. They should pay for their own environmental improvements.
- The United States is not spending anywhere near the amount that the Chinese government is spending on environmental projects, which is approximately \$5 billion. One should not underestimate the financial contribution of the PRC to their own environment. The United States mainly contributes ideas and technologies to China's environment, not money.
- It is unreasonable to ask China to fund environmental programs themselves because they simply do not have the money. If the U.S. attempts to force China to fund these programs themselves, or to adopt a U.S. environmental agenda, they will simply walk away. The costs of this are too large for the United States to ignore.
- The resources for a move to sustainable development in China has to come from the private sector. The U.S. needs to figure out where U.S. public and private goals mesh, and then put an emphasis on these areas. Business has the mechanisms to make change in China, but

lacks the access that government can provide. The window of opportunity for this type of change, however, is closing. U.S. businesses are getting frustrated with the Chinese and thinking of moving to other markets. Money is beginning to go elsewhere and will not return to the Chinese market. To accomplish U.S. environmental goals in China we need a huge amount of capitol, and time is quickly running out.

Options for U.S.-PRC Engagement Strategies

- The U.S. has an interest in China because of its sustainable development goals and China's burgeoning markets. However, the U.S. must also convince Congress and the general public to view reduced CO₂ emissions in China as a direct U.S. benefit.
- The Japanese and the Europeans want to be increasingly involved in China, but the Chinese often prefer to deal with the United States. The involvement of the United States in China is largely driven by U.S. firms and economics.
- While the United States has a fairly substantial bilateral trade deficit with China, the focus of U.S.-PRC relations should be human rights concerns and not trade.

Issues such as clean drinking water for children would gain the support of both Congress and the general public.

- The Administration and Congress are going to need to work out their differences for there to be any real progress on U.S. relations with the Chinese. The U.S. has a tendency to be drawn into national security issues, but it needs to be cognizant of other issues of national interest as well, such as economics. The U.S. government must take the lead on these issues and begin to act in a consistent manner.
- One needs to distinguish between levels of policy and political uncertainty when discussing U.S. government relations with China. A great deal of uncertainty in the Chinese market will not be eliminated by improved bilateral relations.
- Both the Chinese and Congress look at environmental issues as fluff. This is due to a lack of funding for environmental projects and a seeming lack of importance placed on them by the United States. Agencies like the SPC, which actually makes decisions, do not regard environmental issues highly.

Energy Policy Options for U.S. Decision Makers

February 26, 1997

While the initial focus of this meeting was to provide ideas on specific projects and initiatives which could be undertaken in China, most participants felt that, because the United States does not currently have the financial resources to support such projects or initiatives, this was not the best way to engage the Chinese. Much of the discussion focused on the idea of creating two groups, both composed of members from public agencies, private industry and NGOs, to specifically address impediments to U.S.-PRC cooperation on energy issues. The involvement of private industry was seen as especially important to this process since most of the funding for clean energy technologies will come from the private sector.

The first of these groups would focus on the structural reforms necessary to make private sector investment in China viable for U.S. companies and to reverse the trend of decreased international investment in China's energy sector. The goal of this group would be to provide a forum for U.S. companies and the Chinese to discuss specific impediments, brainstorm about solutions to these impediments, and discover the means by which the U.S. government could provide technical and legal assistance to the Chinese to institute these reforms.

The second group would focus on impediments in

the United States to increased cooperation with the Chinese on energy and environmental issues. This group could benefit from a Chinese perspective on the difficulties of doing business with U.S. companies and could also make suggestions on how to best convince Congress of the benefits of improved bilateral cooperation with the Chinese.

The benefit of groups such as these is that they are low cost, will help establish trust in U.S.-PRC relations and will address the issue most imperative to U.S. investment in the Chinese energy market: legal and financial reforms.

Discussion also focused on whether it is best to approach high level officials regarding energy reforms or to concentrate on second tier bureaucrats who actually write the briefing papers for higher level officials. While many participants felt that only high level officials have the political power to make any significant changes, others believed that the lower level bureaucrats would be more receptive to ideas about environmental technologies and energy reform.

Another area of discussion concentrated on the prospects of joint research and development (R&D) and joint commercialization. While many supported joint R&D, most participants felt that joint commercialization presented better investment opportunities for U.S.

industry. Some participants mentioned fears over intellectual property rights violations and believed that joint commercialization with Chinese partners was a more secure investment. There was agreement on the belief that the key to working with the Chinese on both joint R&D and joint commercialization is building lasting partnerships that continue through the research, development, and manufacturing phases.

The following recommendations were also made for the consideration of the full working group:

Technologies

- Implement demonstration projects and joint R&D for biogas turbines and coal bed methane projects.
- Use fuel cell technology in both the stationary power and transportation sectors.
- Fuel cell technology is currently available for mid-sized stationary power needs and can be provided for a lower cost than many hotels and hospitals currently pay for electricity.
- A good opportunity for fuel cell application in transportation may be in locomotives. The Ministry of Railways is currently exploring electrification of its locomotives. Fuel cells may provide a more cost effective and environmentally benign alternative to electrification and could provide good opportunities for joint commercialization.

Areas for Reform

- Encourage the Chinese to conform to international contract standards for natural gas exploration. The Chinese have done this in the past with oil exploration and a similar effort would make investment in this area much more attractive to U.S. businesses.
- Help the Chinese create market pricing mechanisms for their energy sector.
- Provide assistance to the Chinese in reforming their state enterprises.

Engaging the Chinese

- Discuss our shared vision about China's development and how energy efficiency is a key element of this vision.
- Present environmental and energy issues from the perspective of China's economic development interests.
- Establish contact with new Chinese government agencies, such as the newly created Ministry of Natural Gas.
- Tie specific, large scale proposals to policy discussions in order to generate high level Chinese interest.
- Provide advice to Chinese think tanks that write and develop legislation.
- Use the current political climate in China to set the groundrules for improved bilateral relations and progress on environmental reforms.

The Context for U.S.-PRC Cooperation in the Energy Sector

March 5, 1997

Chinese Domestic Impediments and Ideas for U.S.-PRC Cooperation on Energy Issues

Chinese Domestic Impediments

There are two key Chinese impediments to U.S.-PRC cooperation on energy projects:

- The Chinese still equate sustainable development with slow growth and feel that the United States is pushing sustainable development as a means to keep their economic growth in check; and,
- The current political climate in China — especially after the death of Deng Xiaoping — makes it difficult for high level Chinese bureaucrats to institute the mechanisms under which a shift to sustainable development could take place.

For U.S. environmental assistance to succeed, the United States must convince the Chinese that it has a strong interest in China's continued economic growth, and that economic growth does not necessarily equate

to increased environmental degradation. The United States will have to demonstrate to the Chinese convincingly that increased growth and pollution can be decoupled without sacrificing any of their economic goals.

Ideas for U.S.-PRC Cooperation on Energy Issues

- A multilateral group to address energy and environmental issues throughout all of Asia. As proposed, this group would include: governmental representatives from Asian countries, the United States, the European Union, and other interested countries; non-governmental organizations (NGOs); and private business representatives. This group would create a more neutral forum in which ideas from different sectors and countries could be shared. The group would discuss issues such as technology transfer, policy changes to supplement technological fixes, and energy efficiency strategies. The group could have specialized working groups, such as those that exist under the Asia-Pacific Economic Cooperation (APEC), which would report

back to the main group. Suggested umbrella organizations for such a group included: 1) The World Bank; 2) the Global Environmental Facility; 3) the Sustainable Development Forum with China; and, 4) a combination of multilateral development banks and private foundations.

- Sister-city or U.S. state-Chinese province partnerships in which cities/states/provinces would collaborate to share technologies, policies, energy efficiency strategies, and other environmental solutions. This might help to avoid possible political problems associated with Chinese central government involvement while creating enduring bilateral relations at the local level. Many U.S. mayors are interested in such projects.

Possible Proposals or Initiatives

- The only way that the Chinese will match their energy efficiency goals is through pricing reforms in the energy sector. The United States should therefore provide technical and policy assistance to the Chinese in implementing indirect market mechanisms in the energy sector.
- In other parts of the world, countries have been able to swap debt for environmental improvements. While China does not have this type of international debt, the core idea of such a system may have applications in China.
- Demonstration projects for energy efficient technologies in rural areas of China are a good way to show the Chinese that the United States is interested in the development of their entire country and not just the more economically developed Southeastern region.
- Policy changes, in energy efficiency for example, are our best strategy since they can have a substantial effect but have relatively low implementation costs.

Engagement and Diplomatic Strategies

- The United States should approach the Chinese with a list of their environmental accomplishments and praise them for their progress on environmental issues. Future bilateral environmental agreements should focus on expanding upon China's existing successes. This suggestion is rooted in the fear that the Chinese will take any offer of help from the United States as condescending.
- The United States should engage the Chinese on a trilateral basis with a mutual ally, such as Japan or South Korea, to help normalize U.S.-China relations and to share environmentally sound technologies.
- The United States has been extremely successful in raising environmental consciousness throughout the world. We should take this type of 'salesman' approach to China and convince them of the importance of their environmental problems.
- The United States should offer specific lessons from

its own mistakes and technological advances.

- Broad issues likely to be supported by the Chinese, such as environmental education, should be the focus of near-term bilateral engagement.
- Persistence will be key to any engagement strategy.

The Chinese Perspective

- The Chinese are most concerned with results, and are willing to work with both governmental and non-governmental partners that have the funding and mechanisms to deliver.
- The Chinese understand why the United States has a commercial interest in assisting them on energy issues, but they do not see how U.S. assistance will benefit them commercially. This is an important barrier to any U.S. efforts.
- The Chinese believe that the United States has thus far been unable to back up its proposals with adequate funding.
- The Chinese put a greater emphasis on technological fixes than policy changes, as is evidenced by their selections for Agenda 21 projects.
- Chinese state agencies are sometimes uncomfortable working with U.S. NGOs and the United States should be aware of the impact that NGO involvement may have on the success of a project.

The U.S. Domestic Context

Congressional Context

The current Congressional view of China is not a favorable one. While Congress has been influenced by increased Chinese lobbying and input, the U.S. Administration's determination to improve U.S.-China relations, and support of the Administration's China policy from the private business sector and NGOs, U.S. China policy remains an extremely partisan issue for the following reasons:

- The U.S. media is still taking a very anti-Chinese stance. The impact of the media's coverage of the Hong Kong transfer and general Chinese issues on U.S. public opinion should not be underestimated.
- It is unclear how much of an impact "Donorgate" will have on overall U.S.-China relations and, specifically, on Vice President Gore's upcoming visit to China. Those in the Democratic Party who do not support Gore may see this as the perfect opportunity to attack him, using the Administration's China policy as its main weapon.
- Those on the far Right, who also disagree with the Administration's China policy, may use "Donorgate" as an opportunity to voice more opposition to improved ties with the Chinese.

The anti-Gore Democrats and the far Right may gather enough power to affect significant change in the Administration's China policy, in light of the extensive media attention they have generated thus far. The immediate question is how close Gore will want to be associated with the Chinese.

Donorgate

Over 30 members of Congress will be traveling to China over the spring recess, and Congressional co-delegates will be traveling with the Vice President during his visit to China in March. One of the Congressional delegations during the spring recess will be led by Congressman Newt Gingrich.

While the Donorgate scandal may not have stopped members of Congress from planning visits to China this spring, it has made them very sensitive about their visits. Concerns have been voiced over the payment of dinners and hotel rooms, and members of Congress are sure to be highly aware of these issues during their stay in China.

Some participants believed that because half of

Congress does not have any opinion on China, the impact of Donorgate should not be overestimated. Donorgate, however, does not seem to have affected the Chinese, who may not realize the possible importance of this issue.

General Comments

The environment may soon become the fourth main foreign policy issue with China, joining trade, human rights and security. However, it may take an environmental crisis in China for such a development to occur.

Environmental issues should generally be seen as a positive way to engage the Chinese. WTO negotiations also might be a means of helping the Chinese adopt such measures as energy pricing reform. The upcoming conference on climate change in Kyoto can also be an impetus to raise environmental concerns. The Chinese, however, are significantly less receptive to managing global environmental problems, such as climate change, than domestic issues.

Transportation Options and Trends in China

April 2, 1997

Chinese Transportation Options and Trends

Transportation Design and Planning

China currently has a five-year plan to develop an approximately 35,000 kilometer national trunk highway system, which will connect much of south and north-east China with the northwestern cities of Dahuangshan and Ürümqi. While the five-year time frame for the plan is somewhat unrealistic — as is the 3.2 trillion yuan set aside for transportation in the 9th five year plan — the plan does give an indication of where the Chinese plan to spend transportation funds in the near future.

Since China's publicly funded transportation infrastructure cannot possibly match the speed of its private sector driven industrial growth, China is currently experiencing a transportation bottleneck: the main Chinese transportation goal is simply to increase their passenger and freight mobility. The challenge for the Chinese is to optimize their transportation while not falling into an American-style system — an outcome that is feared by both the Chinese and the United States.

When analyzing transportation issues, it is important to understand that they are integrated systems, as opposed to separate factors, which must be properly balanced. Items to be considered when optimizing a transport system include:

- Identifying the objective ("cost function");
- Establishing the criteria ("constraint equations");
- Identifying the factors that can be adjusted ("parameters");
- Solving the problem ("minimize the cost"); and,
- Understanding that the system is not steady-state and will change over time.

During the development of their transportation system, China should consider the following factors...:

- Demand for mobility;
- Supply of transport infrastructure;
- Design of transport infrastructure;
- Efficiency of transport systems operations design and management; and,
- Integration of land use and transport infrastructure development.

...and constraints:

- Energy;
- Air quality, noise, and other environmental impacts;
- Land area; and,
- Investment capital.

To address immediate transport system concerns, the Chinese should consider the following factors:

- Infrastructure investment
 - WHAT: Roads, rails, waterways, ports, and airports.
 - WHO: Ministry of Finance, Ministry of Communications, World Bank, Asian Development Bank, investment banks, and development consortia.
 - HOW: Demand, supply design, and operations.
- Research
 - WHAT: Research institutes and collaborative research projects.
 - WHO: Universities, state ministries, and businesses.
 - HOW: Joint research initiatives and academic interaction.

In the long-term, the following factors are of high importance:

- Integrated land use and transport infrastructure planning, design, and implementation;
- Multimodal approach to supply; and,
- Education and training.

Potential destabilizing factors for China's transportation system planning include:

- Institutional segregation of transport and land use decision makers;
- Reliance on internal combustion engine technology. The Chinese are very concerned about this technology but must achieve their end goal of increased mobility;
- Western highway interchange design. This must be different than the model currently used in the United States if it is to meet Chinese transportation, land use and economic demands; and,
- Foreign equity positions in transport infrastructure projects. An important consideration since transportation choices often have a significant impact on land use.

Possibilities for U.S.-China cooperation on transportation include:

- The United States can become a professional and intellectual partner for China. The Chinese have already studied U.S. highway regulations and standards: partnerships with the Chinese will allow them to learn from our transportation missteps and help them develop a multimodal system;

- Efforts should be made to maintain the necessary levels of both U.S. and Chinese awareness of the transportation needs and the impacts of Chinese transport system development.

An example of how transportation system choices can impact land use, the environment, and investment capital can be seen through the design of interchanges on Chinese highways. In 1976, Gordon Wu, a Hong Kong entrepreneur, was able to secure the right-of-way to build a privately owned turnpike between Guangzhou and Hong Kong. Mr. Wu determined that he could get the best return on his investment by maximizing the retail space at the 15 turnpike interchange sites he was given, leading him to design an interchange that optimized land use (by placing a retail mall underneath the interchange) and incorporated public transportation accessibility. Innovative ideas such as this one are crucial to the development of an environmentally-sensitive transport system in China, and would be a main benefit of joint U.S.-China research on transportation issues.

Sustainable Transport

Sustainable transportation must be analyzed as a system, rather than just singular factors such as fuels or emissions. Transport efficiency can be reached through integrated transport planning (ITP), which consists of five factors:

- Economic incentives to moderate demand;
- Management of existing infrastructure;
- Public transport emphasis;
- Fuel and vehicle efficiency standards; and,
- Land use and urban design.

The International Institute for Energy Conservation (IIEC) is currently developing a sustainable transport program for Xiamen, China. Xiamen was chosen for its size, transportation needs and concerns, and the stated willingness of local bureaucrats to utilize an ITP approach for their city's growing transport needs. As with many Chinese cities, Xiamen's top three transport problems are: 1) air pollution; 2) traffic congestion; and 3) energy conservation. While none of these problems are currently of a critical nature in Xiamen — as opposed to the situations in other Chinese cities — Xiamen's transport related problems have the potential to become like Mexico City or Bangkok's. CO₂ emissions, it should be noted, are not on the list of Xiamen's current transport-related problems, even though these emissions are becoming increasingly important.

In conjunction with the U.S. Environmental Protection Agency, IIEC held a series of workshops on an integrated approach to mobile source emissions reduc-

tions in Xiamen. These sessions identified unmanaged vehicle growth as the major transport problem in Xiamen, resulting in increased air pollution, traffic congestion and excessive energy consumption. Suggested potential measures to overcome these problems included:

- Making public transport a priority;
- Improving pedestrian engineering and urban design;
- Using cleaner, more energy-efficient fuels;
- Establishing and enforcing vehicle emissions standards; and,
- Initiating a data collection program for full cost analysis.

The Chinese are interested in the following technologies to assist them in implementing these measures:

- Emissions inspection and ambient air quality monitoring and display equipment;
- Advanced communications technology to facilitate public transport and to manage demand for travel;
- Alternative fuels, vehicle conversion kits, and infrastructure technology;
- Intelligent Transport Systems (ITS) applications for vehicle fleet and monitoring; and,
- Geographic Information Systems (GIS) applications for land use planning and economic analysis.

Solving Chinese Traffic Congestion Problems

- Low-tech solutions, such as traffic lights at intersections and better traffic management, can help solve urban traffic congestion. New roads are not always the best solution;
- Traffic management and other low-tech solutions suffer from a lack of interagency, or even intercity, discourse on traffic congestion problems;
- Designating certain roads as pedestrian- or bicycle-only could help ease traffic congestion problems;
- The success of a transport system is heavily reliant on how you interconnect modes of transport and integrate them into a system.

Technological versus Institutional Reform

- While technological improvements can help temper many of China's transport problems, without institutional and policy changes, technology will simply be overrun. As was the case in the United States, the Chinese are using the rubber, oil, and asphalt industries to boost their economy — technology simply cannot overcome this institutional bias towards the automobile industry;
- Technology cannot solve land use problems. A basic policy framework is the best strategy to address China's

transport issues;

- Fuel cells have the potential to help reduce Chinese transport energy efficiency and mobile source air pollution concerns.

Railways and Air Transport

- Rail is still the backbone of China's transport, and the Ministry of Railways has a great deal of money which it is using to make impressive improvements to China's rail system. Passenger rail cars in China are better than many currently found in Europe;
- The Ministry of Railways is placing a high priority on improving coal rail transport, but perhaps the most efficient way to improve coal transport would be to wash the coal prior to transportation. Unfortunately, pre-washing coal is problematic because water sources are generally not located near coal mines;
- Air transport in China is largely unregulated and very complicated. Foreign investment is highly regulated and airports can be opened at the discretion of local authorities.

Automobile Industry Perspective

- United States auto manufacturers doing business in China realize that there are bigger transport issues than personal mobility. Their perspective recognizes the entire transport system infrastructure and they are not focused singly on the internal combustion engine;
- The number of personal automobiles in China will not dramatically increase unless there is a dramatic increase in personal income and infrastructure development;
- Environmental issues must be addressed in a systematic fashion. Many factors beyond cars and trucks are largely responsible for current conditions;
- The use of certain technologies, such as catalytic converters, does not currently make sense in China because the Chinese still use leaded gasoline.

Financing Transport Systems in China

- Multilateral bank financing of road building in China has decreased recently. The World Bank is now holding China to more stringent technical road construction standards and is forcing them to be more responsible in their transport planning. The Asian Development Bank has decided not to spend any more money on Chinese roads until at least the year 2000;
- While China may adopt an automobile tax similar to that used in the United States, like the United States it will most likely not be used to fund the transport sector. The Chinese will probably follow the example of the United States and use this money to help them balance their budget;
- While foreign investment in air transport is discouraged, significant direct foreign investment is being

made in the automobile and road building industries; the Chinese should be concerned about the potential domestic impact of foreign interests in these industries;

- Foreign direct investment, in the automotive industry for example, can be the fastest way to bring environmental and safety improvements to China's transport system.

U.S.-PRC Cooperation on Transport Systems

- The United States should focus on local pollution and energy efficiency problems that have secondary global

impacts in order to reach its goal of reducing greenhouse gas emissions;

- Multilateral cooperation on transport systems is imperative because no single country has the perfect system or correct transport answer;
- Working with the Chinese on developing appropriate pricing systems for their toll roads may help institute a user pays principle, increase carpooling, and reduce overall automobile use.

The Chinese Political Economy and Central-Local Government Dynamics

Urban, Township and Village Air Pollution

May 7, 1997

The Chinese Political Economy and Central-Local Government Dynamics

The Chinese Governmental Structure

The Chinese governmental structure is multi-layered, with functionally defined hierarchies. At the top of this structure is the central government in Beijing. The next level down is occupied by the provinces, followed by cities and then the counties. Townships are on a level below counties, followed by villages. Everything in this system is bound by level: Beijing never directly connects with the counties, and vice versa.

Every unit in this organizational hierarchy is assigned a bureaucratic rank. A basic rule is that units of the same rank cannot issue binding orders to each other. This can be very important as, for example, ministries at the Center have the same bureaucratic rank as do provincial governors. A ministry, therefore, cannot issue a binding order to a province, (the premier, vice premiers, and commissions at the Center all out-rank provinces and thus can issue binding orders to them).

The relationship between territorial and functional levels of the government is also highly important: when analyzing the Chinese governmental structure, and how laws and regulations are enforced within the structure, it is imperative to understand the relationship between *tiao* (inter-level relations) and *kuai* (intra-level relations). This relationship will often have a significant impact on the unit of the government that has the most influence and power over a specific regulation.

Due to the structured level system, binding orders can only come from a higher ranking bureaucratic unit. For example, a Ministry cannot issue a binding order to a province, and a county cannot issue a binding or-

der to a city. Against this bureaucratic background, a basic reform deal has been struck in which each territorial level (Center, province, city, county, township) gives the level directly below it some flexibility, with the proviso that this flexibility is used effectively to increase economic output and thus maintain social and political stability. Because this is not codified in law or in the constitution, the result is ongoing bargaining over the extent and limits of this level-by-level flexibility.

Because political relationships between levels are negotiated in this system, the central government can only achieve policy enforcement when the following conditions are met:

- All of the top central party leaders agree on the policy;
- The top leaders consider the policy a priority; and,
- The results of the policy are measurable.

Chinese Enterprises

Cities, counties, townships and villages, and sometimes even provinces can have enterprises in China. These enterprises generally are not run by the private sector but by the government at the level in which they operate. To use the township level as an example, the township essentially acts like a territorial corporation overseeing the actions of a township enterprise. The township selects the leaders of the enterprise, manages its finances, and has control over many personnel decisions within the enterprise. While the daily management of business is done by the enterprise itself, the township serves as the "corporate" headquarters. The township leaders are consequently rewarded for the success of an enterprise, and therefore have a stake in ensuring that, for example, environmental concerns do

not hinder an enterprise's profitability. Due to the strong relationship between an enterprise and its local government, enterprises generally compete only with other enterprises outside of their township, village or city.

The Impact of the Chinese Governmental Structure on Environmental Enforcement

Each unit in the environmental regulatory hierarchy is subordinate to the territorial government at its own level, rather than to the environmental bureaucracy at the next higher territorial level. But, as indicated above, most territorial governments have officials that have, effectively, become entrepreneurs. As a consequence, on a systemic basis, the entrepreneurs who are government officials control the regulators.

For example, a township government controls its local Environmental Protection Bureau (EPB). The township EPB thus is not under the effective control of the EPB at the county level above it. This has created a circular system of environmental enforcement at the township and village levels which not infrequently produces a pattern such as the following:

- The EPB issues a fine against a polluting enterprise;
- The fine is paid by the enterprise to the township government; and,
- The township government provides a tax break to the polluting enterprise to offset the assessed fine.

This system renders the EPB powerless while encouraging enterprises to maximize profitability and employment at the expense of the environment.

The Potential for Progress on Environmental Issues

Not only is the political system in China negotiated, but the economy is as well. All facets of the government are enmeshed with economic goals: making money is a legitimate — and often the most important — goal. Due to this, environmental problems are often ignored or not given a high priority. For example, while agricultural development has gone up in recent years, it is still in reality given relatively low priority in the competition for funds because it does not have high economic potential.

In order for environmental progress to be made in China, new regulations must:

- Be made profitable for counties;
- Include funding mechanisms to cover front end costs of implementation;
- Sharply limit downside risks;
- Have the support of key officials and have a strategy for neutralizing skeptics; and,
- Ensure that they are given to the proper persons and

agencies to implement.

Additional Comments

- The most effective way to engage the Chinese on environmental issues is to: 1) provide them with environmental information and data; 2) allow them to analyze the data themselves; 3) create an epistemic community of scientists to work on the issue, if necessary; 4) show high level governmental support for progress on the issue; and, 5) set deadlines by which goals and objectives to address the issue should be met.

- Some of the most serious environmental problems in China are at the local level. In these situations, creating a closed, small-scale, economic system in which environmental costs can be assessed is the best way to address environmental degradation.

- The tendency for the central government to spin off state-owned enterprises (SOEs) may have economic benefits, but it works against environmental concerns; the enterprises are under less governmental control and are more apt to abuse the environment for economic profit.

- It is more beneficial to shut down an SOE than to provide money for it to be cleaned up. This money would only prop up an SOE that is a drain on the economy and, more than likely, a bad polluter.

- The approaches of enforcing environmental regulations through rules and regulations (the 'stick' approach) and market incentives (the 'carrot' approach) must be used together to be effective in China.

- There will be no solution to Chinese environmental problems without a national policy on the environment. However, there must be an effort — and incentives at the lower levels of government — to enforce environmental regulations.

Urban, Township and Village Air Pollution

Main Factors Contributing to Urban Air Pollution

- Coal use in urban areas produces 14.14 million tons of soot, 18.25 million tons of sulfur dioxide, and 11.63 million tons of industrial dust per year. This is approximately 75% of the total output of these pollutants in China.

- Automobile ownership has expanded from 710,000 automobiles in 1991 to 1,500,000 in 1995.

- The number of urban citizens has risen from 19.4% of the total population in 1980 to 28.9% in 1995.

The Results of These Factors

- Beijing, Shenyang and Xian are three of the top ten most polluted cities in the world.

- 500 major cities in China do not meet World Health Organization (WHO) air quality standards.

- Photochemical smog exists in Beijing, Shanghai, Lanzhou and Chengdu.

- Acid rain is problematic south of the Yangtze River, in the regions east of the Qinghai-Tibetan Plateau, and in the Sichuan Basin.

Efforts to Improve Urban Air Quality

Total suspended particulate (TSP) levels seem to be falling in Chinese cities, but this is mainly due to higher stacks, central heating, and the movement of coal plants to rural areas. Governmental efforts include the:

- National 9th Five Year Plan which has an environmental protection component and long term targets for the year 2010;
- 4th National Conference on Environmental Protection;
- Plan for major pollutants and emissions controls during the 9th Five-Year Plan period;
- China Trans-Century Green plan;
- New law on control of atmospheric pollution; and,

- 1 July 1997 regulation enforcing unleaded fuel use in Beijing.

A new air quality program is underway and will include weekly public announcements regarding air quality levels in urban areas.

Township and Village Air Pollution

Environmental issues in China should be examined as one part of a linked chain along with technology, energy and health. This Technology-Energy-Environment-Health chain exists at the township and village enterprise (TVE), household, and industry levels. In addition, it is important to consider Chinese environmental issues by region because environmental and economic concerns vary throughout China. Economic analyses can also be utilized to combine quantitative and qualitative methods and determine the impacts of pollution from TVEs on health.

Discussion with the Chinese Citizen Involvement in Environmental Protection Delegation from the People's Republic of China

May 7, 1997

During this special session, the working group was visited by the Chinese Citizen Involvement in Environmental Protection Delegation. The nine member delegation, comprised of representatives from Chinese academic institutions, non-governmental and quasi non-governmental organizations, and government agencies, spoke with the working group for approximately two hours on a variety of environmental topics. The following is a summary of the major themes and observations made by the delegation members.

Citizen Involvement in Environmental Protection and Environmental Awareness

Citizen Involvement in Enforcing and Developing Environmental Legislation

- While scientists and environmental experts are definitely involved and consulted by the government when developing environmental legislation, the opinions of citizens are rarely taken into consideration.
- The government relies on tips from the general public to target polluting companies and to ensure that closed-down companies do not re-open.

Citizen Involvement at the Local Level

- At the provincial level, public participation encompasses the consideration of public opinion in the implementation of NEPA policies and in monitoring pollution from industries.
- In the city of Dalian, Liaoning Province, there is a 24

hour phone hotline to receive complaints about the environment from citizens and also a radio talk show devoted to airing environmental complaints. Both the hotline and the radio show receive a high number of calls.

Environmental Awareness

Environmental awareness in China is rapidly rising due to a number of factors:

- As the income level of Chinese city dwellers rises, they are paying more attention to quality of life and environmental issues;
- Environmental problems impact the daily lives of Chinese: people want to breathe clean air and have clean and reliable sources of water;
- Campaigns through newspapers and NGOs have helped raise awareness of environmental issues;
- Environmental education programs have been especially helpful;

- Media coverage on the environment and international programs has been useful in raising awareness of global problems; and,
- Central government campaigns have been very important in creating awareness, especially in rural areas.
- There are large discrepancies regarding environmental awareness between urban and rural areas. In cities, economic improvements create a greater desire for quality of life improvements. In rural areas, people are poor and are most concerned with improving the livelihoods of their families; environmental concerns are not a top priority.
- Environmental awareness is also correlated to pollution levels: when pollution directly affects the daily lives of Chinese, awareness about these issues rise accordingly.
- NEPA is working in poor rural areas to help develop sustainable development policies which will ensure both environmental protection and economic development.
- Demonstrations and protests about environmental problems in China have occurred and have had some positive results. But, because the government generally frowns upon them, they are not given much publicity. As the environment gets worse, however, the incidence of demonstrations and protests will probably rise.

How Environmental Laws and Policies are Formed

- Many environmental laws and policies in China are formed with the advice of scientists, scholars, and even NGOs, who are given preliminary versions of these documents to review.
- NEPA is active in promotional activities on the environment, and provides the State Council with environmental reports and findings. These actions often bring environmental problems to the attention of the State Council.

How Environmental Laws and Policies are Enforced

- The State Council only gets involved in very serious environmental problems that are politically difficult to ignore. Less critical problems have a more vague process for being addressed. The role of NGOs in this arena is weak: there is no set process for their voices to be heard.
- China is taking pollution issues very seriously and has already closed down 62,000 polluting industries. The central government has recently targeted small-scale pulp factories for their high levels of pollution.
- The effectiveness of laws has recently been measured by a three year project entitled, "Chinese Environmental Central Work." The data for this project has been collected but a report has not yet been issued.

- In the past, environmental impact assessments were only done on projects. However, assessments are now taking a more strategic approach and are being implemented at the policy level. Just recently, the amended water pollution act added a mechanism by which public opinion could be included in policy decisions through systematic questionnaires.
- Lawmakers have recently drafted an amendment to the criminal law which would add environmental destruction as a punishable crime. This law still must be deliberated upon and passed by the National People's Congress.

Chinese Environmental NGOs

There are two types of NGOs in China:

- Non-governmental organizations (NGOs) which are based on the American model and are completely independent of the government. NGOs in China are fairly new and are mainly trying to gain an understanding of the policies NEPA is making.
- Quasi non-governmental organizations (QUANGOs). QUANGOs have existed for a much longer period of time in China and have been influential and instrumental in developing Chinese environmental policy. They receive some funding from the government and are regularly consulted on environmental matters. These groups are generally not grassroots-based but have been formed at the governmental level.

The Chinese Society for Environmental Sciences

The Chinese Society for Environmental Sciences (CSES) is a classic example of how a QUANGO is formed in China. CSES was established in 1979 just as environmental awareness was emerging in China. This new environmental movement was led by scientists and scholars who banded together to create CSES. CSES was opened by members within the State Council and still receives some government funding. One of CSES's first accomplishments was to call for the creation of a government agency to address environmental issues. This effort eventually led to the creation of NEPA. CSES is now consulted on environmental laws and has convinced the government to sponsor numerous environmental conferences.

An Example of Environmental Enforcement: Pulp Factories

The Initial Problem

- In general, the government has taken the approach of closing down all industries which fall under a specific manufacturing level, as opposed to focusing on specific companies that are very bad polluters. For example, the government recently shut down all pulp factories with an annual production of less than 17,000 pounds. It was determined that technological solutions

to the pollution problems of these companies were not economically feasible, so the government simply closed them.

- This decision was made by the State Council in July 1996 and was enforced through government channels, mainly at the provincial level.
- The pulp factory issue was acted upon by the central government due to the significance of the impact these industries were having on the environment. The issue came to the attention of the central party through the personal experiences of provincial leaders.
- Some factories are consolidating to avoid the new regulations while others are re-opening after their initial shut-down. The government is relying on citizens to report factories which are illegally being re-opened.

Secondary Impacts as a Result of the Solution

- A secondary impact of these factories being closed is

that there is now no use for rice crop wastes. Many Chinese farmers would appreciate U.S. technological assistance and training on how to best utilize these wastes. However, the best solution to this problem may be methodological and not technological: by simply using these crop wastes as organic fertilizer, these farmers could both vastly improve their soils and reduce water contamination due to chemical fertilizers.

- China is already experiencing the downstream impacts of high fertilizer use. China is working hard on eco-agriculture and has implemented successful models, but economic return from eco-agriculture is not very high.
- The problem with the methodological solution is that Chinese farms are usually very small and farmers are conscious of their costs. Chemical fertilizers are cheap, easy to use and have high short-term returns.

Discussion with Qu Geping

May 19, 1997

During this special session, the working group was visited by Professor Qu Geping, Chairman, Committee on Environmental Protection and Natural Resources Conservation, National People's Congress, and former Administrator, National Environmental Protection Agency (NEPA). Professor Qu answered questions on a variety of topics regarding environmental issues in China and U.S.-China relations. The following is a summary of Professor Qu's remarks.

The Committee on Environmental Protection and Natural Resources Conservation

Since its establishment in 1993, the Committee on Environmental Protection and Natural Resources Conservation (Committee) of the National People's Congress (NPC) has focused on two major tasks: 1) creating and reforming environmental legislation; and 2) enforcing new and existing legislation. In the past four years, the Committee has passed or amended laws in four areas: air, water, noise and solid waste. A key challenge to the Committee has been to evaluate how environmental laws will work under the new economy. To learn more about this process, the Committee is examining the experiences and lawmaking procedures of the United States and other developed countries.

To address enforcement issues, the Committee undertook an extensive review process — the largest of its kind ever performed by the NPC. This survey looked at the implementation of environmental legislation at the provincial level and also examined rural areas to assess implementation among the poor. In addition, the Committee helped set up hotlines in cities for people to call and talk about environmental problems. This effort raised environmental awareness among both citizens and lawmakers.

The Committee also initiated a plan entitled the Transcentury Chinese Environmental Tour. This plan uses the media to expose polluters and has successfully brought attention to the serious environmental problems of the Huai River. The plan has also raised general public awareness of environmental issues and even encouraged government officials to take notice of environmental problems.

In the past four years, the Committee has done a great deal to establish a democratic and legislative process in China, and has been effective in raising public awareness about environmental issues.

The Impact of Public Opinion

Through the Transcentury Chinese Environmental Tour, the government has incorporated public opinion at the provincial and city level into the decision-making process. Strong opinion at the local level can also push the central government to take action on environmental issues.

The Possibility of an Energy Efficiency Law

While the Committee and NEPA have been working on the development of an energy efficiency law, this goal has not yet been reached. The energy effi-

ciency law is necessary to promote economic growth, but it is somewhat unpopular because it will force the closure of a number of factories.

Management of Water Resources

There are areas of China that are facing severe water scarcity. The Yellow River, for example, is completely dry at its lower reaches during certain months of the year. This problem is more one of management than of drought; the Committee is looking to revise the current water law to incorporate water management policies. The Chinese water problem is due mostly to distribution: water resources in China rank sixth in the world. New water diversion projects are underway and the Chinese are studying the watershed management plans of the Thames River in England and the Tennessee Valley.

Watershed management can also solve trans-provincial pollution problems. NEPA has worked on this problem by forcing provinces with high levels of water-born pollution to treat water flowing downstream at the provincial border.

The greatest problem facing watershed management plans in China is simply changing people's view of water as a resource. At present, if water is available it is simply used: both Chinese citizens and government officials are lacking an overall perspective on how water as a whole should be managed.

The New Law on Public Announcement of Pollution Levels

The decision to announce environmental pollution data to the public was made approximately two months ago by the State Environmental Protection Commission of the State Council. If implemented, this decision will go a long way towards raising environmental awareness and helping curb environmental degradation. It is currently unclear how this information will be distributed; implementation will be difficult because many cities do not want to make pollution data public. However, since this decision was made by the State Council, they are required to abide by it.

The Cost of Environmental Pollution

The following comments were given in response to a question about the validity of World Bank figures which estimate the cost of environmental pollution in China to be approximately 6% of GDP:

The World Bank knows China very well, and if they state that the cost of environmental pollution in China is 6% of annual GDP, this figure should be trusted. Many Chinese policies, including pricing policies, are first proposed by the World Bank and then accepted by the central government. While some Chinese Ministries do not accept the World Bank's figures, they are

generally very reliable.

U.S.-China Cooperation on Energy Issues

Perhaps the most important area in which China can benefit from U.S. assistance on environmental issues is coal technology. The Chinese need more innovative coal burning technology to increase efficiency and decrease emissions. While the United States has more advanced coal technology, the two countries need to move away from dialogue and towards action and collaboration.

In response to Professor Qu's comments, a working group member offered the following observation:

In two weeks, the Department of Energy will be hosting the first meeting under the new Environmental Forum between the United States and China. The two countries already have agreements on coal combustion, but lack similar efforts on natural gas development. The best technology for natural gas exploration and development is not owned by the U.S. government but by U.S. companies who feel that the exploration regime in China is unattractive. The U.S. government has little leverage to convince these companies to invest in China: the appropriate technology will only be transferred if the prospects for these companies are made more attractive.

The problem with natural gas exploration in China is that reserves are low. Some natural gas beds have recently been discovered in Shanxi and the government is building a pipeline that will bring natural gas from this province to Beijing in approximately two months. However, there is not much gas in these reserves and their overall impact on energy use will be very low.

Chinese Activities on Climate Change Issues

Climate change is a very important issue to the Chinese government. However, for China and other developing countries to make significant progress on climate change issues, developed countries will need to provide the necessary funding and technologies.

Chinese companies have been asked by the government to reduce their SO₂ and CO₂ emissions, and these companies will be forced to abide by this request or face closure when China joins the WTO. China has also recently passed a coal law and an air pollution law to regulate CO₂ emissions. Small scale power plants have been closed due to their inefficiency in relation to emissions levels and screening and washing of coal has been encouraged in the new laws.

In general, China is doing more than any other developing country to reduce greenhouse gas emissions. The key to any true progress, however, is financing assistance from developed countries and facilitating the transfer of new technologies.

Bilateral Relations on the Environment: Successes and Failures from the U.S. and Abroad

June 4, 1997

European Union-PRC Bilateral Relations on the Environment

The European Union's Efforts in China

The European Union (EU) lacks extensive bilateral relations with China on environmental matters: member states have traditionally initiated their own agreements with China, and the EU as a whole is just beginning to undertake independent efforts with the Chinese. The current consensus in the EU is that it has much to learn from Japan and the United States regarding bilateral relations with the Chinese.

Despite European intentions to build an environmental profile comparable to those of the United States and Japan, the EU generally feels that its geographical distance from China gives it less of a natural connection with China. The Europeans, however, recognize the potential of China's markets and are increasingly interested in improving relations with the Chinese and establishing new trade in a variety of areas.

The goal of most European Community (EC) projects in China is technology sales and spin-offs for European companies. The Europeans tend to place a greater emphasis on projects that will have a sizable impact on trade with China, or that will contribute to EU dominance of a sector of the market or geographical region. This emphasis on trade has created an interesting dichotomy for the Europeans: the EC is, in essence, competing with its own member states for business in China, causing many member states to be hesitant in their support of EC efforts.

The EC has targeted three issue areas for projects on the environment in China:

- **The Brown Environment (urban pollution).** Many European countries have experience with this issue and see it as an area in which they can provide specialized knowledge and technology;
- **Energy Efficiency and Clean Technology.** By the year 2020, Europe will receive 70% of its energy from foreign sources. European interest in China on energy efficiency is seen largely as a way for the Europeans to reduce future emissions and to create potential cost savings for themselves;
- **Soil Conservation and Poverty Alleviation.** This has been given less importance but some new projects are focusing on this area.

The EC has several Directorate Generals (DGs) involved in environmental affairs:

- DGI — External Affairs
- DGIII — Industrial
- DGXI — Environment
- DGXVI — Energy

Both DGI and DGXI began working on environmental matters in China in 1985. Yet it is only in the last two years that the two Directorate Generals began coordinating their efforts in China. DGXVI began working in China at an earlier date and still maintains separate plans and objectives. DGXI holds meetings every six months on the Chinese environment and all member states — with the exception of Greece — have attended these meetings, demonstrating the interest of member states in environmental efforts in China.

Efforts of EU Member States in China

Most member states have their own relations regarding the environment with China:

- **Germany** is the largest EU player on environmental issues in China, focusing mainly on water pollution, the brown environment, carbon dioxide, coal technology and energy efficiency. The Germans have concentrated on the central and coastal regions of China (specifically in Shandong, Tianjin, and Beijing). Germany has provided a significant amount of funding for afforestation projects and modest sums for biodiversity efforts in Hainan and Yunnan provinces. The Germans are also planning projects to address global environmental problems, including ozone layer protection, carbon dioxide reduction, and energy efficiency, with the ultimate objective of sparking technology sales. The German finance company, DEG, provides financial assistance to promote German technology in China.
- **The United Kingdom** is a smaller player in China that deals mostly in brown environment, water, energy efficiency and transportation projects. Over 45% of British projects in China are environmental in nature and many of these are operated in conjunction with the World Bank. The UK has chosen to focus on projects in Shanghai, Jiangsu, Tianjin, Beijing, and Guangdong.
- **France's** activities on the environment in China are relatively small and focus mainly on research training and the environmental applications of biotechnology.
- **Italy** would like to become more involved in Chinese markets and environmental assistance but, so far, has

limited its efforts in China.

- **The Netherlands** offers training in clean production efforts in China.
- **Belgium** is involved in university training projects in Liaoning.
- **Denmark, Spain, and Sweden** are all increasing their efforts in China.

EC-PRC Bilateral Relations on the Environment

In its efforts to establish bilateral relations on the environment with China, the EC has dealt mainly with the State Science and Technology Commission (SSTC). Despite efforts by the Europeans to include the National Environmental Protection Agency (NEPA) in discussions of environmental matters, the SSTC has generally kept NEPA out of negotiations with the EC. In 1995, the EC and China created the EC-China Environmental Management Cooperation Program which has provided over 13 million ecu [the currency of the EU] for technical training in environmental fields. In addition, the Administrative Center for China's Agenda 21 (ACCA21) has partnerships with France and Norway. Germany will soon be involved in a similar partnership. The China International Training Center for Sustainable Development also works closely with ACCA21 and will be a major player in EC training projects.

Another successful EC program in Asia is the Regional Institute of Environmental Technology (RIET). RIET is an EC-Singapore partnership that was established in 1993 to facilitate the transfer of environmental technology to Asia. RIET will soon be launching the "Asia Eco-Best" program to further promote EC environmental technology throughout Asia. This program will be partially supported with EU funding for the next 5 years.

The EC has initiated three main projects on the environment in China:

- The first project started was the EC-China Environmental Management Cooperation Programme to improve expertise and training in industry and to find outlets for European technology. Most training is to be done in Beijing.
- In Southern Yunnan, the EC has established a project to study soil erosion and poverty alleviation. The EC has approved a pilot phase for this project and has awarded one million ecu in initial funding. The project has developed suggestions for watershed management, water management and social forestry projects.
- The EU is launching the Liaoning Environmental Integrated Project, which will focus on: 1) the development of urban environmental planning and management; 2) the promotion of environmental awareness, cleaner production, waste recycling, and energy efficiency; 3) Liao River basin pollution control; and, 4)

support for economic and social restructuring in five municipalities. The EU is currently talking with the World Bank and U.S. based international banks in the hope that they will help finance this project.

Japan-PRC Bilateral Relations on the Environment

Among non-communist countries, Japan is the oldest aid donor to China and was the first to re-establish relations with the Chinese after the Tiananmen Square demonstrations. Despite a recent suspension of aid due to protests over nuclear testing, China is once again a main recipient of Japanese development aid, with environmental aid becoming an increasingly important component of Japan's assistance package.

Beginning in the 1960's with oil and offshore drilling development, energy sector development has comprised of over 70% of Japanese aid to China. Environmental aid to China, though, is a new concept in Japan: prior to 1987, Japan did not offer non-concessional environmental loans to China. However, through the efforts of the Ministry of Foreign Affairs (MoFA) and the Ministry of International Trade and Industry (MITI), environmental aid has become one of the three pillars of Japanese development assistance.

Japanese interest in environmental aid to China is a result of four factors:

- The power of the Chinese economy and a desire to create a market for Japanese technologies;
- Concerns about transboundary environmental issues such as acid rain and global climate change;
- An attempt by Japan to improve its international role on environment and development issues, and to improve its bilateral relations with China; and,
- Japanese concern about its own energy security and dependence on foreign energy sources. Efforts to assist China with energy development can be seen as a way for Japan to address their own energy concerns.

Development aid from Japan is controlled by the Ministry of Foreign Affairs (MoFA), the Ministry of International Trade and Industry (MITI), the Ministry of Finance (MFA), and the Economic Planning Agency. The Environment Agency has no jurisdiction over development aid. Since the late 1980s, there have been numerous institutional changes in Japan in order to control the adverse environmental impacts of development assistance. The MoFA has published environmental guidelines for development projects, and an Official Development Assistance Charter, which includes environmental protection as one of its principle goals, was formulated in 1993.

In addition to environmental programs that go through traditional aid channels, MITI established a Green Aid program. China is a main recipient of Green

Aid, which is designed to promote the spread of alternative energy sources and energy efficiency. Green Aid programs also provide training on environmental technologies and aim to create policy dialogues on energy and environment issues. Under this program, MITI created the Center for Energy and Environmental Technology in Beijing in 1996.

The Green Aid program has focused on a variety of areas, including:

- Air pollution surveys;
- Wastewater treatment and reutilization;
- Energy efficiency in iron works and coal boilers;
- Emissions reductions to meet Agenda 21 requirements; and,
- Desulfurization projects which capitalize on Japanese technology in this area.

In addition to Green Aid, the Environment Agency is working on acid rain and greenhouse gas monitoring with China and has promoted local level projects such as the partnering of cities. Japanese NGOs are also showing growing interest in working with Chinese counterparts on environmental issues.

Additional Comments on Bilateral Environmental Relations with China

Incentives for Technology Transfer to China

- The Japanese offer favorable loan packages as technology transfer incentives. A high priority is placed on demonstration projects, and sites are often visited by official and non-official delegations.
- Japan works with its industrial counterparts to assess the proper technological solution to their problems. The Japanese are heavily involved in the initial project assessment phase.
- In the European Union, member states offer soft loans as an incentive to technology transfer. The lack of incentives offered at the EC level is due to the fact that the EC banking system is not firmly established enough to offer economic incentives.

Japanese Demonstration Projects in China

• MITI has initiated 20 demonstration projects in China. Ten of these projects are for cleaner coal burning, energy efficiency and desulfurization. These projects allow many companies — and especially those with desulfurization technology — to be involved in Chinese technology development and to keep staff on site to train Chinese technicians. The Japanese have taken a very long term view of the Chinese market: they are willing to fund stand-alone projects with no patent exchange in order to introduce Japanese technology to

China. Many of these technologies are re-engineered to be less costly for Chinese markets.

- Demonstration projects in China are currently suffering because the Chinese central government terminated funding grants to local governments in 1994. Financing difficulties at the local level have caused many of these projects to be delayed.
- With an eye towards the future, the Japanese view these projects as a way to learn more about Chinese manufacturing capacity, bureaucracy, and the Chinese labor force.

General comments

- Japan is the only G-7 country that has no formal environmental assessment process; thus, development aid has generally not been subject to environmental criteria. Most environmental assessments of development projects have taken the form of end-of-pipe adjustments.
- While Indonesia has recently become the largest recipient of Japanese development aid, China still receives a large portion of Japanese aid and the two recipients often switch places between the first and second slot. Japan's interest in Indonesia is based largely on its strong petroleum industry.
- There are a lack of environmental regimes in Asia to deal with transboundary issues such as fisheries and marine pollution. Some progress is being made with acid rain, but little attention is given to transboundary water issues.
- Even though China has turned down all Joint Implementation/Activities Implemented Jointly (JI/AIJ) projects and funding for political reasons, the Japanese have funded \$30 million in Chinese iron works pilot projects as a test to learn about the JI process and the means by which it can turn Green Aid projects into JI projects.
- Japanese capacity building in China exists in the form of energy projects. Some of this capacity building is accomplished through open programs such as export credits, while other capacity building is achieved through directed programs such as Green Aid, which receives its funding from domestic energy taxes.
- The driver of environmental change in China will be policy and not technology. The Chinese need to make political, legal and institutional changes before technology can have an impact. The first step taken by the Chinese needs to be education: progress on environmental issues will be achieved only after basic needs are met and the general public becomes knowledgeable about environmental issues.
- A mechanism to encourage environmental change should be standardized environmental criteria which export credit agencies can follow. These standards would help create an incentive for developing coun-

tries to make costly improvements that benefit the environment.

- NGOs can play an important role by simply being the vehicle that brings different governments, agencies, and interest groups together. The ability of NGOs to act as catalysts for policy change should not be underestimated.

U.S. Bilateral Relations on the Environment

While the State Department has recently made progress in establishing bilateral relations on the environment with a number of developing countries, these relations have brought certain issues to the fore. Key issues of concern include: 1) selecting which countries to engage on environmental issues; 2) determining how environmental concerns should be incorporated into general bilateral relations; and, 3) balancing the need for development and environmental aid to these countries while still encouraging them to abide by international environmental guidelines and agreements.

In selecting which countries to engage on environmental issues, the State Department has focused its diplomatic environmental efforts on pivotal players in the global environment: this category includes countries whose actions will have a major impact on global fisheries, global climate change or ozone depletion. Countries such as China, India, Russia and Brazil are included in this category. In an effort to engage these countries on environmental issues, the State Department has developed common agendas on the environment. However, there is an inherent strain within these fora: it is often unclear to both the United States and the country involved whether the U.S. goal is to assist the country in their development, or to try and steer them towards adhering to international conventions on the environment and taking a more sustainable approach to their development.

Environmental issues also tend to become linked with overall bilateral relations. This has recently occurred through the Gore commissions (Gore and Chernomyrdin, for example). In a majority of these commissions, an environmental subcommittee is created underneath the umbrella of the bilateral forum. A result of this connection is that progress on environmental issues is often seen within the context of furthering other bilateral goals.

The common agenda framework is not only limited to developing countries, but has been pursued with the Japanese and European Union, as well. These fora place an emphasis on taking a multilateral approach to global environmental concerns. The Japanese MoFA and the State Department chair the U.S.-Japan common agenda, which meets regularly to discuss how the United States and Japan can work jointly to solve environmental problems. The United States has a similar common agenda with the EU through DGXI. While much of the focus of this group has been on differences

between the environmental priorities of the United States and the European Union, it has recently begun to look at how the two countries can coordinate their efforts on the environment to help solve environmental degradation in the Newly Independent States, Central Europe (especially Poland, Hungary and the Czech Republic), and Asia.

The most important lesson learned from past bilateral efforts on the environment is that these interactions often create a dynamic in which the U.S. raises concerns about global issues yet sometimes lacks the money to fund development projects to solve domestic environmental concerns in the country with which it is engaged. This situation will remain the same during bilateral relations on the environment with China. The main difference between China and other countries, however, is that China will soon become the major player on global environmental issues and it is in the best interest of the United States to work with the Chinese and to ensure that they fill this role in a responsible manner.

Hydroelectricity and Nuclear Energy in China

Summary of Working Group Discussion on Energy Issues

July 2, 1997

Hydroelectricity in China

Background on China's Hydroelectric Power

The total installed capacity of China's hydroelectric power, as of the end of 1995, was 220 gigawatts (GW) per year, generating over 1000 kilowatt (KW) hours of energy. Between 1995 and 2000, newly commissioned hydroelectric capacities are expected to be between 17-18 GW per year. By 2000, hydroelectric power will probably account for 23% of China's generating capacity and 15% of its annual electricity generation. This percentage should remain static until 2003, when the Three Gorges Project begins power generation.

Of China's four major power networks, the Central China Power Network receives the highest percentage (31%) of its electricity generation from hydroelectricity, while the East and North China Power Networks have a relatively low share of hydroelectric power generation. The Northeast Power Network has a slightly higher mix of hydro power than the aforementioned East and North Power Networks, but this amount is decreasing.

Fifty percent of Chinese hydroelectric power resources are in the Yangtze River basin. The second largest resources are in Tibet, but these are very remote from load centers and are unlikely to be significantly developed in the medium term. The next largest resources are in Yunnan province, accounting for 10 percent of energy potential, most of which is in the Lancang catchment (Chinese name for the Mekong River). The Yellow (Huanghe) and Pearl (Zhujiang) each account for about six percent of resources. In the former case, the projects are largely developed for irrigation and flood control, with power considered a secondary benefit. In the latter case, projects are developed for power but multi-purpose benefits are still very substantial.

There are about twenty large hydro projects currently underway in China. When completed, these projects will add approximately 8,000 megawatts (MW) of electricity to China's total electrical generation.

Impediments to Hydroelectric Development in China

The main impediment to China's hydroelectric development is a lack of funds. This problem has two root causes: 1) the Three Gorges Project is using the majority of central government allocated hydroelectric development funds; and 2) the Chinese prefer to use domestic funds to pay for local costs and foreign funds

to pay for foreign costs in their development projects. Approximately 70% of civil costs for Chinese hydro projects are local costs, creating a situation in which a lack of domestic funds can halt a project.

Funding shortages should be partially remedied soon when recently constructed hydro projects begin to turn a profit, which can then be fed into new hydro development. Additionally, provinces have begun sharing the costs of a project based on the percentage of power they will receive from it. However, this model has achieved only limited success because inland provinces — which have the highest potential for hydro development — do not have the money to pay for their share of development. At the same time, they are hesitant to let other provinces develop their water resources because they feel ownership over the energy which it will produce. Currently, there is no royalty model which would provide compensation to inland provinces for use of their water resource by a coastal province.

Social and Environmental Concerns of Hydro Projects

From a World Bank perspective, China's recent hydroelectric power development has been very successful; China's resettlement policies are the best in the world. These resettlement policies were developed in the 1980s, and were probably about 2 to 3 years ahead of the development of remarkably similar policies by the World Bank. The 'development based' policies have been designed by the Chinese in such a manner that resettlement planning and implementation must provide a source of future income for all resettlers as well as improved housing and infrastructure.

On environmental issues, the Chinese were also slightly ahead of the World Bank in the early 1980s and the rigor of their environmental work has continued to improve since then. Recent EIAs of dam and multi-purpose projects have been very thorough and are generally of similar standards to those prepared in developed countries.

Chinese Resettlement Policies

- Chinese resettlement policies have been successful and have incorporated a participatory process. The initial conceptual resettlement plan is usually developed by a regional design institute, based on the remaining land resources after inundation. This plan is designed mainly to establish resettlement feasibility and likely costs. The completed plan is followed by an

intensive compensation negotiation process involving provinces, counties, and townships and villages, all of which are intent on obtaining the maximum benefit from the project. Compensation for infrastructure, generally at replacement cost for considerably improved facilities, is usually handled by the province or county managing infrastructure construction. Compensation for land is given to the village and compensation for assets is given directly to individuals. Both the village and the individuals have the ability to decide how they want to spend their money. In principle, village funds are shared among individuals, but in practice a variety of income generation projects emerge ranging from individually managed enterprises or land plots to enterprises owned by the entire village or township. Each resettlement project is subject to appraisal by township and counties as to its likely financial viability and sustainability.

- The World Bank has served as a positive model for Chinese resettlement policies, yet it has never influenced the amount of money spent on resettlement for a project. At the time of the Shuikou project in 1997, the resettlement budget amounted to \$2000 per head. With growing economic development, and therefore increased compensation, budgets have gradually increased. The Three Gorges resettlement budget amounts to about \$5000 per head and will undoubtedly increase during implementation.
- Individuals affected as a result of resettlement are incorporated into the decision making processes, and any dissatisfaction by individuals with their packages is resolved through a conflict resolution process provided by law.
- The type of corruption that one would expect to find with resettlement policies, especially in regard to funding distribution, does not seem to be occurring.

Additional Comments on Hydroelectric Power

- Transmission costs can be substantial for hydroelectric projects, adding up to 15% to the cost of a project. For the Three Gorges Project, transmission costs will equal approximately \$7 million. These transmission costs can make smaller hydro projects unfeasible; transmission costs for nuclear and coal projects generally amount to approximately 5% of the total project costs.
- Transmission losses in China are fairly low, averaging about 12% throughout the entire country. For the Three Gorges Project, transmission losses will be approximately 2%, which is very low for new hydro projects.
- A good example of how money from existing dams can be used to finance new projects can be seen through the Ertan dam project. Ertan is owned by a limited liability company (LLC), which pays dividends to its shareholders from its profits. These dividends, and the profit from Ertan, can be reinvested in new dam

projects.

- All indicators suggest that the Three Gorges Project will be completed on time or with a year delay at most. The first stage diversion, due to occur towards the end of 1997, will occur on time.

Nuclear Power in China

China's Current and Future Nuclear Plans

There are three key factors that require China to expand its nuclear generating capacity: 1) the large geographic distances between energy resource deposits and the centers of energy demand; 2) the expanding electric energy needs of China's fast growing economy and population; and, 3) the environmental and human health costs that come from continued heavy reliance on coal. China's current energy mix presents major problems:

- Seventy-seven percent of China's coal comes from the interior of the country or the north, tying up rail transportation throughout the country;
- Hydroelectricity is mainly concentrated in the western half of the country, far from areas of high energy demand;
- China is the sixth largest producer of oil in the world, but is a net oil importer. By 2010, China will import 2 million barrels of oil a day, which is equal to the daily oil output of Kuwait;
- China's natural gas potential is unknown, but even if significant resources are found, expensive pipelines and distribution systems will need to be created; and,
- Biomass is the main source of energy for 90-100 million Chinese.

For these reasons, nuclear energy is a viable alternative for electric generation in China.

Installed electric generation capacity in China was 215 GW in 1995; it is planned to be 300 GW by 2010 and 553 GW by 2020. At least 17 GW of new capacity must be added each year to meet these goals. In comparison, the United States has an installed generating capacity of 706 GW and added only 5.7 GW in 1995, some of which was equipment to replace old generating units.

Nuclear energy currently accounts for 1.3% of the total Chinese annual energy output. This amount is expected to rise to 3.6% by 2010. China's nuclear capacity will increase to 20 MW per year by 2010, 50 MW by 2020, and 150 MW by 2050.

There are three nuclear plants currently operating in China, with eight more plants under construction. Of the three existing plants, one is a 300 MW plant located in Qinshan (south of Shanghai) and completed in 1991. The other two are French designed 906 MW plants completed in 1993 and 1994 and located in Daya

Bay. Hong Kong receives 70% of its electricity from these two plants.

The Chinese are currently constructing eight new nuclear plants:

- Two 600 MW plants of Chinese design will be located in Qinshan;
- Two Canadian Candu 740 MW plants will also be built at Qinshan;
- Two 985 MW plants of French design are being constructed in Lingao, near the Daya Bay plants; and,
- Two 1000 MW Russian VVER plants will be built at Lianyungang in Jiangsu province, north of Shanghai.

In order for the Chinese to reach their 2010 nuclear goals, they will need to add 11.2 new GW of nuclear energy at an approximate cost of \$1 billion per GW. Current Chinese nuclear plants range in size from 600 MW to 1000 MW. In comparison, the United States generates approximately 100 GW of power from 109 nuclear plants. The United States has no current plans for new nuclear plants.

Nuclear Safety

The United States and China have been cooperating on nuclear safety and regulatory matters since 1981. But with nuclear plants coming from France, Canada and Russia, it is to these countries that China now turns for assistance. There are three major nuclear concerns regarding China's program:

- A large variety of nuclear plant designs creates management difficulties. The Chinese need to standardize their plant designs, and are likely to choose a French design. U.S. plant designs are the safest, but U.S. manufacturers are currently restricted from selling nuclear technology to China;
- The disposal of nuclear waste. Nuclear waste in China, however, is relatively minimal, equaling only 20 tons per reactor each year; and,
- Nonproliferation concerns have been the main factor in restricting U.S. nuclear trade with China. The Chinese developed a nuclear bomb in 1964 and signed the Non-Proliferation Treaty (NPT) in 1992. However, the Chinese have supplied Iran and Pakistan with nuclear technology.

One of the major problems facing the implementation of nonproliferation commitments by China is the lack of an adequate export control regime. The Chinese are currently developing such a regime which will go a long way towards assuring the United States government that they will be able to enforce their nuclear non-proliferation obligations.

Prospects for Civilian Nuclear Trade with China

In 1985, President Ronald Reagan signed and Congress approved a joint resolution with the Chinese to open trade in nuclear technology. However, Congress attached non-proliferation conditions to this resolution. This clause stated that before United States trade restrictions could be lifted, the President must certify to Congress that China is not assisting other nations to acquire nuclear weapons. After 1989, additional conditions were added, including an enhanced prohibition on nuclear cooperation and a requirement that the President assure Congress that China is progressing on political reforms.

In order to open trade in civilian nuclear technology with China, the President must: 1) issue four certifications; 2) write a report to Congress; and 3) either issue a statement on China's progress on political reforms or issue a National Interest Waiver for this provision. Congress would have thirty session days to oppose the President's decision, but the President could veto a legislative attempt to maintain restrictions.

The Chinese are currently making progress with their export controls and there is hope that President Clinton will be able to make the certifications that will open nuclear trade with China during Jiang Zemin's visit to the United States later this year.

Summary of Working Group Discussion on Energy Issues

A Government Perspective

There are four general points that stand out from working group discussion:

- **Commitment to Chinese Economic Growth.** This is an issue of credibility with China. The United States needs to assist the Chinese on environmental issues and not attack them: the United States should support Chinese economic development and prove that environmental protection can only be achieved through economic growth. Increased governmental funding and support for environmental investment in China would help accomplish this goal.
- **Coherence of Policy.** This is more of an issue of credibility within the United States. The Clinton Administration needs to clearly articulate an overall U.S. policy towards China: the lack of such of a policy not only impacts government agencies working with their Chinese counterparts, but also U.S. private industry attempting to do business in China. The United States also must stop criticizing every Chinese energy source and instead work with the Chinese to create a credible alternative energy framework which meets their energy needs and economic goals. With a concerted effort in this direction, the United States may very well have an impact on Chinese energy development in the 10th Five Year Plan.

• **Levels of Engagement.** The United States may want to look at new levels of engagement, such as state-province and city-to-city relationships, and multilateral or trilateral engagement. The National Governor's Association or National Conference of Mayors could help develop state-province or city-to-city relationships, and the relationship between the Sigur Center for Asian Studies, the Center for Area Studies of Keio University and the China Institute of Contemporary Relations could provide a strong example of a successful trilateral relationship.

• **Roles of Players.** While the Federal government, NGOs, universities and private business each has a distinct role to play in U.S.-China relations, synergies can clearly be achieved by working together. If this does not occur, we face a dilution of efforts. An example of the usefulness of a coordinated effort can be seen through the accomplishments of the U.S.-Chongqing Task Force on Energy/Environmental Technology Cooperation.

An NGO Perspective

When working with China, it is important for the United States to know exactly what it wants out of the relationship but be prepared to engage on a level that the Chinese feel is important to them; this holds true for NGOs as well. The role of the NGO in China is somewhat unclear. One purpose of NGOs is to initiate and facilitate change, yet this is a new approach for the Chinese culture. It is therefore important for NGOs to proceed cautiously in China, and to work with — not against — the Chinese.

An important way that government, private businesses, and NGOs can work together is to stimulate G-7 interest in environmentally sustainable investment in China. Harmonized standards for bilateral loan guarantees, insurance and investment agencies will facilitate appropriate investment and technology transfer, and will both help China's economic growth and protect its environment.

Domestically, NGOs need to accept that Congress often has conflicting agendas and will constantly change its course in terms of its policies on U.S.-China relations. NGOs need to ensure that their perspective is heard, and be clear about what they hope to gain from engagement with China.

NGOs can also help facilitate communication between different levels of engagement, both domestically and abroad.

A Business Perspective

The United States government should communicate to the Chinese the many benefits of environmentally sensitive growth. The United States needs to recognize that economic growth is a necessary condition for environmental protection when dealing with China. U.S. NGOs, private businesses and government agen-

cies should also assume that there will not be a significant change in U.S. governmental financial support for environment or development projects in China, and should base their strategies on this assumption.

Another important area in which the United States can assist the Chinese is with lead gasoline phaseout and petroleum clean-up. United States policy and technical experience in these areas would be extremely valuable to the Chinese.

An additional approach would be support for energy service companies (ESCOs) that promote energy savings and conservation through private enterprise rather than the central government. These ESCOs have been both financially and environmentally successful.

Science and technology is another key area for U.S.-China cooperation: science and technology opened the door to U.S.-China relations and should still be an important player in developing mutually beneficial relationships.

The United States should address global concerns such as climate change by focusing on local environmental issues, such as energy conservation, epidemiological studies and alternative energy sources, that will have secondary impacts on the global environment. Energy conservation and air pollution reductions can also be sought by relating these issues to China's domestic public health care expenditures.

Conferences on the Environment in China

THE 1997 CHINA ENVIRONMENT FORUM

Integrating Economic Development, Social Progress, and Environmental Sustainability

November 18-21, 1997

Beijing, People's Republic of China

Sponsored by the National Environmental Protection Agency and organized by the Institute of Human Ecology and the Chinese Society of Environmental Sciences.

For more information contact: <http://www.ihei.com>

In the United States, contact: Andrew Sell, P.O. Box 4611, Charlottesville, Virginia 22905; phone: 804-963-7683, fax: 804-963-7683, e-mail: ihei@aol.com

In China, contact: Dr. Diane Chang, CITIC Building, Suite 801, 19 Jianguomenwai Avenue, Beijing 100004, People's Republic of China; phone: 86-10-6500-2255, ext. 3818, fax: 86-10-6403-0058, e-mail: dianex@public.bta.net.cn

INTERNATIONAL COOPERATION CONFERENCE ON ENVIRONMENTAL PROTECTION PROJECTS

November 20-21, 1997

Beijing, People's Republic of China

The conference will provide participants with information on priority environmental protection projects and opportunities for seeking potential funding sources, exploring cooperation patterns, and showcasing environmental technologies.

For additional information contact: Ms. Fang Li, Division of Bilateral Relations, Department of International Cooperation, National Environmental Protection Agency; phone: 86-10-66151934, fax: 86-10-66151762

SINO-SWEDISH CONFERENCE ON INDUSTRIAL WASTE WATER TREATMENT AND CLEAN TECHNOLOGIES

December 1-3, 1997

Tianjin, People's Republic of China

The conference will cover the following topics: state-of-the-art waste water treatment and clean technologies; cost-efficient solutions for Chinese water conditions; advancements in engineering and research; industrial environmental administration and management; and future cooperation possibilities with China.

For additional information contact: IVL - The Swedish Environmental Research Institute, P.O. Box 210 60, S-100 31 Stockholm, Sweden; phone: 46-8-729-1500, fax: 46-8-731-8516, SSETC@ivl.se or tepi@mail.zlnet.co.cn, Web page: <http://www.ivl.se>

INTERNATIONAL SYMPOSIUM ON GLOBAL ENVIRONMENT AND IRON AND STEEL INDUSTRY (ISES '98)

April 14-16, 1998

Beijing Continental Grand Hotel, Beijing, People's Republic of China

Organized by: the China International Culture Exchange Center, the Chinese Society for Metals, and the United Nations Environment Programme.

For additional information contact: ISES '98 Secretariat, The Chinese Society for Metals, 46 Dongsixi Dajie, Beijing 100071, People's Republic of China; phone: 86-10-65133925, fax: 86-10-65124122, email: csm@public.bta.net.cn; Web page: <http://159.226.63.200/~rxliu/csm.html>

ENVIRONMENTAL SCIENCES AND SUSTAINABLE DEVELOPMENT IN THE 21ST CENTURY

International Symposium for Celebrating the Centennial of Peking University

May 2-5, 1998

Peking University

Beijing, People's Republic of China

This conference is currently accepting papers for presentation. The themes of the symposium will include: ozone layer

protection and global environmental problems; atmospheric chemistry and physical processes; water resources and the water environment; ecology and biodiversity conservation; environmental monitoring and information acquisition; environmental management and regulations; urban and regional environmental problems; environmental pollution and control; and theory and practice of sustainable development.

For additional information contact: Zhang Shiqiu, Associate Professor, Centre for Environmental Sciences, Peking University, Beijing, 100871 People's Republic of China; phone: 86-10-62751926, fax: 86-10-62751927, email: pku100@ces.pku.edu.cn, <http://laes.ces.pku.edu.cn/>

CHINA-U.S. CONFERENCE ON THE ENVIRONMENT: BUSINESS RELATED ISSUES

May 26-29, 1998

Beijing, People's Republic of China

This conference is currently accepting papers for presentation.

For additional information contact: Global Interactions, Inc., 14 West Cheryl Drive, Phoenix, Arizona 85021; phone: 602-943-3922, fax: 602-943-4458, e-mail: global@goodnet.com, <http://www.goodnet.com/~global/ensched.htm>

INTERNATIONAL CONFERENCE ON CHINA'S ENVIRONMENT—LAW, POLICY, TECHNOLOGY AND BUSINESS

August 16-20, 1998

Beijing, People's Republic of China

This conference is sponsored by the Professional Association for China's Environment and is currently accepting papers for presentation. Topics to be discussed at the conference include: environmental laws and policies; water and wastewater industry; air pollution control and the energy industry; sustainable biodiversity and natural resources conservation; solid waste and hazardous waste treatment and management; and, China and the global environment.

For more information contact the PACE homepage at: <http://www.chinaenvironment.net/>

The Professional Association for China's Environment

The Professional Association for China's Environment (PACE) is a non-profit, non-governmental organization, focusing on China's environmental issues. The main objectives of PACE include: (1) to facilitate China-related information dissemination by publishing newsletters, journals and books in the areas of environmental policy, indicators, and technologies; (2) to foster information exchange and education through organizing conferences, seminars, and workshops; (3) to develop and conduct educational and technical training programs for Chinese policy makers and professionals in the public and private sectors; and, (4) to conduct research on China's environmental problems.

Begun in December 1996, PACE has quickly emerged as a worldwide professional network on China's environment. As of the end of September 1997, it had 318 members of which 47% are from universities; 17% from the private sector; 17% from governments or international organizations; 13% from research institutes; and 5% from NGOs. By region, members based in the United States account for 66%; Europe 15%; and China 14%. PACE's monthly electronic publication, the *China Environment Reporter*, can be found on the organization's web site (www.chinaenvironment.net) and has been released and distributed worldwide. PACE also maintains a listserv (pace@gmu.edu) which links environmental professionals from around the world. In August, 1998, PACE will host an international conference in Beijing on China's environment. The conference will focus on China's environmental laws and policies, its need for environmental research and technologies, and its emerging environmental markets.

Inventory of Environmental Work in China

Government Agencies

BATTELLE-AISU

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

Focus: energy efficiency, electricity

Beijing Energy Efficiency Center (BECon)

Partners: Energy Research Institute and Lawrence Berkeley National Laboratory

BECon was established in 1993 in cooperation with three organizations — Battelle, Energy Research Institute, and Lawrence Berkeley National Laboratory. Today, it has a full-time staff of twelve professionals and many consultants. BECon is undertaking a number of projects throughout China aimed at increasing efficient use of electricity in China. See also Beijing Energy Efficiency Center.

BATTELLE-AISU

Alternative Electric Power Futures for China:
An Analysis of Economic and Environmental Costs

Focus: energy, electricity

Partners: Beijing Energy Efficiency Center and the Energy Research Institute of the State Planning Commission

The objective of this project is to produce an economic analysis that will estimate the least costly means of meeting China's future electricity needs. The project will be implemented jointly by Battelle and the Beijing Energy Efficiency Center. The Energy Research Institute of the State Planning Commission will play a major role in the research. A key component of the research will be determining how to internalize environmental costs for China's electricity sector.

BATTELLE-AISU

U.S.-Chongqing Cooperation in
Energy and Environment

Focus: energy, gas, electricity

Partners: Center for Strategic and International Studies, Department of Energy

At the request of the U.S.-Chongqing Task Force in Energy/Environmental Technology Cooperation, the Center for Strategic and International Studies, and the U.S. Department of Energy, Battelle has initiated a study to: (1) understand Chongqing's energy-efficiency needs; (2) identify specific opportunities for cooperation; and (3) advise U.S. businesses on commercial opportunities. The findings of the report were discussed with the Task Force in February, 1997.

DEPARTMENT OF AGRICULTURE

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

Focus: agriculture

Research Agreement: Scientific Cooperation on Agriculture

This project focuses on scientific cooperation programs in: (1) biological controls; (2) production and utilization of composts from organic by-products; (3) introduction of parasitoids in China for the control of an exotic mealybug; (4) evaluation of germplasm of the nitrogen-fixing symbiont of soybean; and, (5) nitrous oxide emissions.

DEPARTMENT OF AGRICULTURE

U.S./PRC Scientific Cooperation in Agriculture

Focus: agriculture

Partners: Ministry of Agriculture

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

**DEPARTMENT OF AGRICULTURE/AGRICULTURAL
RESEARCH SERVICE**

Web address: <http://www.ars.usda.gov/>

Focus: agriculture

Research Agreement: Biological Control

Partners: Chinese Academy of Agricultural Sciences (CAAS)

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 and rangeland and aquatic weeds to reduce pesticide inputs. The work will be performed at the joint Sino-American Biological Control Laboratory in Beijing.

**DEPARTMENT OF AGRICULTURE/FOREIGN
AGRICULTURAL SERVICE**

Web address: <http://www.fas.usda.gov/>

Focus: agriculture

Research Agreement: Agricultural Technology

This 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 exchange.

**DEPARTMENT OF AGRICULTURE/FOREIGN
AGRICULTURE SERVICE**

Research Agreement: Genetic Resource Conservation

Focus: agriculture

Partners: Chinese Academy of Agricultural Sciences (CAAS)

This 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.

DEPARTMENT OF AGRICULTURE/FORESTRY SERVICE

Web address: <http://www.fs.fed.us/>

Focus: forest health, conservation

Research Agreement: Forest Management

This 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.

DEPARTMENT OF AGRICULTURE/FORESTRY SERVICE

Cooperation Agreement: Reforestation

Focus: forest health, conservation

Cooperation for more than ten years on China's reforestation program with the establishment, monitoring and genetic screening of North American tree species plantations in China.

**DEPARTMENT OF AGRICULTURE/NATURAL RESOURCES
CONSERVATION SERVICE**

Web address: <http://www.nrcs.usda.gov/>

Focus: soil, conservation

Cooperative Agreement: Soil Stabilization

Cooperative projects to collect, evaluate and exchange tree, shrub and plant species suitable for soil stabilization, wind-breaks and erosion control to conserve and maintain valuable land areas.

**DEPARTMENT OF AGRICULTURE/NATURAL RESOURCES
CONSERVATION SERVICE**

Focus: wildlands, conservation, restoration

Research Agreement: Restoration and Conservation of
Grasslands

Partners: Chinese Academy of Agricultural Sciences (CAAS)

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.

DEPARTMENT OF COMMERCE

Focus: environment, education

Web address: <http://www.doc.gov/>

Web address: http://www.tradecompass.com/library/books/com_guide/China.toc.html

Global Observations to Benefit the
Environment (GLOBE)

Partners: Multiple

In 1995, China agreed to participate in the GLOBE program. GLOBE brings together children and young people in the collection and exchange of environmental information to improve appreciation and understanding of the environment. The U.S. company Ameritech will provide financial assistance for China to acquire the necessary infrastructure. At least four schools have already been identified by the Chinese government for participation in this program.

**DEPARTMENT OF COMMERCE/NATIONAL OCEANIC AND
ATMOSPHERIC ADMINISTRATION (NOAA)**

Focus: hazardous materials, waste

Cooperative Agreement: Hazardous Materials

Partners: Chinese Academy of Transportation Science (CATS)

NOAA/NOS (National Ocean Service of NOAA) has completed work with colleagues at the CATS in the area of Hazardous Materials Response and Assessment (HAZMAT). NOS helped develop hazardous material response contingency plans for the Guangzhou port area. The techniques and procedures for developing these contingency plans will be applied by the Chinese to other ports along the Chinese coast (Xiamen, Shanghai, Ningbo, Calian, and Tianjin).

DEPARTMENT OF COMMERCE

Focus: trade, environment, training

U.S.-China Joint Commission on Commerce (JCCT)

Partners: Chinese government and trade agencies

The JCCT is composed of four separate working groups: the Trade and Investment working group; the Business Development working group; the Commercial Law and Reform working group; and the Management Education and Training work program. Each working group meets independently with their Chinese partners to conduct training, produce demonstrations and discuss strategies.

DEPARTMENT OF COMMERCE

Focus: trade, technology transfer

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

The US&FCS staff in China offers a number of services for the Chinese market, including business counseling, export assistance, market and policy information, and introductions to Chinese government officials and other business contacts. US&FCS staff have also completed numerous market analyses on the environmental sector, and will open the Shanghai Commercial Center to support visiting U.S. businesses with a major focus on environment.

DEPARTMENT OF COMMERCE

Focus: water, climate change, flooding

Tropical Ocean Global Atmosphere Program

This project involves the sharing of environmental data resources gained from the Tropical Ocean Global Atmosphere Program.

DEPARTMENT OF COMMERCE**Focus:** training, energy, water

Cooperation Agreement: Training and Personnel Exchanges

Partners: Multiple Chinese government agencies

NOAA's capacity building efforts regarding China have been active in personnel exchange, collaborative research, and technical training with many Chinese agencies, including the State Oceanic Administration, the Chinese Meteorological Administration, the Chinese Academy of Sciences, the Ministry of Agriculture, the Ministry of Transportation, the Ministry of Water Resources, and others.

Through the U.S. Country Studies Program, NOAA has assisted China with their climate change action plan and China's Agenda 21. U.S. support for the action plan has totaled approximately \$200,000 with additional support in the form of technical assistance. NOAA is working on 10 projects in activities implemented jointly to reduce greenhouse gases in industry and to promote energy efficiency.

DEPARTMENT OF COMMERCE**Focus:** water, fisheries, marine

Cooperation Agreement: Marine and Fisheries

Cooperation in the field of marine and fishery science and technology involves many programs in four main areas: (1) oceanographic data and information exchange; (2) role of oceans in global climate change; (3) living marine resources (aquaculture and carrying capacity); and, (4) marine environmental studies. Cooperation in coastal zone management is expected to increase in 1997.

Fishery relations between the United States and China are generally positive, focusing on Pacific fisheries of mutual interest such as Alaska polluck and salmon. The United States is urging China to join the North Pacific Anadromous Fish Commission and sign/accept recently concluded international fishery agreements. A recent U.S. court decision requiring foreign commercial shrimp fleets to employ turtle excluder devices by 1 May 1996, or face an embargo of wild-caught shrimp, is a particularly sensitive issue.

DEPARTMENT OF COMMERCE**Focus:** water, hydrology

Cooperation Agreement: Hydrology

Partners: Ministry of Water Resources and the National Weather Service (NWS)

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 COMMERCE/(NOAA)**Focus:** climate, energyWeb address: <http://www.noaa.gov/>

Cooperation Agreement: Atmospheric Science

Cooperation under the bilateral atmospheric science and technology protocol includes collaboration and exchange in the following six subject areas: climate studies, mesoscale meteorology, atmospheric chemistry, satellite meteorology and meteorological satellites, training and meteorological modernization.

DEPARTMENT OF ENERGY (DOE)**Focus:** energy, coalWeb 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>

Protocol on Fossil Energy Research and Development for Cooperation on Clean Coal Technology

Partners: State Science and Technology Commission (SSTC)

DoE and SSTC launched a demonstration project using Integrated Gasification Combined Cycle Technology.

DEPARTMENT OF ENERGY

Focus: energy, air pollution, greenhouse gases

Carbon Dioxide Induced Climate Change Research

Partners: Chinese Academy of Sciences

The DoE and the Chinese Academy of Sciences established a joint research program to study possible global warming due to enhanced greenhouse effect.

DEPARTMENT OF ENERGY

Focus: energy, climate change

U.S. Country Studies Program

Partners: State Science and Technology Commission

Under the U.S. Country Studies Program (CSP), (program to help developing countries meet their commitments under the Framework Convention on Climate Change) China was awarded funding to conduct a climate change country study. In addition to funding, the U.S. CSP has arranged for over 20 U.S. experts to provide training and technical assistance to nearly 100 experts in China on climate change assessment methods. The U.S. CSP has also provided China with state-of-the-art climate change assessment tools (e.g., models, databases, handbooks, etc.). In October 1995, the U.S. CSP awarded an additional amount of money to China for the preparation of their climate change action plan. China had requested additional money for this plan. Since more money was not available, the Chinese have agreed to use the resources to prepare a strategy for mitigating greenhouse gases in the energy sector. This work is also directed by the State Science and Technology Commission and will be completed by September 1997.

DEPARTMENT OF ENERGY

Focus: energy, climate change, greenhouse gases

Protocol on Fossil Energy Research and Development for Cooperation in the Area of Regional Climate Research

Partners: China Meteorological Administration

DoE and the China Meteorological Administration are undertaking a joint study to develop regional climate models for assessing regional climate changes and impacts.

DEPARTMENT OF ENERGY

Focus: energy, coal

Protocol on Fossil and Energy Research and Development for Cooperation in Coal Preparation and Waste Steam Utilization

Partners: Ministry of Coal Industry/Central Coal Mining Research Institute

DoE and the Central Coal Mining Research Institute are working together to provide analysis on technologies for coal cleaning and waste stream recovery.

DEPARTMENT OF ENERGY

Focus: energy, coal

Protocol on Fossil Energy Research and Development for Cooperation on Coalbed Methane and Utilization

Partners: Ministry of Coal Industry

DoE and the Ministry of Coal Industry are working to develop a joint research program to utilize coalbed methane for potential electricity and district heating, while mitigating pollution.

DEPARTMENT OF ENERGY

Focus: energy, coal

Asia Pacific Economic Working Group

Partners: Multiple

The Asia Pacific Economic Cooperation (APEC) Regional Working Group, which includes the United States and China, developed clean coal and energy efficiency programs to improve environment and energy conservation.

DEPARTMENT OF ENERGY**Focus:** energy efficiency

Annex on Cooperation in 10 Areas to Promote Sustainable Development and Trade

Partners: State Planning Commission**DEPARTMENT OF ENERGY****Focus:** energy efficiency, renewable energy

Asia-Pacific Economic Cooperation (APEC) Energy Efficiency and Renewable Energy Project

This project seeks to promote sustainable development in the Asia-Pacific region. APEC distributes information on member economies' 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.

DEPARTMENT OF ENERGY**Focus:** energy efficiency, training, Agenda 21

U.S.-China Energy and Environment Center

Partners: Environmental Protection Agency, Chinese government agencies, private industry, academia

The Center is co-sponsored by the U.S. and Chinese Governments as well as industry and academia. DoE and EPA are the U.S. government sponsors. 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.

DEPARTMENT OF ENERGY**Focus:** energy, technology

U.S. Technologies for International Environmental Solutions (USTIES) Program

Partners: Environmental Protection Agency (EPA)

This program, part of the President's Environmental Technology Initiative at EPA, provides funding for competitively selected projects which apply U.S. technology solutions to international environmental problems. China was a principal focus in FY 95 funding. DoE has received funding for FY 97, 98, and 99 for additional work with China.

DEPARTMENT OF ENERGY**Focus:** energy

The Yixing Environmental Park

Partners: Department of Commerce and Environmental Protection Agency

The Departments of Energy and Commerce and EPA are working together with China to support the development of this \$2.3 billion environmental-industrial park, located in Yixing. China is seeking international partnerships to promote the development of a domestic environmental technologies industry by offering preferential treatment for firms located in the 11 square kilometer park. Incentives include lower taxes, reduced land costs, preferential housing, and a waiver of internal migration restrictions.

**DEPARTMENT OF HEALTH AND HUMAN SERVICES/
OFFICE OF PUBLIC HEALTH****Focus:** disease, healthWeb address: <http://www.hhs.gov/progorg/ophs/>

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 HEALTH AND HUMAN SERVICES/
NATIONAL CANCER INSTITUTE (NCI)**

Focus: cancer, health

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 INTERIOR/
BUREAU OF LAND MANAGEMENT (BLM)**

Focus: land use planning

Web address: <http://www.doi.gov/>

Web address: <http://www.blm.gov/>

Cooperation Agreement: Land Use Planning

Partners: State Lands Administration

BLM cooperates with the State Lands Administration of China, primarily through the exchange of delegations on land use planning and land records administration.

DEPARTMENT OF INTERIOR/BUREAU OF RECLAMATION

Focus: water resources, conservation/management

Web address: <http://www.usbr.gov/>

Memorandum of Agreement: Water

Partners: Ministry of Water Resources

The Bureau of Reclamation and the Chinese Ministry of Water Resources have a two-pronged Memorandum of Agreement (MOA): (1) the exchange of information, skills and techniques for water resources management and conservation; and, (2) the exchange of information, skills and techniques for enhancing the environment. To date, neither side has used the MOA to implement any activities.

**DEPARTMENT OF INTERIOR/
FISH AND WILDLIFE SERVICE (FWS)**

Focus: wildlife, education

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

Nature Conservation Protocol

Partners: Various Chinese government agencies

FWS administers exchanges with China under the bilateral Nature Conservation Protocol. Exchanges being carried out during 1995-1996 include environmental education and public outreach training, surveys of fauna and flora in wildlife refuges of both countries, shed monitoring in the Yangtze River, joint sea turtle beach surveys in Texas and Mexico, and cooperation on implementation of the Convention on International Trade in Endangered Species (CITES).

**DEPARTMENT OF INTERIOR/
NATIONAL BIOLOGICAL SERVICE (NBS)**

Focus: habitat, wildlife

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

Cooperation Agreement: Habitat Conservation

Partners: Fish and Wildlife Service (FWS)

NBS co-leads with FWS the U.S.-China Nature Conservation Protocol. Its 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 INTERIOR/
U.S. GEOLOGICAL SURVEY (USGS)**
Web address: <http://www.usgs.gov/>

Focus: water quality, surface water

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.

DEPARTMENT OF INTERIOR/U.S. GEOLOGICAL SURVEY

Focus: water, rivers, erosion

Research Agreement: River Erosion

Partners: Ministry of Water Resources

This agreement sponsors research on China's heavily sedimented rivers. In March 1995, five Chinese scientists from the Ministry of Water Resources visited the United States. The visit included planning sessions between the USGS and Chinese scientists to discuss ongoing activities and future plans for a joint study of sediment transport.

DEPARTMENT OF INTERIOR/U.S. GEOLOGICAL SURVEY

Focus: water, agriculture, land subsidence

Cooperative Agreement: Groundwater
Pumping Strategies

Partners: Ministry of Geology and Water Resource

A project is being developed to determine ground-water pumping strategies to reduce damage from land subsidence. Two USGS scientists propose to meet with key personnel from the Ministry of Geology and Water Resources in Beijing. The meeting will focus on funding strategies for a joint research proposal developed two years ago to study land subsidence problems in Tianjin.

DEPARTMENT OF TRANSPORTATION

Focus: transportation

Web address: <http://www.dot.gov/>

Protocol on Cooperation in Science and
Technology of Transportation

Partners: Chinese Ministry of Communication

Areas covered under this protocol, signed in 1983, include: port engineering; waterborne transportation; shipping management; highway engineering; traffic management systems; and urban transportation. Recent joint efforts have also included oil pollution at sea.

**DEPARTMENT OF TRANSPORTATION/
FEDERAL HIGHWAYS INTERNATIONAL**

Focus: transportation

Intelligence Transportation Service Project (proposed)

The Department of Transportation is planning a pilot project to use innovative traffic planning systems to reduce traffic congestion in Chinese urban areas.

ENVIRONMENTAL PROTECTION AGENCY (EPA)

Focus: air pollution, energy

Web address: <http://www.epa.gov/>

Fourier Transform Infrared Spectrometer System
(FTIR) for Monitoring Air Toxic Compound Emissions

Partners: Chinese National Environmental
Monitoring Center of NEPA

ENVIRONMENTAL PROTECTION AGENCY

Focus: air pollution, energy, fire protection

Halon Phaseout Program

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

The first project under this program trains 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. Funding has been provided from bilateral contributions to the Montreal Protocol Fund.

ENVIRONMENTAL PROTECTION AGENCY

Focus: air pollution, energy, health

Children's Lung Function Study

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

This is an epidemiological study, begun in 1988, of the effects of air pollution on children's lung function. Health surveys are sent out twice a year to children in four cities, Wuhan, Chongqing, Guangzhou, and Langzhou in China. The project yields extremely valuable data for use in U.S. standard setting, especially for particles (fine and PM10).

ENVIRONMENTAL PROTECTION AGENCY

Focus: automobiles, oil, transportation, energy

Automotive Technologies/Leaded Gasoline Phaseout

Partners: National Environmental Protection Agency

EPA supported a major conference/workshop in October 1995 in Beijing which provided recommendations to the Chinese government for inclusion in the five-year plan and related statutes on fuels (including leaded gasoline phaseout), emissions controls, and transportation planning. EPA cooperation was instrumental in China's adoption of legislation calling for the phaseout of lead in gasoline. In addition, a NEPA official spent three months at EPA, and EPA is working closely with NEPA and other organizations on implementing regulations, including training in Shanghai and Xiamen, on mobile sources air pollution control and lead phaseout.

ENVIRONMENTAL PROTECTION AGENCY

Focus: climate change, energy

Liaoning Province Greenhouse Gas Inventory and Options for Reduction

Partners: Illinois Department of Energy and Natural Resources, and Liaoning Province Environmental Protection Bureau

Begun in May 1995, this cooperation should result in preliminary steps towards implementing emissions reduction pilot projects within the next three years.

ENVIRONMENTAL PROTECTION AGENCY

Focus: climate change, policy

Climate Change Country Study

Partners: Multiple agencies

This study is an interagency effort to assist China in the development of a national action plan for climate change.

ENVIRONMENTAL PROTECTION AGENCY

Focus: coal, energy, health

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

Partners: National Health and Environmental Effects Research Lab and NEPA

This study is a multidisciplinary one which 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.

ENVIRONMENTAL PROTECTION AGENCY

Focus: coal, energy, methane

Coalbed Methane Recovery and Utilization

Partners: Ministry of Forestry, United Nations Development Program (UNDP), and Global Environmental Facility

EPA, with UNDP, manages 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.

ENVIRONMENTAL PROTECTION AGENCY

Focus: development, industry

Yixing Environmental Industrial Park

Partners: Department of Energy (DoE), Chinese State Science and Technology Commission

In cooperation with DoE, this project will provide advice to the Chinese State Science and Technology Commission on implementing Agenda 21 plans for this major center of the environmental industry. A computerized information exchange system and offices in the United States and China will enable the U.S. private sector to obtain information on opportunities for involvement in park industries.

ENVIRONMENTAL PROTECTION AGENCY

Focus: energy efficiency

Sectoral Energy Efficiency Studies

Partners: Lawrence Berkeley Laboratory

Through Lawrence Berkeley National Laboratory and Chinese cooperators, this project will assess alternative energy utilization scenarios for particular sectors — beginning with 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.

ENVIRONMENTAL PROTECTION AGENCY

Focus: energy efficiency

Beijing Energy Efficiency Center

Partners: Department of Energy, EPA, World Wildlife Fund (WWF)

Established in 1993 with support from DoE, EPA and WWF, this quasi-non-governmental center supports energy policy reform, business ventures, demonstration projects, and public education. See also Beijing Energy Efficiency Center.

ENVIRONMENTAL PROTECTION AGENCY

Focus: energy efficiency

Energy Efficient Buildings Project

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

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

ENVIRONMENTAL PROTECTION AGENCY

Focus: energy efficiency, renewables

Asia Pacific Initiative for Renewable Energy and Energy Efficiency

Partners: Department of Energy, Export Council for Renewable Energy, International Institute for Energy Conservation, and Asia Pacific Economic Cooperation (APEC)

The objective of this two year program is to increase diffusion of renewable energy technologies to Asia through training workshops, regulatory development, and technology demonstrations.

ENVIRONMENTAL PROTECTION AGENCY**Focus:** energy efficiency, CFCs

Energy Efficient and CFC-free Refrigerators

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

This project works at the regulatory and factory levels to assist with the conversion of refrigerator factories to produce models which use 50% less energy and are non-ozone depleting. The project is funded in phases by U.S. bilateral contributions to the Montreal Protocol Fund, plus additional GEF funding. Additional work was done through an EPA grant to the University of Maryland in FY94 for design and testing of domestic Chinese refrigerators and to the Lawrence Berkeley National Laboratory for market transformation of the refrigerator industry.

ENVIRONMENTAL PROTECTION AGENCY**Focus:** energy, gas

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 which uses one-third less water and produces less CO₂ and toxic emissions than other coal-burning technologies. The project involves cost efficiency studies, research and identification of manufacturing capabilities in China, and workshops and training.

ENVIRONMENTAL PROTECTION AGENCY**Focus:** energy, pollutionDemonstration of Combined NO_x/SO_x Control Technology**Partners:** Nalco, Shougang Corporation, CEPA and Beijing EPB

The objective of this two-year project is to conduct a field demonstration of NO_x and SO_x removal technology that was jointly developed by EPA and Nalco Fuel Technologies. This low-cost technology could reduce NO_x and SO_x emissions by up to 70 percent.

ENVIRONMENTAL PROTECTION AGENCY**Focus:** energy, technology

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.

ENVIRONMENTAL PROTECTION AGENCY**Focus:** hazardous waste, toxics disposal

Hazardous Waste and Toxics Disposal

Partners: New York State EPA, NEPA

The goals of this project are to strengthen China's toxic waste regulation, to assist NEPA with demonstration facilities and specifications, and to evaluate hazardous waste treatment technologies for China.

ENVIRONMENTAL PROTECTION AGENCY**Focus:** health, radon

Lung Cancer and Indoor Radon Pilot Study

This study will examine a sampling of dwellings in Gansu Province and is part of a larger project funded by the National Institutes of Health.

ENVIRONMENTAL PROTECTION AGENCY

Focus: pollution, education, training

Pollution Prevention and Environmental Education

Partners: Air and Waste Management Association, Tianjin City, Anhui Province, and the 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, and with the Global Village Institute on environmental education programs.

ENVIRONMENTAL PROTECTION AGENCY

Focus: pollution, energy

Pollution Prevention Assessments, Demonstrations, and Evaluations in the Petrochemical, Pharmaceutical, and Metal Finishing Industries

Partners: State of Illinois EPA, World Bank, United Nations Environment Program (UNEP)

The goal of this two-year project is to diffuse pollution prevention technologies and methods through workshops, assessments, and technology demonstrations.

ENVIRONMENTAL PROTECTION AGENCY

Focus: pollution, water

Pollution Prevention and Control in the Huai River Basin

Partners: World Bank and the Delaware River Basin Commission

The project will bring U.S. technologies and approaches to bear on the vast environmental damage in the Huai River Basin. Working closely with the World Bank and the Delaware River Basin Commission, which is carrying out a scoping study, this effort will lead to a \$1.2 million World Bank-financed feasibility study and possibly a \$50 million, World Bank-financed pilot project.

ENVIRONMENTAL PROTECTION AGENCY

Focus: waste, hazardous materials

Waste Acid Recovery

Partners: Department of Energy, Beijing and Shanyang EPBs

This two-year project demonstrated DoE-developed technology for recovering and recycling spent acids from electroplating and electronics manufacturing.

ENVIRONMENTAL PROTECTION AGENCY

Focus: water, marine, pollution

Coastal Marine Quality

This project will develop models to predict changes in coastal marine water sediment quality due to wastewater marine disposal.

ENVIRONMENTAL PROTECTION AGENCY

Focus: water, pollution

Membrane Drinking Water Treatment

Partners: U.S. 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.

ENVIRONMENTAL PROTECTION AGENCY**Focus:** water, pollution

Biomonitoring of Toxic Discharges, Nanjing River

This project will develop toxicity identification techniques for highest risk discharges.

ENVIRONMENTAL PROTECTION AGENCY**Focus:** wind energy

Wind Energy Mapping

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

ENVIRONMENTAL PROTECTION AGENCY**Focus:** air and water pollution

Ecological Monitoring Network and Air/Water Monitoring

Partners: Chinese National Environmental Protection Agency (NEPA)

EPA is assisting the NEPA on technical assistance projects funded by the World Bank, including: (1) development of a national ecological monitoring network; and, (2) improvement of air and water monitoring technologies in China.

EXPORT-IMPORT BANK**Focus:** financingWeb address: <http://www.exim.gov/>Web address: <http://www.exim.gov/country/ebd-y-05.html>

Environmental Exports Program

The features of this program include: (1) a short-term Environmental Export Insurance Policy that provides enhanced short term, multibuyer and singlebuyer insurance coverage for small business environmental exporters. Features of the insurance policy program include policies which deliver 95% commercial coverage and 100% political coverage with no deductible; and, (2) enhanced medium and long-term support for environmental projects, products and services. These enhancements include local cost coverage equal to 15% of the U.S. contract price, capitalization of interest during construction, and maximum allowable repayment terms permissible under OECD guidelines.

Exports that fall under the Environmental Exports Program include: instruments to measure or monitor air or water quality; emission control devices; effluent pollution control devices; equipment for systems for waste disposal, refuse collection and waste water treatment; services to upgrade environmental regulations; design and training for environmental assessments; ecological studies; ecological monitoring equipment; toxic material handling devices; and certain renewable and alternative energy equipment.

FISH AND WILDLIFE SERVICE (FWS)**Focus:** wildlife, biology

Nature Conservation Protocol

Partners: Ministry of Forestry and Ministry of Agriculture

The U.S.-P.R.C. Nature Conservation Protocol Joint Committee convenes biannually to review completed activities and negotiate exchanges to be carried out over the coming two years. The last such meeting took place in Washington, D.C. in March 1997. Accomplishments of the Protocol include exchanges of specialists in: sea lion/sea otter biology; monitoring of international trade in endangered wildlife species; research on sturgeon, shad and sea turtles; biodiversity management in wildlife refuges and nature reserves; and conservation education/public awareness.

LAWRENCE LIVERMORE NATIONAL LABORATORY (LLNL)**Focus:** water, desalinizationWeb address: <http://www.llnl.gov/>

Cost Effective Desalinization Using Capacitive Deionization

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

LAWRENCE LIVERMORE NATIONAL LABORATORY

Focus: water, planning

Regional Water Resource Planning and
Infrastructure Building

Partners: World Bank and Asian Development Fund

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

LAWRENCE LIVERMORE NATIONAL LABORATORY

Focus: physics, engineering

Environmental Technologies and
Evaluation Methodologies

Partners: China Academy of Physics/Institute
of Environmental Research and Engineering

LLNL has had interaction with the China Academy of Engineering Physics/Institute of Environmental Research and Engineering to discuss possible collaboration on the development of environmental technologies and evaluation methodologies.

**NATIONAL AERONAUTIC AND
SPACE ADMINISTRATION (NASA)**

Focus: mapping

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

Research Agreement: Mapping

Partners: 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

Focus: biodiversity, parks, sustainable development

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 Ministry of Construction.

**NATIONAL PARK SERVICE (NPS)/
OFFICE OF INTERNATIONAL AFFAIRS**

Focus: sustainable development, parks, biodiversity

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

Partners: Peace Corps

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)

Focus: nuclear energy

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

Cooperative Agreement: Nuclear Safety

Partners: 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 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.

U.S. ARMY CORPS OF ENGINEERS
Web address: <http://www.usace.army.mil/>

Focus: water, dams

Research Agreement: Dams

Partners: 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 PEACE CORPS
Web address: <http://www.peacecorps.gov/>

Focus: parks

Parks Management Project (proposed)

Partners: National Park Service and Chinese Ministry of Construction and National Parks

The Park Service is currently negotiating with the U.S. Peace Corps and the Chinese to utilize Peace Corps volunteers to train Chinese park service officials in park management.

Nongovernmental Organizations

BEIJING ENERGY EFFICIENCY CENTER (BECON)
Web address: <http://www.gcinfo.com/becon/index.html>

Focus: energy efficiency

Energy Efficiency and Renewables in Town and Village Enterprises (TVEs)

Partners: World Wildlife Fund (WWF), Center for Renewable Energy Development

BECON has recently begun a collaboration with WWF to develop efficiency and renewables in TVEs. Construction and development in TVEs is a main component of national development. The level of efficiency in the small towns is relatively low compared to urban areas. An objective of the project is to develop 2-3 full-scale proposals for obtaining external financial support.

BEIJING ENERGY EFFICIENCY CENTER

Focus: energy efficiency, electricity

China Green Lighting Program

Partners: UNDP, SETC, SSTC, National Council of Lighting Industry, Ministry of Construction, and Ministry of Electronics

The China Green Lighting Program, which is specifically authorized in the Ninth Five-Year Plan and which is funded through BECON with a \$1 million grant from the United Nations Development Program (UNDP), will last for five years. The program's purpose is to improve consumer's awareness of "green lighting," which implies educating and training of large-scale buyers, such as operators of buildings and public facilities. BECON has held an international symposium on green lights with over 140 participants and, in October 1996, opened a China Green Lights Center in Beijing — a permanent exhibition of the products of over 60 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.

BEIJING ENERGY EFFICIENCY CENTER

Focus: energy, greenhouse gases

Demonstration and Information Center

Partners: World Bank, European Union

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 through market-oriented mechanisms. The project will create three companies, one each 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 which will be provided through an information dissemination center. The Center will manage \$5 million of this amount. 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 will be available in 1998. A European Union grant of \$4.5 million will be available from April 1997 to maintain momentum.

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.

BEIJING ENERGY EFFICIENCY CENTER

Focus: oil, energy, training, electricity

Demand Side Management and Integrated Resource Planning

Partners: Department of Energy, Electric Power Research Institute (ERI), Battelle, and the Environmental Defense Fund

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.

CIESIN

Focus: climate change, environmental data

Web address: <http://www.ciesin.org/>

Model Visualization and Analysis Service: Integrated Assessment of Climate Change

Partners: National Institute of Public Health and Environmental Protection (RIVM), Battelle, Carnegie Mellon University, and the Stanford University Energy Modeling Forum

To help those interested in the climate change issue better understand the development and potential application of Integrated Assessment Models (IAMs), CIESIN has developed the Model Visualization and Analysis (MVA) Service as part of its Socioeconomic Data and Applications Center (SEDAC). The MVA service allows users to access a database of precomputed model scenarios and to visualize data of interest over the Internet. Model scenarios address such issues as choice of energy technologies, development of biomass-based fuels, and introduction of carbon taxes.

CIESIN

Focus: environmental data

World Data Center-A for Human Interactions in the Environment

CIESIN's World Data Center-A for Human Interactions in the Environment serves the scientific community by archiving and disseminating interdisciplinary data and information concerning human interactions with the environment. The Center focuses in particular on georeferenced data on population and administrative boundaries that are needed for a wide range of interdisciplinary research.

The Center archives or provides access to: population dynamics; land and freshwater resources; agriculture and food security; industry and energy; economic activity; policy and institutions; human attitudes, preferences, and behavior; and human and environmental health.

CIESIN**Focus:** environmental data, population

China Administrative Regions Data

Partners: Chinese Academy of Surveying and Mapping and the China in Time and Space project at the University of Washington

CIESIN's China Administrative Regions Data provides accurate and highly reliable spatial data on the country. The data consists of 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.

The databases may be overlaid with a variety of agricultural, land use, environmental, and socioeconomic data to track China's economic rise, population growth, and environmental change.

CIESIN**Focus:** environmental treaties, resources

Environmental Treaties and Resource Indicators

Partners: Multiple

The interactive Environmental Treaties and Resource Indicators (ENTRI) system is a World Wide Web tool that integrated data about the content and status of environmental treaties with national resource indicators and other socioeconomic and environmental information. ENTRI draws on diverse data from organizations around the world.

ENTRI currently provides access to information on approximately 435 environmental treaties and 145 natural resource indicators. The treaty status information is current as of January 1996. ENTRI covers nine global environmental issues: 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.

CIESIN**Focus:** population, climate, environmental data

Gridded Population of the World

Partners: National Center for Geographic Information and Analysis (NCGIA)

Gridded Population of the World (GPW) is a unique global demographic dataset that provides consistent population estimates referenced to a grid of five minute by five minute latitude-longitude quadrilaterals. GPW contains estimated 1994 population counts and densities based on population data for 217 countries, including China.

GPW is a tool which can 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.

CIESIN**Focus:** population, environmental data

Ulysses Cross-Tabulation Engine

Ulysses is an Internet service that provides direct access to millions of household and person census records from the 1970, 1980 and 1990 U.S. Census and the 1982 China Census. Users may select specific records from the census data to produce detailed statistics and cross-tabulations.

Ulysses accesses the U.S. Census Public Use Microdata Samples (PUMS). The data covers various topics including: housing unit type, size, location, value, and age; persons by sex, age, and race; households by size, type, and income; level of education; occupation; employment status, income; and marital status, family membership.

**EAST-WEST CENTER, ENVIRONMENT AND
POLICY INSTITUTE****Focus:** developmentWeb address: <http://www.ewc.hawaii.edu/>

Selected Activities Related to Promoting Environmentally Sound Development in China

The Environment and Policy Institute of the East-West Center has different operations for air pollution, hazardous waste,

water management, agroecosystems, forestry, urban environments, policy implementation, technology transfer and oceans and coasts in China.

ENVIRONMENTAL DEFENSE FUND (EDF)

Web address: <http://www.edf.org/>

Focus: environmental management

Environmental Management Project

Partners: Beijing Environment and Development Institute

EDF is currently undertaking a project, with the Beijing Environment and Development Institute, to develop strategies for implementing BEDI's Total Emissions Control Policy.

ENVIRONMENTAL DEFENSE FUND

Focus: energy, computer modeling

ELFIN Computer Modeling Training

Partners: 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).

FRIENDS OF THE EARTH (FoE)

Web address: <http://www.foe.co.uk/>

Web address: <http://www.foe.co.uk/foei.html>

Focus: hydroelectric, water

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 10 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.

INTERNATIONAL INSTITUTE FOR ENERGY CONSERVATION (IIEC)

Web address: <http://www.iiec.org/>

Focus: energy efficiency, technology

Technology Transfer Initiative

IIEC is beginning a 3-year project to promote the transfer of energy-efficient motor and transformer technologies to China. The project will also include marketing and education activities and the development of finance mechanisms for the purchase of energy-efficient equipment.

INTERNATIONAL INSTITUTE FOR ENERGY CONSERVATION

Focus: energy, transportation

Xiamen Sustainable Transport Project

Partners: City of Xiamen, U.S. Environmental Protection Agency

IIEC is working with the City of Xiamen to undertake an Integrated Transport Services planning activity. The purpose of the project is to analyze the most cost-effective and least polluting way to improve Xiamen's transportation system.

INTERNATIONAL INSTITUTE FOR ENERGY CONSERVATION

Focus: natural gas, transportation

Compressed Natural Gas Transportation Project

IIEC is currently developing a proposal for a transportation project that will convert fleet vehicles in Beijing from gasoline to compressed natural gas.

INTERNATIONAL INSTITUTE FOR ENERGY CONSERVATION**Focus:** energy efficiency, policy

Energy Efficient Transformers

Partners: Multiple Chinese agencies and enterprises

IIEC is working with several Chinese agencies and enterprises to promote the use of energy-efficient transformers in China. The focus of this project is to develop policies that encourage Chinese electric utilities to purchase transformers based on total life-cycle cost analysis.

INTERNATIONAL RIVERS NETWORK**Focus:** rivers, waterWeb address: <http://www.irn.org/>

Three Gorges Campaign

The goal of this campaign has been to increase public awareness regarding the environmental and social impacts of the Three Gorges Dam and to lobby Washington on the importance of this project. Accomplishments of the 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 will not guarantee loans to U.S. companies seeking contracts for the Three Gorges Dam.

IUCN — THE WORLD CONSERVATION UNION**Focus:** biodiversityWeb address: <http://www.iucn.org/>

Technical Advice on China's Biodiversity Action Plan

The Head of IUCN's Biodiversity Programme has provided technical advice to the development of China's Biodiversity Action Plan and continues to advise the Chinese on several major project initiatives being taken to implement this plan.

IUCN — THE WORLD CONSERVATION UNION**Focus:** conservation

Regional Action Plan for Protected Areas of East Asia

IUCN worked with Chinese experts to develop this plan, which includes many priority actions for China. In following up on this Action Plan, IUCN will promote greater international and national investment in high priority areas. IUCN hopes to work with the World Wildlife Fund and other partners in future work on protected areas in China.

IUCN — THE WORLD CONSERVATION UNION**Focus:** conservation, biodiversity

Membership in the China Council for International Cooperation on Environment and Development

The Director General of IUCN is a member of the China Council for International Cooperation on Environment and Development, which is a high level body of international and Chinese experts that provides advice on China's environment and development problems to the State Council and senior leaders, including directly to the State Premier and President. IUCN has played an especially significant role in the Biodiversity Working Group.

IUCN — THE WORLD CONSERVATION UNION**Focus:** conservation, biodiversity

State Membership in The World Conservation Union

China became a State member of IUCN in October 1996, with the Ministry of Foreign Affairs serving as the formal channel for contacts with the Government. Direct technical contacts are, however, pursued with a range of Ministries and Departments, notably the National Environment Protection Agency, the Ministry of Forestry, the Academy of Sciences and the State Oceanic Administration, as well as with the various initiatives and committees organized and chaired by these bodies.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY (MIT)Web address: <http://web.mit.edu/>**Focus:** energy, coal, air pollutionClean and Efficient Utilization of Coal in China:
Environmental Aid and Coal Combustion**Partners:** Tsinghua University, Tokyo University,
Swiss Federal Institutes of Technology,
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 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.

NATIONAL COMMITTEE ON U.S.-CHINA RELATIONS**Focus:** environment, planning

Internship Program

Partners: National Environmental Protection Agency
(NEPA), and the State Planning Commission's Department
of Regional Economy and Spatial Planning

The National Committee has invited three interns — from China's National Environmental Protection Agency, from the State Planning Commission's Department of Regional Economy and Spatial Planning, and from China Environment News — to spend six months working in a variety of environmental protection organizations. They have spent time in government agencies, NGOs, and at universities learning about the relationship among government, NGOs, the private sector, and academia in the pursuit of environmentally sound practices.

NATIONAL COMMITTEE ON U.S.-CHINA RELATIONS**Focus:** sustainable development, conservationSustainable 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.

NATURAL RESOURCES DEFENSE COUNCIL (NRDC)Web address: <http://www.nrdc.org/>**Focus:** energy, policy

Environmental and Energy Policy Development

Partners: 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 environ-

mental 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.

NATURAL RESOURCES DEFENSE COUNCIL

Focus: mapping, climate change, modeling

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.

NATURAL RESOURCES DEFENSE COUNCIL

Focus: energy efficiency

Demonstration of a Model Energy Efficiency Project **Partners:** AES Corporation

NRDC met in January with the President of AES China Generating Co. Ltd., an American independent power company currently operating with power plants in China. AES 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 cogeneration 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: (1) A co-generation plant in Tianjin which will focus on energy efficiency mainly for end-users; (2) 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; and, (3) 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.

PACIFIC ENVIRONMENT AND RESOURCES CENTER

Focus: biodiversity, conservation, energy

Web address: <http://www.pacenv.org/>

China Biodiversity Conservation Project **Partners:** Ministry of Forests

The Pacific Environmental Resources Center has several projects under the China Biodiversity Conservation Project, the majority of which are grassroots. 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 renewable energy promotion in the rural Southwest (proposed).

PACIFIC ENVIRONMENT AND RESOURCES CENTER

Focus: renewable energy

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 (cooking, heating, and lighting, etc.). 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.

PACIFIC ENVIRONMENT AND RESOURCES CENTER

Focus: watershed conservation

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

Focus: biodiversity

Web address: <http://www.si.edu/>

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.

SMITHSONIAN INSTITUTION

Focus: biodiversity

Biological Diversity Program

Partners: 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.

SMITHSONIAN INSTITUTION

Focus: biodiversity, flora

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.

SMITHSONIAN INSTITUTION

Focus: climate change, water

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.

SMITHSONIAN INSTITUTION

Focus: conservation

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.

SMITHSONIAN INSTITUTION

Focus: conservation, training

Wildlife Conservation and Management
Training Program

Partners: 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 17 of these training courses have been undertaken in China since 1987.

**STANFORD UNIVERSITY/INSTITUTE FOR
INTERNATIONAL STUDIES (IIS)**

Focus: ozone, climate, greenhouse gases

Web address: <http://www-iis.stanford.edu/>

Montreal Protocol Research

IIS graduate students have been working on projects aimed at keeping China in compliance with the Montreal Protocol.

**STANFORD UNIVERSITY/
INSTITUTE FOR INTERNATIONAL STUDIES**

Focus: energy

Energy Development Conference

Partners: NITO, Japan; Tsingua 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.

U.S.-CHINA ENVIRONMENTAL FUND (USCEF)

Focus: conservation, planning, tourism

The Great Wall at Badaling

Partners: Beijing Municipal Government

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 through the design and development of the International Friendship Forest, a 75-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.

U.S.-CHINA ENVIRONMENTAL FUND

Focus: environmental education

Sister City Program for U.S.-China High Schools

Partners: National Environmental Protection Agency,
Municipal Environmental Protection Bureaus

USCEF has initiated a sister city environmental education exchange for high school students in the United States and China. To date, eighteen cities are participating. The program will promote an exchange of teachers, city education and environment officials, NGOs, and industry representatives. Focus will be on experiential out-of-classroom activities with monitor-

ing projects and the development of municipal State of the Environment Reports.

U.S.-CHINA ENVIRONMENTAL FUND

Focus: pollution prevention/control, training, technology transfer

Pollution Prevention and Control

Partners: Multiple

USCEF has two programs underway in China on pollution prevention and control. The first focuses on environmental infrastructure finance and the methods to increase private sector investment for pollution control. The second activity is a training and technology transfer program for rural areas and pollution from township and village enterprises.

U.S.-CHINA ENVIRONMENTAL FUND

Focus: conservation, planning, development, tourism

National Parks, World Heritage Sites

Partners: Ministry of Construction

To address the needs for economic development in communities surrounding national parks and to protect these outstanding cultural and natural sites, a technical assistance program is being designed with the Office of National Scenic Areas in the Ministry of Construction. Activities will include training, strategic planning utilizing GIS, interpretive signage, visitor programs and education, and exchange with U.S. park professionals.

UNIVERSITY OF WISCONSIN

Web address: <http://www.wisc.edu/>

Focus: natural resources, conservation, environmental management

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/>

Focus: conservation, resource management

Natural Resource Management in the Upland of Asia: Developing Tools for Local Policy

Partners: Chiang Mai University, Thailand 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.

WINROCK INTERNATIONAL

Web address: <http://www.winrock.org/>

Focus: agriculture

LEAD21 Program

Partners: Starr Foundation, Chinese Education Authority, and Chinese agricultural universities

The LEAD21 program brings instruction in agricultural economics, agribusiness principals, and policy reform to China, 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. The on-site LEAD21 program began in July 1996 and will be completed in August 1998.

WORLD RESOURCES INSTITUTE (WRI)
Web address: <http://www.wri.org/>

Focus: health

Translation Project

Partners: Chinese researchers

WRI is currently working with Chinese researchers to translate their papers on health and environmental issues. The aim is for these reports and papers to gain an international audience and widespread recognition.

WORLD RESOURCES INSTITUTE

Focus: health, air pollution, energy

Economic Analysis of Air Pollution on Health Related Issues

WRI is currently administering a project through its Health and Environment Program that is aimed at addressing the impacts on health due to air pollution. The project will incorporate economic analyses of air pollution on health issues, such as lost wages and health care costs, and will attempt to determine the external costs of air pollution in terms of health.

WORLD RESOURCES INSTITUTE

Focus: water pollution

Water Pollution

WRI is in the research stage of a project on water pollution in China.

WORLD WILDLIFE FUND (WWF)

Focus: energy, climate

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 CO₂ 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 CO₂ 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 township and rural economies.

WORLD WILDLIFE FUND

Focus: wetlands

National Wetland Conservation Action Plan

Partners: 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.

WORLD WILDLIFE FUND

Focus: wildlife

Giant Panda Conservation, Management Plan for the Giant Panda and Its Habitat

Partners: Ministry of Forestry, Chinese zoos

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 14 new panda reserves, maintaining or re-establishing "bamboo corridors" which allow the otherwise isolated groups of pandas to communicate and to interbreed, and improving the

management and protection of panda reserves.

WORLD WILDLIFE FUND

Development of Environmental Education

Focus: education

Partners: National Environmental Protection Agency (NEPA), State Education Commission (SEC)

In 1993, the Chinese embassy in Switzerland approached WWF for help in furthering environmental education in China. In cooperation with NEPA 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.

Harvard University Committee on Environment China Project

An interdisciplinary research collaboration by Harvard University and a number of Chinese institutions, the Harvard University Committee on Environment China Project seeks integrated strategies to address a range of harmful energy-based emissions in concert. Based equally in the United States and China, over 50 professors, researchers, and policymakers now comprise the team, with a disciplinary reach that includes science, public health, engineering, economics, public policy, law, political science, anthropology, and business. The program is led by Michael B. McElroy and Xiping Xu at Harvard and Shi Dinghuan and Wang Hanchen in China, and is sponsored by State Councilor Song Jian and National People's Congress Environment Committee Chair Qu Geping.

Eighteen stage-setting studies conducted in the program's preliminary phase on a range of topics are now being published in an edited volume, *Energizing China: Reconciling Environmental Protection and Economic Growth*, distributed by Harvard University Press. Nine linked subprojects of more extensive original research are currently underway in the program's externally funded Phase II. These include:

- A dynamic economy-energy-environment model to project growth and the emissions trajectory of the Chinese energy economy, and to conduct environmental policy simulations, such as comparing enactment of new regulations versus imposition of a carbon tax;
- A technology and investment assessment of the alternatives to coal in the Chinese electric power sector, with a decision-making framework based on a mathematical programming model;
- A multidisciplinary investigation of factors in environmental policy implementation in a small Chinese city and its rural environs. The core activity is an urban-rural random household survey of indoor and outdoor air quality, respiratory health, economic conditions, household energy use, and popular perceptions of environment and legal recourse to pollution hazards;
- An ongoing study of environmental law development in China—particularly the revised Air Pollution Prevention and Control Law—and impediments to its implementation;
- A Chinese-led study to develop equitable regional “action plans” for integrated abatement of sulfur dioxide and carbon dioxide, given economic and resource disparities within China;
- Use of a 3-D chemical tracer model to explore measurement strategies to quantify China's *net* contributions of a range of important greenhouse gases, taking into account both anthropogenic emissions and natural sources and sinks;
- A multidisciplinary assessment of the challenges and impediments in Sino-American “joint implementation/activities implemented jointly,” private-public investment mechanisms to limit emissions under the Framework Convention on Climate Change;
- Harvard Business School cases on the role of foreign investment and trade in Chinese environment. The current case examines the efficiency gains of Honeywell digital control equipment in a Beijing district heating system; and,
- A newly-developing study to estimate economic losses from air pollution impacts on human health.

The subprojects have differing grant terms and will produce a stream of results, to be presented at program workshops, conferences, policy briefings, and in scholarly journals and other published media.

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