

FOIA MARKER

This is not a textual record. This is used as an administrative marker by the William J. Clinton Presidential Library Staff.

Collection/Record Group: Clinton Presidential Records
Subgroup/Office of Origin: Council of Economic Advisers
Series/Staff Member: Subject Files
Subseries:

OA/ID Number: 21608
FolderID:

Folder Title:
[Global Climate Change & China] [loose] [5]

Stack:	Row:	Section:	Shelf:	Position:
S	21	5	1	1

UNCLASSIFIED

Printed By: Barbara M. DeRosa x74069

ACTION EAP-01

INFO	LOG-00	ACDA-08	ACDE-00	INLB-01	AGRE-00	AID-00	AIT-03
	CEA-01	CIAE-00	CTME-00	INL-01	DINT-00	DODE-00	ITCE-00
	SRPP-00	EB-00	EXME-00	EUR-01	E-00	FBIE-00	UTED-00
	FRB-00	H-01	TEDE-00	INR-00	ITC-01	L-01	ADS-00
	NSAE-00	OES-01	OMB-01	OPIC-01	PM-00	PRS-00	SP-00
	SSO-00	SS-00	STR-00	TRSE-00	USIE-00	SA-01	EPAE-00
	SNIS-00	NISC-00	PMB-00	DRL-04	G-00	NFAT-00	SAS-00

/027W

-----595F04 291027Z /38

R 291029Z JUL 98

FM AMEMBASSY BEIJING

TO SECSTATE WASHDC 1546

INFO USDOC WASHDC

USDOE WASHDC

WHITE HOUSE WASHDC

AMEMBASSY SEOUL

AMEMBASSY ULAANBAATAR

AMEMBASSY ALMATY

AMEMBASSY TOKYO

AMCONSUL SHENYANG

AMCONSUL GUANGZHOU

AMCONSUL SHANGHAI

AMCONSUL HONG KONG

AIT TAIPEI 7877

AMCONSUL CHENGDU

UNCLAS SECTION 01 OF 04 BEIJING 012969

STATE FOR EAP/RA, EAP/CM, EB/IEP, EB/ODA, AND INR/B

USDOE FOR INTERNATIONAL AFFAIRS

USDOC FOR 4420/IEP/EAP/OPH/DFOREST

USDOC FOR 6111/ITA/TD/ENERGY

E.O. 12958: N/A

TAGS: ENRG, EPET, EIND, EINV, ETRD, CH

SUBJECT: CHINA: GROWING THE ECONOMY ON NEGATIVE ENERGY GROWTH?

BEIJING 01 OF 04 12969

1. Summary and comment. In the face of claims that China's economy grew by 7 percent in the first half of 1998, just-released official statistics state that energy production shrank by 5.5 percent during the same period. Although China's overall energy production figure does not directly represent energy consumption--a figure which is not released--some component figures do approximate consumption, and others provide sufficient basis to estimate consumption. These figures show sharply lower energy consumption in the first-half of 1998 than in 1997.

2. Production of coal, which comprises some 75 percent of China's primary energy shares, was down by at least 7.8 percent in the first half. This figure, combined with growing coal stockpiles and only marginal effects of lower exports, indicates that actual coal consumption--which reflects primarily on power generation and industrial users--was down even further. Growth in electricity generation--at one percent--was only one-quarter of the growth seen in the first half of 1997, and is on track to be the lowest annual growth in generation since this figure was tracked, beginning in 1981; this may be significant, given an apparent correlation in China between GDP growth and growth in electrical generation. Crude oil was the only energy source where apparent consumption grew significantly--although oil accounts for only about 17 percent of China's primary energy shares. Production of natural gas fell by 1.4 percent. End summary and comment.

Energy Production In First Half of 1998 Down 5.5 Percent

UNCLASSIFIED

Printed By: Barbara M. DeRosa x74069

3. Recently released statistics from the Chinese State Statistical Bureau (SSB) state that energy production in the first-half of 1998 dropped 5.5 percent compared to energy production in the first half of 1997. (Note: The total energy production figure given is actually 12 percent below the figure published for the first-half of 1997. The discrepancy apparently arises from a later, although unpublished, downward adjustment to the 1997 figure. Extended monitoring of SSB statistics, however, shows that such unexplained, unpublished, after-the-fact "adjustments" nearly always result in showing more favorable growth trends for the current year. End note.)

4. The comparable 1997 figure showed growth in energy production of 2.3 percent. Although growth in energy production had dropped to 2.0 percent by the end of 1997, the figure for the first half of this year shows a particularly rapid decline.

5. Although China's overall energy production figure does not directly represent energy consumption--a figure which is not released--some component figures do approximate consumption, and others provide sufficient basis to estimate consumption. These figures appear to show sharply lower energy consumption in the first-half of 1998 than in 1997.

Consumption of Coal Down Significantly

6. Coal, by far, remains China's primary source of energy, providing some 75 percent of overall primary energy shares. Production of coal in the first half of 1998 was down 7.8 percent compared to the same period last year. (Note: The China Coal Newspaper reported this week that first-half coal production had shrunk by 12 percent from last year's level. The discrepancy between the SSB and Coal Bureau newspaper is particularly interesting in light of the apparent drop in overall energy production of 12 percent, noted in para 3. End note.)

7. Despite several weeks stoppage of coal mining earlier this year, coal stockpiles have continued to grow according to the Coal Bureau. The negative growth in production combined with the growing stockpiles indicates that actual coal consumption is down even more than the 7.8 percent decrease in coal production, and sharply negative compared to last year. (Note: We have not yet obtained exact figures for coal imports and exports this year. While exports are reportedly down, they are marginal compared to overall production--accounting for only 1-2 percent of production

BEIJING 02 OF 04 12969

in 1997--and are thus unlikely to have a major effect on this estimate of consumption.)

8. Based on China's coal consumption mix, the large drop in coal consumption appears mainly attributable to a drop in industrial activity and nearly flat consumption for power generation.

Table 1: Coal Consumption Mix 1995, By Percent*

Agriculture	1.3
Power Generation	32.3
Steam and Hot Water Production	4.3
Coking	13.4
Chemical raw materials and products	7.8
Ferrous metals	9.4
Nonmetal mineral products	9.8

Printed By: Barbara M. DeRosa x74069

Other Industrial	8.5
Construction	0.3
Transportation	1.0
Residential	9.8
Commercial	0.7
Others	1.4

(* Figures provided by contact in a Chinese government energy research institute.)

9. Note: The Coal Industry newspaper this week reported that losses at key state-owned coal mines for the first half of 1998 stood at RMB 1.75 billion (USD 211.6 million). In addition, according to the report, unpaid bills owed to these coal mines totaled RMB 33 billion (USD 3.99 billion). Interestingly, Vice Premier Wen Jiabao last week told Exim Bank Chairman James Harmon that a move toward profitability in coal mining was one reason why China might make its 8 percent growth rate target. This would appear to be at variance with the actual conditions. End note.

Consumption of Crude Oil Still Growing, Natural Gas Down

10. Crude oil was the only energy source where apparent consumption grew significantly--although oil accounts for only about 17 percent of China's primary energy shares. While domestic production fell 1.2 percent in the first half of the year compared to 1997 first-half production--due to falling international prices--net imports have continued to climb. Apparent consumption (domestic production plus imports minus exports) has thus grown by around 15.9 percent compared to the first half of 1997. However, inventories of domestic crude are reportedly still swelling, indicating that actual growth in consumption is something less than 15.9 percent.

Table 2: Apparent Crude Oil Consumption: First Half of 1997 vs 1998 (millions of tons):

	1998	1997
Domestic Production	79.302	80.822
Imports	16.572	14.420
Exports	7.312	10.230
Apparent Consumption	98.562	85.012

(Source: Chinese Customs and SSB figures.)

11. Meanwhile, actual consumption of oil products--including gasoline, diesel, kerosene, and lubricants--inched up only 1.9 percent, according to an oil industry newsletter put out by China's official news agency. This figure may, however, have been based on production--if so, it probably overestimates consumption as inventories of finished oil products are soaring, according official Chinese press. At the same time, production of natural gas, accounting for 1 to 2 percent of primary energy shares, was 1.4 percent less than last year's first-half levels, according to the SSB. (Note: Again, the SSB's production figure of 10.742 billion cubic meters of gas is much higher than the "combined onshore and offshore gas production figure reported in the Chinese

BEIJING 03 OF 04 12969

press of only 7.2 billion cubic meters. End note.)

Growth in Electricity Generation One-Fourth of 1997 Level

Printed By: Barbara M. DeRosa x74069

12. Growth in electricity generation has been down sharply since the beginning of 1998, up only 1.0 percent over the first six months compared to the same period last year. This growth was less than one-quarter of last year's first-half growth figure of 4.4 percent and year-end figure of 4.5 percent. Even if 1998 second-half growth in generation were to shoot up markedly--which appears unlikely--the 1998 year-end growth figure will still likely be the lowest rate of growth since the figure was tracked, beginning in 1981.

13. There has historically been a strong correlation between growth in electrical generation and GDP growth in China.

Table 3: Correlation of GDP Growth and Electricity Generation Growth:

	Growth in Electrical Generation	Real Growth in GDP*
1981	2.9	4.4
1982	5.9	8.8
1983	7.2	10.4
1984	7.3	15.2
1985	8.9	13.5
1986	9.5	8.8
1987	10.6	11.6
1988	9.6	11.3
1989	7.3	4.1
1990	6.3	3.8
1991	9.0	9.2
1992	11.3	14.2
1993	10.9	13.5
1994	10.9	12.6
1995	8.5	10.5
1996	7.2	9.6
1997	5.2	8.8

(* = GNP figures used for 1981-1983. All figures are official Chinese statistics. Note: This chart's interpretability is improved when portrayed as a line graph.)

14. The official electricity generation growth figure essentially includes all electricity consumed by the electric grid. (Note: It does not include electricity generated by any "inside the fence" generators at industrial facilities.) Since electrical generation approximates consumption, and since some three-quarters of all such electricity in China is consumed by industry, this extremely low growth figure likely reflects mainly on the pace and direction of industrial production.

Table 4: 1996 Electricity Consumption Shares By Sector (in percent):

Heavy Industry	59.3
Light Industry	14.8
Urban and Rural Residential	10.7
Municipal Commerce and Other	7.2
Agriculture	6.1
Transportation and Telecommunication	1.9

(Source: 1997 Electric Power Yearbook.)

Comment

15. Despite the margin of error introduced when attempting to

UNCLASSIFIED

Printed By: Barbara M. DeRosa x74069

extrapolate energy consumption based on energy production figures, it appears obvious that energy consumption in the first half of 1998 was less than during the same period in 1997. This suggests that, if GDP growth were 7 percent, the apparent slowdown of productivity in heavy industry, China's main energy consumer,

BEIJING 04 OF 04 12969

would have to have been more than offset by productivity gains in less energy-intensive industries. In the absence of major gains in electrical efficiency--unlikely during the last 6 months--the degree of such productivity gains would have to have been remarkable. Sasser

UNCLASSIFIED

US Initiative on Joint Implementation: China: 1995-1998

Background: The U.S. Government has placed a high priority on encouraging the PRC to meaningfully participate in the U.N. Framework Convention on Climate Change (FCCC) and reduce China's rapidly rising greenhouse gas emissions. The US efforts, beginning in 1994, have resulted in significant Sino-U.S. cooperation on climate change, and has helped gradually increase their receptiveness to U.S. priorities under the FCCC. Encouraging the Chinese government to participate in the Activities Implemented Jointly (AIJ) pilot phase under FCCC has been an strategic task for U.S. Initiative on Joint Implementation (IJI). In the past, China has been critical of Joint Implementation at the U.N., while experimenting with it in the pilot phase within the State Science and Technology Commission (Now the Ministry of Science and Technology). Japan, the Netherlands, and Germany all have fledgling AIJ programs with China. In addition, the World Bank and Norway have initiated a joint AIJ program with China.

US Efforts: Building on the U.S. CSP success, recent U.S. efforts to demonstrate the benefit of AIJ and identify potential joint implementation investment opportunities have sparked Chinese greater interest in AIJ project development. A small group of senior US and Chinese State government officials had several bilateral discussions on AIJ activities. A *Bilateral AIJ Roundtable* took place in Beijing November, 1996. Consistent with the technology priorities identified for the China Climate Change Country Study, the Chinese participants reported the list for potential AIJ projects in: energy conservation technologies; industrial boilers, China's Green Lights project, renewable energy, coal bed methane, forestry, cogeneration and efficient electric power -- including clean coal technologies, and energy conservation in village enterprises. The US-PRC Bi-lateral Energy Efficient Demonstration Building Project has been a consistent topic of discussion for the past two years (More in Dept. of Energy summary). USIJI is also actively working with U.S. private sector project developers in these areas.

China's AIJ Project Office Proposal: During the many AIJ related discussions with China, the US has offered PRC opportunities for U.S. technical assistance to build the in-country capacity to identify, evaluate, and approve and monitor AIJ projects. Recently U.S. IJI has received a pre-proposal from the China CSP Coordinator to establish an office to coordinate and develop projects under the AIJ pilot phase. However the Project Office proposal has not been funded yet. The China Coordinator's pre-proposal also requests training for the AIJ office senior staff. The PRC has nominated a senior analyst to participate in the US Visiting Analyst Program this year. Mr. Lu Xuedu is visiting the US CSP/IJI Office now.

AIJ Related Information:

1. China has announced in March 1998 the establishment of the Climate Change Research Institute in the Tsinghua University at request of the Government. The Institute will focus mostly on socioeconomic impact assessments due to policy changes in climate related issues. It is to the US advantage to provide models, data and other technical assistance to help the Institute successful and valuable for policy formulation. Tsinghua University is the best well-connected and influential university with the Chinese Central Government.
2. China is serious in implementing their AGENDA 21 projects. It will be advantageous to link potential AIJ project with Agenda 21 project to facilitate acceptance and approval from China. Mr Wang Weizhong, a Visiting Analyst in the US CSP a year ago, is now the Director General of the China Agenda 21 Office.
3. U.S. CSP is in regular contact with senior PRC officials that are responsible for FCCC and AIJ activities. Improving US-PRC mutual understanding on AIJ issues are vital for future project development.

Issues Which May be Raised by Chinese:

A. Fossil Power Energy:

- Coal thermal power energy will still be the major source of electric power in China for some years to come because of its abundance;
- Clean coal technology needs to be emphasized for GHG mitigation;
- China should be encouraged to take energy efficiency, alternative and renewable energy measures.

B. Three Gorges Project:

- The question may be informally asked by the Chinese why the US is not supporting the mutual-beneficial "Three Gorges Project", which viewed by China as an environmental cautious, clean energy, and flood control and life-saving project, (Some resentful feelings among certain Chinese people due to misunderstanding the US positions on this issue may be worth looking into!);
- Chinese people have discussed the positives and the negatives of this issue nationally for more than 50 years before the decision to start the Project,.
- Major reasons for the project as Chinese claimed are:
 1. Flood control---The down streams of the Yangtze River have frequent floods year after year. For example, this year's flood has already caused at least 2,000 death and more than 100,000 people homelessness.
 2. Environment cautious---The Project has no significant damage to the environment along the river. The environment will only be better after the project than before;
 3. Clean Energy---China needs the energy for development, It is clean energy.
- The US industry has lost a good opportunity for making monies on this big Project.

C. Effective Communication Mechanism:

- On climate change and environment issues, an effective and frequent communication mechanism to exchange information and ideas, research results, policy analyses, and many topics is needed among US-PRC government officials, NGO's, academicians, as well as the public for appropriate subjects in order to improve mutual understanding.
- Scientists are usually more open-minded in discussion based on scientific evidences. Certain important climate change mitigation issues can be exchanged in scientific workshop format among scientists of both sides to come up with synergized solutions;
- Chinese have more respect for educated and scholastic people. In dealing with China, knowing people and friendship are very important factors to reach satisfactory agreements.
- It is advantageous for US to cultivate some Chinese friends in the climate change arena.

FAX TRANSMITTAL

of pages ▶

To	Ms. Susan Gordon	From	Joseph Huang
Dept./Agency	State/DES	Phone #	202-586-3090
Fax #	202-647-0191	Fax #	202-586-3485
NSN 7540-01 317 7388		5099 101 GENERAL SERVICES ADMINISTRATION	

Chronology of US-PRC Climate Change Activities:

- 1992 US and China both signed in UN Framework Convention on Climate Change
- 1992 US announced the US Country Studies Program
- 1993 China submitted the China Country Study Proposal to US (November)
- 1994 The First U.S. High-Level Country Studies Program Delegation Visited China
- 1994 The China Country Study Proposal was reviewed and funded
- 1994-98 The US CSP sent more than 25 Technical Assistance Teams to visit China
- 1994-98 Over 15 China Country Study Teams have participated in bilateral and multilateral Country Studies' workshops
- 1995 Secretary Hazel R. O'Leary of Department of Energy visited China
- 1995 China's Country Study Team member, Mr. Wang Weizhong from Ministry of Science and Technology, visited US CSP for six months under CSP visiting Analyst Program
- 1996 International workshop on Greenhouse Gas Mitigation Technology and Measures in Beijing, China
- 1996 US-PRC AIJ Roundtable in Beijing
- 1997 US Technical Team to China to Assist China's Scoping Meeting in Planning for Climate Change National Action Plan
- 1998 UN CTI/Industry Joint Seminar on Climate Technology Diffusion in Asia, Beijing.
- 1998 President Clinton Visited China and Discussed Environment and Climate Change in Beijing University and in Guilin City
- 1998 China's Country Study Team member, Mr. Lu Xuedu from Ministry of Science and Technology, is now visiting US CSP for three months under CSP visiting Analyst Program

**Office of Global Change
Bureau of Oceans and International Environmental and Scientific Affairs
U.S. Department of State**



To: Stephanie Benkovic, EPA/OAR
Maurice LeFranc, EPA/OP
David Bleyle, EST Beijing
Alan Yu, EST Tokyo
Linda Silverman, DOE
Mark Mazur, DOE
Duane Lakich, AID
Victoria Greenfield, DOS/EB
Mario Merida, DOS/EB
Joe Aldy, CEA
Adele Morris
Ray Squiteri ~~Ray Squiteri~~, Treasury
Sue Bliniaz, DOS/L

565-2140
260-6405 401-0454
011-86-10-6532-6422
8-688-5229
586-4341
586-9626
216-3174
7-5713
7-4037
395-6870
622-1294
6-7115

Fax #:

Phone #:

From: Duncan Marsh

Subject: China's submissions on CDM, emissions trading

Date: 04/12/99

Pages: 9, including cover sheet

☐ **Urgent**

☐ **For Review**

☐ **Please Comment**

☐ **Please Reply**

Please find attached China's submissions to the UNFCCC Secretariat on the CDM and emissions trading, submitted in late February. They were passed to us last Friday at the U.S. - China Forum on Environment and Development. Please share as appropriate.

Regards,

2201 C Street, Room 4330
Washington, DC 20520
tel.: (202) 647-4688
fax: (202) 647-0191
dmarsh@state.gov

Inputs from China on
“Emissions Trading” under Article 17 of the KP

25 February 1999

I. General comments

(I) Nature and Scope of ET under Article 17 of the KP

The “emissions trading”(ET) under Article 17 of the KP is a very limited kind of “trading”. As clearly provided for in Article 17 of the KP, “Any such trading shall be supplemental to domestic actions for the purpose of meeting quantified emission reduction commitments” under Article 3 of the Kyoto Protocol (KP). This means:

1) that the nature, purposes and scope of the ET under Article 17 are essentially no other than being supplemental to domestic actions for meeting Annex B Parties’ quantified limitation and reduction commitments under Article 3 of the KP – not for international speculation, etc.;

2) that, as such, any emissions trading under Article 17 of the KP does not bestow rights or entitlements to Annex B Parties;

3) that the emissions trading under Article 17 of the KP is merely the “transfer and acquisition”, between Annex B Parties, of emission reduction unit (ERUs) or part of an assigned amount under Article 3.10 and 3.11 of the KP;

4) that such “transfer and acquisition” are essentially for addition and subtraction in the respective inventories of “the acquiring Parties” & “the transferring Parties”, as has been clearly stipulated in Article 3.10 and 3.11 of the KP respectively;

5) that such “transfer and acquisition” (NOT buying and selling) must be transparent and must be in compliance with the relevant provisions of the KP;

6) that it is wrong to attempt going beyond the provisions of the KP to twist the “ET” under Article 17 into a so-called “market-based” international buying and selling system or regime, bringing in “brokers”, etc.

(II) Climate change effectiveness (See: Work Programme “Elements”, No.5 under “General”):

Such “emissions trading” under Article 17 of the KP shall bring about real,

measurable and long-term benefits related to the mitigation of climate change.

(III) The principle of "supplementarity" must NOT be violated:

On this principle, the KP has clear provisions relating to the 3 mechanisms. Specifically, regarding ET, Article 17 stipulates: "Any such trading shall be supplemental to domestic actions for the purpose of meeting quantified emission limitation and reduction commitments" under Article 3 of the KP. Therefore, concrete ceiling for the total amount of overseas offsetting acquired from the 3 mechanisms of the KP should be defined quantitatively and qualitatively. (See: Elements No.9 under Article 12, No.19 under General, No.6 under Article 6, and No.8 under Article 17— as listed in the "Work Programme", annexed to COP Decision 7/ CP.4 . (doc. FCCC/CP/1998/16/Add.1)

II. Key Elements on "Emissions Trading" under Article 17

1. The "emissions trading" under Article 17 is the "transfer and acquisition", between the Parties included in Annex B, of emission reduction units (ERUs) or part of an assigned amount under Article 3.10 and Article 3.11.
2. Any such trading under Article 17 of the KP does not bestow rights or entitlements to Annex B Parties.
3. Any such trading shall be supplemental to domestic actions by Parties included in Annex B for the purpose of meeting their quantified emission limitation and reduction commitments under Article 3.
4. The purpose of the "emissions trading" under Article 17 of KP is to assist Parties included in Annex B in fulfilling their commitments under Article 3, as a supplementary means.
5. "Emission trading" under Article 17 shall be conducted between or among the Parties included in Annex B to the Protocol.
6. Such "trading" shall bring about real, measurable and long-term benefits related to the mitigation of climate change.
7. "Transfers and acquisitions" of any emission reduction units or any part of an assigned amount could be effected through a bilateral or multilateral arrangement between or among the Parties included in Annex B, without creating a new international business transaction system or regime.
8. "Transfers" of any emission reduction units or any part of an assigned amount by a Party included in Annex B to another Party would be valid only if it is reported and verified that the former would have fulfilled its commitments under Article 3, in accordance with the rules and guidelines to be decided by the Conference of the

Parties.

9. Parties included in Annex B shall be eligible to "transfer" or "acquire" part of the assigned amount, if they:

- (a) are in compliance with Articles 3, 5, 7, and are responsible for meeting their commitments under the KP;
- (b) are not in violation of the compliance Article, namely Article 18 of KP;
- (c) have a transparent national system for recording and verification of such "transfers" and "acquisitions".

III. Relevant work to be assigned to SBSTA and SBI

The above issues, along with the relevant Elements on "emissions trading" between Annex B Parties under Article 17 as listed in the Work Programme adopted by COP-4, should be studied thoroughly by SBSTA and SBI. On this basis, SBSTA and SBI should work out recommendations on the relevant principles, modalities, rules and guidelines for "emissions trading" between Annex B Parties under Article 17 of the KP.

Inputs from China on CDM

February 1999

These are initial inputs from China on CDM in light of Decision 7/CP.4 on Work Programme on mechanisms of the Kyoto Protocol, as adopted at COP-4. The numbering of each of the following points refers to the numbering of the elements in the Work Programme. More comments may follow.

I. Basic Principles

(1) Purpose of CDM projects activities:

In accordance with Article 12.2 of the Kyoto Protocol, each CDM project shall meet the 2-fold purpose, namely, (a) to assist the developing country Parties in achieving sustainable development and in contributing to the ultimate objective of the Convention, and (b) to assist the developed country Parties in achieving compliance with their quantified emissions limitation and reduction commitments under Article 3 of the Kyoto Protocol.

(2) The "part of" commitments under Article 3, namely, the principle of supplementarity :

It must be ensured that CDM project activities shall be supplemental to domestic actions by developed country Parties to meet part of their QELRCs (quantified emissions limitation and reduction commitments).

(3) Compatibility with sustainable development priorities/strategies:

Whether a CDM project could promote sustainable development of a developing country Party shall be decided by the developing country Party itself, not by other Parties or international institutions.

(4) Special needs of least developed countries:

It should be ensured that certain numbers of CDM projects should be implemented in the least developed country Parties to meet their special needs. And this issue shall be resolved in conjunction with the implementation of Article 4.8 and 4.9 of the Convention.

(5) Criteria for the CDM project:

- a) CDM project shall be implemented between Annex I and non-Annex I country Parties on a voluntary basis. The governments of the participating Parties shall bear the overall responsibility for the CDM project.
- b) CDM activities shall be project based, and shall be carried out on a project-by-project basis.
- c) CDM project shall be implemented in accordance with the requirements of Article

- 12.2, 12.3 and 12.5 of the Protocol.
- d) CDM project should promote the transfer of advanced technologies needed by the developing country Parties.
 - e) CDM project activities should be carried out in accordance with methodological guidelines and criteria to be adopted by COP/moP.
 - f) Funding for the CDM project shall be additional to ODA, GEF and other financial commitments of the developed country Parties under UNFCCC, under the Kyoto Protocol and commitments under other relevant international conventions and their protocols. Moreover, funding for the CDM project shall be provided by the project participating developed country Party to the project participating developing country Party on a grant basis, with the CERs acquired from the CDM project as returns for the participating developed country Party for meeting part of its QELRCs, in accordance with the relevant provisions of Article 12 and Article 3 of the Kyoto Protocol.
 - g) Technology transfer in CDM project shall be additional to the Annex II Parties' commitments on technology transfer to developing country Parties under UNFCCC.

(6) Adaptation:

The issue of "Adaptation Costs" is an important issue and needs further study. This issue has to be resolved in conjunction with the implementation of Article 4.8 and 4.9 of the Convention. A special fund should be established to assist covering the adaptation costs taking into account the implementation of Article 4.8 and 4.9 of the Convention.

II. Methodological and Technical Issues:

(11) "Part of " Annex I commitments. Vide No. (2) above.

(12) Additionality criteria in project funding:

Funding for the CDM project shall be additional to ODA, GEF and other financial commitments of the developed country Parties under UNFCCC, under the Kyoto Protocol and commitments under other relevant international conventions and their protocols. Moreover, funding for the CDM project shall be provided by the project participating developed country Party to the project participating developing country Party on a grant basis, with the CERs acquired from the CDM project as returns for the participating developed country Party for meeting part of its QELRCs, in accordance with the relevant provisions of Article 12 and Article 3 of the Kyoto Protocol.

(14) Criteria for real, measurable and long-term environmental benefits related to mitigation of climate change:

This issue concerns "climate change effectiveness", and should be resolved, taking into account the additional reduction in emissions at the project level as against the baseline of the CDM project. This issue is complicated, maybe evolving with the passage of time, and needs further study.

(15) Criteria for certification:

Emission reductions resulting from each CDM project shall be certified by the operational entity to be designated by COP/moP in light of the requirements of Article 12.5 of the Protocol and in accordance with the modalities, rules and procedures to be adopted by COP/moP.

(16) Criteria for project baseline:

The baseline of CDM project shall be determined reasonably to ensure the realization of additional reduction in emissions at the project level as against the baseline of the CDM project.

Only project-by-project, not sector or country baseline, shall be applied to CDM project.

(18) Systems for independent auditing and verification of project activities:

The systems for independent auditing and verification of CDM project activities, including modalities and procedures, shall be elaborated by COP/moP at its first session, with the objective of ensuring the transparency, efficiency and accountability.

(19) Format for reporting:

The governments of the participating country Parties in a CDM project shall report to COP/moP on the progress and results of the CDM project activities on a project-by-project basis, by using a uniform reporting format to be adopted by COP/moP.

(20) Implication of Article 12.10 of the Kyoto Protocol, including implications for a possible interim phase approach to the CDM and of the activities implemented jointly (AIJ) under the pilot phase:

Article 12.10 of the Kyoto Protocol may have negative impacts on the implementation of the developed country Parties' commitments under Article 3 of the Protocol, and will have negative impacts on the continuation of AIJ projects. SBSTA should be requested to study these issues and propose recommendations to cope with those negative impacts for consideration by COP/moP.

(21) Outcome of methodological work on Article 3.3 and 3.4:

This issue needs further study in view of its complexity.

(22) Environmental additionality and baselines: Vide No.(5) and No. (14) above.

(24) Criteria for sustainable development: Vide No.(3) above.

(25) Determination of additionality of emissions reductions/removals:

The issue of "additionality of emissions reductions/removals" is an important issue, which should be addressed in the light of the realization of additional reduction in emissions at the project level as against the baseline of the CDM project.

(27) Fungibility among mechanisms:

The concept of "fungibility" among the three mechanisms of the Kyoto Protocol is totally unacceptable.

III. Process

(30) Acquisition and transfer of certified emission reduction units:
Acquisition of certified emission reduction units(CERs) should be carried out in accordance with Article 3 of the Protocol, in particular its Article 3.12. Any CERs which a Party acquires in accordance with Article 12 shall be added to the assigned amount for the acquiring Party(Article 3.12). This, along with the provision in Article 3.13, rules out using CERs for international speculation, etc. Vide No. (5.f) above.

(31) Determination of share of proceeds for adaptation:
Vide No. (6) above.

(35) Approval by involved Parties of sustainable development:
Vide No. (3) above.

(38) Reporting:
Reporting and related format shall be elaborated by Cop/moP. In the case of the developing country participating Parties in the CDM projects, the reporting shall be carried out on a project-by-project basis. In the case of the developed country participating Parties in the CDM projects, the reporting shall not only be submitted to COP/moP on a project-by-project basis, but shall also be reflected in their inventories.

(39) Auditing and verification: Vide number (18) above.

(40) Eligibility of AIJ projects under the CDM beginning in 2000:
Vide No. (20) above.

IV. Institutional Issues

1. COP/moP

As the supreme body of CDM, the Convention COP serving as the meeting of Parties to the Protocol is the supreme body for CDM decision-making , with overall responsibilities for all CDM issues; in particular, (CDM-43)*

- a) To elaborate the modalities and procedures of the CDM project activities as provided for in Article 12 of the Kyoto Protocol;
- b) To decide on acceptance or refusal of CERs of CDM projects;
- c) To determine the quantification of "part of their QELRCs" ; (CDM-11)

* The number in the parentheses means the Element number in the Annex to Decision 7/CP.4. The same for the following numbers in the parentheses.

- e) To ensure that "a share of the proceeds" from certified CDM projects is used to cover administrative expenses and to assist developing country Parties that are particularly vulnerable to the adverse effect of climate change to meet the costs of adaptation. (General--6, CDM--6, 31,32)

2. Role and responsibilities of Governments of Parties participating in CDM project: (CDM--49)

- a) The Governments shall bear overall responsibilities for approval and implementation of CDM projects, for non-compliance and for reporting.
b) The Governments shall be responsible for the public and/or private entities that may be involved in the CDM projects.

3 EB (Executive Board)

- a) Operating under the authority and guidance of the COP/moP, the EB shall assist in supervising relevant CDM project activities. (CDM--43,44)
b) The EB shall implement the decisions and policy guidances on CDM to be adopted by COP/moP. (CDM--43,44)
c) The EB shall assist in supervising the operational entities designated by the COP/moP.
d) The composition of the EB must be in line with the UN practice of equitable geographical representation (equitable regional distribution). (CDM--46)
e) The EB may make recommendations to the COP/moP on matters relating to independent auditing and verification of CDM project activities, etc., as provided for in Article 12 of the Protocol.

4 OE (Operational Entities) (CDM--45, 48)

- a) OE shall be designated by the COP/moP and shall be limited in number to ensure transparency and credibility.
b) The OE, so designated, shall certify the emission reductions resulting from each CDM project activity in accordance with Article 12.5 of the Kyoto Protocol and in accordance with the modalities, rules and procedures to be adopted by COP/moP. Further study is needed.



OFFICE OF THE VICE PRESIDENT
WASHINGTON

June 21, 1999

Her Excellency
Zhu Lilan
Minister of Science and Technology
Beijing, People's Republic of China

Dear Minister Zhu:

I regret I did not have the opportunity to meet you during the second session of the U.S.-China Forum on Environment and Development in April. Clearly, the Vice President and Premier Zhu Rongji made important progress in advancing bilateral cooperation on environment and development. I have enclosed for your reference copies of reports from the four Forum working groups, and an English-language version of our joint statement at the conclusion of the Forum.

At an appropriate moment, the Vice President will write to Premier Zhu with his thoughts on the next steps we might take in the Forum. I look forward to further contact with you.

Sincerely,

A handwritten signature in black ink, reading "Leon Fuerth".

Leon Fuerth
National Security Advisor
to the Vice President

Enclosures: As stated

cc: Ambassador Li Zhaoxing



OFFICE OF THE VICE PRESIDENT
WASHINGTON

U.S.-China Joint Statement
Second Session of the Forum on Environment & Development
April 9, 1999

At the invitation of President Clinton of the United States of America, Premier Zhu Rongji of the People's Republic of China paid an official visit to the United States from April 6 to April 14 of 1999. During the visit, Premier Zhu Rongji and Vice President Al Gore co-chaired the second session of the U.S.-China Forum on Environment and Development in Washington, DC, on April 9, 1999. The first session of the Forum was held in Beijing in March 1997.

Vice President Gore and Premier Zhu Rongji delivered opening remarks of the Forum. They agreed that the U.S. and China should work together to achieve our common goals of improving the standard of living of all people while protecting and preserving the world's natural resources. They charged the Forum's four working groups to find ways in which our cooperative efforts can further these goals. The Vice President and Premier also met with executives of American companies from the energy and environment sectors to discuss such issues as strengthening the cooperation in the area of environment protection between the business sectors of the two nations.

Vice President Gore and Premier Zhu Rongji had productive discussions on a variety of issues related to the Forum. They agreed that the United States and China will increase their efforts to improve, protect and preserve the world's natural resources by working together to combat global threats such as climate change, desertification, and loss of biodiversity, managing water resources, developing cleaner and more efficient sources of energy, minimizing air pollution and its effects on human health, and mitigating and reducing natural disasters.

During the Forum, several concrete steps were taken to further our cooperation on these issues. These include:

- The U.S. EPA and the Chinese State Environment Protection Administration and other counterparts signed 10 Statements of Intent outlining cooperation on air quality management, energy efficient buildings, clean air and energy technologies, the relation of air pollution to human health, and a feasibility study on sulfur dioxide.
- The United States and China agreed that Peace Corps will conduct the Environment Education Project in China.
- The U.S. and China agreed to utilize the U.S. Export-Import Bank's new \$100 million credit line to finance, on the basis of mutual consent, projects focused on

renewable energy, energy efficiency, and clean coal technology. The Department of Energy hopes to provide expert assistance for this program.

- The United States and China agreed to consider a dialogue on land use management to further cooperative efforts to fight deforestation, desertification, destruction of wetlands and rangeland degradation.
- The U.S. and China will hold the Second Meeting of the Oil and Gas Industry Forum in Houston in July 1999.
- The U.S. and China will hold a joint seminar on water resource management in Arizona, April 19-22, 1999.
- The National Oceanic and Atmospheric Administration (NOAA) and the State Oceanic Administration have established a Joint Commission on Coastal Management to develop plans for the sustainable use of coastal ecosystems.
- NOAA, the State Oceanic Administration, and the Chinese Meteorological Administration will hold a joint workshop and a symposium on climate forecasting.
- The Department of Agriculture's Economic Research Service and China's State Statistical Bureau will sign a letter of intent to initiate a three-year cooperative research project, based on the results of China's first agricultural census, to study the linkages between the crop and livestock sectors, farm productivity and economies of scale, urban agriculture, and rural labor quality and migration issues.
- The United States and China agreed to continue the high-level dialogue on climate change agreed to at last year's presidential summit in China.

Vice President Gore and Premier Zhu expressed satisfaction with the activities of the Forum to date. They urged participants to further strengthen cooperation in the important areas covered by the Forum and agreed to encourage participation in Forum activities by business and other sectors. They decided that the next session of the Forum will be held under the auspices of the moderators in China, and the specific time will be decided through diplomatic channels.

✓
**Energy Policy Working Group of the
U.S.-China Forum on Environment and Development
April 9, 1999
Washington D.C.**

The Energy Policy Working Group of the U.S.-China Forum on Environment and Development held its second session in Washington D.C. on April 9, 1999, at the U.S. Department of Energy. The meeting took place in conjunction with the second plenary session of the U.S.-China Forum on Environment and Development on April 9, 1999, under the co-chairmanship of Vice President Al Gore and Premier Zhu Rongji. The Energy Policy Working Group was co-chaired by Mrs. Song Mi, Director-General, Department of Basic Industries, State Development Planning Commission and Dr David J. Jhirad, Senior Advisor for International Affairs, Office of the Assistant Secretary for Policy and International Affairs, U.S. Department of Energy. A complete delegation list from both countries is attached.

The major outcomes of the meeting are provided below:

- Discussion of next steps in implementing the Export-Import Bank \$100 Million Clean Energy Program
- Discussion of next steps in renewable energy cooperation, including projects underway to¹:
 - Complete Xiao Qingdao (PRONOUNCE: SHAW-CHIN-DOW) village power project in island off the coast of Shandong province;
 - Completion of two bilingual reports: i) PV industry and technical status in China; ii) renewable energy business profile in 6 provinces;
 - Development of an internet web site in both countries in support of renewable energy business development;
 - Provision of technical assistance in 3 building designs using ground source heat pumps (totaling 2.5 million square feet) and training in exchange for China's commitment to purchase U.S.-made equipment;
 - Upcoming completion of 240 Solar Home Systems in Inner Mongolia;
 - Technical assistance for the Lanzhou Testing and Training Center;
 - Updating a biomass resource database.
 - Consideration of joint renewable energy forum and exhibition in Beijing, possibly in the spring of 2000.
- Review of the summary report of the first session of the U.S.-China Oil and Gas Industry Forum and plans for the next meeting in July 1999 in the United States.

¹ These are those projects using FY 1998 Funds

- Confirmation of plans for a natural gas utilization study, under a letter of intent signed by EPA and China's State Development Planning Commission.
- Discussion leading, in the next few months, to a new fossil energy technology development and utilization protocol between DOE and the appropriate Chinese government organization that reflects the recent Chinese Government reorganization and current areas of interest for cooperation.
- Discussion of plans for the development of a Coal Mine Methane Market Development Plan, a joint project between China's State Administration of Coal Industry and EPA.
- Discussion of plans for the next phases of cooperation in the "Technology Cooperation Agreement Pilot Project: Clean Air and Cleaner Energy Technology Cooperation", led by EPA with China's State Development Planning Commission.
- Reporting on status of several activities in energy efficiency:
 - plans for the second meeting of the U.S.-China Energy Efficiency Steering Committee in June of 1999 in Beijing (Dates of June 24-25 have now been confirmed);
 - the convening of a motor challenge workshop, concentrating on pumping systems in Beijing in the summer of 1999;
 - status of a design study (to be completed) for an energy efficient building demonstration project in Beijing, being coordinated by DOE and China's Ministry of Science and Technology;
 - confirmation of USG offer to continue to provide technical assistance in energy efficiency policies.

Summary

In opening the session, the U.S. Co-Chair reviewed desired outcomes of the meeting. These included: identifying/clarifying next steps in implementing the \$100 million U.S. Export-Import Bank/DOE Clean Energy Program; exchanging views on energy policy developments; agreement on the second session of the Oil and Gas Industry Forum; identifying areas to strengthen cooperation in clean coal technology, energy efficiency and renewable energy; confirming cooperative agreements with EPA for a natural gas utilization study, coalbed methane market development plan, and technology characterization pilot project. The U.S. Co-Chair called attention to Premier Zhu's statement at the Forum plenary session that morning that energy cooperation was beneficial to the environment and also to improving the bilateral trade balance.

Energy Policy Developments

The U.S. Co-Chair made available a copy of his prepared remarks highlighting developments in U.S. national energy strategy since the March 1997 Forum meeting and distributed a copy of the "Comprehensive National Energy Strategy" released in April 1998.

The PRC co-chair reported on energy developments in the PRC since the March 1997 Forum. She noted rapid increase in energy and electricity demand and continued structural changes, including a decline in the percentage of coal in the energy mix to 74% and increased use of natural gas. She indicated that there had been an improvement in the management of coal mines, and a new system put into place to manage large-scale energy projects. She pointed to continued progress in energy conservation, with the ratio of energy use to GDP having fallen to 0.5, a 50% reduction since the late 1970s. Developments in other areas noted were: the delegation of the management of all state-owned coal mines to local governments; the establishment of a new national electric power corporation; a major restructuring of the petroleum industries; and a decision, as of June 1998, to link domestic crude oil prices to international ones.

The PRC co-chair indicated that, since the first meeting of the Forum, the PRC had focused on the following areas: reductions/closures in low-efficient, low-capacity fossil energy power plants; increases in the deployment of desulfurization technology; increased emphasis on solar, wind and other new technologies; efforts to restructure the electric power grids; attempts to lower the sulfur content of coal use; efforts to deploy coal gasification technology. In reference to energy cooperation, mention was made of the MOU for the \$100 million Clean Energy Program and cooperation in other areas, such as oil and gas, and renewable energy. The PRC co-chair emphasized that the PRC would do its part to promote greater cooperation in the energy sector and explore areas to further improve bilateral cooperation.

The U.S. co-chair complimented the PRC on the restructuring of their electricity and petroleum sectors. He noted that, given the extensive amount of capital investment needed for energy expansion worldwide (an estimated \$300 billion per year), much of this investment will have to come from the private sector. This indicates the need for continued energy reforms to attract investment needs. He complemented the PRC on reforms taken to date and encouraged the PRC on this path. He said that there were opportunities to make energy an important part of the trade balance and economic future of both countries and indicated that the U.S. would like to collaborate with China to bring advanced technologies to commercial reality.

\$100 Million U.S. Export-Import Bank/DOE Clean Energy Program

U.S. Export-Import Bank officials discussed the program and next steps in implementing it. They noted that Ex-Im Bank Chairman Harmon looked forward to implementing the Clean Energy Program. China was already the largest customer of Ex-Im Bank, with cumulative exposure of almost \$6 billion, and was one of the largest future markets for clean energy

technology. The Memorandum of Understanding for the Clean Energy Program was signed on March 29; signatories were the State Development Planning Commission; the China Development Bank; Ex-Im Bank; and the U.S. Department of Energy. Projects eligible for inclusion under the program include: wind; solar, and geothermal technologies; industrial cogeneration; energy efficiency building technologies; low nitrous oxide burners; and SO₂ reduction technologies.

Under the terms of the MOU, both the U.S. Department of Energy and the Ex-Im Bank plan to encourage U.S. private industry to work with the relevant Chinese authorities to support the identification, assessment, and implementation of appropriate projects that will showcase innovative U.S. energy technologies that provide reliable, cost-effective, and environmentally-sound energy production and savings. Ex-Im Bank officials indicated that U.S. exporters and other interested parties could contact two Ex-Im Bank project officers for more information: Mr. Kyle Jackson at 202-565-3927 or Frank Wilson at 202-565-3920. In follow-up discussion, the Chinese Delegation indicated that they had already identified three potential projects for the Clean Energy Program; the Bao Ding solar energy cell project (still in feasibility study and approval stage); a power project in Inner Mongolia (a feasibility study has been submitted to the SDPC for approval); and a geothermal project, still in the proposal/formulation stage. The Chinese delegation indicated that they did have some difficulty with the U.S. loan terms because the financial profitability of all three of these projects were not high, although the social benefits were very high. The Chinese delegation asked whether there could be better interest rate terms available for the Ex-Im Bank program.

Ex-Im Bank officials responded that, with regard to the terms of the Clean Energy Program, there were two structures (direct loan or guaranteed loan). Under the latter, there was a possibility for the two negotiating parties (i.e., the U.S. company and Chinese buyer) to negotiate better terms. Ex-Im Bank officials indicated that each project being considered would be reviewed by Ex-Im Bank's energy and environment division. They noted that notification of the prospective projects could take various forms: project ideas submitted by SDPC to Ex-Im Bank or DOE; direct application by the U.S. exporter to Ex-Im Bank etc. Ex-Im Bank officials indicated that it would be worthwhile to explore other ways to discuss/identify projects of which the U.S. side might be aware which would qualify for this program. In regard to the potential eligibility of projects, Ex-Im Bank could issue a Letter of Interest to the U.S. exporter, and copy Chinese representatives at SDPC or CDB to notify them that the prospective project would qualify for the program.

The PRC co-chair indicated that the SDPC was likely to participate in the development of the first few projects for the Clean Energy Program. China would examine the projects to see if they are worthwhile. After the projects were approved and agreements signed among the parties, the CDB would make an application for the Clean Energy Program. Ex-Im Bank officials indicated that all three of the projects which the PRC co-chair had described would be eligible to apply for the Clean Energy Program – there was no question about that. In regard to how to approach Ex-Im Bank for the Program, Ex-Im Bank officials noted that: DOE was interested in providing input and guidance; that the SDPC has identified mechanisms which they feel would

be appropriate and that if the PRC has projects it feels strongly about, they can contact Ex-Im Bank directly or go through DOE to see if the projects are suitable for the Clean Energy Program; China could invite the U.S. exporter to bid on given projects; and U.S. exporters would subsequently apply to Ex-Im Bank for a letter of interest or loan/loan guarantee. The PRC co-chair described her understanding that the proposed projects have to go through certain procedures. She asked if the SDPC was responsible for the selection of the projects and would they all have to fall under specified criteria. She also indicated her understanding that the U.S. exporters bidding on the projects could apply directly to Ex-Im Bank during the initial stages of negotiations for letters of interest. She said we should move the projects forward on this basis. Ex-Im Bank officials responded that this understanding was essentially correct. The SDPC would be a very important player on the Chinese side in identifying and selecting projects. Ex-Im Bank officials said that one suggestion would be that, after projects have reached the negotiating stage between the Chinese and U.S. company, it would help facilitate the process if DOE and Ex-Im Bank were notified about the projects. Subsequently, the U.S. exporter could approach Ex-Im Bank.

Oil and Gas Activities

An official from DOE's Office of Fossil Energy, also a U.S. member of the Steering Committee for the U.S.-China Oil and Gas Industry Forum, reported on the outcomes of the first session of the Forum in November 1998 and plans for the second session in July 1999. He noted that the November 1998 session was very successful and had resulted in agreement to continue this two-way dialogue with specific areas of focus for the second session. He noted that the summary report of the first session had already been agreed to by both sides in English and distributed copies of the Summary report. One of the action items emerging from the first meeting was to expand membership in the Steering Committee, from both U.S. industry and Chinese petroleum entities.

He indicated that this had been accomplished: all five of the Chinese petroleum entities were represented on the Steering Committee; and companies Phillips, Chevron, and ARCO had been added. He asked for reflections from the Chinese delegation on the first session. Mr. Zhu responded that, while he did not personally participate in the session, CNPC participants had prepared an internal report on the meeting and briefed all levels of their company. He noted that CNPC attached a great deal of importance to experience provided by the U.S. side, and exploration of China's long-term natural gas goals. He indicated that his government is seeking to adopt effective measures to encourage natural gas development and use and the development of a natural gas infrastructure. He said Chinese companies desired to cooperate with U.S. companies in initial work on large projects. A gas assessment was already underway with Exxon and an MOU had been signed with Enron for a long-distance natural gas pipeline. He indicated that, through the Forum, we can enhance and promote cooperation between our two industrial sectors. Both governments should encourage their industries to proceed with projects. He indicated that the willingness of U.S. companies to transfer technology would enhance their prospects.

DOE officials noted that the Forum Plenary session had included a Business Roundtable with U.S. CEOs and Premier Zhu Rongji and senior officials of his delegation. They noted that U.S. industry reportedly made 2 or 3 points in regard to the Chinese market: that they would like to establish long-term business partnerships with the PRC industry counterparts; that appropriate technology transfer could occur, but only on commercial terms; that U.S. industry would like to see reforms in China continue and be assured of adequate rates of return on investments; and that there must be equal and symmetrical access to information on R&D and end use markets.

In regard to LNG, a DOE official noted that the LNG roundtable in Beijing during Secretary Daley's recent visit provided a good opportunity to speak with Chinese officials, including Minister Bao Xu Ding of the SDPC, regarding the parameters of the announced LNG project in Guangdong province. He indicated that the U.S. welcomes the opportunity to continue this dialogue as to how the U.S. could be useful in facilitating the decision-making process on the project. He said there had been a positive response from the Chinese side regarding their willingness to review U.S. industry bids for the LNG facility. The DOE official also reiterated the USG offer to make available its technical exports to assist China in crafting a national natural gas policy.

In response, the Chinese delegation indicated that the local government in Guangdong had been authorized to go ahead with the LNG project and that the feasibility study for the project had already been concluded. He said such individual projects will be the responsibility of the local governments. He noted that future prospects for LNG were bright. He said that, in addition to LNG, China wanted to continue to develop its substantial offshore gas resources. He indicated that resources that could be exploited economically amounted to more than 3 billion cubic meters. China anticipated that total production from offshore areas is already 4 billion cubic meters and that this would rise to 10 billion by the year 2004. He noted successful projects already concluded, including Chevron effort to invest \$40 million for gas exploration.

DOE officials noted that natural gas would be a special area of focus for the second session of the U.S.-China Oil and Gas Industry Forum and distributed a preliminary agenda for that session. China was asked to submit any additional topics as soon as possible to the Steering Committee so that the agenda could be finalized.

An official of the U.S. Department of Commerce, the Counselor to the Department of Commerce, described insights gained from U.S. industry in previous discussions and at the morning's Business Roundtable, as well as the Oil and Gas Industry Forum which he co-chaired in Beijing. He noted their interest in: mutual access to markets; exchanges on oil and gas industry practices to help identify areas where government practices and regulations could act as barriers to greater investment. He also indicated U.S. and Chinese industry's common interest in international projects for energy supplies to China, in both Central Asia and Russia. He encouraged China to work with Qatar for enhanced gas supplies and with other countries with whom the USG and China have common interests.

EPA/SDPC Cooperative Study of Natural Gas Utilization in China

An official of the U.S. Environmental Protection Agency next described plans for the "Cooperative Study of Natural Gas Utilization in China", under a Letter of Intent signed on April 9 between EPA and the State Development Planning Commission. He noted the benefits of natural gas because it had no emissions of SO₂ or particulates and 60% fewer CO₂ emissions compared to coal. Enhanced natural gas use would thus result in substantial reductions in China in all these emissions. He described the tentative schedule for the study with discussions with the SDPC to begin in a May visit to Beijing by EPA officials. That meeting would aim at confirming the schedule for the study. The goal is to initiate the study quickly and to report progress on it and seek inputs/comments at the next meeting of the U.S.-China Oil and Gas Industry Forum in July.

The Chinese Delegation responded that the PRC is very interested in improving air quality and had decided to embark on this study to reduce carbon emissions. It was noted that the State Council and one dozen Chinese agencies have jointly decided to embark on clean air projects, including a clean vehicle action plan. There was an agreement to phase out leaded gasoline in automobiles and to install devices to reduce tailpipe emissions. There were also efforts to promote use of LPG and CNG in vehicles and to promote electric vehicles. The clean vehicle action plan would be started with pilot projects in 12 cities, with the aim of gradually expanding the effort more widely. These pilot projects will open up opportunities for cooperation in natural gas – either CNG or LPG. The EPA official noted that EPA is very interested in looking at the transport sector as part of the natural gas study and opportunities for enhanced gas use in the sector. The Chinese delegate indicated that China's Ministry of Science and Technology would contact EPA to discuss this further.

A Sustainable Coal Industry

An official of China's State Power Corporation distributed a paper on "China's Power Industry and Environmental Impact" and made brief summary comments. He noted efforts by the PRC to improve the efficiency and reduce the environmental impacts from the production and burning of coal. Some progress has been made, but there is a need for a major effort to promote cooperation in advanced technologies. In 1985, the Minister of the Coal Industry signed a fossil fuel protocol with DOE; there has been progress under the agreement through 1997. China has also participated in clean coal technology conferences in Beijing and exchanged ideas on strengthened institutional arrangements between the FETC and Chinese institutions. A concrete issue is the need for an organizational institution to promote the exchange of information and exchange of personnel. China is hoping to apply advanced technology in the area of coal washing to reduce emissions from coal. Also, the PRC is hoping to promote advanced technology for desulfurization. They would like the U.S. to cooperate with them in this field.

Currently, 500,000-600,000 boilers in China use coal. The PRC official indicated that there were opportunities to explore joint research in LNG. Reference was also made to the coal

liquefaction project in cooperation with HTI of New Jersey and disappointment that the 3 ton level test did not proceed due to lack of DOE funding. China indicated that this project was quite meaningful for the future and hoped that DOE would continue its support. The PRC official noted that coal burning was one of the major concerns in the energy sector in China and expressed his hopes that DOE will continue to implement specific cooperative projects. The PRC co-chair added that there were many problems associated with coal utilization in China and that increased attention was being given to the impact of coal on the environment and on air quality. China is one of the major coal producing countries; the issue is how to use policy as a lever to motivate industry to use clean coal technology and how to reduce its cost, so that it is more competitive. These questions would be a useful focal point for discussion between the two countries.

An official of DOE's Office of Fossil Energy responded to China's concern over the coal liquefaction project. He noted that there had been outstanding results from the benchmark tests completed for this project, but that DOE funding originally envisioned for the 3 million ton scale test had to be applied to repair some of the support facilities for the project. HTI is now modifying these units to make a successful test run in the future. DOE has included a request for the necessary funding for completing the 3 million ton test in its budget request for Fiscal Year 2000. If secured, this funding would be available in October of 1999. The PRC expressed disappointment in this slippage, noting that it also has cooperative projects with Germany and Japan, and hoped that U.S. project could proceed; otherwise, these two countries would have an advantage in this area.

In other areas, the DOE official noted the U.S. offer to have Chinese coal tested at an IGCC plant in Tampa, Florida. He noted that this could be extremely valuable to China and provide valuable technical information, otherwise only available by constructing a demonstration plant. He noted that China did not accept this offer last year, but now that the IGCC feasibility study had been completed, perhaps it would revisit this offer. The DOE official summarized cooperation already underway between the USG and PRC through the Energy and Environment Technology Center in Beijing. He pointed to the complexity of clean coal projects, with potential cooperation covering areas from coal preparation, and coal conversion to coal combustion and electric power generation. He also noted the complexity of organizations in China dealing with these efforts, at both the provincial and central government level. To streamline U.S. cooperation with China, DOE is looking toward making the Federal Energy Technology Center the focal point for managing clean coal technology cooperation with Chinese counterparts, and looking to develop a new fossil energy protocol which would include provisions for new institutional arrangements between FETC and counterpart Chinese research institutes. The Chinese delegation responded that there was a clean coal task force within the SDPC that should be the focal point for our future contacts and for managing bilateral clean coal technology cooperation. The PRC suggested that the upcoming U.S./Sino clean coal technology conference would be a good opportunity to exchange ideas on the elements of a new fossil energy protocol.

Coal Mine Methane Market Development Plan

An EPA official described a new coal mine methane market development plan to be developed over the next two years, under a letter of intent between EPA and China's State Administration of Coal Industry. He noted that enhanced development of coal mine methane has substantial potential in regard to: increased mine safety; environmental protection; reduction of greenhouse gases; and promoting economic development goals. The EPA official indicated that the PRC had made significant progress in coal mine methane recovery and use but that significant potential remained, on the order of 2-6 billion cubic meters. A number of U.S. companies, including Texaco, Arco, and Phillips, are involved in coalbed methane projects in the PRC. However, the barriers to enhanced development of coal mine methane included lack of information by western investors on potential projects, partially because of the small size of many of these projects. The EPA official said that the new coal mine market development plan would seek to develop an information database on coal mine methane projects that would be developed under the existing China Coalbed Methane Clearinghouse and distributed internationally to potential investors. The project would be undertaken over a two year period. The PRC responded that China is looking at ways to strengthen cooperation with foreign entities in this area, which was the basis for the establishment of the United China Coalbed Methane Company and incentives provided for investments in coalbed methane projects. The EPA official noted that in coal mine methane, as opposed to coalbed methane, there was a need for more engagement with the coal industry and more cooperation with Western companies. He also indicated that U.S. companies would be interested in how they might eventually receive greenhouse gas reduction credits for coal mine methane projects in China.

Technology Cooperation Agreement Pilot Project (TCAPP) or the "Cleaner Air and Cleaner Energy Technology Cooperation Agreement"

An EPA official noted that a letter of intent had been signed between EPA and the State Development Planning Commission to continue work under the Technology Cooperation Agreement Pilot Project or TCAPP which had been underway for two years. This cooperative program would now continue for three years. The goal would be to use the project as a model for technology cooperation under the Framework Convention on Climate Change and to share lessons learned under the project with other countries under the Convention. The EPA official distributed a handout on the TCAPP program. The PRC Delegation indicated that this was a very important project and that it had organized a task force to push this type of cooperation forward. The PRC noted that there were important issues which could be addressed through this work, such as the availability of matching funds for certain projects using the World Bank and other organizations.

Renewable Energy Cooperation

An official from DOE's Office of Energy Efficiency and Renewable Energy reviewed the status of cooperation under four cooperative annexes under the U.S./China Energy Efficiency and Renewable Energy Protocol signed in 1995. He noted that the four annexes for the protocol

covered: rural electrification; wind energy; renewable energy business development; and geothermal energy. In wind power development, he described the upcoming completion of the Xiao Qingdao village power project on an island off the coast of Shandong Province, technical assistance for wind resource assessments, and technical support for a Wind Energy Center in Beijing. In renewable energy business development, the DOE official referred to the upcoming completion of two bilingual reports: one on the PV industry and its technical status in China; and renewable energy business profiles in 6 key provinces. In addition, an internet web site was being developed in both countries, and a regional rural electrification workshop was being planned. The DOE official also described plans for technical assistance in 3 building designs in China using ground source heat pumps and training in exchange for China's commitment to purchase U.S.-made equipment. The U.S. was also considering a proposal by China's Ministry of Science and Technology for a joint Renewable Energy Forum and Exhibition to be held in Beijing in the late fall of 1999; the most likely date appears to be in the spring of the year 2000. In rural electrification, another 240 Solar Home Systems were to be completed in Inner Mongolia; technical assistance was planned for the Lanzhou Testing & Training Center; and technical assistance was also under consideration in support of the SDPC's Brightness Program. In regard to biomass energy, a biomass resource database was being updated; there was continuing information exchange; and planning for a workshop on biogas and for training on geographic information systems.

In response, the PRC delegation noted that renewable energy applications are vital in China, because China still has 60 million people without electricity and there are long-term structural problems, including inadequate grid capacity and an inadequate distribution network. PRC official noted efforts to expand the electric power network in rural areas; and to further rationalize power generation needs. Environmental protection was of increasing priority. The basic principles being followed were to focus on hydropower development, development of nuclear power to a reasonable degree, increase the development of the electric grid and diversify away from coal use (which was still 75% of energy needs). Renewable energy would play an important role in bringing electric power to people in rural areas.

Energy Efficiency Cooperation

An official of DOE's Office of Energy Efficiency and Renewable Energy reviewed the status of cooperation with the PRC in energy efficiency and the next steps in this process. He emphasized that energy efficiency is a common challenge to both the U.S. and China and that there are substantial opportunities for improvements in both countries. He said that since most of the industrial production capacity built today will still exist 15 years from now, industrial technologies chosen today will affect patterns and efficiency of energy use for decades to come. He stressed that increasing energy efficiency not only reduces energy costs, waste and pollution, but can also promote productivity and product quality. The U.S. realized that the PRC had already taken important steps in energy efficiency including the enactment of the Law on Energy Conservation in January 1998. U.S.-China Bilateral cooperation in energy efficiency was conducted under the Protocol for Cooperation in the Fields of Energy Efficiency and Renewable Energy signed in 1995 between DOE and the then State Science and Technology Commission.

An energy efficiency steering committee between DOE and the SDPC has been established and held its first meeting in Beijing in May of 1997.

The Steering Committee has activities underway in ten areas: energy policy, information exchange, industrial process controls, lighting, finance, district heating, energy-efficient buildings, cogeneration, energy-efficient motor systems; and amorphous core transformers. Significant progress has been made in most of these areas since the first meeting of the Steering Committee. A second meeting is planned for June 1999 in Beijing. Electric motor systems have been identified as a particular area of emphasis, because electric motors consume about 50% of industrial electricity and significant energy savings are possible with more efficient motors and systems. Significant progress has been made in this area, including the completion of a motor market study and a motor challenge workshop held in Beijing in 1998. The next step planned is another motor challenge workshop in the summer of 1999, concentrating on pumping systems, and discussion of bilateral assistance in helping the PRC develop a motor challenge program in one province.

The U.S. and China had also collaborated on policies to promote energy policy, including a workshop held in Beijing in December 1997 in which over 40 Chinese officials participated. The DOE official indicated that the U.S. would be very happy to provide further technical assistance to China in the development of China's Law on Energy Conservation and its ongoing efforts to demonstrate energy standards, upgrade energy monitoring and data gathering and use energy appliance labeling.

In a third area, the U.S. and China are cooperating in a design study for an energy efficient building demonstration project. This work was being conducted under a Statement of Work signed in July 1998 between DOE and the Ministry of Science and Technology. It provides for a technical and financial feasibility assessment and the development of a project plan, including budget and cost shares for the U.S. private sector and China entities who might participate in the construction phase of the demonstration building. The building would be designed to incorporate a demonstration center for energy saving technologies and to house the Administrative Center for China's Agenda 21. The technical analysis portion of this effort is nearing completion. The U.S. National Resources Defense Council will lead an assessment of potential U.S. private sector contributions to the construction phase, should the project proceed.

Concluding Remarks

The U.S. and PRC co-chairs each took note of the many achievements in energy cooperation between the US and China and the next steps identified in this meeting of the Energy Policy Working Group. These include: the Ex-Im Bank Clean Energy Program, as well as cooperation in clean coal technology, energy efficiency, renewable energy, oil and gas, and coal mine methane. Both sides expressed the hope that following the meeting, these efforts would move forward and that there would be a continued exchange of information. The U.S. co-chair noted that a summary report of the meeting would be prepared within two weeks and suggested that the two sides share their written reports and the concrete steps that we can take to implement the

various outcomes that were identified. He also noted that there was a need for correspondence between the two sides on the possible role of various foundations under the Energy and Environmental Cooperation Initiative. He indicated that a number of foundations has expressed interest in participating under the Initiative and had written with specific ideas or proposals. It would be useful to exchange information with China on these proposals.

**Participants in the Energy Policy Working Group of the
U.S.-China Forum on Environment and Development**

Representatives from the People's Republic of China:

SONG Mi, Director-General, Department of Basic Industries, State Development Planning Commission (Co-Chair)

JIA Yinghua, Deputy Director-General, Department of Power, State Economic and Trade Commission

YANG Han, Deputy Director-General, Department of Planning and Development, State Coal Industry Administration

CHEN Shuyun, General Engineer Office of Policy Research, China National Nuclear Corporation

LUO Ming, Director-General, Office of Enterprises Policy Research, China National Offshore Oil Corporation

ZHU Binggang, Director-General, Department of Planning, National Petroleum Corporation

TAN Aixing, Director-General, Department of Foreign Affairs, State Power Corporation

SHI Dinghuan, Director-General, Department of Industrial Technology, Ministry of Science of Technology

JIAN Wei, First Secretary for Science and Technology, Embassy of the People's Republic of China to the United States

United States Government Delegation:

David Jhirad, Senior Advisor for International Affairs, Office of the Assistant Secretary for Policy and International Affairs, U.S. Department of Energy

Robert S. Price, Jr., Acting Deputy Assistant Secretary for Science and Technology Policy and Cooperation, U.S. Department of Energy

Abraham E. Haspel, Deputy Assistant Secretary for Energy, Environmental and Economic Policy Analysis, U.S. Department of Energy

Robert W. Gee, Assistant Secretary for Fossil Energy, U.S. Department of Energy

James A. Mahoney, Vice President, Engineering and Environment Division, U.S. Export-Import

Bank

Jan Kalicki, Counselor to the U.S. Department of Commerce

Edward Ciampa, Senior Loan Officer, U.S. Export-Import Bank of the United States

Donald Juckett, Director, Office of Natural Gas and Oil Import and Export Activities, Office of Fossil Energy, U.S. Department of Energy

Sun Chun, Senior Executive Advisor for International Activities, Office of Fossil Energy, U.S. Department of Energy

Robert Dixon, Director, International Initiatives, Office of the Assistant Secretary for Energy Efficiency and Renewable Energy, U.S. Department of Energy

Allan Hoffman, Associate Deputy Assistant Secretary for Utility Technologies, Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy

Peter Salmon-Cox, International Specialist, Office of Industrial Technologies, Office of the Assistant Secretary for Energy Efficiency and Renewable Energy, U.S. Department of Energy

Paul Schwengels, Senior Program Manager, Office of Policy, Environmental Protection Agency

Karl Schultz, Coalbed Methane Program Manager, Office of Air and Radiation, Environmental Protection Agency

Other United States Government Participants and Staff Support:

Lee Gebert, China Program Manager for Renewable Energy, Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy

Theodore Atwood, Manager for the Pacific Rim Programs, Office of Coal and Power Systems, Office of Fossil Energy, U.S. Department of Energy

Donna Bobbish, Senior Director, Regulatory Policy, Office of Policy and International Affairs, U.S. Department of Energy

Padraic Sweeney, International Trade Specialist, International Trade Administration, U.S. Department of Commerce

Ted Macdonald, Pollution Prevention Program Manager, Office of International Activities, Environmental Protection Agency

Lawrence Cohen, International Economist, U.S. Department of State

Denise C. Dwyer, International Relations Specialist, Office of Policy and International Affairs

Peter Paul Jodoin, Senior Officer for Asian Affairs for Science and Technology Cooperation,
Office of Policy and International Affairs

Kevin Koppel, Minerals Management Service, U.S. Department of the Interior

Edward R. Rossi, International Relations Specialist, Office of Policy and International Affairs

**Environmental Policy Working Group of the
U.S.-China Forum on Environment and Development
April 9, 1999
Washington, D.C.**

The Environmental Policy Working Group was co-chaired on the U.S. side by Carol M. Browner, Administrator of the U.S. Environmental Protection Agency (USEPA), and Frank E. Loy, Under Secretary of State for Global Affairs. Xie Zhenhua, Minister of State of the State Environmental Protection Administration (SEPA), and Lu Shumin, Director-General, Department of America and Oceania Affairs, Ministry of Foreign Affairs, co-chaired the People's Republic of China delegation. Lists for both delegations are attached.

The session, which met for three and a half hours, was divided into two interrelated parts: the first focussing on environmental issues of bilateral concern and cooperation, and the second concerning multilateral environmental matters. The agreed Agenda and Schedule are also attached.

On bilateral issues, the two sides exchanged views on the recent exchange of visits of Minister Xie and Administrator Browner, and then discussed cooperative environmental projects, including the on-going air quality monitoring project. A discussion then ensued on possible new air pollution control projects, industrial pollution prevention and energy efficiency issues, and possible expansion of U.S. Peace Corps activities in China into environmental education. Forestry cooperation, air quality/pollution management issues, air pollution and health issues, and municipal solid waste treatment and urban water issues were also discussed. After the conclusion of the Working Group meeting, six separate Statements of Intent on environmental cooperation issues were signed between USEPA and SEPA; and one between USEPA and the State Administration of Coal Industry of China. These were in addition to three Statements of Intent concluded earlier in the day, including one between USEPA and SEPA and two between USEPA and the State Development and Planning Commission of China.

On multilateral issues, the two delegations exchanged views on global climate change, including the High Level Dialogue between the two governments on climate change, and Clean Development Mechanisms Issues and other environmental financing issues. Desertification issues and international forests issues were also discussed. The two sides examined international chemicals issues, including the Persistent Organic Pollutants and Prior Informed Consent Regimes and associated agricultural issues, as well as biodiversity matters, specifically the Biosafety Protocol to the UN Convention on Biological Diversity.

Bilateral Issues

Mr. William A. Nitze, Assistant Administrator for International Activities, USEPA, opened the discussion on bilateral environmental cooperation issues on behalf of Administrator Browner who was called away on urgent business. Mr. Nitze welcomed the Chinese participants and noted the importance of the Forum in engaging both sides on environmental issues, congratulating the Chinese side for the commitment to this effort and hard work to make the Forum a success. Because the meeting started late, both sides agreed to work quickly through the agenda.

Minister Xie captured the current state of industrial development and its impact to the environment in China. He noted that the many small and medium sized industries in China produce visible environmental impacts including groundwater pollution and acid rain. China is in need of a better groundwater resource management scheme and is prepared to spend over 100 trillion RMB on addressing the acid rain problem, he said. The environmental restoration effort will be initiated in the "key" cities, such as Beijing, he noted. In addition, protection and restoration of the marine environment is also important to the Chinese, the Minister stated.

Mr. Xie described some of the active efforts being made by China to protect the environment, including "total emissions control," the target of which is to hold emissions of certain pollutants (primarily SO₂) in certain areas to 1995 levels in the year 2010; ecosystem management including massive tree planting programs; CFC phase-out efforts; chemical waste management programs; and setting aside 7.6% of the country's land for nature reserves. With respect to lead phase-out in gasoline, 20 some cities have begun to use unleaded gasoline, the Minister noted. Sustainable development is the goal for eleven major key cities. In terms of greenhouse gas emissions reduction, Minister Xie described population control programs in terms of their benefit in limiting growth in energy consumption, as well as efforts to develop non-coal energy sources including nuclear, wind and solar.

Both sides reviewed the progress on bilateral cooperation since the last Forum meeting, including successful exchanges of visits between Minister Xie and Administrator Browner. Mr. Nitze also mentioned the success seen to date on the Air Quality Monitoring Cooperation Project between USEAP and SEPA that involves the State of California. Mr. Wang Zhijia, Director-General, Department of International Cooperation, State Environmental Protection Administration, agreed with Mr. Nitze and further elaborated that up to eleven cities will have automated air monitoring systems purchased from Dasibi at the end of Phase I of the project. SO₂, a major concern to China, is included in the Air Monitoring Network Project.

Turning to new projects under discussion at this meeting, Mr. Nitze invited USEPA colleagues to describe several projects on which the U.S. and China had come to agreement. First, for the project on market-based mechanisms for SO₂ control, the

signing of which had just been completed prior to this meeting and witnessed by the Vice President and Premier, Mr. Paul Stolpman, Director, Office of Atmospheric Programs, USEPA, briefly described U.S. efforts and the benefits and cost reductions incurred. Mr. Wang noted that SEPA is very interested in market mechanisms but noted that they are not the only way to control pollution, and that the U.S. and China need to move forward step by step. Mr. John Beale, International Programs Manager, Office of Air and Radiation, USEPA, described what the two sides intend to do for the Air Quality Management Assessment Project and the Industrial Pollution Prevention and Energy Efficiency Project. Mr. Stolpman also mentioned the Energy Efficient Building Project which was being discussed in the Commercial Cooperation Working Group of the Forum, noting that buildings are responsible for significant pollution levels and that more pollution is caused by working in an office building than by driving to work. Mr. Wang also expressed that China is interested in the U.S. expert recommendations on the implementation and development of clean coal technologies.

Ms. Ellen Paquette, Regional Director for Europe, the Mediterranean, and the Asia Region, U.S. Peace Corps, described a new agreement with China to expand next year its English-language training programs into environmental education. Most of the Peace Corps work in China has been related to teaching English, and Ms. Paquette said that environmental education could be incorporated into current lecture material. Mr. Wang welcomed suggestions from Peace Corps on ways to raise environmental consciousness in children and adults alike. Mr. Yao Changtian, Deputy Director-General, Department of Development Planning, State Forestry Administration, described China's efforts to reinforce protection of reserved areas, of which there are 926 in China, to prevent erosion through wetlands preservation and planting, and other programs. He emphasized that most of the ecological preservation efforts and minimization of deforestation and agricultural activities have taken place on the upstream portions of the Yangtze River. Mr. Gary Man, Program Coordinator for Asia and the Pacific, Office of International Programs, U.S. Forest Service, responded that there are many similarities between the forests of the U.S. and China, and that the U.S. Forest Service looked forward to continued cooperation with China.

Mr. David Gardiner, Assistant Administrator for Policy, USEPA, noted that the U.S. and China had not yet come to agreement on two projects relating to the Clean Development Mechanism (CDM) on project based crediting and forest sinks. Because these projects are between USEPA and the State Development and Planning Commission, they were not discussed in detail. The U.S. side noted a desire to hold workshops to further explore bilateral cooperation in this area. Mr. Nitze noted that new projects examining the co-benefits (in terms of public health and the economy) of air pollution and greenhouse gas emissions control measures, as well as new air pollution and health research projects, will make the benefits of environmental management more clear to policy makers and the public. Minister Xie agreed, noting that U.S. cooperation on monitoring, forecasting and benchmarking would be particularly helpful. He also suggested that USEPA consider cooperating on an analysis of the sources of air pollution in China.

Finally, the Chinese delegation described China's needs in the areas of solid waste and waste water management, noting the need for improving waste management beyond current waste burial programs. Nearly 70% of China's waste water is discharged without treatment and water pollution fees have not rectified the problem. The U.S. side noted the successful initiation of cooperation on landfill methane and solid waste management, initiated at a Mayor's workshop last month in Nanjing and co-sponsored by the UN Development Program.

Multilateral Issues

Under Secretary Loy opened the discussion by congratulating China on efforts it has undertaken to date to address environmental issues and praised the bilateral cooperation between the two sides on such matters. He noted, however, that the United States and China can't effectively address environmental problems independently, and that the two countries need to work together in multilateral fora considering such issues. Mr. Loy observed that the U.S. and China had worked effectively in such fora on some international environmental issues such as chemicals matters. He stated that the U.S. recognized that there exist differences of views between the two sides on a number of multilateral environmental issues, but said that the U.S. and China have a responsibility to all peoples. He stated that the U.S. and China have a special role given each others' influence, size and power. Mr. Loy then observed that perhaps no issue is more important in this regard than global climate change, and proposed that the U.S. and China hold another session of their High Level Dialogue on Climate Change this summer.

Global Climate Change: On global climate change, Under Secretary Loy observed that as the two largest emitters of greenhouse gases that contribute to climate change, the leadership of the U.S. and China in the international community is essential to solve this problem. He noted that the challenge is to build a global system to limit and reduce where possible the rate of emissions growth while protecting economic growth. Mr. Loy stated that with China's help, the incentives to energize technology, capital, and the international rules can be developed that will benefit China in the process.

Acting Assistant Secretary of State for Oceans and International Environmental and Scientific Affairs, Melinda L. Kimble, proceeded to provide a progress report on global climate change discussions since the last Forum meeting, specifically focussing on the first High Level Dialogue session held in September 1998 in Beijing. She stated that the two days of meetings with a number of Chinese ministries were productive, noting that views on the problem of climate change were exchanged, actions to address it were presented, and opportunities for bilateral cooperation were discussed. Ms. Kimble opined that the session was particularly valuable in helping to understand each government's position in the multilateral negotiations on climate change. She stated that at the meeting, the U.S. outlined why it believes China could benefit financially, technologically, and environmentally from taking on a greenhouse gas emissions target under the Buenos Aires Action Plan and the Kyoto Protocol that allows for very substantial growth in emissions, and participating in emissions trading. Ms. Kimble

noted that the U.S. heard China's concerns at that time with this approach, but that the U.S. continues to believe that there may be opportunities to narrow the differences of views. She stated that it was clear that while the U.S. and China may have some differences in the negotiations, there was strong interest in opportunities to work together to address climate change and related issues. In this regard, and within the context of the multilateral UN Framework Convention on Climate Change, Ms. Kimble noted that the two sides had identified an ongoing interest in cooperative opportunities presented by carbon sinks and the Clean Development Mechanism. She concluded that both sides emphasized the need for continued and strengthened cooperation, and agreed to continue the Dialogue.

Under Secretary Loy then congratulated China for its outstanding work to produce the China Climate Change County Study, stating that it was a significant accomplishment involving many Chinese ministries and institutions. He noted that the U.S. was pleased to have recently received the English translation of the report, which was completed with assistance from the U.S. Country Studies Program, USEPA, U.S. Department of Energy, and the U.S. Agency for International Development. Mr. Loy then called on Todd Stern, Assistant to the President for Special Projects, and coordinator for U.S. climate change policy, to describe U.S. domestic programs to reduce emissions.

Mr. Stern noted that the U.S. is spending approximately \$4 billion annually on climate change related projects, including \$1.4 billion in research and development. He noted that these funding levels represented a 35% increase over the previous year, which was a 25% increase over the year before that. He stated that the U.S. was focussing particularly on high efficiency automobiles, bioenergy, energy and environmental technologies, and other forms of energy efficiency. Mr. Stern noted that in addition to other groups, the U.S. has an extensive consultative process with the energy sector.

Mr. Loy concluded that it is clear that the U.S. and China are both taking actions domestically to address climate change, and that the bilateral cooperation between the two countries on this issue is growing significantly. He stated that it is essential, as the two sides move forward with national and bilateral cooperation on climate change, to enhance cooperation in the multilateral negotiations, and in this regard, that the High Level Dialogue on Climate Change was very useful. He again proposed another session of the Dialogue to be held this summer, without great publicity or a repetition of previously stated positions, but rather as an exchange of ideas.

Minister Xie responded by stating that climate change was discussed at length in the working lunch held earlier in the day between the Vice President and Premier. He noted that China understands the measures that the United States is taking domestically to address climate change and asserted that China is likewise taking measures. The Minister agreed with the need for the U.S. and China to cooperate on this matter and opined that such cooperation could lead to business cooperation and assist with solving the trade deficit between the two countries. He stated his agreement with continuing the dialogue, but noted that it needed substance and that simply repeating old positions

would not be meaningful. Under Secretary Loy concurred that a free discussion was needed – one that would not bind either side, that was low key, and that did not anticipate a result such as a communiqué. He stated that time needed to be taken to prepare and plan for the Dialogue so that effective and meaningful results would be obtained.

A discussion on Clean Development Mechanism (CDM) issues then ensued. Acting Assistant Secretary Kimble stated that, in the context of the Kyoto Protocol and the Buenos Aires Action Plan, the challenge is to develop a system that assists developing countries such as China to limit their emissions growth while pursuing sustainable economic development. The engine for such a system must be the use of market-based mechanisms such as the CDM and emissions trading. She noted the differentiated nature of the Kyoto Protocol with regard to emissions reductions and stated that developed countries had agreed to reduce their emissions. But the overall problem is one of global emissions growth, and in this regard the Kyoto Protocol must be used effectively.

Ms. Kimble noted that the U.S. has the technology available to assist China with its emissions, but restricting the mechanics of the CDM does not help in this process. She also noted that the CDM could be beneficial to China with its forest sector, and that the CDM could become operational by 2000; therefore, there is increased urgency to China's participation in the CDM as soon as possible.

Gao Yanping, Director, Division of Environment, Department of Treaty and Law, Ministry of Foreign Affairs, responded that China agrees that climate change is an important issue and that the Kyoto Protocol and CDM are important legal instruments. She stated that China's gross domestic product on a per capita basis was low and that China's per capita greenhouse gas emissions were similarly low. Though China opposed emissions limitation commitments on developing countries, it would act responsibly and not refuse to make efforts to limit emission at home. Ms. Gao said many nations have not done in-depth study on the CDM, and that an international debate is needed. She said it will be necessary to first get clear principles and rules in place for the CDM, abiding by the UNFCCC and the Kyoto Protocol, following which we can gradually set up the mechanism in a step-by-step process. Ms. Gao noted that China had submitted its views to the UNFCCC Secretariat in February on the CDM and, in this regard, noted that China believes certain principles needed to be included, particularly regarding methodological and institutional issues.

Under Secretary Loy reiterated that the Kyoto Protocol is essentially a document of differentiated obligations that the U.S., along with others, recognize and support. He stated that China's position on the CDM appeared reasonable, and agreed that discussions are needed on the principles and institutions that would ensure that the CDM would be simple enough to use and would provide certainty that emissions reductions are real and measurable. He noted that the circumstances under which the U.S. would be able to submit the Kyoto Protocol to Congress for ratification would require some sort of increased participation by developing countries. Mr. Loy felt it was in the mutual interests of all to play an appropriate role in a global system with differentiated

responsibilities. Mr. Loy further stated that on the matter of technology and technology transfer, the U.S. recognized that without the wide application of technology, the problem of climate change was unlikely to be solved. He hoped the two sides could discuss further at the High Level Dialogue the mechanisms needed to speed up the flow of technology. Ms. Kimble added that the U.S. had recently submitted its own technical papers on the CDM and other Kyoto mechanisms.

The discussion then turned to Environmental Financing Issues. USEPA Assistant Administrator for International Activities, William A. Nitze, opened the discussion by noting that the issue is one involving the dilemma of how to purchase environmental technologies. He suggested that in order to initiate cooperation between the U.S. and China on environmental finance, a first step might be to organize consultations between U.S. and Chinese financial and environmental experts. Mr. Nitze stated that the U.S. is not as effective as Japan or the European Union in providing attractive financing, but that the U.S. is interested in providing assistance to the energy and electricity generating sectors. He proposed that the U.S. and China begin a dialogue on the issue of environmental project financing.

Minister Xie responded that without U.S. grants or low interest financing little could be done to aid in implementation of the UN Framework Convention on Climate Change. He concurred that Japan and the European Union have far more attractive financing packages than the U.S., and posed the question of why China should cooperate with the U.S. when the U.S. can't compete in this particular market. Under Secretary Loy agreed that China should purchase the most economical materials; David Sandalow of the Council on Environmental Quality and the National Security Council said that the U.S. has superior environmental technology and suggested the need for a dialogue on the issue. Minister Xie concluded by suggesting that perhaps there was a need to nationalize environmental technologies.

Desertification Issues: Ms. Gao opened the brief discussion on desertification issues by underscoring the severity of the problem in vast areas of China and the importance of the United Nations Convention to Combat Desertification (CCD) as a means of providing needed international technical and financial cooperation to China. She noted that 46 million square meters of China suffers from desertification and dryland degradation, or approximately 30% of China's land area, and nearly 20% of China's population. The negative effects of desertification, Ms. Gao stated, are extraordinarily serious in developing countries. She noted China's status as a party to the CCD and observed that the U.S. has still not ratified the CCD. She affirmed the importance of U.S. ratification of the CCD and expressed the hope that this would occur as soon as possible. We were reminded that at the last Conference of Parties (COP) in Dakar in November 1998, Congressman Donald Payne (D-N.J., and Ranking Minority Member of the House International Relations Subcommittee on Africa) indicated that the U.S. was in the process of ratifying the Convention. Ms. Gao stated that China was taking measures to address its desertification problems by supporting the CCD and appointing officials to

address desertification/soil erosion. But, she stated, China needs financial resources and technology to do this effectively.

Ms. Kimble responded by noting that the U.S. has many areas subject to desertification and drought and has built an experience base on how to manage them. She reiterated the importance the U.S. attaches to the CCD. She informed the Chinese side that the U.S. has signed the Convention and has sent it to the United States Senate for advice and consent to ratification. She also stated that Secretary of State Albright had included the CCD in the urgent (top) category for legislative action by the Congress this year. She also noted that she would be chairing a forum of U.S. environmental and business interests regarding the CCD in the next few weeks. The Chinese side indicated their strong desire to have U.S. ratification completed by the next COP to be hosted by Brazil in late 1999.

International Forests Issues: Mr. Yao Changtian, Deputy Director-General, Department of Development Planning, State Forestry Administration, led the brief discussion on multilateral forest issues by stating that management of forests in China is based on sustainable development principles. He noted that China has developed a reforestation plan and established a sustainable development center. Ms. Gao further said that China participates in many international meetings, including the UN Intergovernmental Forum on Forests (IFF), with an effort towards discussion of future international arrangements to promote sustainable forest management.

Brooks Yeager, Deputy Assistant Secretary of State for Environmental Affairs, responded by stating that the U.S. is encouraged by the importance Premier Zhu placed on forest issues in his opening address to the Forum earlier in the day. Mr. Yeager noted that the U.S. and China had worked closely at the recent UN Food and Agriculture Organization Ministerial Meeting on Forestry in drafting an action oriented ministerial declaration. Such collaboration, he stated, is not only very welcome but also essential if the U.S. and China are to bring about a positive outcome to the ongoing debate on forests in the United Nations.

Mr. Yeager then reiterated the U.S. position that we do not believe a new legally binding forest convention is the best vehicle to promote international cooperation for sustainable forest management. He noted that the U.S. is concerned about sterile negotiations that would take away from concrete actions on the ground, such as implementing criteria and indicators. Mr. Yeager stated that the U.S. wants to work with China in the IFF. With further regard to criteria and indicators, Mr. Yeager said that the U.S. highly valued the participation of China in the Montreal Process Working Group (MPWG) for Sustainable Forest Management. He noted that the U.S. looks forward to working with China at the next MPWG meeting, which the U.S. will host this fall, and that the U.S. hopes China will consider hosting a meeting.

China did not respond to the U.S. comments on the Montreal Process. Ms. Gao stressed that consensus needs to be reached before discussion about the concrete elements of a

legally binding instrument can be undertaken. She noted that China understands the U.S. position, and that the two countries' goals for sustainable forest management are the same.

International Chemicals Issues: Deputy Assistant Secretary Yeager opened the discussion by indicating U.S. satisfaction with the Prior Informed Consent (PIC) Convention and expressed optimism about its prospects for early ratification by the U.S. He expressed the U.S. hope that China too would be in a position to ratify at an early date. Mr. Yeager noted that the U.S. enjoyed a close and cooperative relationship with China during the PIC negotiations, and characterized both countries' positions as pragmatic and sensible.

Turning to the ongoing negotiations on a Convention on Persistent Organic Pollutants (POPs) through the UN Environment Program, Mr. Yeager indicated that the U.S. sought a practical and sensible agreement in this area as well and one that effectively addresses transboundary risks associated with the highest priority substances. He expressed a hope that the U.S. and China could find areas where they could work together in this regard.

Mr. Yeager noted that because of the considerable local risks posed by POPs releases, most countries across all regions of the world had already taken strong action on most of the POPs. He stated that the U.S. believes that the task of the negotiations was to build on this momentum by moving away from the relatively few remaining uses as alternatives become available. As an example, Mr. Yeager noted that China had already indicated under the voluntary Prior Informed Consent procedure that it had banned all of the POPs substances that had been listed under PIC, including such substances as DDT and chlordane. He stated that the U.S. view is that the Convention would be instrumental in directing resources through the Global Environmental Facility (GEF) and other mechanisms toward better addressing this problem. Mr. Yeager noted that on technical issues, such as criteria and technical exemptions, the U.S. and China were likely to have much in common. He stated that the U.S. believes that the first Criteria Experts Group report reflected an excellent technical outcome on this issue, and that the U.S. wants to ensure that we build on this outcome in future meetings.

Minister Xie deferred to Mr. Lu who stated that China had agreed to reduce the use of POPs, but that China needed the financial resources and technology to reduce the harmful effects of POPs. He stated that the international community must agree to an acceptable timetable to reduce the use of POPs. On the PIC Convention, Ms. Gao responded by indicating that the development of the PIC Convention was very positive and that China was doing its best to sign and ratify it, hopefully in the near future. With further regard to the POPs agreement, Mr. Gao Shangbin, Deputy Director, Department of Science and Technology, Ministry of Agriculture, expressed China's view that the Convention would need to take into account different conditions of developing countries, and that there would need to be differentiated obligations. He also stressed the importance of financing for the implementation of the agreement. Mr. Yeager responded

by stating that the U.S. recognized the need for technical assistance to developing countries.

Biodiversity Issues/Biosafety Protocol: As the Working Group meeting was running late when this agenda item was reached, it was decided to spend less than the allotted time on the Biosafety Protocol. Under Secretary Loy opened the discussion by saying that the United States was disappointed in the results of the suspended Biosafety negotiating session in Cartagena held last Fall. The U.S. is committed to achieving a Biosafety Protocol, but one that is practical and does not unduly hinder research or trade in biotechnology products, he stated. Mr. Wang responded that China too was disappointed by the outcome of the talks in Cartagena. He went on to say that China and other G-77 countries were very concerned about the role of big business in the negotiations. He claimed that China witnessed business representatives interacting with negotiators in the negotiating rooms in Cartagena. Mr. Wang went on to say that helping commercial activity is not the topic of the Protocol; protecting human health is the true topic.

Mr. Loy responded by noting that the U.S. cares about human health issues, but human health issues should be discussed in the Codex Alimentarius meetings under the auspices of the UN Food and Agriculture Organization. The Biosafety negotiating mandate is about protecting biological diversity. He reiterated that there are very important issues that still need to be discussed in the Biosafety Protocol negotiations, including the impact of the future agreement on the world trading system. Mr. Loy concluded the discussion up by saying that this technology is important to growing economies, and our countries need to discuss in-depth our differences.

U.S.-China Forum on Environment and Development

ENVIRONMENTAL POLICY WORKING GROUP

April 9, 1999
U.S. Department of State

Agenda and Schedule

Loy Henderson Auditorium

- 10:00-12:15 pm Opening Plenary Session
 10:00-10:25 am – Vice President/Premier Address
 10:30-10:35 am – Dr. Lane/Mme. Zhu Remarks
 10:35-10:45 am – Introduction of Working Group Chairs
 10:45-11:15 am – Water Management Discussion
 11:15-11:30 am – Coffee/Tea Break
 11:30-12:15 pm – Working Group Chairs Presentation of
 Working Group Goals/Issues
- 12:15-1:30 pm U.S.-China Environment Working Group Luncheon
 Henry Clay Room, Eighth Floor, U.S. State Department

Room 1105 – U.S. State Department

- 2:00-2:30 pm Introduction and Welcoming Remarks
 (U.S./EPA & State Dept. – China/SEPA and MFA)
- 2:30-3:55 pm Discussion of Bilateral Issues
- | | |
|--|------------|
| A. Progress Reports since last Forum Meeting | 10 minutes |
| 1. Minister Xie and Administrator Browner Exchange of
Visits (China – U.S./EPA) | |
| 2. Air Quality Monitoring Cooperation Project
(U.S./EPA – China) | |
| B. New Air Pollution Control Projects (U.S./EPA – China) | 15 minutes |
| C. Industrial Pollution Prevention and Energy Efficiency
(U.S./EPA – China) | 10 minutes |
| D. Environmental Education
(U.S./Peace Corps – China/MFA & SEPA) | 10 minutes |

- E. Forestry Cooperation/Ecological Forest Environment Development Issues (China/SFA - U.S./EPA & USDA) 10 minutes
- F. Air Quality/Pollution Management Issues (U.S./EPA – China) 10 minutes
- G. Air Pollution and Health Issues (U.S./EPA – China) 10 minutes
- H. Municipal Solid Waste Treatment Strategy Development and Urban Water Environmental Issues (China/MOC – U.S./EPA) 10 minutes

3:55-4:10 pm Coffee/Tea Break

4:10-5:25 pm Discussion of Multilateral Issues

- A. Progress Reports since last Forum Meeting High-Level Global Climate Change Dialogue (U.S./State Dept. – China) 10 minutes
- B. Global Climate Change 20 minutes
 - 1. Clean Development Mechanism Issues (U.S./State Dept. – China/MFA)
 - 2. Other Environmental Financing Issues (U.S./EPA – China/MFA)
- C. Desertification Issues (China/MFA – U.S./State Dept.) 5 minutes
- D. International Forests Issues (China/SFA – U.S./State Dept.) 10 minutes
- E. International Chemicals Issues POPs Regime/PIC Regime/Associated Agricultural Issues (U.S./State Dept. – China/MOA) 20 minutes
- F. Biodiversity Issues Biosafety Protocol (U.S./State Dept. – China) 10 minutes

5:25-5:50 pm Closing Remarks
(U.S./EPA & State Dept.– China/SEPA & MFA)

5:50-6:00 pm Signing Ceremony of Environmental Cooperation Statements
of Intent Between the U.S. and China (U.S./EPA – China)

Revised 4/8/99

U.S.-China Forum on Environment and Development

ENVIRONMENTAL POLICY WORKING GROUP

April 9, 1999

U.S. Department of State, Room 1105

U.S. Delegation

BROWNER, The Honorable Carol M.

Administrator of the U.S. Environmental Protection Agency (Head of Delegation)

LOY, The Honorable Frank E.

Under Secretary of State for Global Affairs, U.S. Department of State (Co-Head of Delegation)

KIMBLE, Melinda L.

Acting Assistant Secretary of State for Oceans and International Environment and Scientific Affairs, U.S. Department of State (Alternate Head of Delegation)

NITZE, William A.

Assistant Administrator for International Activities, U.S. Environmental Protection Agency (Alternate Co-Head of Delegation)

STERN, Todd

Assistant to the President for Special Projects, The White House

SANDALOW, David

Associate Director for the Global Environment, White House Council on Environmental Quality, and Senior Director for Environmental Affairs, U.S. National Security Council

GARDINER, David

Assistant Administrator for Policy, U.S. Environmental Protection Agency

PERCIASEPE, Robert

Assistant Administrator for Air and Radiation, U.S. Environmental Protection Agency

YEAGER, Brooks

Deputy Assistant Secretary of State for Environmental Affairs, Bureau of Oceans and International Environmental and Scientific Affairs, U.S. Department of State

WOLCOTT, Rob

Acting Deputy Assistant Administrator for Policy, U.S. Environmental Protection
Agency

PAQUETTE, Ellen

Regional Director for Europe, the Mediterranean, and the Asia Region, U.S.
Peace Corps

Environment Working Group - Working Staff

METELITS, Michael

Director, Office of Environmental Policy, Bureau of Oceans and International
Environmental and Scientific Affairs, U.S. Department of State

CASWELL, Stephanie

Deputy Director, Office of Ecology and Terrestrial Conservation, Bureau of
Oceans and International Environmental and Scientific Affairs, U.S. Department of
State

MIOTKE, Jeff

Deputy Director, Office of Global Change, Bureau of Oceans and International
Environmental and Scientific Affairs, U.S. Department of State

MARGOLIS, Jonathan A.

Director, Office of Policy Coordination and Initiatives, Bureau of Oceans and
International Environmental and Scientific Affairs, U.S. Department of State

GORDON, Susan

Advisor to the Assistant Secretary and Deputy Assistant Secretary for
Environmental Affairs, Bureau of Oceans and International Environmental and
Scientific Affairs, U.S. Department of State

DILDAY, William E.

Special Advisor for East Asian and Pacific Affairs, Office of Policy Coordination
and Initiatives, Bureau of Oceans and International Environmental and Scientific
Affairs, U.S. Department of State

TALLEY, Trigg

Foreign Affairs Officer, Office of Environmental Policy, Bureau of Oceans and
International Environmental and Scientific Affairs, U.S. Department of State

GORJANCE, Mary

International Relations Officer, Office of Environmental Policy, Bureau of
Oceans and International Environmental and Scientific Affairs, U.S. Department
of State

TUMINARO, John

Foreign Affairs Officer, Office of Ecology and Terrestrial Conservation, Bureau
of Oceans and International Environmental and Scientific Affairs, U.S.
Department of State

CONWAY, Ellen M.

International Relations Officer, Office of Ecology and Terrestrial Conservation,
Bureau of Oceans and International Environment and Scientific Affairs, U.S.
Department of State

GRAHAM, Dianne

International Relations Officer, Office of Ecology and Terrestrial Conservation,
Bureau of Oceans and International Environmental and Scientific Affairs, U.S.
Department of State

MARSH, Duncan R.

Foreign Affairs Officer, Office of Global Change, Bureau of Oceans and
International Environmental and Scientific Affairs, U.S. Department of State

McLEAN, Brian

Director, Acid Rain Division, Office of Atmospheric Programs, U.S.
Environmental Protection Agency

LEAF, Dennis

Senior Advisor, Office of Atmospheric Programs, U.S. Environmental Protection
Agency

BENKOVIC, Stephanie

Senior Environmental Policy Analyst, Acid Rain Division, Office of Atmospheric
Programs, U.S. Environmental Protection Agency

YU-TING, Liu

Program Manager, Office of International Activities, U.S. Environmental
Protection Agency

WOLFSON, Steve

Counsel, Office of Global Change, U.S. Environmental Protection Agency

BAILEY, Marianne

Senior Program Manager for Asia, Office of International Activities, U.S.
Environmental Protection Agency

DIEU, Joseph Martin

Climate Program Manager, Office of International Activities, U.S. Environmental
Protection Agency

DWYER, Dennis

U.S. Department of Energy

SIMON, Sue
U.S. Department of Commerce

MORRIS, Adele
U.S. Department of the Treasury

WASHBURN, Kathryn
Director, Office of International Affairs, U.S. Department of the Interior

STOLPMAN, Paul
Director, Office of Atmospheric Programs, U.S. Environmental Protection
Agency

SHAPIRO, Martin
Programming and Training Director for Europe, the Mediterranean, and Asia
Region, U.S. Peace Corps

MAN, Gary
Program Coordinator for Asia and the Pacific, Office of International Programs,
U.S. Forest Service

BRADLEY, Richard A.
Senior Advisor, U.S. Department of Energy

BLANCHARD, Shauna
U.S. Peace Corps

NATHAN, Ari
U.S. Environmental Protection Agency

HUANG, Joseph
U.S. Country Studies Program

WU, Chieh
Senior Scientist, Office of Research and Development, U.S. Environmental
Protection Agency

STEELE, Doug
Senior Program Manager, Office of Research and Development, U.S.
Environmental Protection Agency

ANDRASKO, Jr., Kenneth J.
Forestry Advisor, Office of Policy, U.S. Environmental Protection Agency

FREEMAN, Bill

International Program Manager, Office of International Activities, U.S.
Environmental Protection Agency

FRAENKEL, Amy

International Policy Advisor, Office of International Activities, U.S.
Environmental Protection Agency

PURVIS, Nigel

Office of the Under Secretary for Global Affairs, U.S. Department of State

FERGUSON, Dan

Foreign Agricultural Service, U.S. Department of Agriculture

PITTS, Keith

Office of the Secretary, U.S. Department of Agriculture

FULLER, Irving

Office of Prevention, Pesticides and Toxic Substances, U.S. Environmental
Protection Agency

KRUGER, Joe

U.S. Environmental Protection Agency

BASTA, Dan

Director, Special Projects Office, National Ocean Service, National Oceanic and
Atmospheric Administration, U.S. Department of Commerce

BEALE, John

International Programs Manager, Office of Air and Radiation, U.S.
Environmental Protection Agency

WHITE, William

Advisor to the Administrator, U.S. Environmental Protection Agency

BLEYLE, David

Environment, Science and Technology Counselor, U.S. Embassy Beijing

JENSEN, Janice

Office of Pesticides Programs, U.S. Environmental Protection Agency

WALKER, Kathleen

Office of Research and Development, U.S. Environmental Protection Agency

DRIGGERS, Donald

U.S. Environmental Protection Agency

MacDONALD, Ted

Pollution Prevention Program Manager, U.S. Environmental Protection Agency

SPITALNIK, Ellen

Senior Advisor, Office of Solid Waste and Emergency Response, U.S.
Environmental Protection Agency

SEIGEL, Jane

Senior International Trade Analyst, Office of Environmental Technologies
Export, International Trade Administration, U.S. Department of Commerce

JOHNSON, J. Brian

National Oceanic and Atmospheric Administration, U.S. Department of
Commerce

GARBACCIO, Richard

U.S. Environmental Protection Agency

O'NEIL, Brendan

Office of the Administrator, U.S. Environmental Protection Agency

COHEN, Shelley

Program Manager, Landfill Methane Program, Office of Atmospheric Programs,
U.S. Environmental Protection Agency

BUCKLEY, Katherine

Program Manager, Office of Atmospheric Programs, U.S. Environmental
Protection Agency

GIBSON, John

Counsel to the White House Climate Change Task Force

RODAN, Bruce

U.S. Environmental Protection Agency

CIVIC, Melanne

Global Issues Analyst, Office of the Geographer, U.S. Department of State

GARDEN, Les

Office of Energy, Infrastructure, and Machinery/Basic Industries, International
Trade Administration, U.S. Department of Commerce

U.S.-China Forum on Environment and Development

ENVIRONMENTAL POLICY WORKING GROUP

April 9, 1999

U.S. Department of State, Room 1105

People's Republic of China Delegation

XIE Zhenhau, Minister of State for Environmental Protection, State Environmental Protection Administration

LU Shumin, Director-General, Department of America and Oceania Affairs, Ministry of Foreign Affairs (Head of Delegation)

WANG Zhijia, Director-General, Department of International Cooperation, State Environment Protection Administration (Deputy Head of Delegation)

RAO Bin, Deputy Director-General, Department of Science and Technology, Ministry of Construction

YAO Changtian, Deputy Director-General, Department of Development Planning, State Forestry Administration

ZHAO Yingmin, Director of the Minister's Office, State Environmental Protection Administration

ZHANG Shingang, Director, Bilateral Relations Division, State Environmental Protection Administration

GAO Yanping, Director, Division of Environment, Department of Treaties and Laws, Ministry of Foreign Affairs

GAO Shangbin, Deputy Director, Department of Science and Technology, Ministry of Agriculture

CAI Lijie, Consultant (Minister's Interpreter), Department of International Cooperation, State Environmental Protection Administration

SHU Qing, Consultant, Department of International Cooperation, State Environmental Protection Administration

GUO Jing, Embassy of the People's Republic of China in the United States, Washington. D.C.

4/8/99

**Science for Sustainable Development Working Group of the
U.S.-China Forum on Environment and Development
April 9, 1999
Washington, D.C.**

Neal Lane, Assistant to the President for Science and Technology and co-chair for the Science for Sustainable Development Working Group, opened the meeting noting that this year marked the 20th anniversary of U.S.-Chinese collaboration in science and technology. He expanded on the important role played by science and technology in U.S.-Chinese relations, and especially for this Forum. Because science and technology has the twin goals of promoting environmental production while improving economic growth, he said, they are the root of all future progress.

Dr. Lane then proceeded to outline the range of discussions to be held that afternoon. The working group would first hear a report on progress made since the last Forum meeting in Beijing in March 1997. Topics included areas of interest to both countries - natural disasters, agriculture, water, coastal management, climate science and environmental monitoring. The working group would then move to address new issues, including ideas on biocomplexity, sustainable development, and land use.

Dr. Lane concluded his opening remarks by stating that his goal for the meeting was to develop further ways in which the U.S. and China could cooperate on the new issues presented before the working group. He was eager to hear the ideas which his Chinese colleagues were ready to present.

Madam Zhu Lilan, Minister for Science and Technology and co-chair of the Working Group with Dr. Lane, next proceeded to make her opening remarks. She stressed the importance of following the United Nation's Agenda 21, which seeks to build coordination between a nation's economic and environmental activities. The role of science and technology, she said, is important in "eliminating contradictions" between these two activities. Science and technology will be important in finding solutions to the questions of population control, eliminating poverty, developing new energy sources, and maintaining sustainable development.

The question of how to raise the standard of living while having an eye to the environment, is now a big issue for Chinese society, she said. The Chinese government is looking to use international cooperation to solve some of the problems they face. Today the U.S. and China will look at the problems with water, land use, and the mitigation and remediation of natural disasters.

Madam Zhu noted that at the working lunch with Vice President Gore and Premier Zhu Rongji, the topic of improving development programs through market mechanisms was discussed. She believed however, that in order to be truly effective, the power of the markets had to be combined with the promise of science and technology. This way the

U.S and China could have sustainable development on one hand, and cooperation in science and technology on the other.

Natural Disasters

Dr. D. James Baker, Under Secretary of Commerce and Administrator of the National Oceanic and Atmospheric Administration (NOAA) in the Department of Commerce, spoke first in updating the Working Group on progress made since the last meeting. One of the Forum's big successes in the past year was the Natural Disaster Mitigation and Reduction Workshop held in November 1997. Dr. Baker co-chaired the workshop with Chinese Vice Minister of State for Science Deng Nan. Dr. Baker reported that in depth discussions were held at the workshop at the technical level, with many experts in the field in attendance. This workshop, he said, was a good example of the strength of the Environment and Development Forum. Currently, the Joint Report of the Natural Disaster Workshop is available, and the proceedings will be available shortly.

Kay Goss, Associate Director of the Federal Emergency Management Administration (FEMA), next described the increasing dialogues which have been taking place between the U.S. and China, in part as a result of the Forum's Natural Disaster workshop. She noted that since March 1997, there has been a growth in exchanges on emergency management between FEMA and the Chinese Ministry of Civil Affairs, the Chinese Academy of Sciences, Chinese firefighters, Chinese river basin managers, and the Chinese Peoples' Liberation Army. In total, FEMA has met with over 20 Chinese delegations, and the fields covered include flood planning, disaster relief, fire fighting, and earthquake mitigation.

Putting the work of FEMA into a larger context, Ms. Goss noted how disaster relief is vital to maintaining a nation's infrastructure, building sustainable development practices, strengthening the government, and social well being. The Memorandum of Understanding, which FEMA is preparing to sign with the Chinese, will be able to help both governments in all these capacities.

Ms. Goss also noted FEMA's work with the Vice President in planning to solve the Year 2000 (Y2K) computer problem. FEMA is preparing contingency plans for the Y2K problem, and will be prepared to respond in case of emergencies.

Finally, Ms. Goss introduced the issue of the Global Disaster Information Network (GDIN), which will hold its second meeting from May 11-14, 1999, in Mexico City. GDIN was established in an effort to integrate all sources of disaster management information. The theme of the upcoming meeting will be to work on preparedness into the new millenium.

In his response to the presentations by Dr. Baker and Ms. Goss, **Wu Jisong**, Director General of the Department of Water Resources and Hydrology in the Ministry of Water Resources, focused on four points: the current status of preparedness, government efforts

to mitigate natural disasters, successes of the U.S.-China cooperation in natural disasters, and possibilities for future cooperation.

Mr. Wu noted first that the number and frequency of natural disasters in China is very high. To quantify this in economic terms, Mr. Wu asserted that 3-6% of China's GNP is annually lost due to natural disasters. In 1997 the drought, intense storms, and coastal flooding caused the most damage, while in 1998 earthquakes and flooding were the major cause of damage. The economic loss from the 1998 flooding alone is estimated by the Chinese to stand at almost \$30 billion.

In an attempt to mitigate these damages and prevent future loss, Mr. Wu noted that the government has approached the problem on three fronts. First, the Chinese government has enacted six laws, which will bind future economic development planning with plans for mitigating natural disasters. Second, the Chinese government has advanced many new engineering projects, which will work to prevent and reduce the effects on natural disasters on the ground. Finally, the Chinese government took several steps to fight natural disasters on a more technical level. They have engaged in capacity building and have established three disaster-monitoring systems. One is an earthquake forecasting-center, another is a marine-disaster forecasting-center, and the third is medium-term climate forecasting-center.

While reviewing the current status of U.S.-Chinese cooperation, Mr. Wu noted the success of the Natural Disaster Workshop, noted earlier by Dr. Baker of NOAA, and mentioned the upcoming seismic disaster cooperative projects undertaken jointly by the National Science Foundation (NSF) and Chinese Seismic Bureau (CSB).

Finally, Mr. Wu turned to the prospect of future cooperation between the U.S. and China. Mr. Wu stated that the U.S. and China should work for more exchanges of data and information; that the two countries should cooperate on developing observational equipment and technology, and forecasting future natural disasters; and the two sides should further cooperate on developing emergency response planning. Lastly, he said, the two countries should work to exchange their respective technologies and experience. Mr. Wu placed special emphasis in learning from the experience of the U.S. government with the New Deal program during the Roosevelt Administration. He posed four questions regarding this program:

- What influence did the improvement of the water sector have on the development of the national economy?
- How did the New Deal program aid the development of water conservancy and hydropower? What types of projects were undertaken (e.g. the construction and improvement of reservoirs, the diverting of water projects, hydropower and irrigation projects, etc.)?
- What policies were adopted to assist the development of the water sector by the government?
- Who financed the New Deal projects (the Federal government, local government, private companies, etc.), and were certain funds directed only to

certain targets (e.g. were Federal funds used mainly on big and medium-sized projects)? Also, was there any insurance coverage on the projects?

In response to the Chinese presentation, Dr. Baker stated that he was pleased with the U.S.-China cooperation on disasters. He appreciated the opportunity to learn from the Chinese experiences, but more importantly, felt that this was an opportunity for the both U.S. and China to learn not only about natural disasters, but also how to study them in the future.

In response to a question from the U.S. delegation, Director Ni stated that although China already has a disaster management system similar to GDIN, it will consider cooperating with the other GDIN member nations if a patch or cross over between the two systems is possible.

Climate Science

The issue of climate variability, impacts and scientific understanding was next on the agenda and again introduced by Dr. D. James Baker of NOAA. Dr. Baker focused his comments on the socio-economic utility of improved climate forecasting capabilities. The ability to accurately forecast seasonal to interannual climate variability for such events as El Nino promises significant returns and savings for societies and economies. However, the ability to deliver specific forecasts useful to specific users in agricultural, water resource management and other industries requires further advances in understanding of the physical forces underpinning climate variability. Accurate, timely forecasts promise to improve the efficient allocation of resources and produce lowered stable prices of agricultural, energy, and other natural resources. As two key countries, the U.S. and China have great potential to make contributions to the understanding and predictability of climate variation. The relative expertise, resources, strengths and geographic position of the U.S. and China indicate cooperation should be strengthened in climate forecasting research, applications, observations and assessments. Stronger international cooperation promises efficiencies in conducting certain research and development projects in this area, especially as we look to begin a new century.

Dr. Baker announced the upcoming U.S.-China Climate Workshop and Symposium on seasonal to interannual climate variability that will be held in Beijing in September 21-24, 1999. NOAA and the Chinese Meteorological Administration and State Oceanic Administration, will co-host these events. Delegates from other Asian regional nations will be invited to attend to increase the utility and relevancy of the meetings to improved research and science initiatives. Items already on the draft agenda include: national climate program overviews of the U.S. and China, climate theory and processes, modeling and prediction, observations and data-set generation and assimilation, theoretical studies of El Nino and extreme events (monsoons, hurricanes, and other events), and prediction modeling and real time forecasting.

Concluding his remarks, Dr. Baker noted the good relationship NOAA shares with key science agencies in China, including the Chinese Oceanic Administration, the Chinese

Meteorological Administration, the Chinese Academy of Sciences and the Ministry of Science and Technology. These relationships have been built on the 20-year history of the US-China Science and Technology Agreement and through associated cooperative projects, such as TOGA, South China Sea Monsoon Experiments and others. It was his hope that the forthcoming U.S.-China Climate Workshop and Symposium will contribute to the science agenda and the sustainable development agenda for the next 20-year period.

Ding Yihui, Director General of the National Climate Center, China Meteorological Administration, responded to Dr. Baker's presentation. He stated that much of the China's research on climate variability has focused on studying the 1998 floods and studying short-term climate protection.

According to Ding Yihui and the research carried out by his office, the main factors behind the 1998 Yantze River floods were ENSO-El Nino, above normal snow fall on the Tibet Plateau, a weak monsoon season, and other factors. Understanding these factors has help China develop an accurate climate prediction and weather forecasting model, based on predicting where the rain belt would move.

Ding Yihui also noted China's recent progress in developing what he called the NCC Model System. The NCC Model System is a short-term climate prediction system, which combined several oceanic, atmospheric and regional models. Since the last meeting of the Forum, forecasting maps based on this system were distributed throughout China, and actual events were found to coincide with the models.

Ding next listed some of China's most recent and successful meteorological experiments. These include: South China SMEX, which studied monsoons; HUBEX, which studied river basins; TIPEX, which studied Tibet; and HUMEX, which also studied monsoons. Many of these experiments were successful, Ding stated, due to the cooperation between the U.S. and China with their respective doppler radar technologies.

Ding Yihui lastly raised some areas for potential future cooperation. He advocated jointly studying the causes and mechanisms behind meteorological events such as typhoons and monsoons, and arranging for an exchange of relevant data from both countries.

Integrated Coastal Management

Once again, Dr. Baker of NOAA began the discussion. Dr. Baker noted that at the previous U.S. China Environment and Development Forum (Beijing, 1997), coastal management was an important topic on the sustainable development agenda and one for which increased cooperation was called. In the U.S. the coastal regions contain over 50% of the population and produce approximately 33% of GDP. Coastal regions in China are similarly vital with 60% of GDP derived from coastal regions and 40% of the population inhabiting the area. Coastal areas of both countries continue to develop at a significantly

higher rate than interior areas. The coastlines of both countries are among the longest in the world and share many common problems.

Since the last Forum meeting, a joint integrated coastal management panel was established in September 1998. This panel is a tangible result of the Forum's ability to concentrate attention and results in shared national priorities.

Three partner reserve and marine sanctuaries were established in 1997 and 1998 between China and U.S. to promote improved management of marine protected areas, specifically addressing local management challenges for coral reefs (Florida-Hainan Province), mangroves (Florida-Guangxi) and wetland habitats (Maryland/Virginia-Tianjin). In June 1999, local Chinese marine-reserve managers will visit these sister sanctuaries in the United States to learn U.S. management approaches and begin drafting Chinese management plans for application in China's context. NOAA provided management training at an Integrated Coastal Management-Marine Protected Areas (ICM-MPA) Management Workshop, March 22-26, 1999, in Hainan Province to 35 Chinese coastal resource managers. Training topics included: introduction and application of ICM principles in coastal regions, promotion of ecotourism for MPA's, and education and outreach in MPA management.

The Second Meeting of the ICM Joint Coordination Panel (JCP) will be held in July 1999 to define the second phase of the US-China ICM work plan covering 1999 to 2001 period.

Ni Yuefeng, Director General of the Department of Science and Technology at the State Oceanic Administration, responded to Dr. Baker's comments by noting China's comprehensive management of its coasts. China has passed legislation regarding the use of territorial seas, continental shelves and exclusive economic zones, laying submersed cables, conducting oceanographic studies, protecting the marine environment, traffic safety, and the exploitation of mineral and oil resources. According to Director Ni, between 1989 and 1995, 3663 marine zones were divided and classified for their protection.

Director Ni also noted that comprehensive management experiments were also conducted on these marine zones and tideland resources.

To further improve its coastal management, Director Ni stated that China will continue to reform and strengthen its legal system and enforcement mechanisms. As an example, in 1998 custom authorities were empowered to enforce these coastal management regulations. Director Ni predicted that the Chinese government will soon empower even more agencies to enforce its coastal management regulations.

Director Ni completed his presentation with suggestions for future U.S.-Chinese cooperation on coastal management. He advocated the establishment of a demonstration area to set up models and train the next generation of coastal managers. He also

advocated the U.S. and China expand their cooperative research on the sustainable use of coastal resources.

Sustainable Development

The U.S. delegation opened the discussion on Sustainable Development Progress with a presentation by **Dr. Rosina Bierbaum**, Associate Director for Environment in the White House Office of Science and Technology Policy. Her presentation was focused on three central themes: Integrated Environmental Monitoring and Research; Integrated Science for Ecosystem Challenges (ISEC); and the Ecosystem Report Card.

With regard to Integrated Environmental Monitoring and Research, Dr. Bierbaum discussed that the latest thrust in U.S. policy is to link the thousands of National and Regional environmental survey centers. The project is based on combining highly detailed information from index sites, medium-level information from the national and regional surveys, and mass data from inventories and remote-sensing programs. This will give the U.S. the ability to monitor progress in sustainable development on a national scale.

Moving the discussion to the Integrated Science for Ecosystem Challenges (ISEC) project, Dr. Bierbaum informed the Working Group of the initial priorities of ISEC. They include (1) Biodiversity and Species Decline, (2) Harmful Algal Blooms and Hypoxia Eutrophication, (3) Habitat Conservation and Ecosystem Productivity, and (4) Information Management and Integrated Assessments.

Finally, Dr. Bierbaum reported on the development of the Ecosystem Report Card. Dr. Bierbaum stressed that it is not enough to merely monitor and research the status of ecosystems. It is just as important to assess any progress or further degradation in an ecosystem's health. The goal is to develop standardized indicators, similar to economic indicators, which could be openly used to measure ecosystem health. Dr. Bierbaum noted that the Vice President is firmly behind the Ecosystem Report Card concept, and has challenged OSTP to work with citizen groups to develop the Report Card by 2001. The first draft of the Report Card should be completed by May 1999.

Wang Weizhong, Director of the China Agenda 21 Administration Center, presented China's progress on sustainable development. Mr. Wang stated that his nation's progress on sustainable development has been focused around the United Nations Agenda 21. From China's perspective, the crux of Agenda 21 is that sustainable development is not limited to environmental concerns only. The economy too is an integral part of any sustainable development plan.

Mr. Wang reported that the co-dependence of environmental and economic concerns is appropriately reflected in the current 5-year plan, recently passed by the Chinese government. The next step, he said, is to strengthen the laws, which will enforce this 5-year plan. China has passed six new environmental laws, for a total of 395. China's next hurdle will be enforcement of these laws.

With the acceptance of the 5-year plan, the Chinese government is encouraging regional and local governments to adopt their own sustainable development plans. These plans should reflect the uniqueness of each area's income base, climate and risk to natural disasters.

Mr. Wang also expanded upon the importance of science and technology for the future. He discussed how the Ministry of Science and Technology (MOST) has prepared a plan to use science for social development. Currently 29 pilot programs in sustainable development have been sponsored by MOST. These programs seek to make more comprehensive use of the natural resources available.

Finally, Mr. Wang expressed his interest in promoting international cooperation. He outlined these nine areas where immediate action could be taken:

- 1) Capacity Building
- 2) Sustainable Agriculture
- 3) Cleaner Industry
- 4) Clean Energy and Transportation
- 5) Sustainable Utilization of Natural Resources
- 6) Pollution Control
- 7) Combating Poverty
- 8) Population Health and Human Settlement
- 9) Climate Change and Biodiversity

Mr. Wang closed by reviewing China's perspective on sustainable development and Agenda 21. He felt that the policies geared toward sustainable development required strengthening. The policies should be based regionally, and work towards capacity building. Reflecting what Dr. Bierbaum had said earlier, a standardized set of indicators also needs to be established, in order to make available a continuous standard of measurement. Second, China needs to promote Agenda 21 at the local levels. As he said earlier, sustainable development policies need to be found at the national, regional, and local levels. Third, sustainable development would be helped if both the U.S. and China worked together to promote the transfer of environmentally sound technologies. Finally, China will work to establish a national sustainable development network system. With this project, they hope to work closely with FEMA.

Responding to Mr. Wang's presentation, Dr. Baker of NOAA stated that he was very impressed with the Agenda 21 plan. He noted that in the U.S., sustainable development is approached from a broad, national perspective. As an example, he cited the President's Council on Sustainable Development. He also noted that in the U.S., stewardship, rather than exploitation of our natural resources, is used to guide our actions.

Ms. Goss of FEMA also responded to Mr. Wang's presentation. She expressed her enthusiasm for the community based projects proposed by Mr. Wang. Local projects, she said, help to institutionalize sustainable development policies. As an example, she cited FEMA's practice of having disaster management based locally, where they can bring

together public and private resources. Ms. Goss raised the possibility of having a "sister-cities" exchange with the Chinese to further learn from each other's best practices.

Ms. Goss also expressed interest in Mr. Wang's statement on technology transfer. She proposed that maybe the U.S. and Chinese could work together to look at data compiled by each government's scientists, and transfer it to the public sector.

Mr. Wang responded positively to Ms. Goss's "sister cities" idea, and to her ideas on technology transfer. Mr. Wang noted that a technology transfer agreement already exist between China, Japan and UNESCO, which is similar to the one between the U.S., India and Singapore.

Mr. Wang also noted that one problem China was facing with its sustainable development program was the large number of indicators, over 140, which were used to measure progress. This made it difficult for local officials to assess the success of their community-based projects.

On all these projects, Mr. Wang expressed an interest in working more with the United States.

Liu Yanhua, Director General in the Department of Rural and Social Development, in the Ministry of Science and Technology, was also enthused with the "sister city" proposal. He noted that mayors from 20 different Chinese cities participating in the Agenda 21 program will be the U.S. shortly. This visit could be the first step in developing the sister city idea into an actual program.

Biocomplexity

Dr. Rita Colwell, Director of the National Science Foundation (NSF), gave the final presentation regarding progress toward sustainable development. The focus of her presentation was biocomplexity, which she defined as looking at scientific phenomena at many scales, and realizing the interconnectedness of all things. She quoted John Muir, the American naturalist, who said, "When we try to pick out anything by itself, we find it hitched to everything else in the universe."

The biocomplexity paradigm requires that scientists from different countries, cultures, and disciplines work together, as global events such as pollution and infectious diseases do not respect national boundaries or human divisions.

As an example of the biocomplexity model, Dr. Colwell cited the recent work to understand the toxicity cycle of the Chesapeake Bay. Another example of biocomplexity theory in use is NSF's Integrated Science for Ecosystem Challenges program. In this program, the value of biodiversity is related in terms of economic gains, and is estimated at hundreds of billions of dollars to the U.S. economy each year.

Water Resource Management

Dr. Dennis Hjeresen, Program Manager at Los Alamos National Laboratory, began the discussion on the U.S.-China Water Resources Management Workshop, which was to be held in April 1999, in Tuscon, Arizona. Forty-six Chinese and over one hundred U.S. water management experts were expected to be in attendance.

Dr. Hjeresen began by outlining the objectives of the Workshop. He said the Workshop was designed to: 1) Identify and prioritize key areas for cooperation and follow-up activity; 2) Enhance commercial opportunities; 3) Provide the basis for a bilateral agreement; and 4) Publish its proceedings.

Dr. Hjeresen also outlined possible next steps for the Workshop. These include delivering its recommendations to the Vice President, the Premier, the Forum, and through them to participating Agencies and Ministries, and/or Congress; developing resources to create a sustainable program; and/or establishing a joint Project Office to plan, coordinate, and execute program activities.

In concluding his remarks, Dr. Hjeresen presented a plan for the Forum's consideration, which would build upon the Water Workshop. He outlined a plan for the U.S.-China Water Resources Management Program in which a coordinating body would work to develop bilateral, water resources agreements between the two nations. It could also maintain a database of all existing cooperative activities, and conduct follow-up workshops and conferences in order to maintain a dialogue.

Qin Dahe, Director General in the Department of Resources and Environment, within the Chinese Academy of Sciences, presented China's perspective on the Water Workshop. Noting the different problems faced by different regions in China, i.e. water conservation in the north, water quality control in the south, and while acknowledging the low efficiency of water usage over-all in China, Mr. Dahe stated that China's priority in water management was the sustainable use of new resources. New resources to be exploited include glaciers, underground desert water, and water gained from wetlands. Watershed management in the Yellow and Yangtze River basins is also important.

In order to address these concerns, the Chinese will focus their research in the areas of water conserving technology in farming, recycling water, technology for developing new water resources, and watershed management.

Mr. Dahe closed his presentation by proposing several areas for collaboration between the U.S. and China. The list of possibilities included:

- 1) Technology to increase water-use efficiency
- 2) Technology to prevent erosion, salinization, and desertification
- 3) Managing watersheds
- 4) Sustainable use of other water sources
- 5) Package technology for high-value crops for sustainable agriculture
- 6) Developing databases and support systems

7) Wetlands management.

Agriculture

Deputy Under Secretary in the Department of Agriculture, **James Schroeder**, opened the discussion on Agriculture. He stated that the U.S. has three objectives in its agricultural cooperation with China. First, the U.S. seeks to increase technological cooperation. Second, the U.S. seeks to have specific technologies exchanged. Third, the U.S. seeks a resolution to the trade dispute between the two countries.

Mr. Schroeder noted the work of the U.S. Trade Representative and MOFTEC, in negotiating an agreement on cooperation. The agreement included sections technology cooperation and scientific exchanges, cooperation in developing agricultural sectors, and resolving future trade disputes. This agreement will become a very important road map for the future, but it has not yet been signed.

Unfortunately, the agreement has been caught up in politics. Mr. Schroeder warned that if the agreement is not signed, China would encounter problems with the private sector. (NOTE: The Agricultural Trade Agreement was signed the next day, April 10.)

Miley Gonzalez, Under Secretary in the Department of Agriculture, further elaborated on the U.S. position on agriculture. He reiterated Mr. Schroeder's hopes for a quick signing of the U.S.-Chinese trade agreement, as it would encourage cooperation between the two countries.

He stated that it was important to the U.S. for research in agriculture to increase. Feeding the world's population will become one of the greatest threats to global stability in the next century. For this reason, sharing information is of mutual benefit.

As a positive example of sharing information, Mr. Gonzalez mentioned the Joint Research and Education Program carried out in the field of forestry. This program, he noted, has helped resolve some of the problems the U.S. and China have faced. It could be used as a model for future cooperation.

Mr. Gonzalez closed by noting that this century's global economy has had an industrial base. It has relied heavily on fossil fuels. In order to have sustainable development, the economy of the 21st century will need to be bio-based.

The Chinese report on agriculture was given by **Wang Xiwu**, Director General of Science and Technology in the Ministry of Agriculture. Mr. Wang stated that China continues to feed 22% of the world's population with only 7% of its arable land. This provides a powerful incentive for the Chinese to follow sustainable development practices.

According to Mr. Wang, currently China is facing five problems. First, their huge population is putting enormous pressure on the quality and quantity of food in China.

Second, there are enormous shortages in natural resources. This includes both land and water. Third, China is in a situation of runaway pollution. Fertilizer run-over into the rivers is particularly egregious. Fourth, China has a poor emergency response infrastructure. The Chinese will have to develop more and better tactics to stave off natural disasters. Fifth and finally, China must alleviate the level of poverty faced by most citizens.

To counter these problems, Mr. Wang laid out a course of action. First, China must protect its basic farmland. Over 70% of its farmland is dry, and in need of technological solutions. China must also work more with the international community, and learn from its neighbors. Third, the Chinese must implement a restoration plan, whereby they will improve the low-yield and degraded grasslands. Two thirds of China today falls into this category. China must at the same time harness new resources to ease its water shortage. Finally, China must follow the ecological agricultural practices as outlined in the Agenda 21.

Mr. Wang did offer up two specific areas for cooperation between the U.S. and China. First, Mr. Wang suggested that U.S. and Chinese scientists work together to examine and compare various models of agricultural development. Second, the Chinese are looking to develop a renewable energy source for rural areas, and U.S. cooperation would again benefit both sides.

Land Use

The final item on the Working Group's agenda was the issue of land use. Land Use is an issue which the Vice President had asked the Working Group to begin to address, and this was the first time the issue had been discussed. Dr. Neal Lane made a presentation on behalf of the U.S. to explore interest in a joint dialogue on land use management. Dr. Lane began by stressing the importance of proper land use management, and noting that both the U.S. and China suffer from land degradation – including deforestation, wetlands disturbance, and rangeland degradation. He explained that U.S. experts who came together to discuss this idea tried to answer three basic questions: 1) What are the most pressing land use challenges; 2) Where is there greatest benefit from bilateral cooperation; and 3) Where is the expertise and resources to address this issue? Dr. Lane presented four categories or possible discussion topics for a land use dialogue: land degradation, land use choices and their impacts, urban land use planning and livability issues, and tools available for land and other resource management. Dr. Baker introduced Margaret Davidson and Tony LaVoi, of NOAA's National Ocean Service, who made an abbreviated presentation which highlighted the benefits of using Geographic Information System (GIS) technology to assess land use and to aid land use management decisions.

Dr. Lane proposed that if both sides agreed that land use management was worthy of further discussion, a group could be constituted to consider a bilateral dialogue on the issue. Madame Zhu agreed.

The Chinese also noted that in the past, their land use policies had led to soil degradation, which in turn led to food shortages. Land use was inefficient, and much of the territory was not used at all. Development of land resources was also constrained by environmental factors.

Since the 1990s, however, China has begun to develop strict land use policies, which have encouraged good farming and forestry practices. Unfortunately, to date this process has been long, expensive, and mostly restricted to urban areas. The Chinese have been successful though in increasing the use of their urban land. They would also like to increase the amount of land under cultivation, and use urban land even more efficiently by increasing construction density.

The Chinese have also increased the amount of their cultivated land through better planning, and are proud that they have enhanced their intensive land use methods to maximize the exploitation of the resources available to them. They plan to further enhance reform of land use measures, including looking at realistic resource pricing.

In outlining areas where Chinese sustainable development practices could be aided through international cooperation, the Chinese gave five examples. First, the Chinese want to make sustainable use of their construction lands. Second, the Chinese want to further study sustainable use of agricultural lands. Third, the Chinese want to develop a strategy for sustainable use of currently unused lands. Fourth, the Chinese want to study market mechanisms, which help maximize land use. Finally, the Chinese wish to further investigate re-assessing land use policies with the help of new technologies, such as GIS and internet technologies.

Conclusion

Madam Zhu Lilan concluded the Chinese presentations at the Working Group by recognizing the success of the Forum, while acknowledging the effects of time limitations on the discussions.

The meeting ended with both Dr. Lane and Madam Zhu encouraging the delegations to continue to work together on these important issues, and toward the next affirmative step the Forum can take, rather than waiting for the next meeting of the Forum. If the U.S.-China Environment and Development Forum is to be a success in the future, emphasis needs to be placed on the actions which rise from these gatherings and the success of collaborative activities.

**Commercial Cooperation Working Group of the
U.S.-China Forum on Environment and Development
April 9, 1999
Washington, D.C.**

The Commercial Cooperation Working Group (CCWG) of the U.S.-China Forum on Environment and Development met on Friday April 9, 1999 at the U.S. Department of Commerce, from 2:00 to 5:30PM. Co-chairmen were Deputy Assistant Secretary of Commerce for Basic Industries Alan Bowser and Deputy Director General Dai Yunlou of the Department of America and Oceania Affairs of the Ministry of Foreign Trade and Economic Cooperation (MOFTEC) of the People's Republic of China.

The U.S. delegation was composed of representatives of the departments of Commerce, Energy, Housing and Urban Development, and Interior, as well as the Export-Import Bank of the United States. Representatives of several private U.S. companies were also part of the U.S. delegation at the CCWG, the only working group of the U.S.-China Forum with private-sector participation. Private-sector members of the U.S. delegation included representatives of the Coalition for Employment Through Exports, Enron, Ford Motor Company, Lemna International, the National Association of Home Builders (NAHB), the National Ocean Industry Association (NOIA), and Phillips Petroleum.

The Chinese delegation included representatives of MOFTEC, the Ministry of Science and Technology, the Ministry of Construction, China Petroleum Equipment Corp., China Petrochemical Group Corp., State Power Corporation, and the State Environmental Protection Agency. U.S. observers noted that the Chinese delegation was relatively younger than might have been expected, with most members apparently in their 30s or 40s. In addition to Mr. Dai (who was based at the Chinese Embassy in Washington for three years and speaks English well), a number of other members of the Chinese delegation made presentations during the course of the CCWG.

Given the extensive agenda and the fact that the CCWG was meeting in Washington, the U.S. delegation was large. U.S. delegates frequently rotated in and out of seats at the CCWG conference table, with major changes occurring at the two breaks. The smaller Chinese delegation remained constant throughout the CCWG.

This report is composed of 11 sections that correspond to the various items on the CCWG agenda. It is based on notes compiled by Rachel Halpern and Michael Beeman, both international trade specialists with the Energy Division of the U.S. Department of Commerce. Padraic Sweeney, also an international trade specialist with the Energy Division, edited the report and wrote the introduction. For more information regarding the CCWG and this report, contact Mr. Sweeney at (202) 482-0135.

Welcoming Remarks

DAS Bowser welcomed the Chinese delegation, and noted that both the U.S. and China agree on the importance of protecting the environment while developing economically.

Deputy Director General Dai of MOFTEC applauded the Commerce Department's years of cooperation with his Ministry. He emphasized that the protection of the environment is an important priority for the Chinese Government, and welcomed the increase over the past few years of U.S. investments in this field. Mr. Dai listed some of the recent achievements in this field, including the development of a network of data on earthquakes in the region, and the development of a computer-assisted weather forecasting system. He welcomed the signing during Secretary of Commerce William Daley's recent trip to China of several contracts and other agreements between U.S. and Chinese companies in the environmental and energy efficiency sectors, the total value of which he gave as more than \$1 billion.

Oil and Gas Industry Forum

Counselor to the Department of Commerce Jan Kalicki thanked the Chinese Government for its help in putting on a successful Oil and Gas Industry Forum, which resulted in the two sides agreeing on a work program to develop regulations concerning oil and gas investment, identify measures to help China increase its use of natural gas, and address barriers to U.S. investment in China's hydrocarbon resources. Kalicki then expressed concern that last year the U.S.-China trade deficit was nearly twice the level of 1994, and that U.S. exports to China have remained a small percentage of U.S. global exports for more than a decade—1.8 percent in 1985 and 2.1 percent today. He urged the Chinese delegation not to allow this to let U.S.-China commercial relations deteriorate.

Department of Energy Senior Advisor Andy Vitali announced that the second Oil and Gas Forum will take place in Houston in July, and distributed a draft agenda. He welcomed China's efforts to increase gas use, and suggested that China could benefit from U.S. experience in moving from its current dependence on coal.

Dai Yunlou stressed China's need for U.S. financing, both public and private, and investment in the power sector. He asserted that there is currently about \$7.3 billion of foreign direct investment in the power sector, a number that needs to be increased. He noted that foreign investment and financing is especially needed in central and western China, and in equipment and facilities to protect the environment. China has already introduced cleaner power facilities with U.S. cooperation, Mr. Dai went on, and would like to see more cooperation in this area. He said that China does not provide any guarantees on the investor's rate of return, so that investors are encouraged to control costs.

Another member of the Chinese delegation discussed China's petroleum industry. Recently, the Chinese Government restructured the petroleum industry, and now the China National Petroleum Company (CNPC) has integrated upstream and downstream operations. China has imported \$360 million worth of oil and gas equipment from the United States (he did not specify during

what time period). Recent agreements with Phillips Petroleum, ARCO, and other U.S. companies were important examples of cooperation between the U.S. and Chinese oil and gas industries. China welcomes investment in the oil and gas sector, and will continue making reforms to attract such investment.

DeAnn Craig of Phillips Petroleum presented a list of reforms that China should implement to attract more investment in the energy sector. 1) China must strengthen the rule of law, and increase transparency in its legal and regulatory system. 2) Investors must be assured that oil and gas regulations will not be changed arbitrarily; they must know which laws apply to them and which agencies to deal with, and they must know that these agencies are independent of politics. 3) China should increase foreign companies' access to oil and gas resources, and not reserve its most promising resources for domestic firms. 4) Companies need to have access to all geological and seismic data. 5) The power, refining, and petrochemical sectors must be opened up to foreigners as well. 6) Investors also must be able to profit from their investments; the Chinese Government should remember that it is competing with other countries for investment dollars. Currently, U.S. companies have invested \$6-7 billion in China's energy sector, but will probably recoup only about half. One improvement would be increasing companies' ability to import equipment and fuel if it is more cost-effective.

Off-Shore Mock Lease Sale

Carolita Kallaur of the Department of the Interior's Minerals Management Service's (MMS) described her agency's role as manager of the outer continental shelf's hydrocarbon resources and as collector of revenue from federal and Indian lands. She noted that MMS is the "cradle to grave regulator" for companies working on the outer continental shelf, and emphasized that foreign companies bid for leases on an equal basis with U.S. companies.

Bob Stewart of the National Ocean Industry Association described the concept of a mock lease sale, a training exercise in which participants learn about the bidding process from both a regulator's and a company's perspective. He suggested that China may be interested in holding such an exercise with his organization.

The Chinese side expressed interest in the mock lease sale, and asked for written information.

Environmental Commercial Priorities

Carlos Montoulieu, Acting Deputy Assistant Secretary of Commerce for Environmental Technology Exports, described the activities of the Environment Subgroup of the bilateral Joint Commission on Commerce and Trade. The Subgroup has implemented 26 projects over the past 4 years, including an urban air quality monitoring project and several water resource projects.

Joe Hillings of Enron urged China to solve its environmental problems using proven, market-based approaches to attain environmental goals, rather than implementing increased regulation. He noted that by 1985, such programs saved US firms over \$5 billion dollars and helped them achieve their intended environmental objectives. By 2000, these programs will have saved US

industry more than \$20 billion dollars. The benefits of these emissions trading programs go beyond cost savings. He encouraged China to adopt market-based environmental programs like emissions trading and water discharge trading not only to meet increasing demands for better air and water quality, but also to promote innovation in pollution control, easier permitting, and simpler, more efficient systems to administer.

Viet Ngo of Lemna International recommended that China make a commitment to solving environmental problems now to avoid repeating other countries' mistakes. He encouraged China to prevent future problems by taking advantage of the environmental solutions available from U.S. companies. He described a \$120 million joint venture to provide waste water collection services in Guangzhou which was established in 1997. The joint venture project will provide a Build-Operate-Transfer (BOT) wastewater collection and treatment service plant to the City of Guangzhou to help clean the Pearl River, an important drinking water source for southern China. The project faces many obstacles before construction can begin. By contrast, such projects in other developing countries like Turkey or Poland, take approximately two years or less to arrive at an equivalent point. To help such projects move forward quickly and encourage lively U.S. private sector involvement, the Chinese government should encourage local governments to streamline the permitting process. The central government should itself issue permits faster, cut taxes and import duties on environmental projects, establish bilateral agreements to expedite urgent projects, encourage early U.S. private sector participation by co-sponsoring design and planning studies for major environmental projects, and set up deadlines for local authorities to meet air and water quality standards.

The Chinese delegation applauded U.S.-China cooperation in the environmental sector. Air and water treatment are priorities, and China would like to increase cooperation in this area. Only 100 of China's cities have water treatment facilities. To aid U.S. companies seeking to enter the Chinese market, the Chinese urged the U.S. Government to expand its own support for U.S. companies, because they are lagging behind European companies. The signing of the Phase II Letter of Intent for the urban air quality monitoring agreement was warmly welcomed by the Chinese delegation.

Wang Tianxi of the Chinese Ministry of Construction reported that the Ministry is responsible for many urban environmental projects. Wastewater treatment is a priority for China, and there are 306 water support projects planned for next year. The Chinese government would like U.S. financing for urban projects.

Alternative Fuel Vehicles

Chen Chuanhong of the Chinese Ministry of Science and Technology (MOST) described the development of alternative fuel vehicles as a critical part of China's environmental protection strategy. MOST is promoting alternative fuel vehicles (AFVs) and electric vehicles. There are AFV programs in 22 Chinese cities, including Shanghai, and a total of approximately 6000 AFVs in China. The Chinese Government is interested in AFV development in other countries and what other governments are doing to promote them.

Jim Wilson, Director of the Commerce Department's Office of Energy, Infrastructure, and Machinery stressed that government incentives are the key to getting alternative fuel vehicles on the road. He recommended that China work with U.S. companies which have technology and equipment that China can use. The Commerce Department and China's State Administration for Machinery Industry will sponsor a seminar on alternative fuel vehicles in Beijing in June to discuss these issues.

Dennis Schuetzle of the Ford Motor Company described how Ford has been working with China on development of an AFV strategy that would allow China to reduce emissions in an economical way. Ford has sponsored workshops and conferences on the subject, and has also done a study of the potential for using coal as a transport fuel in China. Ford is now concentrating on compressed-natural gas and liquefied-petroleum gas (LPG) vehicles in China, and is working with Chinese organizations on new formulations of diesel fuel. Ford also has a visiting scientist program that enables Chinese scientists to come to work at Ford labs. Schuetzle recommended that China develop incentives, mandates, and infrastructure to support gas and LPG vehicles, and promote the development of renewable energy. Ford hopes to establish an environmental vehicle center in Beijing to support AFV development and the retrofitting of existing vehicles.

The Chinese side reported that the government will make major investments in alternative fuel vehicles. The national government will contribute the equivalent of \$6 billion for this purpose, with the balance coming from the provinces. China's Minister of the Environment was to visit Ford the week after the meeting of the Forum on Environment and Development, to explore options for alternative fuel vehicles. The Chinese side asked that at the alternative fuel vehicle seminar, exhaust systems and catalytic converters be put on the agenda.

Housing Initiative

Elinor Bacon of the Department of Housing and Urban Development (HUD) announced that Commerce Department and HUD along with China's Ministry of Construction are developing workplans to implement the U.S.-China Housing Initiative. The initiative will be coordinated through the U.S.-China Residential Building Council, which will be co-chaired by the Secretaries of Commerce and Housing and Urban Development and the Minister of Construction. The Residential Building Council will draw on housing expertise from the U.S. private sector and government agencies involved in environmentally efficient housing materials and design. Also, during Secretary Daley's recently-completed mission, the departments of Commerce and HUD and Ministry of Construction initialed a memorandum of understanding to work on topics of mutual interest, including housing finance and low-income housing programs.

Chris Twarok of the Commerce Department's Forest Products and Building Materials Division noted that residential construction raises important environmental issues. Energy efficient materials should be introduced to Chinese builders and the Residential Building Council will be an effective forum to expose China to the wide-variety of energy-efficient and affordable materials and techniques the United States can offer. He mentioned that the National Institute of Standards and Technology will conduct a workshop on building codes and standards that will be

targeted directly at Chinese officials instrumental in their housing reform. Also, the Environmental Protection Agency and China's State Environmental Protection Agency were about to sign a letter of intent on a cooperative project.

Katalin Vaughn of the National Association of Home Builders discussed her organization and its high level of interest in environmentally efficient housing development, building, and design.

Wang Tianxi of the Ministry of Construction and Zhang Shigang of the State Environmental Protection Agency noted that China's residential housing market is very large. The current five-year plan calls for construction of 1.2 billion square meters of housing. The Chinese Government would like China to upgrade the quality of its housing construction and has developed a new system to promote housing standards. The Chinese Government also wants to cooperate on projects to save energy, and in developing loans for residential housing.

Finance

David Bowie of the Commerce Department's Office of Finance stressed that the U.S. Government is committed to promoting investment by American firms in China, and is working to help improve the availability of both official and private financing. In pursuit of this goal, the Department of Commerce and the Department of Energy co-sponsored a seminar on project finance with China's SDPC last September in Beijing. Bowie emphasized that because lenders and investors must identify and mitigate risk before committing funds, the Chinese government should continue to improve the investment climate in China. Currently, companies find the investment environment less than hospitable, which increases the likelihood that they will invest their capital elsewhere. A more favorable investment climate in China will include fair and transparent regulatory practices, a streamlined and transparent project approval process with clear lines of responsibility among government entities, support for the sanctity of contracts and stronger application of the rule of law to commercial life. The Chinese Government should engage investors in discussions about proposed reforms.

Frank Wilson of the Export-Import Bank of the United States reported that Ex-Im Bank has financed \$15 billion worth of U.S. exports to China since it opened there in 1982, and is dedicated to being a reliable partner with China in efforts to improve that country's economy. However, new business in China has leveled out at about \$1-1.5 billion per year. Ex-Im Bank would like this to increase, and has signed a MOU that dedicates \$100 million for new energy/environmental projects next year. Ex-Im Bank's current exposure in China is \$5 billion, and it would like to increase this to \$10 billion over the next 5 years.

Ed Rice of the Coalition for Employment Through Exports noted that the coalition's members are all interested in China. He noted that projects must be designed to meet private lender standards because even with Ex-Im Bank guarantees, a portion of each project must be financed privately.

Mr. Dai expressed admiration for Ex-Im Bank's work in China, and recommended that the U.S. side discuss systemic problems with the SDPC. The Chinese State Environmental Protection

Agency and the SDPC will sponsor a conference on related issues in the near future. The Chinese delegation promised to provide their U.S. counterparts with information about it.

Meteorological Satellites

The Chinese side expressed concern that the U.S. government quickly approve the export by IBM to China of a computer that will improve weather forecasting.

Commercial Projects

Jay Brandes, Deputy Director of the Commerce Department's Advocacy Center, noted that progress has been made recently on a number of commercial projects in the environmental sector. In particular:

- Enron has signed a MOU with the China National Petroleum Company (CNPC) to build a gas pipeline from the Sichuan Basin to the city of Wuhan in southern China. The pipeline is expected to be completed in 2000, and it will be first pipeline in China built with foreign equity participation.
- Dasibi Environmental Corporation signed an agreement for Phase 2 of its urban air quality monitoring project; Ex-Im Bank has approved a loan for Phase 1.
- The Ex-Im Bank has signed a memorandum of understanding to provide \$100 million for financing clean energy projects in China.
- Dessen International has signed a contract with a Chinese company to build 100 homes in Shanghai using American designs and technology.
- Ellicott International of Baltimore Maryland signed a memorandum of understanding with the China Water Investment Corporation to sell the material to build 20-40 dredges in China to mitigate floods.

Brandes then urged that the service contracts for the Xi Lang wastewater treatment be executed promptly so that the project can proceed.

Year 2000 Problem

Assistant Secretary of Commerce for Trade Development Mike Copps advised the group that Y2K may cause major problems in the energy and environmental sectors because of their dependence on technology. He noted that Secretary Daley and the Chinese Minister of Information co-hosted a Y2K conference recently in Shanghai, and said that there may be another such event in Beijing in May.

Dai agreed that the Y2K problem is serious, and said that the government had 18 different agencies working on it.

Discussion

A Chinese official recommended that, because China is primarily an agricultural country, that agriculture, which was considered in another Forum working group, should be on the agenda of

the next Commercial Cooperation Working Group.

The Chinese side stated that the Working Group should also address barriers to Chinese exports. The U.S. government should eliminate sanctions on China, such as the restriction on the U.S. Trade and Development Agency operating in China. In return, the Chinese government will encourage Chinese companies to import more U.S. goods and to work with U.S. companies.

DAS Bowser and Deputy Director Dai agreed that the CCWG had produced a useful discussion of a broad range of bilateral commercial issues. They recognized that these issues were the subject of ongoing consultation between U.S. and Chinese government agencies, companies, and other entities. They agreed to meet in Beijing in June to further explore how they might cooperate in advancing the United States' and China's mutual interests in these areas.

16 December 1996
ENGLISH/CHINESE ONLY

SUBSIDIARY BODY FOR SCIENTIFIC AND TECHNOLOGICAL ADVICE
Fifth session
Bonn, 25-28 February 1997
Item 7 of the provisional agenda

TECHNOLOGY AND TECHNOLOGY INFORMATION NEEDS

Comments from a Party

Note by the secretariat

By its decision 7/CP.2 (FCCC/CP/1996/15/Add.1), the Conference of the Parties, at its second session, requested the Convention secretariat to give high priority to the development and completion of a survey of the initial technology needs, as well as technology information needs, of Parties not included in Annex I to the Convention, with a view to providing a progress report to the Subsidiary Body for Scientific and Technological Advice at its fourth session. The COP also urged non-Annex I Parties to communicate initial information to the Convention secretariat not later than 1 December 1996 regarding technologies and know-how required to address climate change and its adverse effects that could be compiled by the secretariat into a detailed list of technology needs required by developing country Parties, taking into account that more elaborate technology needs would be included in their initial national communications.

In regard to the latter request, the secretariat has received a submission from China. In accordance with the procedure for miscellaneous documents, this submission is attached and reproduced in the languages in which it was received without formal editing. Any further submissions from Parties will be issued in an addendum to the present document.

In regard to the first request, the secretariat has initiated a survey of the technology needs of 20 Parties not included in Annex I, to obtain preliminary information and to test a survey instrument. The secretariat will provide information on the results of this survey at the fifth session of the SBSTA.

中 华 人 民 共 和 国 外 交 部 条 约 法 律 司
Department of Treaties and Law, Ministry of Foreign Affairs
225 Chaonei Street, Beijing 100701 Tel (86 10) 6525 5520 Fax (86 10) 6513 4505

14 November 1996

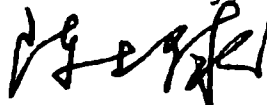
Mr. Michael Zammit Cutajar
Executive Secretary
Climate Change Secretariat
PO BOX 260124
D-53753
Bonn
Germany

Dear Mr. Cutajar,

I have the honour to communicate to you the initial information regarding technologies and know-how required to address climate change and its adverse effects, in accordance with the decision taken at COP2 on development and transfer of technologies. Please find enclosed a List of Technologies for that purpose.

With regards.

Yours sincerely,



CHEN SHIQIU
Director General

(Unofficial translation)

LIST OF TECHNOLOGIES

1. Integrated Gasification Combined Cycle (IGCC)
2. Direct Reduction
3. CFB Coal Gasification for Ammonia Synthesis
4. Vapour Emission Control Systems
5. Biomass Gasification & Purification
6. Fuel Forest-Fired Power Generation in South China
7. Fuel Cells
8. Smelting Reduction
9. Poultry/Livestock Wastes for the Production of Organic Compound Fertilizer--Complete Technology
10. No-tillage for Man-made Forest in South China
11. Forest Ecosystem Management Systems
12. Waste Land Afforestation for Mine Area
13. Solar Hot Water Heater--Vacuum Tube
14. Rice Husk Energy Transfer Instrument
15. Pony-tail Pine Protection in Acid Rain Area

1. Integrated Gasification Combined Cycle

1.1 Technology Name

Integrated Gasification Combined Cycle

1.2 General Characteristics

Integrated Gasification Combined Cycle (IGCC) is an advanced power generation technology. The fundamental of IGCC is uses the cleaning gas produced from gasification and purification as fuel for the turbine, combines the gas turbine with steam turbine. It consists of coal pre-process, coal gasification, gas cleaning, and combined cycle power generation. The main advantages of IGCC are as follows: First, it offers high thermal efficiency, reached from 40 percent to 50 percent is 10 percent higher than of pulverized-coal (PC) fired power generation. The unit coal consumption is 310 gce/kWh. Second, it is relative insensitive to feedstock, allowing all types of coal to be fired. Third, it has a good commercial market.

1.3 Cost Information

The capital cost of early IGCC technology for the Cool Mater plant is much higher, and reached \$2.538/kW. Now for the commercial IGCC plants (500 Mw), the capital cost is approximately \$900/kW. The operating and maintenance cost for this plant amount to about 4 to 4.5 cents/kWh, which design lifetime expected 20 years.

1.4 Environmental Effects

The IGCC plant has low emissions of pollutants, and good environmental characteristics. Its desulphurization efficiency reached from 90 percent to 99 percent used a cleaning measure, and SO₂, NO_x and particulate emissions had been controlled. It reduces the formation of NO_x to levels from 25 percent to 60 percent lower than that from a conventional PC plant, as the same of burning natural gas. Increased thermal efficiencies result in lower carbon dioxide emissions per unit electric generation, is about 0.8 kg/kWh.

1.5 Market Potential

With the development of society and economy of China, the present thermal power capacity will need to be expanded further. IGCC is an advanced power generation system that combines a higher coal-electricity production of efficiency with clean coal combustion technology. It is anticipated that IGCC technologies have the capacity to

replace the steam turbine in the fossil-fired power plant, as a key development direction in this field.

China fully recognizes the problems of sustainable development and pays much attention to the retrofitting of aged power plants by introducing advanced technologies and new models of power generation. China has already imported more than ten sets of oil-fired or gas-fired combined cycle units. In addition, China's Ministry of Electric Power has emphasized the power generation technology of IGCC by placing it on the agenda of its plan for middle-term and long-term development of electric power. So, it can serve as the foundation for a large-scale application and diffusing of IGCC technology in China by introducing advanced technology of IGCC and constructing a demonstration power plant.

1.6 Other Information

- For the form of introducing, it is suggested to combine cooperative research (such as on new thermal cycle and system, integrity of system) with technology imports (such as gasification, hot dry cleaning, and advanced gas turbine).
- Based on the technical cooperation and imports, it is proposed to construct a 200 Mwe IGCC demonstration power plant with good values for spreading by using the GEF grants and loans of low interest from financial organizations.

2. Direct Reduction

2.1. Technology Name

Direct reduction

2.2 General Characteristics

The direct reduction technique of producing sponge iron is one of iron-smelting processes, which uses gas or liquid fuel and non-coking coal as energy and reducer, reduces metal iron at the temperature condition that iron ore (or include iron pellet) is solid. Considering the different reducer used, the direct reduction technique can be generally classified into two sub categories: gas-based process and coal-based process. Based on the difference reductive device, it can be divided into vertical furnace process, reaction pot process, fluidized-bed process, and rotary kiln process, etc. The output around the world in 1994 was 28.2 million tons and the average utilization rate of the device was 73 percent. The widest processes used in industry now are Midrex and HYL in gas-based process, as well as SLRN and DAVY's DRC in coal-based process. It was reported that the process used in DAVY's Direct Reduction Plant was rotary kiln, which reduce directly using coal-based as reducer. The metallization rate was 93 percent, iron rate was 96 percent, per ton direct reduction iron consumed 0.425 ton solid carbon, and 90-120 kWh electricity (of which 65 percent in direct reduction plant, 26 percent in material plant, 9 percent was auxiliary consumption).

2.3. Cost Information

The first direct reduction iron plant, named Kazuo County's Sponge Iron Smelting Plant in Liaoning province of China, invested 52.92 million yuan, the capacity was 25,000 tons, the average 10000 tons capacity investment was 2117 yuan, this number is \$122.87 in Venezuela and \$161.20 in Europe.

2.4 Environmental Effects

The energy consumption of the direct reduction technique is low, which is only from 40 percent to 50 percent of that of iron-melting in blast furnace, so it can reduce from 50 to 60 percent CO₂ emissions per ton steel.

2.5. Market Potential

The output of electric steel only occupies 22 percent of the whole steel output in China, while this share in developed country has reached from 30 percent to 40 percent, 56 percent in Italy. With the increase of steel accumulating in China, the retrieve amount of scrap steel will be going up, and electricity is relatively plenty, so

the short process used scrap steel as material will develop rapidly, therefore, the requirement of sponge iron with little impurity will grow rapidly.

2.6 Other Information

- To introduce the technique of coal based as reducer is more conformable with the actual situation in China with an abundant coal and a limited nature gas resource. The contents of technique introduced include process technique, production software, key parts in the main device, and automatic control unit in instruments and meters.

- The main problem in introducing the line of sponge iron production is funds. It is necessary for China to obtain the help from GEF, to gain donation accounting for more than 1/3 of the total funds for projects, and loan with lower interest rate. After the projects being founded, China's Ministry of Metallurgical Industry will bring it into line with the country's overall plan, and help the enterprises to put into effect the funds and equipment's domestic.

- China's Ministry of Metallurgical Industry will be in charge of introducing affairs, and put them into practice in Xining Steel Plant and other plants.

3. CFB Coal Gasification for Ammonia Synthesis

3.1 Technology Name

CFB Coal Gasification for Ammonia Synthesis

3.2 General Characteristics

The technology of CFB coal gasification is a new process under R&D to convert a wide variety of solid fuels--biomass, coal, wastes into crude gas for fuel, town, and synthesis gas production in recent years. This technology is very suitable for replacing the old low efficiency UGI gasification process in small size ammonia plants which gasifier capacity limit is around 150 Mwth. The first commercial scale plant based on CFB gasification (27 Mwth) which produced low-Btu gas from bark was put into operation in Austria in 1986, and the gas is used in a paper mill for lime calcining. Up to now, there is no commercial plant for ammonia synthesis that has been in operation.

3.3 Cost Information

The CFB gasifier is operated at pressure less than 0.15 Mpa (called "quasi-atmospheric"). This pressure level allows continuous fuel feeding and ashes removing by using rotary feeders, obviating the necessity for lock hopper systems like with most pressure gasification temperature. Since both CFB and UGI gasifier are operated at the same pressure level, the existing UGI gasification plant can be replaced by CFB that need introduce N_2 to system prior to compression to keep the almost same content in the crude gas generated from CFB and UGI. So, it only needs to construct a CFB gasifier which corresponds to about 100,000 TPY of NH_3 capacity, without the necessity to renew the whole existing down stream compression and purification units. It also can reduce a lot of investment and the operation cost obviously.

3.4 Environmental Effects

It is the appropriate range of capacity for one atmospheric CFB gasifier (500 TPD of coal feed) which corresponds to about 100,000 TPY of NH_3 capacity. It uses 20.8 tons of coal to produce 13.89 tons of in one hour, and the average coal consumption for per ton of NH_3 is 1.497. It accounts for 64 percent of the total output of ammonia synthesis in China, which used coal by UGI gasifier. This process emits about 4000 m^3 of purge gas for per ton of NH_3 which the CO_2 content is 12 percent, that is 1.0 tons. If we use CFB gasifier to replace UGI gasifier to generate urea or ammonium

bicarbonate, it is zero emissions under normal conditions, and the carbon content of ash is lower than 5 percent. So, if the 50 percent of UGI gasifier were replaced by CFB gasifier, it will reduce 7.8 Mt of CO₂ emissions.

3.5 Market Potential

In China, the output which produced from the middle and small size ammonia plants amounts to 80 percent of the total output of nitrogenous fertilizer, among which, about 80 percent of the total capacity need to be fed with coal. These plants were almost use anthracite coal to generate gas by the conventional UGI gasifiers. The production of anthracite coal is relative concentration, but the ammonia plants is distributed around country. This not only result in a long distance transport of coal, but also affects the utilization ratio of ammonia plant capacity by limited resources. Meanwhile, the UGI gasifier is disadvantageous for its low efficiency, low carbon conversion rate, and difficulty with pollution control. For all these aspects, it is very necessary for China ammonia industry to seek a gasification process which both improved environment and used local coal resources, this issue also is a common problem. So, the CFB coal gasification for ammonia synthesis has good values for spreading.

3.6 Other Information

- At present, the CFB coal gasification which generated fuel and town gas has reached industrialization, but no one can be used for ammonia synthesis. So, it needs to do more detailed work, though the Lurgi had operated in its Research and Development Center.
- It is suggested that introduce this technology from Lurgi company by the Ministry of Chemical Industry of China, and which will be applied in the Xuanhua Ammonia Plant in Hebei province.

4. Vapour Emission Control Systems

4.1 Technology Name

Vapour Emission Control Systems

4.2 General Characteristics

Vapour Emission Control Systems are designed to collect vapours of flammable cargoes from tanker cargo tanks, and process vapours onboard or at shoreside terminal during cargo loading and unloading operations, in order to reduce the flammable vapours emit to the atmosphere, promote the operation safety, and protect the environment pollution. It includes the vapour collection system and the vapour processing unit. The vapor collection system consists of closed gauging device, liquid overfill protection system, vapour overpressure and vacuum protection system, and vapour line connection system. The vapour processing unit means the components of a vapour control system that recovers, destroys, or disperses vapour collected from a tanker. at present, this system uses many different technologies, such as carbon bed absorption and lean oil absorption.

4.3 Cost Information

In order to coordinate the issues of interest to each other on "safety transportation and environment protection " in ocean shipping, Intentional Maritime Organization (IMO) draw up a convention (MARPOL 73/78) on preventing ocean pollution from shipping. China is a signed country. According to the management regulation under port' country recommended by IMO, it is the duty for the port administration to allow ship leave, until the ship is in accord with the demands. Before the implementation of the annex 6 of the convention, some developed country had already carried out similar regulation, such as USA, in the chapter one of the 46 CFR, published in October 1, 1990, had provided a clear definition on the vapour emission control systems. So this technology not only concerns the reduction of the amount of ocean shipping and environment pollution, but also relate the problem whether China's ship can enter other country's port and other country's ship will be allow making port in China or not. At the moment, this system is expensive in the international market.

4.4 Environmental Effects

In China, about 1/3 of the freight volume of the petroleum is used international trade, and resulting in a worldwide environment pollution. If we use the vapour emission

control systems, it will operate in the closed condition for cargo loading or unloading, and meet emission standards, even realize zero emission. It also will recover the vapour, save energy, and reduce the loss of cargo. Meanwhile, besides cover the shipping transport need, this system is efficient, reliable and safety, which will be manufactured and spread domestically, and can also been used in land area based on introducing technology.

4.5 Market Potential

The characteristics of the shipping equipment have to be consistent with international standards, these devices have to accord the demands for the shoreside facilities at port of the other country, also, these devices should meet the requirements of standards of international convention. It's the same the other way round. So, for the equipment located both onboard and shoreside terminal need to be approved by the local administrations based on the regulation recommend by the international organization. At present, there are no user for vapour emission control systems in China, and its market potential also is very large. It's the best way for China to meet this issues by introducing the commercial technology.

4.6 Other Information

- It is suggested that adopt technology license to introduce the commercial techniques and process, and manufacture key equipment domestically, supported by the GEF grants.
- It is suggested that this technology will be responsible for technology introducing by the Ministry of Communications of China, and which will be carried out by the Shanghai Ship & Shipping Research Institute.

5. Biomass Gasification & Purification

5.1 Technology Name

Biomass Gasification & Purification

5.2 General Characteristics

Biomass gasification technology is a method of converting woods, stalks and some other solid biomass fuels which are not appropriated for direct use into convenient gas fuels used for cooking, generating, as well as for some industrial purpose after cleaning. It includes air gasification, oxygen gasification, thermolysis, steam gasification, etc. The key technology of process is biomass gasification equipment and fuel-purification equipment. By statistics in 1993, there were 343 biomass gasification thermal-power plants in the world, and the countries holding the leading technology in this field are Sweden, USA, etc. Canada also has put some products of biomass gasification furnace in different specification into market. Which use wood-dusk and paper or not waste as a fuel, and produce coal gas to drive internal combustion engine for electricity generation. The gasification efficiency at biomass gasification equipment in advanced countries have reached from 60 percent to 90 percent. the caloric values of fuel gases are ranged from $1.7 - 2.5 \times 10^4 \text{ KJ/m}^3$.

5.3 Cost Information

The current biomass gasification equipment developed by the advanced countries are general large scale with high automation and complex technical process, merely for power generation and heating supply, the costs are rather higher. The utilization of biomass gasification in China are mainly on drying or space heating and power system, the biomass gasification equipment used for power generation have two kinds, they are grain husks coal gas and oil gas double fuels generator units which is suitable for enterprise's small-scale power generation, the cost of Electricity generation and the per investment of power station are both reduced about 30 percent.

5.4 Environmental Effects

Because of biomass resource's renewable property, large quantities and high efficient utilization can bring about an obvious benefit of environment and ecosystem. Gasifying one ton of biomass fuel can reduce 1.3-1.5 tons of CO_2 emission and is equivalent to 0.5 tce of fossil energy resource.

5.5 Market Potential

At present, China's biomass gasification equipment R&D is still on the original stage, the level of gasification technology research is relatively lower, especially on the aspects of increasing fuel gas caloric value and its cleaning degree, we still have some technical barrier. It is prospecting that the demand for high quality cleaning - gasification energy will increase, as China countryside overall economic growth, the biomass gasification, being a way of energy end-use, will become one of the main issues for rural energy development and utilization. Its market has big potential. The key demand markets are as follows: (1) Forest areas with rich and concentrated biomass resource. In terms of country's total wood output of 60 Mm^3 , the waste will be above 25 Mm^3 . (2) Farm area with abundant and high quality grain crops stalks. It is calculated that the annual yield of grain crops stalks in China has exceeded 600 Mt which is equivalent to 300 Mtce of energy. (3) Agriculture and forest products processing industries with energy short. Each year China has wood waste of wood processing industries about 20 Mm^3 and grain crops husks waste about 50 million tons. (4) No-coal or short coal prairie and mountain areas.

5.6 Other Information

- Selecting appropriate gasification equipment and cleaning technology suited to characters and tech-economic level of China's rural areas. The introduced equipment scale should be small or middle size with gasification furnace diameter under 1000 mm and gas output of 200 m^3 . Adopting the forms of cooperation development or trade license introduced technology, organizing equipment production and demonstration spread domestically.
- The Ministry of Agriculture will be charge of technology introducing, this project will be coordinated the implementation by Institute of Energy under Shandong Academy of Science.

6. Fuel Forest-Fired Power Generation in South China

6.1 Technology Name

Fuel Forest-Fired Power Generation in South China

6.2 General Characteristics

As an alternative energy, fuel forest-fired power generation in south China is a conversion process from biomass energy to electricity power. Biomass energy power generation has several systems, such as direct combustion of biomass, combined combustion and DFSS. The current prevalent biomass power generation technology use condensing turbine, another choice is gas turbine, its coal gas fuels are produced by biomass thermal-chemical gasification. The most possible biomass power generation technology can be BIG/GTS which will probably become a commercial power generation in this century. Fuel forest-fired power generation is belong to specific feedstock supply system, it's also no technical problems existed. There have been some experimental examples in Indonesia and Guatemalan.

6.3 Cost Information

Although we have some examples of fuel forest-fired power generation, the economical benefit problem still remains unsolved. The solid biomass fuels have relatively higher ratio of input and output transportation cost and power cost. So, the urgent need is in order to develop an experimental research, reduce power cost and make this technology have both environment and economical benefit.

6.4 Environmental Effects

The CO₂ emission reduction by using fuel forest-fired power generation determined by how much firewood used. It depends on the power station scale. Taking an example of small network severed by five sub-regions. Supposing each sub-region has 500 ha, the annual biomass output would be 40m³ (about 18 tons carbon), the carbon emission would reduce 22500 tons per year. The amount of CO₂ emission caused by burning firewood also can be offset by CO₂ absorption during firewood growing, so, the fuel-fired power generation will not increase CO₂ emission. Meanwhile, woods usually do not contain sulfur element. It also can have some impact on atmospheric SO₂ emission and acid rain controlling.

6.5 Market Potential

The operation purpose of firewood plantation is to produce biomass fuel, among the energy forest operated by the means of short rotation, the firewood plantation process has certain good features of rapid profit, high output, good adaptability, low cost, etc. The South of China shares a warm climate with abundant rain and forest resources, so the firewood plantation by utilizing local fast-growing tree feeds would achieve a short production period and a larger yield. It's really an expected way to reduce carbon emission by using fuel forest-fired power generation. As the increasing realization of environment issues, more and more people would like to accept biomass energy. Therefore, the market for this technology will be promising.

6.6 Other Information

- Expecting get some funds from GEF for the technology introducing. In order to reduce transportation expenses, the small power station should be built beside mountains in the scale of sub-region unit, and connecting several these small power station forming a regional network.
- The Ministry of Forest will take responsibility for technology introducing, this project will be coordinated the implementation by both Tropical Forest Research Institute, Ministry of Forest and Guangdong Forest Bureau.

7. Fuel Cells

7.1 Technology Name

Fuel Cells

7.2 General Characteristics

Fuel cell is a device which can transfer chemical energy of the fuel into electric energy. Its main body is composed of two different kinds of polar materials and the matching electrolyte. When fuel and burning-rate accelerator are piped into two poles separately by an aiding device, chemical reaction will occur in the electrolyte under the affections of both polar materials and electrolyte (including catalyst sometimes), and then power energy will directly be generated. The efficiency of power-generating of fuel cells can be from 40 percent to 60 percent, which is two times of that of thermal power generation. Total efficiency can reach 80 percent, for the heat blown off can also be used. Fuel cell can use a great number of kinds of fuel, and the scale and application of the cell can be chosen. Now there are some advanced fuel cells in some countries, for example, the fuel cells invented in Australia is the third generation of ceramic polar fuel cells, and phosphoric acid type fuel cells made in America used phosphoric acid as the electrolyte. In Japan the fuel cells with 11,000 kW have been working smoothly, and the total installment capacity of the cells has reached 18,000 kW. Japan also invented metal fuel cells which can generate electricity only at 80 °C or so. It is reported recently that Sanyo Electric Corp. Limited had developed portable fuel cells using compressed hydrogen, whose power has been about 100 kW. It can be predicated that this technique will be commercialized and become dominating technique in this filed in 1996.

7.3 Cost Information

From the view of the investment of capital construction, it is reported that the cost for advanced large device is about \$600 per kW, if added with waste disposal cost, it would reach \$1400 per kW. The investment to the small power plants whose technique is not advanced will be higher. Under current conditions, the producing cost of fuel cells is much higher — about \$2500 per kW due to the complicated techniques, and the capacity is 20,000 kW. Nevertheless, when the capacity can reach 20,000 to 30,000 kW, this technique will be economical. For the operation cost, comprehensive circulation cost of combustion turbine is \$0.077 per kWh, the cost of coal-burning power generation is \$0.083 per kWh, and the cost of fuel cells is 0.073\$ per kWh. From the view of the cost of electricity transmission and distribution, the cost of

electricity transmission and distribution in developed countries is \$500 per kW. While in developing countries, power consumer is more scattered, and the cost is more high. However, fuel cells can save this cost, for they do not need electricity transmission and distribution.

7.4 Environmental Effects

Fuel cells almost neither produce greenhouse gases such as CO₂ which can cause the global warming nor blow off SO_x or NO_x. They are clean energy resources, polluting environment very little, and not like power plants which will consume great lands. Present examples indicate that using fuel cells can reduce the emission of CO₂ at 40 percent to 60 percent, SO_x and NO_x at about 90 percent.

7.5 Market Potential

Because of the wide range of application, fuel cells have very large market capacity. Now they can be applied in some special fields. When being economical, they can be applied in extensive circumstances.

7.6 Other Information

- It is suggested that the way of "Starting from Application, Developed by Projects" should be adopted. First, it is necessary to introduce fuel cells consuming common energy resources and set up typical examples according to the need, and then to introduce fuel cells matching with biomass gasification unit and to develop apartment or district type co-generation by biomass energy.
- The Ministry of Electric Power and the Ministry of Agriculture are planed to take charge of the work of introducing and implementing the technique.

8. Smelting Reduction

8.1 Technology Name

Smelting reduction

8.2 General Characteristics

The smelting reduction technique of producing molten iron is one of direct iron-smelting process, which use pulverized coal and oxygen, reduce with ore powder in the condition of high temperature and liquid state, and make most of the reactions happened in the liquid oxidize phases. Smelting reduction will be the new technique of iron and steel smelting in the 21 century. The first time to do technique experiment was in steel ladle in West Germany in 1977. South Africa imported a set of smelting reduction technique and device (Corex device) from Austria Iron & Steel Union in 1985, which can produce 0.3 million ton molten iron per year, and put it into production in the end of 1989, producing 0.34 million ton molten iron per year, per ton iron average consumed 640 cubic meters oxygen, coal 1183 kg, and meanwhile, produced lots of high calorific value gas as by-product, the compositions of the molten iron and its temperature are almost same as that of the production from the blast furnace. Puxiang Iron and Steel Plant in South Korea has constructed a set Corex device which can produce 0.6 million tons molten iron per year. At present, the following process would become the process in a scale of production: Japan's DIOS process, Australia's HIS melt process, Russia's ROMELT process, Germany's Lurgi process and America's AISI process, etc.

8.3 Cost Information

Smelting reduction technique cuts down the coke oven and sintering workshops, so its construction cost is less about 20 percent to 30 percent than that of blast furnace process. It can reduce a lot of employees, therefore, lessen the operation cost: the processes can reduce energy consumption, the cost of the products will be down, the cost is about 10 percent to 20 percent lower than that of the blast furnace process.

8.4 Environmental Effects

The smelting reduction technique of producing molten iron can cut down environment pollution, it can obviously reduce the emission amount of poisonous gas, such as dust, SO_2 and NO_x . 40 percent of dust emission in steel production can be reduced because of omitting sintering and coking process, especially, the investment of controlling pollution in a ton steel production dropped over 25 percent because of reducing pollution from polycyclic aromatic hydrocarbon in the coking. Meanwhile, because of omitting energy consumption in sintering and coking process, 35 percent of energy

consumption amount for per ton steel can be saved, and about 25 percent of CO₂ emission amount per ton steel can be reduced.

8.5 Market Potential

China is a developing country, the steel output in 1994 reached more than 91 million tons, but the average steel output possessed by per capita was only 60% of that of the world. It's predicted that the steel output in 2000 in China will reach 100 million, there is still a gap of 20 million ton steel. Due to the process technique falls behind the developed countries, the production structure is not reasonable, all of these make material consumption high and environment pollution serious, the quantity and quality of the products could not satisfy demand of the national economic development, therefore, we should adopt new techniques to improve old enterprises so that they can improve both quantity and quality of products, and make the consumption of energy and raw materials lower, protect and improve the environment. It is one of important factors of restricting China's iron and steel industry that the coke resource is limited, so iron-melting using non-coke will be useful to the development of iron and steel industry. So, smelting reduction technique has a vast vista in China.

8.6 Other Information

- It is necessary for China to get funds assistance from GEF to introduce smelting reduction technique.
- According to the level of the technique and economy, Corex process is more ripe in smelting reduction technique. China needs to import Corex's whole set of technique and device.
- The Ministry of Metallurgical Industry of China will be in charge of the introducing affairs.

9. Poultry/Livestock Wastes for the Production of Organic Compound Fertilizer--Complete Technology

9.1 Technology Name

Family Animal wastes Produce Organic Compound Fertilizer

9.2 General Characteristics

This technique is to separate liquid from solid wastes, ferment the separated liquid through anaerobic and aerobic procedures, and then drain when accomplished the national standard. While the separated solid wastes will be fermented again, added dregs of the fermented biogas and supplementary ingredients, and then parched to organic compound fertilizer for sale. Now this technique in Japan, Russia and Taiwan is relatively mature, each has its own advantage, through research and technical and economical comparison, the technique and equipment in Taiwan are more suitable for China's situation.

9.3 Cost Information

The best way to resolve the wastes in the large and middle scale animal farm is comprehensive utilization, only this way can reduce the environment pollution greatly and overcome the poor economic benefit. Organic compound fertilizer is very suitable for fruit, vegetable and greenhouse plant, it not only can promote the growth of plant, but also can improve the products quality, its price is lower than chemical fertilizer but its effect is better. As calculated, the dynamic return period of such technique in large-scale animal farm is about 4 years, the investment interest rate is above 30 percent.

9.4 Environmental Effects

This technique converted wastes into fertilizer, changed the pollution source into usable resources, conserved energy, improved environment. It not only resolved the water and air pollution, but also produced high-quality organic compound fertilizer from solid wastes, formed a healthy cycle of the whole eco-agriculture. Biogas is a kind of high-quality energy, can be used directly in life and manufacture when cleaned. With the application of this technique and building biogas engineering, it will further alleviate the condition of lack of energy in rural areas, and effectively protect the plant and decrease woods damage, it is significant to improve local climate and decrease the emissions of harmful gas.

9.5 Market Potential

Now the disposition of wastes of China's large and middle scale animal farm has not been resolved completely, the research on the double fermentation technique is not mature, has not formed a series of usable equipment and technique. So this technique's market capacity is very large, almost all the animal farm can use this technique. According to statistics, the excreta of chicken and pig produced per year will be 581 million tons, together with other excreta, the total will be 700 million tons, mostly indisposed, only a small part disposed with biogas engineering.

9.6 Other Information

- Plan to build a demonstration project in large scale pig farm in Beijing rural areas with the money presented by GEF, import all the assembly line, including equipment and technique.
- The Ministry of Agriculture is responsible for the import, organized by the Institute of Planning and Design of the Ministry of Agriculture.

10. No-tillage for Man-made Forest in South China

10.1 Technology Name

No-tillage for Man-made Forest in South China

10.2 General Characteristics

No-tillage for Man-made Forest in South China, i.e., do not clear the woods when logged, leave the stumps and branches in the woods, plant the saplings in the space between the stumps, convert the conventional method which burn hill, till land, and plant forest to no-tillage and no-burning method, in order to increase the yield of the land, decrease the carbon loss of the land, promote the absorption of CO₂ in the atmosphere. As reported, logging, tillage and plant cause the carbon loss of about 21 percent average in Europe and America, the range will varied according to the method, the carbon loss ranges from 1 percent to 69 percent, in which the logging-burning-tillage method will cause the greatest loss.

10.3 Cost Information

With the no-tillage method, the land will not be cleared, so it will be inconvenient and more expensive when planting. The weed mowing will increase the cost relatively to the common forest. So, the cost of no-tillage will be higher than common forest planting method. While the earlier productivity level maybe lower than the common forest, but the later growth and overall yield will surpass the common forest, so the gross economic benefit is that the income will be much larger than the cost invested.

10.4 Environmental Effects

No-tillage method will decrease greatly the soil erosion and the organic substances lost, increase the organic carbon content in land and the land productivity, especially in tropics and subtropics. increase the absorption of CO₂ in the atmosphere, decrease other greenhouse gases emissions, and will benefit to the world environmental improvement. The potential can be showed in three aspects, (1). decrease the loss of organic substances, the quantity can not be calculated by now, (2). obviate the direct emissions caused by burning, (3). increase the forest productivity, increase the absorption of CO₂ in the atmosphere because of the decrease of the land degradation. If the no-tillage method implemented on the 80 percent of fir forest and pony-tail pine forest, and presume that the carbon loss decrease by 20 percent and forest yield increase by 20 percent, the fir forest in South China can increase the absorption of carbon in the atmosphere 200 million tons. Such situation can last 30 years, i.e. a

forest logging period, so in this period the absorption of carbon in the atmosphere can be increased 75 million tons per year.

10.5 Market Potential

The fir forest and pony-tail pine in China are a quarter of the whole forest area. the fir forest is 9 million hectares, the pony-tail pine is 14 million hectares, presently all these forest zones carry out the burning—tillage—plant method. Because South China is full of rainfall, and the forest zones are located mostly in steep slopes, this kind of operation will cause nutrients and carbon lost, land productivity constantly decreased. So in the South China artificial forest, in order to increase the organic substances content and decrease land degradation, to implement the no-tillage method is very necessary. And China is a country lacking wood, so the market of this technique is very large.

10.5 Other Information

- Advise importing this technique from the USA, the expenditure expected to get from GEF.
- The Ministry of Forestry is responsible for the import, organized by the Forest Eco-environment Institute of the Ministry of Forestry.

11. Forest Ecosystem Management Systems

11.1 Technology Name

Forest Ecosystem Management Systems

11.2 General Characteristics

By utilizing modern information systems and implementing modern management to forest ecosystem, the forest yield can be increased and resources dissipation can be decreased and the absorption of CO₂ in the atmosphere can be promoted. Forest Ecosystem Management Systems is a new technique, meanwhile a relatively difficult technique. In order to increase forest yield and ability to absorb CO₂, the radical approach is to increase the standard of forest ecosystem management. Now, the yield of intensively managed artificial forest is larger than that of natural forest by several times or even several tenfold. But some intensively managed artificial forest has the problem of land degradation, giving rise to the soil erosion and organic substances loss. To promote the yield of forest generously and depress the land degradation, modern Forest Ecosystem Management Systems must be adopted.

11.3 Cost Information

This project is by implementing modern management to forest ecosystem, to increase the forest yield, decrease resource dissipation. So the investment will focus on local information center, and comprehensively the amount of investment is small and the profit is high. To implement modern management to forest ecosystem is a key step to realize sustainable utilization of resources, and will create significant effect on long-term stability and productivity of forestry.

11.4 Environmental Effects

To implement modern management to forest will greatly increase forest yield, decrease improper utilization and dissipation of forest resources, protect forest resources, improve ecological environment, promote the absorption of CO₂ in the atmosphere, and benefit to China and world environmental improvement. The effect on production increase is determined by quality of the operation, if by most conservative estimate about wood increase of 30 percent per hectare forest, the increase of the whole country's forest will be 85 million m³, is equivalent to an increase of the absorption of CO₂ about 20 million tons

11.5 Market Potential

China is a country lacking wood, the wood market is very large, so the market capacity of this technique can be regarded as unlimited.

11.6 Other Information

- Now the Forest Ecosystem Management Systems in Australia are relatively advanced, so the technique can be imported from Australia by technique cooperation method, investing jointly, in order to use this technique as soon as possible.
- The Ministry of Forestry is responsible for the import of the technique, the Eco-environmental Research Institute and Forest Resources Information Institute of the Ministry of Forestry should organize the implementation.

12. Waste Land Afforestation for Mine Area

12.1 Technology Name

Waste Land Afforestation for Mine Area

12.2 General Characteristics

Afforestation on waste land for mine area to recover the land and vegetation can absorb CO₂ in the atmosphere and improve the environment. It has been confirmed by practice that afforestation on waste land for mine area is a very effective way to recover ecological environment. Confined by the present technology of mining and the low percentage of vegetation (from 4.2 percent to 9.0 percent), the exploitation of waste land in China should be based on afforestation. There are many technical examples to be referred to, for example, in Germany, before reforesting on waste land of lignite coal mine, several ways were adopted to improve the soil microbial activity, in the Former Soviet Union, lime and waste material are scattered on poisonous land of open coal mine area to reduce soil acidity, which has promoted the growth of forest; in New Mexico and Arizona of the USA, planting vegetation by irrigation has been succeeded in waste land of mine area. On afforestation, the techniques of the USA are much more advanced.

12.3 Cost Information

The goals of afforestation on waste land of mine area are to improve ecological environment and to absorb CO₂ in the atmosphere. The project does not intend to gain economic profit, so there is no direct economic beneficial result, but there is indirect environmental benefit, which should be estimated by cost-benefit analysis of the environment.

12.4 Environmental Effects

Afforestation on waste land for mine area can notably improve the condition of ecological environment, which is also beneficial to that in China. Moreover, woods can be formed quickly, so there is no need to renovate the land greatly, and only with a little economic investment, the goal of land renovating can be achieved easily and safely. The woods will stand the soil, clean up the air, prevent water loss and soil erosion and reduce the dust considerably. Another goal of afforestation is to provide timbers and fruits, which has a re-generative function. If all the 14 million hectare land is reforested, 25 million tones carbon will be absorbed each year, providing that

the annual growth rate of every hectare forest is 8 cube metre.

12.5 Market Potential

Reforestation is a feasible way to regain and reestablish the ecological environment in waste mine area. There are about 14 million hectares of waste land in China with growing at a speed of 20,000 hectare per year which has not been reforested, it has great potentiality for reforestation. Therefore, China can not only obtain nearly 2.1 billion cube metre timbers, but improve ecological environment in mine area greatly, by importing the advanced reforestation technology from the USA and applying it throughout China.

12.6 Other Information

- It is suggested to import reforestation technology and mechanical equipment from America, Germany, British etc.. Meanwhile, Chinese government will establish research projects of waste land reforestation, including improved varieties of woods, reforestation pattern, intensive management and so on, and will put forward comprehensive practical technology combinations of reforestation fit for different mine area and waste land.
- The technology is planned to be imported by the Ministry of Forestry, and carried out by Eco-environmental Research Institute of the Ministry of Forestry.

13. Solar Hot Water Heater--Vacuum Tube

13.1 Technology Name

Solar Hot Water Heater--Vacuum Tube

13.2 General Characteristics

Solar hot water heater--vacuum tube is a new type of solar heat collecting device, which can transfer solar energy directly into thermal energy. The adoption of vacuum technique can reduce heat loss of the collector greatly, which makes itself to be with a sound thermal behavior even at high working medium temperature or at low environmental temperature. This device has good performances such as anti-freezing, high bearing strength, easy fixing and maintaining and so on. Heat pipe type vacuum tube solar collector is an outstanding one in its family. Because of the adoption of heat pipe technique, the heated working substance does not flow through vacuum tube directly, and has the advantages of small heat capacity and therm-diode effect. The average efficiency of absorption of heat for vacuum tube solar collector per day is above 50 percent. The collector can be used all the year in northern China, and can provide heat more than 20 percent that of normal plate absorber.

13.3 Cost Information

Solar hot water heater-vacuum tube do not consume energy resources during working, and do not need new investment. It is estimated that only the saving of charges for electricity or gas in three years would be equal to total investment. For a family of three to five members, there is enough water to bath all the year if they have a 1.2 square metre vacuum tube collector. In northern China, even in winter two sunny days can provide enough energy to heat a case of water, so it is no problem for every member to have one or two bathes each week, saving about 400 kilogram coal equivalent.

13.4 Environmental Effects

There is neither pollution to the environment during working, nor emissions of waste gases such as CO_2 , SO_x , NO_x etc..

13.5 Market Potential

By now, heat pipe type vacuum tube solar collectors manufactured by Beijing Institute of Solar Energy have been appraised and been in lots producing. In foreign countries,

Holland's Philips Co. Limited and British Thermomax Co. Limited both have advanced productions taking use of solar energy. Israel's application of vacuum tube solar energy is very popular, and its technique is very advanced. China has more than 200 million families, but the popularity is no more than 0.5 percent, so there is a huge market capacity of 2 million square metre or so each year.

13.6 Other Information

- It is suggested that the production line or the transferring for key technique should be imported. Water tanks and supporting frames necessarily should be manufactured domestically.
- This technique is planed to be imported by the Ministry of Agriculture, and to be implemented by Institute of Energy of Shandong Academy of Science.

14. Rice Husk Energy Transfer Instrument

14.1 Technology Name

Rice Husk Energy Transfer Instrument

14.2 General Characteristics

Rice husk energy transfer instrument is a furnace which can transfer biomass energy of rice's husk into thermal or power energy. It suits to different scales of rice husk energy converter, and the energy transferred will be used to generate power energy, providing heat or dry materials. When its burning is controlled, clean hot gas flow can be obtained, and the carbon content of rice husk can also be controlled, which are significant to increase burning efficiency and provide rice husk on sale. KC furnace generates power by burning husk, because it can partly make use of (directly controllable) the calorific value of fixed carbon of rice husk, the color is tangerine in furnace, and the temperature is about 1100 °C. Chemical incomplete combustion degree is much lower in oxidative environment of the furnace, so combustion efficiency of fuel is much high, and the carbon content of rice husk disposed can be controlled between 10 to 30 percent. The dust of rice husk can be used immediately without drying, for the dust extracted from KC furnace is dry already.

14.3 Cost Information

Rice husk as feed can only be a kind of filler, without much nutritive value. With the development of Chinese grain production, rice husk will not be used as feed, but as a source of fuel, which has important practical significance and social economic benefit. For Chinese rice production area, in the case of lacking fuel and electricity power practically, building relevant rice husk power station, supply center, or drying plant near large or middle rice pearlier factories is a feasible way to comprehensively utilize the resource of rice husk, meanwhile the disposal of the husk can be reduced.

14.4 Environmental Effects

Chinese production of rice is 176 million tones in 1994, about 40 percent of the world's, if converted to rice husk, there would be 34 million tones. Chinese area lacking energy resources (like Zhejiang province), depends on the transported coal, oil and so on from other provinces. Zhejiang province's dominating grain is rice, and most of the rural areas produce rice, so making use of rice husk as power fuel can solve the problem of lacking fuel at a certain degree, especially to those area which is

not crossed by railway. Moreover this is an important to protect forest and reduce the energy consumption for transport.

14.5 Market Potential

China's generating sets mostly belong to stacking retort gas power generating, so the calorific value of fixed carbon of rice husk is relatively less used. In furnace, the color is light red, and the temperature is about 500 to 700 °C. Chemical incomplete combustion degree is much large in neutral or reduction environment of the furnace, so the carbon content not burned in rice husk disposed is about 40 to 50 percent of the dusk. This technique in America is advanced (American PRM Rice Pearlier Corporation), meanwhile China has many experts having study rice husk combustion technique for some years, who can fully assimilate the technique and develop rice husk combustion furnace suits according to Chinese condition. Thus this technique surely has a wide market capacity and a bright future.

14.6 Other Information

- Expert group should be organized to investigate the situation of manufacturing and applying, and should be imported a typical KC furnace.
- This technique is planed to be introduced by the Ministry of Forestry, and to be implemented by Planing and Designing Institute of the Ministry of Agriculture.

15. Pony-tail Pine Protection in Acid Rain Area

15.1 Technology Name

Pony-tail Pine Protection in Acid Rain Area

15.2 General Characteristics

Acid rain caused by SO_2 can do great harm to pony-tail pines of southern China, and has killed many trees. Pony-tail pine protection in acid rain area can promote the growth of forest and speed up absorbing CO_2 in the atmosphere.

15.3 Cost Information

This technique can reduce the harm suffered by pony-tail pines from acid rain, increase the woods, improve ecological environment, and have great economic benefit. It is pointed out by research that, a great number of pony-tail pines in southern China suffer severely from acid rain. By incomplete statistics, the woods lost for this reason are about 600,000 cubic meters each year, that is, the loss of 0.3 billion Yuan. The reduction of the absorption of CO_2 caused by forest lost is great.

15.4 Environmental Effects

This technique can reduce the harm of acid rain to the southern pony-tail pines, increase absorbing resources of CO_2 , slow down the pace of greenhouse effect, and devote to the improving of global environment. Because the distribution of pony-tail pines in southern China is very extensive, and the pines suffer severely from acid rain, the importing of this technique can not only expand the storing of pony-tail pines, and improve the condition of afforestation, but increase the absorption of CO_2 greatly; thus, the goal of reducing the blowing off CO_2 is attained. It is calculated that the woods lost are 600,000 cubic meter per year, this project (if having been carried out) can absorb 140,000 tones CO_2 a year more than before.

15.5 Market Potential

The distribution of pony-tail pines is extensive in China, and they are the typical kind of coniferous trees in humid area of Chinese eastern subtropical zones. Because pony-tail pines have the advantages of adapting environment easily, growing rapidly, and reforesting naturally or artificially without difficulties. Moreover, the timbers of them are widely used, and with high economic benefit, so they play an important role in exploiting subtropical mountain areas and the recovering forest ecosystem. Because the energy structure of China, which is dominated by coal, can not be changed in a short term, and the air pollution tends to be more serious, this technique surely has a good prospects.

15.6 Other Information

- Europe has studied acid rain deeply and thoroughly, so its technique of controlling the harm of acid rain

to forest is much advanced and completed. Although Europe have not studied the harm to pony-tail pines specially, we can import and transfer the technique of reducing the harm of acid rain to forest from Europe.

- This technique is planned to be imported by the Ministry of Forestry and carried out by Eco-environment Research Institute of the Ministry of Forestry together with the Forestry Bureau of Guangxi, Sichuan and Guizhou Provinces.

**White House Climate Change Task Force**

734 Jackson Place, N.W. • Washington, DC 20503

FACSIMILE TRANSMISSION SHEET

To	<i>Gene Alday</i>	From	<i>Jeff Seaknight</i>
Office	<i>-</i>	Date	<i>8/6/99</i>
Fax Number	<i>395-6870</i>	Fax Number	395-2311
Office Number		Office Number	395-2310

Comments:*FYI***Pages:** _____, including this cover sheet.**IF TRANSMITTAL IS INCOMPLETE, PLEASE PHONE**

ANNEX A

CHINA

A.1 SUMMARY

China is second only to the United States in emissions of carbon dioxide. It accounts for approximately 14% of global CO₂ emissions and its share is expected to increase in the coming years. China's ranking as a major emitter of greenhouse gases can be attributed to its large population (more than 1.2 billion people), its rapid economic growth and dramatic industrialization over the past two decades, and its increasing energy use which draws heavily on abundant indigenous coal resources.

Over the past decade, China has increased environmental spending, adopted market incentives, strengthened lawmaking and enforcement, and promoted nationwide environmental education as part of its efforts to curb GHG emissions.

China has also made explicit policy choices regarding industrial structure, power generation, and the preservation of carbon sinks. Environmental problems associated with heavy reliance on coal would be even worse if China had not initiated a

widespread energy conservation program in the early 1980s. This program reduced China's energy intensity by 4.5% each year for the past two decades.¹ From 1980-1990, China's energy efficiency programs resulted in energy savings equivalent to 100-140 million tons of coal and catalyzed conservation investments by Chinese industry of \$5.7 billion.²

China's energy efficiency programs resulted in energy savings equivalent to 100-140 million tons of coal and catalyzed conservation investments of \$5.7 billion.

¹ Pacific Northwest National Laboratory, 1998. *China's Electric Power Options: An Analysis of Economic and Environmental Costs*. Washington, DC.

² Keegan, Patrick et al. 1996 "Seven More Developing Country Examples of Energy Efficiency and Renewable Energy Initiatives." *Examples in Action: Sustainable Energy Experiences in Developing and Transition Countries*. IIEC, Washington DC.

A.2 BASELINE CONDITIONS AND TRENDS

China is the most populous country in the world and the second largest producer of GHG emissions. In 1995 China's emissions of CO₂ totaled 3,192.5 million metric tons, approximately 14% of the world's total. A large amount in absolute terms, it looks slightly less so when considered in relation to China's population. CO₂ emissions per capita were 2.7 metric tons in 1995, far lower than in many industrialized countries. China's contribution to global emissions is expected to reach 15% by 2000 and 25% by 2050.¹

Energy consumption is the primary source of China's GHG emissions and accounted for 80% of its 1990 emissions. China is the second largest energy consumer in the world. In 1995 China's total primary commercial energy demand was 1,240 mtce. Energy consumption has increased on average 4.5% per year over the last 15 years. Energy-related CO₂ emissions have increased steadily over the past two decades as well, more than tripling between 1971 and 1993.² Exhibit A-1 shows a breakdown of these emissions by sector in 1990. Power plants were responsible for approximately 183 million tons of carbon emissions, 29% of the country's total. Three quarters of China's power plants are coal-fired, a fact that explains the power sector's importance as a source of CO₂ emissions.

Exhibit A-1³

1990 Energy-Related CO ₂ Emissions by Sector	
Sector	Share of
Industry	75%
Power	24
Energy production	11
Building materials	9
Iron and Steel	7.5
Chemical materials	7.5
Other	16
Agriculture	3%
Transportation	4%
Other	18%

¹ Rose, A. et al. 1996. "Global Warming Policy, Energy, and the Chinese Economy," *Resource and Energy Economics*, vol. 18, no. 1 (March), pp.1-30.

² OECD. *Climate Change Policy Initiatives 1995/96, Volume II: Selected Non-IEA Countries*, p.45

³ Ye Ruipu, China Environmental Protection Agency, "Studies on Climate Change Problems and Response Measures in China", published in Proceedings from the International Conference on National Action to Mitigate Global Climate Change, June 1994. UNEP Collaborating Center on Energy and Environment Risk National Laboratory, Denmark, June 1995. Beijing, PRC.

CHINA ► A-3

Coal is the largest contributor to energy-related CO₂ emissions. China consumes about 1.4 billion tons of coal each year and relies on coal more than any other country in the world (see Exhibit A-2).⁶ In 1993 coal use accounted for 83% of total energy-related CO₂ emissions.⁷ Both the power sector and the industrial sector are heavily dependent on coal. Industrial boilers are very prevalent in Chinese industry; there are an estimated 430,000 industrial boilers, most of which are coal-fired. Cement production is another source of CO₂ emissions. In 1990 cement production in China was about 210 million tons, producing emissions of about 29 mtC.

Exhibit A-2 Coal as a Source of Fuel in China	
Use	% of fuel supply
Power Generation	76%
Industrial Fuel	75%
Household Energy	80%
Chemical Raw Materials	60%

The transport sector and residential sector are not major sources of GHG emissions. The transport sector contributed only 6.4% of total emissions in 1993 while the residential sector accounted for 13% of emissions. According to projections, the transport sector will

still account for only 5% of CO₂ emissions by 2020. However, the absolute amount of energy consumed by the sector could increase from 45 mtce in 1990 to 173 mtce in 2020. China's forests are estimated to have been a net sink of atmospheric carbon in 1990, reducing total GHG emissions by about 1 percent.

A.3 BROAD ECONOMIC REFORMS AFFECTING GHG SOURCES AND SINKS

The Chinese economy is in the midst of a major transition from a command economy to a market-based one. This transition has resulted in rapid economic growth and a fourfold increase in the size of the economy in the past 15 years. Between 1978 and 1995 real GDP per capita grew by 8% per year.⁸ Beginning in 1978, China launched a series of economic reforms that have liberalized markets for many products and services, introduced competition in industry, and contributed to China's integration with the world economy.

China's remarkable economic growth over the past two decades may be contributing to increased levels of GHG emissions. There are at least two factors, however, which suggest the link between economic growth (and the economic reforms that spurred that growth) and GHG emissions may not be as strong in China's case as in other countries. First, a World Bank analysis of the factors contributing to China's economic growth reveals that labor force improvements, a

⁶ *Op. cit.* 1, p.1

⁷ *Op. cit.* 3, p.45

⁸ The World Bank. 1997. *China 2020: Development Challenges in the New Century*. Washington, D.C. p.1.

CHINA ▶ A-4

high savings rate, and structural change were important components of economic growth." In fact, only 37% of China's annual economic growth is attributed to growth in capital inputs, according to the World Bank.

Second, China's energy intensity has fallen by 50%, or 4.5% per year, despite the high levels of economic growth. The decline in energy intensity is due in part to efficiency gains in the industrial sector. Changing demands for goods and services has altered China's product mix, producing some efficiency gains.

China's energy intensity has fallen by 50%, or 4.5% per year, despite high levels of economic growth.

The beneficial effects of some economic reforms on GHG emissions are discernible. These reforms are discussed briefly below.

A.3.1 Power Sector Reform

The Chinese government is in the process of restructuring its power sector, which has the potential to enhance energy efficiency and reduce GHG emissions. A more market-oriented power sector should expedite the introduction of improved management techniques, a reduction of transmission and distribution bottlenecks that perpetuate inefficient operation of generation plants, and the transfer of more advanced technologies.

China's power industry previously was overseen by the Ministry of Electric Power (MOEP), which was established in 1993 and whose role was to set energy policy, prepare industry regulation, and plan the industry's development. The MOEP owned all of China's generating assets other than those owned by companies not directly managed by the MOEP (i.e. foreign developers). The MOEP was officially dissolved in April 1998 and was replaced by the newly-formed State Power Corporation (SPC). In principle, this first step represents the "corporatization" of MOEP and is intended to facilitate market-based reforms and investment in the power industry.

In a second stage of reform that will follow, the functions of generation, transmission, and distribution will likely be unbundled. Generators would operate in a competitive market. Distribution and transmission would remain under the control of SPC and the Provincial Power Bureaus for the foreseeable future. A pilot competitive generation market is being established in the East China Power Group Area; if successful, the pilot project could lead to the establishment of competitive power markets throughout China.

⁹ *Op. cit.* 4, p.4.

CHINA ▶ A-5

China's efforts to unbundle generation, transmission, and distribution will eliminate some of the discriminatory practices involved in the purchase of power from generation plants. For example, power sector reform will seek to ensure that power plants not owned by local distribution networks receive the same treatment as network-owned plants. The current favoritism shown to network-owned plants means that the more efficient foreign-owned plants are often passed over in favor of a locally-owned plant. Another objective of power sector reform will be to create a national high-voltage network. This would allow regional grids to sell surplus electricity into other regions where supply is insufficient to meet demand. Current transmission bottlenecks mean local power bureaus have limited options for meeting electricity demand and often resort to building new but small plants, which tend to be less efficient than large scale plants, and keeping existing units on line as long as possible. Both changes will mean a more efficient power industry that produces lower levels of GHG emissions.

A.3.2 Trade and Investment Liberalization

Liberalization of trade and investment policies have spurred foreign investment in China and increased competition for industries and businesses. The power sector in particular has attracted significant amounts of foreign public and private investment. From 1979 to 1996, 10% of total investment in the power sector came from abroad. As of early 1998, China had almost 57 GW of foreign-funded electric generation capacity in operation or under construction (China's total installed capacity is approximately 250 GW).

This investment has been critical to bringing in modern, efficient generation plants. The average thermal efficiency of China's power plants is 25-29%.¹⁰ Older plants in particular can be quite inefficient, consuming as much as 25% of the electricity they generate. Based on a survey of U.S. developers investing in China's power sector, about one-third of the developers' plants use advanced generation technologies and one-fifth are cogeneration plants.¹¹

To continue to exploit the environmental and efficiency benefits that foreign-funded power plants offer, the Chinese government recently stated that future foreign investment would be channeled into projects with a capacity exceeding 300 MW. This directive is meant to reverse the trend of provincial and local authorities building smaller power plants, which often have diseconomies of scale in design and operation. Approximately 40% of China's generating units are smaller than 100 MW and only 23% of capacity is in units larger than 300 MW.¹²

¹⁰ Blackman, Allen and Xun Wu. 1998. "Foreign Direct Investment in China's Power Sector: Trends, Benefits, and Barriers". Resources for the Future Discussion Paper 98-50, Washington, DC.

¹¹ *Op. cit.* 9, p. 27.

¹² *Op. cit.* 9, p. 3.

CHINA ► A-6

A.3.3 Energy Price Reforms

Over the past decade energy pricing in China has moved from central government control to a mix of market-driven allocation and government interventions. The result in most cases has been higher prices that more accurately reflect the true costs of supply.

Electricity Prices

China has instituted a number of pricing reforms in the electricity sector to increase the funding sources available to the power sector and to establish tariffs that allow power enterprises to recover the costs of providing power. As a result of these reforms, electric power prices have increased steadily since 1981. On average electricity prices rose 9% per year between 1981 and 1993. The average electricity tariff in 1996 was 283.4 yuan per MWh, 8.1% higher than the average tariff in 1995.¹¹

As part of electricity pricing reforms, China established a new policy for the purchase of power from power plants constructed between 1986 and 1992 that are not financed by the central government and from all plants constructed after 1992. These newer plants charge wholesale tariffs that ensure revenues will be sufficient to cover the repayment of loan capital with interest. This new pricing policy produced significantly higher producer power prices. On average, prices of electricity from newer plants is 65-100% higher than prices of electricity generated by older power plants. The recently-promulgated Electric Power Law provides for further reform of electricity prices by providing the broad principles of a new pricing system keyed to the cost of supply of electricity.

Consumer tariffs have also been affected by pricing reforms. Consumers face two types of tariffs: administered prices and guidance prices. The former type of tariff, set by the government, is typically applied to the amount of electricity consumed up to the consumer's 1985 consumption level. Guidance prices are paid on any consumption that exceeds the customer's 1985 consumption level. This second tariff is a markup to cover the higher costs of power purchased from new plants.

Coal Prices¹⁴

Over the past 3 years, the government has raised or partly deregulated coal prices so that in most areas coal prices now cover the costs

Coal subsidies fell from 37% in 1984 to 29% in 1995; petroleum subsidies fell from 55% in 1990 to 2% in 1995.

¹¹ Personal communication with State Power Corporation representatives, 1998

¹⁴ Source for textbox: Zhang Zhongxiang, 1998, "Is China Taking Actions to Limit its Greenhouse Gas Emissions? Past Evidence and Future Prospect," Netherlands.

CHINA ► A-7

of production and delivery.¹⁵ Current coal prices are close to the direct economic cost of bringing the coal to local markets.

Oil Prices

China has deregulated oil prices except in certain key sectors such as agriculture and the military. Certain levels of oil production can now be sold at market prices. The majority of petroleum product retail prices equal or exceed world prices.

A.4 SECTOR-SPECIFIC ACTIONS AFFECTING GHG SOURCES AND SINKS

Over the past two decades, China has implemented various sectoral programs that have limited China's emissions of greenhouse gases. These programs have targeted energy consumption in buildings and the industrial and residential sectors, fossil fuel use in power production, and the protection of carbon sinks. This section describes China's activities to reduce GHG emissions.

A.4.1 Reducing Energy Use in Industry and Buildings

Energy consumption per unit of output in Chinese industrial enterprises is variable, but overall it is higher than recognized best practices suggest it should be. In the buildings sector, energy consumption has increased steadily in recent years as urban residents purchase more appliances and demand higher quality heating, cooling, and lighting services. In both sectors, however, China has made significant strides in improving energy efficiency within industry and in the buildings sector.

During the 1980's, China developed a comprehensive set of policy directives, procedures, regulations, and technical assistance programs to promote energy efficiency in industry and buildings. Information dissemination efforts provided reference books on higher efficiency technologies, statistics on energy consumption for various production processes, and seminars on energy efficiency. These efforts were bolstered by training courses for technical managers.

Aggressive program targeting energy-intensive industries has achieved energy savings of 1.414 PJ over 15 years; efficiency improvements in steel industry have reduced consumption by more than 20%.

A key focal point of these policies and programs was China's energy-intensive industries such as steel mills and cement industries. In fact, the most impressive technical

¹⁵ World Resources Institute, 1998. *China's Health and Environment*. Washington, DC. (From the WRI website <http://www.igc.org/wri/wr-98-99/prc-laws.htm>).

CHINA ▶ A-8

efficiency improvements occurred in the steel industry, where unit energy consumption fell by over 20% during the 1980s. The cumulative effect of energy efficiency measures over nearly 15 years has been energy savings of 1,414 PJ.¹⁶ To achieve these savings, China encouraged the use of specific technologies and processes, such as the recovery of BOF gas and continuous casting.

The Chinese government developed detailed targets, guidelines, and standards on energy consumption and energy conservation for industrial enterprises. These various initiatives resulted in nearly \$6 billion in investments in energy efficiency in China. Examples of China's energy conservation initiatives include the following:

- ▶ Energy consumption quotas were set to encourage enterprises to consume less energy. Higher prices were charged for any energy consumed above the quota amount. Enterprises that consumed less than their allotted amount received rewards. China also developed standards for energy consumption in several industries.
- ▶ To bolster energy efficiency initiatives in industrial enterprises, the Chinese government established special investment funds that provided capital at subsidized interest rates and set up energy conservation centers to offer technical assistance. The Energy Conservation Investment Company and the Energy Conservation Technological Renovation Fund are two primary channels for government investment in energy efficiency. The Energy Conservation Investment Company's funds have grown by 20% annually since 1990.¹⁷
- ▶ Three recently established energy service companies (ESCOs) will undertake a large backlog of efficiency projects, including electric furnace renovation, electric motor upgrades, insulation of pipes and furnaces, and boiler renovations. The World Bank estimates that these 3 companies will undertake projects valued at \$730 million between 1997-2006.

China has now turned its attention to improving the efficiency of industrial boilers. Medium and small-scale industrial boilers (defined as boilers which produce less than 65 tons of steam per hour), of which China has more than 400,000, consumed over 350 million tons of coal in China in 1990, accounting for around 35% of the country's coal use and around 30% of GHG emissions from energy consumption.¹⁸ Typical efficiency levels for Chinese coal-fired industrial boilers lie in the range of 60-65%. Similar coal-fired boilers of similar scale and application in developed

¹⁶ Liu Zhiping and J. Liu, Y. Wang, 1996. "Energy Consumption in the Iron and Steel Industry in P.R. China." *Energy for Sustainable Development*, Volume III No. 3, p. 21.

¹⁷ Hamburger, J. 1994. "Linking Energy and Environmental Policy in China." Advanced International Studies Unit, Global Studies Program, Battelle, Pacific Northwest Laboratory, Washington, D.C.

¹⁸ World Bank project document, 1998. "China: Efficient Industrial Boilers" available from the World Bank website.

CHINA ▶ A-9

countries rarely operate below 80% net efficiency. If boiler operating efficiency levels in China were brought into line with those of similar sizes in developed countries, current coal consumption could be reduced by around 60 million tons per annum – a savings of nearly 20%.

China has also developed programs designed to reduce energy consumption in buildings. The building sector accounts for 25-30% of commercial energy use in China. Since 1990, building energy consumption has grown 4.4% per year. In 1994, buildings used about 370 Mtoe of energy; coal and electricity respectively accounted for 73% and 21% of the total building energy consumption.¹⁹ One of the best programs China has developed to curb rising energy consumption is the China Green Lights Program.

Established in 1996, the China Green Lights Program (CGLP) is one of China's key national energy conservation programs for the Ninth Five Year Plan. It is managed by the State Economic and Trade Commission and receives technical support from BECon. The project's primary objective is to increase the number of high-efficiency lights in use to 300 million units by 2000, which

China Green Light Program will increase use of high efficiency lighting, saving 22 TWh of electricity per year and reducing CO₂ emissions by 7.4 million tons per year.

would generate 22 TWh of electricity savings each year and 7.4 million tons of carbon emissions avoided annually. A second objective is to stimulate increased production of CFLs. Already CFL production has grown from 38 million units in 1993 to around 100 million units in 1996; the number of lighting manufacturers has risen from about 400 in 1993 to 1,000 in 1997. Some of these manufacturers offer product guarantees to stimulate sales of their products.

The results from early pilot projects are promising: one province reduced its peak load by 300 MW as a result of increased use of CFLs. China also has issued its first national standards for efficient lighting. CGLP is currently developing regulations that will add or modify codes for lighting design in residential and commercial buildings.

China's institutional framework for implementing these and other energy conservation programs includes a series of specialized energy conservation units at different levels of government:

- ▶ **Climate Change Coordination Group.** This national level group was created in 1990 and charged with overall policy formulation for GHG emissions issues.
- ▶ **Beijing Energy Efficiency Center (BECon).** BECon is non-profit organization whose purpose is to promote energy-efficiency policies and business ventures in China. BECon was founded in 1993. BECon's early activities in the area of energy efficiency included:

¹⁹ Nadel, Steven et al. 1997. *Energy Efficiency Opportunities in the Chinese Building Sector*. American Council for an Energy-Efficient Economy. Washington, DC.

CHINA ▶ A-10

initiating a pilot project in integrated resources planning in Shenzhen in southern China; providing training on energy efficiency standards; and developing a transportation plan for Beijing that takes energy efficiency into account.

- ▶ ***China Energy Conservation Investment Corporation (CECIC)***. CECIC was founded in 1994 and replaced the Energy Conservation Investment Company. CECIC has invested in and completed a number of energy conservation, material conservation, and environmental protection projects in energy-intensive industries.
- ▶ ***Energy Conservation Information Dissemination Center (ECIDC)***. Established in January 1998, ECIDC will develop a range of information products related to energy efficiency for dissemination among industrial enterprises.

A.4.2 Reducing Energy Use in the Residential Sector

Residential demand for electricity has grown by an average 17.8% per year since 1986 and is expected to continue growing by 15% annually for the next several years. Unmet demand for electrical appliances, including refrigeration and air conditioning, is the main cause of this high growth. In large cities such as Beijing and Shanghai, the market for refrigerators and televisions exceeds 95% saturation. Air conditioners are now beginning to penetrate urban markets. In response to the growth in household appliances, China has passed minimum efficiency standards for refrigerators, air conditioners, clothes washers, fans, rice cookers, and irons. Standards for refrigerators and air conditioners are being tightened. China's Environmental Protection Agency also bestows Green Labels on refrigerators that do not use R-12, an ozone depleting refrigerant.

Chinese refrigerator designs are generally less than 10 years old and the efficiency of these units is generally better than in many developing countries. Under a joint program with the U.S. EPA, the energy efficiency of Chinese refrigerators should be improved further. This program is working with several Chinese agencies and one of China's major refrigerator manufacturers to develop and commercialize a refrigerator with thicker insulation and high efficiency compressors. This unit will consume less than half of the electricity of current models. The China Refrigerator Project was the first project to receive funding from both the GEF and the Montreal Protocol.

A.4.2 Reducing Fossil Fuel Use in Power Production

The Chinese government has developed a strategy for the sustainable development of the energy sector that involves increased use of clean coal technologies and more development of natural gas, coal bed methane, and renewable energy resources. China's achievements in this area to date include the following:

CHINA ▶ A-11

- ▶ China has encouraged foreign participation in natural gas exploration activities and increased its own exploration budget by 50%.
- ▶ More than 140,000 small-scale wind turbines provide electricity to China's rural populations, particularly in Inner Mongolia.
- ▶ Since 1990 China has installed wind farms with capacity of more than 160 MW, a 12-fold increase over the 1990 level. In comparison, world wind generating capacity increased only 150% between 1990-1995.²⁰
- ▶ In 1989 China recovered 380 million m³ of methane from more than 100 coal mines.
- ▶ Small hydropower stations (less than 25 MW) supply rural China with about one-fifth of its electricity needs. China currently has 6,000 small hydropower stations.

In addition, China recently agreed with the U.S. to establish the U.S.-China Energy and Environmental Technology Center, which will promote the use of advanced energy and environmental technologies.

Development of renewable energy is regarded by the Chinese as an important means to reduce the power sector's heavy reliance on coal and thereby reduce GHG emissions. Over the past 35 years, China has strongly supported the use of small hydropower, biogas, and small wind turbines for renewable energy sources. This was done in part to provide energy and electricity to rural, isolated populations. The New and Renewable Energy Development Program, announced in 1995 by the government of China, aims to lower production costs and increase the contribution of renewable energy resources to overall energy supply. A World Bank-Global Environment Facility project targeting windfarms and solar photovoltaics will also provide crucial support for the continued development of renewable energy in China.

²⁰ Ecological Economics Bulletin, "Wind Energy in China: Institutional Barriers," Volume 3, Number 3, Third Quarter 1998.

CHINA ► A-12

China's potential wind energy resources are large. The exploitable wind resources are estimated at 250 GW.²¹ China's wind energy market has historically been developed for small-scale applications of domestically manufactured wind turbines. Recently, however, demand for larger (300-600 kW), imported wind turbines has increased. China has set a target of developing 1,000 MW of wind energy by 2000, which would require an investment of more than \$1.2 billion.

With exploitable wind resources of 250 GW, China has embarked on active wind power development program; target set to develop 1,000 MW of wind energy by 2000.

China has devoted considerable R&D resources and efforts to establish a local manufacturing capacity for wind turbines. There are 11 national standards and 25 industrial standards that govern the development of small wind turbines. The manufacturing capacity and competence for large wind turbines is relatively nascent; China instead relies on imports of foreign technology.

A.4.4 Protecting Carbon Sinks

China is deficient in forest resources, with only 0.11 hectares per capita. The demand for forest products is also quite high, threatening China's stocks of forest resources. To meet demand and

China has implemented the largest afforestation program in the world, planting an average of 3.25 million hectares per year between 1984 and 1988.

protect its forest resources, China has instituted the largest afforestation program in the world. Between 1984 and 1988, China planted an average of 3.25 million hectares per year; the net increase of forested land was about 0.65 million per year.²² China has also initiated a large-scale protective afforestation program in North China. According to World

Bank data, net decrease in forest area since 1990, if China continues to increase its forested area at the rate of the past 5 years, forests will cover more than 15% of its land area by the end of the century (up from 13.6%).

A.5 ACTIONS THAT EXPLICITLY SUPPORT THE UNFCCC OR CONTROL GHG EMISSIONS

Prior to the Rio Earth Summit in 1992, China hosted the Ministerial Conference of Developing Countries on Environment and Development. In 1992, China attended the Rio Earth Summit and

²¹ *Op. cit.* 9, p.12

²² World Bank, 1996, "China: Issues and Options in Greenhouse Gas Emissions Control," Wash. DC, p. 50.

CHINA ► A-13

subsequently ratified the FCCC in 1993. Since the Rio Earth Summit, China has continued to support GHG emission reduction through the development of its Agenda 21 paper, a two-year climate change country study undertaken with support from the U.S. Country Studies program, and by establishing a National Climate Change Coordination Office. A number of studies on GHG emissions and national response strategies also have been completed. The Chinese government has also planned to compile a national inventory of GHG emissions and sinks, to project national energy use and GHG emissions, and to conduct a macroeconomic analysis of global warming.

China's Agenda 21 currently has 128 projects listed in 9 areas, with a total planned investment of over \$5 billion. The nine project areas include: capacity building for sustainable development; sustainable agriculture; clean production; clean energy/transportation; natural resource conservation; environmental pollution control; regional development; population, housing and social services; and global change, desertification and biodiversity. By October 1996, 42% of the 128 projects had been completed with a total investment of \$1.3 billion. Of this amount, China provided \$0.96 billion.

China has supported environmental protection efforts, including the reduction of GHG emissions, through various legislative initiatives. China's first environmental law, the Environment Protection Law, was passed in 1979. Since then, China has enacted five pollution control statutes and ten natural resource conservation statutes, including the National Standards of Air Pollutants for Coal-Fired Power Plants, which became effective on January 1, 1997. Under the leadership of the Environment and Natural Resources Conservation Committee of the National People's Congress, China plans to enact an additional seven environmental statutes in 1998 and potentially 17 more in 1999. The United States, in comparison, has passed approximately 21 major environmental acts in the past four decades.

The Energy Conservation Law, enacted January 1, 1998, requires development of national energy efficiency standards, increased investment in clean and renewable energy, and retirement of older, inefficient products and equipment.

Perhaps the most important of China's legislative efforts for GHG emissions reduction is China's new Energy Conservation Law which came into force on January 1, 1998. This law was formulated with a view to promoting "energy savings throughout society, improving energy efficiency and economic benefits, protecting the environment, guaranteeing national

economic and social development..." The law requires the government to formulate an energy conservation policy and incorporate it into the national economic plan. Other actions required under the law include the development of national energy efficiency standards, increased investment in clean energy and renewable energy, and the retirement of old, inefficient products and equipment.

CHINA ▶ A-14

China's Trans-Century Green Project is an important component of the Ninth Five Year Plan (1996-2000) and China's long-term environmental targets for 2010. Phase I of the Green Project Plan identifies more than 1,500 environmental projects, some of which will target air pollution and GHG emissions. China has identified approximately 30 projects to specifically address GHG emissions.

A.5.1 Global Environment Facility

To date, GEF funds have been approved for several projects in China and several other projects are in the pipeline. In addition, with support from the GEF, China has completed a climate change mitigation study that involved a comprehensive analysis of GHG abatement options and their relative costs. GEF-funded climate change projects in China include the following:

- ▶ Energy Conservation Promotion Project (World Bank-implemented)
- ▶ Capacity Building for the Rapid Commercialization of Renewable Energy
- ▶ Energy Conservation and Pollution Control in Town and Village Enterprises (UNDP-implemented)
- ▶ Efficient Industrial Boilers (World Bank-implemented)
- ▶ Development of Coal-bed Methane Resources
- ▶ High-Efficiency Refrigerator Project (UNDP-implemented).

Under the Efficient Industrial Boiler project, China will work to acquire advanced technologies and adapt them to Chinese conditions to improve the efficiency of boilers. The project will encompass approximately 20% of total industrial boiler output over a 20-year period. The technological upgrades will be bolstered by a training program and dissemination efforts. This project is being implemented in conjunction with a World Bank program to address industrial pollution in one of China's major urban centers (Chongqing). The project is expected to save 175 million tons of CO₂ emissions.

The Renewable Energy Development Project aims to develop state-of-the-art wind and solar PV technologies. The project's goal is to install 190 MW of grid-connected wind farms in four provinces and to supply about 200,000 PV systems to households and institutions in remote areas of China.

A.5.2 Joint Implementation

Following COP 1, the Chinese government initiated 3 JI projects:

- ▶ a coke dry quenching project at Beijing Capital Steel-Iron Group undertaken with Japanese cooperation

CHINA ▶ A-15

- ▶ the construction of a thermal power plant using CFBC technology with assistance from Norway
- ▶ a building energy efficiency project with assistance from the United States.

Office of Economic Policy

Department of the Treasury
Washington, D.C. 20220

FAX

Date: 8-6-99

Number of pages including cover sheet: _____

	Name	Fax Number	Phone Number
To:	✓ Mark Friedrichs	586-3047	
	✓ David Gardiner	260-0275	
	✓ Michael Shelby	260-0512	
	✓ Joe Kruger	565-6672	
	✓ Bob Tuccillo	395-5836	
	Joe Aldy-Victoria Greenfield	395-6870	
	Janet Anderson	395-2311	
	David Doniger	260-5155	
	Julie Anderson	395-2311	
	Ron Minsk	456-2223	
	Bracken Hendricks	501-8066	
	Jim Rubin	514-4231	
	Ian Bowles	456-2710	
	Holly Kaufman	703-607-3124	
	David Sandalow	456-2710	
	Richard Morgenstern	647-0774	
	Margot Anderson	401-1176	
	Alex Christafaro	260-0780	
	Joe Kruger/Janice Mazurek	565-6673	
	Dan Trilling	366-7618	
From:	Robert Cumby	202-622-2633	202-622-0572
Remarks: ☐ URGENT ☐ For your review ☐ Reply ASAP ☐ Please comment There will be an Early Credit Meeting on Wednesday, August 11, from 3:00 to 4:30 PM in the Lincoln Room at the WHCC.			



New Investment Abroad: Can It Reduce China's Greenhouse Gas Emissions?

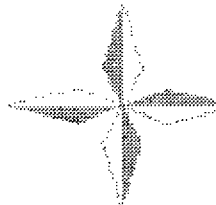
By Allen Blackman

WEDNESDAY, NOVEMBER 11, 1998 -- In the next thirty years, developing countries will become the leading source of greenhouse gas emissions thought to cause global warming. Most of these emissions result from burning fossil fuels like coal and oil. Yet countries where weak public sectors and widespread poverty are pressing concerns are unlikely to be willing or able to undertake costly measures to lower emissions.

Energy efficiency improvements may help resolve the dilemma. They not only reduce emissions of greenhouse gases but in some cases also significantly cut operating costs. Conceivably, firms in developing countries could be induced to invest in energy efficiency with minimal prodding. Foreign direct investment (FDI) by multinational corporations may be a principal means of transferring both the technology and the financial capital needed for such investments.

The Chinese electricity generating sector is an important test case for this hypothesis. China is already the world's third leading source of greenhouse gases and is likely to become the biggest contributor before the middle of the next century. China's fast-growing, almost exclusively coal-fired power sector is responsible for roughly a third of these emissions. In the early 1990s, China opened its doors to foreign direct investment in the power sector, a development that was met with a wave of enthusiasm by multinational corporations. What impacts has this recent opening had thus far?





But not all the characteristics of FDI in China's power sector are encouraging from the standpoint of energy efficiency. To avoid the lengthy central government approval process for large plants and to minimize risk, early FDI tended to be in small-scale plants that are generally not as energy-efficient as large-scale plants. Perhaps more important, data from trade journals indicate that despite investors' early enthusiasm, the volume of FDI in China's power sector will likely fall short of government targets for the year 2000 by a substantial margin. In large part, this short-fall is the result of persistent institutional barriers to FDI. Survey data suggest that the most important barriers are the uncertainties associated with the approval process for FDI projects, the regulation of the electricity sector, and the risk of default on power purchase contracts.

Allen Blackman (blackman@rff.org) is a fellow in RFF's Quality of the Environment Division. This essay is based on the longer discussion paper, Foreign Direct Investment in China's Power Sector: Trends, Benefits and Barriers (129 KB), by Blackman and Xun Wu. The paper is an output of a December 1997 workshop that brought together diverse national, institutional and disciplinary perspectives from the Beijing Environment and Development Institute in China, the Central Research Institute for the Electric Power Industry in Japan, and RFF in the U.S.

This essay appears in the Fall 1998 issue of Resources, RFF's quarterly publication of news and analysis on issues related to the environment and natural resources. To download the complete issue as a PDF file, click [here](#).

[home p.](#)

[features](#)

[perspectives
on policy](#)

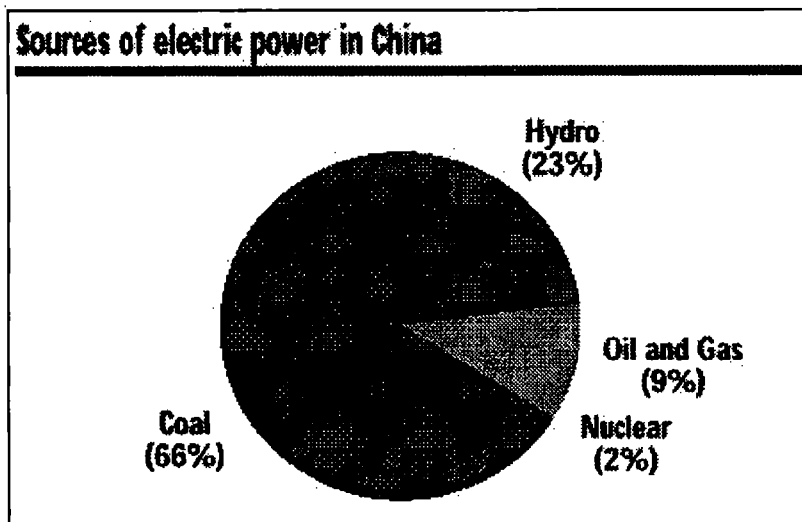
[at the
negotiating table](#)

[research
spotlight](#)

[by the
numbers](#)

[trading
post](#)

[archives](#)



Data from an original RFF survey of twenty American wholly-owned or joint-venture power plants in China suggest that FDI is indeed having a significant positive impact on energy efficiency. Average rates of coal consumption per kilowatt hour of electricity generated for the plants surveyed are considerably lower rates than rates for new Chinese plants of similar scale, and are even lower than rates for new American plants. The main reason is that almost a third of the twenty plants use state-of-the-art generating technologies such as combined-cycle gas turbines (CCGTs) and circulating fluidized bed (CFB) boilers. These technologies have characteristics that make them especially attractive in China. Both CCGTs and CFBs accommodate the use of relatively cheap and plentiful low-grade fuels, a valuable feature given that the quantity and quality of fuel supply in China is uncertain.

In addition, unlike conventional steam turbines, CCGTs can be run efficiently even when started up and shut down on short notice as is often required in China. The plants in the RFF sample are even more efficient than rates of coal consumption indicate: a fifth of them use "waste" heat to generate heat or steam for industrial or residential facilities.

FAX

To: Joe Aldy

From: Stephanie Benkovic

Hi Joe-

When we spoke I forgot to confirm that you received the pages from the World Bank report with valuation to agriculture crop damage due to air pollution, let me know if you didn't receive that fax. Or if you want some suggestions on working that info into the paper.

Attached is an article by Chinese scientists on forest land lost due to acidic deposition. One possible sentence for the paper under III. B. Costs of Local Air Pollution could read, "Current air pollution levels also damage ecological resources. Forests in southwest China have suffered growth rate losses of up to 20 percent from the deposition of air pollutants commonly known as acid rain." Or whatever.

Ciao

Stephanie

To Joe Aldy .
395 - 6870
6 PAGES .

Effects of Acid Deposition on Forest in South China

Feng Zongwei Tao Fulu

(Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences, Beijing 100080, China)

ABSTRACT Acid deposition has caused serious damage to the forests of China. In this paper, the quantification theory I is used to calculate the forest volume loss caused by acid deposition in seven provinces of south China. The results show that contribution rates of acid deposition to forest volume loss in seven provinces of south China vary from 24.5% to 37.91%; the volume loss rates range from 7% to 20%. Total volume losses per year are $1.0145 \times 10^6 \text{ m}^3$, of which Zhejiang province are the greatest, totaling $3.841 \times 10^5 \text{ m}^3$, while Anhui province are the least, amounting to $1.59 \times 10^4 \text{ m}^3$.

KEY WORDS acid deposition, damage, forest volume loss

1 Introduction

With the fast growing of modern industry and sharply increasing of energy consumption primarily coal, air pollution and acid deposition are getting more and more serious. According to the White Paper on Environment in China, emission of SO_2 derived chiefly from combustion of coal amounted to approximately 18 million tons in 1993. Several years' monitoring data indicated clearly that acid rain in China occurs mainly in the south part of Yangtse River, and that with the lowest rain pH value was concentrated around the cities of Chongqing, Guiyang, Changsha and Hangzhou. Energy consumption comes mainly from coal combustion, moreover the coal in South China has relatively high content of sulfur than that in North China, which result in relatively high concentration of SO_2 in atmosphere. The daily mean concentration of SO_2 (mg/m^3) per year and mean rain pH value from 1990 to 1993 in some cities of seven provinces in south China were listed in table 1.

Acid deposition arising from the coal combustion has caused serious damages to the forests and crops. Declining of the masson pine forest at the Nanshan Mountain of Chongqing and effects of acid deposition on forest in Southwest China have been reported (Feng et al., 1986, 1993). During "the 8th Five-Year Plan (1991-1995)" researchers from the Chinese Academy of Sciences made an investigation on the effects of acid deposition on forests in seven provinces of south China including Jiangsu, Zhejiang, Anhui, Fujian, Hunan and Hubei. In this paper some results were provided as following.

2 Field Investigation and Methods

Field investigations were carried out by plot method. Plots were established at stands in areas polluted differently by acid deposition. In each plot the site factors, such as elevation, slope direction, aspect, degree, soil thickness, A₁ layer thickness and environmental factors, such as rain pH value, concentration of SO_2 were recorded. In addition the D.b.h. (diameter at breast height) and height of all trees were measured to get standing volume of sample plot.

In order to study the relationship between many factors and tree growth, the method of quantification theory I (Lang, et al., 1993) was used.

The forest volume loss rate caused by acid deposition was calculated using the formula:

where: P_{ij}
volume of j fe
contribution ra
The forest

where: W
by acid deposi

Table 1. An

Province	R
Jiangsu	
Zhejiang	
Anhui	
Jiangxi	
Hunan	
Hubei	
Fujian	

* The data

3 Resu

Base:
sample da
to get th

Table 2

Contrib
Pinus m
Contrib
Cunning

China

30, China)

paper, the
in seven
st volume
nge from
e are the
m³

consumption
According to
mbustion of
ata indicated
that with the
angsha and
oal in South
latively high
er year and
China were

o the forests
g and effects
986, 1993).
of Sciences
es of south
some results

inds in areas
ation, slope
es, such as
ter it breast

method of

anula:

$$P_{ij} = C_{ij} \cdot C / D_{ij}$$

(1)

where, P_{ij} = the loss rate of j forest volume at i area, %; $C_{ij} = D_{ij} - d_{ij}$; D_{ij} = the contrast volume of j forest at i area, m^3 ; d_{ij} = the actual volume of j forest at i area, m^3 ; C = the contribution rate of acid deposition to forest volume loss, %.

The forest volume loss caused by acid deposition was calculated according to the formula:

$$W_n = \sum_{i=1}^n G_n \cdot \theta_n \cdot P_n$$

(2)

where, W_n = forest volume loss caused by acid deposition, m^3/a ; θ_n = forest area damaged by acid deposition, hm^2 ; G_n = the annual growth volume of forest, $m^3/(hm^2 \cdot a)$; P_n = loss rate, %.

Table 1. Annual daily mean concentration value of $SO_2(mg/m^3)$ and annual mean pH value from 1990 to 1993 in seven provinces of south China*

Province	Region	Nanjing	Xuzhou	Changzhou	Suzhou	Wuxi	Huaiyin	Yangzhou
Jiangsu	SO_2	0.065	0.083	0.076	0.069	0.129	0.028	0.076
	pH	4.85	6.91	--	6.11	5.77	5.78	4.95
Zhejiang	Region	Hangzhou	Wenzhou	Ningbo	Shaoxing	Zhoushan	Lian	Jinhua
	SO_2	0.119	0.060	0.043	0.058	0.018	0.036	0.036
	pH	4.48	4.82	4.55	4.85	4.74	4.05	4.62
Anhui	Region	Hefei	Huabei	Huainan	Wuhu	Luan	Yicheng	Tongling
	SO_2	0.036	0.020	0.034	0.052	0.016	0.04	0.126
	pH	5.35	6.10	6.05	4.84	--	4.90	4.70
Jiangxi	Region	Nanchang	Pingxiang	Jiujiang	Xinyu	Ganzhou	Yichun	Fuzhou
	SO_2	0.040	0.065	0.082	0.018	0.044	0.052	0.025
	pH	4.21	4.58	5.04	6.29	4.34	4.81	4.13
Hunan	Region	Changsha	Yiyang	Hengyang	Huailu	Xiangtan	Jishou	Yueyang
	SO_2	0.125	0.134	0.053	0.061	0.071	0.212	0.034
	pH	4.42	--	4.67	4.40	4.35	4.90	--
Hubei	Region	Wuhan	Yichang	Huangshi	Ezhou	Shashi	Xingmen	Shiyan
	SO_2	0.039	0.227	0.102	0.090	0.064	0.024	0.015
	pH	--	4.59	4.35	--	4.56	--	--
Fujian	Region	Fuzhou	Xiamen	Sanming	Ningde	Longyan	Quanzhou	Zhangzhou
	SO_2	0.093	0.013	0.049	0.033	0.034	0.021	0.039
	pH	4.71	--	5.11	4.47	4.46	4.96	4.92

* The data are provided by Chinese Research Academy of Environmental Sciences

3 Results and Discussion

Based on the local natural conditions, site factors were selected and classified. Every site factor in sample data were quantified according to classification of factors and inputted into quantification theory to get the contribution rate of acid deposition to forest volume loss, which was listed in table 2.

Table 2. Contribution rate of acid deposition to forest volume loss in seven provinces of south China.

	Jiangsu	Zhejiang	Anhui	Fujian	Jiangxi	Hunan	Hubei
Contribution rate to the loss of <i>Pinus massoniana</i>	32.88%	32.3%	31.7%	30.49%	29.74%	33.13%	27.24%
Contribution rate to the loss of <i>Pinus bungeana lanceolata</i>	37.05%	36.8%	24.5%	37.91%	37.26%	32.15%	32.24%

The forest volume loss rate caused by acid deposition in South China were calculated by formula 1 and mapped using a grid resolution of 1° longitude by 1° latitude as the resolution scale. The map was drawn based on the forest loss rate in every grid, which was calculated using area-weighted method, i.e. using volume loss rate of each damaged stand at different areas to multiply corresponding area damaged (θ_n) respectively, the results were added and then divided by the total area of forest in the grid to get the forest volume loss rate caused by acid deposition in $1^\circ \times 1^\circ$ grid. Forest volume loss rates were divided into 5 classes, their ranges were listed in table 3.

Table 3. Class and its range of forest volume loss rate

Class	0	I	II	III	IV
Range	0%	1-3%	3-5%	5-10%	>10%

Considering the damage status of different types of forests to ascertain the forest volume loss rate and its class in each grid, the results were mapped with a scale of 1:6000000 (Figure 1).

The hilly mountain area of the seven provinces is one of the commercial forest zones in China and the area of timber forest accounted for 64 percent of the total forest area there. Due to the pollution of acid deposition, however forest growth there has been decreased to different degrees. The results of investigation on damaged forest area in the seven provinces of south China were listed in table 4.

Table 4. Forest area damaged by acid deposition in 7 provinces of south China. (10000 hm^2)

Province	Total forest area	Timber stand area	Area damaged			Percentage of damaged area to total forest area	Percentage of damaged area to timber stand area
			<i>Pinus massoniana</i>	<i>Cunninghamia lanceolata</i>	Total		
Jiangsu	47.80	14.60	4.08	2.01	6.09	12.74	41.71
Zhejiang	403.72	273.79	33.55	5.13	38.68	9.58	14.13
Anhui	225.61	146.59	2.63	0.28	2.91	1.29	1.99
Fujian	614.84	405.81	6.66	10.38	17.04	2.77	4.10
Jiangxi	546.23	374.89	12.04	14.95	26.99	4.85	7.20
Hunan	753.84	421.33	9.65	8.13	17.78	2.36	4.22
Hubei	477.25	328.57	10.47	8.25	18.72	3.92	5.70
Total	3069.29	1965.58	79.08	49.13	128.21	4.18	6.52

The data from table 4 showed that the total forest area damaged by acid deposition in seven provinces of south China amounted to $1.2821 \times 10^6 \text{ hm}^2$, of which *Pinus massoniana* stands was $7.908 \times 10^5 \text{ hm}^2$, and *Cunninghamia lanceolata* forest was $4.913 \times 10^5 \text{ hm}^2$. Damaged forest area took up 4.18% of the total forest area and 6.52 percent of timber forests area respectively. Among the seven provinces, Zhejiang province was the most serious, and the forest area damaged was $3.668 \times 10^5 \text{ hm}^2$. Anhui province was the least and the area is $2.91 \times 10^4 \text{ hm}^2$.

As we know, acid deposition damaged forest heath and would further result in the reduction of timber production. The volume loss of forests in the seven provinces of south China was calculated by formula 2 and listed in table 5:

As the table 5 showed, influenced by acid deposition, the volume loss rate ranged from 7% to 20% and averaged 13.2%. Those of *Pinus massoniana* stands and *Cunninghamia lanceolata* stands were 12.4% and 13.9% respectively; annual volume loss totaled $1.0145 \times 10^6 \text{ m}^3$, that of Zhejiang province was the greatest, totaling $3.841 \times 10^5 \text{ m}^3$; Anhui was the least, amounting to $1.59 \times 10^4 \text{ m}^3$.

Table 5. The volume loss of forest damaged by acid deposition in seven provinces of south China

Province	volume loss rate %			annual volume loss (10000 m^3)		
	<i>Pinus massoniana</i>	<i>Cunninghamia lanceolata</i>	Average	<i>Pinus massoniana</i>	<i>Cunninghamia lanceolata</i>	Total
Jiangsu	13.7	10.5	12.1	3.31	1.70	5.01
Zhejiang	20.2	19.4	19.8	29.91	8.50	38.41
Anhui	7.9	7.1	7.5	1.35	0.24	1.59
Fujian	7.0	12.1	9.6	2.93	7.97	10.90
Jiangxi	14.7	15.9	15.3	8.19	13.33	21.52
Hunan	10.3	18.3	14.3	4.78	8.01	12.79
Hubei	12.9	14.3	13.6	5.94	5.29	11.23
Total	12.4(Average)	13.9(Average)	13.2(Average)	56.41	45.04	101.45

References

- Feng Zongwei, Cheng Chuying, Zhang Jiawu, Zeng Shiyu, Zhao Jielu, Deng Shijian. Atmosphere Environment and Acid Rain, 1986, 2(3):38-45
- Feng Zongwei, Chen Chuying and Zhang Jiawu. Research progress on the effects of acid deposition of forest in Southwestern China. In: Proc. of China-Japan Joint Symp. on the Impacts and control Strategies of Acid deposition on Terrestrial Ecosystems. Beijing: China Sciences & Technology Press, 1993, 62-77
- Lang Kuijian, Kang Shouzheng. IBM-PC programme series -- mathematical statistics, investigation and planning, management and supervision. Beijing: Chinese Forestry Press, 1993, 115-118

酸沉降对中国南方森林的影响

冯宗炜 陶福禄

(中国科学院生态系统研究中心 100080 北京)

摘要 酸沉降对中国的森林造成了严重伤害, 本文利用致理理论, 计算了中国南方七省区由于酸沉降造成的森林蓄积量损失。结果表明, 在南方七省区, 酸沉降对森林蓄积量损失的贡献率变化在 24.5-37.91% 之间, 蓄积量损失变化在 7-20% 之间, 每年的蓄积量总损失量为 $1.0145 \times 10^6 \text{ m}^3$, 其中浙江省损失最大 ($3.841 \times 10^5 \text{ m}^3$), 安徽省的损失最小 ($1.59 \times 10^4 \text{ m}^3$)。

关键词 酸沉降, 危害, 森林蓄积量损失

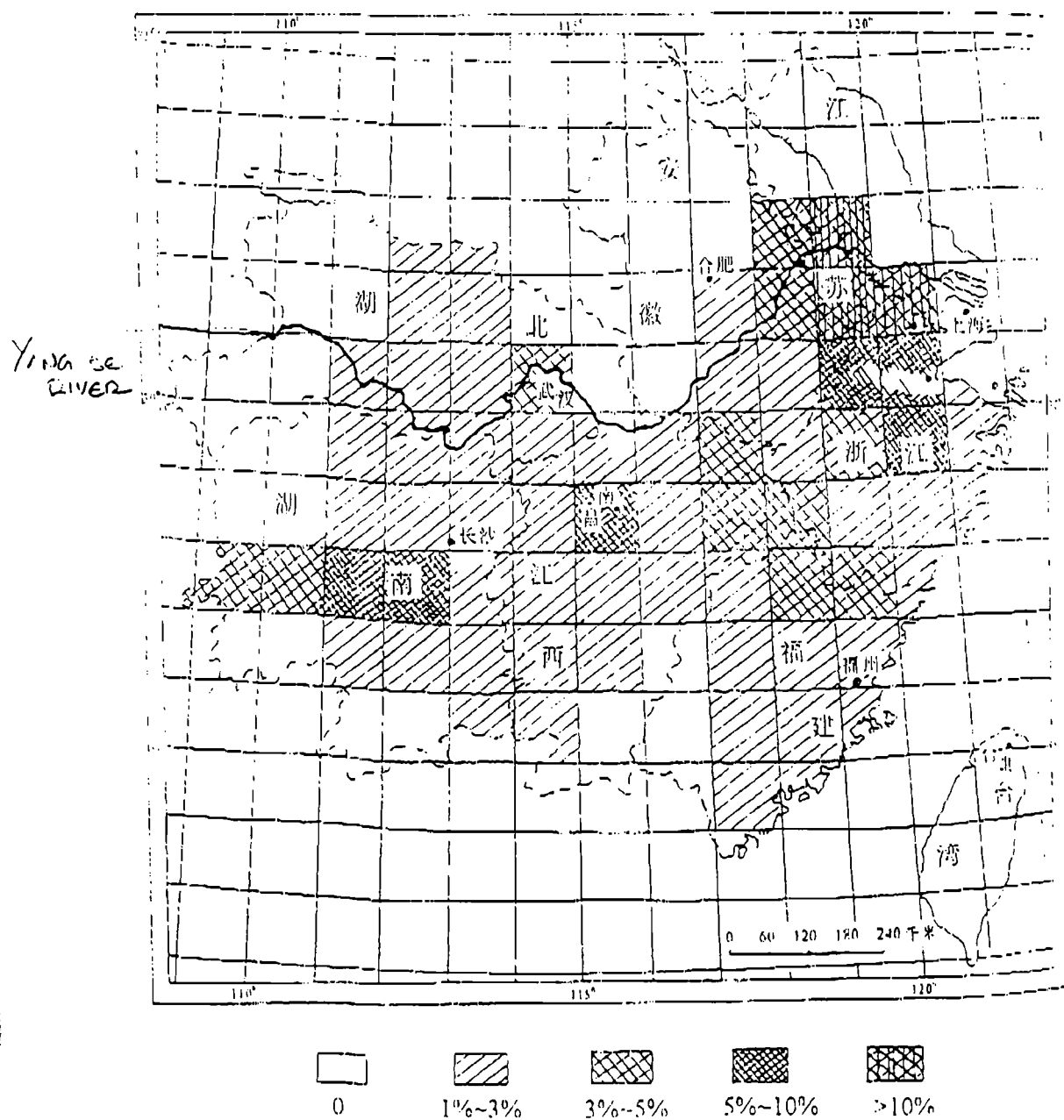


Figure 1 Distribution map of forest volume loss caused by acid deposition in seven provinces of south China

Association of Air Pollution with Hospital Outpatient Visits in Beijing

XIPING XU

DOUGLAS W. DOCKERY

Department of Environmental Health
Harvard School of Public Health
Boston, Massachusetts

and

The Channing Laboratory
Brigham and Women's Hospital
Harvard Medical School
Boston, Massachusetts

DAVID C. CHRISTIANI

Department of Environmental Health
Harvard School of Public Health
Boston, Massachusetts

and

Pulmonary and Critical Care Unit
Massachusetts General Hospital
Harvard Medical School
Boston, Massachusetts

BAOLUO LI

Beijing Union Medical College
Beijing, China

HUIYING HUANG

Institute of Medical Information
and Hospital Management of Beijing
Beijing, China

ABSTRACT. Data collected at a community-based hospital in Beijing, China, were analyzed in an assessment of the association of air pollution with daily outpatient visits. Total suspended particle (TSP) measurements were available for 210 d (mean, 388 $\mu\text{g}/\text{m}^3$; maximum, 1 255 $\mu\text{g}/\text{m}^3$), and sulfur dioxide (SO_2) measurements were available for 2 d (mean, 119 $\mu\text{g}/\text{m}^3$; maximum, 478 $\mu\text{g}/\text{m}^3$). The average number of daily hospital outpatient visits was 1 386; approximately 8.5% of these visits were to the surgery department, 7.9% were to the pediatrics department, and 20.6% were to the internal medicine department. A large increase in nonsurgery outpatient visits was observed in association with increases in both SO_2 and TSP in linear regression models, after adjusting for temperature, humidity, season, and day of the week. The estimated effects (in which the most polluted days were compared with the least polluted days) on nonsurgery outpatient visits were increases of 20% ($SE = 5\%$) and 17% ($SE = 4\%$) in association with increases in SO_2 and TSP, respectively. In a department-specific analysis, the association was found to be 1.5- to 2.0-fold stronger for pediatrics and internal medicine visits than for other types of visits. The separate associations of SO_2 and TSP with internal medicine visits remained statistically significant when both SO_2 and TSP were considered simultaneously and when adjustment was made for surgery visits. SO_2 and TSP were found to be significant, independent predictors of internal medicine visits in both winter and summer. The association between outpatient visits and air pollution appeared to be stronger in summer than in winter, although the summer daily mean SO_2 concentration was only 17 $\mu\text{g}/\text{m}^3$ (maximum, 51 $\mu\text{g}/\text{m}^3$). These data, together with data obtained in previous studies, provide coherent evidence that current air-pollution levels in Beijing are associated with adverse health outcomes, and they also suggest that air pollution in Beijing needs to be controlled more effectively.

ACUTE HEALTH EFFECTS of air pollution have been evaluated by mortality, hospital admissions, emergency room visits, and hospital outpatient visits. Episodes of high particulate and sulfur dioxide (SO_2) concentrations

have been associated with excess daily mortality, even when concentrations are below the cutoff established by air quality standards of the World Health Organization (WHO).¹⁻⁴ Studies based on hospital records have

correlated increased air pollution with increased daily hospital admissions⁵ and with increased emergency room visits.⁶⁻⁸ Few studies, however, have examined the association of air pollution with daily hospital outpatient visits, mainly because of the difficulty in obtaining complete information for such visits in a given community.

Each year in the United States, there are about 2 million deaths,⁹ approximately 31 million hospital admissions,¹⁰ and about 693 million visits to physicians' offices.¹¹ Therefore, data on mortality, hospital admissions, and emergency room visits can reflect only a small proportion of the population potentially affected by air pollution. In contrast, information on hospital outpatient visits offers greater coverage because it encompasses less severe cases; thus, this information may confer a greater power to detect health effects of air pollution. A nonlinear association between daily mortality and air pollution has been documented on the basis of data from London¹² and China.⁴ One explanation is that the deaths of individuals who are susceptible to the effects of air pollution reduce the pool of subjects at risk for early death from subsequent episodes of air pollution.¹² If this hypothesis is true, then visits to physicians' offices that return the affected individuals back to the pool at risk may not show such nonlinearity.⁴ In this study, daily outpatient visits at Fuxing Hospital, a community-based hospital in Beijing, were used to investigate the acute effects of air pollution. Exposure-response relationships were also examined in low- and high-pollution seasons (i.e., summer and winter). Fuxing Hospital is located in a residential district (Xichen) of central Beijing (north and west of Tiananmen Square) that is free of major manufacturing industries. Bicycles are the primary form of transportation. The major source of air pollution consists of coal stoves used for heating and cooking. Few homes are air conditioned, and windows are kept open during the summer.

Method

Daily numbers of outpatient visits in 1990 were obtained from the Fuxing Hospital Reception Department, where all patients must register and pay a registration fee prior to seeing a physician. Patients are seen in specific departments, including surgery, pediatrics, internal medicine, obstetrics and gynecology, orthopedics, dermatology, neurology, ophthalmology, ear-nose-throat, stomatology, and Chinese traditional medicine. Outpatient visits occur all day on Monday, Tuesday, Thursday, Friday, and on Wednesday and Saturday mornings. Patients can see doctors on Sunday, Wednesday afternoon, and Saturday afternoon if they agree to pay a higher registration fee. There were 10 legal holidays in 1990: January 1 (New Year); January 27, 28, 30 and 31 (Chinese New Year); May 1 and 2 (International Labor Day); May 13 (recess); and October 1 and 2 (National Day). On these days, only emergency rooms were open; these days were therefore excluded from the analyses.

Total suspended particulate (TSP) and SO₂ concentrations were measured at WHO's Global Air Monitoring

Stations that are located in the center of the Xichen and Dongchen residential districts. TSP was measured gravimetrically, and SO₂ was measured by colorimetric pararosaniline methods.¹³ Daily air samples were collected and analyzed for 2 to 3 wk each mo, starting with the 2nd wk of the month. In 1990, the highest daily TSP concentration was 2 235 µg/m³ (January 17, 1990); this level, which is more than 6 standard deviations (200 µg/m³) above the annual mean level (388 µg/m³), was approximately 1 000 µg/m³ higher than the second highest level (1 255 µg/m³) found on December 8, 1990. The high level found on January 17, 1990, was excluded from the analysis because it was attributed to strong winds and wind-blown dust. The mean concentrations of TSP and SO₂ measured at the Dongchen and Xichen sites were used for analysis. Temperature and humidity data were obtained from the Beijing Weather Bureau.

Daily hospital outpatient visits were distributed approximately normally. Daily outpatient visits were regressed by means of a linear regression with a Markov correction for auto-correlation in time-series data.¹⁴ In an effort to make the regression coefficients comparable among the different departments, the daily visits to each department were expressed as percentages, by dividing by annual mean number of visits and multiplying the result by 100. The basic model can be expressed as

$$E(Y_t) = \alpha f_1(X_t) + \beta f_2(Z_t) + \sum_j \gamma_j Y_{t-j}$$

where $t = 1, 2, \dots, 365$ (day of year); $j = 1, 2, 3$ (lag day for outpatient visits); y_t is the percentage of visits on day t ; x_t is the vector of covariates on day t (i.e., temperature, humidity, season, and day of the week); and z_t is the vector of air pollution variables on day t . Smoothing plots, obtained by a generalized additive modeling technique, were first produced to determine the functional dependence between daily hospital visits and covariates, without imposing a rigid parametric assumption about that dependence.^{15,16} The regression coefficients were then estimated by a quasi-likelihood approach¹⁴ with robust estimates of variances.¹⁷ Given that the model included previous days' outpatient visits, the estimated coefficients for air pollution represented the effects, based on the previous days' visits.

Results

The mean number of hospital outpatient visits in Fuxing Hospital in 1990 was 1 386/d; 8.5% of those visits were to the surgery department; 7.9% to the pediatrics department; 20.6% to the internal medicine department; and the remaining 63.1% to other departments, including obstetrics and gynecology, orthopedics, dermatology, neurology, ophthalmology, ear-nose-throat, stomatology, and Chinese traditional medicine. TSP measurements were available for 210 d (mean, 388 µg/m³; maximum, 1 255 µg/m³), and SO₂ measurements were available for 206 d (mean, 119 µg/m³; maximum, 478 µg/m³). TSP and SO₂ concentrations were much lower in summer than in winter (Table 1).

Locally weighted regression analysis (Fig. 1), including temperature, humidity, day of the week, and season, showed a negative association between daily surgery visits and SO_2 and showed a positive association between daily nonsurgery visits and SO_2 . Both surgery and nonsurgery visits increased at low concentrations of TSP; however, nonsurgery visits increased substantially—whereas surgery visits decreased—at high concentrations of TSP. These locally weighted regressions suggest that daily nonsurgery hospital outpatient visits were associated linearly with SO_2 and with the square root of TSP, after adjustment for all other covariates. These other covariates showed nonlinear dependencies with regard to daily hospital visits and were therefore modeled as indicator variables in the final regression models.

SO_2 and TSP were each highly significant predictors for total and nonsurgery outpatient visits. The estimated effects (in which the most polluted days were compared with the least polluted days) on nonsurgery outpatient visits were increases of 20% ($SE = 5\%$) and 17% ($SE = 4\%$) in association with SO_2 and TSP, respectively. In a department-specific analysis, the association was found to be 1.5- to 2.0-fold stronger for pediatrics and internal

medicine visits than for other types of visits. No significant association of air pollution with surgery visits was observed (Table 2). In this data set, SO_2 and TSP were highly correlated ($R = .6$). In an assessment of the independent effects of SO_2 and TSP, both pollutants were included simultaneously in the model (Table 2). The magnitude of the estimates for TSP and SO_2 each decreased by approximately 30% to 40%, but the association for each pollutant remained statistically significant for nonsurgery outpatient visits. Again, the estimated effect was about 1.5- to 2.0-fold stronger for pediatric visits and internal medicine visits than for other types of visits.

In a separate analysis, the association of surgery visits with nonsurgery visits was also significant ($\beta = 0.23$, $SE = .05$). Moreover, the R^2 for nonsurgery visits was 0.947 (adjusted $R^2 = .940$) in the model that included both pollutants and was 0.960 (adjusted $R^2 = .954$) in the model that included an additional term for surgery visits. These results suggest inadequate adjustment for the unmeasured confounding factors. Surgery visits were used as a surrogate for these factors and were included as a predictor of nonsurgery visits (Table 3).

Table 1.—Analysis of Weather, Air Pollution, and Hospital Outpatient Visits in Beijing (1990)

Variable	Days	$\bar{X}$	SD	Min	Max
<i>Entire study period (1 y)</i>					
Hospital outpatient visits					
Surgery	355	1 386	539	110	2 180
Nonsurgery	355	1 268	194	105	1 998
Pediatrics	355	109	46	16	276
Internal medicine	355	285	111	29	499
Others*	355	874	350	56	1 436
Total	355	1 386	539	110	2 180
Weather					
Temperature ($^{\circ}\text{C}$)	355	13	11	-10	30
Humidity (%)	355	59	20	10	99
Air pollutants					
TSP ($\mu\text{g}/\text{m}^3$)	210	388	200	106	1 255
SO_2 ($\mu\text{g}/\text{m}^3$)	206	119	133	6	478
<i>Summer (May–October)</i>					
Weather					
Temperature ($^{\circ}\text{C}$)	179	22	4	11	30
Humidity (%)	179	67	15	20	93
Air pollutants					
TSP ($\mu\text{g}/\text{m}^3$)	104	289	128	106	763
SO_2 ($\mu\text{g}/\text{m}^3$)	98	17	12	6	51
<i>Winter (November–April)</i>					
Weather					
Temperature ($^{\circ}\text{C}$)	176	4	7	-10	19
Humidity (%)	176	52	22	10	99
Air pollutants					
TSP ($\mu\text{g}/\text{m}^3$)	106	486	210	133	1 255
SO_2 ($\mu\text{g}/\text{m}^3$)	108	211	125	12	478

*Obstetrics and gynecology, orthopedics, dermatology, neurology, ophthalmology, ear-nose-throat, stomatology, and Chinese traditional medicine.

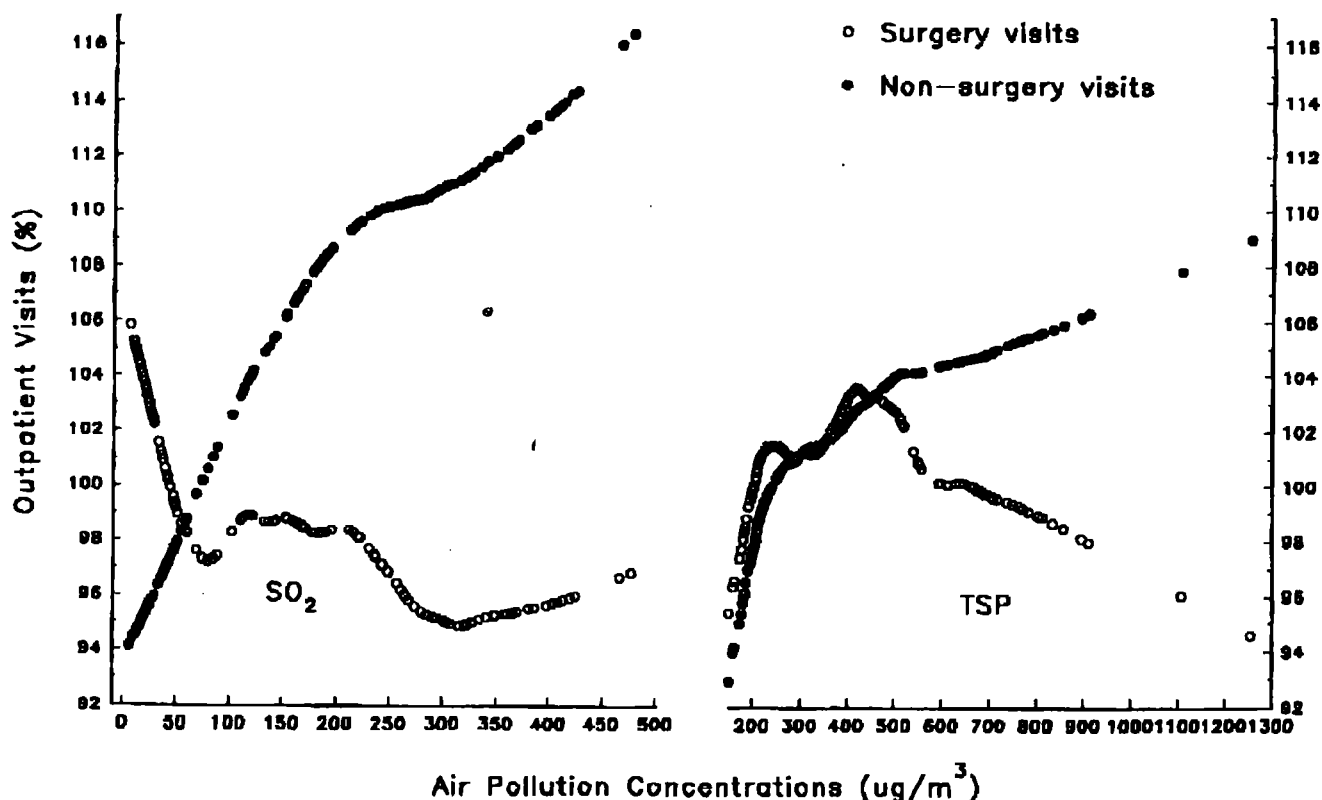


Fig. 1. Locally weighted regression smoothing plots of surgery and nonsurgery hospital outpatient visits versus SO_2 and TSP concentrations. A generalized additive modeling approach was used to control for temperature, humidity, day of week, and season.

When the estimates from the model without adjustment for surgery visits were used for comparison, the estimated association of air pollution with nonsurgery visits increased by 25% (from 12.7% to 15.9%) for SO_2 , but the association decreased by 15% (from 12.4% to 10.5%) for TSP. The association of SO_2 and TSP with internal medicine visits remained statistically significant (Table 3).

In a season-specific regression analysis, SO_2 and TSP were included simultaneously, and adjustments were made for temperature, humidity, day of the week, and surgery visits. SO_2 and TSP were each found to be significant predictors of internal medicine visits in both summer and winter (Table 3). The association between outpatient visits and air pollution appeared stronger in summer than in winter, although the mean daily SO_2 concentration was only $17 \mu\text{g}/\text{m}^3$ (maximum, $51 \mu\text{g}/\text{m}^3$) during summer.

Given that air samples were collected and analyzed for only 2 to 3 wk during each month in each monitoring station, the daily air pollution data were not complete. However, selection of days for the collection of air samples was random and independent of air pollution levels. There was no statistically significant difference in terms of temperature ($\Delta = 0.6^\circ\text{C}$, $p = .58$), humidity ($\Delta = 0.7\%$, $p = .74$), surgery visits ($\Delta = 0\%$, $p = .99$), or nonsurgery visits ($\Delta = 1.4\%$, $p = .74$), between days with complete air-pollution measurements and those without.

Discussion

Chronic exposure to high concentrations of TSP and SO_2 has been associated with an increased prevalence of respiratory diseases¹⁸ and with reduced pulmonary function¹⁹ in adult never-smokers in Beijing. A previous study in residential areas of Beijing noted an association between SO_2 levels and daily mortality.⁴ Information on morbidity collected from hospital records included information recorded for emergency room visits, hospital admissions, and outpatient visits. Bates and Sizto⁵ reported that levels of sulfate particulate matter and ozone were associated with hospital admissions in Ontario, Canada. Pope had reported an association between concentrations of inhalable particles and hospital admissions for respiratory diseases in Utah Valley and Salt Lake City, Utah.^{21,22} Sarnet et al. reported associations between levels of both SO_2 and TSP and daily respiratory emergency room admissions for respiratory symptoms in Steubenville, Ohio.⁶ Goldsmith et al. studied a variety of air pollutants and found an important effect of sulfate levels on daily emergency room admissions for all causes in two areas of Los Angeles that had high SO_2 levels.²³ Schwartz et al.⁸ found that the daily number of emergency room visits for asthma by patients who were less than 65 y of age was significantly associated with particulate exposure in Seattle, Washington. Sunyer et al.⁷ reported an association between emergency room admissions for chronic obstructive pul-

Table 2.—Linear Regression Analysis of Estimated Effects* (Percentage Increase) of SO₂ and TSP on Hospital Outpatient Visits: Comparison between Most Polluted and Least Polluted Days

Type of visit	SO ₂ (μg/m ³)			TSP ^b (μg/m ³)		
	β	SE ^c	t	β	SE ^c	t
<i>Pollutants analyzed separately</i>						
Surgery	-5.2	13.2	-0.4	3.7	8.1	.5
Nonsurgery	22.2	5.7	4.1	17.3	4.1	4.2
Pediatrics	38.2	13.7	2.7	28.9	9.5	3.0
Internal medicine	30.7	8.5	3.7	25.6	5.7	4.5
Others ^d	15.1	5.7	2.7	11.8	4.2	2.8
Total	20.3	5.2	4.1	16.5	4.0	4.1
<i>Pollutants analyzed simultaneously</i>						
Surgery	-14.6	14.8	-1.0	8.2	8.4	1.0
Nonsurgery	12.7	6.0	2.1	12.4	4.2	2.9
Pediatrics	24.4	18.3	1.3	19.1	11.5	1.7
Internal medicine	17.5	9.0	1.9	19.2	6.0	3.2
Others ^d	7.6	6.4	1.2	8.6	4.5	1.9
Total	10.7	5.6	1.9	12.3	4.3	2.9

Note: Values for SO₂ and TSP were 478 μg/m³ and 1 255 μg/m³ on the most polluted day and 6 μg/m³ and 106 μg/m³ on the least polluted day.

*The model was adjusted for quintiles of temperature, quintiles of humidity, indicator variables for the day of the week, and season.

^cStandard errors were estimated by robust method.

^dObstetrics and gynecology, orthopedics, dermatology, neurology, ophthalmology, ear-nose-throat, stomatology, and Chinese traditional medicine.

monary disease and levels of SO₂ and black smoke in Barcelona, Spain.

Few reports on air pollution and outpatient visits are available. Lutz found a strong positive correlation between average weekly pollutant levels and the percentage of diagnoses made by respiratory tract and cardiac physicians during visits to a small family practice clinic in Salt Lake City, Utah.²⁰ The study was limited by use of weekly, rather than daily outpatient visits. Two major factors restrict the potential for epidemiologic studies of the short-term association of air pollution with outpatient visits in the United States: (1) outpatient visits are usually scheduled by appointment, and (2) many patients do not visit doctors in local clinics or hospitals. Therefore, outpatient records from a hospital do not reliably reflect the true morbidity in a given community.

In China, patients seek medical care in their designated local hospitals. Outpatient visits are scheduled on a first-come, first-serve basis. Visits to doctors in higher level hospitals often require referral from local community hospitals. Thus, records from a community-based hospital provide reliable information on morbidity for a geographically defined population and offer an opportunity to evaluate the association between daily hospital outpatient visits and air pollution.

A statistically significant relationship was found between increased levels of TSP and SO₂ and an increased number of daily hospital outpatient visits. The estimated associations with air pollution were 1.5- to 2.0-fold stronger for pediatrics and internal medicine visits than for other visits. Increased levels of TSP and SO₂

were associated independently with increased numbers of outpatient visits. The association remained significant for internal medicine visits, even after adjustment for surgery visits. In season-specific analyses, SO₂ and TSP were each associated significantly with internal medicine visits in both winter and summer. The mean daily SO₂ concentration was only 17 μg/m³ (maximum, 51 μg/m³) during summer, a value that is far below the cut-off level designated in the WHO-recommended air-quality standard. This study and several previous investigations^{4,18,19} provide coherent evidence that current air-pollution levels in Beijing are associated with adverse health outcomes, including decreased pulmonary function, respiratory symptoms, increased numbers of hospital visits, and increased mortality. These data indicate that attention needs to be given to reduce air pollution in Beijing.

In the present study, the range of SO₂ levels (maximum to minimum) was 45 μg/m³ in summer and 466 μg/m³ in winter, for a 10-fold seasonal difference. However, the adjusted between-season difference in the percentage of internal-medicine visits was less than 2-fold (16% in summer and 28% in winter). A similar pattern of seasonal differences was observed for TSP. These results were consistent with those of a previous study on mortality,⁴ suggesting a steeper association between morbidity and air pollution at low concentrations of pollutants than at high concentrations. Such a nonlinear association is contrary to the model in which effects are minimal or undetectable at low concentrations, but such effects rapidly become stronger with increasing exposure above some

Table 3.—Linear Regression Analysis of Estimated Effects* (Percentage Increase) of SO₂ and TSP on Hospital Outpatient Visits: Comparison between Most Polluted Days with the Least Polluted Days (SO₂ and TSP were Included in the Model Simultaneously)

Type of visit	SO ₂ (µg/m ³)			TSP ^h (µg/m ³)			Surgery visits (%)		
	β	SE ^a	t	β	SE ^a	t	β	SE ^a	t
<i>Entire study period (1 y)</i>									
Nonsurgery	15.9	6.9	2.3	10.5	3.7	2.9	.23	.05	4.3
Pediatrics	25.8	18.5	1.4	18.4	11.5	1.6	.10	.08	1.3
Internal medicine	22.1	10.3	2.1	17.6	5.5	3.3	.26	.08	3.5
Others [‡]	11.0	6.8	1.6	6.8	3.9	1.7	.24	.05	4.7
<i>Summer (May–October)</i>									
Nonsurgery	9.5	3.8	2.5	10.0	5.4	1.9	.24	.08	3.0
Pediatrics	2.3	8.4	0.3	6.8	8.3	.8	.19	.11	1.7
Internal medicine	16.0	4.7	3.4	14.2	6.6	2.1	.25	.09	2.7
Others [‡]	7.7	4.1	1.9	8.8	5.4	1.7	.25	.08	3.2
<i>Winter (November–April)</i>									
Nonsurgery	15.5	5.8	2.7	14.5	4.1	3.5	.20	.06	3.4
Pediatrics	28.0	17.3	1.6	13.5	14.7	0.9	.00	.14	.0
Internal medicine	27.5	9.7	2.8	19.4	6.1	3.2	.25	.10	2.5
Others [‡]	6.6	5.9	1.1	11.7	4.9	2.4	.20	.06	3.5

Note: Values for the most versus the least polluted days were as follows: all year, 1/m 478 versus 6 µg/m³ for SO₂ and 1 255 versus 106 µg/m³ for TSP; summer, 1/m 51 versus 6 µg/m³ for SO₂ and 763 versus 106 µg/m³ for TSP; and winter 1/m 478 versus 12 µg/m³ for SO₂ and 1 255 versus 133 µg/m³ for TSP.

*The model was adjusted for quintiles of temperature, quintiles of humidity, indicator variables for the day of the week, season, air pollutants, and surgery visits.

^aStandard errors were estimated by robust method.

[‡]Obstetrics and gynecology, orthopedics, dermatology, neurology, ophthalmology, ear-nose-throat, stomatology, and Chinese traditional medicine.

threshold value. On the basis of similar nonlinear associations in London mortality data, Schwartz and Marcus¹² hypothesized that the deaths of individuals susceptible to the effects of air pollution reduced the pool of subjects at risk for early death from subsequent episodes of air pollution. If this hypothesis is true, reversible health outcomes that return the sensitive individuals to the pool at risk (e.g., hospital outpatient visits) may not show such nonlinearity. However, our data do not support this hypothesis. Alternatively, actual exposure to air pollution may vary with season and therefore with air pollution levels. Use of coal stoves for cooking and heating is the major indoor source of air pollution in the areas studied.^{18,19} Indoor SO₂ and TSP concentrations are likely to be higher in homes, schools, or workplaces equipped with such stoves. Thus, the overall level of exposure of the population is greater than outdoor monitoring indicates, especially in the winter, when doors and windows are kept closed. This factor may partially explain the nonlinear seasonal differences in the association of SO₂ and TSP with morbidity observed in this study. It is also possible that interactions of SO₂ and TSP with humidity and temperature may modify the transformations of these pollutants and their potential toxic effects.

Previous studies on morbidity based on hospital records^{5-8,20-23} have not focused on the outpatient surgery visits. In our study, such visits were associated significantly

with nonsurgery visits during both summer and winter ($p < .01$), after adjustment for confounding factors such as weather, day of the week, and season; this observation suggests that other unmeasured factors may be affecting both surgery and nonsurgery outpatient visits. If this is true, the association of air pollution with morbidity (as reflected by internal medicine visits) can be confounded by these unmeasured factors; surgery visits may be a surrogate for those unmeasured factors. One conservative approach to sorting out the true effects of air pollution from those of unmeasured covariates is to include surgery visits as a covariate in the model as a surrogate measure of these factors, together with air pollution. The association with SO₂ was increased, and the association with TSP was decreased, after adjustment for surgery visits.

If air pollution that results from SO₂ and TSP is associated with daily morbidity, it must affect the respiratory system first. A major limitation of this study was the lack of specific diagnostic information within department visits. Indeed, the majority of patients presenting with respiratory symptoms were referred to the internal medicine and pediatrics departments, and the increased risks for internal medicine and pediatric visits were consistently the highest.

An influenza epidemic can have a major impact on outpatient visits; therefore, we plotted daily nonsurgery

visits against time. There was no indication of such outbreaks in 1990. In the multiple-regression model, the day-to-day variation in outpatient visits was controlled with the Markov approach (i.e., by adjustment each day for the number of hospital outpatient visits on previous days). Therefore, the estimated effects for TSP and SO₂ in this report represented the contribution of current days' pollution to the outpatient visits, based on previous days' visits. Time-series studies of acute effects of air pollution are limited by the availability of air-monitoring data. In residential areas of Beijing, the single most important source of air pollution is coal combustion associated with heating and cooking in households. The major pollutants from coal combustion include particulates, SO₂, carbon monoxide, carbon dioxide, and volatile organic compounds. We examined only TSP and SO₂, the only two pollutants monitored under the WHO Global Air Monitoring System. Given that TSP and SO₂ may be highly correlated with other pollutants emitted from the same source, we cannot rule out the possibility that TSP and SO₂ are simply surrogates for a complex mixture of air pollutants. A more accurate way of assessing the effects of separate pollutants would be to use human chamber studies, which have been used to evaluate the acute effects of short-term exposure.²⁴ In addition, the actual composition, the physical state, and the size distribution of particulates may profoundly affect their toxic action.²⁵ The TSP level itself does not imply any distinct pattern in terms of size or composition. The proportion and components of respirable particles may vary greatly in different seasons and in different areas. Better assessment of exposure is needed in future studies.

* * * * *

This work was supported in part by National Institute of Environmental Health Sciences Grant ES-00002 and Environmental Protection Agency Cooperative Agreement CR-811650. Although the research described in this article has been supported by the United States Environmental Protection Agency (EPA) through Cooperative Agreement CR-816071 to Brigham and Women's Hospital, it has not been subjected to EPA review. Therefore, this report does not necessarily reflect the views of the EPA, and no official endorsement should be inferred.

Submitted for publication October 29, 1993; revised; accepted for publication June 6, 1994.

Requests for reprints should be sent to Xiping Xu, M.D., Assistant Professor, Department of Environmental Health, Harvard School of Public Health, 655 Huntington Avenue, Boston, MA 02115.

* * * * *

References

- Schwartz J, Dockery DW. Particulate air pollution and daily mortality in Steubenville, Ohio. *Am J Epidemiol* 1992; 135:12-19.
- Schwartz J, Dockery DW. Increased mortality in Philadelphia associated with daily air pollution concentrations. *Am Rev Respir Dis* 1992; 145:600-04.
- Dockery DW, Schwartz J, Spengler JD. Air pollution and daily mortality in St. Louis and Eastern Tennessee, Ohio. *Environ Res* 1992; 59:362-73.
- Xu X, Gao J, Dockery DW, Chen YD. Air pollution and daily mortality in residential areas of Beijing, China. *Arch Environ Health* (in press).
- Bates DV, Sizto R. Hospital admissions and air pollutants in Southern Ontario: The summer acid haze effect. *Environ Res* 1987; 43:317-31.
- Samet JM, Speizer FE, Bishop Y, Spengler JD, Ferris BG, Jr. The relationship between air pollution and emergency room visits in an industrial community. *J Air Pollut Control Assoc* 1981; 31:236-40.
- Sunyer J, Saez M, Murillo C, Castellsague J, Martinez F, Anto JM. Air pollution and emergency room admissions for chronic obstructive pulmonary disease: a 5-year study. *Am J Epidemiol* 1993; 137:701-05.
- Schwartz J, Slater D, Larson TV et al. Particulate air pollution and hospital emergency visits for asthma in Seattle. *Am Rev Respir Dis* 1993; 145:600-04.
- U.S. Department of Health and Human Services. Vital Statistics of the U.S. in 1989. Hyattsville, MD: NCHS, 1992.
- U.S. Department of Health and Human Services. National Hospital Discharge Survey, 1991 annual report. DHHS Publication no. (PHS) 93-1775. Hyattsville, MD: NCHS, 1993; series 13, no. 114.
- U.S. Department of Health and Human Services. National Ambulatory Medical Care Survey, 1989 summary. DHHS Publication no. (PHS) 92-1771. Hyattsville, MD: NCHS, 1992; series 13, no. 110.
- Schwartz J, Marcus A. Mortality and air pollution in London: a time series analysis. *Am J Epidemiol* 1990; 131:185-94.
- World Health Organization. Global environmental monitoring system—urban air pollution, 1973-80. London: University of London, 1984.
- Zeger SL and Qaqish B. Markov regression models for time series: a quasi-likelihood approach. *Biometrics* 1988; 44:1019-31.
- Hastie TJ, Tibshirani RJ. Generalized Additive Models. New York: Chapman and Hall, 1990.
- Cleveland WS. Robust locally weighted regression and smoothing scatterplots. *J Am Statist Assoc* 1979; 74:829-36.
- Liang KY and Zeger SL. Longitudinal data analysis using generalized linear models. *Biometrika* 1986; 73:13-22.
- Xu X, Wang LH. Association of indoor and outdoor particulate level with chronic respiratory symptoms among adult never smokers. *Am Rev Respir Dis* 1993; 148:1516-22.
- Xu X, Dockery DW, Wang LH et al. Effects of air pollution on adult pulmonary function. *Arch Environ Health* 1991; 46:198-206.
- Lutz LJ. Health effects of air pollution measured by outpatient visits. *J Family Practice* 1983; 16:307-13.
- Pope CA. Respiratory disease associated with community air pollution and a steel mill, Utah Valley. *Am J Pub Health* 1986; 79:623-28.
- Pope CA. Respiratory hospital admissions associated with PM10 pollution in Utah, Salt Lake, and Cache valleys. *Arch Environ Health* 1991; 46:90-97.
- Goldsmith JR, Griffith HL, Detels R, et al. Emergency room admissions, meteorologic variables, and air pollutants: a path analysis. *Am J Epidemiol* 1983; 118:759-78.
- Hackney JD, Thiede FC, Linn WS. Experimental studies on human health effects of air pollutants. IV. Short-term physiological and clinic effects. *Arch Environ Health* 1978; 33:171-81.
- U.S. Environmental Protection Agency (EPA). Review of the national ambient air quality standards for particulate matter: assessment of scientific and technical information. EPA-450/5-82-001, 1982.