The China Sustainable Energy Program
中国可持续能源项目

FORUM ON IMPLEMENTING CHINA'S 2010 20-PERCENT ENERGY INTENSITY TARGET

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NINTH SENIOR POLICY ADVISORY COUNCIL MEETING

November 9-10, 2006

Yalong Bay Mangrove Tree Resort
Sanya, Hainan Province
P.R. China

Jointly Sponsored By:
The National People's Congress
Development Research Center of the State Council

With Assistance From:
The Energy Foundation

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IMPLEMENTING CHINA'S 2010 ENERGY EFFICIENCY TARGET FOR A SUSTAINABLE ENERGY FUTURE

Forum on Implementing China's 2010 20-Percent Energy Intensity Target

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FORUM ON IMPLEMENTING CHINA'S 2010 20-PERCENT ENERGY EFFICIENCY TARGET

SPONSORED BY: ENVIRONMENTAL PROTECTION & RESOURCES CONSERVATION COMMITTEE OF THE NATIONAL PEOPLE'S CONGRESS;
DEVELOPMENT RESEARCH CENTER OF THE STATE COUNCIL
WITH ASSISTANCE FROM: THE ENERGY FOUNDATION

NOVEMBER 9-10, 2006

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DRAFT AGENDA

THURSDAY, NOVEMBER 9, 2006

Moderator: MAO Rubai, Chairman, Environmental Protection & Resources Conservation Committee of National People's Congress

9:00 am	**WELCOME REMARKS**
9:00 am	*MAO Rubai,* Chairman, Environmental Protection & Resources Conservation Committee of the National People's Congress (ERC of NPC)
9:15 am	Vice President, Development Research Center of the State Council (DRC)
9:25 am	*William K. REILLY,* Former Administrator, U.S. Environmental Protection Administration (U.S. EPA); President & CEO, Aqua International Partners

PART ONE: KEYNOTE SPEECHES

9:30 am	**IMPLEMENTATION OF THE 2010 20-PERCENT ENERGY INTENSITY IMPROVEMENT TARGET** *HE Bingguang,* Deputy Director-General, Department of Environment and Resource Comprehensive Utilization, National Development and Reform Commission (NDRC)
10:00 am	**WAYS AND MEANS OF IMPLEMENTING THE 2010 ENERGY INTENSITY IMPROVEMENT TARGET** *FENG Fei,* Director-General, Department of Industrial Economics Research, DRC
10:30 am	**DISCUSSION**
10:45 am	**BREAK**

10:55 am

ENERGY SAVING POTENTIAL AND POLICY ANALYSIS OF ECONOMIC STRUCTURAL ADJUSTMENT

YAO Yufang, Professor, Institute of Quantitative and Technical Economics, China Academy of Social Sciences

11:20 am **ALLOCATION OF THE NATIONAL ENERGY INTENSITY TARGET TO THE PROVINCES AND SECTORS: POLICY RECOMMENDATIONS**

ZHOU Dadi, Director-General, Energy Research Institute

11:45 am **TOP-1000 ENTERPRISES ENERGY-EFFICIENCY PROGRAM: POLICY DESIGN AND IMPLEMENTATION**

WANG Xuejun, Professor, Department of Urban and Environmental Sciences, Peking University

12:10 pm **DISCUSSION**

12:25 pm **LUNCH**

PART TWO: GOVERNORS ROUNDTABLE DISCUSSION:

LOCAL IMPLEMENTATION IS THE KEY FOR SUCCESS

Moderator: *MAO Rubai*, Chairman, Environmental Protection & Resources Conservation Committee of National People's Congress

1:40 pm **REMARKS FROM GOVERNORS**

Beijing

Shanghai

Shandong

Zhejiang

3:20 pm **DISCUSSION:**

HOW SHOULD THE EASTERN REGION ACT ON THIS?

3:50 pm **BREAK**

4:10 pm **REMARKS FROM GOVERNORS**

Chongqing

Guangdong

Ningxia

Liaoning

5:25 pm **DISCUSSION:**

WHAT ARE THE MAJOR ISSUES FOR IMPLEMENTING THE ENERGY INTENSITY IMPROVEMENT TARGET IN THE WESTERN AND CENTRAL REGIONS?

5:55 pm **CLOSING REMARKS**

MAO Rubai, Chairman, ERC of NPC

CHEN Qingtai, Former Vice President, DRC

6:10 pm **ADJOURN**

6:30 pm **DINNER**

FRIDAY, NOVEMBER 10, 2006

PART THREE: MEASURES FOR IMPLEMENTING THE ENERGY INTENSITY TARGET

Moderator: Vice President, DRC

9:00 am **SPECIAL MEASURES FOR ACHIEVING THE NATIONAL ENERGY INTENSITY TARGET**

TANG Yuan, Director-General, Department of Industry, Transportation and Trade, State Council Research Office

9:25 am **ACHIEVING THE 2010 20-PERCENT ENERGY INTENSITY TARGET THROUGH INDUSTRIAL TECHNOLOGY ADVANCEMENT**

HE Jiankun, Executive Vice President, Tsinghua University

9:50 am **STRENGTHENING THE BUILDING ENERGY EFFICIENCY REGULATORY SYSTEM**

WU Yong, Deputy Director-General, Department of Science and Technology, Ministry of Construction

10:15 am **BREAK**

10:45 am **INVESTMENT AS AN INDICATOR FOR SUCCESS**

BAI Rongchun, Former Director-General, Energy Bureau, NDRC

11:10 am **SO_2 EMISSIONS CONTROLS IN THE 11TH FIVE-YEAR PLAN: INTERACTION BETWEEN THE 20-PERCENT ENERGY INTENSITY TARGET AND THE 10-PERCENT ENVIRONMENTAL POLLUTION REDUCTION TARGET**

LI Xinmin, Deputy Director-General, Department of Pollution Control, State Environmental Protection Administration

11:35 am **DISCUSSION**

12:10 pm **CONCLUDING SPEECHES**

Vice President, DRC

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William K. REILLY, Former Administrator, U.S. EPA; President & CEO, Aqua International Partners

12:30 pm **ADJOURN**

FORUM ON IMPLEMENTING CHINA'S 2010 20-PERCENT ENERGY INTENSITY TARGET

NOVEMBER 9-10, 2006
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Presenter Biographies

BAI Rongchun

Mr. Bai has many years of experience in engineering and administration. From 2003-2004, Mr. Bai was the Deputy Director of the Energy Bureau at the National Development and Reform Commission. After finishing his studies in Thermal Engineering at the Harbin Institute of Technology in 1965, he worked as an engineer in the Fifth Design Research Institute of Machinery and Energy Conservation in the Department of Engineering. He was also Director of Energy Conservation and Building Materials in the Production Division of the National Machinery Industry Commission (1986-1988); Director of Industry Economics in the Production Division of the Department of Machinery & Electronics (1988-1991); Director of Production and Deployment in the State Development & Planning Commission (1991-1993); and Director of the Economy Coordinating Division, Resources Conservation & Comprehensive Utilization Division, and Industry Planning Division at the State Economy & Trade Commission, successively from 1993 to 2003.

FENG Fei

Feng Fei is the Director of the Industrial Economics Research Department and a Research Fellow at the State Council's Development Research Center (DRC). Dr. Feng joined DRC in 1993, after completing his doctoral and post-doctoral work at Tsinghua University. He also studied public policy at Carleton University and the University of Toronto in 1994**.**

Dr. Feng's research focuses on industrial development policies, particularly those governing the restructuring and regulation of industrial-sector monopolies. He has participated in numerous research projects at DRC, including *Strategic Restructuring of China's Economic Structure*, *WTO's Impact on the Auto Industry*, *Reforming and Restructuring Monopolies in the Industrial Sector*, *Strategies for the Sustainable Development of China's Power Industry*, and *Reforming Power Industry Regulation in China*. Dr. Feng is also a senior consultant to several government departments and private firms.

HE Bingguang

Mr. He is Deputy Director-General of the Department of Environment & Resources Conservation at the National Development and Reform Commission. He is responsible for some of China's most important international cooperation projects in the field of energy and the environment including those funded by the Global Environment Facility and the European Union.

HE Jiankun

Professor He Jiankun is Executive Vice President of Tsinghua University and a professor of energy economics and policy at Tsinghua University's Institute of Nuclear and New Energy Technology. He is also Vice President of the Chinese Energy Research Society (CERS) and

Chairman of CERS's Energy Systems Engineering Committee. Professor He has both a Bachelor's and a Master's of Engineering from Tsinghua University.

Professor He's research interests include energy systems analysis, energy modeling, strategic responses to climate change, resource management, and sustainable development. He has been engaged in energy planning and energy system modeling since the early 1980s and has served as principal researcher for a number of key national and international research projects in the energy field.

LI Xinmin

Li Xinmin is Deputy Director of the Pollution Control Department at the State Environmental Protection Administration. He graduated with a Master's of Science from the Environmental Science Department at Jilin University. Deputy Director Li is charged with the regulation of air pollution, vehicle pollution, and industrial pollution. He has many years of experience with environmental impact assessments, working to formulate laws and regulations for optimal environmental management.

TANG Yuan

Tang Yuan is Director of the Department of Industry, Transportation, and Trade in the State Council Research Office. He received his doctorate at the Power Science College under the Ministry of Energy and completed a post-doctorate at the System Research Institute of the Chinese Science Academy.

Dr. Tang's expertise is in the fields of macroeconomic analysis, industrial policy, resources policy, energy policy, and state-owned enterprises reform. He has served in the following positions: Vice Division Chief of the Department of Economic Forecasting under the State Information Center, Division Chief of the Research Office under the State Economy and Trade Commission, Vice Director of the Research Office of Chongqing Municipal Party Committee, and Vice President of the Chongqing Machine and Electricity Holding Company (Group).

WANG Xuejun

Wang Xuejun is a professor at the College of Environmental Sciences at Beijing University. With over 20 years of experience in energy and environmental policy, Professor Wang has worked with the National People's Congress, the National Development and Reform Commission, and the State Environmental Protection Administration on a number of projects sponsored by the World Bank, the United Nations Development Programme, the Asian Development Bank, and other international organizations. He has also led a series of Energy Foundation-funded projects focused on the Top-1000 Enterprises Program, Energy Efficiency Agreements, and energy conservation policies. Professor Wang was the recipient of the National Science Fund for Distinguished Young Scholars from the National Science Foundation of China and the First-class Award for Natural Science issued by the Ministry of Education, and was selected to participate in the Trans-Century Training Program for the Talents, established by the Ministry of Education. Professor Wang has published over 10 books and 160 papers.

WU Yong

Mr. Wu is Deputy Director-General of the Department of Science & Technology at the Ministry of Construction (DOST/MOC). While at DOST/MOC, he has worked on the implementation scheme of the Building Energy Efficiency (BEE) project, which is one of the *National Ten Key Energy Saving Projects,* formulating a mid- and long- term BEE development plan; and headed the drafting of the *Regulations of BEE Management*. Mr. Wu has many years of experience at the former Ministry of Urban and Rural Construction and Environmental Protection, where he worked as an assistant engineer in the Bureau of Municipal Engineering and Public Utilities and Bureau of Urban Construction; engineer in the Division of Engineering and the Division of Science and Technology; Deputy Division Chief of Comprehensive Affairs and Planning; and Division Chief of Industrial Development. He has also worked in policymaking, including work on the long-term civil works development program and implementation programs of the 8^{th} and 9^{th} 5-Year Plans, focusing on legislation concerning urban and rural construction. He graduated with a B.S. in Civil Engineering from Chongqing Architecture University (Chongqing University), and in 1994, he studied at the Institute for Housing and Urban development Studies in the Netherlands.

YAO Yufang

Yao Yufang is a researcher and professor at the Institute of Quantitative and Technical Economics at the Chinese Academy of Social Sciences (CASS). She graduated from the Electric Motor Department of Zhejiang University with a degree in Electric Systems. Professor Yao joined the Institute of Quantitative and Technical Economics at CASS in 1982, where she conducts research in the field of quantitative economics and energy-economy system analysis. She has published over 30 books and papers, and has chaired or participated in such projects as the former Department of Energy's *China's Medium and Long-term Energy Strategy Study*; the Chinese Academy of Engineering's *Sustainable Energy Development Strategy Study*; the Climate Change Office of the National Development and Reform Commission's *Impacts of CO2 Mitigation on China's Economic Development*; and the former State Power Corporation's *Electricity Demand of An All-around Well-Off Society*.

ZHOU Dadi

Zhou Dadi is Director-General and Researcher at the Energy Research Institute of the Development and Research Commission. He is also Deputy Director of the Energy Research Council and is a committee member for China's 863 Energy Planning Commission. He holds physics and engineering degrees from Tsinghua University.

Mr. Zhou has 20 years of experience in energy policy in China, including research in energy economics, energy policy, and systems analysis. He is well known for his work on China's energy development strategy, structural reform, efficiency, import/export strategy, and pricing reform. He has directed research studies including *The State of China's 2020 Sustainable Energy Development*, *China Medium-Term Energy Strategy*, and *China Petroleum Strategy Research*. In 2000, he was the recipient of an award from the Organization for Economic Co-operation and Development for promoting international climate technology.

Implementation of the 2010 20-Percent Energy Intensity Improvement Target

He Bingguang
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National Development and Reform Commission

I. The energy efficiency targets during China's 11th Five-Year Plan (2006-2010)

The 11th Five-Year Plan (2006-2010) includes the energy intensity improvement target of 20 percent per unit GDP, as compared to 2005 levels, by 2010. The average annual energy savings rate should be about 4.4 percent. A total of 560 million tons of standard coal should be saved during this period.

The energy efficiency targets during the 11th Five-Year Plan period are set by the National People's Congress (NPC), and are legally binding. All levels of government must incorporate the targets during the 11th Five-Year Plan period within their individual local economic and social development plans, and must ensure that the goals are achieved.

II. Strategies for meeting the energy efficiency targets during the 11th Five-Year Plan

The first strategy in meeting the targets is promoting energy efficiency through structural adjustments. We shall promote the coordinated development of tertiary industries, develop the service industry, adjust the industry's internal structure, and optimize energy consumption.

The second strategy is promoting energy efficiency through technological advancement. We shall increase R&D for the promotion of advanced energy efficient technologies, implement ten key energy efficiency projects, and cultivate the energy efficiency service system.

The third strategy is promoting energy efficiency through stronger management. We shall strengthen the energy efficiency legal system, establish a system of responsibility and appraisal mechanisms, set up evaluation and auditing systems for fixed assets investment projects, enhance energy efficiency management for key energy-consuming enterprises, improve energy efficiency labeling and authentication systems for products, reinforce electricity demand-side management and electricity dispatching management, control indoor air-conditioning temperature, and intensify supervision and examination for energy efficiency.

The fourth strategy is to promote energy efficiency energy through more extensive reforms. We shall quicken the energy price mechanism reforms, establish stable input mechanisms to support energy efficiency, implement taxation policies to promote energy efficiency, push forward a urban heating supply system reform, and carry out a rewards system for energy efficiency.

II. Key fields in energy efficiency during the 11th Five-Year Plan

During the 11th Five-Year Plan, we will emphasize energy efficiency in the following six fields: first, reinforcement of industrial energy efficiency; second, increasing construction energy efficiency; third, strengthening transport energy efficiency; fourth, guiding commercial and civilian energy efficiency; fifth, improving rural energy efficiency; and sixth, promoting government institutional energy efficiency.

IV. Ten key energy efficiency tasks

(1) Establish and implement the energy efficiency targets' responsibility system.

This task includes: first, disaggregating the energy efficiency targets, and implementing a strict responsibility system; second, publishing the targets and encouraging public input; and third, improving the energy efficiency appraisal system.

(2) Control growth, adjust storage capacity, and optimize industrial structures.

First, we shall strictly control the sources of increasing energy consumption, and establish a system for appraising and auditing energy efficiency for fixed assets investment projects. Second, we will hasten the phasing out of outdated production technologies and equipment. Third, we must develop tertiary industries and the hi-tech industry.

(3) Comprehensively implement ten major energy efficiency projects.

We shall study and formulate policies and measures to support ten major energy efficiency projects, further increase funding, and examine the implementation of major projects.

(4) Emphasize energy-saving activities among the top 1,000 energy-intensive enterprises.

(5) Establish robust safeguarding mechanisms for energy efficiency.

Such mechanism include: deeper energy price reform; increased funding for government energy efficiency programs and expanded enterprise financing channels; and preferential tax polices for energy efficiency.

(6) Intensify efforts to build a system of laws for energy efficiency.

Such efforts include: first, improving the energy efficiency laws, regulations, and standards systems; second, stepping up implementation of the mandatory energy efficiency labeling system; and third, strengthening energy efficiency implementation supervision, and making illegal activities known to the public.

(7) Strengthen energy statistics and metering management.

We must improve the statistical system and methods of relevant institutions, and establish an efficient energy efficient statistical system; reinforce auditing of per unit GDP energy consumption targets; and strengthen energy metering management.

(8) Set up the National Energy Efficiency Center.

(9) Push forward the government's energy efficiency efforts.

(10) Strengthen publicity, education, and training regarding energy efficiency.

Such efforts include: first, carefully organizing and producing an annual national publicity week on the issue of energy efficiency, while promoting frequent energy efficiency publicity and training activities; second, mobilizing the entire society to save energy, and advocating more economical modes of energy consumption; third, incorporating energy efficiency principles into basic education, vocational education, higher learning, and technical training systems; fourth, scientifically popularizing energy efficiency; and fifth, improving the energy efficiency education of workers and staff, and extensively implementing proposed energy efficiency activities.

Ways and Means of Implementing the 2010 Energy Intensity Improvement Target

Feng Fei
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1. Conditions and Challenges for Realizing the 2010 Energy Intensity Target

Even though the central government has announced the 20 percent energy intensity reduction target for 2010, energy intensity in 2006 is still rising, putting the 2010 target further from reach. This trend is driven not by increasing energy consumption per unit of production (energy consumption for some products, such as iron and steel, is actually decreasing), but rather the rapid growth of energy-intensive heavy industry. China's high economic growth rate in recent years has been driven by the accelerated growth of heavy industry, which resembles the early stages of mid-term industrialization in developed countries. China's energy intensity development can be characterized as being on the left side of an inverted, U-shaped curve. Other unique characteristics of China's economy include significant potential for structural upgrades and energy efficiency technological innovations, considering the low levels of current efficiency. These conditions make it possible for China's energy intensity to decrease while allowing for rapid economic growth during the mid-term of China's industrialization process.

However, such achievements are difficult to realize in the near future. Due to the fact that the rapid expansion of heavy industry has caused the rise of China's energy intensity, the key to resolving the problem is preventing the economic structure from becoming further dominated by heavy industry, the growth of which is currently driving economic expansion but also driving up total energy consumption. While industrial structures cannot be made anew in the short term, we must try to balance the economic growth rate with sustainable development measures, and focus on improving our capacity for sustainable development.

2. Basic Rules for Implementing the Energy Intensity Target and Two-Dimensional Disaggregation

The Three Basic Rules:

1. Combine legal and administrative tools, with a primary focus on market-based tools.
2. Concentrate on the current problems, and try to establish long-term mechanisms for solving them.
3. Clearly define the responsibilities of the central and local governments, disaggregate the national target to every level of government, and take effective measures to ensure that local governments will implement their specific goals.

It is necessary for national targets to be disaggregated, but we should pay attention to two issues. First, methods of disaggregation should be scientific; and second, when we disaggregate the national target to energy-intensive sectors, we should not only pay attention to the industrial sector, but also to previously-ignored sectors, such as buildings and transportation.

3. Three Means to Achieve the 2010 Energy Intensity Target

Generally speaking, there are three means to achieve the 2010 energy intensity target: (1) structural adjustments, (2) technological innovations, and (3) institutional reforms. Estimates indicate that technological energy efficiency could contribute 35-40 percent, meaning that structural energy efficiency would have to reach 60-65 percent. Additionally, policy adjustments and the establishment of new institutional systems will also influence structural and technological energy savings.

The areas of focus should differ in the short, medium, and long terms. In the short term, focus should be on institutional reforms, such as adjustments to energy pricing policies, tax and fiscal policies, and government regulations, so as to control volatility in the development of the energy-intensive sectors and to promote the employment of advanced technologies.

In the medium term, focus should be on technological innovation, such as adoption of leapfrogging technologies and encouraging technological breakthroughs in key areas which can increase energy efficiency and optimize economic structure.

4. Policy Recommendations

The central government should reform the energy management system, improve energy efficiency management, and eliminate the "supply first; savings second" mindset.

Instead, we should:

- Incorporate energy efficiency and environmental goals in the evaluation criteria for local government officials; establish dynamic monitoring and evaluation mechanisms for energy efficiency.
- Reform energy pricing policies to reflect resource constraints, market supply and demand, and externalities, such as pollution.
- Reform tax and fiscal policies to encourage energy efficiency and penalize waste.
- Significantly increase energy efficiency investments, establish new mechanisms to encourage enterprises to save energy, and set up energy auditing mechanisms.
- Establish market access to include energy efficiency and environmental performance in key energy-intensive sectors, and limit exports of energy-intensive products.
- Implement mandatory energy efficiency standards. By doing so, total energy savings from 12 key energy-intensive end-use products (such as home appliance, lighting devices,

commercial/industrial equipment) will contribute 6.36% to China's overall energy intensity target.

- Explore the immense potential for technological energy efficiency by (1) establishing market-based incentives to encourage technological innovation and adoption of new technologies, through tax and fiscal policies; (2) establishing and strengthening energy efficiency standards; and (3) promoting the adoption of new energy-saving technologies in areas with the greatest energy-saving potential.

Prioritize environmental regulation to put environmental factors at the forefront of economic and social development decision-making; establish a market-based environmental protection system by establishing emissions trading mechanisms and imposing more strict pollution levy standards so that the cost of polluting exceeds the costs of pollution treatment; establish a mandatory market exit system; encourage public participation, and improve the environmental litigation system.

Energy Saving Potential and Policy Analysis of Economic Structural Adjustment

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I. Background

1. In recent years, due to the excessive development of energy-intensive industries, supplies of coal, electricity, and fuel have failed to meet the demands of economic development, creating a situation unheard of since 1978. Both economic development and quality of life have suffered, and the reliance on coal-based growth and fossil fuel consumption has exerted severe pressures on the environment.

China's 11th Five-Year Plan (2006-2010) calls for China to "optimize structure, improve efficiency and reduce consumption, based on a doubling of per capita GDP between 2000 and 2010; to significantly improve resource efficiency; and, to reduce energy consumption per unit of GDP by 20 percent compared to 2005 levels. The proposal to reduce "energy consumption per unit of GDP" (hereinafter referred to as energy intensity) by 20 percent is an important and historical target.

Achieving the lower energy consumption indices in the 11th Five-Year Plan will require structural changes in the economy and has the potential to transform the mode of economic growth. Structural change (shifting from heavy to lighter industries) supporting the 11th Five-Year Plan energy savings targets is the central theme of this paper.

2. Research conducted by scholars in China and abroad on the role of energy-saving technology and structural energy efficiency shows differing estimates of technology's contribution to the amount of energy savings and to changes in energy intensity. Early results of the study suggested that technology accounts for 20 to 30 percent of energy saving, and structural changes account for 70 to 80 percent of savings. However, in recent years, findings suggest that structural changes since 1990 have had a minimal effect compared to efficiency gains (i.e., technology). It is necessary to conduct an in-depth study to arrive at an objective and realistic conclusion.

II. Content

1. Calculating the contribution quotient of efficiency versus structural shifts to changes in total energy intensity.

(1) The exact contribution of economic structure and energy efficiency to actual energy savings has not been established. The four common formulas generally used by domestic and international scholars for calculating these contributions to energy savings have two main parts: industrial (sector or product) energy intensity changes, and energy intensity changes resulting

from industry economic structural changes.

Due to the difficulty in obtaining accurate statistics, defining the contribution of sector energy intensity changes to the overall energy intensity change can be difficult. It is even more difficult to define the contributions of product energy intensity changes to the total energy intensity changes. If research is done at the sector level, we must differentiate the contribution of energy efficiency improvement from that of economic structural change.

The main factors affecting sector energy intensity (sector energy consumption and sector added value) include energy efficiency changes (technology advancement), changes in product structure, and added value. Therefore, using the contribution of changes in sector energy intensity as the contribution of sector energy efficiency (or the technological contribution) is not appropriate. Doing so tends to overestimate the contribution of energy efficiency, and to underestimate the contribution of economic structural change.

(2) The results from four methods of calculations for the contribution quotient of sector structure and sector energy intensity contribution for 29 sectors (including 19 industry sectors and 5 energy industry sectors) are shown in Table1.

Table 1. Sector energy intensity contribution quotient and sector structure contribution quotient in the change of total energy intensity between 1995 and 2004

Years	Total energy intensity change	Method No.3		Method No.4		Method No.2		Method No.1	
		Dept intensity	Dept structure	Dept intensity	Dept structure	Dept intensity	Dept structure	Dept intensity	Dept Structure
1995-1997	-0.213	102	-1.7	100.4	-0.47	100	0	99.8	1.7
1995-2000	-0.517	100	0.0	98.2	1.7	98	2	97.6	1.97
1997-2000	-0.305	97	3.0	96.4	35.3	96	4	96.3	3.68
2000-2002	-0.118	121	-21	116	-16.4	115.6	-15.6	115.7	-15.7
2002-2003	0.063	8.32	91.7	9.52	91.3	9.43	90.6	9.5	90.5
2003-2004	0.064	64.5	35.5	65.9	34	68.7	31.3	6.4	35.9
2000-2004	0.045	-285	385	-230	330	-230	330		

Note(1) the unit of total energy intensity is tons of coal equivalent (tce)/10,000RMB added value; (2)Increased value is the price in 2000; (3) the unit of sector intensity contribution quotient and sector structure contribution quotient in percentage.

The results indicate the following:

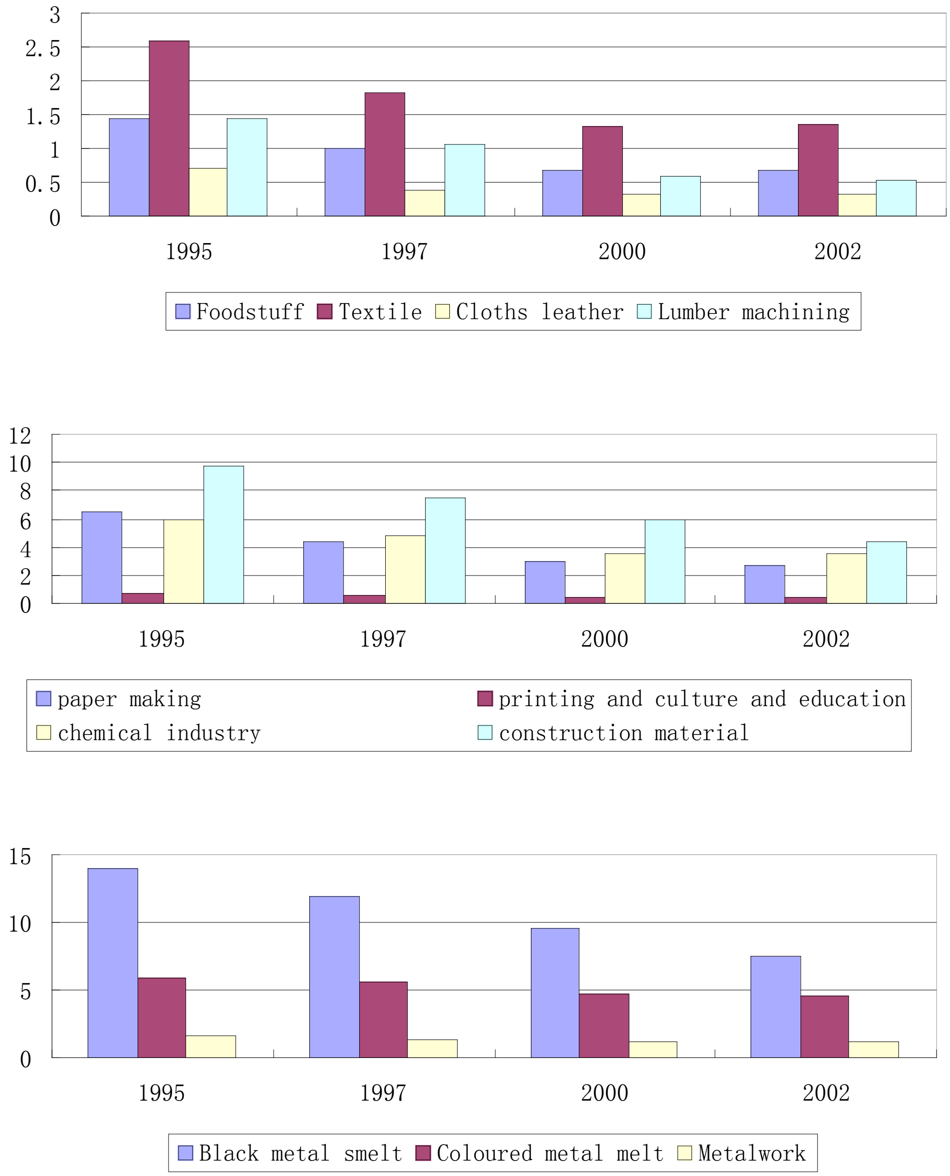
- First, the results from the four methods of calculation are very similar.
- Second, total energy intensity decreased between 1995 and 2002. The sector contribution quotient was large and the structure saving energy contribution was small.
- Third, total energy intensity increased after the year 2002. In this phase, sector energy intensity still played an energy-saving role, and the contribution of sector structure was negative as energy-intensive industry grew quickly. Structural changes served to increase total energy intensity.
- Fourth, energy intensity of the energy sector between 1995 and 2002 contributed to the 29 major sectors showing a downward trend in energy intensity; the energy intensity of part of the industrial sector decreased further. These results are shown in the Table 2 and Figure 1.

Table 2. Energy intensities in 11 sectors

Sector	1995	1997		2000		2002	
		Intensity	Increasing rate	Intensity	Increasing rate	Intensity	Increasing rate
Foodstuffs	1.446	0.987	-17.4	0.690	-13.8	0.665	
Textile	2.580	1.833	-15.8	1.331	-12.4	1.355	
Leather	0.698	0.369	-27.0	0.330	-14.0	0.329	
Lumber machining	1.437	1.067	-13.9	0.576	-18.6	0.543	
Paper making	6.486	4.332	-18.3	3.033	-11.2	2.746	
Printing culture and education	0.771	0.605	-11.4	0.446	-10.0	0.425	
Chemistry industry	5.990	4.861	-10.0	3.517	-10.0	3.353	
Construction material industry	9.747	7.451	-12.6	5.922	-9.5	4.350	
Black metal smelt	13.939	11.977	-7.3	9.577	-7.2	7.503	-11.5
Colored metal smelt	5.866	5.586	-2.4	4.670	-4.5	4.557	
Metalwork	1.572	1.296	-9.2	1.149	-6.0	1.136	

Note: (1) the unit of energy intensity is tons of coal equivalent (tce)/10,000RMB added value;(2) The growth rate is an average annual rate , the unit is the percent, negative values indicate the decline in 1997 during which the annual average rate fell to 1995-1997 levels, and the value in 2000 is the average annual decline rate observed between 1995 and 2000.

Figure 1. 11 sectors from 1995 to 2002 energy intensity change (tce/10,000RMB added value)



- Fifth, sector structure decreased between 1995 and 2002, the structure of energy-intensive industries did not change; and, the structure of machine manufacturing—especially traffic manufacturing and communications equipment manufacturing—increased.
- Sixth, total energy intensity rose between 2002 and 2004, mainly because industry structure shifted towards heavier industry and the proportion of energy-intensive industries increased. Details are shown in table 3.

Table 3. Energy intensity changes in 11 industrial sectors			
	2002	2003	2004
Foodstuffs	0.665	0.608	0.703
Textile	1.355	1.163	1.678
Leather	0.329	0.339	0.352
Lumber machining	0.543	0.588	0.616
Papermaking	2.746	2.821	2.935
Printing culture and education	0.425	0.539	0.491
Chemistry industry	3.353	3.403	3.616
Construction material industry	4.350	4.704	5.061
Black metal smelt	7.503	7.153	7.497
Colored metal smelt	4.557	4.812	4.975
Metalwork	1.136	1.137	1.146

(3) Calculations for the energy saving contributions of different phases of efficiency-increasing energy (technology) and structural changes between 1995 and 2004:

- First, in order to calculate the contribution of energy efficiency, we must deconstruct sector energy intensity. Due to the difficulty of obtaining the product energy intensity statistics, we need to analyze the product energy efficiency change (technology advancement) in certain sectors—particularly energy-intensive sectors—between 1995 and 2004. For example, from 1995 to 2000, the contribution of technological advancement to the energy intensity change in the non-ferrous metal industry was 19.6 percent; the contribution of economic structural change was 80.4 percent.
- Second, the contribution of structural energy savings between 1995 and 2004 are shown in table 4.

Table 4. The contribution of energy efficiency and energy-saving contributions between 1995 and 2004

Years	Energy intensity changes (ton standard coal/ten thousand increased value)	Method 4		Method 2	
		Efficiency (%)	Structure (%)	Efficiency (%)	Structure (%)
1995-1997	-0.213	34.2	65.7		
1995-2000	-0.517	39.7	60.3		
1997-2000	-0.305	55.0	45.0		
2000-2002	-0.118	78.8	21.2		
2002-2003	0.063	13.0	87.0		
2000-2004	0.046	4.0	96.0	6.3	93.7

Note：Increased value is the price in 2000

- Third, results have been analyzed preliminarily.
  —The results prior to disaggregation should be termed sector energy intensity contribution and sector economic structural contribution, and the disaggregated results can be termed efficiency contribution and economic structural contribution.

—The results indicate that when the total energy intensity falls, the contribution of structural savings is substantial, mostly above 60 percent. After the year 2000, the total energy intensity rose as the excessive development of energy-intensive industries resulted in shifts towards heavier industry in sector structure

—In our opinion, as sector classification in statistical data is broad, the results are most indicative of general trends. To further enhance the accuracy of research results in this field, it is necessary to collect, analyze, and calculate the contribution of products and energy intensity, which will enable research results to better reflect the actual situation.

2. There are three scenarios for economic development and energy demand analysis from 2005 to 2010. Using the input-output model, we calculated the sector output and total output of 29 sectors, as well as sector energy consumption and total energy consumption of these 29 sectors. We did this by calculating the total demand of the end products and adjusting the end product structure (investment, consumption, import, and export), as well as inter-sector input-output coefficients. We recommend the following:

(1) Changes in investment scale and structure to reverse the rapid industrial development between 2002 and 2005. The energy-intensive development has created tensions between energy supply and demand. Therefore, we must analyze historical trends, as well as current investment scale and structure.

(2) Analysis of the annual history of the import and export scale and the structure of imports and exports; and, analysis of their impact on energy consumption, with a view towards adjusting the size and structure of imports and exports, ensuring economic growth in imports and exports, and reducing energy consumption.

(3) Estimation and analysis of future trends in the main industry products.

(4) Reduction of energy intensity by 20 percent by developing structural efficiency saving, according to the three scenarios of the 2010 goals.

(5) Submission of policy recommendations regarding measures for achieving the 2010 energy intensity target under the three scenarios.

III. Preliminary Conclusions

According to the high, moderate, and low scenarios, through structural adjustment and technological advancement, overall energy intensity can be reduced to 87.5 percent, 86.9 percent, and 86.3 percent by 2010 (energy saving rate will be at 12.5 percent, 13.1 percent, and 13.7 percent respectively). The technological contribution will be 3.6 percent, 3.5 percent, and 3.4 percent, and the structural contribution will be 10 percent. However, this result will not be sufficient to achieve the 20 percent energy savings goal.

Extensive development in heavy industry, led to a 48.8 percent rise in the proportion of secondary industry, while the proportion of the tertiary industry remained 40.1 percent. If this growth continues until 2010, energy consumption per unit GDP will increase from 1.3900 to 1.4535, an increase of 4.6 percent over 2005.

To achieve the 20 percent energy savings goal by 2010, we need to further optimize the economic structure—especially product structure—on the basis of the high and moderate development scenarios. In the mean time, we should also improve energy efficiency through technological advancement in order to reduce the overall energy intensity to 80.9 percent. With these improvements, energy consumption per unit GDP will fall by 19.1 percent relative to the 2005 level. In this process, sector structural adjustment will reduce energy consumption by 9.2 percent; product structure adjustment will reduce energy consumption by 4 percent (total contribution of sectoral and product structural adjustment will be 69 percent); and technological advancement will reduce energy consumption by 5.9 percent (contributing 31 percent to the total energy savings).

From 1995 to 2000 the total decline in energy intensity, structure energy-saving contributions remained high, mostly above 60 percent. After 2002, energy intensity generally increased, and over 90 percent of this increase was caused by "heavier" industry. The structure of energy plays a negative role. Scenarios from 2005 to 2010 indicate that the share of contributions from structure will be 62 percent, with efficiency contributing 38 percent. In the scenario in which the 20 percent energy intensity goal is reached, the contribution of structural adjustment will be around 69 percent.

In order to achieve the 2010 goal, the role of economic structure is greater than that of efficiency. We need to change China's high input, high consumption, and high-polluting mode of economic growth. More effective measures should be taken to control the scale of investment, adjust the investment structure, adjust import and export ratio policies; and promote energy efficient products.

Allocation of the National Energy Intensity Target to the Provinces and Sectors: Policy Recommendations

Zhou Dadi
Director-General
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1) The significance of establishing and realizing the 20 percent energy saving target.

The formulation of the 20 percent energy savings targets in the 11th Five-Year Plan is an important decision by the Chinese Communist Party and China's central government in the implementation of a scientific development strategy, and is key to transforming China's economic growth pattern and creating a new industrialization path. Establishment of the energy saving target is, foremost, a political decision. If China can realize this target while maintaining declining energy consumption per GDP between 2010 and 2020, it will be possible for China to maintain energy consumption per unit GDP elasticity of about 0.5, i.e., economic growth with relatively slow energy consumption growth. More importantly, meeting the target will facilitate a shift in China's economic development pattern from high input/high pollution/low efficiency to low input/low pollution/high efficiency.

The establishment of the 20 percent target is based on macro-level analysis of the needs of sustainable social and economic development in China, as well as the potential for efficiency gains. On one hand, China has sustained high economic growth with relatively low energy consumption elasticity (0.5) in the last 25 years. On the other hand, China's per unit GDP energy consumption is clearly high, though there is significant energy saving potential for products and technology such that decreases in GDP energy intensity are quite feasible. China has very limited energy resources, so the conflict between energy and growth is a long-term concern. The environment's capacity has been exceeded; highly-polluting and energy-intensive growth cannot be sustained, and China needs to explore new development paths. This 20 percent reduction target is a compulsory target. However, this target has not been clearly disaggregated and there is a lack of clear implementation plans. Targets have not been allocated among sectors and regions, nor between structural and technical measures. We need to explore this multifaceted issue in order to formulate specific action plans, based on local conditions.

2) Analysis of approaches contributing most to realizing the energy intensity target for 2010.

One important finding is that structural adjustment is the most important element for meeting the target. Structural adjustment refers not only to optimizing industrial structure among sectors, but also to the adjustments made within each industry, including product distribution. The energy savings from structural adjustment will account for 60 to 70 percent of total energy consumption reductions for the 2010 target; technological progress will only contribute 30% to the total savings.

Structural adjustment efforts require review of the current economy and of energy development trends to identify the driving forces behind a high GDP energy consumption elasticity. Only policy recommendations based on such analysis could address the key problems and improve energy efficiency.
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China's economic development trend is characterized by high energy intensity, and booming energy consumption and pollution problems are in part a result of market signals and outdated policies. Government adjustment of market-based incentives and market regulations is fundamental to transitioning towards sustainable energy development.

Economic structure is determined by end-user demand, which is influenced by consumer behavior and China's role in the global economy. Efforts should be taken to shift towards environmentally-friendly consumer behavior, and China should sacrifice a degree of competitiveness, which has lead to natural resources depletion and environmental degradation.

3) Allocating and evaluating the components and responsibilities within energy saving management.

Central government agencies need to adjust the policies under their jurisdiction, including policies regarding industry, technology, investment, price and tax, finance, import and export, management of land and mining resources, and consumption. We need to establish a market management system that will promote energy saving through mandated standards, as well as mechanisms governing market entry and elimination. The policy environment for energy saving needs to be improved through government guidance on macro-level policy, as well as market-based signals.

Local governments need to adjust local policies to improve local energy saving management. They should have specific energy saving plans, require enterprises to take action on energy saving management, and introduce advanced technologies to carry out the specific energy saving target.

The energy saving target should be integral to plans for enterprise energy management and technology development.

Supervision and evaluation systems are also necessary.

3) Disaggregating the energy-saving and energy consumption reduction targets amongst regions.

The State Council has already approved and distributed the provincial disaggregation scheme for the energy-saving and energy consumption reduction targets of the 11th Five-Year Plan. These targets were mainly determined by province proposals. For those with targets lower than the national average, the National Development and Reform Commission (NDRC) worked to adjust the targets with consideration to various factors, including development level, industry structure, energy consumption per GDP, gross energy consumption, energy consumption per capita, and energy reliance. Methods were qualitative and subjective, giving consideration to the relationships between each factor and to gross energy requirements. The State Council asked local governments to disaggregate provincial targets to cities and counties, a task that faces similar challenges.

The "reasonable and scientific" disaggregation of the targets is a complex project, involving the coordination of multiple objectives that may conflict with one another. Some of the targets are difficult to quantify or evaluate. There is also a need for tools with which evaluate and analyze targets.

Since structural change is the primary tool for implementing energy-saving and energy consumption reduction targets, it is difficult to conduct technical comparisons of energy-saving potentials in each area, with cost-benefit analysis for each region an even greater challenge. It is necessary to develop analytical tools to help local governments with target dissaggretation. Such tools would also help the central government and local governments to develop incentive and restriction policies to achieve the targets.

The fundamental aim in allocating and reaching the energy saving goals in local provinces and regions is to change China's current economic and industrial development path. The allocation of the energy saving goals need to be based on local conditions, such as the extent to which the locality is developing along the correct path. Those that deviate from this path should intensify their efforts for change.

One option is to develop a comprehensive indicator system that focuses on problems related to socioeconomic development and energy consumption, and that can be used to identify whether any given situation is sustainable, or is becoming more sustainable. Based on these indicators, local energy saving potentials, cost effectiveness of energy savings, capacity to reach the energy saving goals, and other urgent concerns could be made evident to local governments, which could then assess needs for additional changes, modification of targets, and shifts in strategy.

4) Use “average cities” to facilitate other regions’ efforts to save energy and reduce raw materials consumption.

With the 20 percent reduction as the goal, local governments need to be innovative in their planning and take a step-by-step approach, given that the actual effects of detailed plans are determined by local situations, government’s momentum, and a myriad other factors. “Average cities” and provinces can act as models in these efforts. First, there needs to be comprehensive policy analysis to identify the energy saving potential, and the possible measures that can be undertaken. The study will form the basis for developing robust plans and scientific management systems. All stakeholders should be encouraged to be involved. If these regions can reach their energy saving goals, their success will motivate other regions to do the same, so that the national as a whole can achieve its ultimate goals.

It is also important to select different types of representative provinces. Research organizations and local government departments in charge of energy savings should work together to develop analytical tools and methods, establish a working plan for energy saving, and explore new policies, management regulations, and technologies to save energy. In addition, it will be essential for all participants to exchange ideas and experiences periodically, in order to highlight valuable experiences .

Top-1000 Enterprises Energy Efficiency Program: Policy Design and Implementation

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The Top-1000 Enterprises Energy Efficiency Program, initiated by the National Development and Reform Commission (NDRC) and other government agencies, was launched in April 2006. With the support of the Energy Foundation, we have been involved in a number of activities, including designing the national action plan, compiling guidelines, breaking down the energy saving targets, and policy design.

According to the 11th Five-Year Plan, energy intensity of domestic GDP shall be reduced by 20 percent between 2005 and 2010. Industry is the major energy consumer in our country, accounting for approximately 70 percent of total national energy usage. The comprehensive energy consumption of China's 1000 most energy intensive enterprises amounted to 670 million tons coal equivalent in 2004, accounting for 33 percent of national energy consumption, and 47 percent of industrial energy usage.

Carrying out this Program will help promote the development of energy conservation techniques, strengthening energy saving management and improving energy utilization efficiency. It will also help to increase enterprise economic benefits and mitigate energy and environmental constraints, guaranteeing the realization of the targets of the 11th Five-Year Plan.

The 1,000 enterprises are large-scale, financially independent enterprises in nine major energy consuming industries: iron and steel, non-ferrous metals, coal, electric power generation, petroleum and petro-chemical, chemical industry, building materials, textiles, and paper. In 2004, 1,008 enterprises consumed more than 0.18 million tons of coal equivalent of comprehensive energy each.

The major targets of this Program are the following: significantly improve the top-1000 enterprises' energy efficiency; reduce unit energy consumption to domestic best practice level for all major products; have some enterprises attain either international best practice levels or sector best practice levels; improve the energy efficiency of each sector; and achieve energy savings of approximately 100 million tons of coal equivalent in the 11th Five-Year period. This target has been broken down to the provincial level. All 1,008 enterprises have signed energy conservation agreements with local governments and have promised to reach the energy savings target in the next five years.

This Program raises systematic requirements for enterprise energy conservation, and includes such elements as energy saving targets, energy auditing, energy planning, etc. A tracing and evaluation system will be established.

A reasonable incentive mechanism is essential for the success of this Program. Our policy recommendations are varied in the angle of approach, and include energy conservation voluntary agreements, and financial and taxation policies. We recommended policy tools that may be applied in the near future. At the same time, a concrete implementation plan for policy introduction was introduced.

Special Measures for Achieving the National Energy Intensity Target

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The 11th Five-Year Plan, approved by the Fourth Plenary Session of the 10th National People's Congress, formally listed as a binding target, the goal that energy consumption per unit GDP during the 11th Five-Year Plan should be 20 percent lower than that at the end of the period of the 10th Five-Year Plan. This is a significant but challenging target. Such an important goal cannot be accomplished without the adoption of more effective measures.

Many shortcomings exist in China's energy efficiency framework. First, there is no definite policy of rewards and punishments to promote energy efficiency. Second, the new energy efficiency mechanisms are still imperfect. Third, there exists no coordinating body and no performance assessment system. Fourth, investment in energy efficiency, especially investment in energy efficiency research and development, are seriously inadequate. Fifth, some local governments do not prioritize energy efficiency.

In order to accomplish the energy efficiency goal, the following special measures must be adopted immediately:

(1) Delegate responsibility for implementing the energy efficiency goal. The target for reducing unit energy consumption by 20 percent should be reasonably distributed amongst all regions and amongst key energy consumption enterprises, with clearly defined responsibilities. When implementing the target, three factors must be considered. First, it is necessary to consider differences in regional development. Second, renewable energy developed after 2006 should be excluded from the 20 percent reduction calculations, in order to further encourage renewable energy development. Third, administrative departments and industry associations play an important role in assigning the energy efficiency goal to different sectors.

(2) Use economic tools to promote efficiency. China must pay close attention to policies such as fiscal tax, credit, and pricing to benefit energy saving. The ministries and commissions of the Central Authorities have recently published one or two important policies that are crucial in promoting the energy efficiency target. Examples include *Regulations on the Administration of Architectural Energy Efficiency* and *Reformation on Charging Method of Architectural Heating* from the Ministry of Construction; *Regulations on the Administration of Energy Efficiency of Transportation* from the Ministry of Communications; *Preferential Tax Policies on Highly-efficient Energy-saving Equipment* from the Ministry of Finance, and *Fuel Oil Tax*. In the near future, one or two important implementation regulations will be publicized by the departments and bureaus of provinces and municipalities nationwide.

(3) Improve energy efficiency laws, regulations, and technological policies. *The Energy Law* was recently listed to undergo legislative procedures, and the process of legislation should be expedited. It is also necessary to amend and perfect laws and regulations such as *Energy*

Efficiency Law, *Electric Power Law*, and to list *Petroleum and Natural Gas Law* in the legislative procedure, as early as possible. The formulation and improvement of product energy efficiency standards and labeling needs to be accelerated. It is imperative to strengthen the implementation of the energy efficiency technical policies and energy efficiency standards.

(4) Take advantage of critical elements in the energy efficiency effort. Reduce energy consumption in energy-intensive industries, China's 1000 key enterprises, and major products. Pay close attention to rising energy-consuming sectors, such as buildings and transportation, and to the energy efficiency efforts in those areas. Let the government be an exemplar of efficiency, and by the end of 2007, maximize the energy efficiency work in the buildings of central governmental agencies, and municipal and provincial governments. For the main high energy consumption enterprises and large-scale public buildings (hotels and office buildings, etc.) that cannot reach their energy efficiency goals by the end of 2006, a system of quota management shall be carried out such that their extra use of energy shall be purchased at a higher price.

(5) Increase Energy Efficiency Input. Shift investment impulse and assets to energy efficiency, renewable energy, and environmental protection. Each level of government should set aside special funds and increase energy efficiency input, and intensify support for energy efficiency technology development, the promotion of new projects, and discounted loans for energy efficiency projects. Set up special energy efficiency funds for enterprises' efficiency projects, allowing enterprises to draw up to a certain percentage of sales income, which is then recorded in costs. Financial institutions should also take measures to strengthen credit support for energy-saving projects to meet energy efficiency's demand for funds.

(6) Enhance Mechanisms Promoting Energy Efficiency. The focus is to promote information dissemination, and the popularization and application of new energy efficiency technologies, new experiences, new processes, and new equipment pertinent to energy efficiency; to promote the use of contracts in energy management and in the industrial development of energy efficiency; to widely use electricity demand-side management to guide consumers to economize. The building of an energy efficiency service system should be intensified. Electric network companies and local energy efficiency associations should set up independent energy efficiency service companies. Electricity efficiency has a 30 billion RMB market, and energy efficiency companies, when initially established, should rely on the government and market mechanisms for tax support.

(7) To Accelerate Structural Adjustment and Increase Lifestyle Changes. We should intensively adjust the industrial structure, product structure, technological structure, and organizational structure; encourage enterprises to use energy-saving equipment, and work to develop emerging high added value, less energy consuming, and less polluting industries in order to transform and upgrade traditional industries; increase the proportion of the service sector, and accelerate the transformation of economic structure from high energy consumption and inefficiency to the low consumption and high efficiency model.

(8) Establish an Energy Efficiency Performance Appraisal System. We should strengthen energy efficiency statistics and energy savings performance assessment, evaluate energy efficiency efforts, and establish a strict energy-saving appraisal system to carefully evaluate the completion of each energy efficiency task and to improve rewards and punishment mechanisms. First, regions should set up authoritative supervisory centers, authorized by the government to exercise governmental regulatory functions to solve the problem of insufficient manpower and resources. Second, the central government should send supervisory staff to provinces, municipalities, localities, and counties at each layer of government to ensure accountability.

(9) Enhance Organization and Leadership of Energy Efficiency. We should establish and perfect a new energy efficiency organizational system and working system. First, the central authorities will restore the energy efficiency working conference, and expand it to include energy-saving, environmentally friendly, land-use issues, coordinating and leading different departments to accomplish the three major binding targets. Second, provinces and municipalities should set up energy-saving and environmentally friendly land use offices to coordinate the work of the various departments. Third, a strong energy efficiency regulatory system and working mechanism should be established, setting up specialized agencies responsible for energy efficiency. Fourth, the Central Party School and the State Council Administrative College will directly train the main leading officials at the county level, concluding the training by 2007.

Achieving the 2010 20-Percent Energy Intensity Target Through Industrial Technology Advancement

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Technological energy efficiency is defined as energy savings due to improved energy conversion and end-use utilization efficiency. In addition to technological energy efficiency, changes in industry structure, product structure, and increased product value can also bring about structural energy savings.

1. Evaluation of technological energy savings in the 10^{th} Five-Year Plan (2000-2005)

From 1990 to 2000, the decrease in energy consumption per GDP reached 6.5 percent per annum and energy system efficiency increased by five percent; thus, technological contributions to energy consumption per GDP were 27 percent.

From 2000 to 2005, the average annual GDP growth rate was 9.48 percent, while energy consumption per 10,000 RMB of GDP increased from 1.40 tce to 1.43 tce, with an average energy consumption elasticity of 1.05 in constant 2000 prices. These trends were brought about by the fact that the growth rate of heavy chemical industries and high-energy consumption industries in that five-year period exceeded that of GDP. From 1990 to 1999, heavy industry accounted for roughly half of the industrial sector, a figure that rose to 65 percent after 2000, and the contribution of heavy industry to GDP also increased by about two percent. Shifts in the economic structure cause GDP energy intensity to increase, while technological innovation has brought about improvements in energy conversion and utilization.

In the 10^{th} Five-Year Plan period (2000-2005), the per unit energy consumption of high energy-consuming products was reduced, and technological advancement boosted reductions in energy consumption per GDP, as shown in Table 1. However, since the growth of energy-intensive industries far exceeded GDP growth, energy consumption by heavy industry per unit of value was over twice the average energy consumption per unit of GDP; such developments counteracted the effect of technological advancement, resulting in a slight increase in GDP energy consumption intensity.

Table 1. Energy consumption per unit and output changes of high-energy-consuming products

	2000	2005	Reduction Rate (%) 2005-2000	Annual Output Growth Rate (%) 2000-2005
Coal consumption per unit power supply（kgce/kWh）	392	376	41	12.8
Energy consumption for cement （kgce/t）	181	157	13.3	12.3
Comparable energy consumption per unit steel production（kgce/t）	784	700	10.7	22.4
Energy consumption for electrolysis aluminum（kWh/t）	15480	15080	2.6	22.7
Energy consumption for ammonia synthesis (kgce/t）	1372	1240	4.2	11.8

2. Analysis of potential technological energy savings in the 11th Five-Year-Plan period (2006-2010)

Current energy utilization efficiency in China is about 10 percent lower than in developed countries, and the energy consumption per unit of product in energy-intensive industries such as electric power, iron and steel, non-ferrous metal, petrifaction, building materials, chemical, light industry and textiles, is 40 percent higher than in developed countries. The utilization efficiency of commonly used equipment such as coal burning industrial boilers and electromotors is about 10 to 20 percent lower than in developed countries. In terms of heat preservation, building performance is two to three times lower in China than in developed countries. Clearly, the potential for technological energy savings is significant.

The key questions are what is the amount of potential energy savings within the 11th Five-Year period, and what are the measures necessary to achieve these savings? Energy-savings programs are often hindered by market failures, which discourage energy-saving actions despite technical and economic advantages. For such programs to become widespread, related service systems need to be established and industrialized, and supported with financial and tax incentive policies; technical standards and market supervision mechanisms must be incorporated in market-entry and management systems; and other institutional barriers must be overcome. China is currently preparing to modify the *Energy-Saving Law*, which will lead to the issuing of many regulations and policies encouraging energy savings, and will strengthen macro-management and energy-savings guidelines. Such developments are indicative of the significant progress will be made in technological energy savings during 11th Five-Year plan period, relative to the 10th Five-Year plan period.

While the Chinese economy will grow at an average rate of 7.5% during the 11th Five-Year plan, energy conversion and utilization efficiency will be improved through the use of new technologies and processes. Generally speaking, energy efficiency of new equipment is higher than that of old equipment; therefore, it is advantageous to improve energy efficiency during periods of rapid economic growth. Energy utilization efficiency improvements brought about by regenerating and improving old equipment is defined as stock technological energy-savings. The efficiency of domestic advanced smelting and electric furnace technology is at least twice that of domestic backward technologies; in coal-produced electricity, the difference is 240 gce/kWh; in cement, the difference is 90 kgce/ton; moreover, the process of change is relatively slow. Most of the investment to expand capacity in the 11th Five-Year period if for constructing projects or completing previously-planned projects, for which the efficiency levels have already been determined and cannot be significantly improved. Therefore, the government should focus on supervision of programs and their operations.

In order to improve stock energy-savings and improve energy-saving technology, the National Development and Reform Commission (NDRC) is implementing a management project to raise energy efficiency in 1000 large and mid-sized enterprises. It is possible that the state's mid- and long-term energy-savings objectives will be realized or exceeded during 11th Five-Year-Plan period, as shown in Table 2.

Table 2. Decreasing energy consumption per unit during 11th Five-Year Plan (State mid- and long-term energy-savings plan)

	2005	2010	Reduction Rate (%) 2005 to 2000
Coal Consumption for Power Supply (kgce/kWh)	377	360	4.3
Overall Energy Consumption of Cement（kgce/t）	181	157	13.3
Overall Energy Consumption of Steel(kgce/t)	760	680	10.5
Overall Energy Consumption of ammonia synthesis（kgce/t）	1210	1140	5.8

Energy consumption per unit in high-energy-consuming products will decline more than 5 percent on average in the period of the 11th Five-Year Plan

3. Measures and macro-effects of technological energy-savings

During the 10th Five-Year Plan period, the government promoted technological energy-savings in regions and enterprises, along with supervision and management for energy-saving goals. Ten major energy savings projects have been put forward and implemented by the NDRC: the coal-fired industrial boiler (kiln) reconstruction project, regional combined heat and power (CHP) projects, waste heat and pressure utilization projects, oil conservation and substitution projects, motor system energy conservation projects, energy system optimization projects, construction energy savings projects, the Green Lighting Project, government energy savings projects, energy savings monitoring, and technological service system construction. For energy-intensive industries, such as steel, buildings, chemicals, and electricity, increased production capacity utilizes advanced technologies as much as possible, with emphasis on the changes for which capacity currently exists. In these industries, energy consumption per unit should be lowered by five to 10 percent. Building energy efficiency efforts must take advantage of the rapid growth rate in the buildings sector (two billion square meters of new buildings), with strict implementation of the planned 50 percent efficiency improvement in building standards. Large-scale urban constructions in particular, fifteen to 20 percent of which should be reconstructed to save energy, require heavier penalties and stricter monitoring. Additionally, the technological standards for electric power, including industrial boilers, end-use appliances, and other universally used equipment must be raised. Expanding energy-efficiency cannot rely solely on the market, but also requires promotion by multiple levels of government.

In the 11th Five-Year Plan period, the efficiency of energy conversion and end use utilization have the potential to increase more rapidly than during the 10th Five-Year period, with conversion and utilization system efficiency increasing by 2.5 to three percent and with technological energy savings reaching 200-250 Mtce. Such developments will contribute 30-38 percent to the objective of a 20 percent reduction in GDP energy consumption intensity. As Table 3 shows, if we exclude changes in industrial and product structure from consideration, GDP energy consumption intensity will decline by 6.4-7.8 percent due to technological energy savings.

Table 3. Analysis of the effect of technical energy-savings in the 11th Five-Year Plan

	Energy Saving 200 Mtce	Energy Saving 250 Mtce
Annual GDP Growth Rate (%）	7.5	7.5
Energy Saving required for achieving the target of energy intensity reduction by 20% (Mtce)	639	639
Technical Energy Saving Contribution Rate	31.2	39.1
Energy intensity reduction resulted from energy technology innovation (%)	6.2	7.8

4. Conclusion

(1) To achieve the goal of 20% reduction in GDP energy intensity, proposed in China's 11th Five-Year Plan, it is necessary to strengthen and promote technological energy savings, update the industrial structure, and increase controls on the development of energy-intensive industries. Without such measures, the growth of energy-intensive industries will increase GDP energy intensity, and counteract the energy intensity-reducing effect of technological energy savings. If the product mix and industrial structure at the conclusion of the 10th Five-Year Plan is

maintained throughout the 11th Five-Year Plan period, the potential GDP energy intensity reductions through technological energy savings will not exceed 10 percent.

(2) Energy intensity objectives are dynamic. To achieve a given rate of reduction in GDP energy intensity, greater GDP growth elasticity of energy consumption increases, and terminal gross energy consumption grows faster. If, in the 11th Five-Year Plan period, the average annual GDP growth rate increases from 7.5% to 10% and achieves the objective of 20% reduction in GDP energy intensity, gross energy consumption by 2010 will increase from 2556.4 Mtce up to 2865.8 Mtce. The current energy supply and construction plans follow the baseline of 2550 Mtce in 2010. With excessive growth of the GDP, the 11th Five-year Plan period will bring about energy supply shortages, and rapid growth of gross energy consumption will be difficult for China to support. While we must focus on the 2010 20-percent energy intensity reduction target, we must also control GDP growth, altering China's development path and controlling increases in energy demand.

Strengthening the Building Energy Efficiency Regulatory System

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1. Challenges to Building Energy Efficiency (BEE) in China

The 11th Five-Year Plan (2006-2010) includes an energy intensity improvement target of 20 percent per unit GDP by 2010. The *National Mid- and Long-Term Energy Saving Plan* proposes that, through the implementation of the *10 Key Energy-Saving Projects*, China can save 240 million tons of coal equivalent (tce) during the 11th five-year period; of which the BEE sector will save 101 million tce, accounting for 42% of the overall savings.

Analysis of the energy saving goals can be broken down into three sections : 1) new buildings; 2) existing buildings; and 3) buildings constructed with renewable energy principles. In order to achieve such goals, we recommend the following institutional reforms in BEE management, including six basic systems and three basic policies.

2. Six Basic Systems for BEE

2.1 Market access systems for BEE in new buildings

1) Current status of BEE management for new buildings:

Currently, the implementation of BEE rules and standards is insufficient. According to the results of a 2004 Ministry of Construction (MOC) study, of over 3,000 new buildings constructed in major cities, buildings meeting BEE standards during the design phase only account for 80%, 50% and 10% of new buildings in the northern, transitional, and southern heating zones, respectively. After construction, the number of buildings meeting the BEE standard only reaches 60%, 50%, and 8%, respectively.

Government monitoring is insufficient with respect to BEE standards in these new buildings: BEE monitoring is commonly excluded from the government's monitoring responsibilities, and such monitoring cannot extend throughout the entire construction process. There are insufficient market incentives for developers to comply with BEE standards; developers have no desire to build energy efficient buildings, and residents have no motivation to save energy.

2) Market access system for BEE in new buildings:

The system should provide for comprehensive BEE management of engineering projects, including project approval, planning, construction design, construction, and verification of completion. At each stage, responsibilities should be clarified to ensure effective BEE management. The following must be implemented:

- A BEE labeling system for real estate developers.
- A compulsory BEE evaluation system for government and large public buildings.
- A voluntary BEE evaluation system for buildings that have lower energy consumption than national standards.
- New buildings not satisfying BEE standards should not to be allowed to enter the market.

2.2 System for BEE retrofitting of existing buildings

1) Difficulties in the BEE retrofitting of existing buildings:

The BEE retrofitting of existing buildings has faced many obstacles due to lagging heating system reform, outdated technologies, incomplete financing and investing systems, complex and different categories of ownership rights, difficulties in calculating BEE benefits, and general legal and policy issues.

2) Rules for BEE retrofitting of existing buildings:

Government responsibilities:

- Investment in residential and government buildings.
- Investment in the public interest regarding government office and large public buildings.

Owner’s responsibilities (for commercial buildings):

- Bear the costs of BEE retrofitting.
- Ensure the protection of their legal rights.
- Use market strategies in BEE retrofitting.

Content of the system:

- Data collection and analyses for existing buildings, including building age and structure, and an energy consumption system.
- A plan for BEE retrofitting.
- Implementation of BEE retrofitting.

Local government implementation procedure:

- Organize surveys of existing buildings.

- Confirm the master plan for BEE retrofitting.
- Formulate financing and investing schemes.
- Organize implementation.
- Evaluate and verify effective implementation.

2.3 Systems to manage buildings' energy consumption

1) High building energy consumption in China

High energy consumption in large public buildings is a major issue. In Beijing, large public buildings such as hotels, commercial complexes, and offices account for only 5.4% of the total area of civil buildings, but account for nearly 50% of such buildings' electricity consumption (about 3.3 billion kWh annually), which means the electricity consumption per area is 10-15 times that of common residential buildings.

Energy consumption by government office buildings is surprisingly high. Buildings for Beijing's governmental organizations consume 80 to 150kWh per unit area, which is four to eight times as much as residential buildings. Government officials consume 3.35 tce per person, which is about seven times as high as the average resident (0.47 tce).

The main causes of these unsustainable patterns are design and construction, policy-making institutions, and management.

2) Building energy management mechanism:

- Energy consumed in buildings shall be measured and recorded.
- Local governments' construction administration departments shall collect and monitor basic data concerning buildings.
- Heating and power suppliers shall provide energy consumption data, as well as set up and publicize an energy consumption policy decision-making database. Rationed energy is to be consumed by buildings, particularly by government and large public buildings.
- Steps to be taken: 1) identify the main energy consumers; 2) record energy consumption data; 3) develop a power consumption rationing model; 4) modify the rationing rate accordingly. 4) audit energy efficiency, specifically for government office buildings and large public buildings.
- Procedures: 1) investigate existing building's energy management; 2) calculate and analyze the energy consumption index, energy costs, and consumption effect; 3) analyze and evaluate BEE retrofitting from an economic and technical perspective; 4) make suggestions for energy efficiency auditing, publicizing, and improvement.

3) Regulation of large public and government office buildings' energy management:

According to energy consumption data and energy efficiency audits, regulations will be enacted introducing different energy rations. Eligible buildings will be allowed to continue operation, while those disqualified will be given a specified period of time for improvement. The latter will receive incentives including subsidized loans. If there is no improvement, a progressive tax will be charged.

2.4 BEE labeling

1) Functions and categories of BEE labeling:

Functions:

- Improve monitoring.
- Disseminate measures.
- Guide user demands.
- Guide technological innovation.
- Provide a basis for economic incentives.

Categories:

- Civil and ordinary public buildings will receive a compulsory label, for which the constructors are responsible
- Large public and government office buildings will be labeled according to evaluations.
- The "unconstrained label" will be reserved for lower energy-consuming buildings.

2) Control mechanisms among labelers

BEE labelers should develop good control mechanisms. Such labelers include government departments, developers, evaluation organizations, and consumers. The government and consumers should monitor developers and evaluation organizations.

2.5 Building energy consumption recording mechanisms

1) Present status of building energy consumption recording in China:

Building energy consumption recording in China is handled by many sectors. The system is underdeveloped, recording devices are outdated, indexes are incomplete, and recording channels are unreliable. As of yet, no scientific recording system has been developed.

2) A building energy consumption recording system will:

- Provide a database for national BEE policy development.

- Provide an information source for use in improving existing BEE.
- Guarantee implementation of energy consumption rationing for public buildings and energy efficiency auditing.
- Providing a basis for operational management of energy consumption systems.

At present, there is no concrete date substantiating excessive building energy consumption in China. With a lack of accurate and reliable data, it is very difficult to develop energy policy; it is critical to set up a recording system for building energy consumption.

3. Implementation of building energy consumption recording systems:

Municipal departments administering construction, and BEE management organizations, should monitor and collect data for large public buildings. For ordinary public and resident buildings, spot checks should be carried out, and property management companies and energy suppliers should report consumption data, summarize and analyze the data, set up a database, and report to administrative departments.

2.6 BEE promotion, restriction, and prohibition system

Implementing a BEE system requires solving the informational disconnect between producers and consumers.

1) System requirements:

- Regulate the market for BEE materials and products, and improve their quality.
- Solve problems concerning the use of materials, products, and technologies in BEE.
- Direct the development of technologies, materials and products.

2) Content of the regulations:

- A national catalogue of prohibited, restricted, and promoted products.
- A department under the State Bureau in charge of construction to formulate and publish new BEE technologies, techniques, and materials.
- A catalogue of new products.
- A catalogue of energy-intensive technologies, equipment, materials, and products that are restricted or prohibited.
- A catalogue for local promotion, restriction, and prohibition of products.
- Prevention mechanisms for local governments from engaging in regional discrimination or biased promotion.

3. Three basic policies of BEE

3.1 Policy for cultivating the BEE service system

1) Definition of BEE service:

Service scale: whole-process or partial service covering BEE design, financing, renovation, procurement, operations and management, energy efficiency auditing, and testing. Main method: EMC (Energy Management Contract)

2) Regulating the content of BEE service:

Principles:

- Guided by the government.
- Enhance supervision.
- Promote changes in a stable manner.
- Have both national and international perspectives.

Recommendations:

- Government supervision and economic stimulation should play a leading role at the initial stages to cultivate a market for BEE services.
- Government supervision and market guidance should be combined during transitional stages to develop a mature BEE service market and industry.
- Market-oriented distribution will be adopted at later stages, while the government will play a supervisory role.

Policy implementation content:

- Supervision of BEE services.
- Management of qualifications for enterprises offering BEE services.
- Management of professional qualifications for staff in the field of BEE service.
- Incentives for BEE service: BEE service entities will enjoy the same preferential policies as national hi-tech enterprises, such as low tax rates or tax exemptions (exemptions for the first two years, with a rate 75% of the standard due tax for the next three years).

3.2 Economic incentives for BEE

1) Necessity of economic stimulation for BEE:

- BEE generates significant, positive externalities but needs policy support.
- BEE requires significant amounts of work and needs stable funding.
- Incentive polices are an effective means of government control on the macro level.
- The lack of an incentive policy is a major factor in the slow progress of BEE.

2) Thoughts and framework for China's BEE economic incentive policy:

Designing the policy:

- The incentive policy will differ for different levels of BEE.
- For those who fail to meet the standards, no incentive will be given.
- The incentive policy will differ by entity.
- The incentive policy will differ by building type (for example, the policy will not be same for residential, public, and new buildings).
- Currently, most buildings in China are not energy efficient, so financial subsidies should be adopted to promote BEE renovation.

The policy framework should include incentive policies for:

- Energy efficient and land-saving buildings.
- Renovation of existing buildings.
- Large-scale public buildings.
- Use of renewable energy in buildings

3) Prerequisites for policies:

- Stable source of funding.
- Viability within current financial circumstances.
- Legal backing.
- Technical support.

3.3 Policy for the use of renewable energy in buildings

1) Plans for the use of renewable energy:

- Rooftop solar energy production.
- Limited use of geothermal energy.
- Promotion of surface water heat pumping.

2) Policy for the use of renewable energy:

Strategies and industrial policies for the use of renewable energy will be formulated by the central government. Central and local governments will give financial support to pilot projects in different cities, demonstrating positive effects brought about by renewable energy in buildings. Pilots will also boost technological development, and will help cultivate relevant industries. Practical experience will be accumulated and available for dissemination.

Investment as an Indicator For Success

Bai Rongchun
Former Director-General, Energy Bureau
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Over the next four years, China's economy will continue to grow quickly, while the objective is to reduce energy consumption per unit GDP by 20 percent relative to the 10th Five-Year Plan period. Important methods for realizing the 11th Five-Year Plan energy saving targets include accelerating innovation in energy conservation, eliminating outdated equipment, technology and techniques, and raising energy savings levels. According to estimates, the total investment required for energy conservation innovation and energy efficiency improvement during the eleventh-five year period is about RMB 420 billion ($50 billion USD). It is necessary to enact favorable policies and increase financial resources in order to put in place the kind of investment mechanisms that can improve energy saving levels.

1. Energy conservation innovation and energy efficiency improvement is fundamental to bringing about technological solutions to energy savings challenges.

China's average annual GDP growth rate reached 9.7% from 1980 to 2000, while the rate of increase of energy consumption was only 4.6%, and elasticity was only 0.47. China met the target of having economic growth rely half on energy development and half on energy savings. Clearly, energy saving was successful in that period, largely because of the series of energy saving economic policies enacted from the 1980s to the mid-1990s.

For example, investment in the construction of energy saving infrastructure and in innovation in energy saving technology was RMB 34 billion, the investment from local governments and enterprises was RMB 56 billion, the total investment was RMB 90.35 billion, and the energy saving capacity was about 118.2 million tons of coal equivalent (tce) (see table below).

1981~1995 Energy Saving Infrastracture Construction and Technology Innovation				
Category	Investment(0.1billion Yuan)	National Investment(0.1billion Yuan)	Local and Enterprises(0.1billion Yuan)	Saving Energy Amounts(10 thousand tce)
Energy Saving Infrastructure	426.5	187.2	239.3	4140
Technology Innovation	477	156	321	7680
Total	903.5	343.2	560.3	11820

2. Insufficient investment in energy conservation innovation and energy efficiency improvement has significantly restricted energy saving efforts.

With the gradual establishment of a market economy, energy investment, like the bulk of investment, has become increasingly diversified. Investment scale in energy infrastructure construction has grown quickly. After 1998, local governments and enterprise management replaced special funds for constructing an energy saving infrastructure and for improving energy saving technology. Though total energy investment increased, the investment percentage in energy efficiency decreased greatly.

In 1983, the percentage of energy conservation investment in total energy investment was 13%, however, it decreased to 4% in 2003. Investment was reduced because of weakened economic policy in the area of energy conservation, such that there was little investment in R&D. Of the investment in industry enterprises R&D, which was 53.58% of China's total R&D investment, only 2% went to energy conservation and energy efficiency. This greatly restricted the development of energy conservation technology, leading energy consumption per unit GDP to increase during the 10^{th} Five-Year period.

3. There has been large-scale investment in energy conservation innovation and energy efficiency improvement in the 10^{th} Five-Year period.

In 2005, per unit GDP energy consumption was 1.22 tce per RMB 10,000 (2005 price); according to the objectives of the 11^{th} Five-Year Plan, the per unit GDP energy consumption should reach 0.98 tce per RMB10,000 by 2010, with energy saving potentials of 628 million tce.

Such large scale energy saving potentials can be divided into three main sources: structure, technology, and management. According to past experiences and recent research, one third of the energy savings, or 210 million tce, can occur through technology. Each tce of energy saved requires about RMB 2000 of investment: the 11^{th} Five-Year period will require RMB 420 billion, and RMB 84 billion per year.

In order to promote energy saving efforts in key areas, the National Development and Reform Commission (NDRC) has issued *Implementation Guidelines for the Ten Key Energy-Saving Undertakings in the Tenth Five-Year Plan*. This year, it budgeted RMB 540 million to support 98 key energy conservation projects, and it is estimated that RMB six billion of that investment will go to energy efficiency. However, this is only seven percent of the total energy investment.

4. Increasing investment in energy conservation innovation and energy efficiency is necessary.

Energy conservation innovation and energy efficiency improvement can bring about broad economic and social benefits, and are basic elements of a sustainable energy strategy. However, energy saving investment is currently a highly scattered secondary investment. Even in market-based developed countries, energy saving market failures exist. China will be in a primary market phase for the foreseeable future, and there are many market obstacles—including investment, technology, and information—that affect efforts to promote energy conservation. Because market failures and market obstacles exist, China's great energy saving potentials cannot be easily realized, needing policy guidance and powerful economic-inspired policies to expand the scale of energy saving investment. We suggest the following;

1) Increase the government's energy saving investment. The first approach for meeting this objective is to include energy saving funds in the national budget and establish special funds for energy saving, with corresponding funds established by local governments. The main expenditures would include R&D, major energy conservation demonstration projects, and the industrialization of energy saving and construction of service systems. The second is to establish specialized energy conservation funds, which would be used primarily to expand the use of proven energy conservation technologies, with emphasis on the ten key energy saving projects.
2) Support energy conservation through tax policy. First, R&D budgets for energy saving equipment and products technologies should increase, with the incentive of allowing enterprises to deduct 150% of R&D expenditures from their total income when calculating taxes. Second, enterprises that purchase energy saving equipment and products should have 30% of these costs reimbursed as tax returns. Third, income tax should be halved for all enterprises that produce energy saving products. Fourth, the depreciation period for energy conserving products or for obtaining energy saving techniques should be shortened. Finally, all advanced energy-saving technologies that cannot be produced domestically should be exempt from duties and import taxes.
3) Increase financial support. The national development bank should (1) adjust the loan structure to favor sustainable energy projects, such as energy conservation projects; (2) increase loan amounts to energy conservation; formulate mechanisms to ensure the promotion of energy conservation; make full use of financial tools; (3) expand energy saving loans made by commercial banks; and (4) make use of the financial sector's power to issue enterprise construction bonds or allow enterprises to be publicly listed, in order to give preference to energy conservation-related projects.
4) Build information dissemination systems for energy conservation. Information released should include policy trends, energy saving investment guidance, information about advanced energy-saving technologies, techniques, and products. Such actions can drive varied investors to invest in energy conservation.

SO_2 Emission Controls in the 11th Five-Year Plan: Interactions Between the 20-Percent Energy Intensity Target and the 10-Percent Environmental Pollution Reduction Target

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While China has become one of the world's leading economies in recent years, the accompanying over-consumption of resources and energy has lead to significant destruction of China's already-threatened environment. In 2005, coal consumption amounted to 2.24 billion tons, and total SO_2 emissions increased by 27 percent over 2000, amounting to 25.495 million tons. Power plants accounted for 50 percent of these SO_2 emissions. One-third of China feels the effects of acid rain pollution. Additionally, the frequency and acidity of acid rain has increased in recent years. Among the 522 cities being monitored, 40 percent cannot reach the second level of national air quality standards, and some provinces have not one city that meets second level air quality. Another 10 percent of cities have not attained the third air quality level. The rapid increase in the automobile population has resulted in an increase in waste gas, NO_x, suspended particulates, and VOCs; the result has been air pollution from mixed compounds, constantly worsening smog, and reduced visibility. In short, China now faces several new challenges in implementing air pollution control measures.

This essay reviews the State Environmental Protection Administration's (SEPA) current measures for controlling air pollution, focusing specifically on the expected results of the 11th Five-Year Plan and the expected increases in the China Communist Party Central Committee's support for technological development, given the 11th Five-Year Plan's requirements to reduce energy consumption per unit of GDP by 20 percent and to cut down pollution emissions by 10 percent. In order to fulfill the goal of reducing major pollutants by 10 percent, SEPA will use scientific methods to set standards and distribute the SO_2 emission index among provincial Environmental Protection Bureaus (EPBs) and national electricity generating enterprises. SEPA will focus on the implementation of energy-saving mechanisms and on the use of market instruments (such as emissions trading) to fulfill these goals; it will also continue to emphasize environmental protection and enforcement capacity building projects in general.

The China Sustainable Energy Program
中国可持续能源项目

Ninth Senior Policy Advisory Council Meeting

IMPLEMENTING CHINA'S 2010 ENERGY INTENSITY TARGET FOR A SUSTAINABLE ENERGY FUTURE

November 10, 2006

Yalong Bay Mangrove Tree Resort
Sanya, Hainan Province
P.R. China

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The David and Lucile Packard Foundation, The William and Flora Hewlett Foundation, in partnership with the Energy Foundation

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CHINA SUSTAINABLE ENERGY PROGRAM
9TH SENIOR POLICY ADVISORY COUNCIL (PAC) MEETING
Implementing China's 2010 Energy Efficiency Target For a Sustainable Energy Future

NOVEMBER 10, 2006

SANYA, HAINAN, P.R. CHINA

DRAFT AGENDA

2:00 pm	**WELCOME REMARKS** *Colburn S. Wilbur,* Chair, Senior Policy Advisory Council, and Trustee, The David and Lucile Packard Foundation

PART ONE: LAWS AND KEY POLICIES

2:15 pm	**IMPLEMENTATION OF THE RENEWABLE ENERGY LAW: PRACTICE AND CONCERNS** *Wang Zhongying,* Director, Center for Renewable Energy Development, Energy Research Institute
2:40 pm	**PROGRESS OF THE ENERGY CONSERVATION LAW AMENDMENTS** *LI Mingzhi*, Deputy Director of the Economic Affairs Office, Financial & Economics Committee, National People's Congress
3:05 pm	**INTRODUCTION TO THE DRAFTING OF CHINA'S ENERGY LAW** *Zhou Fengao,* Director, Institute of Energy Law, North China Electric Power University
3:30 pm	**DISCUSSION**
4:00 pm	**BREAK**

PART TWO: CSEP: SHORT-TERM TARGETS AND LONG-TERM GOALS

4:15 pm	**TOWARD A LONG-TERM ENERGY PLANNING VISION FOR 2050** *Yang Fuqiang,* Vice President and Chief Representative, The Energy Foundation Beijing Representative Office

4:35 pm **DISCUSSION: MEMBERS OF THE SENIOR POLICY ADVISORY COUNCIL AND GUESTS**

6:20 pm **CLOSING REMARKS**
Colburn S. Wilbur, Chair, Senior Policy Advisory Council

6:30 pm **ADJOURN**

6:45 pm **BANQUET**

CHINA SUSTAINABLE ENERGY PROGRAM

9th Senior Policy Advisory Council Meeting

NOVEMBER 10, 2006

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Peter BRADFORD

Peter Bradford is one of the United States' most experienced public utility regulators. He is a Former Commissioner of the U.S. Nuclear Regulatory Commission, and was Chairman of the New York State Public Service Commission from June 1987 to January 1995 and the Maine Public Utilities Commission from July 1982 to 1987. He has also served as President of the U.S. National Association of Regulatory Utility Commissioners. Mr. Bradford currently teaches and consults on utility regulation and energy policy in the U.S. and abroad. He is Vice-Chairman of The Union of Concerned Scientists, a leading U.S. NGO seeking practical solutions to environmental problems based on rigorous science and innovative policy, and is the author of *Fragile Structures: A Story of Oil Refineries, National Security and the Coast of Maine*. Mr. Bradford is a graduate of Yale University and Yale University Law School.

CHEN Qingtai

Chen Qingtai is the former Vice Minister of the State Council Development Research Center, a member of the China Monetary Policy Committee, Deputy of the National Congress of the Communist Party of China, and a member of the Standing Committee of the 10th China People's Political Consultative Conference. He has extensive macro-economic management experience in both the private and public sectors. In the private sector, he has served as Chief Engineer, President, and Chairman of China No. 2 Automobile Works, Chairman and General Manager of the United Company of Dongfeng Auto Industry, and Chairman of Shenlong Automobile Company. He is also currently Independent Non-Executive Director of Sinopec Corp. In the public sector, he has served as Deputy Director of the State Council's Economic and Trade Office, and Deputy Minister of the State Economic and Trade Commission. Mr. Chen is a graduate of Tsinghua University where he studied power and dynamics engineering.

CHEN Yuan

Chen Yuan has been Governor of the China Development Bank and Secretary of the CPC China Development Bank Committee since 1998. His previous posts include Secretary of the Xicheng District Committee of the Beijing Municipal Committee of the Communist Party (CPC); Director-General of the Beijing Municipal Commerce and Trade Department; Deputy Secretary of the leading party members' group; and Vice Governor of the People' s Bank of China. Mr. Chen graduated with a Master' s degree in Industrial Economics from the Graduate School of Chinese Academy of Social Sciences.

FU Zhihuan

Fu Zhihuan is Chairman of the Finance and Economics Committee of the 10th National People's Congress. Mr. Fu served as Minister of the Railways Ministry from 1997 to 2003, and has been involved in electric engine research and development for over 20 years, formerly serving as Chief Engineer and Director of the Railways Ministry's Science and Technology Department and President of the Harbin Railway Bureau.

HUANG Yicheng

Formerly Minister of Energy, Huang Yicheng works with the State Power Corporation—created out of the former Ministry of Electric Power—to help shape policies to restructure China's electric utility sector. Minister Huang is also Honorable President of the China Energy Research Society, a group of active and retired high-level energy policy makers from leading research institutes.

Thomas JOHANSSON

Thomas Johansson was formerly Director of the Energy and Atmosphere Programme at the United Nations Development Programme and is currently Director of the International Institute for Industrial Environmental Economics at Lund University, Sweden. He is also International Co-Chairman of the Working Group on Energy Strategies and Technologies of the China Council on International Cooperation for Environment and Development, a founding member and current Chairman of the International Energy Initiative Board of Directors, Chairman of the United Nations Economic Commission for Europe's Energy Efficiency 2000 Project, a member of the Board of Directors of the Swedish State Power Board (Vattenfall), and Chairman of the United Nations Solar Energy Group for Environment and Development. Dr. Johansson also serves on the Editorial Board and Board of Directors of numerous energy and scientific journals. He was a recipient of the Volvo Environment Prize in 2000.

LOU Jiwei

Lou Jiwei is Vice Minister of the Ministry of Finance. Mr. Lou has considerable experience formulating China's fiscal and monetary policy: he has served as Deputy Leader of the State Council's Working Group on Public Financial and Monetary Policy, Director of the Cost Price Division in the Chinese Academy of Social Sciences's Institute of Economy and Trade, Deputy Head of the Shanghai Commission for Economic Restructuring, and Director-General of the State Commission for Economic Restructuring's Macro Regulation Department. Mr. Lou has also been Vice Governor of Guizhou Province. He has a Master's degree in quantitative economics from the Chinese Academy of Social Science.

MAO Rubai

Mao Rubai is a member of the 10th National People's Congress (NPC) Standing Committee and Chairman of the NPC's Environmental Protection and Resources Conservation Committee. Mr. Mao has over 40 years of government service, previously serving as Vice Chairman of the Tibetan Autonomous Region's Government, Deputy Minister of the Ministry of Construction, and Chairman of the Hui Autonomous Region of Ningxia's People's Congress. Mr. Mao was also a member of the 15th Communist Party of China's Central Committee.

PAN Yue

Pan Yue is Vice Minister of the State Environmental Protection Administration, and in his first two years in that position has gained international recognition as a "courageous voice for a greener China." Before becoming a government official, he was a journalist, including three years as Vice Editor-in-Chief of China Youth Daily. Dr. Pan has also served as Vice Administrator of the State Administrative Bureau of State-Owned Assets, Vice Administrator of the State Bureau of Quality and Technical Supervision, and Vice Director of the Office for Economic Restructuring of the State Council.

QIU Baoxing

Qiu Baoxing is Vice Minister of the Ministry of Construction. He has a Ph.D. in Economics from Fudan University and a Ph.D. in City Planning and Design from Tongji University. Dr. Qiu is also a visiting professor at Zhengjiang University, Zhejiang University of Technology, and Fudan University, and a part-time professor at Nanjing University and Nanjing Finance and Economics University. He served as mayor of Hangzhou from March 1999 to October 2001.

QU Geping

Qu Geping has been a pioneer in environmental protection in China, working to integrate environmental protection policies into China's development strategies since 1972. He was Deputy Director of China's first environmental protection institution and the first Administrator of China's National Environmental Protection Agency. He also served as the first Deputy Director of China's State Environmental Protection Agency and chaired the Environmental Protection and Resources Conservation Committee under the National People's Congress. In recognition of his seminal environmental protection work in China, he has received prestigious international awards, including a Gold Medal from the United Nations Environment Programme in 1987 and the Blue Planet Prize in 1999.

William K. REILLY

William K. Reilly was the seventh U.S. Environmental Protection Agency (EPA) Administrator, serving from 1989 to 1993 under President George H.W. Bush and heading the U.S. delegation to the landmark United Nations Earth Summit in Rio de Janeiro in 1992. Mr. Reilly's work prior to his term as EPA Administrator was equally distinguished: he was President of both the World Wildlife Fund and The Conservation Foundation, Executive Director of the Rockefeller Task Force on Land Use and Urban Growth, a member of the President's Council on Environmental Quality under President Richard Nixon, and Chairman of the Natural Resources Council of America, an association of all major conservation groups. Mr. Reilly was also the Payne Visiting Professor at Stanford University in 1993-1994. Currently, Mr. Reilly is Founding Partner of Aqua International Partners, an investment fund in the water sector in developing countries, and Chairman of the World Wildlife Fund Board of Directors. He also serves on the board of directors of The David and Lucile Packard Foundation, the National Geographic Society, ConocoPhillips, DuPont, Ionics, and Royal Caribbean International.

Susan F. TIERNEY

Susan F. Tierney has served as Assistant Secretary for Policy at the U.S. Department of Energy, Secretary for Environmental Affairs in Massachusetts, Commissioner of the Massachusetts Department of Public Utilities, Executive Director of the Massachusetts Energy Facilities Siting Council, and Senior Vice President and Managing Principal of Lexecon, Inc. Dr. Tierney is now Managing Principal of Analysis Group in Boston, Massachusetts, where she consults on energy policy, regulation, and economics, particularly in relation to the electric and gas industries. Dr. Tierney is also Chairwoman of the Board of Directors of The Energy Foundation and Clean Air-Cool Planet; a director of Catalytica Energy Systems Inc., the Northeast States Clean Air

Foundation, the Electric Power Research Institute, and the Climate Policy Center; and a member of the Harvard Electric Policy Group, the Massachusetts Renewable Energy Trust Advisory Council, and the Environmental Advisory Council of the New York Independent System Operator. She has published widely and frequently speaks at industry conferences.

WANG Yumin

Dr. Wang Yumin is currently Vice Minister of the State Electric Regulatory Commission and a member of the 10th National Committee of the China People's Political Consultative Conference for the Population, Resources, and Environment Committee. Early in her career, Dr. Wang worked as Operation Master in the Electric Branch, Deputy Director, and Chief Engineer at the Tongliao Power Plant. From 1991 to 1998, she was the Deputy Director-General and Chief Engineer of the Electric Power Construction Bureau, Northeast China Electric Power Administration. From 1998 to 1999, Dr. Wang was Director-General of the Liaoning Provincial Electric Power Bureau, becoming Board Chairman and General Manager of the Liaoning Power Bureau from 1999 to 2001. From 2001 to 2002, she was Deputy Chief Economist and Director-General of the Grid Construction Department at the State Power Company. Since 2002, she has been Board Chairman of the China Guangdong Nuclear Power Company, and in 2003 was named a Member of the Nuclear Power Steering Group of the State Council. She received a Ph.D. in Engineering from Wuhan's Water Conservancy and Electric Power University.

Colburn S. WILBUR

Colburn S. Wilbur is a current Trustee and former Executive Director and President of the David and Lucile Packard Foundation. Mr. Wilbur is Chairman of the China Sustainable Energy Program's Senior Policy Advisory Council, a member of the advisory boards of The Sierra Club Foundation, the Entrepreneurs Foundation, and the American Land Conservancy, as well as an advisor to other philanthropic organizations in the United States, Great Britain and China. He served as Executive Director and CEO of the Sierra Club Foundation from 1960 to 1976. Mr. Wilbur has also served as a Senior Fellow of the Council on Foundations and was honored with their Distinguished Grantmaker Award in 1999.

XIE Fuzhan

Xie Fuzhan is the Commissioner of China's National Bureau of Statistics, and a consultant for the Committee of Consultation and Appraisal under the Chinese Academy of Sciences. Mr. Xie served many years as the Vice Chairman of the Development and Research Center of the State Council. His previous posts include Associate Professor, Professor, Deputy Director-General, Director of the General Office, and Secretary-General of the Academic Committee. Mr. Xie studied at Huazhong University of Science & Technology, and received his Masters from the Automation Research Institute of the Ministry of Machinery Industry. From 1991 to 1992, Mr. Xie was a visiting scholar at Princeton University, and is a recipient of the *Special Government Allowance*.

XU Kuangdi

Xu Kuangdi is Vice Chairman of 10th National Committee of the China People's Political Consultative Congress (CPPCC) and President of the Chinese Academy of Engineering. From 1995 to 2001, he served as the Mayor of Shanghai, and he has also served as Executive Vice President of Shanghai Polytechnic University, Director of the Shanghai Municipal Higher Education Bureau, Director of the Shanghai Municipal Planning Committee, and Deputy Secretary of the Communist Party of China's (CPC) Shanghai Municipal Committee. Dr. Xu was an alternate member of the 14th CPC Central Committee and a member of both the 15th and 16th CPC Central Committees. He graduated from the Beijing Institute of Iron and Steel Engineering in 1959.

YANG Jike

Currently President of the South-North Institute for Sustainable Development, Yang Jike pioneered China's rural economic reform while Vice Governor of Anhui Province. Dr. Yang has also served as President of the China Energy Research Society, a member of the National People's Congress Standing Committee, and a member of the Standing Committee of the China People's Political Consultative Conference, the most senior advisory body to the National People's Congress and State Council.

ZHANG Guobao

Zhang Guobao**,** currently Vice Chairman of the National Development and Reform Commission, is one of the foremost figures in China's infrastructure, industrial, and high-tech development planning. He was formerly Vice Chairman of the State Development Planning Commission, and has helped formulate China's 6th, 7th, 8th, 9th, and 10th Five-Year Plans. Mr. Zhang also served in several director-level positions within China's State Planning Commission prior to its reorganization into the State Development Planning Commission.

Presenter Biographies

LI Mingzhi

Li Mingzhi is Vice Director of the Office of Economy under the Finance and Economy Committee of the National People's Congress. He received a bachelor's degree from the Department of Economic Management in the School of Economics at Beijing University (now known as Beijing University Guanghua Management School) in 1990. In 1998, he studied Common Law, European Union law, and English at Nottingham Trent University. In 2002, Vice Director Li completed a Master's of Science at Holland Utrecht University's law school, with a focus on law economics.

WANG Zhongying

Wang Zhongying is Director of, and an Associate Researcher at, the Center for Renewable Energy Development, a research institute affiliated with the National Development and Reform Commission's Energy Research Institute. Prior to 1995, Dr. Wang studied conventional energy policy, energy supply and demand analysis, and energy supply modeling. His most recent research focuses on renewable energy policy development and technology commercialization. Dr. Wang received his Ph.D. from Tsinghua University's Institute of Energy System Analysis and Technical Economy in 1989.

YANG Fuqiang

Dr. Fuqiang Yang is Chief Representative and Vice President of the Energy Foundation's Beijing Office. Dr. Yang has been involved in energy and environmental issues for more than 30 years, and his experience and contact network in energy policy research and formulation in China are vital to the success of the China Sustainable Energy Program. Previously, Dr. Yang was a principal research associate at Lawrence Berkeley National Laboratory on China's energy and environmental issues, and published a number of reports in the field. In 1984, as a fellow of the World Bank, Dr. Yang worked on regional energy planning at Cornell University. Before moving to the United States, Dr. Yang worked with the Energy Research Institute of the State Development Planning Commission on renewable and rural energy policy, energy modeling and forecasting, project evaluation, and long term planning. Dr. Yang received his Ph.D. in Industrial Engineering at West Virginia University in 1991 and his B.S in Physics at Jilin University in China in 1977.

ZHOU Fengao

Professor Zhou Fengao is an expert member on the committee to draft China's *Energy Law* and heads the Energy Law Research Institute at Huabei Electric University. He is a councilman with the Legal Education Association at the China Legal Studies Institute and was named a Beijing College and University Outstanding Young Teacher. Professor Zhou graduated from Wuhan University Law School and received a Ph.D. in International Law from Renmin University.

Recently, Professor Zhou worked on the 2006 National Social Science Fund program, “Research on International Law and Domestic Law in the Energy Sector,” which examines China’s energy legislation as it relates to international laws. He has also assisted in drafting the *Electric Power Management Regulations*. In 2006, he participated in the National Electric Power Management Committee’s Policy Research program, “Electric Power Management Administrative Agency on Research for Theory Implementation and Establishing Policy Systems.”

Implementation of the Renewable Energy Law: Practice and Concerns

Wang Zhongying
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I. *Renewable Energy Law* Implementation Framework

The *Renewable Energy Law of the People's Republic of China* (RE Law) was adopted at the Standing Committee of the Tenth National People's Congress (NPC) on February 28, 2005. In January 2006, the National Development and Reform Commission (NDRC) released three important documents: *National Renewable Energy Industrial Development Guidance Catalogue*, *Administration of Renewable Energy Power Generation*, and *Rules for Renewable Energy Generated Electrical Pricing and Cost-sharing Management*. In July 2006, the Ministry of Finance also promulgated the *Provisional Measures for Administration of Special Funding for Developing Renewable Energy Resources*. Meanwhile, the *National Medium and Long Term Renewable Energy Development Plan*, formulated by NDRC, entered the final approval stage by the State Council. In connection with the renewable energy-generated cost-sharing measures, NDRC issued the "0.1 fen increase" policy on July 1, 2006 to support renewable energy power generation. Thus, the implementation details, rules, and basic conditions of the RE Law were put into place, ensuring that the law was ready to take effect in January 1, 2006.

The overall framework for the development of national renewable energy has been established, the state has formulated national renewable energy development goals, and specific measures have been implemented through national and provincial renewable energy development plans. The state has decided on the grid-connected price for renewable energy power generation, and has required power companies to purchase all electricity produced by administration-approved or listed renewable plants, based on the grid-connected price and on the winning bid for project tendering. The grid-connected price of power generated by renewable energy is higher than conventionally generated energy; the extra costs incurred because of mandatory grid connection must be shared by national grid end-users.

Although the RE Law has is in effect, renewable energy technologies and supporting policies for development and utilization vary in strength, and some policies are unclear with regard to implementation. For example, there is a need to clarify the effectiveness, policy strength, and operability regarding the development and utilization of solar energy, geothermal energy, and ocean energy, as well as non-power generating renewable energy. Many problems still exist that need to be solved in connection with implementation of the RE Law.

II. Effects and Problems in Implementing the RE Law

Nearly one year after the implementation of the RE Law, we can see that on one hand a wave of renewable energy development and utilization has been created, with particular eagerness for rapid returns from both wind energy and biomass energy; in some regions, this market may even be saturated. On the other hand, the results of implementation of the law have not been satisfactory, and China has failed to bring about large-scale renewable energy development and utilization. On the whole, China has not laid a solid enough foundation for comprehensive development and utilization of renewable energy; we are not fully prepared for the rapid developments in this sector.

At present, the problems with renewable-related technology and R&D systems are the biggest obstacles for renewable energy development. For example, with regard to the development of wind power, available resources have not be qualified, grid construction is lagging, and technology (wind-powered electric generators) is falling behind; regarding biomass energy, the market has become volatile, due mostly to resource uncertainty. There also exists the challenge of coordinating ecological problems (biological diesel and cassava-based ethanol) with the State's development strategy. Because of limited resources, we must carefully consider whether biomass should be used mainly for power generation or as a petroleum substitute; after all. Furthermore, due to the lack of reporting and supervision mechanisms, specific projects have yet to be carried out for the renewable energy cost-sharing policy, which has not yet been implemented.

In fact, various renewable resources have particular characteristics in terms of both development and utilization. According to the type and source of resources, the energy may be a direct result or a by-product of utilization. For example, with the treatment and utilization of industrial and agricultural organic wastewater and urban organic garbage, energy is the by-product. There are many kinds of renewable resources, including water energy, solar energy, wind energy, biomass energy and ocean energy.

The development and utilization of such resources involves various governmental administrative departments. For example, the development of biomass energy is not only under the administration of the relevant energy department, but there is also a close relationship with the agricultural and forestry departments. The top level administrative agencies of the State Council include the National Development and Reform Commission, the Ministry of Agriculture, the State Environmental Protection Administration, the Ministry of Finance, the Ministry of Science and Technology, the Ministry of Construction, and the Forestry Bureau. The situation is similar in local governments. With so many departments involved in the administration of renewable energy development and utilization, there is no unified development goal, strategy, or unity and coordination, making it difficult renewable energy development. The formulation and effective implementation of the development plan, and the implementation and supervision of the RE Law, are all dependent on coordination and cooperation between the departments listed above.

In view of the fact that so many governmental administrative departments are concerned with renewable energy development and utilization, it would be beneficial if each department has clear responsibilities. With the multiple government entities involved in policy, lack of unification and coordination can prevent actual accomplishments, and the system may be prone to corruption or abuse.

1. Coordination and cooperation are crucial to the multi-department system

Because each type of renewable energy has its own characteristics, and is administered simultaneously by many governmental departments, inter-departmental coordination and cooperation is crucial. The prerequisite for robust renewable energy development in China is coordination and cooperation.

The state has not yet formed a coordinated force to support renewable energy development. Although the RE Law is already in effect, and despite the rapid increase in global oil prices, an extreme shortage of energy, and the widespread energy security crisis, renewable energy development in China is making very slow progress. The relevant energy departments under the State Council need to take the lead in coordinating and consolidating the implementation of the renewable energy development and utilization program and strategies. However, the interests of departments are being prioritized ahead of the interests of the state. For example, renewable energy resources are of the utmost importance for renewable energy development and utilization. Some of them come directly from natural resources (e.g., the wind and the sun), while others need to be developed. For example, biomass resources need to be planted and harvested, and its planting requires integrated planning and deployment, so that biomass production does not take place in grain-producing areas, nor in places that destroy forests or wetlands. Many needed measures exceed the current responsibilities attributed to particular departments, which need to take charge of resources, develop projects, and construct and manage biomass energy resources and biomass liquid fuel processing plants.

2. Technical R&D and market utilization of renewable energy are seriously disjointed

One of the major problems causing a bottleneck in renewable energy development is the issue of technologies having independent property rights. The wind power industry must deal with wind turbines, and the solar power industry deals with silicon materials. The auto industry has been sold to foreign enterprises, but China must ensure that it has its own technical products as well, such as large-scale thermal generator divisions and hydroelectric power divisions. According to the current national renewable energy development targets set for 2020, renewable energy will be a RMB 2 trillion market (2005 prices). If we don't have world-class domestic technologies, this RMB 2 trillion cake will be swallowed up by foreign enterprises.

In addition, our scientific research system has certain problems: those in charge of technical R&D are not concerned about the industry itself, and those in charge of industrial development have no assets to deal with the technology, thus causing serious discrepancies between the technical R&D and market utilization divisions within the renewable energy sector. Experiences in the U.S. with renewable energy technical R&D and market utilization could serve as a reference for China. In the U.S., the Department of Energy is affiliated with the U.S. State Department, which is the administrative department for the state's energy technology, R&D, and industry. At the early stages of technology development, energy enterprises are involved and invest funds, which is added to the R&D funding invested by the state. Then, when a technology has been successfully developed, it is immediately applied to the energy industry. China has followed this successful strategy in the development of large-scale thermal generators and hydroelectric generators, with technical R&D closely tied to industrial application.

3. Difficulties with enforcement and inspection in implementing the RE Law

Because there are so many renewable energy-related administrative departments, the leading and coordinating functions of the state's renewable energy administrative departments and their authoritative status have not received proper approval and recognition. Although the RE Law has begun implementation, the functions and roles of the individual departments lack unity and coordination, and it is difficult for them to perform their own responsibilities according to the regulations of the RE Law. The enforcement and inspection abilities of the NPC also lack an appropriate means of punishment. Therefore, law enforcement inspection and supervision after implementation of the RE Law are confronted with numerous difficulties.

4. Open and transparent legal implementation mechanisms are lacking

In regards to implementation of the RE Law, it is clear that open and transparent legal enforcement mechanisms are needed. Such mechanisms apply to decisions concerning the overall renewable energy goals and development plans, pricing, project approval, and project tendering organization. In accordance with the principles of transparency and efficiency, we should seek public opinion, promptly release relevant decisions, and publicly report on activities and progress. Except for the franchised tendering of wind energy projects, numerous renewable energy-related administrative activities currently lack openness and transparency.

III. Further improvement on the Implementation of the RE Law

Currently, many implementation measures and details concerning renewable energy development are not as good as they should be. Without a lasting development strategy, the state is unable to properly guide the development of the renewable energy industry. Although it is difficult in a short period of time to make substantial changes to China's current scientific research and industrial supervision system, we can nevertheless seek to solve certain key problems, strengthen the detailed rules concerning implementation of the RE Law, and promote its improvement.

1. Formulate the overall development strategy, then research and implement the technological route to renewable energy development

Currently, renewable energy development lacks established policies and full utilization of natural resources and technologies; in addition, many plans remain inoperable and development prospects are unclear. In fact, each renewable energy technology has unique and objective rules for development, so the many failures and lessons, as well as successful experiences, in the rest of the world may serve as references for us. As it stands, we need policies to be fully put in place, and we need to implement the state's overall renewable energy goal and plan, yet we still have no clear path to follow. Therefore, by formulating the development route for renewable energy technologies in such sectors as wind power, biomass energy and solar energy, we may be able to clarify the technological path for renewable energy development, and we may be able to resolve problems. For example, with respect to wind power development, we need to solve the problems of resources, power grid, wind turbine manufacturing and industrial development. Through studying and formulating the development path for renewable energy technology, and promoting clear practices and incentive measures in detailed and legally-binding implementation rules, we can formulate realistic policies and measures for supporting the development of renewable energy.

2. Improve the operational mechanisms for renewable energy-related cost-sharing implementation

The implementation and realization of renewable energy development goals are embodied by the individual projects currently underway. Compared with conventional energy, renewable energy development and utilization costs are high. In order to address this imbalance, a renewable energy cost sharing mechanism has been established, giving support to the development and utilization of clean energy, guaranteeing energy security as well as protecting the environment. The RE Law has been in effect for almost one year, but the cost sharing mechanism has not been implemented for all new projects, and this is unfavorable for the sustainable development of renewable energy projects.

The basic conditions for the cost-sharing mechanism have been put in place, but details regarding implementing the cost-sharing mechanism, and other specific measures, need to be clarified. Details are currently needed regarding how to declare subsidies for new projects, how to regulate the surplus and deficiencies among power grid companies, whether central and local projects both receive equal treatment, and whether the Electricity Regulatory Commission will supervise such specific operational processes. All such problems need to be clarified through rules on specific cost-sharing implementation and operations. Only in this way can we inspire greater enthusiasm amongst enterprises, take advantage of government efforts to develop the renewable energy market, encourage market entry, and promote renewable energy development.

3. Establish a supervision mechanism to implement the RE Law

In order to effectively implement the RE Law, two additional tasks need to be carried out: first, we need to research and formulate relevant administrative rules and regulations, and technical standards and local codes; second, we must gradually establish and improve implementation capacity, which involves government management systems, market-oriented mechanisms and a system for public supervision.

As a result of the efforts of the NPC and the State Council, as well as those of people from all sectors of society, the formulation of relevant administrative rules, regulations, and technical standards, has already begun. However, the corresponding implementation mechanisms still have not elicited sufficient attention. Since the implementation of China's renewable energy program involves many different government departments, the energy system and pricing mechanisms are in the process of transformation, and public participation and societal supervision are still very weak.

The NPC should establish legally binding supervision mechanisms, promote the creation of favorable governmental administrative systems, market system, and social supervision mechanisms, to guarantee the effective implementation of the RE Law. It should push the government to establish and improve systems for government transparency with regard to planning, project approval, and pricing, and should ensure that people from all sectors of society are able to understand the government's decision-making information in a timely manner, giving the public opportunities to be involved in the decision-making process. It should also establish a regular appraisal and reporting system for the implementation of the RE Law. The State Council and provincial power administration departments should regularly report on implementation of the RE Law to the standing committee of the People's Congress of the same level, and to make this information public.

Progress of the *Energy Conservation Law* Amendments

Li Mingzhi
Deputy Director, Economic Affairs Office
Financial & Economics Committee of the National People's Congress

I. Implementation status

The current *Energy Conservation Law* was adopted in the Eighth National People's Congress in November 1997, and implementation began on January 1, 1998. The following activities indicate that the promulgation and implementation of the *Energy Conservation Law* is on track:

- **Yearly promotion campaigns:** The "energy conservation promotion week campaign" is carried out once a year. In 2005, the first national "Exhibition of Building the Economical Community" was held, and a grand campaign to promote the theme of "Nationwide Energy Conservation and Joint Action" was organized.

- **Relevant laws and statutes promulgation:** These laws and statutes include *Management Methods for Energy Conservation Work in Key Energy Consumers*, *Management Methods for Electricity Saving*, *Management Rules for Energy Conservation of Civil Buildings* and *Management Methods for Accreditation of China Energy Conservation Products*. More than 70 by-laws and government regulations related to energy conservation have been promulgated in more than 20 provinces across the country.

- **Energy conservation management promotion:** The *Medium and Long Term Special Plan of Energy Conservation* has put forth key energy conservation fields in industry and buildings, and started ten key energy conservation projects. Since March 2005, 22 state mandatory standards related to the energy efficiency of major industrial equipment, household appliances, and lighting have been implemented, and a uniform energy efficiency labeling system has been implemented for energy-consuming products. The Ministry of Finance and other departments have put forth two batches of energy conservation products in government purchase plans, promulgated in 2004 and 2005. The Ministry of Construction has set the target that new buildings in towns nationwide shall reduce energy consumption 50% by 2010, and a preliminary building energy conservation design standard system has been established. In recent years, the Ministry of Communications has carried out energy conservation assessments of 26 new port constructions or expansion projects.

- **Technical progress promotion:** China must promote energy conservation technologies like cogeneration, central heating, energy efficient motors, automobile's electric control for fuel saving, circulating flow bed, clean coal, etc., and improve the technological level of high energy conservation industries like iron and steel, nonferrous metals, cement, coal and coking.

During the eight years since the implementation of the *Energy Conservation Law*, the unit energy consumption for GDP has been reduced, from 1.56 tons coal equivalent (tce) per RMB10,000 in 1998 to 1.43 tce in 2005 (both are the comparable prices in 2000). The unit energy consumption for major energy-consuming products has been reducing gradually and energy efficiency has improved slightly.

II. Deficiencies in the current law and amendment recommendations

Amendments to the current *Energy Conservation Law* are necessary in order to address the continual reform of China's economic system, and rapid economic and social development.

China's energy conservation management is in a grave state. During the 22 years after reform and opening up, China's unit GDP energy consumption was on a downward trend. However, entering the 21st century, China's energy consumption per RMB10,000 GDP has been on the reducing-first- and-increasing-later trend. Especially in recent years, efficiency of energy use has reversed, and energy consumption per unit output value has been increasing instead of decreasing. According to the"11th Five-Year" Plan, China's energy consumption for RMB10,000 GDP in 2010 shall be reduced by 20% relative to the end of the"10th Five-Year Plan" period, with a 2006 reduction target of 4.4%. However, China's energy consumption for RMB10,000 GDP in the first half of this year but increased by 0.8% relative to the same period in 2005, continuing the upward trend in the"10th Five-Year Plan" period.

Major problems and constraints exist in the current *Energy Conservation Law*:

First, regarding enforcing institutions, the bodies for enforcement and supervision have not been specified; the legal status of competent energy conservation administrative departments and their administrative responsibilities and authority are not adequately clear, lacking in special regulatory organization; and the related institutions that provide energy conservation services are not specified.

Second, regarding the scope of adjustment, the current law lays particular emphasis on standardizing industrial energy conservation, without detailed regulations and without addressing with energy conservation of buildings, transportation, governmental departments, and public utilities to date.

Third, regarding management, some clauses are tinted with characteristics of planned management, and cannot adapt to the changes in government functions under market conditions or new changes in management methods of energy conservation; fail to promote new, market-oriented energy conservation management mechanisms; lack detailed regulations on how to stimulate and guide rational consumption of energy; and lack detailed regulations on how to develop and promote energy conservation technologies and products through taxes, pricing, government purchase, and other adjustment and control tools. Practice has proven that administrative means are not very effective, and tools such as fiscal tax and pricing mechanisms must be adopted to curb energy-wasting behavior and to encourage energy-saving behavior.

Fourth, regarding institutional design, some clauses are principle-oriented and not highly operable, especially lacking in mandatory punitive and enforcement approaches, with inadequate punishment for inefficient energy use and waste. The current *Energy Conservation Law* must be amended based on a summary of its current implementation, and by learning from international best-practice, in order to provide more effective and long-term legal security.

III. Amendment progress

As approved at the 10th National People's Congress Standing Committee, the amendment of *Energy Conservation Law* has been listed in the *Standing Committee's Legislation Plan*. According to the preliminary arrangement, it will be submitted to the National People's Congress' Standing Committee for review in 2007, and the drafting work will be organized by the Fiscal and Economic Committee of the National People's Congress. On March 23, 2006, Fu Zhihuan, Chairman of the Fiscal and Economic Committee under the National People's Congress, presided over the meeting of the drafting group, where they discussed and adopted the *Energy Conservation Law Amendment Drafting Work Plan*. Besides members from the National People's Congress Fiscal and Economic Committee, the Energy Conservation Law Amendment Drafting Group is also comprised of responsible officials from ten departments including the State Development and Reform Committee and the State Council Legislation Office. The group also invited nine experts in energy and law as members of the Legislative Consulting Team.

The Energy Conservation Law Amendment Drafting Group has been working diligently since its establishment on March 23, 2006. From April to June, it produced 10 monographic studies. In May and June, members participated in inspecting the enforcement of the *Energy Conservation Law*, sponsored by the National People's Congress Standing Committee. The draft amendment of the *Energy Conservation Law* (1st version) was formed in July. In early August, the work group amended the draft and circulated it for advice among members of the Draft Group, liaison persons in all related departments, and a consulting expert team. In September, the work group studied the feedback, and formed the second version of Energy Conservation Law Amendment Draft. On September 26, the Draft Group will call on the second plenary session to discuss and take up the second version of the draft.

IV. Main amendments to the *Energy Conservation Law*

The first idea is to further clarify and highlight the position of energy conservation in China's overall energy strategy. Compared with the current *Energy Conservation Law*, the new draft has (1) legally defined the important strategic status of energy conservation in China's national economy and social development; (2) clarified the responsibilities of government and relevant departments in energy conservation work; (3) stipulated a series of important energy conservation rules (e.g. rules on energy conservation target assessment and examination, fixed asset investment projects, rational energy use assessment and review, energy conservation standards, energy efficiency labeling of energy consuming products, energy conservation product accreditation, etc.); (4) put forward policy guidelines to facilitate energy conservation work; and (5) strengthened the legal framework for energy conservation.

The second idea is to pay attention to the role of market mechanisms in energy conservation management, particularly to establish an effective incentive mechanism and adopt economic levers, including fiscal tax approaches, to form an energy conservation mechanism that combines incentive mechanisms and regulatory mechanisms.

The draft amendment stipulates the following clauses:

First, the central treasury, and local treasuries above the county level, shall set aside special energy conservation funds, include the funds in budgetary management, and specify directions for fund use. Second, the state shall stipulate a favorable tax policy, so as to facilitate energy conservation and control energy wasting behaviors from the three aspects of production, consumption, import and export. Third, the state shall implement government purchase policies that promote energy conservation, and relevant departments of the State Council shall stipulate and adjust the government purchase list of energy conservation products. Fourth, the government shall gradually increase the proportion of energy conservation investment in its overall energy investment. The state shall stipulate the fiscal policy of discount loans, and guide social capital, such as bank loans, to increase their input towards energy conservation. Fifth, the state shall develop special measures to facilitate demand-side energy management.

The current *Energy Conservation Law* does not involve market-oriented energy conservation management mechanisms such as demand-side management, contracting energy management, and voluntary agreements for energy conservation. The amendment draft has added the following new rules: (1) the state shall encourage and facilitate demand-side energy management, and power, natural gas, and other energy suppliers shall be responsible for strengthening communications and promotion work regarding demand-side management; (2) grid enterprises shall buy 100% of the grid electricity from the residual heat and pressure of power generation projects, and provide on-grid service for these projects; (3) the state shall push forward market-oriented energy conservation management mechanisms, including contracting energy management and voluntary agreements for energy conservation; (4) the state shall support the development of energy conservation consultancy, assessment, inspection, test and accreditation, so as to establish and perfect energy conservation technical service system; and (5) the state shall encourage and allow a role for non-profit organizations such as energy conservation associations.

The state shall enhance the effectiveness and operability of relevant mechanisms, and clarify the respective responsibilities of relevant government departments to ensure clear-cut systems, specific measures, proper supervision, and security. In particular, regulations regarding the arrangement of energy conservation capital and incentives must be guaranteed and finalized with effective mechanisms. Besides strengthening the leadership and management for energy conservation work, the government shall also be an exemplary model in energy conservation for the whole society.

Clause eight in the current *Energy Conservation Law* stipulates that the State Council and the departments managing energy conservation work in local people's government above the county level are responsible for supervising the energy conservation work in their administrative jurisdictions. In practice administrative organs at the basic level are do not know which department is responsible for energy conservation work. Another emerging problem is that relevant departments may overlap in their responsibilities, causing weakened conservation efforts. Given that the central and local administrative departments for energy conservation work have not set clear divisions in responsibility, the amendment draft stipulates that the State Council and local governments at different levels above county-level shall specify which administrative department is responsible for energy conservation work, as well as its responsibilities.

Clause eight also specifies that relevant departments of the State Council and local governments are responsible for supervising and managing energy conservation work within their authority, but it does not establish a coordination mechanism such that one department takes the overall responsibility and divides the work between the departments. The draft amendment stipulates that relevant departments of the State Council and local government at different levels above the county-level shall perform their regulatory responsibilities within their authority, and accept the instruction and coordination of competent administrative departments for energy conservation work.

The current *Energy Conservation Law* does not specify a department dedicated to energy conservation enforcement. In practice, many energy conservation jobs are not supervised and illegal energy-use behaviors cannot be stopped or investigated. In this amendment, the establishment of an energy conservation supervision department is written into the law according. It specifies that designated administrative departments for energy conservation work in provincial governments, autonomous regions, and municipalities directly under the central government will set up the energy conservation supervision departments to be responsible for the routine supervision of energy conservation within their own administrative regions. It also stipulates specific functions for the energy conservation supervision departments, such as supervising the energy conservation work of key energy consumers. These functions do not overlap those of the Quality Supervision and Inspection, the Industrial and Commercial Administrative Management, and other departments, and establish a clear relationship with the construction and transportation departments. At the same time, the authorities responsible for punitive measures are clearly divided in terms of legal obligations.

The state shall supplement the administrative regulations on energy conservation in key energy-consumption fields, industries, and energy-consuming end products, so as to fill omissions in the systems. For example, in industrial fields, clear regulations shall be developed for requirements of energy conservation in the transportation sector, and more detailed and specific rules shall be worked out for the management of energy conservation in buildings. Also, future energy conservation management work will pay more attention to the management of energy-consuming end products. Relevant rules regarding this, especially incentives, shall be further supplemented and improved.

Urbanization and increased living standards will increase the energy consumption in buildings, vehicles, government departments, and other public utilities, weakening energy conservation work. To increase the awareness of the general public and strengthen energy conservation work in this area, the draft amendment has added three sections about energy conservation related to buildings, vehicles, and public utilities, specifying basic energy conservation systems and management measures. The new sections will emphasize the responsibilities of relevant governments agencies, such as (1) developing special industrial energy conservation plans and standards; (2) implementing the energy conservation target responsibility system for public institutions; (3) reforming the heating systems of existing buildings; and (4) developing management methods for temperature control of air conditioners in public buildings. The State Council and relevant departments are also developing relevant statutory documents and policies.

The state shall perfect regulations on legal obligations, strengthen the system's power as a constraining force, and strengthen the authority of the *Energy Conservation Law*; and exercise stricter punishment for different entities of government departments, enterprises, other units and individuals that violate the *Energy Conservation Law*.

The current *Energy Conservation Law* has fewer punitive clauses and lacks in enforcement measures. In this amendment, relevant rules and clauses are added to define legal obligations, and some mandatory administrative measures are added.

The draft amendment has added the following ten clauses:

1. Legal obligations for fixed asset investment projects that are not assessed or reviewed for rational energy use, or for when construction is started without approval or authorization.
2. Legal obligations for no labeling or false labeling of energy efficiency when products are required to be labeled uniformly.
3. Legal obligations for use of forged accreditation signs or infringement of accreditation signs for energy conservation product.
4. Legal obligations for not equipping inspection and metering devices as specified, or not using energy metering data or using forged data as given by energy monitoring and metering devices as specified.
5. Legal obligations for key energy consumers that do not submit the report of energy use on time or submit false reports.
6. Legal obligations for energy producers and dealers that provide energy products free of charge, or at low price, or charge a flat-rate schedule; legal obligations for violations of building energy conservation standards.
7. Legal obligations for use of technologies, equipment, materials and products in buildings that are listed in the Prohibited Catalogue.
8. Legal obligations for when energy conservation inspection, test, audit and consulting service organizations provide false data or false analysis reports.
9. Legal obligations for when the government and other public institutions do not give priority to purchasing the energy conservation products on the government's purchase list or purchase the products and equipment that have been eliminated by the state by official order.
10. Legal obligations for when grid enterprises do not purchase 100% of the electricity generated by residue heat and pressure.

Introduction to the Drafting of China's *Energy Law*

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Energy has become one of the "bottlenecks" of economic development in China. This is reflected in the energy structure, inefficiency and inconsistencies in energy security, increasing conflicts between energy and the economy, conflicts between environmental protection and social development, and the urgent need for an energy administration system. To maintain steady economic growth, to build a harmonious socialist society, and fulfill the goal of building a well-off society, it is necessary to break the energy sector's constraints on economic development. These objectives require a corresponding system of energy laws.

I. Framework of China's current energy laws and regulatory system

A. Makeup of the current energy laws and legislative framework

In the nearly 30 years of reform and opening-up, China has achieved considerable results in the field of energy legislation. Laws such as the *Coal Law*, the *Electric Power Law*, the *Energy Conservation Law* and the *Renewable Energy Law*, as well as a large number of energy-related administrative regulations and policy documents, have been promulgated and implemented. A preliminary framework of energy laws and regulations in China has been formed. The current framework of laws and regulations consists of the following:

1. Energy laws and administrative legislation

(1) Natural resources laws (seven items): The *Forest Law* (promulgated in 1984 and revised in 1998), the *Grassland Law* (promulgated in 1985 and revised in 2002), the *Land Administration Law* (promulgated in 1986 and revised in 1998 and 2004), the *Mineral Resources Law* (promulgated in 1986 and revised in 1996), the *Detailed Implementation Rules of the Mineral Resources Law* (promulgated in 1994) and the *Water Law* (promulgated in 1988 and revised in 2002);

(2) Coal laws and regulations (11 items): The *Mine Safety Law* (promulgated in 1992), the *Regulations for the Implementation of the Mine Safety Law* (promulgated in 1996), the *Administrative Measures for Coal Production Permits* (promulgated in 1995), the *Detailed Implementation Rules of the Administrative Measures for Coal Production Permits* (promulgated in 1995), the *Administrative Regulations for Township Coal Mines* (promulgated in 1994), the *Implementation Measures of the Administrative Regulations for Township Coal*

Mines (promulgated in 1995), the *Coal Law* (promulgated in 1996), the *Measures for Administrative Punishments Concerning Coal* (promulgated in 1997), the *Administrative Measures for Executive Law Enforcements Concerning Coal* (1997), the *Measures for Examination and Approval of Opening of Coal Enterprises* (promulgated in 1997) and the *Regulations for Coal Safety Supervision* (promulgated in 2000).

(3) Electricity power laws and regulations (12 items): The *Regulations for the Protection of Power Facilities* (promulgated in 1987 and revised in 1998), the *Detailed Implementation Rules of the Regulations for the Protection of Power Facilities* (promulgated in 1992 and revised in 1998), the *Administrative Provisions for Sea Floor Power Cables,* (promulgated in 1989), the *Implementation Measures of the Administrative Provisions for Sea Floor Power Cables* (promulgated in 1992), the *Regulations for Compensation for Land Acquisitions and Immigrant Settlement in Medium- and Large-Scale Water Conservancy and Hydropower Project*s (promulgated in 1991), the *Administrative Regulations for Reservoir and Dam Safety* (promulgated in 1991), the *Administrative Regulations for Grid Scheduling* (promulgated in 1993), the *Implementation Measures of the Administrative Regulations for Grid Scheduling* (promulgated in 1994), the *Electric Power Law* (promulgated in 1995), the *Regulations for Power Supply and Use* (promulgated in 1996), the *Regulations for Immigration in the Yangtze River Project* (promulgated in 2001) and the *Regulations for Power Regulation* (promulgated in 2005).

(4) Oil and natural gas laws and regulations (four items): The *Regulations for Foreign Cooperation in Extracting Sea Oil Resources* (promulgated in 1982 and revised in 2001), the *Administrative Regulations for Sea Oil Exploration, Development and Environmental Protection* (promulgated in 1983), the *Regulations for Foreign Cooperation in Extracting Land Oil Resources* (promulgated in 1993) and the *Regulations for the Protection of Oil and Natural Gas Pipelines* (promulgated in 2001).

(5) Nuclear power laws and regulations (five items): The *Administrative Regulations for the Monitoring of Safety of Civilian Nuclear Facilities* (promulgated in 1986), the *Supervision Regulations for Nuclear Materials* (promulgated in 1987), the *Regulations for the Emergency Administration of Nuclear Power Plant Accidents* (1993), the *Supervisory Regulations for Nuclear Export* (1997) and the *Supervisory Regulations for the Export of Civilian and Military Nuclear Products and Related Technologies* (promulgated in 1998).

(6) Laws and regulations on energy conservation and renewable energy (two items): The *Energy Conservation Law* (promulgated in 1997) and the *Renewable Energy La*w (promulgated in 2005).

(7) Environmental protection laws (seven items): The *Ocean Environment Protection Law* (promulgated in 1982 and revised in 1999), the *Water Pollution Prevention and Control Law*

(promulgated in 1984 and revised in 1996), the *Atmospheric Pollution Prevention and Control Law* (promulgated in 1987 and revised in 1995 and 2000), the *Environmental Protection Law* (promulgated in 1989), the *Law on the Prevention and Control of Environmental Pollution Caused by Solid Waste* (promulgated in 1995), the *Environmental Impact Assessment Law* (promulgated in 2002) and the *Radioactive Contamination Prevention and Control Law* (promulgated in 2003).

2. Relevant laws concerning the provision of energy

Main laws relating to energy (16 items): The *General Principles of the Civil Law* (promulgated in 1986), the *Law on Industrial Enterprises Owned by the People* (promulgated in 1988), the *Company Law* (promulgated in 1993 and revised in 1999, 2004 and 2005), the *Income Tax Law on Enterprises with Foreign Investment and Foreign Enterprises* (promulgated in 1991), the *Law on the Administration of Tax Collection* (promulgated in 1992 and revised in 1995 and 2001), the *Statistics Law* (promulgated in 1983 and revised in 1996), the *Standardization Law* (promulgated in 1988), the *Product Quality Law* (promulgated in 1993), the *National Security Law* (promulgated in 1993), the *Science and Technology Advancement Law* (promulgated in 1993), the *Construction Law* (promulgated in 1997), the *Price Law* (promulgated in 1997), the *Law on Tendering and Bidding* (promulgated in 1999), the *Promotion of Clean Production Law* (promulgated in 2002), the *Safe Production Law* (promulgated in 2002) and the *Administrative Permit Law* (promulgated in 2003).

3. Departmental rules and normative documents concerning the energy industry

Project planning type (3 items), resources management and utilization type (31 items), investment management type (22 items), project construction type (20 items), energy conservation type (18 items), environmental protection type (22 items), standards and specifications type (19 items); and price and tax type: price type (14 items), tax type (13 items), fee type (8 items), fund type (seven items) and other types (10 items).

4. Policy documents made by various energy industry departments:

Coal policy documents (148 items), electric power policy documents (180 items), oil and natural gas policy documents (83 items), and policy documents on rural energy, renewable energy and new energies.

B. Existing problems in current energy legislation

Despite the fact that a foundation exists for China's energy laws and policy construction system, there are still difficult and urgent measures needed to improve the energy laws in China. On the whole, energy legislation has yet to be adapted to the needs of both energy and economic development in China. This is mainly reflected in the following:

1. The energy law system is not robust. China lacks basic energy laws that encompass the greater energy strategy and policy orientation, such as the *Energy Law*. Current energy laws tend to be individual laws that regulate a certain energy field or lay out the legal relationships within a certain field, such as the *Electric Power Law*, the *Coal Law*, the *Energy Conservation Law* and the *Renewable Energy Law*. Moreover, omissions in China's system of individual energy laws include the *Oil Law*, the *Natural Gas Law*, the *Nuclear Energy Law* and the *Energy Utility Law*.

2. There are inconsistencies between energy laws themselves, and between energy laws and other laws. The guiding concepts and basic principles for the various individual energy laws lack clarity and uniformity. When drawing up and revising individual laws, different departments have difficulty reaching agreements. There is a lack of consistency and compatibility between the newly adopted energy legislation and the existing energy legislation, between energy legislation at different levels, and between the energy laws and other related laws. Such inconsistencies limit the effect of implementing the energy laws.

3. Energy laws, administrative regulations and department rules are not properly coordinated. The provisions of several current energy laws are general, and can only be effectively implemented through a large number of supplementary administrative regulations and departments' administrative rules. The introduction of much-needed administrative regulations have been inhibited by a lack of organization in the drafting process, difficulties in inter-departmental coordination, or canceling of the responsible departments.

4. Energy laws and regulations need to be more comprehensive. China's current laws lack provisions for energy security and energy emergencies. There is also a lack of measures regarding the implementation of energy security guarantees. Implementation and coordination are both difficult. In addition, China lacks legal provisions for international energy cooperation. This is detrimental to making full use of domestic and international markets and resources.

5. There is a lack of coordination and balance in energy laws and energy policies. For example, there is an over-reliance on policy and a neglect of law. Some policies give different priority to development of energy resources and conservation. The central government and local governments at all levels are all involved in policymaking, and one's action is not always consistent with the others'.

II. Basic approaches to drafting the *Energy Law*

A. China's objectives in formulating the *Energy Law*

China has three main objectives in drafting the *Energy Law*:

1. Help China's energy strategies and comprehensive, long-term energy policies be synthesized into a system of laws. Such developments would allow for greater enforcement of guarantees, more stabilizing mechanisms in energy strategy implementation, and would provide a legal basis for the government to formulate and implement specific energy policies.

2. Eliminate inconsistencies between various individual energy laws, and between energy laws and non-energy laws. Looking at the energy legislation practices in China, both specific energy laws and basic energy laws are needed. Individual laws tend to address the regulation of industry, and are specialized and limited in scope to particular legal adjustments. However, a comprehensive and fundamental law is needed to address the legal relationships involving the overall energy sector.

3. Use the law to establish and improve China's energy security and emergency systems, such as the energy reserve system and energy emergency system, thus stabilizing energy supply, creating incentives for energy demand reduction, and safeguarding national economic security.

B. Guiding principles for formulating the *Energy Law*

The guiding principles are the following: to maintain a scientific perspective in guiding China's social and economic development; to set social and economic development on a comprehensive, coordinated and sustainable path that focuses on the need to adjust the economic structure, change the economic growth pattern and create a resource-conserving and environment-friendly society; and to create an administrative system and mechanisms that ensure diversified development, give priority to conservation, and use domestic coal production as a basis for building a stable, economical, and clean energy supply system.

C. The main roles of the *Energy Law*

In accordance with the guiding principles mentioned above, the *Energy Law* should function as the basic law in China's energy sector, addressing overall strategy and fundamental aspects of the energy sector, coordinating laws in the specific energy fields, and connecting energy resources exploration, research and development, production and transportation, trade and consumption, utilization and conservation, foreign cooperation, and energy security and supervision.

D. Key issues that need to be solved by the *Energy Law*

The *Energy Law* needs to:

1. Specify China's overall energy development strategy, including strategic principles, policies, goals, and mechanisms for energy development and utilization;
2. Establish guiding concepts and basic principles for the legislation of individual laws in the energy sector, and coordinate the legislation of various individual laws;
3. Specify the legal status of the *Mid- and Long-Term Energy Plan* in order to provide legal backing for energy development objectives;
4. Draw up laws and specifications to comprehensively improve energy utilization and energy efficiency, promote technological innovations and industry structure reforms, promote the development of a recycling economy, and promote an energy-efficient mode of economic development;
5. Establish specific energy policy systems, with legal specifications for policy systems regarding energy resource exploration, market access, administrative management, pricing, reserves, investment, taxes, statistics and auditing;
6. Establish a system of laws to address energy security guarantees and energy emergencies; and
7. Provide specifications regarding international energy cooperation and exchanges and to actively address the issue of the impact of climate change on China and the world.

The overall objective of drawing up the *Energy Law* is to fulfill the goals of guaranteeing China's energy supply, promoting energy development, optimizing the structure of the energy industry, safeguarding energy security, optimizing energy utilization and strengthening cooperation in the energy industry.

III. The *Energy Law* drafting process

With approval from the State Council, work on drafting the *Energy Law* began earlier this year. Efforts will be made to form a draft *Energy Law* by the end of 2007, for reporting to the State Council.

Drafting consists of 3 stages: (1) survey and research period (six to nine months); (2) drafting period (six to eight months); and (3) verification and revision period (four to six months). The goal is for drafting to be complete within two years.

Currently, work is progressing on scheduled. Completed work includes the following:

1. An *Energy Law* Drafting Group has been established. The secretariat and expert panel in this group provide organizational and institutional guarantees for the drafting process. On January

24, 2006, an inter-agency group for drafting the *Energy Law* was established. Members include fifteen organizations under State Council, the Financial and Economic Affairs Committee and the Environment and Resources Committee of the National People's Congress and the State Commission Office for Public Sector Reform, such as the Office of the National Energy Leading Group, the National Development and Reform Commission, the Legal Affairs Office of the State Council, and the Ministry of Finance. The group leader is Ma Kai, Director of the NDRC. The group secretariat is responsible for organizing specific actions related to the drafting of the *Energy Law*, such as surveys and research on special topics and problem areas, as well as the drafting and verification of legal documents. In March 2006, an expert panel on the drafting of the *Energy Law* was established to provide consulting services. The panel consists of 16 experts from the fields of energy, law, economics and public administration

2. Surveys, research, informal discussions, and workshops have been carried out. The four research projects that have already been undertaken are the following: research on the concepts and drafting principles of the *Energy Law*; research on the relationship between the *Energy Law* and related domestic laws and regulations; research on energy legislation and energy systems in foreign countries; and research on the relationship between energy strategy planning, energy policies and the *Energy Law*. As the next step, further research will be conducted on energy tax forms, price and investment policy systems and legislation, energy market regulation and quota restrictions, and the inclusion of time limits and legal liabilities within the energy laws. Special topic surveys and research on energy legislation have been conducted in major energy resource producing provinces and large energy consuming provinces, such as Shaanxi and Zhejiang. Along with Tsinghua University, the Energy Law Research Society of the China Law Society, CNOOC and US experts were invited to lecture on the *US 2005 Energy Policy Law*. Australian experts were also invited to provide an introduction to Australian energy legislation.

3. A system of working relationships and liaisons has been established between relevant government departments, energy industry associations, energy enterprise groups and public research institutions. This has opened up channels of communication, which is advantageous for obtaining an extensive understanding of actual conditions, and for obtaining a comprehensive and multifaceted array of opinions from various sources regarding energy legislation. The next step is to establish a similar system of working relationships and liaisons with local government departments involved in the drafting of the *Energy Law*. Twelve issues of the *Energy Law Drafting Briefing*, which reports on drafting issues and progress, have been publicized and distributed. The mechanisms described above assure the smooth implementation of the various elements in the drafting process.

4. Proposals and suggestions of the relevant People's Congresses were incorporated into the drafting of the *Energy Law*. We maintained open communication and received positive feedback.

5. Principles of democratic and open legislation were followed in drawing up the *Energy Law*.

Specifically:

- We have incorporated public participation in formulating the *Energy Law*. Beginning May 1, 2006, we sought input on the *Energy Law* through questionnaires via the media and the internet, in order to compile feedback from all sectors of society. Public participation mechanisms included phone calls, letters, text messages, and internet chats. To date, we have received 700 items of feedback. We have undergone careful filtering, analysis, and verification of the information, and have publicized responses through the media. Valuable suggestions will be incorporated in the legislative process.

- We have increased legislative transparency. More specific tasks include (1) regular publicizing of reports on the drafting of the *Energy Law*, including developments and problems (eleven such reports have been put forth). These were to relevant domestic entities and international groups stationed in Beijing. (2) Publicizing developments in *Energy Law* formulation through the media. We took interviews with Xinhua New Agency, CCTV, and educational TV stations, and publicized *Energy Law*-related developments through the People's Daily, Economist Daily, various energy industry associations, enterprises' publications, magazines and other publications. (3) We organized a symposium with the Chinese People's Party Consultative Committee (CPPCC) members and readers of the CPPCC publication, at which ten CPPCC members and two members of its standing committee were present to express their opinions and provide reference and consulting to legislation efforts.

- We have included domestic and international efforts in the legislative process. For domestic experts, we established the *Energy Law* drafting small group in March 2006, with sixteen experts in energy, law, economics, and public administration. In addition, in the process of drafting the law, when we encounter issues with energy tax systems and pricing, we immediately invite relevant experts to participate in informal discussions to aid the legislation process. Regarding international experts, we are currently working with relevant international groups stationed in Beijing to convene the *"International Forum on China's Energy Law."* There will be 10 international experts in attendance to speak about their experiences with energy legislation.

- We are publicly seeking opinions regarding the *Energy Law* draft. Beginning in June 2006, we have collected feedback from the 16 small group members and experts, and are designing and comparing several legislative models. We have formulated two to three main principles, plans, and content areas, and will make alterations and improvements after the models undergo discussion by the national energy departments. We designed drafts of the baseline principles, clauses and activities for this year, and we are working to submit the draft plan by the end of 2007. At the appropriate time, we will publicize the draft, hold domestic and international seminars, allow the draft to undergo testing and verification, and allow for the public comment on improvements to the law. Concurrently, we will hold the *"International Forum on the China Energy Law Draft,"* where we will invite international experts to share suggestions for improving the law.

IV. Legislative goals of China's *Energy Law*

The Energy Law plays an important role in the energy law and regulation system. It can be characterized as a basic energy law, mainly addressing fundamental, comprehensive, and general issues in the energy sector. The legislative purposes of the *Energy Law* are the following:

1. To guarantee the implementation of energy strategies. The *Energy Law* can help China's energy strategies and comprehensive, long-term energy policies to be synthesized into a system of laws. Such developments would allow for greater enforcement of guarantees and more stabilizing mechanisms in energy strategy implementation, and would provide a legal basis for the government to formulate and implement more specific energy policies.

2. To guarantee national energy and economic security. The *Energy Law* will encourage the exploration and development of energy resources, strengthen international energy cooperation, improve the energy reserve and energy emergency system, promote innovation in energy technology, promote the development of renewable energy and new energy resources, promote energy efficiency improvement, and ensure the security of the energy supply.

3. To create a resource-efficient and environment-friendly society. Formulating the *Energy Law* will allow for optimization of the energy industry structure, restrict the development of energy-intensive and heavy-polluting industries, promote the development of a recycling economy, and develop a mode of economic growth characterized by low energy consumption, low pollution levels, and high efficiency. At the same time, the adjustments of rights and obligations put forth in the *Energy Law* will promote compliance with energy-efficiency and clean energy goals throughout society, which is key to ensure the building of a resource-efficient and environment-friendly society.

4. To improve energy production safety. The *Energy Law* will improve awareness of energy production safety issues, improve energy production safety systems, specify safety standards, promote innovation in safe energy production technologies and management, and improve energy production safety.

5. To perfect the energy regulatory systems and mechanisms, and standardize the actions of market entities. The *Energy Law* will standardize institutional structures and arrangements

within energy regulatory bodies, management systems and operational mechanisms, and will standardize the behavior of the government, enterprises, consumers, and other market entities with regard to energy development and utilization.

6. To promote innovation in energy-related science and technology from independent sources. Through formulating the *Energy Law*, China will have specific standards regarding the development of science and technology related to energy and its utilization. There will also be patent protection and other policies concerning energy technology, and enterprises will have greater capability for independent innovation, thus promoting innovation and progress in energy science and technology.

7. To improve China's energy law system and promote administration according to law. The *Energy Law* will provide guidance for the formulation and revision of individual energy laws, will resolve inconsistencies between energy laws themselves and between energy and non-energy related laws, and will enable the structure and content of China's energy law legislative system to be concise, comprehensive, and consistent.

8. To actively address the enormous challenge of climate change. According to the different stages of China's social and economic development, we must formulate long-term and consistent measures and policies, along with intermediate goals, to control and reduce greenhouse gas emissions in cooperation with the international community.

In sum, we must pool the wisdom and efforts from diverse sources, continue to make energy legislation more open and transparent, and strive to draft an *Energy Law* that is innovative, operable, robust, consistent with the particular conditions in China, and focused on the future.

Long-Term Implementation of Energy Intensity and Efficiency Standards: Moving Towards Cleaner Energy and Lower Carbon Emissions in 2050

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The Energy Foundation

In 1980, during the early stages of the "Reform and Opening-up" period, Deng Xiaoping put forth a three-step plan for economic growth, with development goals for 2000, 2020 and 2050. From 1980-2000 China succeeded in quadrupling GDP while only doubling energy use. It was an extraordinary achievement in the history of the world's economic and energy development.

China's economy is continuing to develop rapidly, with the 2020 economic goals quadrupling relative to 2000 levels. In order to safeguard China's energy supply, energy-efficiency, institutional improvement, environmental protection, government management, and market-driven sustainable energy development strategy, we need to continue to implement strategies that prioritize energy efficiency, repeating the more sustainable energy consumption trend of 1980-2000. However, developments during the Tenth Five-Year period have deviated from the 2020 strategic goals. Fast-paced economic growth has relied on high inputs of natural resources, high consumption, high pollution, and low efficiency. This kind of development path has caused natural resource waste, worsening environmental conditions, threats to public health, and dependence on foreign resources, bringing unprecedented challenges to the *2020 Energy-Efficiency and Sustainable Energy Development Strategy*.

In the past twenty years of China's energy strategy, the 11th Five-Year Plan (2006-2010) is the first to include limits on energy consumption per unit GDP. Emphasizing energy efficiency, the Plan has led to the establishment of quantitative standards, which have provided a workable way to measure developments in management, policy and strategy. Efficiency standards address the core issue of ensuring China's long-term, sustainable energy development. For a country that is currently modernizing rapidly, but has a relatively resource-impoverished population, the issue of reducing energy consumption while growing economically is clearly important.

In the 26 years since reform and opening-up, China has maintained a rate of economic development that the world has rarely seen. According to the 2020 and 2050 development goals, China is to continue this impressive growth for the next 40, or even 70, years. Deng Xiaoping already established the 2020 and 2050 economic development goals; now, quantitative standards have been added to the population, energy-saving and environmental protection agendas. The addition of such standards can improve China's economic structure, and can ensure China's economic health for the next 50 years.

Energy efficiency goals are a fundamental part of environmental and global warming mitigation strategies. Global warming is a global challenge; according to a World Bank report, one fifth of the health conditions in developing countries can be attributed to global warming and other pollution problems, costing millions of lives. Increasingly, scientific data shows that global warming is an irrefutable phenomenon that humanity must come together to address.

According to 2004 global warming impact data, global warming's potential for destruction in China is enormous. China's droughts and floods will increase, and glaciers will retreat (glaciers in the western mountainous regions have already been reduced by 21 percent in the last two decades and will only continue to recede at an expedited rate), posing a grave threat to China's already limited water resources. By the end of this century, agricultural production costs will increase, with production decreasing and capacity falling by roughly 10 percent. Within the same timeframe, sea levels in the five coastal regions will rise by at least 30 to 60 centimeters. Freshwater supply and quality will diminish. In 2006, Beijing suffered frequent sandstorms, and Chongqing experienced an unprecedented 20 consecutive months of record high temperatures. Southern China has experienced extreme flooding, the north drought, and the frequency and damage inflicted by typhoons has increased significantly. These are insufferable consequences that demonstrate the danger global warming poses to China and the rest of the world.

Thus far, we have reached the following consensus on global warming: atmospheric carbon dioxide must stabilize at 450 ppm in order to keep global temperatures from rising beyond 2 degrees Celsius. According to China's current mineral resource consumption and carbon dioxide emissions levels, it is likely that before 2030, China will become the largest carbon-emitting country in the world. If, in the few Five-Year Plans before 2020, China can meet consecutive 20-percent energy intensity reduction targets, it will be possible to realize the goal of only doubling energy consumption while quadrupling GDP. Looking towards 2050, there are a number of consecutive challenges China must overcome in order to meet it's efficiency targets: maintaining rapid economic growth with only slight increases in fossil resource use (i.e. carbon emissions); maintaining rapid economic growth while holding fossil resource use constant; and finally, maintaining rapid economic growth while reducing fossil resource use. The ultimate objective is to ensure that 2050 carbon emissions remain at the average 2030, or even 2020 levels. China's ability to implement these objectives will significantly influence growth in other developing countries, and the overall global efforts to mitigate global warming.

The challenge now lies in addressing the shorter-term issues of the 2020 goals, while keeping in mind the longer-term 2050 interests. In order to reach the 2050 goals, the current 2020 strategies need to take on a more far-sighted approach by considering these questions: Can China ensure stable economic growth in a sustainable manner? Will China's objective of building a harmonious society ensure long-term peace and stability? Can China's sustainable energy development meet the needs of rising living standards? Will we recognize the responsibilities that China must fulfill with regard to global warming? Every effort in the present must correspond with the 2050 plan.

There are many possible scenarios for the state of China's energy in 2050. The government is currently formulating the 2030 national energy strategy, and it is time to decide if China will take a sustainable energy development path. In order to meet Deng Xiaoping's 2050 goals, the 2020 and 2030 energy plans must mutually reinforce sustainability, utilizing energy efficiency and renewable energy standards to accomplish our energy goals.

China Sustainable Energy Program
Renewable Energy Program Strategy

Overarching goal: Encourage bulk purchases of renewable energy by China's electric utilities and independent power producers in order to drive down the cost and speed the adoption of renewable energy technologies.

Goal #1: Help China set and meet aggressive targets for national and provincial renewable energy deployment, particularly by using renewable portfolio standards, public benefits charges, incentives for distributed generation technologies, and renewable energy pricing regulations.

Means:
We can achieve this goal by helping China do the following.
1. Per *Renewable Energy Law* mandate, adopt and enforce a legally-binding national renewable energy target.
2. Develop renewable energy feed-in tariff and cost-sharing mechanisms, and conduct pilot programs to assay their effectiveness.
3. Grant wind concessions to increase investment in large-scale wind energy development.
4. Encourage investment in distributed generation technologies and develop renewable energy microgrids.
5. Establish "green pricing" programs to increase local markets for renewable energy.

Evaluation Criteria (Key Performance Indicators):
We support and evaluate projects based on their ability to deliver measurable progress in the form of key performance indicators. We use the following metrics to monitor overall progress.
1. Whether national renewable energy feed-in tariff mechanisms are established in China and how effectively they are implemented. (Target: at least 10 percent of all electricity to come from renewable energy sources, particularly wind, by 2020.)
2. The number of megawatts of new renewable energy facilities installed as a result of provincial renewable energy policies, e.g., mandatory market share (MMS) policies and system benefits charges.
3. Whether a national wind concession policy is adopted and the amount of investment in large-scale wind development within the government-awarded concessions.
4. Whether rural microgrids are established, augmenting volume purchases of renewable energy.
5. Whether major utilities adopt green pricing programs to increase new renewable energy development.

China Sustainable Energy Program
Renewable Energy Program Ongoing Projects

Beijing Oriental Environment Research Institute

Grant Date: 11/1/2006 **Duration:** One year **Amount:** $40,000

Description: To develop a monitoring and evaluation mechanism supporting the implementation of the National *Renewable Energy Law* and regulations.

Center for Renewable Energy Development, Energy Research Institute

Grant Date: 3/1/2006 **Duration:** One year **Amount:** $80,000

Description: To develop strategies to ensure the stability of China's wind energy market.

Grant Date: 3/1/2006 **Duration:** One year **Amount:** $120,000

Description: To build the capacity of provincial governments to develop and implement plans and policies promoting renewable energy development.

Grant Date: 6/1/2005 **Duration:** One year **Amount:** $70,000

Description: To formulate detailed implementation regulations for China's *Comprehensive Renewable Energy Policy*.

Center for Resource Solutions

Grant Date: 3/1/2006 **Duration:** One year **Amount:** $180,000

Description: To build the capacity of provincial governments to develop and implement policies promoting renewable energy development.

Fujian Energy Research Society

Grant Date: 7/1/2006 **Duration:** One year **Amount:** $50,000

Description: To develop a detailed roadmap for renewable energy development in Fujian province.

Gansu Huineng New Energy Design and Research Institute

Grant Date: 7/1/2006 **Duration:** One year **Amount:** $50,000

Description: To develop an action plan to help Gansu province achieve its provincial renewable energy development targets.

Institute of Electrical Engineering, Chinese Academy of Sciences

Grant Date: 3/1/2005 **Duration:** One year **Amount:** $25,000

Description: To formulate a solar photovoltaic technology development and utilization plan for China's *11th Five-Year Plan*.

Institute of Energy, Environment, and Economy, a project of the Tsinghua University Education Foundation

Grant Date: 7/1/2006 **Duration:** One year **Amount:** $50,000

Description: To develop a program to train provincial government officials in renewable energy development and set up a fellowship program for graduate students studying renewable energy.

Shanghai Energy Conservation Supervision Center

Grant Date: 3/1/2005 **Duration:** One year **Amount:** $20,000

Description: To design a regulation and certification system for Shanghai's green pricing program.

Sichuan University

Grant Date: 11/1/2006 **Duration:** One year **Amount:** $45,000

Description: To support the development and implementation of a mandatory market share (MMS) policy for renewable energy development in Sichuan province.

China Sustainable Energy Program
Renewable Energy Program Project Updates

Goal: Encourage bulk purchases of renewable energy by China's electric utilities and independent power producers in order to drive down the costs and speed the adoption of renewable energy technologies.

Building Provincial Governments' Capacity to Implement the *Renewable Energy Law*

Approved in February 2005, China's *Renewable Energy Law* (RE Law) went into effect on January 1, 2006. The RE Law called for China to set renewable energy development targets and instructed the national and provincial governments to develop and execute plans for meeting these targets. Sixteen percent of all energy consumed in China is to come from renewable energy resources and China must have a total of 120 GW in renewable power generation capacity—30 GW of wind, 30 GW of biomass, and 60 GW of small hydro—by 2020. To support the development of renewable energy in China, the National Development and Reform Commission (NDRC) has set forth regulations and policies such as renewable energy tariff-setting and cost-sharing mechanisms. In addition, China has established targets to develop individual renewable power generation technologies.

To allow these targets to materialize, CSEP is working to build government capacity at the local and national levels to develop and carry out specific renewable energy development plans. The Center for Renewable Energy Development (CRED) is leading these efforts through the following activities (1) compiling manuals providing the technical background necessary to understand and detailing the contents of the RE Law and its supporting regulations; (2) training provincial government officials, renewable energy developers, and manufacturers on national renewable energy policies; (3) helping four provinces—Jiangsu, Gansu, Fujian, and Jilin—develop renewable energy plans as well as policies and enforcement mechanisms to put those plans into action; and (4) summarizing the experiences of these four provinces, distilling lessons and best practices for dissemination to all of China's provinces.

Tsinghua University is also working to improve RE Law implementation by building China's capacity to conduct integrated renewable energy development planning, i.e., planning that takes policy, economic, business, and social perspectives into account. Tsinghua is currently training provincial government officials in renewable energy development strategies, and is setting up a fellowship program for graduate students intending to pursue public administration or academic careers related to renewable energy development and utilization.

Recommendation: NDRC and other government agencies should promulgate all policies and regulations necessary for the implementation of the *Renewable Energy Law* as soon as possible. They should ensure that all provinces develop renewable energy development targets, and have the ability to meet those targets.

Developing Mandatory Market Share Policies to Reach National Renewable Energy Goals

Heeding the RE Law's call for China to develop a total volume target for renewable energy, NDRC recently drafted its *2020 Renewable Energy Development Plan* and *Renewable Energy Target Allocation Plan*, which sets forth ambitious national renewable energy development targets: by 2020, 16 percent of all primary energy consumed in China is to come from renewable sources and China is to have 120 gigawatts (GW) of renewable power generation capacity.

One form of regulation that can help China reach these targets is a mandatory market share (MMS) policy, which requires utilities to supply or purchase a specific percentage of electricity from renewable energy sources. Utilities are permitted to achieve their renewable energy goals through the installation of renewable facilities and/or purchase of tradable renewable energy credits. CRED and international consultants from the Center for Resource Solutions (CRS) are now working with policymakers in China's central and provincial governments to develop a national MMS policy and implementation strategy.

In addition to its work on national MMS policies, CRED has established MMS targets of 14 percent in Fujian Province and 10 percent in Sichuan Province by 2015. The Fujian Energy Research Society and Sichuan University are now implementing these targets in two MMS pilots projects, with support from CRED and international guidance from the World Bank and Global Environment Facility's China Renewable Energy Scale-up Program,.

We are also supporting the Gansu Huineng New Energy Design and Research Institute (GNEDI) to work with CRED to develop a renewable energy development plan for Gansu province, a wind- and biomass-rich province in northwestern China. Gansu's provincial government recently committed to large-scale renewable energy development, with plans to install 1,000 MW of wind farms by 2010 and 4,000 MW by 2020, while developing a local wind industry. The province is also interested in using its abundant agricultural and forestry biomass both for grid-connected power generation and distributed renewable energy microgrids in rural areas.

Recommendation: NDRC should require at least fifteen percent of all electricity produced in China to come from renewable sources by 2020, using renewable energy market share requirements to meet this national goal.

Establishing Public Benefits Funds Supporting Renewable Energy Development

Wires charges, also known as public benefits charges or system benefits charges, are small surcharges collected from either generators or consumers on all kWh flowing through the transmission and distribution grid. These funds can be used to support energy efficiency, renewable energy, and energy technology research and development programs.

The newly-approved RE Law mandates the establishment of a public benefits fund (PBF) to support renewable energy development. This is a tremendous development; PBFs are an effective way to facilitate the institutionalization of renewable energy investment in China's emerging competitive electricity markets, creating durable mechanisms to steer China's power generation decisions toward a low-carbon path. The PBF was created by the Ministry of Finance (MOF), with collaboration and support from NDRC and CRED. MOF released the national PBF scheme early in 2006 and grantees are helping MOF and NDRC to finalize the administrative scheme.

In addition to this renewable energy PBF, we are supporting the development of plans for a national energy efficiency PBF: last year, after reviewing domestic and international clean energy funds, NDRC's Energy Research Institute (ERI), CRED, the Beijing Energy Efficiency Center (BECon), NDRC's Institute of Economic Research (IER), and MOF's Financial Research Institute designed a PBF that uses utility-funded wires charges, higher electricity rates reflecting environmental costs, pollution fees, and government financing to support energy efficiency and renewable energy projects. Hebei, Fujian, and Jiangsu provinces have already established local PBFs supporting the implementation of demand-side management (DSM) programs that are serving as important models for the development of the national PBF.

Recommendation: China should establish a national PBF that provides matching funds to provinces for energy efficiency and renewable energy.

Improving Wind Concession Projects

Wind concessions are another tool used to increase renewable energy use. A wind concession is a grant of land in a wind-rich area, awarded through competitive bidding to the developer that can provide wind electricity at the lowest price per kilowatt-hour. Utility companies then enter a power purchase agreement (PPA) with the developer, agreeing to purchase the electricity produced at the developers' bid price. The combination of wind concessions and PPAs increases wind energy investment and stimulates competition among wind energy providers, lowering the price of wind energy.

With international assistance from CRS, CRED evaluated factors affecting wind power prices, and drafted a policy framework, wind power tariff structure, implementation strategy, and comprehensive guidebook for wind concession projects in China. In 2006, NDRC approved three rounds of concession projects totaling 1,150 megawatts (MW) of capacity and representing an investment of approximately US $1.1 billion. Winning bids have ranged from 4.8 to 6.8 U.S. cents/kWh, a significant reduction from the cost of previous wind farms. In August 2006, an additional 700 MW were tendered. In the fourth round of concessions, wind turbine manufacturers were encouraged to participate in bidding in conjunction with wind developers, a policy designed to promote the growth of a domestic manufacturing industry. There are difficulties, however, such as developers' posting of unrealistically low bids to win contracts, a concern that CRED is currently assessing and working to mitigate.

Recommendation: China should develop officials' capacity to tender wind concession projects to expedite project approval and ensure a stable wind market. Procedures and criteria for selecting the winning bids should be consistent and transparent and formulated so that the best overall bids win the concessions.

Establishing Tariffs and Cost-sharing Mechanisms for Grid-Connected Renewable Energy

Developing and institutionalizing appropriate tariff-setting and cost-sharing mechanisms is essential to implement and enforce the RE Law's mandatory renewable energy development targets and requirement that utilities purchase all qualified renewable energy power at a fixed power tariff..

CRED and Tsinghua University, with guidance from the Energy Bureau and NRDC's Department of Pricing, developed analytic principles and economic assessment tools to determine tariff levels for various renewable energy technologies, and to establish incremental cost-allocation schemes. With CRED and Tsinghua University's analysis in hand, NDRC developed, and subsequently promulgated, tariff-setting and cost-sharing regulations. Unfortunately, the new tariff-setting regulations eliminate wind energy feed-in tariffs, and instead, require bidding to establish wind energy tariffs. We are working to evaluate the impact of this unexpected change.

Recommendation: Electricity tariffs should incorporate the higher up-front costs of renewable energy technologies. Returns on renewable power investment should be at least that of investing in conventional coal-fired power generation.

Facilitating Wind Power Industry Development

China relies heavily on foreign loans and imported wind turbines to develop its abundant wind resources. To develop local capacity and reduce costs, the Chinese government aims to develop large commercial wind projects using local manufacturers. China has succeeded in developing a moderate domestic market through a series of wind concession projects. However, a lack of strong domestic manufacturing, service, and maintenance capacity remains a barrier to meeting NDRC's latest plan, installing at least 30 GW of wind generation capacity by 2020.

Last year, CRED worked to tackle this barrier, creating a wind industry development roadmap delineating the most effective ways to build wind turbine manufacturing capacity in China. The roadmap focuses on increasing domestic research and development to develop China's wind turbine production capacity.

NDRC's recent decision to eliminate wind energy feed-in tariffs, however, threatens the stability of China's wind market and China's ability to meet its wind energy development targets. CRED is working this year to (1) predict the impact this decision will have on China's wind market; (2) compare the impact that competitive bidding and production quota approaches generally have on wind industry investment; and (3) develop strategies, including the possible revision of China's wind power tariff-setting mechanisms, to ensure the stability of the wind market. CRED will also measure wind resources in China, identify the most suitable geographic areas for wind development, devise plans to integrate wind farms in the central power grid, and launch pilot programs that construct 1,000 MW-scale wind farms in wind-rich provinces—potentially Gansu, Hebei, and Inner Mongolia.

Recommendation: China should encourage bulk wind energy projects to increase market demand for local wind turbines and attract investment into the wind industry.

Developing Green Electricity Pricing Programs

The higher up-front development costs of renewable energy are a principal barrier to renewable energy use and commercialization, particularly in China, where costs are currently borne only by customers living adjacent to generation facilities. Green pricing, a program allowing customers to pay a small surcharge on their electricity bills to cover the incremental cost of renewable energy, supports greater utility investment in renewable energy.

With international assistance from CRS and co-funding from the World Bank, the Shanghai Energy Conservation Supervision Center (SECSC) and the Shanghai Economic Commission have designed a green pricing program for Shanghai, making Shanghai the first city in China to implement a green pricing program. In late 2005, fifteen industrial enterprises became the program's first participants, agreeing to purchase the entire output of a 20 MW wind farm in Shanghai. The Shanghai Municipal Government recently expanded the green pricing program to include residential users, and is considering developing a 100 MW wind farm, per SECSC's recommendation. Shanghai's green pricing program is a prime exemplar for replication nationwide.

Recommendation: The central government should encourage more cities to adopt green pricing programs and more utilities to develop new renewable energy power generation projects, in order to expedite the commercialization of renewable energy in China.

Advocating Distributed Renewable Energy Development

Conventional energy policies perpetuate inequitable access to electricity. In 2000, China's four richest coastal provinces consumed about two and a half times as much energy per household as poorer interior provinces, and many rural households remain with electricity. The Chinese government is addressing these inequities, investing billions of dollars in rural energy development. Conventional energy policies, however, emphasize a centralized distribution system of commercial energy, a high cost approach to rural electrification that increases fossil fuel use.

Distributed renewable energy microgrids can provide a cost-effective and clean alternative to costly utility grid (transmission line) extensions. There are barriers to their use, however, including high capital costs, unclear incentive policies, and a lack of institutional support from the central government. The China Energy Research Society (CERS) recently analyzed ways to overcome these barriers through government policies and financing mechanisms. They drafted the *Study of Investment Mechanisms for Off-Grid Electricity Generation Systems in Rural China* and recommended that the government increase its investment in rural off-grid distributed generation systems, including a subsidy program for remote, rural households.

Other groups have also been examining the issue of renewable energy for rural areas. In 2004, Tsinghua University analyzed current and projected future rural energy demand—evaluating various scenarios and developing a rural energy consumption indicator system for 2020—and identified policy options to promote distributed renewable energy development in rural areas. In addition, in 2005, the Chinese Academy of Sciences' Institute of Electric Engineering assisted NDRC's Energy Bureau to develop China's *11th Five-Year Plan for Solar Photovoltaics*.

Recommendation: The State Council should incorporate distributed renewable energy power generation and rural energy development into its *Western Development Plan* and provide financial incentives to spread renewable energy microgrids to remote areas.

China Sustainable Energy Program
Electric Utilities Program Strategy

Overarching goal: Steer investments in China's power sector away from fossil fuel-based electricity generation toward energy efficiency and renewable energy.

Goal #1: Help China develop and implement policies that maximize energy efficiency and renewable energy use in the power sector.

Means:
We can achieve this goal by helping China do the following.

1. Develop national policies, e.g., public benefits charges, renewable portfolio standards, tax incentives, distributed generation policies, and integrated resource planning, to minimize overall power usage and maximize renewable energy generation.
2. Conduct energy efficiency and renewable energy policy pilot projects worthy of national replication in at least two provinces.
3. Apply integrated resource planning principles when siting and developing new generation facilities to inject least-cost planning principles into competitive generation markets.

Evaluation Criteria (Key Performance Indicators):
We support and evaluate projects based on their ability to deliver measurable progress in the form of key performance indicators. We use the following metrics to monitor overall progress.

1. Whether national energy efficiency and renewable energy policies are adopted and how effectively they are implemented.
2. Whether at least two provinces conduct energy efficiency and renewable energy policy pilot programs and the extent to which the policies are effective.
3. The amount of energy saved, amount of renewable energy deployed, and amount by which carbon emissions are reduced due to energy efficiency and renewable energy policies affecting the electric utilities sector.

Goal #2: Help China establish strong emissions and energy efficiency regulations for power plants in order to shift China's electricity generation investments away from coal-fired power plants toward cleaner generation facilities and demand-side energy efficiency.

Means:
We can achieve this goal by helping China do the following.

1. Adopt a cap-and-trade program for power plants based on "generation performance standards" (GPS).
2. Conduct GPS pilot programs in at least two provinces.

Evaluation Criteria (Key Performance Indicators):
We support and evaluate projects based on their ability to deliver measurable progress in the form of key performance indicators. We use the following metrics to monitor overall progress.

1. Whether national power plant emissions and energy efficiency policies are adopted and the extent to which they are effectively implemented. (Target: GPS-based policies to limit SO_2 emissions to 4.3 g SO_2/kWh by 2010 and 3.2 g SO_2/kWh by 2020.)
2. Whether at least two provinces conduct GPS pilot programs and the amount by which the programs decrease emissions and increase energy efficiency.
3. The amount of investment in cleaner generation facilities and amount of energy savings effected by GPS-based policies.

China Sustainable Energy Program
Electric Utilities Program Ongoing Projects

Beijing Energy Efficiency Center

Grant Date: 3/1/2006 **Duration:** One year **Amount:** $55,000

Description: To develop national DSM policies, advocate the reform of power sector regulatory practices to encourage DSM, and coordinate provincial DSM pilot projects.

China Electric Power Promotion Council

Grant Date: 7/1/2006 **Duration:** One year **Amount:** $50,000

Description: To identify least-cost ways to meet China's growing energy demand using integrated resource planning (IRP), build IRP capacity in China, and select pilot cities to demonstrate the use of IRP principles in planning power sector development.

Chinese Research Academy of Environmental Sciences

Grant Date: 6/1/2005 **Duration:** One year **Amount:** $70,000

Description: To develop policies and regulations to implement a generation performance standard-based pollutant emissions cap-and-trade program.

Energy Research Institute

Grant Date: 11/1/2006 **Duration:** One year **Amount:** $62,000

Description: To develop a national public benefits fund to support end-use energy efficiency and renewable energy development.

Institute of Economic Research

Grant Date: 11/1/2006 **Duration:** One year **Amount:** $60,000

Description: To support the development of power tariffs that provide incentives to energy efficiency and clean power generation.

Institute of Economic System and Management

Grant Date: 7/1/2006 **Duration:** One year **Amount:** $100,000

Description: To build the State Electricity Regulatory Commission's (SERC's) capacity to develop and enforce policies and regulations encouraging demand-side energy efficiency improvement and renewable energy use.

Natural Resources Defense Council, Inc.

Grant Date: 3/1/2006 **Duration:** One year **Amount:** $90,000

Description: To develop national DSM policies, advocate the reform of power sector regulatory practices to encourage DSM, and coordinate provincial DSM pilot projects.

Regulatory Assistance Project

Grant Date: 3/1/2006 **Duration:** One year **Amount:** $200,000

Description: To provide technical support and training to the Chinese government and research institutions in power sector regulations that encourage demand-side energy efficiency and renewable energy.

Shanghai Energy Conservation Supervision Center

Grant Date: 7/1/2006 **Duration:** One year **Amount:** $40,000

Description: To develop and implement demand-side management policies and programs in Shanghai.

State Grid Corporation Demand-Side Management Instruction Center

Grant Date: 11/1/2006 **Duration:** One year **Amount:** $60,000

Description: To continue to support the development and implementation of "energy efficiency power plants" (a demand-side energy efficiency program) in Jiangsu Province, and to support their replication nationwide.

State Power Economic Research Center

Grant Date: 3/1/2006 **Duration:** One year **Amount:** $55,000

Description: To develop national DSM policies, advocate the reform of power sector regulatory practices to encourage DSM, and coordinate provincial DSM pilot projects.

China Sustainable Energy Program
Electric Utilities Program Project Updates

Goal #1: Help China develop and implement policies that maximize energy efficiency and renewable energy use in the power sector.

Reforming Power Sector Regulation

In 2002, China's electric utility monopoly, the state-owned State Power Corporation (SPC), was divided into 11 power generation and transmission companies. To oversee the utilities industry and ensure that the companies invest in energy efficiency and renewable energy, the State Council—following the design of a multi-ministerial project that was headed by the Institute of Economic System Management (IESM)—established an independent regulatory body, the State Electricity Regulatory Commission (SERC), in 2003. To date, SERC has about 1,000 staff members in six regional and several provincial offices.

Per SERC's request, CSEP grantees, especially the Regulatory Assistance Project (RAP), have since worked with IESM to train SERC personnel. In 2005, IESM's work focused on helping SERC establish regional regulatory agencies and to formulate regulations encouraging clean energy generation and demand-side management. The following year, IESM aimed to establish utilities reporting requirements and a system of indicators, used to monitor utilities compliance with regulations on renewable power generation, emission levels, demand-side energy efficiency, and power market operation. CSEP also supported a two-month training of a senior SERC official in the U.S. with RAP, the U.S. Federal Energy Regulatory Commission (FERC), and the California Power Utilities Commission (PUC). Training focused on experiences in the U.S. regarding the government regulatory framework for the power sector, as well as the policy instruments used to regulate the utilities.

Recommendation: Electric utilities generate more revenue than any other enterprises, and government regulation of electric utilities is justified because of the substantial public interest in having reliable, efficiently- and cleanly-produced electricity. China's utility regulatory bodies will largely determine utilities' environmental impact and must safeguard these public goods. Policy-makers should:

- Mandate that utilities spend at least two percent of all revenues to mitigate the public health and environmental impacts of fossil-fuel-based electricity generation;
- Design utility sector regulations that reduce the environmental impacts of electricity production;
- Require utilities to supply or purchase a specified amount of electricity from renewable sources;
- Require utilities to invest in energy saving end-use technologies when doing so is cheaper than increasing production capacity; and
- Provide utilities with a return on energy efficiency investment equal to or greater than returns on increased production.

Developing and Advocating Demand-Side Management (DSM) Policies

China has managed its escalating power demand largely through adding new generation capacity and load management practices; institutional and policy barriers, particularly a lack of mechanisms to fund efficiency programs through electricity revenues, have prevented China from aggressively pursuing more cost-effective approaches, focused on improving end-use efficiency. With assistance from international DSM experts at the Natural Resources Defense Council (NRDC) and RAP, the State Power Economic Research Center (SPERC) and the Beijing Energy Efficiency Center (BECon) are beginning to tackle barriers to utility-financed DSM programs, educating central government policy makers in DSM and its strategic importance in improving energy efficiency.

With the assistance of SPERC, BECon, NRDC, and RAP, DSM pilot programs in Jiangsu, Shanghai, and Guangdong are achieving significant electricity savings. Jiangsu, in particular, has become a national example in DSM implementation: over the past three years, more than 1.4 billion RMB (US $175 million) in public and private DSM investment have yielded annual energy savings of over 930 million kilowatt-hours (kWh), reducing peak demand by 350 MW and saving 590 million RMB (US $74 million).

We are also supporting the development of Energy Efficiency Power Plants (EPPs), end-use energy efficiency projects designed to deliver the energy and capacity equivalent of large conventional power plants. An EPP is "constructed" by requiring utilities to purchase the energy saved through energy efficiency projects; these utility costs are then recovered through power rates. CSEP will soon begin implementing EPPs in Jiangsu province, Shanghai, and Guangdong province. Jiangsu and Shanghai have completed designs and official commitments for implementing EPPs; Guangdong is in the process of designing its EPP plans with a $600,000 grant from Asia Development Bank (ADB), which will be joined by another $100 million from ADB for implementation. The Jiangsu EPP project—developed by the State Grid Corporation DSM Instruction Center (SGC-DSMIC) with international assistance from NRDC and RAP—could cut peak electricity demand by over 600 megawatts (MW) at only a third of the cost of building a new power plant of equivalent production capacity. RAP, NRDC, and Optimal Energy will provide international best practice guidance during the development of the Guangdong project.

Recommendations:

- China should reform its tariff structures so that utilities recoup their investment in demand-side energy-saving technologies. SERC should adopt a revenue cap on utilities' electricity rates to eliminate potential conflicts of interest for utilities when implementing DSM projects.
- China should establish a national fund that provides matching funds to provinces for DSM projects.

Power Sector Scientific Planning Method Studies

China's response to power shortages has mirrored its response to the general increase in energy demand, with a turn to supply- side options, such as the addition of new power generation capacities, before tapping into cost-effective demand-side energy efficiency potentials. In the last three years, China has installed over 150 gigawatts (GW) of new generation capacity, 80 percent of which is coal-fired, and a significant proportion of which dodged proper planning processes and environmental evaluation.

We are supporting the China Electric Power Promotion Council (CEPPC) to conduct an integrated resources planning (IRP) study to: (1) define the content for a new scientific power sector plan; (2) develop a new scientific power sector planning method based on the least cost of the whole society; (3) disseminate and conduct training on scientific power sector planning to gain acceptance; and (4) select a regional power pool to conduct pilot project.

Recommendation: Government planning agencies and electric utility regulatory agencies at the national, regional, and provincial levels should ensure that utilities meet energy needs at the lowest "all-in" cost and should pursue cost-effective energy efficiency and renewable energy programs before adding new generation capacity.

Goal #2: Help China establish strong emissions and energy efficiency regulations for power plants in order to shift China's electricity generation investments away from coal-fired power plants toward cleaner generation facilities and demand-side energy efficiency.

Developing and Advocating Generation Performance Standards Programs

Generation performance standards (GPS) cap power plant emissions based on the amount of electricity produced, encouraging energy efficiency and cleaner electricity generation. Over the past three years, the Chinese Research Academy of Environmental Sciences (CRAES) and local grantees have helped GPS gain widespread acceptance in China. After conducting local GPS pilots in Zhejiang, Shandong, Shanxi, and Jiangsu provinces, CRAES developed GPS for sulfur dioxide emissions and a policy and regulatory framework ensuring GPS monitoring and enforcement in 2004.

In 2005, CRAES convinced SEPA to (1) build a GPS-based total emissions control mechanism to limit thermal power plant emissions for China's *11th Five-Year Plan*; (2) design an emissions trading program to supplement GPS and test it at the provincial level; (3) develop procedures to enforce GPS; and (4) develop GPS training programs for provincial officials. The following year, SEPA signed SO2 emissions reduction contracts with China's major power generating companies and provinces located in the two control zones (SO2 and acid rain), which put forth reduction targets and laid out the specific actions to be taken by involved parties. In the 11th Five-year Plan for Environmental Protection, SEPA adopted a total emissions cap requiring 10 percent reductions in major pollutant emissions, using GPS to allocate emissions allowances to provinces. The plan puts forth a separate allocation scheme specifically designed for the power sector, with allocations solidified by the signing of the emissions reduction contracts.

Recommendation: SEPA should develop a multi-pollutants (including carbon dioxide) generation performance standards for power plant emissions and develop regulations for GPS enforcement.

Power Tariff Study to Encourage Clean Generation and Energy Efficiency

China's power tariff-setting practices have two main problems: they (1) neglect environmental and public health externalities associated with fossil fuel-fired power generation and (2) discourage utilities from making cost-effective energy efficiency improvements. The Chinese Research Academy of Environmental Sciences (CRAES) and the Institute of Economic Research are addressing both shortcomings, developing management methods and policies to internalize environmental costs in electricity tariffs, which were submitted to SEPA,

Grantees' recommendations were also included in NDRC's latest *Implementation Methods for Power Tariff Reform*, such as economic incentives for coal-fired power plants fitted with sulfur scrubbers, as well as energy pricing options for inefficient industries. NDRC's latest tariff scheme also included a surcharge for renewable energy power generation. In the next phase of these activities, IER will design power tariff-setting mechanisms that give greater support to clean power generation and DSM.

Recommendations:

- China's electricity tariffs should fully internalize the environmental costs of electricity generation to create a level competitive playing field for energy efficiency and renewable energy.
- China should supplement electricity tariffs with pollution levies and other environmental policies.

Developing Natural Gas Power Generation Regulations and Incentive Policies

In an effort to reduce pollution and diversify power generation methods, the Chinese government is developing and implementing regulations and incentive policies to increase natural gas power generation. Since the environmental costs of conventional coal-fired power generation are not internalized in China's power tariffs, the cost of electricity generated by natural gas power plants is higher that electricity generated by conventional coal-fired plants, a condition that NDRC and SERC want to change.

A team of experts from the Energy Research Institute (ERI) and State Power Economic Research Center (SPERC) have developed pricing, investment, and market-entry policies and regulations for natural gas power generation, based on their study of natural gas power generation policies used in other countries mechanisms to efficiently utilize natural gas most efficiently, the role of power generation in natural gas market development, and the technical and economic feasibility of integrating gas-fired power plants into China's power market; and (4) ERI's reports have been submitted to NDRC and SERC for consideration.

Recommendation: China should fully internalize the environmental costs of power generation into power tariffs, and implement regulations and incentive policies that level the competitive playing field for natural gas power generation.

China Sustainable Energy Program
Buildings Program Strategy

Overarching goal: Increase building energy efficiency through the use of appliance energy efficiency standards and building energy codes.

Goal #1: Increase the energy efficiency of household appliances and equipment by using energy efficiency standards and energy labels.

Means:
We can achieve this goal by helping China do the following.

1. Train government research institutes and other parties involved in energy efficiency policy development and implementation in appliance standards analysis.
2. Develop and adopt a mandatory energy efficiency standard for at least one new appliance each year, per China's plans.
3. Develop energy labels.

Evaluation Criteria (Key Performance Indicators):
We support and evaluate projects based on their ability to deliver measurable progress in the form of key performance indicators. We use the following metrics to monitor overall progress.

1. The amount of energy saved and amount by which carbon emissions are reduced through the use of appliance standards.
2. Whether a national energy efficiency standard and energy label are adopted for one new appliance annually.
3. The extent to which appliances actually meet energy efficiency standards.
4. Whether a regular process of standards updates ("reach standards") becomes institutionalized at the national level.
5. Whether China increases its appliance energy efficiency standards development, implementation, and enforcement budgets.

Goal #2: Help China develop and implement residential and commercial building energy codes in its central and southern climate zones.

Means:
We can achieve this goal by helping China do the following.

1. Build institutional capacity in energy analysis, standards development, energy efficient building design and operation, and policy formulation.
2. Ensure building energy codes in China's central and southern climate zones are enforced.

Evaluation Criteria (Key Performance Indicators):
We support and evaluate projects based on their ability to deliver measurable progress in the form of key performance indicators. We use the following metrics to monitor overall progress.

1. The amount of energy saved and amount by which carbon emissions are reduced due to new building energy codes.

2. Whether major cities in China’s central and southern climate zones adopt and effectively implement new building energy codes.
3. The extent to which newly-constructed buildings comply with new codes.
4. Whether effective national building code implementation incentive policies, regulations, and penalties are adopted and enforced at the local and national levels.
5. Whether the analytic capacity of domestic institutions is increased, facilitating future code development.
6. Whether our six pilot cities in China’s central and southern climate zones hire and train a cadre of building inspectors to enforce building energy efficiency codes.

China Sustainable Energy Program
Buildings Program Ongoing Projects

American Council for an Energy Efficient Economy

Grant Date: 12/1/2006 **Duration:** One year **Amount:** $15,000

Description: To assist China in the revision of the refrigerator energy efficiency "reach" standard.

Alliance to Save Energy

Grant Date: 7/1/2006 **Duration:** One year **Amount:** $20,000

Description: To help China implement an energy efficient windows labeling and certification program.

Beijing Association for Sustainable Development

Grant Date: 3/1/2006 **Duration:** One year **Amount:** $40,000

Description: To accelerate the adoption of a reach energy efficiency appliance standards for room air conditioners in Beijing and Shanghai.

China Building Energy Efficiency Association

Grant Date: 12/1/2005 **Duration:** One year **Amount:** $55,000

Description: To develop national reach building codes.

China National Institute of Standardization

Grant Date: 12/1/2006 **Duration:** One year **Amount:** $45,000

Description: To assist China in the revision of the refrigerator energy efficiency "reach" standard.

Grant Date: 7/1/2006 **Duration:** One year **Amount:** $40,000

Description: To develop mechanisms to monitor and enforce compliance with appliance energy efficiency standards in China.

Grant Date: 12/1/2005 **Duration:** One year **Amount:** $36,000

Description: To develop energy efficiency standards and labels for variable-speed air conditioners.

Chongqing Construction Technology Development Center

Grant Date: 3/1/2006 **Duration:** One year **Amount:** $50,000

Description: To establish local regulations and policies for building energy code compliance in Chongqing.

Chongqing University

Grant Date: 12/1/2006 **Duration:** One year **Amount:** $60,000

Description: To develop energy performance standards for both central air conditioners and large-scale commercial buildings in the Hot-Summer Cold-Winter (Central China) region.

Energy Research Institute

Grant Date: 7/1/2006 **Duration:** One year **Amount:** $35,000

Description: To develop policies to improve the energy efficiency of large commercial buildings in China.

Fuzhou Sixin Science and Technology Promotion Center

Grant Date: 12/1/2006 **Duration:** One year **Amount:** $30,000

Description: To develop policies improving the energy efficiency of large commercial buildings in China.

Guangzhou Institute of Building Science

Grant Date: 12/1/2006 **Duration:** One year **Amount:** $30,000

Description: To develop policies improving the energy efficiency of large commercial buildings in China.

Information Center of the Ministry of Construction

Grant Date: 12/1/2006 **Duration:** One year **Amount:** $20,000

Description: To develop policies improving the energy efficiency of large commercial buildings in China.

Grant Date: 3/1/2006 **Duration:** One year **Amount:** $110,000

Description: To improve building energy code implementation in China's Hot-Summer Cold-Winter (Central China) climate zone based on successful implementation mechanisms developed in Shanghai and Chongqing.

Lawrence Berkeley National Laboratory

Grant Date: 12/1/2006 **Duration:** One year **Amount:** $40,000

Description: To assist China in the revision of the refrigerator energy efficiency "reach" standard.

Grant Date: 7/1/2006 **Duration:** One year **Amount:** $60,000

Description: To help China implement an energy efficient windows labeling and certification program.

Grant Date: 7/1/2006 **Duration:** One year **Amount:** $40,000

Description: To develop mechanisms to monitor and enforce compliance with appliance energy efficiency standards in China.

Grant Date: 3/1/2006 **Duration:** One year **Amount:** $60,000

Description: To accelerate the adoption of a reach energy efficiency appliance standards for room air conditioners in Beijing and Shanghai.

Natural Resources Defense Council, Inc.

Grant Date: 7/1/2006 **Duration:** One year **Amount:** $35,000

Description: To develop policies improving the energy efficiency of large commercial buildings in China.

Research Institute for Standards and Norms

Grant Date: 7/1/2006 **Duration:** One year **Amount:** $80,000

Description: To help China implement an energy efficient windows labeling and certification program.

Shanghai Energy Conservation Supervision Center

Grant Date: 12/1/2005 **Duration:** One year **Amount:** $34,000

Description: To accelerate Shanghai's adoption of reach appliance energy efficiency standards.

Shanghai Municipal Housing Development Bureau

Grant Date: 12/1/2004 **Duration:** Seventeen months **Amount:** $50,000

Description: To develop incentive policies and market-driven programs for improving building code implementation in the Hot-Summer Cold-Winter (Central China) climate zone.

Shenzhen Institute of Building Research

Grant Date: 12/1/2006 **Duration:** One year **Amount:** $30,000

Description: To develop policies improving the energy efficiency of large commercial buildings in China.

Xiamen Academy of Building Research

Grant Date: 12/1/2006 **Duration:** One year **Amount:** $30,000

Description: To develop policies improving the energy efficiency of large commercial buildings in China.

China Sustainable Energy Program
Buildings Program Project Updates

Goal #1: Increase the energy efficiency of household appliances by using energy efficiency standards and energy labels.

Developing Appliance Energy Efficiency Standards

With the rising use of consumer appliances, energy efficiency standards and energy labels for appliances have tremendous potential to impact overall energy consumption in China. To date, grantee-developed standards for refrigerators, room air-conditioners, central air-conditioners, fluorescent lamps, clothes washers, and television sets have been adopted by the Chinese government. By 2020, these standards could cumulatively save 300 million metric tons of coal equivalent (tce) and reduce carbon dioxide emissions by 734 million tons ($MtCO_2$).

In past years, China has focused on setting easy-to-meet standards, enforced within six months of issue and designed to eliminate the least efficient 15 percent of products on the market. Grantees are now encouraging China to shift towards "reach" energy efficiency standards, which "reach" for the efficiency levels of the most advanced products on the international market, and are typically enforced three years after being established. China's new standards for refrigerators, air conditioners, fluorescent lamps, and TVs are all reach standards. Grantees have also worked to develop standards for power supplies and gas heaters; these standards were submitted to the Standardization Administration of China (SAC) for approval in December 2005.

Continuing the expansion of product standards, the China National Institute of Standardization (CNIS) is now developing an energy efficiency standard for a new type of air conditioner on the Chinese market, the variable-speed air conditioner (VSAC). VSACs can significantly decrease air conditioner energy consumption because unlike one-speed air conditioners, which permit only on/off settings, VSAC fan motors can change speeds, thus allowing for air flow to be adjusted to cooling needs. As VSACs are relatively new to the Chinese market, developing a national energy efficiency standard and label now can shape market development to favor more energy efficient models, with significant implications for carbon emissions: enforcing standards and requiring labels for VSACs could reduce carbon dioxide emissions by approximately 9.2 million tons ($MtCO_2$) by 2015.

Enforcing Appliance Energy Efficiency Standards

In addition to continuing development of new appliance energy efficiency standards, we are working to ensure that adopted standards are properly implemented. Doing so requires that accurate information on implementation status can be collected and assessed.

CNIS and Lawrence Berkeley National Laboratory (LBNL) are now in the second year of a three-year project, working to improve appliance energy efficiency standards implementation by developing mechanisms to monitor and enforce manufacturers' compliance. After developing an appliance standards monitoring and enforcement framework last year, CNIS and LBNL will turn to more narrowly focused projects, including the development of detailed implementation regulations, and the strengthening of industrial associations' supervision of manufacturers' compliance and labeling. Grantees will also work to expand policies to the national level, advocating national adoption of implementation regulations, and examining the feasibility of establishing a mandatory certification system in China.

Refrigerator "Reach" Standard Revision

China adopted its current refrigerator efficiency standard several years ago, including a "reach" standard that takes effect in mid-2007. However, the average refrigerator being sold in China already has an energy performance that is 30 percent *better* than the 2007 standard; this is because most of China's refrigerators were originally built to the standards of the international export market. The China National Institute of Standardization (CNIS) has received approval to prepare a new, more stringent standard that "reaches" for best international practice.

In December 2006, CSEP will begin supporting CNIS, ACEEE, and LBNL to revise China's reach refrigerator standards. Grantees will (1) compare the Chinese standard with international best practice in both standards and labeling; (2) assess technical options for cutting energy use; (3) revise the refrigerator standard; and (4) submit the new draft standard to the Standardization Administration of China for approval.

Implementing Appliance Standards Ahead of Schedule in Pilot Cities

Our strategy for improving implementation of appliance standards is that of encouraging individual cities to implement standards ahead of the national schedule. Pilot projects create initial markets for energy efficiency products, provide information pertinent to developing and refining enforcement mechanisms, and build momentum for national adoption of efficiency standards.

Shanghai and Beijing are the current focus of our pilot programs. After the Shanghai Energy Conservation Supervision Center (SECSC) assessed the feasibility of accelerating the adoption of national reach standards for various appliances, the Shanghai municipal government and Shanghai People's Congress agreed to adopt the national reach standard for room air conditioners ahead of the national schedule. SECSC is now developing enforcement policies and mechanisms in Shanghai.

The Beijing Association of Sustainable Development (BASD) and LBNL have also been working to accelerate standards' adoption in Beijing. BASD and LBNL are analyzing data critical to policymakers, including (1) profiles of room air-conditioners currently on the market in Beijing; (2) the total energy savings and reduction in peak electricity demand that would come from adopting the standard; and (3) the cost-effectiveness of accelerated adoption of the standard and adoption of supporting policies. Upon completion, BASD and LBNL will disseminate their recommendations to government agencies, industrial stakeholders, and the media.

Recommendation: In advance of the national schedule, Shanghai's and Beijing's municipal governments should develop and implement aggressive standards for the most energy-consumptive appliances and equipment sold within its jurisdiction. Such action will alleviate peak electricity demand and help to prevent power shortages, while establishing these cities as leaders in sustainable development.

Developing Appliance Energy Efficiency Labels

In addition to energy efficiency standards, we promote two kinds of labels to increase purchases of efficient products: (1) endorsement labels which are affixed to products whose energy efficiency is substantially higher than required; and (2) information labels, which categorize products according to their energy efficiency levels, providing consumers with information of appliances' efficiency and lifecycle energy costs. With our support, both endorsement and information labels are currently in use in China.

The first endorsement label developed in China pertained to standby power, the electricity used to power memory and remote control settings while appliances are "off." Potential energy savings from decreasing standby power are vast: in China, standby power leakage is more than three times higher than in the U.S., and represents as much as 10 percent of all residential electricity use. With grantee assistance, China's first standby power endorsement label, for TVs, was adopted in April 2002. In 2003, China developed standby power endorsement labels for five more products: DVD players, copiers, printers, fax machines, and power supplies. China is now piloting the use of these six voluntary standby power endorsement labels.

While manufacturers may voluntarily affix labels to differentiate their products from competitors', CSEP grantees are also engaged in the development of mandatory energy information labels. With help from grantees, the National Development and Reform Commission (NDRC) launched a nationwide mandatory information label program in March 2005, with pilot projects for refrigerator and air conditioner energy information labels. Manufacturers are now required to attach labels to all refrigerators and air conditioners. The program has met early success: Vice Premier Zeng Peiyan recently commended the labeling program for promoting the production and use of energy efficient products. Now CNIS is working to evaluate, improve and expand the program, and is developing plans to cover three more products: washing machines, unitary air conditioners, and water chillers. On the implementation front, CNIS is training local supervision authorities and energy conservation centers on how to ensure local compliance with the mandatory labeling program. CNIS is also working with the Collaborative Labeling and Appliance Standards Program (CLASP) to translate into Chinese and publish the recently-completed second edition of *Energy Efficiency Labels and Standards: A Guidebook for Appliances, Lighting, and Equipment.*

Developing Set-top Box Energy Efficiency Endorsement Labels

Set-top boxes (STBs), also known as Digital Television Adapters, provide access to digital television for existing analog television sets. Complex STBs perform a variety of functions, including recording, interactive programming, and decoding of encrypted signals; they can also waste up to 25W in standby mode. With the rapid growth in the STB market—by 2015, 300 million households should be converted to digital cable—improving the efficiency of STBs is critical in energy consumption reduction efforts. Improving efficiency by 20 percent by 2015 would reduce carbon dioxide emissions by more than 14 million tons ($MtCO_2$), and obviate the need for four large (500-MW) coal-fired power plants.

The China Certification Center for Energy Conservation Product (CECP), LBNL, and the National Resources Defense Council (NRDC) developed a STB energy efficiency endorsement label and plans for its implementation. Since STBs are a recent addition not only in China but in the international market, these grantees worked with international organizations to coordinate China's STB testing standards with those in the U.S., Europe, and Japan. The labeling system is expected to be adopted and put to use by the end of this year.

While we initially intended to support the development of mandatory STB energy efficiency standards this year, the project team discovered that the Chinese STB market is still too small, and that basic STB performance requirements—preconditions for setting appropriate energy efficiency requirements—have yet to be established. We will support the development of a STB energy efficiency standard once these performance requirements have been set.

Recommendations:

- The Chinese government needs to establish mechanisms to enforce appliance energy efficiency standards and labels, and to penalize manufacturers for non-compliance.
- Government budgets should be increased to further the adoption of appliance standards, as well as to hire and train new monitoring, inspection, and verification personnel. Enforcement teams are needed to inspect appliance factories and retail stores for use of available energy efficiency labels, and to verify that all appliances offered for sale comply with the latest energy efficiency standards.

Evaluating the Implementation of Mandatory Lighting Energy Efficiency Standards

Improvements in the technology of lighting, one of the largest electricity consumers in China, have great potential for energy savings. While mandatory lighting energy efficiency standards are in place, the number of products on the market that comply with these standards is unknown. Furthermore, no penalties exist for non-compliance.

The American Council for an Energy Efficient Economy (ACEEE) and Beijing Electric Light Source Research Institute (BELSRI) are CSEP grantees working to improve the implementation of these standards. To do so, they have identified barriers to standards enforcement, and have tested products from different regions for standards compliance. ACEEE and BELSRI will also develop recommendations for improving standards compliance and upgrading existing lighting standards, to be reported to the central government.

Developing Tax and Fiscal Incentive Policies for Energy-Efficient Products

Higher prices impede the manufacture and purchase of energy efficient appliances and equipment over conventional products, a market barrier that the Ministry of Finance's Research Institute for Fiscal Science (RIFS) and CNIS have worked to overcome by developing incentive policies. To do so, RIFS and CNIS researched international tax and fiscal incentive policies to promote energy efficient products, with attention to those that have proved effective abroad. With this information, grantees formulated specific near- and medium-term policy recommendations and administration procedures; in addition, RIFS developed the first catalogue of energy efficient products to be given tax incentives by assessing the cost effectiveness of various energy efficient products. RIFS and CNIS submitted their recommendations to officials at MOF and NDRC; tax incentives for energy efficient equipment are likely to be adopted soon.

Recommendation: NDRC and MOF should expedite the development of national tax and fiscal policies to promote energy efficient products.

Goal #2: Increase buildings' energy efficiency by helping China develop and implement residential and commercial building energy codes in its central and southern climate zones.

Implementing Building Codes in the Hot-Summer Cold-Winter (Central China) Climate Zone

Residential and commercial building energy codes have been issued for China's Hot-Summer Cold-Winter (HSCW; Central China) Climate Zone—a vast area in east-central China—but enforcement has been weak and inconsistent. To initiate energy code enforcement implementation in this region, we supported implementation pilot programs in the two largest cities in the HSCW Climate Zone, Shanghai and Chongqing, both of which have proved extremely successful.

Shanghai is the national leader in building codes implementation: in August, 2005, it promulgated China's first local provisions on building efficiency, including management provisions regulating each step of the building process. Chongqing's progress in the latter half of 2006 has also been promising, with the Chongqing Construction Technology Development Center (CCTDC) developing quality control standards for energy efficient residential building construction standards, performance standards, and building materials certification standards. In August 2006, CCTDC developed regulations and policies designed to increase compliance with residential and commercial buildings energy codes in Chongqing, which were submitted to the Chongqing Municipal government for approval. CCTDC is now working with Chongqing government agencies to improve implementation of these requirements by developing standards for local implementation, strengthening supervision of construction, developing incentive policies to encourage efficient buildings construction, and establishing a labeling system of energy efficient buildings. Grantees are also conducting demonstration projects to exhibit new energy efficient building technologies and building materials.

Once Shanghai and Chongqing establish effective building code implementation provisions, the next challenge is to apply these mechanisms throughout the HSCW Climate Zone. To this end, we are promoting the institutionalization of building code implementation mechanisms similar to those in Shanghai and Chongqing, and are disseminating information on strategies to increase building energy code compliance in other HSCW Climate Zone cities. The Information Center of the Ministry of Construction (ICMOC) is (1) setting up a website and forum to disseminate policy and technical information on building energy efficiency; (2) establishing mechanisms for collecting up-to-date building energy efficiency information as it becomes available; and (3) providing training, technical support, and outreach work encouraging cities throughout the HSCW Climate Zone to establish supervision systems based on the successful mechanisms developed in Shanghai and Chongqing.

Developing Energy Performance for Central Air Conditioners and Large Scale Commercial Buildings in the Hot-Summer Cold-Winter (Central China) Climate Zone

The energy consumption of commercial buildings is more than ten times that of residential buildings per unit area in China. The electricity consumption of newly built, large-scale commercial buildings could reach 200 billion kilowatt-hours (kWh) by 2020 unless energy efficiency can be substantially improved. Because heating, ventilation and air conditioning (HVAC) systems consume between fifty and sixty percent of the total energy of commercial buildings, increasing the energy efficiency of these systems is key to achieving overall energy efficiency gains.

Starting in December 2006, the CSEP will support Chongqing University in surveying HVAC efficiency levels in Chongqing and Shenzhen, and draft an energy efficiency standard for commercial building HVAC systems. This grant will also generate policy recommendations for HVAC energy savings strategies applicable to other areas in China.

Implementing Building Codes in the Hot-Summer Warm-Winter (Southern China) Climate Zone

At the end of 2003, the Ministry of Construction (MOC) issued a new residential building code for the Hot-Summer Warm-Winter (HSWW; Southern China) climate zone, which, if effectively implemented, will reduce household energy use by 50 percent and eliminate the need for 11 large (500-MW) power plants within 10 years. To ensure effective code implementation, we are pursuing both "bottom-up" and "top-down" approaches.

At the local level, grantees have assisted MOC's implementation of the new code in Guangzhou, Shenzhen, Fuzhou, and Xiamen by developing 3-to-5-year implementation plans, local implementation regulations and policies, and review and monitoring systems for building energy efficiency (BEE) design. Grantees have also created design software and established a labeling program for the most energy efficient buildings. The experiences from these cities are not only regionally applicable, but are critical to policy development as implementation of the new national building code begins (the new code was issued in April 2005).

At the central level, MOC has developed and submitted *National Provisions for Building Energy Efficiency* to the State Council, a national plan to promote building code compliance. Grantees supported MOC in the project by developing an overall framework for monitoring the design, construction, and operation of efficient buildings. MOC also issued regulations to set up a BEE design review system and BEE monitoring system at the state level. MOC is working with cities not only in the HSWW Climate Zone, but in northern and central China, to incorporate local best practice monitoring and enforcement approaches into national policy.

In December 2006, new grants will support ICMOC, the Guangzhou Institute of Building Science (GIBS), the Xiamen Academy of Building Research (XABR), the Shenzhen Institute of Building Research (SIBR), and the Fuzhou Sixin Science Development and Promotion Center (FSSDPC) to continue building code implementation in pilot cities. Grantees will assist by (1) establishing energy efficiency management regulations for both commercial and residential buildings; (2) establishing research and demonstration projects on building energy efficiency labels and methods for collecting statistics on building energy consumption; (3) creating a building energy efficiency database; (4) developing materials standards for energy-efficient building materials; and (5) carrying out technical training on energy efficiency design and application techniques for 500 local technicians.

At the national level, ICMOC will assist the pilot cities by (1) coordinating policy research and demonstration activities; (2) organizing training exchanges and information sharing; and (3) ensuring consistency between local and central government policymaking.

Developing National Reach Building Codes

Although residential building codes are in place in China's Northern-Cold (NC), HSCW, and HSWW Climate Zones, these codes currently have significantly lower energy efficiency standards than building codes in developed countries. This disparity is causing significant energy losses: the establishment of reach residential building codes could reduce building energy consumption by an additional 15 percent from current mandated levels.

The China Building Energy Efficiency Association (CBEEA) is working with several national and regional building energy efficiency institutions—including the China Academy of Building Research (CABR) and Shanghai Academy of Building Research (SABR)—to develop national reach residential building codes. The codes should be ready to submit to MOC for review and approval by the end of 2006, and will go into effect 3-5 years after approval.

Implementing National Commercial Building Energy Codes

The success of a commercial building code pilot project in Shanghai prompted MOC to develop a national commercial building code, which was drafted by MOC with assistance from the China Building Energy Efficiency Association, the China Academy of Building Research, and LBNL. The national code was approved in April 2005 and went into effect on July 1, and its implementation has the potential to reduce carbon dioxide emissions by 870 million tons of carbon dioxide ($MtCO_2$) by 2020. We are now supporting our six HSCW and HSWW building code pilot cities to develop implementation and enforcement procedures to serve as models for national replication.

Developing Tax and Fiscal Policies to Promote Energy-Efficient Buildings

Combining strict enforcement of building energy codes with incentive policies not only promotes compliance, but can encourage developers to exceed the codes' energy efficiency requirements. Improving compliance enhances buildings' energy efficiency, while also expanding the market for new energy-efficient technologies.

The NDRC's Energy Research Institute (ERI) and NRDC have been analyzing incentive policies that serve to augment building codes and to help stimulate the efficient buildings market. In 2005, ERI and NRDC were instrumental in bringing about MOF's decision to renew China's New Wall Material Innovation Fund, which had proven effective and was originally scheduled to be closed in 2005. This year, ERI and NRDC focused on incentive policies to encourage energy efficiency in commercial buildings, which consume several times more energy per square meter of floor space than residential buildings. ERI and NRDC will (1) assess the current energy efficiency of large commercial buildings in China; (2) research international best practices in efficiency codes and fiscal incentive policies for large commercial buildings; (3) analyze barriers to improving energy efficiency in large commercial buildings in China; and (4) develop policies to overcome those barriers.

Implementing China's Energy Efficient Windows Program

Windows, accounting for an average of 25 to 30 percent of buildings' energy loss, are essential to the construction of efficient buildings. With international assistance from LBNL, energy code expert John Hogan, and Alliance to Save Energy, RISN worked to combat this problem by designing a labeling program for efficient windows, The program is aimed at developers and designers needing to meet energy-efficiency code requirements, and is designed to eliminate inefficient windows from the market, increase building code compliance rates, reduce heating and cooling energy consumption by up to 30 percent, and reduce discomfort and noise within buildings. After a pilot program was conducted in Guangdong Province by the Guangdong Provincial Academy of Building Research (GABR), RISN submitted the program and implementation plan to MOC ministers in early 2006.

We are now supporting efforts to expand the implementation of the energy efficient windows labeling and certification program nationwide, focusing on capacity building and research: grantees will (1) train building officials, designers, inspectors, and manufacturers at the national and local levels in how to implement the program; and (2) help China establish laboratories to evaluate window energy efficiency. In September 2006, RISN completed the Management Provisions on Labels of Energy Efficient Windows, which was submitted to MOC for approval.

Supporting Chinese Delegates' at the American Council for an Energy-Efficient Economy Summer Study

The American Council for an Energy-Efficient Economy (ACEEE) hosts a biennial summer study on building energy efficiency, the premier conference of its kind, attended by over 700 leading energy efficiency advocates and international experts. This year, we supported the attendance of six Chinese building energy efficiency experts, who had the opportunity to consult with the foremost international experts in building energy efficiency, comparing Chinese and international best practices. Attendees presented papers and attended formal conference sessions; in addition, informal sessions afforded the chance for Chinese participants to describe their projects in China and to engage in discussions with summer study attendees within their field.

China Sustainable Energy Program
Industry Program Strategy

Overarching goal: Help China develop and implement policies that increase energy efficiency in the industrial sector.

Goal #1: Help China develop and utilize industrial energy efficiency agreements to increase the energy efficiency of its most energy-intensive industrial enterprises.

Means:
We can achieve this goal by helping China do the following.

1. Set energy efficiency targets for China's highest-energy-consuming industrial sectors.
2. Develop regulations and incentive policies, particularly tax and fiscal policies, to compel enterprises to set and meet strong energy efficiency targets.
3. Evaluate and monitor companies' progress in reaching energy efficiency targets.

Evaluation Criteria (Key Performance Indicators):
We support and evaluate projects based on their ability to deliver measurable progress in the form of key performance indicators. We use the following metrics to monitor overall progress.

1. The number of metric tons of coal equivalent (tce) of industrial energy saved and amount by which carbon emissions are reduced through the use of industrial energy efficiency agreements.
2. Whether energy consumption per unit industrial output decreases.

Goal #2: Help China develop and implement mandatory energy efficiency standards for industrial equipment.

Means:
We can achieve this goal by helping China do the following.

1. Develop and implement mandatory energy efficiency standards for major industrial equipment, focusing on the most carbon-intensive equipment first.
2. Develop energy labels for industrial equipment.
3. Establish supervision systems at the national and provincial levels to monitor standards compliance and labels use.
4. Develop incentive policies to promote the manufacture and use of energy efficient equipment.

Evaluation Criteria (Key Performance Indicators):
We support and evaluate projects based on their ability to deliver measurable progress in the form of key performance indicators. We use the following metrics to monitor overall progress.

1. The number of metric tons of coal equivalent (tce) of industrial energy saved and amount by which carbon emissions are reduced through the use of industrial equipment standards.
2. Whether mandatory energy efficiency standards and energy labels for major equipment are adopted.
3. Whether manufacturers implement energy efficiency standards effectively.

4. Whether a regular process of standards updates ("reach standards") becomes institutionalized at the national level.

China Sustainable Energy Program
Industry Program Ongoing Projects

Peking (Beijing) University

Grant Date: 12/1/2006 **Duration:** One year **Amount:** $40,000

Description: To develop policies to guide the National Development and Reform Commission's Top-1,000 Enterprise Energy Efficiency Program.

Grant Date: 12/1/2005 **Duration:** One year **Amount:** $100,000

Description: To set energy efficiency targets and develop regulations, incentive policies, and monitoring mechanisms for the Top-1000 Enterprises Energy Efficiency Program.

China Energy Conservation Association

Grant Date: 4/1/2006 **Duration:** One year **Amount:** $18,000

Description: To promote the nationwide use of energy efficiency agreements in the industrial sector through an information exchange platform.

China National Institute of Standardization

Grant Date: 7/1/2006 **Duration:** One year **Amount:** $30,000

Description: To develop standards governing the amount of energy consumed to produce key industrial products.

Chinese Academy for Environmental Planning

Grant Date: 4/1/2006 **Duration:** One year **Amount:** $100,000

Description: To redesign China's pollution levy in order to bolster implementation incentives for the *Top-1000 Enterprises Energy Efficiency Program*.

Energy Research Institute

Grant Date: 12/1/2006 **Duration:** One year **Amount:** $70,000

Description: To develop energy efficiency evaluation indicators to monitor the energy use of industrial enterprises participating in China's Top-1,000 Enterprises Energy Efficiency Program.

Grant Date: 7/1/2006 **Duration:** One year **Amount:** $80,000

Description: To develop statistical energy use indicators in order to monitor the energy use of industrial enterprises participating in the *Top-1000 Enterprises Energy Efficiency Program*.

Lawrence Berkeley National Laboratory

Grant Date: 4/1/2006 **Duration:** One year **Amount:** $100,000

Description: To help China set energy efficiency targets and develop regulations, incentive policies, and monitoring mechanisms for the *Top-1000 Enterprises Energy Efficiency Program*.

Shandong Association for Resources Comprehensive Utilization

Grant Date: 7/1/2006 **Duration:** One year **Amount:** $50,000

Description: To create a province-wide energy efficiency agreement program in China's Shandong province.

Tsinghua University

Grant Date: 4/1/2006 **Duration:** One year **Amount:** $30,000

Description: To improve industrial enterprises' access to up-to-date energy efficiency technology information, including development of an information dissemination system.

China Sustainable Energy Program
Industry Program Project Updates

Goal #1: Help China develop and utilize industrial energy efficiency agreements to increase the energy efficiency of its most energy-intensive industrial enterprises.

Piloting Industrial Enterprise Energy Efficiency Agreements

China's government is starting to use Energy Efficiency Agreements (EEAs)—originally developed in Europe—to improve the energy efficiency and reduce the carbon emissions of major industrial enterprises. EEAs are voluntary agreements in which individual enterprises or sectors pledge to meet specific energy savings or emission reduction targets, and are a flexible method of reaching national energy savings and air quality goals because enterprises are able to choose the energy efficiency-improving mechanisms that are most cost effective. In a pilot EEA program, the Jinan Steel and Iron Group and Laiwu Steel and Iron Group entered an agreement with the Shandong provincial government in 2003 to reduce carbon emissions by one million metric tons over the following three years. The program was a tremendous success: both steel mills met their energy savings and carbon emissions reduction targets, reducing their carbon dioxide emissions by 1.23 million tons ($MtCO_2$) from 2003 to 2006. Following such results, the Shandong provincial government established an Energy Conservation Fund to support the expansion of the EEA program throughout the province.

The Shandong Association of Resources Comprehensive Utilization (SARCU) is now helping the Shandong Economic and Trade Commission (SETC) to establish a province-wide EEA program in Shandong, with plans to require energy efficiency improvement from Shandong's 100 most energy-intensive enterprises. This Shandong Top-100 Enterprises Energy Efficiency Program (Shandong Top-100 Program) will have direct impact on the energy intensity and air quality in Shandong and China: the program is expected to reduce carbon dioxide emissions by 36.7 million tons of carbon dioxide ($MtCO_2$) by 2010, and will bring Shandong closer to its energy intensity reduction goal of 22 percent by 2010, which in turn furthers China's efforts to reduce energy intensity by 20 percent from 2005-2010. Furthermore, the program will also to provide experience pertinent to National Development and Reform Commission (NDRC) implementation of its Top-1000 Enterprises Energy Efficiency Program (described below).

Designing the China Top-1000 Enterprises Energy Efficiency Program

In April 2006, China's central government launched the *Top-1000 Enterprises Energy-Efficiency Program* (Top-1000 program), the goal of which is to improve industrial energy efficiency by targeting China's 1000 highest-energy-consuming enterprises, which currently account for an extraordinary 50 percent of total industrial sector energy consumption. The strategy for energy intensity reductions is based on EEAs, similar to the Shandong pilot. The carbon emissions reduction potential—198 $MtCO_2$—is enormous.

Ensuring that the Top-1000 program is well designed and effectively implemented will be the Industry Program's major focus over the next several years. We plan to contribute to the efforts of NDRC by developing implementation policies, and by injecting international best practice expertise in reducing industrial energy use through EEAs. Support is growing for the program to be modeled after the successful U.K. Climate Change Levy (CCL) and Climate Change Agreements (CCA) Program, which together provide an incentive for carbon emissions reductions by levying an energy-consumption tax, 80 percent of which is refunded if enterprises voluntarily meet quantified carbon emissions reduction targets. In the U.K., the CCL and CCA programs have proved enormously effective, with participating enterprises exceeding their targets three-fold, while increasing profits. To help design the Top-1000 program, we support the Lawrence Berkeley National Laboratory (LBNL) and Beijing University; recently, we also invited a member of the U.K. team that implemented the CAA Program to work in our Beijing office (funded by the U.K. government).

Implementing China's Top-1000 Enterprises Energy Efficiency Program

Our successful Energy Efficiency Agreements (EEAs) pilot program in Shandong Province has provided a model for developing China's Top-1,000 Enterprises Energy Efficiency Program (Top-1,000 Program). On July 27, 2006, Premier Wen Jiabao kicked off the Program, signing EEAs with 15 of China's largest enterprises, calling for another 985 enterprises to enter agreements with NDRC, and calling for a new National Energy Conservation Center to oversee provincial energy conservation centers that will provide technical outreach and support to Top-1,000 Program enterprises. Successfully implemented, the Top-1,000 Program would be the world's single most ambitious energy efficiency program.

Implementation will be a monumental undertaking: Needed is (1) stepped-up technical input from international best practice experts from the U.S., Europe, and Japan; (2) benchmarking and energy auditing training of the national and provincial energy conservation centers and participating enterprises; (3) targeted assistance to at least two energy-intensive sectors (such as steel and cement); and (4) comprehensive implementation in at least two provinces.

The pilot projects will proceed as follows: the project team will (1) work with steel and cement enterprises in two provinces to set enterprise energy use baselines and targets; (2) develop performance indicators for each sector; (3) distribute enterprise energy auditing and benchmarking guidelines; (4) develop a database for tracking enterprise energy use; (5) develop incentive policies encouraging enterprises to reach and surpass their energy savings targets; (6) develop model EEAs for each participating industrial sector; (7) provide training to the National Energy Conservation Center and its provincial affiliates in all EEA steps and implementation measures; and (8) coordinate with the Ministry of Finance and the State Administration of Taxation to develop incentive policies and efficiency financing policies to support enterprise technical upgrades.

Promoting the Use of Energy Efficiency Agreements

Using EEAs to improve industrial energy efficiency is gaining considerable momentum: in addition to NDRC's Top-1000 Program, many cities and provinces are interested in using EEAs, and the NDRC/UNDP/GEF End-Use Energy Efficiency Program (EUEEP) will soon launch its own EEA demonstration program. Educating industrial enterprises, industrial associations, and government officials on how to design effective EEA programs will help ensure this momentum leads to real action and yields substantial results.

The China Energy Conservation Association (CECA) is now publicizing and advocating EEAs throughout China. Specifically, CECA is (1) publishing newsletters on the progress of EEA programs, including the Shandong pilot, EUEEP pilot, and the Top-1000 Program; (2) holding training and cross-project workshops; (3) maintaining a website and internet forum on EEA use in China; (4) advocating EEAs at domestic and international meetings and workshops on industrial energy efficiency; and (5) investigating opportunities to utilize EEAs in mid- and large-scale energy-intensive enterprises.

Developing Industrial Energy Use and Evaluation Indicators

The success of the Top-1,000 Program depends upon establishing sound statistical and evaluation indicators to measure energy savings and emissions levels. Beginning in 2005, we supported the Energy Research Institute (ERI) to develop a statistical indicator system, which is nearing completion. In December 2006, we will support ERI to complete its work and further develop an additional evaluation indicator system to help enterprises measure their energy use and emissions levels. Collaborating with international experts including LBNL, ERI will test the effectiveness of its evaluation indicator system by conducting case studies to examine actual use by enterprises and sectors. In addition, ERI will generate policy recommendations for submission to the NDRC regarding energy-use evaluations of the Top-1,000 Program.

Developing Policies Guiding the Top-1000 Program Development

Wang Xuejun and his team from Beijing University will work with international consultants led by Lynn Price from LBNL to assist NDRC in designing the Top-1,000 Program. The team will devise a comprehensive approach to implementing the Program, including (1) outreach and training to the new National Energy Conservation Center and provincial energy conservation centers in EEA, benchmarking, energy auditing, and technology upgrading approaches; (2) training of enterprises in evaluating energy benchmarks and setting aggressive efficiency targets; (3) facilitating provincial government involvement in monitoring and evaluating EEA progress; (4) developing incentive policies for enterprise participation in the Top-1,000 Program, to include analysis of how the pollution levy can be used to encourage enterprises to meet and/or exceed their EEAs; and (5) development of tax and fiscal policies to spur investment by enterprises in advanced energy efficiency technologies.

Redesigning China's Pollution Levy System

To promote the success of the Top-1000 Program, proper support policies, such as the pollution levy, must be in place. China's current pollution levy originated in early 1970s, and despite 2003 revisions, needs further strengthening to compel substantial emissions reductions. In response to this need, we supported Beijing University and LBNL in formulating the following program: enterprises that commit to meeting aggressive energy-efficiency targets are provided pollution levy refunds, which are then used to fund efficiency-producing mechanisms. We are now working with Beijing University and the Chinese Academy for Environmental Planning (CAEP) to develop program details and implementation plans, at the request of the State Environmental Protection Agency (SEPA).

Recommendation: NDRC and SEPA should expand the joint use of incentive policies and EEAs across China. The potential for further implementing the strategy of funding efficiency gains with pollution levy refunds should be closely examined.

Increasing Industrial Production Energy Efficiency

The amount of energy used to produce key industrial products in China is, on average, 30 to 40 percent higher than international best practices, a statistic that is largely attributable to the use of outmoded technologies in China, and production by large numbers of small-scale, inefficient industrial facilities. Although the Chinese central government plans to phase out the most inefficient facilities, policies to do so have not been developed to date.

We are now supporting the China National Institute of Standardization (CNIS) to develop standards for the amount of energy that should be consumed in producing certain industrial products. Such standards are essential in order to formulate policies phasing out small-scale, inefficient industrial facilities or requiring industrial facilities to upgrade production technologies. Furthermore, these standards can be used by industries to benchmark energy use, and can serve as baselines in efforts by government and industrial enterprises to set production energy efficiency targets.

CNIS is working with industrial associations to develop standards for several key industrial products, including steel, cement, petrochemicals, and electricity. To develop these standards, CNIS is reviewing how each product is produced, measuring the energy consumed in production, and comparing data with international best practices.

Developing Tax and Fiscal Policies Increasing Energy-Saving Technology Investment

There is little capital investment in energy-saving technology in China, due in part to the difficulty faced by enterprises in obtaining loans for technical upgrades: China's state-owned banks are unaccustomed to providing and disinclined to incur the higher service costs associated with relatively small energy efficiency loans. In addition, the status of energy cost savings as taxable revenue creates a disincentive to invest in energy-saving technology. Based on cost-benefit analysis and European, Japanese, and U.S. best practice, LBNL and the China Energy Conservation Investment Corporation (CECIC) recently formulated several tax and fiscal policies, designed to correct these market failures and thus to substantially increase energy-saving technology investment in the industrial sector.

Improving Implementation of the *Energy Conservation Law*

If China's *Energy Conservation Law* (ECL) were fully implemented, China's total energy consumption would be reduced by 800 million metric tons of coal equivalent by 2020. However, ECL is currently too general for successful implementation. In consultation with several Chinese and international experts, the South-North Institute for Sustainable Development (SNISD), a CSEP grantee, assessed the strengths and weaknesses of ECL and compared it to international best practice. Based on their analysis, SNISD recommended specific energy efficiency and renewable energy policies to make ECL more concrete, and therefore, more effective.

Increasing Industrial Enterprises Energy Efficiency Investment

The vast potential for industrial energy efficiency improvement is hindered by insufficiencies in policy enforcement capacity, information channels, and incentives. With matching funds from the China National Petroleum Corporation and help from the China National Petroleum Corporation's Advisory Center, Tsinghua University's Economic and Management School is working to address all three of these problems, and are researching the following: (1) policies and budgetary changes needed to bolster the policy enforcement capacity of government institutions regulating industrial energy efficiency; (2) energy efficiency technology information dissemination systems needed to educate industrial enterprises about energy efficiency technologies; and (3) policies to stimulate industrial enterprises' investment in energy efficiency.

Goal #2: Help China develop and implement mandatory energy efficiency standards for industrial equipment.

Developing Reach Standards for Electrical Motors

CNIS is developing "reach" energy efficiency standards for energy-consuming equipment, standards that exceed current market average, "reaching" to best international efficiency levels. Once established, manufacturers are typically given three years to raise product efficiency to the new standard.

Assisted by the American Council for an Energy Efficient Economy (ACEEE), CNIS has developed a reach standard for electric motors, which it submitted to the Standardization Administration of China (SAC) for review in January 2006. CNIS recommended SAC to adopt the standard this year, and it will go into effect in 2008. The motor standard matches those in Australia and New Zealand, just below electric motor standards in the U.S., Canada, and Mexico, and is substantially more stringent than the electric motor standard in Europe. If adopted and effectively implemented, the standard will save 44 million tons of coal equivalent and reduce carbon dioxide emissions by 77 $MtCO_2$ by 2020.

Developing Reach Standards for Water Pumps

ACEEE and CNIS recently completed a reach energy efficiency standard for clean water centrifugal pumps, the pumps most commonly used in industrial processes. ACEEE and CNIS already submitted the standard to SAC; hopefully, the standard will be adopted in 2007, and will go into effect in 2010.

Recommendation: NDRC and SAC should accelerate the development and implementation of energy efficiency standards for industrial equipment, including motors, pumps, and compressors. MOF should substantially increase budgets for standards development and implementation personnel at the national, provincial, and local levels.

China Sustainable Energy Program
Transportation Program Strategy

Overarching goal: To reduce carbon emissions and improve air quality by promoting cleaner vehicles and transportation system reform.

Goal #1: Help introduce advanced-technology, electric-drive vehicles into China's fleet in significant, and increasing, volumes.

Means:
We can achieve this goal by helping China do the following.

1. Identify the technical, economic, and institutional barriers to advanced-technology-vehicle (ATV) commercialization and delineate a feasible policy roadmap for ATV development.
2. Develop policies and standards regulating the development and sale of hybrid vehicles.
3. Secure funding for the development and industrialization of advanced-technology buses, trucks, and cars from the Asian Development Bank, European Union, United Nations Development Program, World Bank, and other international development organizations.
4. Conduct provincial and municipal pilot policy projects designed to develop ATV technical capacity and increase ATV sales in China.

Evaluation Criteria (Key Performance Indicators):
We support and evaluate projects based on their ability to deliver measurable progress in the form of key performance indicators. Overall progress includes these metrics.

1. The amount of funding allocated for the research, development, and industrialization of ATVs in China.
2. Whether China adopts policies promoting ATVs.
3. Whether provincial and municipal pilot policy projects expand local ATV technical capacity and increase ATV sales in China.

Goal #2: Increase the efficiency and reduce the emissions of conventional-technology vehicles.

Means:
We can achieve this goal by helping China do the following.

1. Develop strong vehicle emissions regulations and fuel quality standards.
2. Develop local policy pilots projects to promote cleaner vehicle technologies and fuels
3. Strengthen premier research institutions' capacity to conduct transportation sector-related technical analysis, especially their ability to model transportation-sector policies' effect on air quality and calculate fuel quality standards' impact on the cost of fuel refinement.
4. Develop and implement aggressive fuel economy standards and other regulations promoting vehicle fuel efficiency.
5. Develop national policies promoting clean and alternative vehicle fuels and fuel technologies.

Evaluation Criteria (Key Performance Indicators):

We support and evaluate projects based on their ability to deliver measurable progress in the form of key performance indicators. Overall progress includes these metrics.

1. The extent to which new conventional vehicles meet world-class emissions standards.
2. Whether vehicle emissions and fuel economy modeling analyses are considered credible and compelling.
3. Whether tighter vehicle fuel quality standards are adopted and enforced.
4. Whether aggressive fuel economy requirements are adopted and enforced.
5. The number of cities that implement policies and control strategies to promote cleaner vehicle technologies and fuels.

Goal #3: Promote and help China develop sustainable transportation systems, especially bus rapid transit (BRT).

Means:
We can achieve this goal by helping China do the following.

1. Educate central, provincial, and municipal authorities about the benefits of transportation system reform.
2. Develop BRT policies and technical guidelines to stimulate the spread of BRT systems to major cities throughout the country.
3. Develop strategies for improving the efficiency of local transportation systems.
4. Plan and establish pilot BRT systems in at least two Chinese cities.

Evaluation Criteria (Key Performance Indicators):
We support and evaluate projects based on their ability to deliver measurable progress in the form of key performance indicators. Overall progress includes these metrics.

1. Whether superior BRT systems are established in at least two Chinese cities.
2. Whether policies promoting BRT are adopted and enforced.
3. Whether urban transportation plans and policies take into account not only efficiency, but also environmental impacts.

China Sustainable Energy Program
Transportation Program Ongoing Projects

Asian Development Bank

Grant Date: 10/1/2006 **Duration:** One Year **Amount:** $75,000

Description: To support the establishment of the China Air Quality Management Network.

Grant Date: 12/1/2005 **Duration:** One year **Amount:** $35,000

Description: To support the establishment of the China Air Quality Management Network.

Association of Mayors of Guangxi

Grant Date: 9/1/2006 **Duration:** One year **Amount:** $100,000

Description: To develop policies encouraging municipal BRT development in Guangxi province.

Beijing Automotive Research Institute

Grant Date: 9/1/2006 **Duration:** One year **Amount:** $80,000

Description: To develop an action plan to retrofit Beijing's diesel vehicle fleet.

Beijing Transportation Development Research Center

Grant Date: 4/1/2005 **Duration:** Two years **Amount:** $150,000

Description: To develop plans for the operation and management of Beijing's first bus rapid transit (BRT) corridor and help Beijing implement its near-term BRT network development plan.

Chang'an University

Grant Date: 11/1/2005 **Duration:** One year **Amount:** $120,000

Description: To develop plans for a bus rapid transit (BRT) network, including detailed plans for demonstration corridors, in Xi'an.

Center for Renewable Energy Development, ERI

Grant Date: 7/1/2006 **Duration:** One year **Amount:** $70,000

Description: To develop a national development strategy for biofuels.

China Automotive Technology and Research Center

Grant Date: 12/1/2006 **Duration:** One year **Amount:** $75,000

Description: To analyze the effects of implementing the fuel economy standard for passenger cars.

Grant Date: 12/1/2006 **Duration:** One year **Amount:** $100,000

Description: To develop a vehicle purchase tax that encourages the purchase of fuel efficient and cleaner-burning technologies and vehicles.

Grant Date: 12/1/2006 **Duration:** One year **Amount:** $150,000

Description: To develop a fuel tax for China aimed at encouraging fuel consumption savings and the adoption of fuel efficient technologies.

Grant Date: 9/1/2006 **Duration:** One year **Amount:** $80,000

Description: To develop a heavy-duty vehicle fuel economy standard.

Grant Date: 11/1/2005 **Duration:** One year **Amount:** $120,000

Description: To develop a fuel tax for China aimed at promoting the use of clean fuels and advanced vehicle technologies.

Grant Date: 7/1/2005 **Duration:** One year **Amount:** $150,000

Description: To develop a light-duty truck fuel economy standard.

Chongqing Institute of Environmental Science

Grant Date: 11/1/2006 **Duration:** One year **Amount:** $50,000

Description: To develop a comprehensive vehicle emissions control strategy for Chongqing.

The Department of Thermal Engineering, Tsinghua University

Grant Date: 12/1/2006 **Duration:** One year **Amount:** $30,000

Description: To support DTE in promoting IGCC+C sequestration technologies in developing coal-based fuels.

Energy and Transportation Technologies, LLC.

Grant Date: 12/1/2006 **Duration:** One year **Amount:** $25,000

Description: To provide consultation on the development of a fuel efficiency standard for heavy-duty vehicles and on the evaluation the effects of the implementation of adopted fuel economy standards in China.

Grant Date: 12/1/2005 **Duration:** One year **Amount:** $25,000

Description: To analyze the feasibility and cost-effectiveness of applying fuel efficiency technologies to China's light-duty truck and heavy-duty vehicle fleet and determine where to set light-duty truck and heavy-duty vehicle fuel economy standards.

Harvard University

Grant Date: 7/1/2005 **Duration:** One year **Amount:** $65,000

Description: To develop policies for promoting the use of hybrid technologies in China.

International Sustainable Systems Research Center

Grant Date: 12/1/2006 **Duration:** One year **Amount:** $80,000

Description: To support ISSRC to test heavy-duty diesel vehicle emissions, develop a Chinese-based emissions model, and assist Chinese grantees in building an emissions database.

Ji'nan Urban Planning and Design Institute

Grant Date: 12/1/2005 **Duration:** One year **Amount:** $100,000

Description: To develop plans for the implementation of Ji'nan's bus rapid transit (BRT) system.

Kunming Urban Transportation Planning Institute

Grant Date: 12/1/2005 **Duration:** One year **Amount:** $75,000

Description: To continue to improve Kunming's bus priority transit system to become a full-fledged bus rapid transit system.

Machinery Industry Agricultural Vehicles Research and Development Center

Grant Date: 10/1/2006 **Duration:** One year **Amount:** $50,000

Description: To develop an agricultural vehicle fuel economy management system.

Shenzhen Institute of Environmental Science

Grant Date: 6/1/2006 **Duration:** One year **Amount:** $100,000

Description: To develop a comprehensive vehicle emissions control strategy for Shenzhen.

Tianjin Electric Drive Vehicle Research Center

Grant Date: 12/1/2004 **Duration:** Two years **Amount:** $70,000

Description: To demonstrate the use of and help commercialize hybrid vehicles, especially hybrid buses, in Tianjin.

Tsinghua University Education Foundation

Grant Date: 12/1/2006 **Duration:** One year **Amount:** $100,000

Description: To develop a model to analyze the effects of implementing supporting fuel economy policies in China.

Grant Date: 12/1/2005 **Duration:** One year **Amount:** $75,000

Description: To develop a model estimating future vehicle emissions levels in Chinese cities under various potential transportation-sector pollution control policies.

Vehicle Emissions Control Center

Grant Date: 9/1/2006 **Duration:** One year **Amount:** $90,000

Description: To design and implement a plan for introducing low-sulfur fuels in China.

China Sustainable Energy Program
Transportation Program Project Updates

Goal #1: Increase the efficiency and reduce the emissions of conventional-technology vehicles.

1. Improving Vehicle Fuel Efficiency

Improving the Implementation of Passenger Vehicle Fuel Economy Standards

China's first fuel economy standard, a fuel economy standard for passenger vehicles, went into effect on July 1, 2005. The standard stipulates that all new passenger car models must meet the standards before certification, and all old models, those models certificated before July 1, 2005 must meet the standards after July 1, 2006. The passage of this fuel economy standard is a major win: fuel economy standards are the single most effective tool for reducing vehicle fuel consumption and vehicle emissions. The China Automotive Technology and Research Center (CATARC) is now formulating recommendations for the enforcement of this standard, including institutional and administrative structures for monitoring and enforcing compliance with the standard, penalties for vehicle models failing to meet the standard, and standardized procedures for testing passenger vehicle fuel efficiency. CATARC submitted its recommendations to the National Development and Reform Commission (NDRC), the Ministry of Finance (MOF), and the State Administration of Taxation. A CATARC-developed tax penalizing cars that fail to meet the standard should be enacted this year.

Developing a Light-Duty Truck Fuel Economy Standard

After developing the fuel economy standard for passenger vehicles, CATARC turned its attention to light-duty trucks (LDTs). There are currently 700,000 LDTs on the road in China. International experience has shown that if stringent fuel efficiency regulations fail to include LDTs, auto manufacturers will shift from producing passenger vehicles to producing heavier LDTs (e.g., sport utility vehicles), resulting in a decline in overall fleet fuel efficiency and increased dependence on oil imports.

To avoid this situation, CATARC led a research team to develop a LDT fuel economy standard. The team analyzed (1) current LDT fuel efficiency levels in China; (2) the amount by which LDT fuel efficiency could be improved; and (3) the impacts requiring several different LDT fuel efficiency levels would have. Now the LDT fuel economy standard has been submitted to NDRC and the Standardization Administration of China (SAC) and is in the process of review by other countries based on WTO principles. It's expected that the standard will be adopted by the end of this year.

Developing a Heavy-Duty Truck Fuel Economy Standard

CATARC has developed both a passenger vehicle fuel economy standard, which was adopted in 2004 and went into effect last year, and a light-duty commercial vehicle fuel economy standard, which has been submitted to the government and is expect to be adopted this year. This project will support CATARC to develop the fuel economy standards for heavy-duty vehicles.

CATARC will (1) research international experience in heavy-duty vehicle fuel economy regulation; (2) develop standardized procedures for measuring heavy-duty vehicle fuel consumption; (3) establish an evaluation system for fuel consumption limits for heavy-duty vehicles; and (4) determine a heavy-duty fuel consumption regulatory framework and propose it to the National Development and Reform Commission (NDRC) and other government agencies.

Developing a Mandatory Vehicle Fuel Efficiency Labeling System

In addition to developing recommendations for the enforcement of China's passenger vehicle fuel economy standard, CATARC is developing a mandatory fuel-efficiency labeling system, a "showroom sticker" detailing vehicles' fuel economy performance. The system would require manufacturers to affix labels, to be displayed during sale, to every vehicle they produce. Such a labeling system encourages the purchase of fuel efficient vehicles. CATARC is currently surveying international vehicle fuel economy labeling systems; analyzing the different types of vehicles on the road in China; and assessing potential barriers to the implementation of the labeling system. And the system is expected to be adopted by the end of this year and implemented early next year.

Developing a Low-Speed Vehicle (Agricultural Vehicle) Fuel Economy Standard

More than half of China's population—700 million people—live in rural areas. Most vehicles they commonly own and use are highly polluting, diesel-powered agricultural vehicles. More than 2.5 million agricultural vehicles were produced and sold for each of the past ten years, and it is expected that in the coming years, at least 2 million agricultural vehicles will be produced and sold annually. By the end of 2005, China had 24.5 million agricultural vehicles—more than half of all vehicles in China (motorcycles excluded).

These agricultural vehicles are cheaply constructed using very low technology, resulting in high fuel consumption, high emissions, and low safety. There are no standards, regulations, or incentives for advanced technology, and no systems for documenting fuel economy or environmental performance of agricultural vehicles. This project supports the Machinery Industry Agricultural Vehicles Research and Development Center (MIAVRDC) to (1) investigate current technological levels, project the development, measure the current fuel consumption, and identify technologies that could increase the fuel efficiency of agricultural vehicles; (2) design fuel economy standards, fuel consumption limits, and standardized methods for evaluating fuel consumption for both four-wheel and three-wheel agricultural vehicles; (3) design and propose a fuel economy evaluation system, labeling system, and fuel economy certification and publishing system for agricultural vehicles; and (4) develop incentive policies to introduce high technology improvements for agricultural vehicles.

Evaluating the Effects of Implementing the Passenger Car Fuel Economy Standard

On July 1st, 2005, phase I of the fuel economy standards for passenger cars went into effect, in which new vehicle models were required to meet the standards; by July 1st, 2006, in phase II, adjustments were to be completed for old models to meet the standards. For implementation phases to continue, and to add the necessary supplementary measures to phase II, the effects of standards implementation to date must be evaluated. Data on current implementation status will also be a valuable reference as fuel economy standards for non-passenger vehicles are developed.

This project will support the China Automotive Technology and Research Center to study the implementation status of the fuel economy standards for passenger cars, the impact of the implementation of the standard on auto industry, economy, fuel consumption, and environmental protection, and products' fuel economy distribution based on the fuel economy data submitted by the manufacturers. Based on this information, CATARC will generate implementation recommendations and supplementary policies (if necessary) for Phase II standards, and as well as implementation recommendations for Phase III.

Recommendations:

- China should rigorously enforce its fuel economy standards for passenger and commercial vehicles. Fuel economy standards are the single most effective tool for reducing vehicle fuel consumption and vehicle emissions.
- China should establish a powerful enforcement body and implementation mechanism to supervise the implementation of fuel efficiency standards.
- China should adopt fuel economy standards for light-duty trucks and heavy-duty vehicles as soon as possible.
- China should also adopt tax and fiscal policies, including a fuel tax, to promote the manufacture and purchase of fuel efficient vehicles.

2. Reducing Vehicle Emissions and Improving Fuel Quality

Developing a Fuel Quality Improvement Strategy

China's poor fuel quality both pollutes the air and prevents the widespread introduction of advanced technology vehicles and implementation of stricter vehicle emissions standards. The government is pushing the oil industry to improve fuel quality, but several factors impede potential progress. Tsinghua University, the China Research Academy of Environmental Sciences (CRAES), and the China Petroleum Development Planning Institute are working together to help SEPA develop a national strategy to reduce sulfur content in gasoline and diesel fuel, encouraging SEPA to adopt a fuel improvement schedule in step with the national schedule for vehicle emissions control.

Developing a Vehicle Emissions Model Based on Chinese Data

Accurate vehicle emissions models are necessary to maximize the effectiveness of emissions control policies. However, there is still no vehicle emissions model based on Chinese data; most Chinese vehicle emissions analyses use U.S.-based models. Government officials have expressed concern over this lack of domestic emissions models and the resulting inability to make accurate projections of such emissions' public health impact.

To redress this lack of a China-based vehicle emissions model, we have been supporting the International Sustainable Systems Research Center (ISSRC), Tsinghua University's Institute of

Environmental Science and Engineering (IESE), Beijing Jiaotong University, and the Vehicle Emissions Control Center to create an International Vehicle Emission (IVE) model for China. The research team has already completed an IVE model and is now working to make it more comprehensive and accurate.

Developing Policies to Reduce Beijing's Vehicle Emissions

On December 21, 2005, Beijing achieved its air quality target of having the daily average air quality of at least 63 percent of the 365 days in 2005 satisfy national air quality standards. Aggressive air quality control strategies taken by the Beijing municipal government enabled Beijing to achieve this air quality goal. Beijing wants to lead the country in promoting clean air and utilizing clean vehicle technologies, but since the most conventional, easiest-to-implement air quality control measures have now already been adopted in Beijing, more innovative air quality control measures will now be required—especially innovative vehicle emissions control measures—for Beijing to continue to make substantial progress toward clearing the air.

Two such innovative air quality control measures are the introduction of hybrid vehicles and the development of a comprehensive traffic management system that takes the environmental impact of transportation decisions into account. This allocation supports the Beijing Environmental Protection Bureau (EPB) to develop both of these measures in Beijing, with the ultimate goal of developing policies and mechanisms for national replication. In specific, the Beijing EPB will organize a research group to (1) develop the most feasible action plan for the introduction of hybrid vehicles into Beijing's fleets taking into account the costs, fuel savings, and environmental benefits of doing so; (2) develop a traffic management system linking traffic management policy decisions—i.e., decisions regarding parking policies, toll and fee policies, and vehicle travel restrictions—to their effect on vehicle emissions levels; (3) establish a vehicle labeling system and accompanying policies encouraging the use of cleaner vehicles; (4) develop the regulations to recover the fuel vapor; and (5) study the possible fiscal policies to promote the clean and fuel efficient vehicles and technologies in Beijing.

Developing Policies to Reduce Chongqing's Vehicle Emissions

One of the most populated cities in China, Chongqing has a rapidly growing vehicle population, whose poorly regulated emissions are contributing to deteriorating air quality. Because Chongqing is located at the confluence of two rivers, the Yangzi and Jialing Rivers, and situated on hilly terrain, road and residential space are scarce and vehicle emissions are often trapped in the city, exacerbating the effects of air pollution on public health.

As the price of natural gas, which is plentiful in the Sichuan basin, is low in Chongqing, we have the opportunity to help Chongqing develop a vehicle emissions control strategy that includes the utilization of compressed natural gas (CNG); Chongqing's situation represents an opportunity not only to ameliorate the impact of the transportation sector on air quality in a major Chinese city but also to develop initial markets for CNG vehicles. This project supports the Chongqing Academy of Environmental Science (CAES) to develop a comprehensive vehicle emissions control strategy for Chongqing, a strategy potentially involving the use of CNG buses and taxies, more stringent vehicle emissions and fuel quality standards, traffic management policies, and hybrid vehicle promotion policies.

Developing Policies to Reduce Shenzhen's Vehicle Emissions

In 2005, we supported the Shenzhen Research Center of Municipal Development (SRCMD) to analyze ways to reduce emissions from Shenzhen's public buses and taxis. They calculated that replacing old buses with new ones complying with Euro-III emissions standards and introducing hybrid vehicles into Shenzhen's fleet would be the two most cost-effective ways to reduce vehicle emissions.

The Shenzhen Municipal Government is quite interested in such plans, particularly in replacing the city's fleet of conventional-technology taxis with a fleet of hybrid vehicles. We are now working on several fronts to realize this plan and push for the widespread introduction of reduced-emissions and hybrid-electric vehicles in Shenzhen. We are supporting a research team to (1) develop fiscal policies facilitating and a plan for the introduction of hybrid vehicles into Shenzhen's taxi, bus, and governmental vehicle fleets; (2) develop incentive policies to promote the purchase of Euro-III and Euro-IV vehicles; (3) develop policies to push ahead the introduction of cleaner fuels, enabling the implementation of Euro-III and Euro-IV emissions standards and the use of advanced vehicle technologies; and (4) develop a labeling system that identifies environmentally-friendly vehicles (EFVs).

In addition, we supported Beijing Jiaotong University to conduct on-road performance, emissions, and fuel efficiency tests of the Toyota Prius in order to evaluate the suitability of the Toyota Prius for use as a taxi in Shenzhen. The test showed that, compared to the conventional-technology taxis currently used in Shenzhen, the Prius could reduce taxi NOx emissions by 98.5 percent, carbon monoxide emissions by 90.4 percent, and hydrocarbon emissions by 99.4 percent. Shenzhen is now still working with Toyota, NDRC, and the Ministry of Science and Technology (MOST) to develop a demonstration project.

We are also supporting the Shenzhen Institute of Environmental Science (SIES) to study what causes Shenzhen serious haze problems and how to reduce haze in the city. As Shenzhen is a major port, freight trucks are a huge source of PM emissions, which contribute to haze formation. Controlling light- and heavy-duty diesel vehicle emissions will likely be a focus of their haze reduction strategy.

Recommendations: China should take the following measures to reduce vehicle emissions and improve vehicle fuel quality:

- Give the highest priority to fuel quality standards. A gas tax of only 4 cents per gallon could upgrade China's refineries to produce low-sulfur (under 50 ppm) gasoline and diesel fuels, which would do more than any other measure to clean up China's deteriorating urban air quality.
- Develop systems for monitoring and enforcing vehicle emissions standards;
- Establish fiscal policies compelling oil companies to improve fuel quality as soon as possible;
- Create and adhere to a schedule for adopting stringent vehicle emissions and fuel quality standards; and
- Develop tax and fiscal policies promoting the production and purchase of clean vehicles.

3. Promoting the Use of Alternative Fuels

Developing a National Alternative Fuel Development Strategy

Along with coal, oil is fueling China's rapid economic growth, particularly the growth of its transportation sector. China has been the world's second largest oil consumer for the past three years, and in 2004, China's total oil imports reached 122.7 million tons—40 percent of all oil consumed in China. Such high and rising oil consumption and oil import dependence endanger China's environment, economy, and national security. Currently, almost one third of the oil consumed in China is accounted by the transportation sector; China's rapidly increasing vehicle population is a powerful driving force behind skyrocketing oil consumption and import. Using cleaner vehicle fuels would reduce oil demand and reduce vehicle emissions, benefiting China's environment and citizens.

Thus, in late 2003, we began supporting the China National Petroleum and Chemical Planning Institute (NPCPI) and China Society of Automobile Engineering (SAE) to lay an analytically-rigorous foundation for the development of a alternative fuel development strategy by projecting China's future fuel demand and determining the cost-effectiveness of various alternative fuel options by assessing different fuels' environmental, energy, and economic impacts. This rigorous analytical work laid the foundation for their subsequent development of an alternative fuel development strategy.

Developing a Regulatory System for Biofuel Demonstration

A promising alternative fuel that was not a focus of NPCPI and SAE's work is biofuel, gaseous, or liquid fuel derived from biomass. Thus, this year, we are supporting the Center for Renewable Energy Development (CRED) and the Energy Research Institute to (1) review the current R&D status of biofuel technologies and how they are being used both in China and abroad; (2) analyze the economic feasibility of increasing the use of biofuels in China; and (3) develop policies and strategies promoting the commercialization of biofuel technologies. We hope their study will provide the Chinese government with the policy tools needed to stimulate the commercialization and scale-up the use of biofuels.

Promoting IGCC Plus Carbon Capture and Sequestration in the Development of Coal-based Fuels

High crude oil prices and energy security concerns have made coal-based alternative vehicle fuel a key area of development in China's transportation sector, backed by the highest levels of government: the National Development and Reform Commission (NDRC) is intent upon developing a national strategy to develop coal based alternative fuels. However, resource-constraints and environmental concerns—such as severe carbon emissions from direct coal liquefaction—are often left out of plant development plans. CSEP recognizes that research on the application of state-of-the-art technologies internationally can cut carbon emissions and overall coal-based fuel efficiency in China, such as the combination of the Integrated Gasification with Combined Cycle with carbon capture and sequestration (IGCC+CCS). This project will support the Department of Thermal Engineering, Tsinghua University, to develop a report on the benefits of IGCC+CCS, and then promote the application of this technology in China's alternative fuel industry.

4. Developing Fiscal Policies Encouraging Clean, Efficient Vehicles

Adjusting Purchase Taxes to Promote Cleaner and More Efficient Vehicle Technologies

Fiscal policies have been used abroad to reduce private vehicle usage, encourage the use of public transportation, and increase the purchase of clean vehicles while generating revenue to invest in public transportation and advanced vehicle technologies. As private vehicle usage keeps climbing in China, we are supporting the development of such tax and fiscal policies in China. These efforts recently yielded results: based on grantee CATARC's recommendations, China's Ministry of Finance and State Administration of Taxation adjusted China's vehicle excise tax in March 2006 to vary with engine size. Now consumers will have to pay a passenger vehicle excise tax ranging from 3 percent of the vehicle's purchase price for the smallest vehicles to 20 percent for the largest; The new excise tax system went into effect on April 1, 2006. Our next focus is on adjusting the flat 10 percent purchase tax to benefit clean and fuel efficient vehicles.

Following up on this momentum, CATARC is working with international experts to (1) introduce international best fiscal policy practices in promoting clean and efficient vehicle technologies; (2) develop the adjustment schemes of a purchase tax; (3) adjust the custom tax to promote importing clean and fuel efficient vehicle and auto parts; and (4) propose fiscal incentives and penalties for vehicles which meet the next phase of fuel economy standards and those which fail to meet the standards based on the excise tax, purchase tax, and custom tax.

Developing a Fuel Tax for China

Rapid economic development and auto industry growth are increasing China's demand for imported oil at a time when oil prices are skyrocketing and the devastating environmental effects of vehicle emissions are becoming more obvious. Fuel prices in China are low, facilitating high vehicle usage and purchase rates. Fuel taxes are used in many nations and have proven to be an extremely effective tool for limiting vehicle usage, thereby reducing transportation fuel demand and improving air quality. We are now supporting CATARC to develop a fuel tax for China. To develop the tax, CATARC is (1) researching the effects vehicle and fuel taxes implemented abroad have had on countries' fuel consumption, economy, and social life; (2) studying the respective impacts of different types of fuel taxes and different fuel tax rates; and (3) consulting with international fuel tax experts.

Goal #2: Help introduce advanced-technology, hybrid-electric drive vehicles into China's fleet in significant, and increasing, volumes.

Developing Policies Promoting the Manufacture and Purchase of Hybrid Vehicles

CATARC helped NDRC and the Ministry of Science and Technology (MOST) develop hybrid technology performance standards, certification procedures, and financial policies, all of which are needed to sell and register hybrids. Six CATARC-recommended hybrid-related testing procedures and standards were approved in May 2005 and went into effect on October 1, 2005. CATARC is also helping NDRC develop a set of hybrid vehicle incentive policies in order to accelerate the commercialization of hybrid vehicles. These policies include (1) financial incentives for manufacturers, dealers, and consumers to produce, sell, and buy hybrid vehicles; (2) preferential policies for industrialization of, investment in, and international cooperation on hybrid vehicle technologies; and (3) incentives for the bulk purchase of hybrid vehicles to serve as bus fleets, commercial fleets, government fleets, and taxis.

Harvard University's Kennedy School of Government is also helping NDRC develop policies promoting the manufacture and purchase of hybrid vehicles, including (1) research technical and economic policies that have increased the manufacture and purchase of advanced technology vehicles abroad; (2) tailoring these policies to match China's conditions; and (3) exploring ways to foster international cooperation on hybrid manufacture, including the use of incentives to attract hybrid vehicle technologies to China.

Promoting the Commercialization of Advanced Clean Vehicles in Shanghai

In addition to the efforts made at the national level, grantees are also working at the municipal level to conduct policy pilot projects in promoting advanced vehicle technologies. Shanghai intends to lead China in putting advanced technology vehicles on the road. The Shanghai municipal government planned to allocate 1.5 billion RMB to promote ATVs from 2006 to 2008 and committed to produce 1,000 fuel cell vehicles and 100,000 hybrid vehicles by 2010. Tongji University, the *863 Program's* coordinator, made significant progress by developing an electric power train system and a fuel cell car platform, which puts ATVs closer to commercialization. Yet, Shanghai lacks a comprehensive action plan. With Tongji University's assistance, Shanghai released its Guideline for Developing Clean Fuel Vehicles between 2006 and 2008. Tongji University also proposed Shanghai produce and sell 10,000 hybrid buses, 25,000 hybrid taxies, and 300,000 hybrid private cars.

Hybrid-Electric Vehicle Industrialization and Commercialization Strategies

Technical, commercial, and policy barriers must be addressed before the industrialization and commercialization of hybrid-electric vehicles can be realized. The Tianjin Electric Vehicle Research Center (TEVRC), using Japanese and US case studies, is analyzing Tianjin's potential for the industrialization and commercialization of HEVs and developing solutions to barriers. TEVRC is submitting its recommendations to the Tianjin municipal government.

Recommendations:

- Require local governments to procure hybrid vehicle fleets, such as taxi and government ministry vehicle fleets, so that, through volume purchases, the costs of hybrids come down and hybrid technology enters the market more rapidly.
- Conduct local hybrid technology demonstration projects with preference policies and clear targets for hybrid introduction. For example, California catalyzed the development of hybrid-electric vehicles by requiring all manufacturers to sell 10 percent "zero-emissions vehicles" within the state, with partial credit for sales of hybrids. This policy has catalzed a global revolution in advanced vehicle technologies. China could be a leader in developing and adopting similar policies.

Goal #3: Promote and help China develop sustainable transportation systems, especially bus rapid transit (BRT).

Developing a Sustainable Transportation Strategy for China

China lacks a national transportation strategy; no high-level plan prioritizes sustainable transportation development or recognizes the serious energy and environmental costs of *laissez-faire* transportation development. Currently, multiple agencies oversee different elements of transportation system development, leading to myriad interagency conflicts. The China Academy of Transportation Science (CATS) is establishing a task force under the China Council for International Cooperation on Environment and Development (CCICED) to formulate a national sustainable transportation plan that (1) specifies an institutional framework for overseeing sustainable transportation development, (2) plans an integrated, multi-modal transportation system, and (3) delineates a roadmap for China's sustainable transportation policy development.

Promoting Public Transportation

The central government and Beijing's municipal government are standing behind public transportation as a solution to China's transportation problems: on September 23, 2005, China's State Council issued a directive calling for the improvement of public transportation infrastructure and operation and public transportation's prioritization when allocating road resources; and Beijing's Transportation Development Guidelines (2004-2020) set the goal of having public transportation handle 60 percent of total passenger volume by 2010. To reach these goals, China must not only provide comfortable and convenient public transportation options, but also educate citizens about the current advantages and future of public transportation in China.

We are supporting the Ministry of Construction's Public Transit Association to launch a media campaign advertising (1) the advantages of public transportation; (2) the current public transportation options available to citizens; and (3) plans for the development of public transportation. The media campaign will take place continuously throughout 2006, but will feature one intensive week of activities and promotions. MOC is using the media campaign as a way to not only educate the public on the advantages of public transportation, but also to encourage municipal governments to commit to improving their public transportation systems.

Launching the China Sustainable Transportation Center

Our Transportation Program has made extraordinary progress in spreading the word on bus rapid transit (BRT). National and municipal interest (now 20 cities) is burgeoning. Pilots in Beijing, Kunming, Ji'nan, and Hangzhou are all building BRT networks; Chengdu, Chongqing, Xi'an, and Shanghai are all conducting BRT feasibility studies and planning BRT corridors. The program's rapid expansion, however, is challenged by a lack of local technical capacity.

To handle the capacity shortfall, we launched the China Sustainable Transportation Center (CSTC) in 2005 to provide BRT and transportation systems outreach and technical assistance to all cities seeking it. CSTC is currently (1) providing technical assistance regarding BRT implementation to planners and designers in over ten cities; (2) conducting feasibility analyses and developing BRT plans in other Chinese cities; (3) working with the central government and national research institutes to train local administrators and decision-makers in BRT development and implementation; and (4) compiling BRT reference materials detailing international and domestic BRT experience.

Developing Policies Promoting Bus Rapid Transit in China

China lacks national policies promoting BRT development nationwide. The China Academy of Urban Planning and Design (CAUPD) is helping the Ministry of Construction (MOC) develop such policies. CAUPD has organized a group of local and international experts to (1) survey the current status of public transit systems in China; (2) identify barriers to BRT development; (3) analyze strategies for BRT development in different-sized Chinese cities; and (4) develop policies regarding BRT financing, BRT operation and management, multi-modal transportation integration, and urban planning.

Developing Policies Securing Financing for Public Transit Development

BRT is making great progress at the municipal level with pilots underway in many major Chinese cities. Lack of sufficient financial support, however, is a potential barrier to BRT's long-term development in China. In Beijing, the first city to construct a proper BRT system, BRT construction was jointly funded by the municipal government and bus companies. Those bus companies, in turn, invited private investors to fund construction around BRT stations.

This public-private financial structure lacks clearly defined roles and responsibilities for its stakeholders, especially the financial responsibilities of the government in promoting public transit systems. The Institute for Transportation and Development Policy (ITDP) is currently analyzing both international and Chinese financing methods for public transit development and will recommend policies designed to secure financing for the long-term development BRT and other sustainable public transit systems.

Developing BRT in Beijing

Beijing is leading China in BRT development. Beijing's—and China's—first BRT corridor, a 15.8-kilometer-long corridor linking Beijing's southeast suburbs to the city center, went into full operation on December 30, 2005. In its first two weeks of operation, the system handled over 80,000 passengers a day, more than Beijing's light-rail system. New apartment buildings are being constructed along the corridor, adding to the success of the project and the transit-oriented development concept, an urban planning method—used in the design of Beijing's BRT corridor—that makes public transportation the focus of comprehensive urban design plans.

There are some problems, however, particularly with route integration and operation management. We are now supporting Beijing Changdatong Bus Ltd., the company overseeing the development, operation, and management of Beijing's BRT network, to (1) improve the efficiency of Beijing's first BRT corridor, particularly by improving route integration and operation management; (2) evaluate the social and environmental impacts of the corridor; and (3) publicize Beijing's new BRT system, expounding its advantages to residents of and visitors to Beijing. In addition, Beijing Changdatong Bus Ltd. refined plans for Beijing's second and third BRT corridors (Chaoyang Road and Anli Road) and is studying the feasibility of constructing a fourth BRT corridor along Fushi Road. The second corridor has begun construction and should be completed by the end of this year. The Beijing Municipal Government plans to build a six-corridor BRT network, 100 km in total length, by 2010.

Developing BRT in Hangzhou

Hangzhou is also developing a BRT network. The second BRT corridor built in China, Hangzhou's 28-km-long BRT B1 line officially went into operation on April 26, 2006 after just 16 months of planning and construction. The corridor incorporates most key BRT characteristics and uses high-technology domestically-made buses. The operation management, terminal design, fare collection system, and intelligent transportation systems (ITS) used in Hangzhou's BRT B1 line are exemplars of BRT design and operation.

Upgrading Kunming's Bus-Priority System

Kunming is a public transportation pioneer and the first Chinese city to have a centralized dedicated-bus-lane system. We have been supporting Kunming since 2003 to expand and improve its dedicated-bus-lane system. Recently, however, Kunming's bus-priority system has been weakening due to design limitations and operational issues. In response, over the past year the Kunming Urban Transportation Planning Institute (KUTRI) analyzed barriers to upgrading Kunming's system to become a truly world-class BRT system and created plans to further extend Kunming's BRT network. Their analyses show that improvements in system operation, particularly the ticketing system, bus routing, and bus lanes, are most critical. Based on this analysis, KUTRI has created plans to optimize routes and operational management, improve bus-lane infrastructure, and create a new ticketing system. These improvements are all currently underway.

Developing BRT in Ji'nan

Ji'nan's municipal government is turning to BRT, rather than less flexible, more expensive rail development, to alleviate the growing pressure on its existing transportation system. The Jinan Urban Planning and Design Institute, Jinan Municipal Civil Engineering Design Institute, and China Academy of Urban Planning and Design helped Ji'nan design a BRT network, 60 kilometers in total length, that developers hope will handle the majority of trips within Ji'nan's urban area by 2010. Ji'nan began constructing its first BRT corridor in October 2005.

Developing BRT in Xi'an

Xi'an recently received a $240 million World Bank loan to strengthen its transportation infrastructure. Prior to Xi'an's receiving the loan, a research team led by Chang'an University and the Xi'an Urban Planning Institute helped convince the Xi'an municipal government to integrate BRT into the city's master urban plan and develop eight bus-priority corridors. Now the same group is developing BRT plans for Xi'an, in an effort to ensure that BRT is a centerpiece of the World Bank's transportation infrastructure improvement project. In specific, Chang'an University and the Xi'an Urban Planning Institute are (1) conducting urban transportation surveys and creating traffic simulations; (2) identifying the best roads on which to develop BRT corridors and drafting infrastructure designs; (3) designing systems for BRT operation and management; (4) identifying candidate BRT vehicles; and (5) recommending financial and institutional structures to ensure the long-term development of BRT in Xi'an.

Chengdu's BRT Development

Over the last two years, as its vehicle population has grown 20 percent annually, Chengdu has struggled with increased traffic congestion. With our support, the Chengdu Institute of Urban Planning and Design (CIUPD) and Southwestern Jiaotong University convinced the Chengdu municipal government to integrate bus rapid transit (BRT) into its transportation development plans; the recently-drafted *Chengdu Urban Transportation Development White Paper* states Chengdu's intention to construct an over-100-km-long BRT network over the next five years. There is still significant resistance to this plan, however, coming from both politicians—including the mayor of Chengdu—and technical personnel, who do not support BRT development because they do not regard BRT as a modern form of public transportation.

Facing this challenge, we adjusted our strategy for pushing BRT development in Chengdu: we now first want to develop a single BRT corridor in order to convince the mayor of the effectiveness and modernity of BRT. Grantees are already working to convince the mayor to authorize the construction of such a demonstration corridor, and it now seems that he will do so. Once he does, this allocation will support CIUPD and Southwestern Jiaotong University to design the BRT corridor, including (1) operational structures, i.e., bus routes, a dispatch plan, and a feeder bus system; (2) corridor infrastructure, i.e., stations, a ticketing system, a traffic management system, terminals, and pedestrian and bicycle access systems; and (3) financial structures to support and management structures to run the BRT corridor.

Chongqing's BRT Development

The southwestern municipality of Chongqing faces severe transportation challenges, including traffic congestion and increased vehicle emissions. Its problems are compounded by the city's lack of physical space. With an urban population of over seventeen million, the municipal government wants to develop modern public transportation systems employing clean vehicle technologies to alleviate growing environmental crises.

Chongqing is home to a major bus manufacturer interested in pursuing hybrid technology. In December 2003, CSEP met with the Chongqing municipal government, Chongqing Bus Company, and Chongqing Bus Manufacturer. All parties agreed to promote a BRT system that uses hybrid bus technologies. Chongqing could become China's first city to create a BRT system that uses hybrid bus technologies. So far, grantees have completed preliminary BRT development feasibility and traffic flow studies.

Recommendations:

- The central government should designate BRT as the main approach to the development of sustainable urban transportation in China, providing financial support for and encouraging BRT development in all major cities.
- China should develop BRT systems in several cities to serve as sustainable transportation system exemplars, worthy of domestic, even global, imitation.
- China should develop incentive policies and provide technical guidance to promote BRT development across the country.

China Sustainable Energy Program
Low-Carbon Development Paths Program Strategy

Overarching goal: Forward the development and implementation of sustainable energy policies in all energy-consuming sectors by supporting initiatives spanning the boundaries of our other program areas.

Goal #1: Help China develop scenario analysis tools anticipating the impact of today's energy policy decisions and use them to formulate sustainable energy development plans.

Means:
We can achieve this goal by helping China do the following.

1. Develop sustainable energy policy analysis tools and encourage long-term planning agencies at the central and provincial government levels to use them.
2. Develop scenarios for the 2006-2030 timeframe showing the impact of energy policies on carbon emissions. Implement policies effecting the greatest carbon emissions reductions.
3. Develop and implement national policies designed to achieve China's long-term national sustainable energy development goals—reducing GDP energy intensity by 20 percent over the 2005-2010 period and quadrupling GDP while only doubling energy use over the 2000-2020 period.

Evaluation Criteria (Key Performance Indicators):
We support and evaluate projects based on their ability to deliver measurable progress in the form of key performance indicators. We use the following metrics to monitor overall progress.

1. The extent to which sustainable energy scenarios are credible, in circulation, and utilized by China's senior policy decision-makers.
2. The extent to which sustainable energy policy analysis tools and techniques are adopted by Chinese non- and quasi-governmental energy policy organizations.
3. The amount by which carbon emissions are reduced as a result of sustainable energy policies.

Goal #2: Help China develop and encourage China to adopt sustainable energy policies affecting all energy-consuming sectors, particularly "all-in costs" pricing of fossil fuels.

Means:
We can achieve this goal by helping China do the following.

1. Quantify and publicize the social and environmental costs of fossil fuel combustion.
2. Develop tax, fiscal, and/or economic policies that bring China closer to "all-in costs" energy pricing.
3. Establish a strong environmental legal system to serve as a foundation for sustainable energy policy implementation.

Evaluation Criteria (Key Performance Indicators):

We support and evaluate projects based on their ability to deliver measurable progress in the form of key performance indicators. We use the following metrics to monitor overall progress.

1. The extent to which the social and environmental costs of fossil fuel combustion become internalized into the cost of energy.
5. The extent to which central and provincial government decision-makers utilize analytical tools weighing the true, "all-in" costs and benefits of fossil-fuel combustion, energy efficiency, and renewable energy.
6. Whether China establishes a strong environmental legal system.

Goal #3: Encourage China to reform its energy administration to facilitate the development and improve the implementation of sustainable energy policies.

Means:

We can achieve this goal by helping China do the following.

1. Establish a strong Ministry of Energy, with branch offices, to oversee China's energy issues, reducing the inefficiency and complexity of China's energy administration.
2. Reform the State Environmental Protection Agency (SEPA) to bolster sustainable energy regulations.
3. Increase Ministry of Finance budgets for implementing sustainable energy policies.
4. Increase the number of full-time personnel working at government agencies and research institutions on sustainable energy policy development and implementation.
5. Add environmental measures to government officials' performance evaluation criteria.

Evaluation Criteria (Key Performance Indicators):

We support and evaluate projects based on their ability to deliver measurable progress in the form of key performance indicators. We use the following metrics to monitor overall progress.

1. Whether the Ministry of Energy is formed and becomes a strong agency for catalyzing sustainable energy investments.
2. Whether SEPA implements reforms to strengthen sustainable energy policies.
3. Whether the number of full-time personnel working on sustainable energy policy development and implementation in China increases.
4. The extent to which the performance of government officials is evaluated on the basis of the environmental conditions of areas under their jurisdiction.

Goal #4: Encourage China's State Council (cabinet) to issue energy efficiency and renewable energy policy directives to central, provincial, and local governmental entities in order to expedite policy development and implementation in all program areas.

Means:

By monitoring State Council dockets, respond to energy-related issues under consideration by the State Council and urge the inclusion of energy efficiency and renewable energy policy recommendations in State Council discussion.

Evaluation Criteria (Key Performance Indicators):

We support and evaluate projects based on their ability to deliver measurable progress in the form of key performance indicators. We use the following metrics to monitor overall progress.

1. The extent to which the State Council acknowledges the importance of energy efficiency and renewable energy as solutions to critical social and environmental problems.
2. The extent to which State Council directives regarding energy efficiency, renewable energy, and related environmental performance expedite the adoption and implementation of energy efficiency and renewable energy policies at the national, provincial, and local levels, thereby reducing carbon emissions.

China Sustainable Energy Program
Low-Carbon Development Paths Program Ongoing Projects

Beijing Energy Efficiency Center

Grant Date: 8/1/2005 **Duration:** One year **Amount:** $100,000

Description: To develop an integrated carbon emissions and energy demand model to demonstrate how energy efficiency and renewable energy can help China achieve its 2020 economic development goals.

China Academy of Social Science

Grant Date: 3/1/2006 **Duration:** One year **Amount:** $60,000

Description: To develop local, regional, and sectoral action plans and an advanced energy technology development roadmap to direct China's economy toward a less-energy-intensive development path.

China Energy Research Society

Grant Date: 7/1/2006 **Duration:** One year **Amount:** $50,000

Description: To publish and distribute policy recommendations developed by CSEP grantees to senior policy decision-makers at the central and local government levels.

Grant Date: 4/1/2005 **Duration:** One year **Amount:** $50,000

Description: To publish and distribute policy recommendations developed by CSEP grantees to senior policy decision-makers at the central and local government levels.

China Academy of Environmental Planning

Grant Date: 7/1/2006 **Duration:** One year **Amount:** $60,000

Description: To catalyze comprehensive environmental regulatory reform through an assessment of China's State Environmental Protection Administration, provincial environmental protection bureaus, and international best practice recommendations.

Development Research Center of the State Council

Grant Date: 12/1/2006 **Duration:** One year **Amount:** $50,000

Description: To submit policy recommendations developed by grantees in all program areas to the State Council and other senior government ministries.

Grant Date: 4/1/2006 **Duration:** One year **Amount:** $35,000

Description: To develop local, regional, and sectoral action plans and an advanced energy technology development roadmap to direct China's economy toward a less-energy-intensive development path.

Energy Research Institute

Grant Date: 7/1/2006 **Duration:** One year **Amount:** $85,000

Description: To catalyze comprehensive environmental regulatory reform through an assessment of China's State Environmental Protection Administration, provincial environmental protection bureaus, and international best practice recommendations.

Grant Date: 3/1/2006 **Duration:** One year **Amount:** $55,000

Description: To develop local, regional, and sectoral action plans and an advanced energy technology development roadmap to direct China's economy toward a less-energy-intensive development path.

Grant Date: 3/1/2006 **Duration:** One year **Amount:** $50,000

Description: To develop recommendations for a national energy tax for China.

Global Village of Beijing

Grant Date: 12/1/2006 **Duration:** One year **Amount:** $60,000

Description: To continue to support media campaigns promoting key energy efficiency and renewable energy policy recommendations from each of the China Sustainable Energy Program's six program areas.

Lawrence Berkeley National Laboratory

Grant Date: 3/1/2006 **Duration:** One year **Amount:** $150,000

Description: To help China's leading energy policy research institutes develop plans to help China meet its 20 percent energy intensity reduction target.

Natural Resources Defense Council, Inc.

Grant Date: 7/1/2006 **Duration:** One year **Amount:** $65,000

Description: To catalyze comprehensive environmental regulatory reform through an assessment of China's State Environmental Protection Administration, provincial environmental protection bureaus, and international best practice recommendations.

North China Electric Power University

Grant Date: 4/1/2006 **Duration:** One year **Amount:** $100,000

Description: To develop local, regional, and sectoral action plans and an advanced energy technology development roadmap to direct China's economy toward a less energy-intensive development path.

Peking (Beijing) University

Grant Date: 7/1/2006 **Duration:** One year **Amount:** $30,000

Description: To catalyze comprehensive environmental regulatory reform through an assessment of China's State Environmental Protection Administration, provincial environmental protection bureaus, and international best practice recommendations.

South-North Institute for Sustainable Development

Grant Date: 7/1/2006 **Duration:** One year **Amount:** $60,000

Description: To catalyze comprehensive environmental regulatory reform through an assessment of China's State Environmental Protection Administration, provincial environmental protection bureaus, and international best practice recommendations..

Tsinghua University

Grant Date: 3/1/2006 **Duration:** One year **Amount:** $50,000

Description: To develop an advanced energy technology development roadmap to direct China's economy toward a less-energy-intensive development path.

China Sustainable Energy Program
Low-Carbon Development Paths Program Project Updates

Goal #1: Help China develop scenario analysis tools anticipating the impact of today's policy decisions and use them to formulate sustainable energy development plans.

Helping China Reach its Energy Intensity Reduction Target

This spring, the National People's Congress set an ambitious national sustainable energy development target—reducing China's GDP energy intensity, i.e., the amount of energy consumed per unit GDP, by 20 percent over the 2006-2010 five-year period. Helping China reach this target will be a major focus of the Low-Carbon Development Paths (LCDP) Program's work over the next several years. To meet this goal, China must first disaggregate the goal into realizable local and sectoral energy efficiency improvement targets and doable action plans. The LCDP Program is helping China do so, supporting the development of municipal, provincial, regional and sectoral energy efficiency targets and specific plans for how to meet those targets.

In a project coordinated by the State Council's Development Research Center, the Beijing Energy Efficiency Center (BECon), the Energy Research Institute (ERI), the Chinese Academy of Social Science (CASS), and Tsinghua University are working to (1) disaggregate the overall energy intensity improvement target into realizable energy efficiency improvement targets for individual regions, provinces, cities, and sectors, i.e., the buildings, transportation, electric utilities, and industrial sectors; (2) develop local action plans for meeting these targets in two or three provinces to serve as models for national replication; and (3) delineate a technology development roadmap to direct China's economy toward a less-energy-intensive development path. Once the team completes its research, it will submit its recommendations to the State Council and relevant government ministries. Lawrence Berkeley National Laboratory (LBNL) will also consult on the project to ensure that the local action plans, national policies, and technology development roadmap are informed by international best practice.

Recommendation: In order to meet its energy intensity reduction target, China should do the following:
- Disaggregate the national energy target into realizable local and sectoral energy efficiency improvement targets;
- Use both regulations and incentive policies to increase investment in energy efficiency and renewable energy;
- Implement policies designed to make its economic structure less energy-intensive; and
- Use both regulations and incentive policies to support the research and development of advanced energy efficiency and renewable energy technologies.

Local Capacity buildings on Implementing the 2010 20-Percent Energy Intensity Target

China has embarked on an ambitious plan to implement a 20-percent improvement in national energy intensity by 2010. In order to ensure implementation at the local level, the central government has signed individual contracts with provinces on their tailored 2010 energy intensity reduction targets.

This project will (1) assist and train local government leaders in sustainable energy policy options for implementing the 2010 target; (2) provide capacity training for the new National Energy Conservation Center, and (3) provide capacity training for the newly-established provincial energy conservation centers. This project will emphasize provincial and local implementation of all CSEP-supported policy projects to date across all sectors, including buildings (appliance efficiency and building codes), industry, electric utilities, renewable energy, and transportation efficiency. CSEP's consultant, Zhou Fengqi, and grantees, the Development Research Center of the State Council and the Energy Research Institute, will play central roles in furthering implementation of this initiative.

Creating Low-Carbon Scenarios

Scenario analysis is essential to maximize the effectiveness of energy policies; decision-makers need such analytic tools to anticipate the long-term impacts of today's policy decisions. CSEP has supported energy scenarios analysis since its inception. Most recently, several domestic and international policy research institutions—BECon, LBNL, ERI, CASS, the China Energy Research Society (CERS), and Tsinghua University—are working together to create an integrated "top-down" and "bottom-up" model to project China's energy use and emissions over the next 25 years. Right now the team is (1) refining their energy scenario analysis model; (2) projecting the impact of both new policies and new enforcement procedures for current policies on future energy consumption and emissions levels; and (3) analyzing energy consumption patterns over the past 3-5 years to identify the driving forces behind recent energy intensity increases.

Goal #2: Help China develop and encourage China to adopt sustainable energy policies affecting all energy-consuming sectors, particularly "all-in costs" pricing of fossil fuels.

Developing an Energy Tax

China is beginning to consider adopting a national energy tax. The Ministry of Finance (MOF) is already supporting the adoption of a vehicle fuel tax, and is interested in a broader, either revenue-neutral or revenue-generating, energy tax. ERI, whose research has helped catalyze other energy pricing adjustments in China, is developing an energy tax to submit to the State Council, the National Development and Reform Commission (NDRC), MOF, and the State Administration of Taxation. To develop the tax, ERI will (1) develop models showing the environmental and economic impact an energy tax would have in China; (2) study the forms an energy tax typically takes in different sectors; and (3) analyze how much energy consumption would be reduced by imposing an energy consumption tax on individual energy consumers. ERI will also develop plans for the implementation and administration of the energy tax.

Recommendation: In a market economy, tax and fiscal policies should be used to direct investment toward sustainable energy development.

Developing Comprehensive National Energy Policies

China lacks a comprehensive national energy policy to guide energy policy decisions. In its absence, national energy decisions are either effectively left to energy supply companies or made in an ad hoc, nearsighted manner in which pressing energy demands are met by increasing supply through construction of new fossil fuel-fired power plants. As a result, energy consumption is growing at 1.2 times the rate of GDP and approximately 80 percent of new generation facilities built in China are coal-fired. A national energy act is needed to guide China's future energy decisions, ensuring they forge a more sustainable development path, and redress its past mistakes.

We are now supporting a research team to provide China's National Energy Office (NEO) with recommendations for such a comprehensive national energy act. The team's goals will be to draft recommendations that (1) balance economic development, resource conservation, energy development, environmental protection, and public health; (2) adjust China's energy mix, reducing coal usage; (3) prioritize energy efficiency and clean energy development; (4) regulate powerful energy suppliers; (5) make China's energy supply more secure; and (6) commit China to joining the international community in taking steps to reduce global warming.

Recommendation: China should consider adopting an Energy Law resulting in the following:

- Giving increased power to central authorities who can coordinate and govern sectoral interests;
- Requiring new energy development options be assessed by comparing all-in lifecycle costs, i.e., figures that take into account all economic, social, and environmental costs incurred during the lifecycle of an energy investment option;
- Including policies that shift public and private investment toward energy efficiency and renewable energy;
- Encouraging "win-win" approaches that meet China's energy needs while growing the economy and reducing emissions, protecting the environment and China's citizens' health.

Goal #3: Encourage China's State Council (cabinet) to issue energy efficiency and renewable energy policy directives to central, provincial, and local governmental entities in order to expedite policy development and implementation in all program areas.

Facilitating the Submission of Key Energy Policy Recommendations

The State Council's Development Research Center (DRC) and State Council Research Office (SCRO) have been working together to submit grantee energy efficiency and renewable energy policy recommendations to top national leaders and government ministries for several years. Their efforts have strengthened grantee access to national leaders and built momentum for the adoption of several important grantee-developed policies.

Policy recommendations submitted to date include (1) tax and fiscal policies for clean energy development; (2) implementation recommendations for the 2010 20-percent energy intensity reduction target including a proposed allocation of reduction targets to the major energy intensive industrial sectors; (3) policies to encourage cleaner-burning diesel vehicles (and to deter development of traditional diesel vehicles); (4) Bus Rapid Transit (BRT) investment and construction; and (5) the development of energy efficient extra-high voltage transmission lines. DRC also advised senior decision-makers on the implementation of the Renewable Energy Law, building energy efficiency codes, household appliance labeling, and vehicle fuel economy standards. DRC and SCRO have been continuing to submit grantee policy recommendations to top national leaders and government ministries this year. They have also been advising senior decision makers in the implementation of and working with government officials, grantees, and other stakeholders to further develop previously-submitted policies.

Publishing Policy Recommendations in *Energy Policy Research*

The China Energy Research Society (CERS) publishes a magazine, *Energy Policy Research* (*EPR*), a high-quality, high level policy journal that is circulated to senior energy policymakers including Premier Wen Jiabao and other ministerial level officials. The journal serves as an important vehicle for disseminating grantee policy recommendations. We have submitted grantee policy recommendations to the journal since 2002, and are continuing to do so this year.

CSEP grantee reports and policy recommendations are published in the "Sustainable Development Forum" section of *EPR*. Grantee policy recommendations published in 2005 include recommendations regarding policy recommendations to achieve the 2010 energy efficiency improvement target, building energy code implementation, fuel tax development, and the development of "all-in costs" energy pricing. Policy recommendations published in 2006 will center on helping China realize its 2010 energy intensity reduction goal.

Educating the Media and the Public Regarding Sustainable Energy Development

Global Village of Beijing (GVB) is a non-governmental organization that coordinates workshops for Chinese journalists, creates television programs and publications, and hosts public forums to increase public awareness of sustainable development. Over the past year, with our support, GVB organized six workshops and a media campaign on tax and fiscal policies for clean energy development, the promulgation of the *Renewable Energy Law*, the adoption of BRT in China's major cities, pilot projects for renewable energy utilization, and appliance energy efficiency standards and labeling policies. Workshop attendees included journalists from the government-affiliated *People's Daily, Guangming Daily*, and *Xinhua News Agency*. GVB was instrumental in Beijing's decision to raise the standard temperature of air-conditioners in public buildings, which cut peak-load power during summer months and prevented the construction of new coal plants. In addition, GVB's broadcasting and reports on CSEP's *International Forum on Tax and Fiscal Policies for Clean Energy Development* raised public awareness of market-based energy efficiency and renewable energy approaches, and helped raised the interest on the Ministry of Finance in supporting new tax and fiscal policies.

Recommendation: China should inform the public that energy efficiency and renewable energy technology investment is essential for realizing a sustainable energy future.