

**The study of financial mechanisms to support local actions
contributing to climate change mitigation in China**

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I Introduction

1.1 Background

In Asia there is a need to promote developing low carbon society (LCS) not only in developed countries such as Japan but also in emerging and developing countries with growing population and economies in order to mitigate projected global climate change.

There are several local governments in developing Asia which have initiated local actions to mitigate climate change, as shown in ICLEI's Cities for Climate Protection (CCP) programme and a couple of CDM or voluntary offset projects coordinated by local governments. Some of these actions, however, often rely on financial support from international donors to secure initial investments or operation and maintenance costs. Without further financial support, replication of demonstration projects is difficult in these cases. Such need and concern were advocated and shared among cities in developing Asia at 4th Kitakyushu Initiative network meeting, one of the international intercity networks for environmental management, held in June 2007. Although several new initiatives of public finance for mitigation in developing countries have been announced by international donors, the local governments would not be the direct beneficiaries of these financial assistances. Plus, development-oriented small-scale CDM projects at local level have not been materialised well compared to supply-side large-scale mitigation projects under the current international policy of Kyoto Mechanism. Securing the underlying finance also remains a major challenge for local-level demand-side mitigation projects.

Local actions and their international collaboration could be effective to realise decentralised and bottom-up mechanisms to provide global public goods such as stable climate system compared to national actions under international regimes that tend to require large negotiation and transaction costs and may lack swift and flexible response to the issues and because local governments have hands-on experiences of public management in close partnership with other local stakeholders to solve social problems.

The study aims to 1) identify success factors to promote alternative, decentralised and bottom-up financial mechanisms to support local actions contributing to development of low carbon society in the China, in particular success factors and constraints for demonstrated and failed clean development mechanism (CDM) and voluntary offset projects, and to 2) examine promoting factors, under which Chinese local governments could facilitate to promote financial mechanisms for local mitigation projects.

1.2 Scope of the Study

The financial mechanisms for mitigation projects in general include public, private,

social finances and carbon credits. Public mechanisms include grants from national government, local public finance through taxation and bond issuance, finance from public financial institutions, and official development assistance (ODA). Private finance includes private investment for equity, loans from commercial banks, and energy service company (ESCO), which is a special financial scheme for energy efficiency improvement projects. Social finance includes funding from foundation, contribution based on corporate social responsibility (CSR) and NGO's support, and not-for-profit microfinance. There is also a characteristic financial flow for mitigation projects that produces carbon credits. The money is paid for the project proponents when the carbon credits are purchased in advance or after issuance. Transaction of carbon credits is called carbon market. The carbon market is comprised of 1) compulsory market which includes certified emission reductions (CERs) produced by CDM projects and 2) voluntary market which deals with verified emission reductions (VERs).

Among these possible financial mechanisms to implement mitigation projects at local level in developing Asian countries, the study focuses on social financial flow and carbon market as financial mechanisms to promote local-level development-oriented mitigation projects. Public finance and private financial flow will also be studied when they are used to finance mitigation projects that produce carbon credits.

This study also focuses on the following two roles of the local government to promote mitigation projects with financial mechanisms:

1) as implementer: A local government in developing Asia can implement their own energy efficiency projects in water supply and street lighting, waste management projects such as composting of organic waste and transport sector projects, utilising the above financial mechanism

2) as facilitator: A local government in developing Asia can coordinate and facilitate formulation and implementation of remaining types of mitigation projects to mobilise the above financial mechanism. In some cases, a local government can provide the mitigation projects with subsidies, financial coordination services, and necessary land for operation

1.3 Methodology

The purpose of this study is:

1) Identify success factors to promote alternative, decentralised and bottom-up financial mechanisms to support local actions contributing to development of low carbon society in China, in particular success factors and constraints for demonstrated and failed clean development mechanism (CDM) and voluntary offset projects, and to

2) Examine promoting factors, under which Chinese local governments could facilitate to promote alternative financial mechanisms for local mitigation projects.

In order to achieve the goal, according the situation in China, the time frame and the budget limitation, we plan to finish 4 tasks:

Task 1: Analyse the progress of CDM in China.

Activities:

Activity1.1 collect the information of Chinese government policy and administration formality about CDM from internet and literary;

Activity1.2 collect the registered Chinese CDM projects in EB of UNFCCC from <http://cdm.unfccc.int>;

Activity1.3 collect the information of CDM projects that approved by DNA from <http://cdm.ccchina.gov.cn>;

Task 2: Analyse the development oriented local mitigation project in China

Activities:

Activity2.1 analyse the registered Chinese CDM projects in EB of UNFCCC according its scale, involved parties, sector, to know the scope of development oriented local mitigation projects;

Activity2.2 analyse the CDM projects that approved by DNA;

Activity2.3 interview key person in relative research institutes, consulting companies, local governments, collect and analyse the information of local-level development-oriented mitigation projects, including attempted but failed to register as CDM projects and projects that can't produce carbon credit.

Task 3: Case study

Activities

Activity 3.1 Identify three projects from different sectors, if possible, for each category of 1) registered CDM / voluntary offset projects, 2) attempted but 'failed' CDM / voluntary projects, and 3) mitigation projects without producing carbon credits, out of the local-level development-oriented mitigation projects surveyed above, for the in-depth study. For these nine (9) projects, in-detail project description including project proponents, stakeholders and their roles, and planned or actual financing information;

Activity 3.2 contact, interview or visit if possible the key person of the 9 project;

Activity 3.3 design and issue the questionnaires for the 9 projects;

Activity 3.4 collects and analyse the information and questionnaires from the 9 projects specifically.

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Task 4: Analyse the constrains and promoting factors for Chinese local government to promote alternative financial mechanisms for mitigation projects.

Activities

Activity: 4.1. Interview key resource persons

Activity 4.2 Review/ research on secondary information/data sources related to roles of local governments

Activity: 4.3 Summarize results

Task 5: Analyse the role of international networks of local governments, NGOs, and business enterprises that were engaged in the local climate change actions.

Activities:

Activity:5.1. Interview key resource persons

Activity:5.2. Analyze the results and give recommendations.

Task 6: Write the final report

1. 4 Schedule

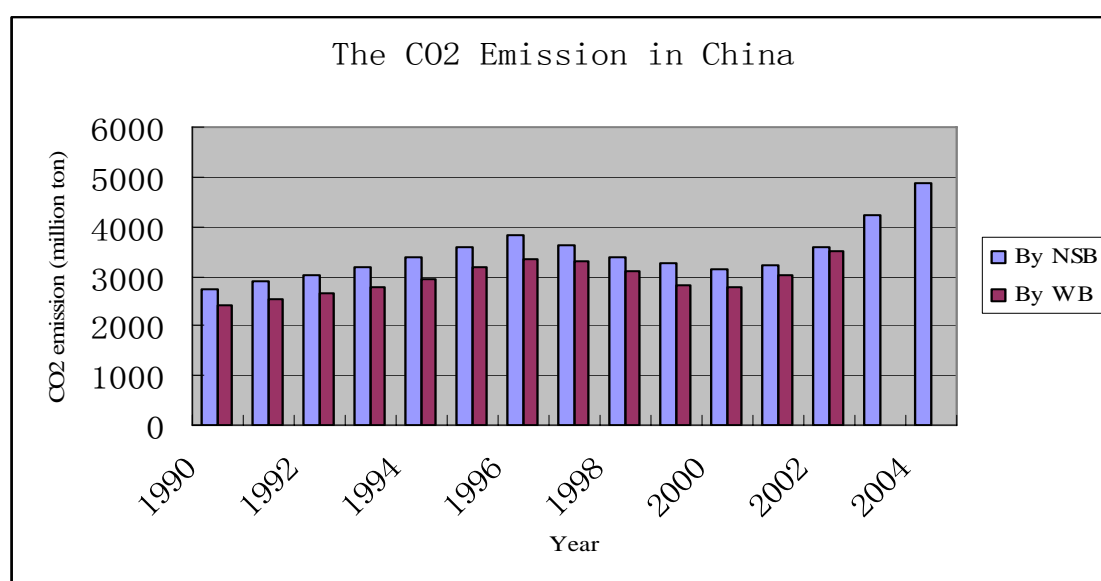
Task	Sep	Oct	Nov	Dec
Task 1: Analyse the progress of CDM in China.				
Task 2: Analyse the development oriented local mitigation project in China				
Task 3: Case study				
Task 4: Analyse the constrains and promoting factors for Chinese local government to promote alternative financial mechanisms for mitigation projects.				
Task 5: Analyse the role of international networks of local governments, NGOs, and business enterprises that were engaged in the local climate change actions.				
Task 6: Write the final report				

II Findings

2.1 Current GHG Emissions in China

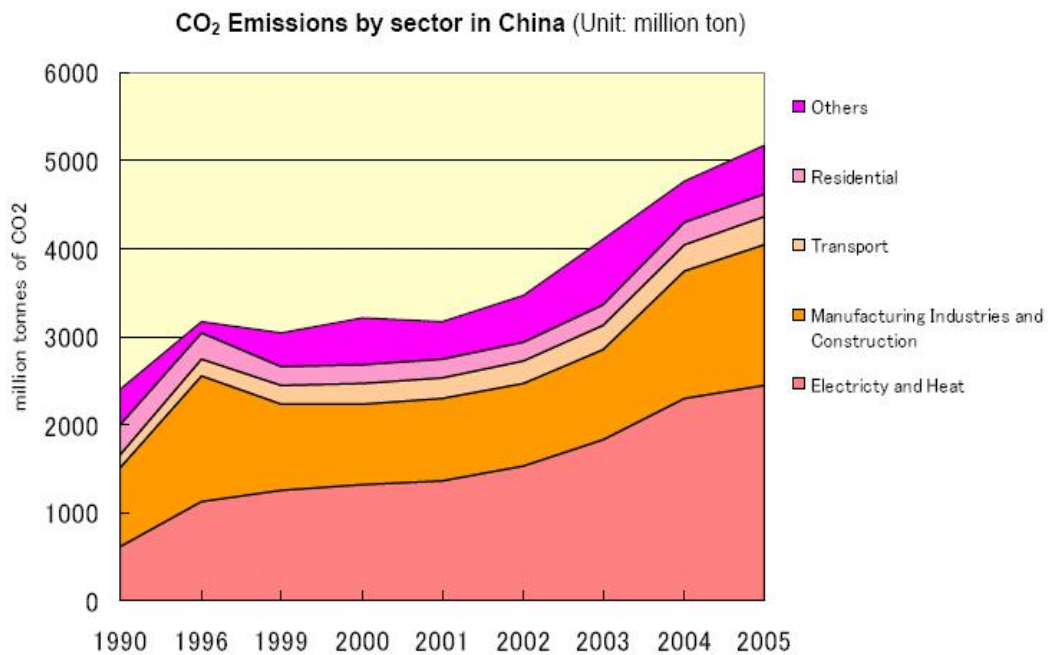
According to the *Initial National Communication on Climate Change of the People's Republic of China*, China's total GHG emissions in 1994 are 4,060 million tons of CO₂ equivalent (3,650 million tons of net emissions), of which 3,070 million tons of CO₂, 730 million tons of CO₂ equivalent (tCO₂e) of CH₄ and 260 million tCO₂e of N₂O. According to tentative estimates by experts from China, China's total GHG emission in 2004 is about 6,100 tCO₂e (5,600 million tons of net emissions), of which 5,050 million tons of CO₂, 720 million tCO₂e of CH₄ and 330 million tCO₂e of N₂O. From 1994 to 2004, the annual average growth rate of GHG emissions is around 4%, and the share of CO₂ in total GHG emissions increased from 76% to 83%.⁴

Chart 2-1-1, the CO₂ Emission in China (1990-2004)



source: 《Introduction to Low Carbon Economy》, Zhang Kunmin, Pan Jiahua, Cun Dapeng, “To Meet Global Warming Challenges in China”, Hu Angang

chart 2-1-2, The CO₂ Emissions by Sectors in China



Source: International Energy Agency (IEA), CO₂ Emissions from Fuel Combustion (1998-2007 edition)

Note: Emission data in Hong Kong is included.

"Others" includes "Unallocated Auto-producers," "Other Energy Industries," "Difference due to Losses and/or Transformation," and "Industrial waste and non-renewable municipal waste."

source: www.iges.or.jp

2. 2 China's Efforts and Achievements in Mitigating

According to the white paper titled "China's Policies and Actions for Addressing Climate Change" issued by the Information Office of China's State Council on Oct 29, 2008, China has actively acted on the mitigation and got great achievement.

China is one of the countries most susceptible to the adverse effects of climate change. In China, the complex climate and a fragile eco-environment that determines its task of adapting itself to climate change is arduous; the large population and a relatively low level of economy determines its development task is a formidable one; the ongoing industrialization process and coal-dominated energy determines its task of controlling greenhouse gas emissions is a tough one.

The strategies and Objectives of China for Addressing Climate Change are: give full effect to the Scientific Outlook on Development, adhere to the fundamental state policy of resources conservation and environmental protection, control greenhouse gas emissions and enhance the country's capacity for sustainable development, center on securing economic development and accelerate the transformation of the pattern of

economic development, focus on conserving energy, optimizing the energy structure and strengthening eco-preservation and construction, and rely on the advancement of science and technology, increase international cooperation, constantly enhance the capability in coping with climate change, and make new contribution in protecting the world environment.

In 2007, the government announced a timetable for different areas to close down their backward production facilities in 13 industries. Until the end of 2007, 14.38 million kw of small thermo-power generating units, 46.59 million tons of iron-smelting capacity, 37.47 million tons of steel making capacity and 52 million tons of cement production capacity was reduced; more than 2,000 heavily polluting papermaking plants, chemical plants, and printing & dyeing mills were close down, as were 11,200 small coal mines.

In 2006, the state supported 111 key energy-conservation projects resulting in an energy-conservation capacity of 10.1 million tons of standard coal. In 2007, the state supported 681 key energy-conservation projects resulting in an energy-conservation capacity of 25.5 million tons of standard coal. Technological transformation conducted by enterprises under the direction of local governments resulted in an energy-conservation capacity of 60 million tons of standard coal. It is expected that an energy-conservation capacity of 240 million tons of standard coal will be created after ten major energy-conservation projects are implemented from 2006 to 2010. With subsidies from the government, 50 million energy-saving bulbs are now being distributed to households all over the country, and within the coming three years more than 150 million energy-saving bulbs will be distributed. energy consumption per-unit GDP in 2006 and 2007 across China was lowered by 1.79 percent and 3.66 percent, respectively.

The Law on Renewable Energy were enacted in 2005 to give priority to renewable energy By the end of 2007, the annual installed capacity of hydropower in China was 145 million kw, ranks the first in the world; the installed wind power capacity is 6 million kw, ranks fifth in the world; solar energy collectors reached 110 million sq m, keeping China the world leader in this field for many years; biomass power is 3 million kw; nuclear power is 9.06 million kw, an increase of 30.5 percent over 2006. The proportion of coal in the consumption of primary energy dropped from 72.2 percent in 1980 to 69.4 percent in 2007. The proportion of hydropower, wind power and nuclear power combined was raised from 4 percent to 7.2 percent in the same period.

By the end of 2007, there were over 26.5 million households in China using marsh gas, saving 16 million tons of standard coal annually, tantamount to a reduced emission of 44 million tons of carbon dioxide. China has constructed 26,600 breeding farm marsh gas projects, and installed 42.86 million sq m of solar-powered heaters in the countryside, 14.68 million sq m of solar energy houses, 1.12 million solar energy stoves and more than 200,000 small wind-driven generators. China has established some demonstration spots for the gasification and solidification of crop stalks. It has

installed firewood- and coal-saving stoves in 151 million households and energy-saving stoves in 34.71 million households.

In the past 20-odd years, some four million ha of trees have been planted every year, the country's rate of forest coverage going up from 12 percent in the early 1980s to 18.21 percent now. In 2006, 35.1 percent of China's urban areas, or 1.32 million ha, were covered with grass or trees. It is estimated that tree-planting activities in China between 1980 and 2005 effectively absorbed 3.06 billion tons of carbon dioxide.

2.3 CDM Authorities in China

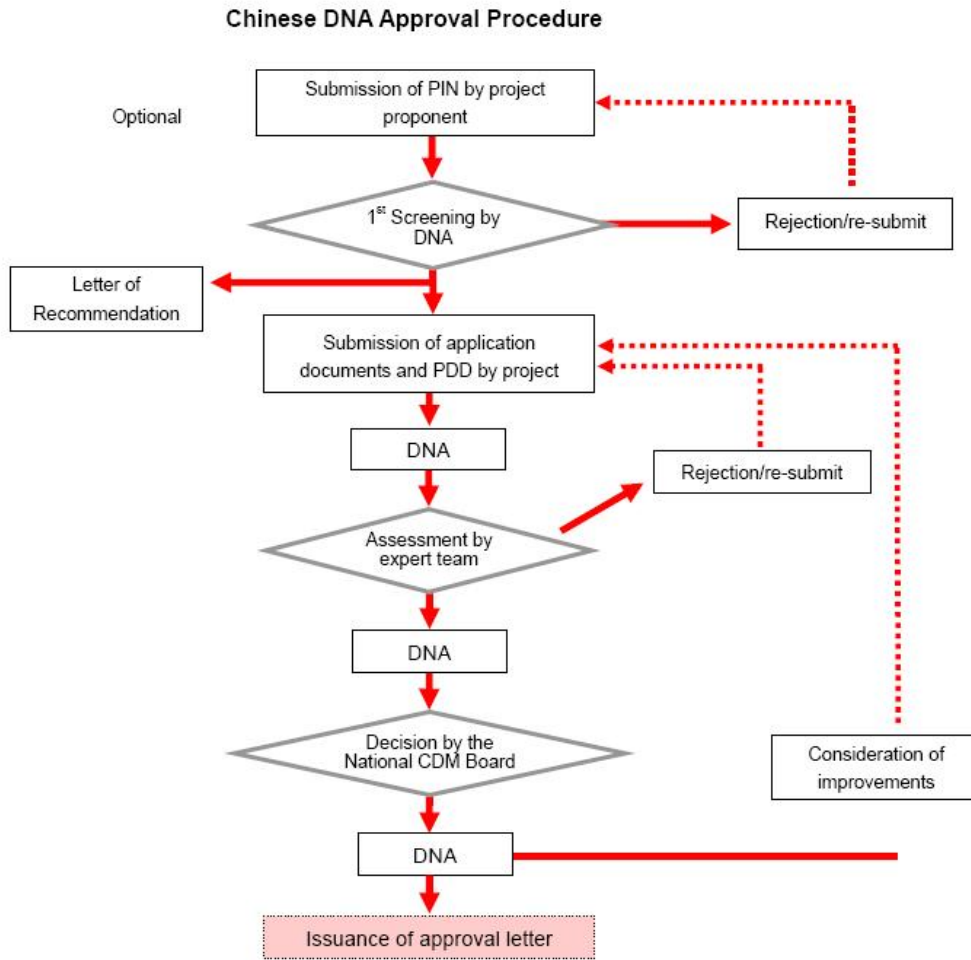
China ratified the Kyoto Protocol in August 2002, around one year later, in the October of 2003, National Coordination Committee on Climate Change (NCCCC) was established to be responsible for the affairs on climate change under the guidelines of the State Council. In the June 30th, 2004, the “Interim Regulations for CDM (Draft)” was released to manage the affairs associated with the CDM in China, which included 12 national ministries and major authorities (listed in Table2-2-2). In the same day, “Measures for Operation and Management of Clean Development Mechanism Projects in China” was issued by the National Development and Reform Commission (NDRC), the Ministry of Science and Technology (MOST), and the Ministry of Foreign Affairs (MFA) and, later, in 12th October of 2005, modified by the NCCCC. This document provides general rules and project procedures as well as admission requirements.

Table2-3-1 - Major national CDM authorities in China

Authorities	Functions
National Coordination Committee on Climate Change (NCCCC)	<p>Making and coordinating national climate change policies</p> <p>Making CDM related national policies, standard and regulations</p>
<p>National CDM Board (NCB)</p> <p>Head: National Development and Reform Commission (NDRC) and National Science & Technology Ministry</p> <p>Deputy head: National Foreign Affairs Ministry</p>	<p>Review and assesses the CDM projects,</p> <p>Report the CDM progress to NCCCC</p> <p>Making CDM project operation regulation and</p>

<p>Member: National Environmental Protection Administration, China Meteorology Bureau, National Financial Ministry and National Agriculture Ministry.</p>	<p>procedure.</p>
<p>National Development and Reform Commission (NDRC) Under it there are experts group and administration center.</p>	<p>Chinese DNA. Receives CDM applications from project owners, issues a “no objection letter” to the buyers, if needed, and issues the approval letter for the application.</p>

Source: «Clean Development Mechanism in Project Development and Practice in China», (China 21st Centenary Agenda Administration Centre, Global Environmental Research Centre of Tsinghua University).



Source: CDM Country Guide for China (IGES, 2005)

Figure2-3-1 - Organizational flow chart for CDM project approval

(Source: "CDM Country Guide for China", Institute for Global Environmental Strategies, Japan)

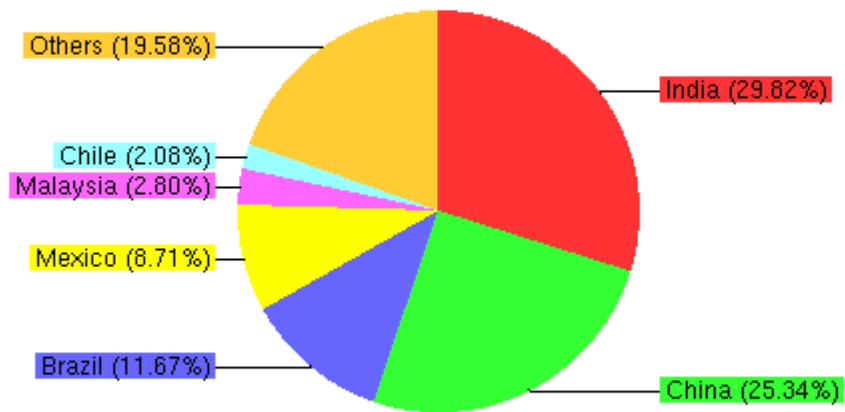
2. 4 The CDM progress in China

2. 4.1 The registered CDM project in EB

China is the No. 2 country according the registered project in EB, is the No. 1 according the issued CERs on December 5, 2008.

Chart2-4-1

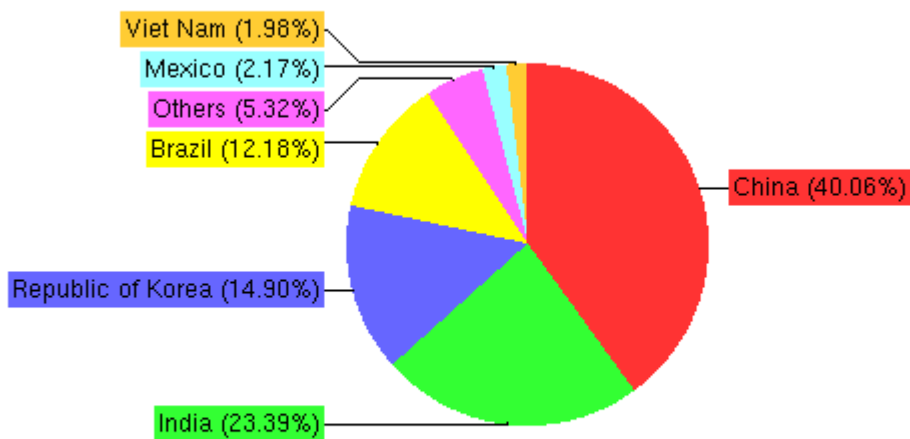
Registered project activities by host party. Total: 1,251



<http://cdm.unfccc.int> (c) 05.12.2008 18:56

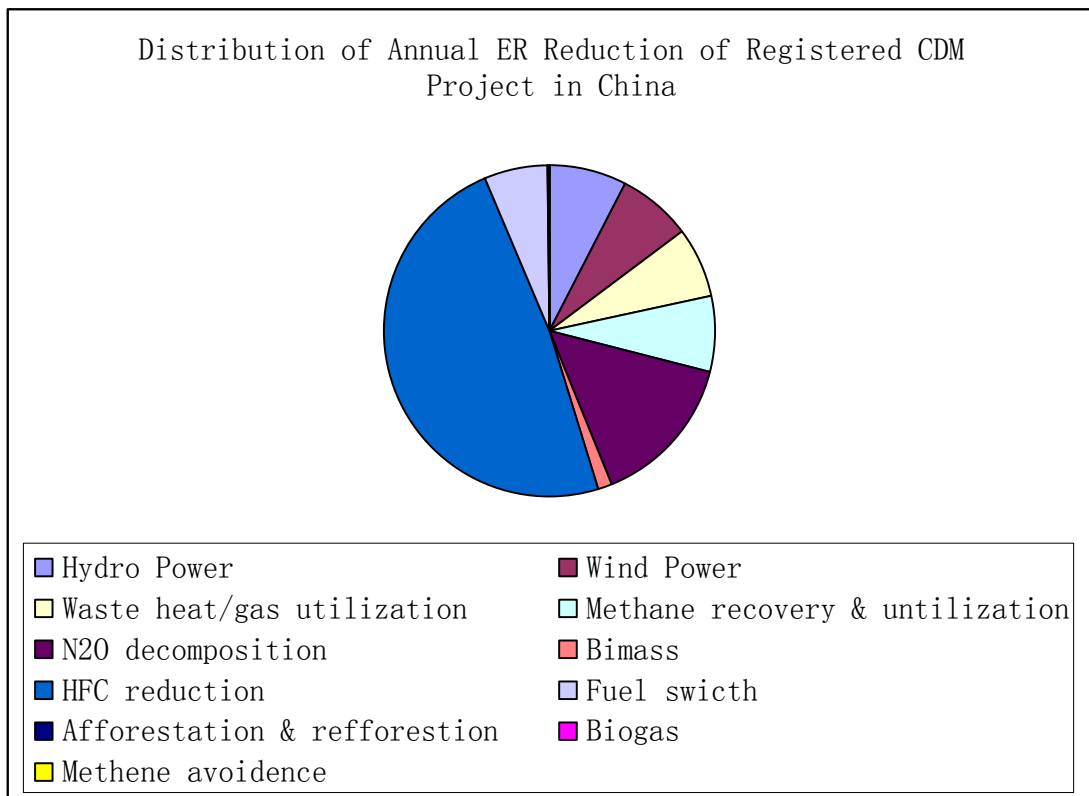
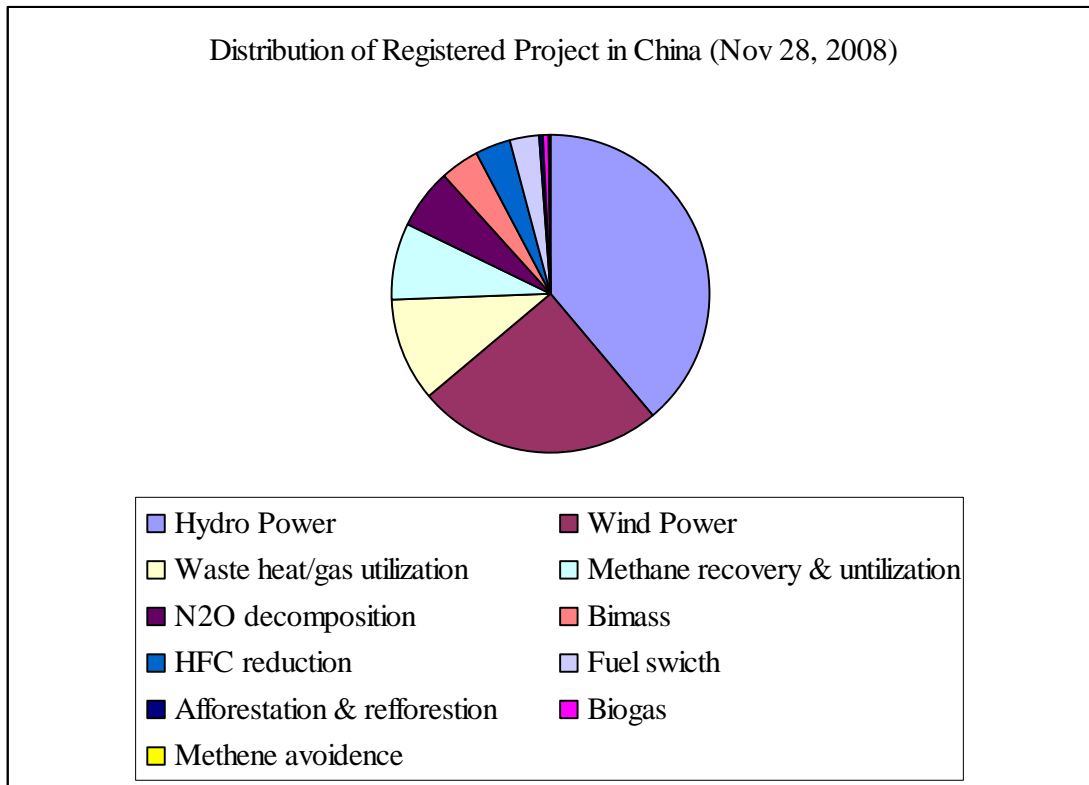
Chart 2-4-2

CERs issued by host party. Total 226,870,286



<http://cdm.unfccc.int> (c) 05.12.2008 14:54

Chart 2-4-3, Distribution of Registered Project by sectors

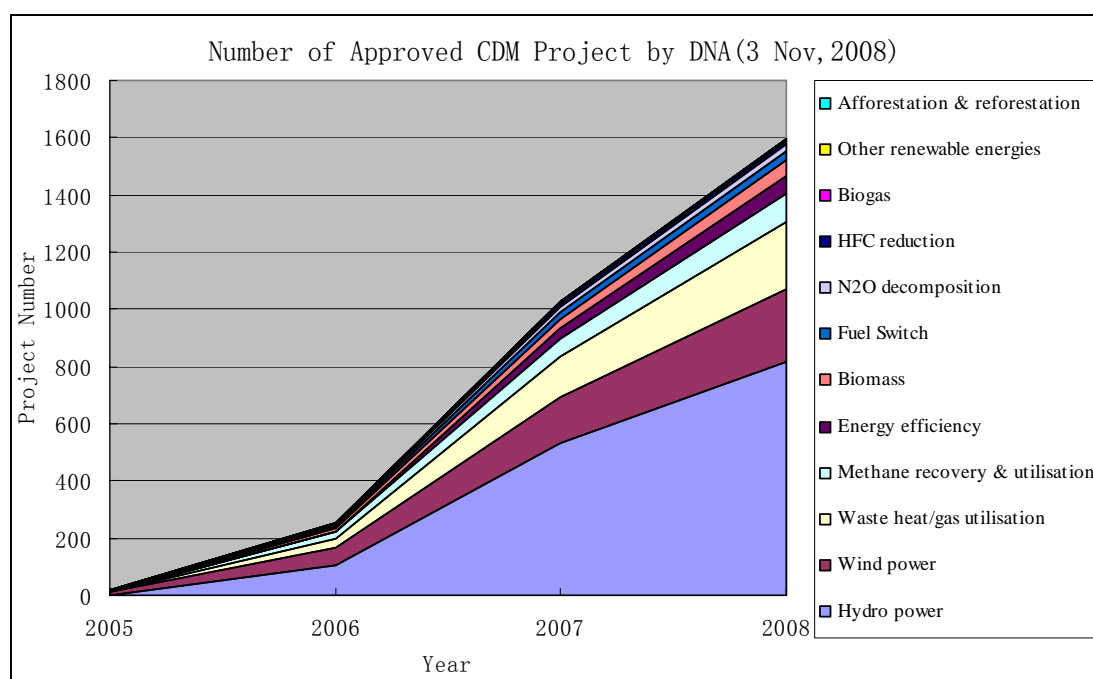


Source: Institute for Global Environmental Strategies,
<http://www.iges.or.jp/en/cdm/report.html>, November 28, 2008

2.4.2 The CDM project approved by DNA of China

The development of CDM project in China developed very fast. The first batch of CDM project approved by DNA of China was in Jan10, 2006. until the end of 2006, 255 projects were approved; in 2007, 773 projects approved; in 2008, until November 3, 570 projects approved, total is 1598. (Source: NCCCC)

Chart 2-4-4 Number of Approved CDM Projects by DNA (30 October, 2008)



2.5 The standard for the case study selection

In China, until November 3, 2008, the registered CDM project in EB is 286, (<http://cdm.unfccc.int>); until November 3, 2008, the approved CDM projects by China DNA was 1598, (Source: NCCCC). In last 3 years, there is a champion for energy saving and pollution emission reduction, the local governments do their best to achieve the goal set by the central government. They initiated numerous projects; most of them have climate change mitigation effect, but do not produce carbon credit. In the vast choices in China and the limited resources of the study, the work team of China set up a standard to choose the cases for study.

2.5.1 The standard we used to choose 3 success CDM / voluntary offset projects:

1. It is registered in EB

2. It is a development oriented project.
3. The local government and communities involved deeply.
4. It is a main category of mitigation project in China.
5. The information is available.

According the standard we set, 3 projects were chosen: 1) Shandong Weihai 69 MW Wind Power Project, 2) Xiaohe Small Hydropower Project and 3) Hebei Jinzhou 24MW Straw-fired Power Project as the success projects. Because:

1. There are 229 projects were energy industry in 286 registered CDM projects of China in EB, that takes 78.4%, mostly were wind power and hydropower;
2. The wind power, hydropower and biomass power are renewable energy, that have significant CO2 emission reduction, in the same time, most of them located in remote rural area, poor and less developed, the project can bring them a good opportunity to develop.
3. The wind power, hydropower and biomass power project are strongly linked to the local government and communities, they need land, need communication with the local people, need local resources. Their raw material are provided locally and their products are used locally.
4. Shandong Weihai 69 MW Wind Power Project is located in the suburb of Weihai, except the (<http://cdm.unfccc.int>), the work team can easy get more information from local relative stakeholders and participants. Xiaohe Small Hydropower Project Hebei Jinzhou 24MW Straw-fired Power Project were one of the earliest success CDM project in China, was chosen as a case study in 《Clean Development Mechanism --Project Development and Practice in China》, China 21 Agenda Administration Centre, Global Environmental Research Centre of Tsinghua University 2008, from this book, we can get more information in detail.

2.5.2 The standard we used to choose the attempted but failed CDM / voluntary projects:

Usually the information of attempted but failed project can not be found in website and literatures. We choose the CDM Project Center of Shandong Province as the team member of the study, from their experience, choose the attempted but failed project. The standard we use to choose the project is as follows:

1. It is initiated as CDM project and asked consultant to do PIN or PDD.
2. It is a development oriented project.
3. The local government and communities involved deeply
4. It is a main category of mitigation project in China.

5. The information is available.

Rizhao Luxinjinhe Methane Power Project, Qingdao Biomass Power Project and Daba Cement Works Waste Heat Recovery and Utilization for Power Generation Project were chosen as case study.

2.5.3 The standard we used to choose the mitigation projects without producing carbon credits:

From the beginning of the Eleventh 5 Years Development Plan of China in 2006, there is a champion for energy saving and pollution emission reduction in the country. All the local governments devoted all their efforts, initiated numerous activities to achieve the goal, most of the activities have climate mitigation effect.

Weihai is a fledging coastal city, developed very fast in last two decades. In 2007, compared with the foundation of prefecture level Weihai city in 1987, developed urban area grow from 13 to 92 km²; urban population grow from 233,000 to 636,000; GDP grow from 3.42 billion to 158.35 billion. The GDP growth rate is 21.14 % annually. But because Weihai has paid much attention on the environmental protection, the environmental quality remains the first class in China. Weihai has got the award of National Sanitary City, National Environmental Protection Model City, National Garden City, and National Excellent Tourism City. The city has twice been named the “Best Model City of Improving Living Environment” by UN. In 2003, Weihai received the “UN-Habitat Scroll of Honor Award.”

Since the beginning of the saving energy, reduce emission champion, Weihai actively participate in 10 aspects:

1. Shut down outdated equipment and process line. Weihai has 11 cement process line, 8 are small with outdated technology, the government will shut down all of them until 2010. Huaneng Weihai Power Station has a 2* 125 MW generator, Weihai Xinli has 5*35 t/h boilers, are on the list of outdated equipment, will be shut down before the end of 2008.
2. Encourage the development of renewable energy. Weihai has rich wind power resources, Weihai government attract and facilitate the power giants to invest the wind power in Weihai, until now, 510 MW wind power mill are in operation, that takes around 10% of power consumption of Weihai. Two nuclear power stations are under feasibility study. One water pump energy reservation station is under construction. The methane programmeme in rural area is developed very fast.
3. Improve the energy efficiency in industry. There are 10 energy saving project in Weihai, that include waste heat recovery in tyre processing, using waste plastic produce package material, recycled cooling water for heating system in power & heat station, innovation of a ship yard power supply system, energy saving lamp using promotion, and energy saving in building construction.
4. Increase the waste water treatment capacity to meet the demand of increased waster discharge.

5. Construct the waste incineration plant, improve the waste treatment efficiency.
6. Expand the clean energy usage; let more household use nature gas.
7. Improve the public transportation system, encourage more passengers use public bus.
8. Strength the supervision, install on line monitoring facility for the all the main pollutants discharge sources.
9. Allocate more money to the foundation of energy saving and emission reduction.
10. Build the recycled economy. Weihai was chosen as the pilot city to build the recycled economy by the provincial government, the building plan created by Harbin University is approved by experts. The government will push forward the practise of the plan.

In 2007 in Weihai, the energy consumption decreased 4.5% per unit GDP, the water consumption decreased 2.0% per unit GDP, the SO₂ emission decreased 1.5% and the COD discharged in the waste water decreased 7.5%.

Weihai is an open city, has economic relationship with 189 countries and region, in 2007, the international trade value is 11.1 billion USD (Weihai Statistic Book). Weihai has established friendship with 8 cities in 8countries (Ube in Japan, Cheltenham in UK, Biella in Italy, Santa Barbara in U.S.A, Sochi in Russia, Timaru in New Zealand, Yuesu City in R.O.K, Sousse in Tunisia). Under the city level, there are 33 friendships between town, school, communities, NGOs etc. In 2006, there were 8691 enterprises owned by foreigners, 194172 foreigners visited Weihai (Weihai Statistic Book). Weihai participated most of the international organizations that provided for the local city, that include the Kitakyushu Clean Environmental Initiative Network, the Asia Urban Information Center of Kobe.

Weihai is a coastal city; it has 987km of coastline, the longest for a city in China. It is fragile for climate change that makes Weihai government and people pay more attention for the mitigation. Weihai is a good case for this study. So the study team of China decided to choose Weihai as focus area, take the follow item as the standard to choose the 3 cases:

1. it is development oriented;
2. it has significant mitigation effect;
3. it is implemented or facilitated by the local government;
4. it is hot of public concerned;
5. it is a under going project.

According this standard, Weihai Waste Incineration Project, Weihai Methane Programmeme for Rural Area and Weihai Urban Greening Project were chosen as cases for study.

2.6 The case study

2.6.1 Shandong Weihai 69 MW Wind Power Project

1) General information of the project

The Project is sited in the north of Weihai City, Shandong Province. The Project involves of installation of 46 sets of turbines, each of which has a capacity of 1500 kW, providing a total installed capacity of 69 MW. According to the anemometry data collected during the past years, the Project site has excellent wind resources with an average wind speed about 6.6 m/s at the height of 70 m and the estimated electricity output supplied to the North China Grid from the 46 sets of turbines of the Project is 140.033 GWh per year.

The Project will reduce 2,882,019tCO₂e GHG emissions in a 7x3 crediting period.



2) Financial analysis of the project

This project is owned by Huaneng Zhongdian Weihai Wind Power Co. Ltd, the total investment of the project is 705.1141 million RMB. The financial analysis of the project is as follows:



Table6-1. Financial Parameters for Calculation of IRR of Total Investment of the Project

NO.	Parameters	Value
1	Installed capacity (MW)	69
2	Electricity supplied to NCG (GWh/y)	140.033
3	Bus-bar tariff (RMB / KWh) ⁷	0.70(excluding VAT); 0.76(including VAT)
4	Project lifetime (yrs)	22.5 (Construction period 1.5 yrs; Operational period 21yrs)
5	Total investment (Million RMB)	705.1141(equity/debt ratio:1:2)
6	Debt rate	6.39%

7	Circulating fund(Million RMB)	1.5
8	Investment of transmission line (Million RMB)	14.8
9	Income tax rate	33%
10	Sale tax (Including tax of city construction and education, Million RMB)	13.28
11	O&M cost (RMB/MWh)	128.5

Based on the data, without CERs sales revenues, the IRR of total investment of the Project is 6.72%, which is lower than the benchmark (8%). The Project is not financially attractive. With CDM, CERs revenue will improve IRR of total investment by up 1.94% above the benchmark scenario.

Therefore, the proposed project, with the CDM revenue, can be considered as financially viable to the investors. Table6- 2 shows the IRR of the Project with and without CDM revenues.

Table6-2. Financial indicators of the Project

IRR(total investment) benchmark=8%	
Without CDM	6.72%
With CDM	8.66%

This CDM project is consulted by Huaneng New Energy Company, the consulting fee is about 0.8 million RMB.

The buyer of the CERs produced from this project is Endesa Generación S.A Spain.

3) Benefits for the local development

Though this project is invested and owned by the Huaneng Zhongdian, a state owned power giant, but also gave a big contribution to the sustainable development of the local economy, society and environment:

(1) Creating revenue to the local government in the form of land purchase and tax

payment;

(2) Creating local employment opportunities during the project construction and operation period;

(3) Improving the environment by reduce the coal consumption and pollutants emissions. Now the wind power takes around 10% of the total power consumed in Weihai.

4) The local government and community involvement of this project

Because the project is benefit to local development, so the local governments are thirsty to invite the project to be constructed in Weihai. They assist the investor to complete the formate, simplify the process, quiken its progress; they provide the land to the wind power plant with top priority and cheapest price though the land usage quota is limited strictly; they actively adjust the relationship of the investor with other stakeholders, make the project goes smoothly.

5) The success factor of the project

(1) The strong background of the investor. Huanneng Zhongdian is a state owned power giant, they have money, have the experience on power project.

(2) The strong support from the local government and communities.

6) Information sources:

United Nations Framework Convention on Climate Change,
<http://cdm.unfccc.int/index.html>

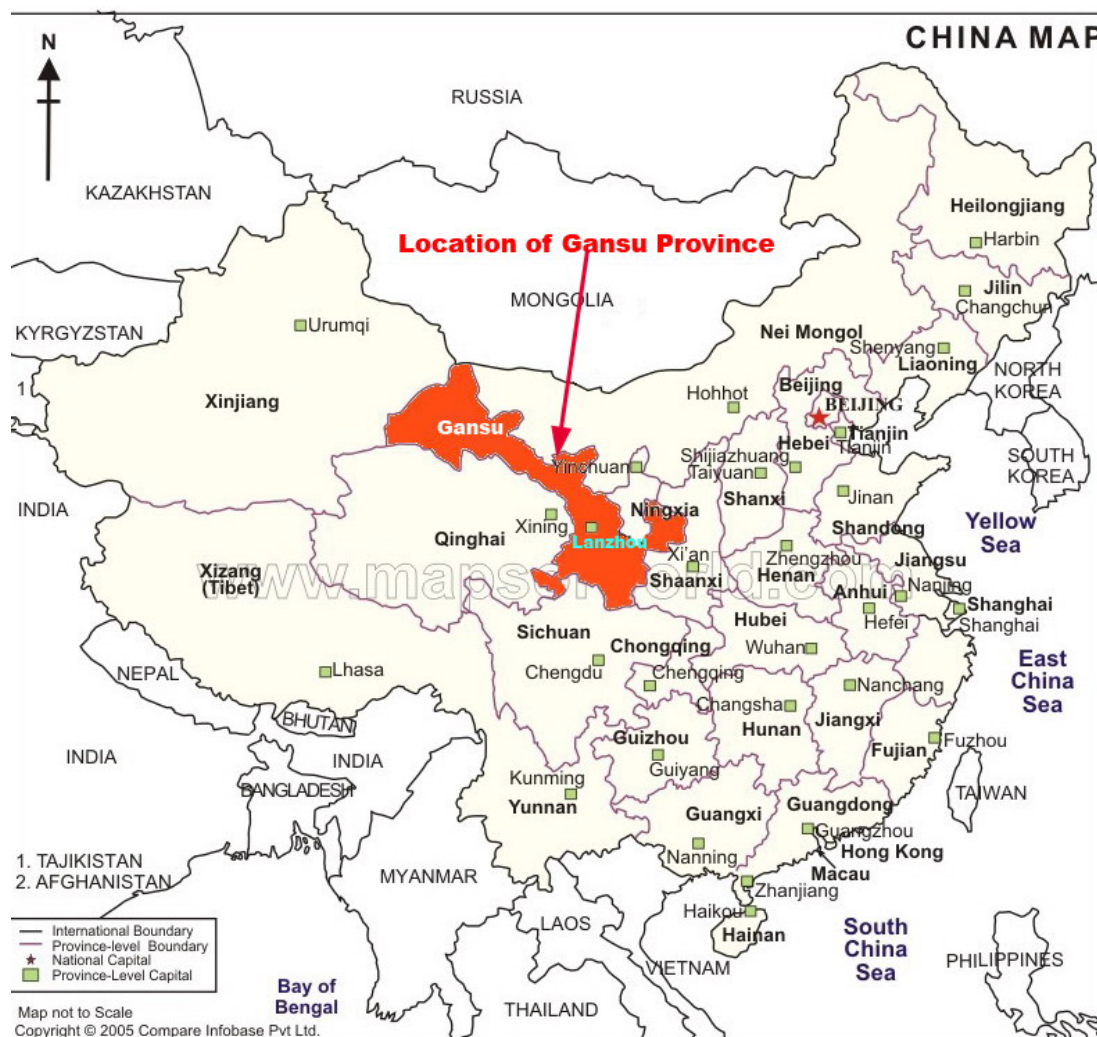
Weihai Development & Reform Bureau

Ms. Lv Xiaohong, Huaneng Zhongdian Weihai Wind Power Co., Ltd

2.6.2 Xiaohe Small Hydropower Project

1) General information of the project

The Xiaohe Small Hydropower Project, a run-of-river hydropower project, is located on Daxia River in Gansu Province. It does not construct barrage, and directly utilize the tail water of Toudaohe Hydropower Station, through diversion sluice, penstock, forebay, pressure pipelines and powerhouse to generate electricity. When this project is put into operation, it will be connected to the Northwest Power Grid (NWPG) of China through Gansu Provincial Grid. Total installed capacity is 9.6MW, provided by three (3) 3.2MW turbines, and annual output is expected to 51,030MWh. The project had started construction on April 26, 2005, and started operation in the end of 2007.



The proposed project activity will expand the capacity of NWPG, and further alleviate the tension of regional electricity supply; on the other hand it will displace part electricity of coal-based electricity generation, consequently reduce the emissions of anthropogenic greenhouse gas (GHGs) by sources.

Total estimated reductions is 291,123 tonnes of CO₂e in 7 crediting years

This project was registered in EB in October 23, 2006.

2) Financial analysis of the project

Xiaohe Small Hydropower Project is owned by Gansu Xiaohe Hengfa Hydropower Co., Ltd, it is a limited liability company owned by several private companies.

According to the “Economic Evaluation Code for Small Hydropower Projects”, which was issued by Ministry of Water Resources in 1995 (Document No.SL16-95) and is the most important reference for small-scale hydropower projects (SHP) assessment

in China, a project will be financially acceptable when IRR is better than the sector benchmark IRR. The benchmark IRR on total investment for small hydro power projects is 10%.

Table 6-3 The calculation factors are as follows:

NO.	Parameters	Unit	Value
1	Annual Export to NWPG	MWh	51,030
2	Power Tariff Rate(including VAT)	RMB Yuan /kWh	0.18
3	Project Lifetime	years	22
4	Total Investment	RMB million Yuan	68.4776
5	VAT	%	6
6	Income Tax	%	33
7	Additional Tax to VAT	%	8
8	Operation and Maintenance Expenses	RMB million Yuan	1.34
9	Expected CERs Price	RMB Yuan / tCO ₂	60
10	CERs Crediting Period	Year	7*3

The IRRs with and without CDM revenues are listed below. Without CDM revenues, the IRR is 7.24%, lower than the financial benchmark rate of return (10%). Calculated investment is 7,025 RMB /KW, which is higher than the weighted average investment in China (about 6,600RMB/KW). Therefore the proposed project activity is not a financial attractive. With CDM revenues, the IRR is increased to above the benchmark and financial acceptable.

Table 6-4, The IRR with and without CDM of Xiaohe Hydropower

Item	Without CDM revenues	Benchmark rate	With CDM revenues

IRR of total investment	7.24%	10.00%	10.89%
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3) Benefits for local development

Xiahe County where the proposed project located had been recognized as one of State Key Poverty Alleviation Counties by the Chinese government. Being a renewable energy project, this project will produce positive environmental and economic benefits, and contribute to the local sustainable development.

- (1) This project activity act as a direct supplement to local power capacity, change the power shortage situation;
- (2) Pay some tax revenues to local government during the operation;
- (3) Bring 30 job opportunities for the local minority nationalities, promote their living standard ;
- (4) Play an active role in protecting and improving regional environment through avoiding environmental pollution caused by coal burning.

4) The involvement of local government and communities

Because this project benefits the local development, so it was welcomed by local government and communities. The local government propaganda the benefits of the project to the farmers, adjust the relationship between the investor and the local communities, made the land transfer smoothly, during the public hearing, no one opposite this project. Combined the hydropower project, the local government constructed a running water project, providing running water to the nearby people. Local government strictly supervise the ecosystem conservation of the project, make sure it follows the guides given by the environmental impact assessment, give enough water to farmland irrigation, all the land affected is restored, specially pay respect to the religion of local Tibetans, moved the project location. All the involvement of local government and communities made the project goes smoothly.

5) Success factors of the project

- (1) Combine the CDM project with the local development.
- (2) Pay more attention to the local minority.

6) Information sources:

United Nations Framework Convention on Climate Change,
<http://cdm.unfccc.int/index.html>

《 Clean Development Mechanism --Project Development and Practice in China》 ,China 21 Agenda Administration Centre, Global Environmental Research Centre of Tsinghua University 2008

Mr. Ma Shuyuan, Xiahe Hengfa Hydropower Co.,Ltd

2.6.3 Hebei Jinzhou 24MW Straw-fired Power Project

1) General information of the project

The Hebei Jinzhou 24MW Straw-fired Power Project is located in Zhangcun, Dongsu Town, Jinzhou City, Hebei Province. It occupies about 6.7 hectare lands with capacity of two 75t/h straw-fired boilers and 12 MW heat-supplying units. During the operation period, it use about 176,000 tons of corn and wheat straw annually to generate about 132 GWh of power and supply 530,000 GJ of heat, which could satisfy the heating demand of 1million M² buildings. The total investment of the project is 259.42 million RMB.



The expected emission reduction in the first 7 year crediting period (January 2007-December 2013) is 1,250,381 tons of CO₂.

2) Financial analysis of the project

The project is owned by Hebei Jiantou Biomass Power Co., Ltd. This company is a joint venture invested by Construction Investment Company of Hebei Province and Shijiazhuang Energy Development Center.

According the calculation, the IRR of the total investment is 5.47% in absence of CDM revenues which is much lower than the benchmark rate of 8%. With the CDM revenue (6 Euro/ tCO₂e, 21- year crediting period) the IRR of the total investment will increase by 5%, which shows that the CDM revenue has significant influence on IRR.

NPV (Total investment)

IRR (Total investment)

(million) $i = 10\%$

Benchmark rate =8%

Without CDM revenue -58,34

5.47

With CDM revenue 25,24

11.82

The project is consulted by the Chinese Renewable Energy Industries Association; the consulting fee is 200,000 Yuan RMB.

3) Benefits to local development

This project carries lots of benefits to the local government and communities: reduce greenhouse gas emissions, improve the environment, increase household incomes, and alleviate poverty in the rural areas.

(1) According to a survey conducted by the project developer, the total production of biomass straw in Jinzhou City is 352,100 tons per year, currently 50,000 tons is utilized for forage, over 85% are left to decay or sometimes burned in open air, that waste the resource, pollute the environment and emission the GHG, cause the global warming. The straw-fired power could solve this problem.

(2) There is not central heating system in Jinzhou City before the project established, they use small boilers to provide heat and steam for the factories and buildings, which are in low efficiency and lack maintenance, leading to energy waste and air pollution.

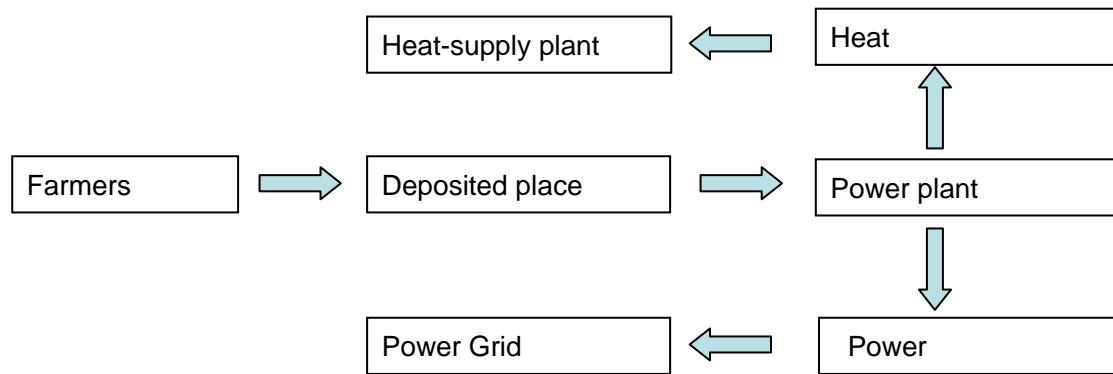
(3) In Jinzhou City, the farmers is poor, construct the strew-fired power project, purchase strew from the farmers, can increase their income, alleviate the poverty.

4) The involvement of local governments and communities

Because this project brings a lot of benefits to local development, so the local governments and communities strongly support this project.

To establish a straw-fired power project, one important thing is to collect and transport straws. The Jinzhou government gives a lot of support to the project and has set up an efficient organization to supply straws to the power station. Another important thing is to eliminate the small boilers, let all the factories and buildings use the centre heating system. The government issued a regulation, held a public hearing, give the small owners of the boilers preferential policies and subsidies, let them follow the general arrangement, make the project goes smoothly. If there is no the local governments and communities' support, there will be no this project.

The detailed straw-supply process and project activities are as following:



5) The success factors of this project

- (1) Local governments and communities' support
- (2) win-win design for farmers and the project investor.

6) Information sources:

United Nations Framework Convention on Climate Change, <http://cdm.unfccc.int/index.html>

《 Clean Development Mechanism --Project Development and Practice in China》,China 21 Agenda Administration Centre, Global Environmental Research Centre of Tsinghua University 2008

Ms. Ma Lingjuan, Chinese Renewable Energy Industries Association

2.6.4 Rizhao Luxinjinhe Methane Power Project

1) General information of the project

Rizhao Luxinjinhe Biochemical co., Ltd is located in Rizhao, Shandong Province, its main production is citric acid, the capacity is 150,000t/a, the number one in China. During the citric acid process, discharge 1500 t/d organic waste water in high concentration. In 2006, they tried to use anaerobic method treating the waste water, produce methane, use the methane generate power. According to the calculation, there are 42,000t/a COD in the waste water that can produce 9,000t/a CH₄, generate 23.4 million KW/a.

Total estimated GHG emission reductions is 1.47 million tones of CO₂e in 7 crediting years

2) Financial analysis of the project

Rizhao Luxinjinhe Biochemical co., Ltd is a private owned company. The total investment of the methane power project is \$20 million. According the calculation, if 80% of the investment comes from loan with debt rate 8%, and the project life time is 14 years, no CDM, the IRR is 0%; with CDM and the CERs is \$7/t, the IRR is 2%.

From the analysis, this project is not a business attractive, even with CDM.

3) Benefit for the local development

- (1) Reduce the pollutants discharged to environment, improve the water quality.
- (2) Reduce the odor H₂S emission, improve the air quality.
- (3) Save the electricity consumption 20 million KWh reduce cost of 10 million Yuan in its lifetime.
- (4) Provide 50 job opportunity for the local people, improve their living standard.
- (5) Increase the local government revenue because the cost saving then more tax can be paid by the company.

4) The involvement of local government and communities

- (1) Provide land for the project.
- (2) Assess the environmental impact of the project, issue permit for the company.
- (3) Public gives their comments and suggestions during the public survey before the government issues the permit.

5) Progress of the project

In the early of 2006, the project was initiated under the pressure of environmental pollution. In June 2006, the company realized this project can apply for CDM and invited the CDM Project Center of Shandong Province as consultant to do the PIN and PDD. But CDM applying procedure usually takes around one year till it get registered in EB. Before the PDD completed, the project was finished in the end of 2006 under the command and pressure of environmental authority. In this case, the project is very hard to meet the additionality of CDM, so they give it up.

6) Lessons learned from this project

In China, the CDM knowledge still limited in the relative government departments and research institutes, most of the entrepreneurs and project managers do not know it. So lots of the projects were not considered for CDM at the early stage though they might qualify. Until they know it can apply for CDM, some time it is too late, because the procedure for a project to be registered as CDM in EB usually takes around one year, and according the practice, if a project is completed will difficult to verify its additionality.

This lesson tells us, strength the CDM knowledge spread, start the CDM consideration as early as possible.

7) Information sources:

Mr. Liu Xiangpeng, Rizhao Luxinjinhe Biochemical co.Ltd

Mr. Liu Zhaosheng, CDM Project Center of Shandong Province

2.6.5 Daba Cement Works Waste Heat Recovery and Utilization for Power Generation Project

1) General information of the project

Daba Cement Works is located in Dezhou City, Shandong Province. The Daba Cement Works has two clinker production lines with capacity of 2500 t/d and 5000t/d. The main objectives of the project activity are to meet the increasing electrical supply needed by the cement works and to reduce greenhouse gas emissions through the recovery and use of waste heat from the clinker production lines. The waste heat currently is vented to atmosphere mainly, with a portion re-circulated within the clinker process to pre-heat input fuel and raw materials. The project activity will capture the waste heat and use it in a power generation plant, the exhaust heat from the power generation plant can still be recirculated to the clinker process. This power generation plant is rated at 12MW and can produce 50419 MWh annually; 49540 tons of CO₂emission can be avoided.

2) Financial analysis of the project

The Daba Cement Works owned by Dezhou Jinghua Group, this project invested by the group.

The total investment of the project is 81.73 million RMB, 52.15 million use loan from the bank. According the experience of similar project, the IRR is around 11%.

3) Benefit to the local development

(1) This project could ease the power shortage in the local area. During the last several years, the economic development in Shandong was very fast, power shortage is an obstacle of the development. The 12 MW power project can improve the situation.

(2) Provide 36 job opportunities for the local people; increase their income, improve their living standard.

(3) Increase the local government revenue through more tax paid by the Daba Cement Works due to its cost reduction and energy efficiency improvement.

(4) Improve the local environment through avoiding the expansion of coal power generation.

4) The involvement of the local government and communities

The local government is a facilitator of the project, provides the land for the project, issues the permit, adjusts the relationship between the project owner and other stakeholders.

The local communities will formally participate the project during the environmental impact assessment, give their comments and suggestions.

5) Progress of the project

In May 2006, the manager of the project asked the CDM Project Center of Shandong Province as consultant preparing the PDD. In July, when the consultant finished the draft of PDD, an accident happened to the boss of the Daba Cement Works, he died. The company was under a big reform since then. The project was delayed until now.

6) Lessons learned

In some extent in China, the boss means very thing for a private company, if the boss changed, every thing changed.

7) Information sources:

Mr. Zhao Xu, Daba Cement Works

Mr. Liu Zhaosheng, CDM Project Center of Shandong Province

2.6.6 Qingdao Fulai Biomass Power Project

1) General information of the project

Qingdao Fulai Biomass Power Project is located in Chengyang District, Qingdao City. The project plan to purchase crop straws from the farmers as fuel to produce heat and power. The project consist of 2*75t/h boilers with 1*12MW steam generator. After it is established, it will use about 85,000 tons of corn and wheat straw annually to generate about 72 GWh of power and supply 260,000 GJ of heat, which could satisfy the heating demand of buildings with an area of 0.5million M².

The estimated emission reduction is 65,000 tCO₂e/a.

2) Financial analysis of the project

Total investment of the project is \$7.5 million that includes \$2 million development cost, \$4 million equipment cost and 1.5 million others. The revenue comes from the electricity is \$4.4 million, comes from the heat supply is \$0.9million.

According the calculation, the IRR without CDM is 5.4%, with CDM is 10.8%.

3) The benefits for the local development of the project

(1) Provide more electricity to the power grid; ease the tension of the power shortage in east part of Shandong Peninsula. These years the manufacture industry developed very fast in this area, the energy demand goes high very quickly, some time the power grid can not meet the demand, the power supply became the bottleneck of development. This project can alleviate the situation for the local area.

(2) Increase the income for the farmers. In the east part of Shandong Peninsula, agriculture is one of the main industries, there are abundant wheat and corn straw in this area. Some of the crop straws are used for the animal raising, some are used for farmland fertilizer, and some are just left to decay or even open burning. This project

will purchase the crop straw from the farmers, that will increase the income of the farmers significantly.

(3) Improve the environmental quality. The crop straw left to decay or open burning causes severe environmental pollution, from the odor and smoke. Use the straw to generate heat and power, can avoid the air pollution.

(4) Provide the revenue to the local government. This project will purchase land, stimulating the transportation sector and pay the VAT to the local government that will improve the development in this area.

4) The involvement of the local government and communities.

(1) Provide land for the project.

(2) Assistant the company to organize the straw collection and transportation.

(3) Assess the environmental impact of the project, issue permit for the company.

(4) Public gives their comments and suggestions during the public survey before the government issues the permit.

(5) Assistant the company get their electricity on the power grid.

(6) Assistant the company to establish the heating system in the local area and adjust the relationship of the company with the heating consumers.

5) The progress of the project

The manager of the project start to consider the CDM in the early of 2006, the consultant, CDM Project Center for Shandong Province, create the PIN for this project in June, 2006. But later, the manager changed his idea, left the CDM progress idle. The reasons are:

(1) This project is not a total new construction, it is planning to reform the existed coal boilers to straw boilers that will cost extra money and has some technical barriers.

(2) The project is located in the urban area; it is difficult to expand land occupation for straw storage and fly ash disposal. The straw transportation also causes environmental concerns.

6) Lessons learned

CDM project need to consider its location and environment, in one site it is feasible, but in another site it may be not.

7) Information sources:

Mr. Zhang Kangzhao, Qingdao Fulai Biomass Power Project

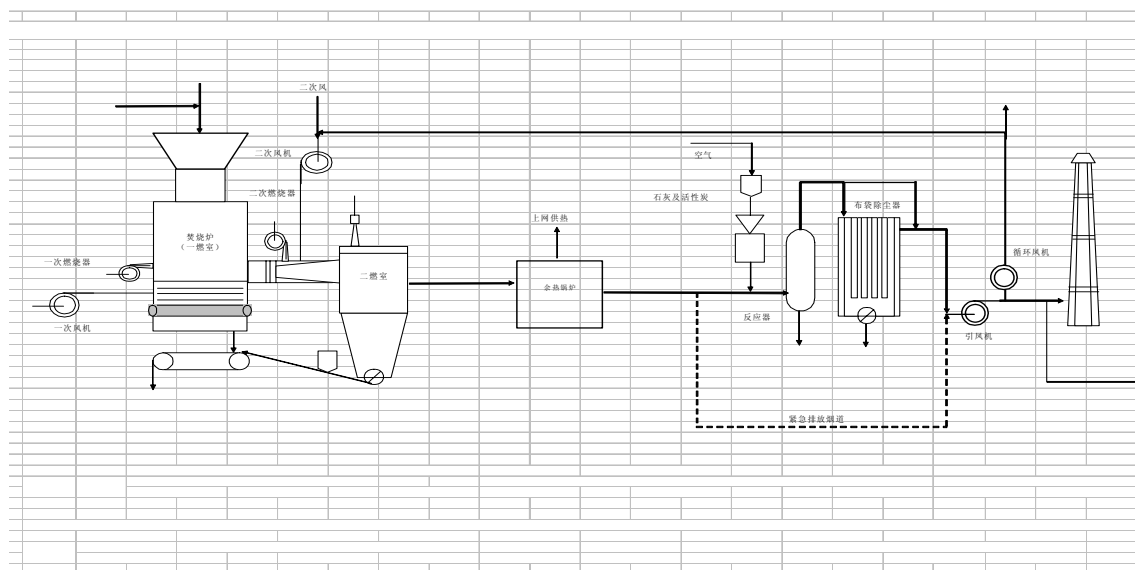
Mr. Liu Zhaosheng, CDM Project Center of Shandong Province

2.6.7 The Weihai Waste Incineration Project

1) General information of the project

Until now, Weihai use the landfill method to treat the solid waste. The last sanitary landfill site was constructed in 2000, total investment is RMB 75 million, its volume is 4.467million cubic meters, can serve for 26 years according the feasibility study at that time. But along the rapid urbanization and economic development, the solid waste generated increased very fast, it is less than 500 t/d in 2000, now is around 700 t/d. the lifetime of the landfill site has only 8 years left, short 11 years than estimated at beginning. And because the land limitation, the environmental problem of the landfill, it is very difficult to choose another landfill site. So the government decided to construct an incineration plant.

The construction site of the incineration plant is located near the landfill site. The capacity of the incineration plant is 700 t/d. The incinerator we chosen is mechanical double grate, incineration temperature is 850—1100°C, use limestone solution treat the acid gas emission, use active carbon treat the organic gas emission, use bag filter treat the dust, the residual from the incinerator goes to the landfill site. The heat will be recovered and supply to the factories and buildings nearby. The process is show in the chart.



This project does not produce CERs, but has significant mitigation effect, because it avoid the methane generation in landfill and the CO₂ emission from coal-burning heating facilities.

2) Financial analysis of the project

Weihai government use BOT method construct this project, through bidding, Shanghai Environment Group is the winner. The total investment is 280 million, the incineration fee is 45 Yuan/t that will be adjusted for every two years and the operation period is 25 years, then the project will be transferred to the local government.

The government allocates the land for this project, responsible for the heat selling and payment for the incineration fee.

3) Benefit for the local development

(1) Improve the environment in Weihai

(2) Provide heat for the nearby area, ease the power shortage problem.

(3) Provide 30 work opportunities for the local people, increase their income, improve their living standard.

4) Involvement of the local government and communities

Solid waste management is the responsibility of local government. Though this project uses the BOT method, but the incineration fee is paid by the government. After the operation period, the project will be transferred to the government. So actual local government is the implementer of the project.

Solid waste is one of the important environmental issues that concerned by every resident. Good waste management encourages all the residents participate, reduce, reuse and recycle. The cost of the waste treatment actual is paid by the residents directly or indirectly because the government revenue also comes from the tax paid by the residents.

A special issue for this project is the environmental impact for nearby people. This project has noise, dust, odor pollution during its construction and operation period, there are farmers nearby, and they strongly protest this project located there, even blocked the road, rally in the front of city hall. After the government improved the environmental protection measure, provide more work opportunities for them, they reached agreement with the government.

5) The engagement of international organizations.

The Kitakyushu Initiative Network (KIN) has sent consultants two times visited the landfill site, gave comments and suggestions. The Asia Urban Information Center of Kobe (AUICK), sent consultants two times visited the landfill site, gave suggestions. There are 6 person from Weihai has attended the training course provided by KIN, AUICK and Ube, the sister city of Weihai in Japan, that focuses on the waste management, three of them directly involved in the project. Chosen the BOT method and using the incineration process, is affected by the engagement of the international organizations in some extent.

6) Information sources:

Weihai Environmental Protection Bureau

Weihai Construction Bureau

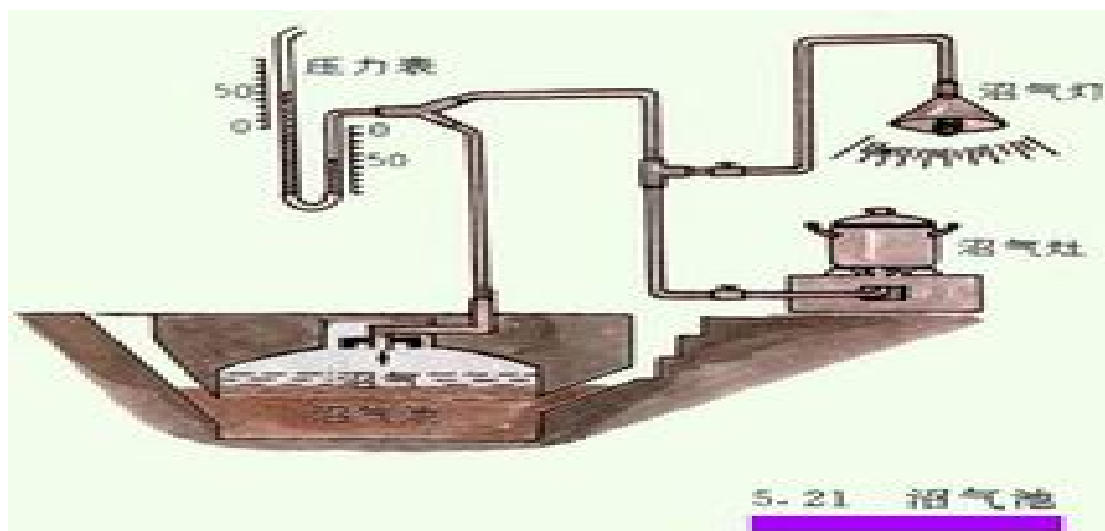
Weihai Landfill Site Administration Office

2.6.8 The Rural Methane Project in Weihai

1) General information of the project

In rural area, use the livestock residual and crop straw to produce methane is an environmental friendly, energy saving and climate change mitigation programme. But because the construction cost, the inconvenient maintains, makes it not easy to be spread in the rural area.

Weihai began the rural Methane programme in the early 1980s, its development fluctuated in different period. In 2006, along with the establishment of scientific development conception in the country, the government put the methane programme on the top priority of rural development again. From the national government to the local level, created rural methane development plan, issued regulations on technology, provide subsidies and service to encourage the rural methane development. The central government takes the rural methane development as one of the indicators for the achievement of the governors and mayors. So the mayors pay much attention on this programme. The government takes some towns, villages and farmers as pilots, use new material and advanced technology, construct the methane tanks, use the methane for cooking, heating and lighting, shows it to the farmers; organize training course for the farmers; provide trunks for the methane tanks' residual remove; establish technical service station in the rural area, make the methane tank construct and operation more convenient for the farmers.



Until the end of October 2008, there are 26928 methane tanks was constructed in the rural area of Weihai, total volume is 250000 m³, can produce 12 million m³ methane annually, that substituted the coal, wood and crop straw burning, reduced the CO₂ emission. According the estimation, the methane tanks in Weihai rural area can reduce the GHG emission 40000 t CO₂e annually.

2) Financial analysis of the project

In Weihai area, the average cost for one methane tank for a farmer household is 2780 Yuan RMB that is a big burden for a farmer. In order to encourage farmers to

construct the methane tank, the central government allocated some national treasure bond foundation to the rural methane programme, that takes about one third of the cost; the local government subsidies one third; so the farmer only pay about one third of the total construction cost.

3) Benefits of the project for the local development

Except the climate change mitigation effect, the rural methane programme brings many benefits for the local both from the development, social and environmental aspects.

(1) Improve the living standard of the farmers. If there is no methane, most of the farmers use wood, crop straw or coal for cooking that is not convenient, not sanitary and harmful for their health.

(2) Protect the environment. If there is no methane, the farmers use wood, crop straw and coal for cooking that emit a lot of dust, smoke and other air pollutants, and the methane programme avoided the trees cutting, conserved the eco system.

(3) The residual from the methane tanks will be used for farmland that will enrich the organic content of the land, avoiding use chemical fertilizer, improve the capacity of the land and make its production organically.

(4) The livestock raising farmers use the livestock's dejecta as feeding material of its methane tank, use the tank's residual for farming, use the farm production for the livestock raising, it became a eco circle.

4) Involvement of local government and communities

The local governments is the initiator and facilitator of the rural methane programme, they provide the information, the training course, the subsidies and free service for the farmers. In Weihai city, the government takes the rural methane programme as one of the main task to improve the rural development, a vice mayor is in charge of this programme, the Weihai Agriculture Bureau is responsible for the programme, under the bureau, there is Weihai Rural Energy Station, which is responsible for the technical service. In the town level cities also have the similar organizations.

The communities in the rural area are the organizers of the methane programme. In China, the villages have their own organization, called villagers committee, all the villagers are members of the committee, and the head of the committee are elected by the villagers. The committee is responsible for all the things that related the villagers. They spread the information, organizing farmers participate the training course, let farmers learn from each other and help each other. The communities are the bridge between the government and the farmers.

The farmers are the implementers and direct beneficiaries of the programme.

5) The engagement of international organizations

The rural methane programme in China has great benefit for the environment both

globally and locally, so many international organizations interested in it, through different channel provide technical and financial assistance. But because the programme spread around the vast rural area and operated by the farmers individually, it is very difficult to organize. Until now there is no success CDM project in this field.

During the rural methane development in Weihai, the local government and the design institute keep in touch and cooperated with several international organizations, got some new ideas and advanced technologies, but have not get the financial support from them now.

For the small methane tank that used for the farmers' household, the Weihai Rural Energy Station has the licence to provide the design service; for the larger methane tank, the design needs to be done by professional institute. The institutes that provide the large methane tank design service are Beijing Ringheri Environment Co.Ltd, Qingdao Tianren Group and Rizhao Hongye Group, mainly Beijing Ringheri Environment Co.Ltd. Beijing Ringheri Environment Co.Ltd follows the development of methane tank design closely, has a good relationship with C.S.T. Industries, Inc in USA, Sattler in Austria and NIRAS in Denmark.

6) Information sources:

Weihai Development & Reform Bureau

Weihai Agriculture Bureau

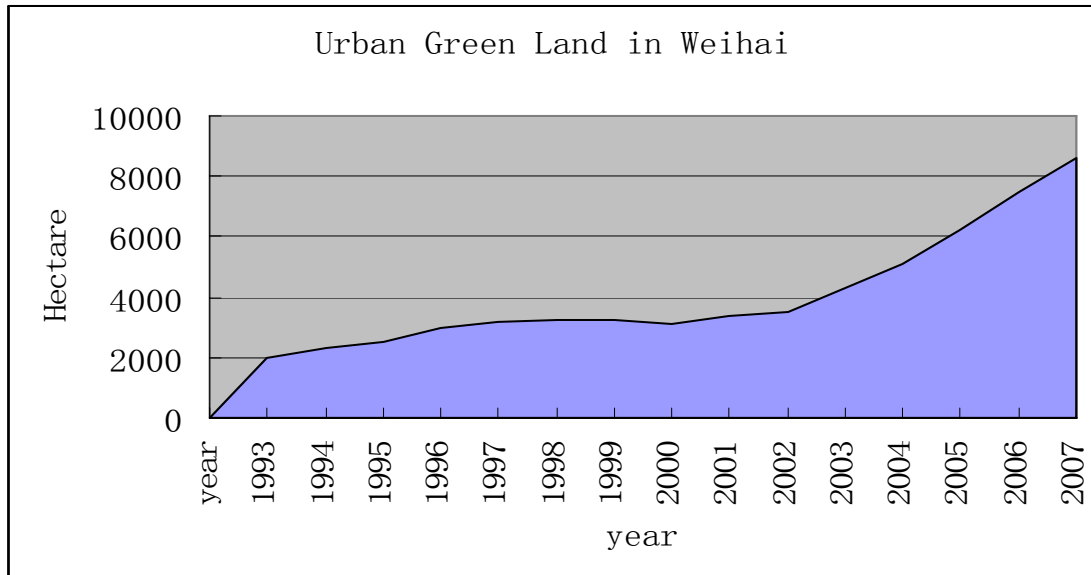
Weihai New Rural Energy Station

2.6.9 The Urban Greening Project in Weihai

1) General information of the project

Urban greening is an urban construction project, environmental project and also a climate change mitigation project. Along with the economic development, urbanization and increasing demand of the residents, urban greening is become a big issue for the local government. The local governments pay more and more attention on the urban greening. The central government also takes urban greening as one of the important indicators for the urban development.

Weihai government has paid much attention on the urban greening in very beginning. The greening land in the urban area increase steadily, from 1965 hectare in 1993 up to 8823 hectare in 2007, increased 4.5 times.

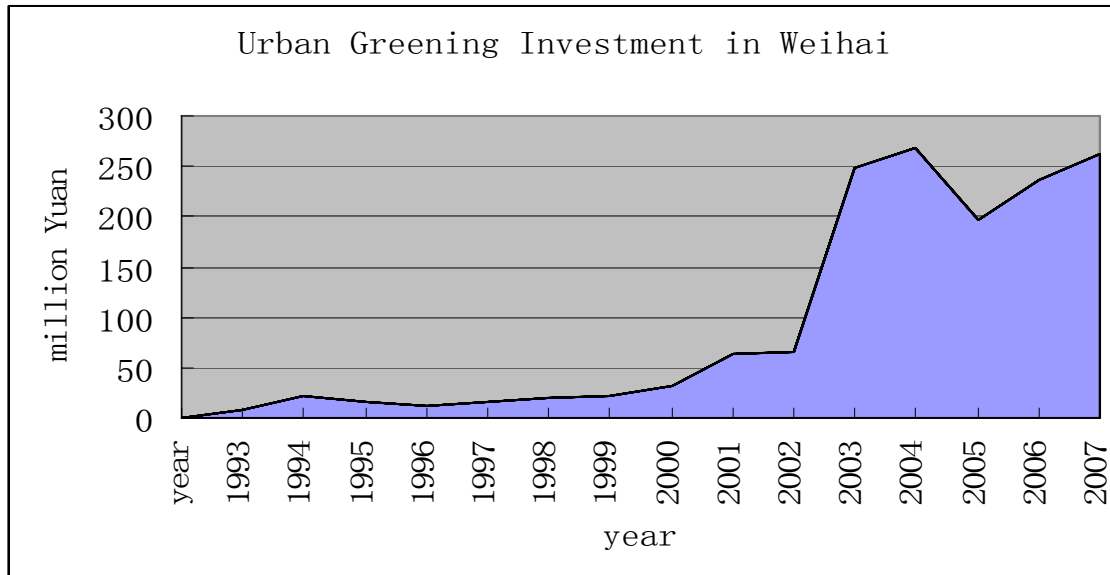


Weihai got the award of Garden City from the national government; got the International Award as the Best Practice for Comprehensive Management of the Living Environment by UN-HABITAT in 1996 and 2000; got the UN-Habitat Scroll of Honor Award in 2003.



2) Financial analysis of the project

The investment on urban greening increased very fast during the last 15 years. From 42 million in 1993 up to 838 million in 2007 that takes about 29% of the total investment of urban public construction and maintains fee of Weihai City.



The urban public construction and maintains fee mainly comes from urban public construction and maintains tax, public affairs plus, allocation from national and local government revenue, water resources fee, public facility connection fee, public facility using fee, land transfer fee and others.

The urban public construction and maintains fee mainly goes to water supply, gas supply, heating, public transportation, roads and bridges construction, drainage, waste water treatment, urban greening, sanitary and others.

3) Benefits of the urban greening

(1) Global warming mitigation. The trees, the grasses and the flowers in the urban area can absorb the CO₂ in the atmosphere; it is a carbon sink project.

(2) Environmental protection. The green land can trap the dust, absorb some of the pollutant gases, obstruct the noise and alleviate the heating island of the urban area, make the urban area environmental friendly.

(3) Aesthetics improvement. The trees, the grasses and the flowers make the urban area more beautiful, let the people feel pleasant.

(4) Create job opportunities for local residents especially for the disadvantaged group. In Weihai, there are thousands of people worked in the urban greening, some are full time workers but most of them are part time workers come from the villages nearby or the urban area that have no skill.

4) The involvement of local government and communities

The local governments is the in the main investor and implementer of the urban greening project. They are responsible for the planning, planting, irrigation and other maintains.

The local communities and residents are the stakeholders of the urban greening, they

pay the cost indirectly through tax, participate the greening activities and enjoy the improvement of the environment.

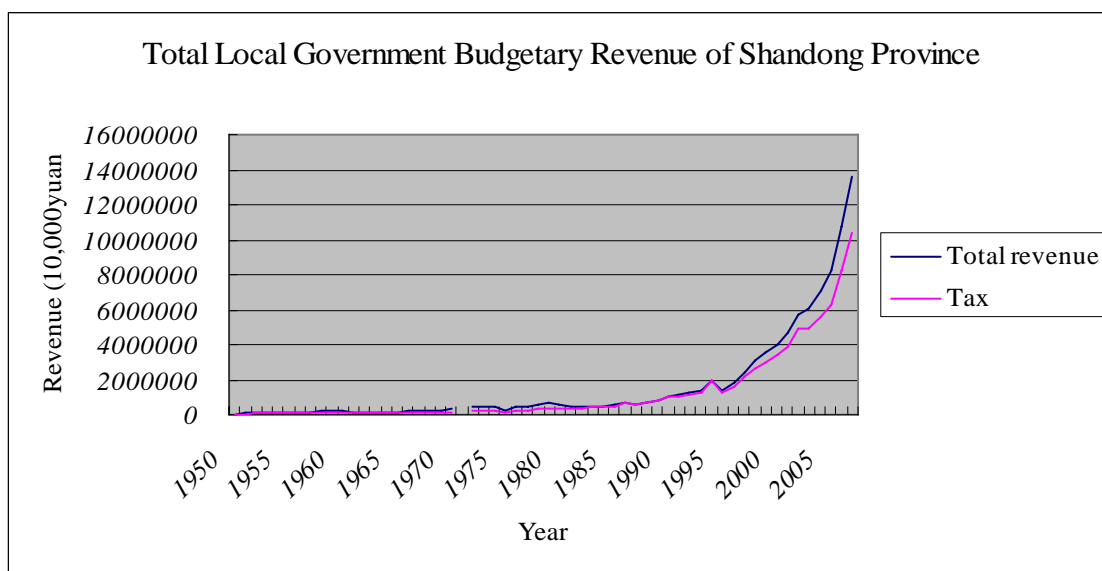
5) The engagement of the international organizations.

Weihai is an open city, for the urban planning, large urban construction projects, the government will hold a international bidding for most of them. The government officers and technicians worked in the urban planning and greening field, most of them have the experience of visiting abroad, collaboration with foreigners, so the greening programme in Weihai has foreign spirit in side.

2.7 Constrains and Promoting Factors for Chinese Local Government to Promote Financial Mechanisms for Mitigation Projects.

In China, the financial sources for climate change mitigation projects mainly comes the local government revenue, like wastewater treatment, solid waste management, public transportation, forestation and urban greening. In some area and cities, the government began to collect treatment fee or usage fee, but it is just a beginning, only takes a small part of the total expenditure. Though the local government revenue grow up very rapidly, but still very hard to meet the demand of the expenditure. The total local government budgetary revenue of Shandong Province gives us a good example.

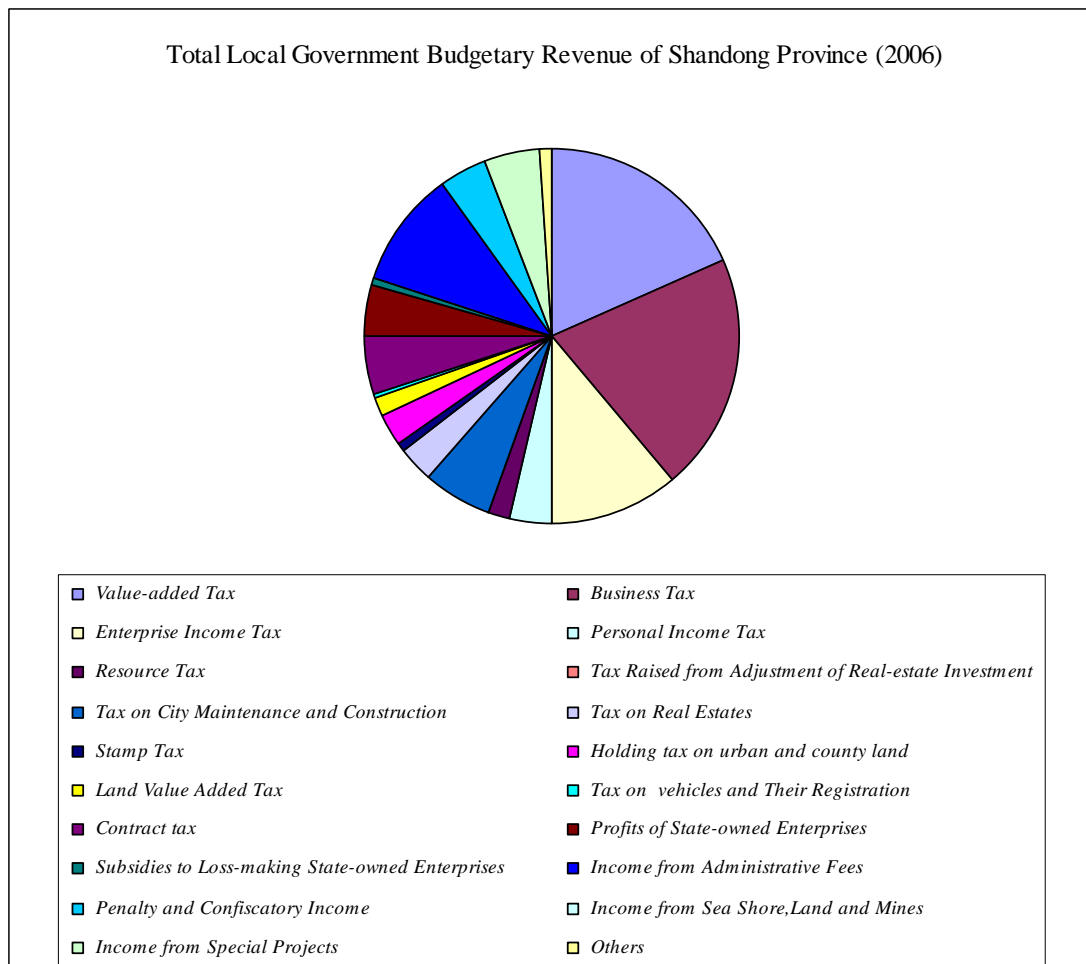
Chart 7-1, The Trend of Local Government Budgetary Revenue



The local government revenue mainly comes from tax. The tax includes: Value-added Tax, Business Tax, Enterprise Income Tax, Personal Income Tax, Resource Tax, Tax Raised from Adjustment of Real-estate Investment, Tax on City Maintenance and Construction, Tax on Real Estates, Stamp Tax, Holding tax on urban and county land, Land Value Added Tax, Tax on vehicles and Their Registration, Contract tax,

Profits of State-owned Enterprises, Subsidies to Loss-making State-owned Enterprises, Income from Administrative Fees, Penalty and Confiscatory Income, Income from Sea Shore, Land and Mines, Income from Special Projects and Others.

Chart7-2 The Proportion of Taxes in Shandong Province in 2006.



Sources: Shandong Statistic Yearbook, 2006.

The item of the local government budgetary revenue is decided by national government, the amount of the revenue mainly depends on the economy scale that is complex issue, is beyond the scope of the study. What we focus on in this study, is the alternative financial mechanism for the mitigation project in local level, mainly carbon market and social financial sources.

Through the study, the Chinese work team found that there are some constrains or obstacles for Chinese local government to use carbon market and social financial sources to promote the mitigation project. They mainly are:

1) The public knowledge about CDM is poor

China has made a great progress in CDM project development, became the second largest CDM project host party in EB and the biggest CERs owner, and the potential CDM market in China is huge, there are more than thousand project approved by DNA of China waiting to be registered in EB, and there are more project under development. But the public knowledge about CDM is still poor. When we do the

study, we interviewed more than 100 people through different channel, most of them do not know much about CDM. There is online survey, CHINA CDM INFORMATION CENTRE, <http://www.china-cdm.org>, one question is What is your opinion about the public knowledge for CDM? Until September 29, 2008, there are 22 visitors answered this question. Their answer is: very good 0, good 0, normal 6, poor 4 and very poor 12.

2) The transfer cost of CDM project is high

According the «Clean Development Mechanism Project Development and Practice in China », (China 21st Agenda Administration Centre, Global Environment Research Centre of Tsinghua University 2008), the CDM project development cost includes two aspects, one is the additional investment for the emission reduction (direct cost), another is the transfer cost for the CERs (indirect cost).

The transfer cost includes:

1. Document preparation cost, PDD etc.
2. Negotiation cost
3. Evaluation cost by DOE
4. Registration cost
5. Monitoring cost
6. Verification cost
7. Consultant cost
8. Charge by DNA

For large CDM project in China, the transfer cost is about \$200,000-250,000. for small CDM project, though the total amount of transfer cost is smaller, but it takes larger percentage of the project investment that makes the project has less economic competitive and less attractive for the international buyers.

Table7-1

Project scope	Emission reduction(tCO ₂ /a)	Transfer cost (USD/t CO ₂)
Super large	>200,000	0.1
Large	20,000-200.000	0.4-1.3
Small	2000-20,000	13
Very small	200-2000	130
Micro	<200	1300

From the table above, you can see, if the project emission reduction is less than 20,000 tCO₂/a, the benefit from CERs selling can not cover its cost according current price.

3) There is a conflict between domestic project approval standard and CDM project requirement.

According the EB regulation, before the project registered by EB, it must be approved by domestic authority. In China, if a project wants to be approved by authority, it must be profitable, its Internal Rate of Return (IRR) must be higher than the benchmark of this industry. But if the IRR of this project is higher than the benchmark of this industry, the project will not have the additionality, it can not be registered in EB. In this situation, some of the proponents just meet the domestic standard first, then modify the feasibility study, makes it meet the CDM requirement.

4) Risk is an obstacle for CDM project.

All the investment projects have risks in some extent, so they are called ventures. But for CDM project, there are more risks. The first one is registration risk. Because the format of registration is complex, the project should complete the domestic format first, from city, to provincial, then to the national level; for the international format, the project should finds the buyer, pass the DOE evaluation, then goes to EB. Normally the whole format takes more than one year, if any thing happens, the project may fail. The second risk is the prepayment of the transfer cost. The transfer cost is about \$200,000-250,000 for large project and should be pre-paid before get the CERs revenue, which is a burden and risk for the proponent. The third risk is the monitoring. For project, like the landfill gas utilization, the gas that really collected usually is much less than the calculated, in this case, the proponent can not get the amount of CERs revenue as they expected.

5) The social financial sources in China is very limited

China is a developing country, the economy just take off in last 30 years. The average income of the people still very low, most of the companies still stay in primary stage. Some people are rich, some companies are huge, but their social responsibility is just emerging in recent years and they are mainly shows in the disaster rescue, like earthquake, children's education in remote poor areas and deadly disease in helpless families. For most of the people and companies, because their knowledge for climate change is poor, think that the climate change is faraway for them, it is not an emergency, so they do not like to donate their limited money in this field.

In developed countries, NGO is a big promoting factor for the climate change mitigation, they raise the fund, organizing activities, push the government move forward. But in China, the situation is different, NGOs are just emerging, their scale is small, financial sources is scarce, the fund they raised can only support their own activities, have no capability to invest in the climate change mitigation field.

To promote the alternative financial mechanisms for mitigation projects in China local

level, the study found the following factors should be addressed:

1) knowledge spread

Global warming and climate change is an obvious phenomenon and it affects every body in the world. CDM is a practical mechanism that lets the developed and developing countries work together to deal with the problem. Now almost every body knows the global warming, but few people know CDM. The governments should use TV, radio, newspaper, internet, training course etc. to spread the knowledge of CDM. Let the local governments and entrepreneurs catch the opportunity, using CDM to reduce the GHG emission, in the same time develop its economy.

2) Capacity building.

CDM needs the consultants to create PIN, PDD, need designated operational entity (DOE) to do the evaluation and monitoring, those are very special technical work. Now in China, most of the provinces have CDM project center, some universities and research institutes can do the CDM project consulting, but no organization got the DOE certification until the end of November, 2008. Compare with the vast country and huge CDM market, it is not suitable.

From 2001 to 2004, in the early stage of CDM, World Bank, Germany, Asia Development Bank, UNEP, Japan, Italy, Netherlands, Australia, Swiss, and Canada, cooperated with Chinese government, universities and research institutes, do CDM research (《Clean Development Mechanism in China—Taking a Proactive and Sustainable Approach》Lv Xuedu, Liu Desun, Global Climate Change Institute of Tsinghua University). In recent years, there are more developed countries and international organizations cooperate with Chinese government in CDM development. These programmes and projects spread the knowledge of CDM, improved the capacity of Chinese government and relative institutes, and created some new methodology that is suitable for China. That is a win-win solution for China, developed countries and international organizations, they got the first hand information of Chinese market, established good relationship, that makes them easy to do the CDM business in China.

3) Create new methodology.

During the last two years, under pressure of increased oil price and environment deterioration, Chinese government initiated a campaign called “Save energy, Reduce emission”. Under this programme, local government and companies take a lot of actions to achieve the goal that includes increase energy efficiency, renewable energy, improve public transportation, waste management etc. They are good for sustainable development, also are mitigation projects for the climate change. But because they are too smaller, or too scattered, according to the existed methodology, they can not be registered in EB to get CERs. Because the total mitigation effect of these activities is huge, and they are thirsty for the CDM assistance, some experts suggest that new methodology need to be created.

4) Open new channels leading private company to invest in mitigation project.

For some urban environmental infrastructure projects, because it is sensible for the public interest, and is not suitable for the market mechanism, like urban water supply,

waste water treatment, waste management, urban heating system, the Chinese government do not allow the private company invest and own the project in these fields. But as a developing country, the government has no enough money to establish the infrastructure to meet the rapid development of urbanization. To solve this problem, some Chinese local governments introduce the BOT (Build, Operation and Transfer), TOT (Transfer, Operation and Transfer) mechanism into the urban infrastructure construction field. They invite the private company to invest, build the project, operating for a period, collect the operation fee, until a certain time, transfer the project back to the local government. For some existed projects, the local government transfer it to private company, use the money to provide more public service, let the private company collect service fee, after a certain time, transfer the project back to the government. In these cases, the government solved the fund shortage problem, provided better service to the public; the private company recovered their investment through fee collection and make reasonable profit. It is a win-win solution.

But it is dilemma to judge the service fee level, if it is too low, will be not attractive for the private company; too high, will affect the residents' daily life, especially the weak group. If we can introduce the CDM mechanism into these fields, that will be much better to improve the environmental protection, the social and economic development as well as mitigation for climate change

5) Encourage NGOs participate in mitigation activity

NGOs are emerging phenomena in China, but compare with other fields, the NGOs in environmental field is more active. According 《The Report on the Development of Environmental NGOs in China, 2008》, created by Chinese Environmental Protection Association, the environment NGOs developed very fast in recent years, until April 2008, there are 3539 environment NGOs in China. The environment NGOs organize the people participate in various environmental activities, like wildlife protection, land greening, environment monitoring, residents' environmental right protection, environmental education etc.

In west countries, NGO is a very important channel to raise the funds, invest in climate change mitigation project. But in China, the situation is different. Most of the NGOs are grass root organization, have no foundation sources, no permanent office. In recent years, the situation is getting better, more enterprises donate the money for NGOs, and some NGOs get support from international organizations. That is a very good start.

The Chinese government should encourage the development of NGO, encourage them participate in environmental protection, in climate change mitigation.

2.8 The role of international networks of local governments, NGOs, and business enterprises that were engaged in the China local climate change actions.

Since its reform in 1978, China opens up to the outside of the world. International cooperation in economy, technology, environmental protection and other fields developed very fast with almost all the countries in the world. International cooperation in local level also developed very fast in recent years, friendship cities, cooperation cities are established in most of the large and costal cities, the economic, culture, information exchanges are quite often, they help each other, learn from each other, move forward together. Compare with national level, the local level international cooperation is more practice, more efficient. To meet the demand and encourage the international local cooperation, some international networks of local cooperation emerged. Along with the local government international cooperation, NGOs and business enterprises are also participating.

Weihai is an open coastal city, has economic relationship with 189 countries and region, has established friendship with 8 cities in 8countries. Under the city level, there are 33 friendships between town, school, communities, NGOs etc. Weihai participated most of the international organizations that provided for the local city, that include the Kitakyushu Clean Environmental Initiative Network (KIN), the Asia Urban Information Center of Kobe (AUICK).

Weihai participated in KIN in the very beginning, took part most of the activities organized by the network, hosted the second meeting of the network. KIN sent experts to Weihai 6 times 20 people, gave their comments and suggestion for the environmental issues in Weihai.

Weihai and Ube, in Japan, established friendship 20 years ago, we organize exchange activities every year. Ube has hired plane two times, organized 500 people visited Weihai. From 2002 to 2005, Weihai and Ube, work together applied the Environmental Governance project that supported by JICA, 13 people from Weihai Environmental Protection Agency and relative departments have gone to Ube, studied and worked with their counterparts, learned advanced technology and good experience.

The Asia Urban Information Center of Kobe (AUICK) holds workshop twice a year, focus on the issue of population, environmental protection and education. Since 2004, 8 senior governmental officers from Weihai participated in the workshop, exchange experience with their counterpart in Kobe and other 8 cities from 8 countries. AUICK sent experts to Weihai 2 times 6 people, monitoring and consulting the programme progress in Weihai.

All the international activities between the local governments are in high efficiency, we are city to city, department to department, technician to technician, do not need the third transfer, that save the time, save the money. The direct contact between the cities, not only improved the issues they deal with, but also improved the capacity building of the people, improved their language, their technology and their skills on international cooperation. The international cooperation between the local governments also opens the channels for national and international organizations, get technical and financial support from them.

Climate change mitigation is a global issue, need international cooperation both in national and local level. From the experience in China, especially in Weihai, to improve the cooperation, we need strengthen the issues as follows:

1) Information exchange

Understand of each other is the basis of cooperation, information exchange is an important measure to understand each other. Information includes culture, environment, economy etc. In developed countries, most of the information is available for the public, except the national and business secret. But for the developing countries, most of the information is not available for the public, one reason is they do not have, another reason they do not like open it to the public. China as a developing country, try to build an open government in recent years, but that need time, need money and the very important thing is need the conception change.

2) Technology transfer

In most of the cases the developed countries have advanced technology, if they can transfer the technology to developing country can solve a lots of problem. The obstacles for the technology transfer, one is on the developed country side, the patent of the technology, to solve it need the support of the country; another is on the developing country side, the adaptation of the technology, need the technicians to understand, handle and adjust it according the situation in the targeted country. Some technology is advanced in the world, but is useless in the targeted country, because the different situation of culture, skill of staff, environment etc. we need cooperation to improve the technology transfer.

3) Financial assistant

For most of the international network of local governments have no foundation, they can not donate or invest much money for the cities in developing countries, but usually they are supported by foundation, they can apply or channel the fund from the foundation. To make the fund application successful, need the cooperation between the cities in developed and developing countries.

For the project of Environment Governance between Ube and Weihai supported by JICA, Ube has good experience on environment governance, called Ube Model, got the award of Best 500 from UNEP; Weihai as fledging city, try to achieve sustainable development both in economy, social and environment, need the experience. Weihai asked the help, Ube carried out the application for JICA, as a grassroot project, JICA approved it in a short time. This may be a good example for the financial assistance.

4) Encourage NGOs and business enterprises participating

In some cases, the government along is difficult to deal with because political reason, in these cases, NGOs and business enterprises may be a good channel. Like the relationship of mainland of China and Taiwan, the formal government contact just began in recent years, but NGOs and business enterprises' contact began several decades ago that made a good basis for the government. The two sides achieved the direct flight, sea road and post communication recently.

After China open up to the outside of the world, more international NGOs established links with the people in China, some have their branches, like Leadership for Environment and Development (LEAD), a international NGO supported by

Rockefeller Foundation, has a programme in China, (LEAD China), and greenpeace China. Because environment is a hot topic and some political reason, most of the activities organized by international NGOs focus on environmental protection. They provide environmental education opportunities; organize environmental protection activities, and donation funds for environmental project. Some international business enterprises that have project in China, also actively participate the environmental protection in China. They bring the advanced technology and administration experience to China, pay more attention for collaborated social responsibility. Ford Motor Company has held 9 times Ford Motor Environment Award in China, support the honoured individuals or NGOs to protect the environment. China is a one of the biggest country in the world both from economy and environment, more international business enterprises and NGOs come China, do business in China, and promote the environmental protection in China.

When the trainees comes from Weihai stayed in Ube, Japan, Ube International Environmental Cooperative Association, a NGO, business enterprises and volunteers, assisted Ube city government organized various actives, like seminar, site see, home stay, invited the trainees to participate, made friends with each other, pushed the project going smoothly. During the workshop organized by AUICK, the participants also experienced similar activities, the effect is very good.

5) Decentralized administration system

To improve the international network of local government, the local governments must have more freedom, to organize the network, to participate the network. These years decentralization is became a trends in the world that gives the international network of local government more chance.

In China, after its economic reform and open up, the local government has more power, more freedom. In the city level, they can make the decision for a foreign direct investment project that the investment is less than USD50 million.

China, as the biggest country in the world according the population, along with its economic development, should play more important rule in the international affaires both in the national level and local level.

III List of key interviewees and references

3.1 List of key interviewees

Dr. Ren Yong, the vice director of Policy Research Center for Environment and Economy, Ministry of Environmental Protection, China

Dr. Liu Zhaosheng, the vice director of CDM Project Centre of Shandong Province

Dr. Liu Wenzheng, professor of CDM Project Centre of Shandong Province

Mr. Song Jixin, the vice director of Weihai Development & Reform Committee

Mr. Cheng Jian, director of project management department, Weihai Development & Reform Committee

Ms. Ma Lingjuan, director assistant, Chinese Renewable Energy Industries Association

Mr. Gao Tongpu, the director of Weihai Science & Technology Committee,

Mr. Xu Donghui, the vice director of Weihai Urban Planning Bureau,

Mr. Sun Fachun, the vice director of Weihai Agriculture Bureau,

Mr. Zheng Weifeng, the vice director of Weihai Economy & Trade Bureau

Mr. Wang Dehe, the vice director of Weihai Communication Bureau,

Mr. Wang Quan, the director of Weihai Rural Energy Station

Mr. Hu Tao, the vice director of Weihai Energy Saving Office

Mr. Qu Hao, the vice director of Weihai Waste Treatment Plant

Mr. Huang Haidong, the director of Weihai Garden and Greenland Administration Office

Mr. Zhang Kangzhao, Qingdao Fulai Biomass Power Project

Mr. Liu Xiangpeng, Rizhao Luxinjinhe Biochemical co., Ltd

Mr. Zhao Xu, Daba Cement Works

Ms. Lv Xiaohong, Huaneng Zhongdian Weihai Wind Power Co., Ltd

Mr. Ma Shuyuan, Xiahe Hengfa Hydropower Co., Ltd

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3) Newspaper & magazine

China Environmental News

China Population, resources and Environment

4) Participated forum

In 23 September 2008, there was a forum about CDM in China hold by New International Exhibition Centre, Shanghai. The theme of the forum is “CDM and the Development of Environmental Technology & Equipment”. One of my team member participated in that forum.

In November 9, 2008, was invited to participate the BAQ2008, in Bangkok, the main theme is focus on climate change.

Appendixes:

- 1. China's National Climate Change Programmeme**
- 2. China's Scientific & Technological Actions on Climate Change**
- 3. China's Policies and Actions for Addressing Climate Change**

China's National Climate Change Programme

**Prepared under the Auspices of
National Development and Reform Commission
People's Republic of China**

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Foreword

Climate change is a major global issue of common concern to the international community. It is an issue involving both environment and development, but it is ultimately an issue of development. As noted by the *United Nations Framework Convention on Climate Change* (hereinafter referred to as UNFCCC), the largest share of historical and current global emissions of greenhouse gases has originated from developed countries, while per capita emissions in developing countries are still relatively low and the share of global emissions originating from developing countries will grow to meet their social and development needs. The UNFCCC stipulates clearly that the Parties to the Convention shall protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities, and accordingly, the developed country Parties shall take the lead in combating climate change and the adverse effects thereof. It further provides that all Parties shall formulate, implement, publish and regularly update national programmes to address climate change.

As a developing country of responsibility, China attaches great importance to the issue of climate change. The National Coordination Committee on Climate Change was established, and a series of policies and measures to address climate change has been taken in the overall context of national sustainable development strategy, making positive contributions to the mitigation of and adaptation to climate change. As it is mandated under the UNFCCC, the Government of China hereby formulates *China's National Climate Change Programme* (hereinafter referred to as the CNCCP), outlining objectives, basic principles, key areas of actions, as well as policies and measures to address climate change for the period up to 2010. Guided by the Scientific Approach of Development, China will sincerely carry out all the tasks in the CNCCP, strive to build a resource conservative and environmentally friendly society, enhance national capacity to mitigate and adapt to climate change, and make further contribution to the protection of the global

climate system.

Article 4, Paragraph 7 of the UNFCCC provides that “the extent to which developing country Parties will effectively implement their commitments under the Convention will depend on the effective implementation by developed country Parties of their commitments under the Convention related to financial resources and transfer of technology and will take fully into account that economic and social development and poverty eradication are the first and overriding priorities of the developing country Parties.” In this connection, while maintaining economic and social development, China will vigorously engage in effective and pragmatic cooperation with the international community as well as individual countries to implement this CNCCP.¹

¹ In case of any discrepancy between the English translation and the Chinese original, the latter shall prevail.

Part 1 Climate Change and Corresponding Efforts in China

Many observations in recent 100 years show that the earth's climate is now experiencing significant change characterized by global warming. And the trend of climate change in China is generally consistent with that of global climate change. To address climate change and promote sustainable development, China has carried out various policies and measures, such as economic restructuring, energy efficiency improvement, development and utilization of hydropower and other renewable energy, ecological restoration and protection, as well family planning, which has contributed significantly to the mitigation of climate change.

1.1 Observations and Trend of Climate Change in China

The Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) has clearly indicated that most of the global warming observed over the past 50 years was likely induced by the increase in concentrations of greenhouse gases (GHGs), such as carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O), due to human activities. In the context of global warming, climate in China has experienced noticeable changes over the past 100 years as well. The major observed evidence of climate change in China includes the following:

- Temperature. Annual average air temperature has increased by 0.5~0.8°C during the past 100 years, which was slightly larger than the average global temperature rise. Most of the temperature rise was observed over the last 50 years. The regional distribution of the temperature changes shows that the warming trend was more significant in western, eastern and northern China than in the south of the Yangtze River. The seasonal distribution of the temperature changes shows that the most significant temperature increase occurred in winter, and 20 consecutive warm winters were observed nationwide from 1986 to 2005;
- Precipitation. In the past 100 years, there was no obvious trend of change in annual precipitation in China, but there exists considerable variation among

regions. The annual precipitation decreased gradually since 1950s with an average rate of 2.9 mm/10a, although it increased slightly during the period of 1991 ~ 2000. The regional distribution of precipitation shows that the decrease in annual precipitation was significant in most of northern China, eastern part of the northwest, and northeastern China, averaging 20~40 mm/10a, with decrease in northern China being most severe; while precipitation significantly increased in southern China and southwestern China, averaging 20~60 mm/10a;

- Extreme climate/weather events. The frequency and intensity of extreme climate/weather events throughout China have experienced obvious changes during the last 50 years. Drought in northern and northeastern China, and flood in the middle and lower reaches of the Yangtze River and southeastern China have become more severe. The annual precipitation in most years since 1990 has been larger than normal, with the precipitation pattern being a dipole, corresponding to frequent disasters in the North and flood in the South;

- Sea level. The rate of sea level rise along China's coasts during the past 50 years was 2.5 mm/a, slightly higher than the global average;

- Glaciers. The mountain glaciers in China have retreated, and the trend is accelerating.

The trend of climate warming in China will further intensify in the future. The projections by Chinese scientists indicate that:

- The nationwide annual mean air temperature would increase by 1.3~2.1°C in 2020 and 2.3~3.3°C in 2050 as compared with that in 2000. The warming magnitude would increase from south to north in China, particularly in northwestern and northeastern China where significant temperature rise is projected. It is estimated that by 2030, the annual temperature would likely increase by 1.9~2.3°C in northwestern China, 1.6~2.0°C in southwestern China, and 2.2~2.6°C in the Qinghai-Tibetan Plateau;

- Precipitation in China would possibly increase during the next 50 years, with a projected nationwide increase of 2~3% by 2020 and 5~7% by 2050. The most significant increase might be experienced in southeastern coastal regions;

- The possibility of more frequent occurrence of extreme weather/climate events would increase in China, which will have immense impacts on the socio-economic development and people's living;
- The arid area in China would probably become larger and the risk of desertification might increase;
- The sea level along China's coasts would continue to rise;
- The glaciers in the Qinghai-Tibetan Plateau and the Tianshan Mountains would retreat at an accelerated rate, and some smaller glaciers would disappear.

1.2 Current GHG Emissions in China

According to the *Initial National Communication on Climate Change of the People's Republic of China*, China's total GHG emissions in 1994 are 4,060 million tons of CO₂ equivalent (3,650 million tons of net emissions), of which 3,070 million tons of CO₂, 730 million tons of CO₂ equivalent (tCO₂e) of CH₄ and 260 million tCO₂e of N₂O. According to tentative estimates by experts from China, China's total GHG emission in 2004 is about 6,100 tCO₂e (5,600 million tons of net emissions), of which 5,050 million tons of CO₂, 720 million tCO₂e of CH₄ and 330 million tCO₂e of N₂O. From 1994 to 2004, the annual average growth rate of GHG emissions is around 4%, and the share of CO₂ in total GHG emissions increased from 76% to 83%.

China's historical GHG emissions are very low and per capita emissions have been below the world average. According to the study carried out by the World Resource Institute (WRI), China's CO₂ emissions from fossil fuel combustion were 79 Mt in 1950, contributing only 1.13% of the world total at that time; cumulative emissions of CO₂ from fossil fuel combustion accounted for only 9.33% of the world total during the period of 1950~2002, and the cumulative CO₂ emissions per capita are 61.7 tons over the same period, ranking the 92nd in the world. Statistics from the International Energy Agency (IEA) indicates that per capita CO₂ emissions from fossil fuel combustion were 3.65 tons in 2004 in China, equivalent to only 87% of the world average and 33% of the level in Organization for

Economic Co-operation and Development (OECD) countries.

Along with the steady social and economic development, the emission intensity defined as the CO₂ emission per unit of GDP declined generally. According to IEA, China's emission intensity falls to 2.76 kgCO₂/US\$ (constant 2000 U.S. dollar) in 2004, as compared to 5.47 kgCO₂/US\$ in 1990, a 49.5% decrease. For the same period, emission intensity of the world average dropped only 12.6% and that of the OECD countries dropped 16.1%.

1.3 China's Efforts and Achievements in Mitigating Climate Change

As a developing country of responsibility, China is among the first to formulate a national Agenda 21 entitled *China's Agenda 21 - White Paper on China's Population, Environment and Development in the 21st Century*, soon after the United Nations Conference on Environment and Development in 1992, and adopted a series of policies and measures taking into account its specific national circumstances, making positive contribution to the mitigation of climate change.

1.3.1 Restructuring the economy, promoting technology advancement and improving energy efficiency

Beginning from the late 1980s, the Government of China paid more and more attention to the change of the economic growth pattern and the restructuring of economy, and integrated the reduction of energy and other resources consumption, the promotion of clean production, and the prevention and control of industrial pollution into its national industrial policies. The industrial structure has been significantly improved through the implementation of a series of industrial policies to accelerate the development of the tertiary industry and restructure the secondary industry. The breakdown of GDP across the primary, secondary and tertiary industries in 1990 is 26.9:41.3:31.8, while in 2005 it is 12.6:47.5:39.9. The share of primary industry declined continuously, and the tertiary grew greatly, especially in sectors such as telecommunication, tourism and finance. The secondary industry has slightly grown in the overall share, but its internal

composition has significantly changed, and the proportion of high value-added products has increased due to the rapid development in machinery, information technology and electronic sectors. Such change has brought about significant energy conservation benefits. During the period of 1991 ~ 2005, China has achieved an annual GDP growth rate of 10.2% with an annual growth rate of 5.6% in energy consumption, i.e. about 0.55 of the elasticity of energy consumption.

As early as 1980s, the Government of China adopted the principle of “equal treatment to development and conservation with immediate emphasis on the latter”, making energy conservation as a matter of strategic importance in energy policy. Energy conservation was effectively promoted through the implementation of the *Law on Energy Conservation of the People’s Republic of China* and relevant regulations, the development of specific energy conservation plans, the adoption and implementation of technology, economic, fiscal and management policies in favor of energy conservation, the development and application of energy efficiency standards and labeling, the encouragement of R&D, demonstration and diffusion of energy-saving technologies, the importing and absorbing of advanced energy-saving technologies, the creation and employment of new energy conservation mechanisms, and the promotion of key energy conservation projects as well. From 1990 to 2005, China’s energy intensity (energy consumption per Million GDP at constant 2000 RMB Yuan) went down from 268 to 143 tons of coal equivalent (tce), decreasing by an average annual rate of 4.1%. The energy consumption per unit of energy-intensive products in the industrial sector declined strikingly. In 2004, as compared with 1990, for generators with capacity of 6MW and above, the unit energy consumption for thermal power supply decreased from 0.427kgce/kWh to 0.376kgce/kWh; comparable energy consumption per ton of steel in key companies decreased from 997kgce to 702kgce; and comprehensive energy consumption per ton of cement in medium and large enterprises decreased from 201kgce to 157kgce. As calculated on the year by year comparison, during the period of 1991 ~ 2005, an accumulated 800 million tce of energy were saved by economy restructuring and energy efficiency improvement, which is equivalent to a reduction of 1.8 billion tons of CO₂ emissions, using China’s 1994 emission

factor of 2.277 tCO₂/tce.

1.3.2 Optimizing energy mix by developing low-carbon and renewable energy

Under national policy guidance and with financial support, the share of high grade and clean energy was improved by strengthening the development and utilization of hydropower, nuclear energy, oil, gas and coal-bed methane , and supporting the development and utilization of new and renewable energy including biomass, solar, geothermal and wind power in rural areas, remote areas and other suitable areas. Share of coal in China's primary energy mix decreased from 76.2% in 1990 to 68.9% in 2005, whereas the shares of oil, gas and hydro increased from 16.6%, 2.1% and 5.1% in 1990 to 21.0%, 2.9% and 7.2% in 2005, respectively.

By the end of 2005, the installed capacity of hydropower generation has reached 117GW in China, accounting for 23% of the total power generation capacity, and the corresponding power generation was 401 TWh, accounting for 16.2% of total electricity generation. There were more than 17 million household biogas digesters that generate 6500 million cubic meters of biogas annually. Over 1500 biogas digester construction projects at large-and-medium-scale have been constructed, generating biogas around 1500 million cubic meters each year. The installed capacity of biomass generation is about 2 GW, among which sugar-cane fired power capacity is about 1.7GW and landfill-powered 0.2GW. Production capacity of ethanol fuel based on crops was 1.02 million ton. More than 60 wind farms were built and connected to the grid with their installed capacity of 1.26GW, and there were also about 200 thousand small-scaled wind power generators operating independently with capacity of 40 MW locating in remote area. The total capacity of photovoltaic generation was around 70 MW, mainly operating for residential power supply in remote area. Heat collecting area of existing solar heaters was up to 85 million square meters. In 2005, the utilization of renewable energy in China equaled to 166 million tce (including large hydropower), accounting for 7.5% of China's total energy consumption in that year, equivalent to a saving of 380 million ton CO₂ emissions.

1.3.3 Launching national wide tree-planting and afforestation campaign and enhancing ecology restoration and protection

Since the reform and opening up to the outside world, tremendous achievement has been made in tree-planting and afforestation along with the implementation of key forest ecological projects. According to the *Sixth National Forest Survey*, the acreage of conserved artificial forests in China was 54 million hectares, ranking the top one in the world, and the amount of growing stock was 1505 million cubic meters. Total area of forest cover in China was 174.91 million hectares, and the percentage of forest coverage increased from 13.92% to 18.21% during the period from early 1990s to 2005. In addition to tree-planting and afforestation, China initiated many other policies for ecology restoration and protection, including natural forest protection, reclaiming cultivated land to forest or grassland, pasture restoration and protection, further enhancing the capacity of forest as the sinks of greenhouse gas. Meanwhile, urban green area grew rapidly in China as well. By the end of 2005, total green area in the built-up urban area in the whole country reached 1.06 million hectares with a 33% green coverage and 8.1 square meters of public green area per capita. The green area helps absorbing CO₂ in the atmosphere. Estimated by relevant experts, from 1980 to 2005, a total of 3.06 billion ton CO₂ absorption was achieved by afforestation, a total of 1.62 million ton CO₂ absorption by forest management, and 430 million tons of CO₂ from deforestation were saved.

1.3.4 Effectively controlling the growth rate of population through family planning

The Government of China has made it a basic national policy to carry out family planning all along, and the excessive population growth trend has been brought under effective control. According to the statistics of the United Nations, China's fertility rate was lower than that of other developing countries and the world average as well. In 2005, birth rate in China was 12.40‰, and the natural growth rate was 5.89‰, dropped by 8.66 and 8.50 permillage points respectively compared to the level of 1990, making China one of the countries with a low fertility rate in the world. As a country with underdeveloped economy, China has

accomplished a historic transition in population reproduction pattern from one featuring high birth rate, low death rate and high growth rate to one featuring low birth rate, low death rate and low growth rate in a relatively short period of time, such a change took decades or even up to a hundred years for developed countries to realize in the past. Since the implementation of the family planning program, over 300 million births have been averted nationally by 2005. According to the average per capita emissions from the IEA statistics, the averted births have resulted in an annual reduction of CO₂ emissions by about 1.3 billion tons in 2005. It is a significant contribution that China achieved in the fields of controlling world population and mitigating GHG emissions.

1.3.5 Strengthening laws and regulations, and policies and measures relevant to addressing climate change

To address newly-emerging issues in recent years, the Government of China has advocated for the Scientific Approach of Development and Strategic Thoughts of Building a Harmonious Society, and accelerated the building of a resource-conserving and environmentally friendly society, thus further reinforcing the policies and measures relevant to addressing climate change. In 2004, *China Medium and Long Term Energy Development Plan Outlines 2004-2020* (draft) was approved by the State Council. In the same year, the first *China Medium and Long Term Energy Conservation Plan* was launched by National Development and Reform Commission (NDRC). In February 2005, the National People's Congress adopted the *Renewable Energy Law of the People's Republic of China*, setting out the duties and obligations of the Government, enterprises and users in development and utilization of renewable energy and a series of policies and measures, including total volume target, mandatory grid connection, price management regulation, differentiated pricing, special fund, favorable taxing, etc. In August 2005, the State Council issued the *Notification on the Immediate Priorities for Building a conservation-oriented Society and Several Opinions on Accelerating the Development of Circular Economy*. In December 2005, the State Council issued the *Decision to Publish and Implement the Interim Provisions on Promoting Industrial Restructuring* and the *Decision to Strengthen Environmental*

Protection by Applying the Scientific Approach of Development. In August 2006, the State Council issued the *Decision to Strengthen Energy Conservation.* All those documents serve as the policy and legal guarantee to further enhance China's capability in addressing climate change.

1.3.6 Further improving institutions and mechanisms

China established the National Coordination Committee on Climate Change (NCCCC), which presently comprises 17 ministries and agencies. The NCCCC has done lots of work in the formulation and coordination of China's important climate change-related policies and measures, providing guidance for central and local governments' response to climate change. In order to fulfill conscientiously China's commitment under the UNFCCC, beginning from 2001, the NCCCC organized the work on the compilation of the Initial National Communication on Climate Change of the People's Republic of China, and presented the report to UNFCCC at the tenth session of the Conference of the Parties (COP10) in December 2004. In recent years, the Government of China has strengthened its comprehensive management of energy that is closely related to addressing climate change by establishing a National Energy Leading Group and its office, which has further strengthened its work on energy management. In October 2005, the amended *Measures for Operation and Management of Clean Development Mechanism Projects* was promulgated by the relevant departments of the Government.

1.3.7 Attaching great importance to climate change research and capacity building

The Government of China highly values its capability and capacity to support scientific studies and researches on climate change, and constantly enhances them. It has implemented a number of key research projects, such as *Study on Forecasting, Impact and Countermeasures of Global Climate Change*, *Study on Global Climate Change and Environmental Policies*, etc. Under the *National Climbing Program* and the *National Key Fundamental Research Program*, projects such as *Study on Formation and Prediction Theory of Key Climate and Weather*

Disasters in China, and *Study on Carbon Cycle in China's Terrestrial Ecosystems and Its Driving Mechanism* were conducted. Under the Innovative Research Program, *Carbon Balance Study in China's Land and Offshore Area* has been accomplished. Other key projects related to climate change were also conducted, including *China's Climate, Sea Level Change and Their Trend and Impact*. *China's National Assessment Report on Climate Change* has been completed. All those studies and researches provide scientific basis for developing national policies to address climate change and for China's participation in negotiations under the UNFCCC. Several projects on international cooperation in Clean Development Mechanism capacity building were also conducted by relevant departments of China.

1.3.8 Strengthening education, training and public awareness on climate change

The Government of China always attaches importance to education, training and public awareness on climate change. *The Program of Action for Sustainable Development in China in the Early 21st Century* states that China will vigorously develop all forms of education at all levels, to enhance the public awareness on sustainable development and enhance their scientific and cultural capacity for their participation in the sustainable development by reinforcing personnel training. In recent years, China has intensified its efforts to promote education, training and public awareness on climate change by organizing various kinds of lectures on climate change basic knowledge, conducting climate change training courses for policy makers at central and provincial levels, and organizing conferences such as Climate Change and Ecological Environment, as well as setting up an official bilingual website on climate change (China Climate Change Info-Net <http://www.ccchina.gov.cn>) in Chinese and English to provide comprehensive information on climate change. Commendable results have been achieved accordingly.

Part 2 Impacts and Challenges of Climate Change on China

Due to limitations on knowledge and analysis methods, there exist large uncertainties in the present assessment of climate change impacts carried out by various countries. Studies indicate that climate change has caused some impacts on China, such as sea level rise in the coastal areas, glacial retreat in northwest area, the earlier arrival of spring phenophase. It will also bring about significant impacts on China's natural ecosystems and social economic system in the future. Meanwhile, as a developing country at a low development stage, with a huge population, a coal-dominant energy mix and relatively low capacity to tackle climate change, China will surely face more severe challenges when coping with climate change along with the acceleration of urbanization, industrialization and the increase of residential energy consumption.

2.1 China's Basic National Circumstances of Climate Change

2.1.1 Inferior climatic conditions and severe natural disasters

China has relatively harsh climatic conditions. Most of China has a continental monsoon climate with more drastic seasonal temperature variations compared with other areas at the same latitude such as North America and West Europe. In most part of China, it is cold in winter and hot in summer with extremely high temperature. Therefore, more energy is necessary to maintain a relatively comfortable room temperature. Precipitation in China is unevenly distributed both seasonally and spatially. Most of the precipitation occurs in summer and varies greatly among regions. Annual Precipitation gradually declines from the southeastern coastal areas to the northwestern inland areas. China frequently suffers from meteorological disasters, which are unusual worldwide in terms of the scope of affected areas, the number of different disasters, the gravity of disaster and the mass of affected population.

2.1.2 Vulnerable ecosystem

China is a country with a vulnerable ecosystem. The national forest area for 2005 is 175 million hectares and the coverage rate is just 18.21%. China's grassland area for the same year is 400 million hectares, most of which are high-cold prairie and desert steppe while the temperate grasslands in Northern China are on the verge of degradation and desertification because of drought and environmental deterioration. China's total area of desertification for 2005 is 2.63 million square kilometers, accounting for 27.4% of the country's territory. China has a continental coastline extending over 18,000 kilometers and an adjacent sea area of 4.73 million square kilometers, as well as more than 6,500 islands over 500 square meters. As such, China is vulnerable to the impacts of sea level rise.

2.1.3 Coal-dominated energy mix

China's primary energy mix is dominated by coal. In 2005, the primary energy production in China was 2,061 Mtce, of which raw coal accounted for as high as 76.4%. For the same year, China's total primary energy consumption was 2,233 Mtce, among which, the share of coal was 68.9%, oil 21.0%, and natural gas, hydropower, nuclear power, wind power and solar energy 10.1%; while the shares of coal, oil, and natural gas, hydropower and nuclear power in the world primary energy consumption were 27.8%, 36.4% and 35.8%, respectively. Because of the coal-dominated energy mix, CO₂ emission intensity of China's energy consumption is relatively high.

2.1.4 Huge population

China has the largest population in the world. In 2005, the population of China's mainland was 1.31 billion (not including Hong Kong, Macao and Taiwan), accounting for 20.4% of the world total. China is still at a low level of urbanization, with a huge rural population of about 750 million, and in 2005, urban population accounted for only 43% of the national total population, lower than the world average. Huge population results in huge employment pressure, with annually more than 10 million new labor forces in the urban areas and about 10 million new rural labor forces moving to the urban areas as a result of the urbanization process. Due to the huge population, China's per capita energy consumption is still at a low

level. In 2005, China's per capita commercial energy consumption was about 1.7 tce, only 2/3 of the world average, let alone the average level of the developed countries.

2.1.5 Relatively low level of economic development

China is currently at a relatively low level of economic development. In 2005, the per capita Gross Domestic Product (GDP) of China was about US\$ 1,714 (based on exchange rate of the same year, the same below), only about 1/4 of the world average level. Remarkable disparity in economic development exists among different regions of China. In 2005, the per capita GDP of the eastern areas of China was US\$ 2,877, while that of the western areas was US\$ 1,136, only 39.5% of the former. The income disparity between rural and urban residents is also great. In 2005, the per capita disposable income of the urban residents was US\$ 1,281, while that of the rural residents was only US\$ 397, equivalent to 31.0% of the former. Furthermore, poverty eradication is still a huge challenge for China. By the end of 2005, the poverty-stricken people in China's rural areas numbered 23.65 million, with the per capita annual pure income less than 683 Chinese Yuan.

2.2 Impact of Climate Change on China

2.2.1 Impacts on agriculture and livestock industry

Climate change has already had certain impacts on agriculture and livestock industry in China, primarily shown by the 2-to-4-day advancement of spring phenophase since 1980's. Future climate change can affect agriculture and livestock industry in the following ways: increased instability in agricultural production, where the yields of three main crops, i.e. wheat, rice and maize, are likely to decline if no proper adaptation measures are taken; changes in distribution and structure of agricultural production as well as in cropping systems and varieties of the crops; changes in agricultural production conditions that may cause drastic increase in production cost and investment need; increased potential in aggravation of desertification, shrinking grassland area and reduced productivity that result from increased frequency and duration of drought occurrence due to

climate warming; and potentially increased rate in disease breakout for domestic animals.

2.2.2 Impact on forest and other natural ecosystems

Climate change has brought impacts on forests and other natural ecosystems in China. For example, the glacier area in the northwestern China shrunk by 21% and the thickness of frozen earth in Qinghai-Tibet Plateau reduced a maximum of 4-5 meters in recent 50 years. Future climate change will continue to impact these ecosystems to some extent. Firstly, the geographical distribution of major forest types will shift northward and the vertical spectrum of mountain forest belts will move upward. The distribution range of major tree species for afforestation or reforestation and some rare tree species is likely to shrink. Secondly, forest productivity and output will increase to different extents, by 1-2% in tropical and subtropical forests, about 2% in warm temperate forests, 5-6% in temperate forests, and approximately 10% in cold temperate forests. Thirdly, the frequency and intensity of forest fires and insect and disease outbreaks are likely to increase. Fourthly, the drying of inland lakes and wetlands will accelerate. A few glacier-dependent alpine and mountain lakes will eventually decrease in volume. The area of coastal wetlands will reduce and the structure and function of coastal ecosystems will be affected. Fifthly, the area of glaciers and frozen earth is expected to decrease more rapidly. It is estimated that glacier in western China will reduce by 27.7% by the year 2050, and the spatial distribution pattern of permafrost will alter significantly on Qinghai-Tibet Plateau. Sixthly, snow cover is subjected to reduce largely with significantly larger inter-annual variation. Seventhly, biodiversity will be threatened. The giant panda, Yunnan snub-nose monkey, Tibet antelope and *Taiwania flousiana* Gaussen are likely to be greatly affected.

2.2.3 Impact on water resources

Climate change has already caused the changes of water resources distribution over China. A decreasing trend in runoff was observed during the past 40 years in the six main rivers, namely Haihe River, Huaihe River, Yellow River, Songhuajiang

River, Yangtze River, and Pearl River. Meanwhile, there is evidence for an increase in frequency of hydrological extreme events, such as drought in North and flood in South. The Haihe-Luanhe River basin is the most vulnerable region to climate change, followed by Huaihe River basin and Yellow River basin. The arid continental river basins are particularly vulnerable to climate change. In the future, climate change will have a significant impact on water resources over China: in the next 50-100 years, the mean annual runoff is likely to decrease evidently in some northern arid provinces, such as Ningxia Autonomous Region and Gansu Province, while it seems to increase remarkably in a few already water-abundant southern provinces, such as Hubei and Hunan provinces, indicating an increase of flood and drought events due to climate change; the situation of water scarcity tends to continue in the northern China, especially in Ningxia Autonomous Region and Gansu Province, where water resource per capita are likely to further decrease in future 50-100 years; providing that water resources are exploited and utilized in a sustainable manner, for most provinces, water supply and demand would be basically in balance in future 50-100 years. However, gap between water resource supply and demand might be expanded in Inner Mongolia Autonomous Region, Xinjiang Autonomous Region, Gansu, and Ningxia Autonomous Region.

2.2.4 Impact on the coastal zone

Climate change has brought certain impacts on the coastal environment and ecosystems of China in some extent, mainly represented by the accelerating trend of sea level rise along the Chinese coast in the past 50 years, which resulted in coastal erosion and seawater intrusion, as well as mangrove and coral reef degradation. The future climate change will have even greater impact on the sea level and coastal ecosystems of China. Firstly, the sea level along the Chinese coast will continue to rise. Secondly, the frequency of typhoon and storm surge will increase, aggravating the hazards induced by coastal erosion. Thirdly, some typical marine ecosystems, including coastal wetlands, mangroves and coral reefs, will be further damaged.

2.2.5 Impacts on other sectors

Climate change may increase the frequency and intensity of the heat waves, hence increase deaths and serious diseases induced by extreme high temperature events. Climate change is likely to stimulate the emergence and spread of some diseases and to increase the magnitude and scope of diseases like cardiovascular diseases, malaria, dengue fever, and heatstroke, endangering human health. Meanwhile, climate change tends to increasingly impact China's medium to large sized projects, due to the increase of extreme weather and climate events and related hazards. Similarly, climate change may greatly harm natural and human tourism resources, as well as tourism security in some areas. In addition, global warming will exacerbate the increasing trend of electricity consumption for air conditioning and impose greater pressure to electric power supply.

2.3 Challenges Facing China in Dealing with Climate Change

2.3.1 Critical challenge to China's current development pattern

Natural resources are fundamental to the development of a national economy. The industrial structure and economic advantages of a country are determined to a considerable degree by its resources availability and combination. China is a country with a large population and at a relatively low level of development, and its economic development has long been constrained by the scarcity of per capita resources and it will continue to be so for a long time. The development history and trend of various countries has revealed the obvious positive correlations between per capita CO₂ emissions, per capita commercial energy consumption and the economic development level. In other words, with current level of technology development, to reach the development level of the industrialized countries, it is inevitable that per capita energy consumption and CO₂ emissions will reach a fairly high level. In the development history of human beings, there is no precedent where a high per capita GDP is achieved with low per capita energy consumption. With its ongoing economic development, China will inevitably be confronted with growing energy consumption and CO₂ emissions. The issue of GHG mitigation will pose a challenge to China to create an innovative and sustainable development pattern.

2.3.2 Huge challenge to China's coal-dominated energy structure

China is one of the few countries whose energy mixes are dominated by coal. In 2005, 68.9% of China's primary energy consumption was coal, while the world average was only 27.8%. Compared with oil and natural gas, coal's carbon content per unit calorific value is 36% and 61% higher, respectively. China will face much more difficulties than other countries in decreasing its carbon intensity per unit of energy for mainly three reasons: its energy mix adjustment is constrained by the mix of energy resources to certain extent; its energy efficiency improvement is subject to the availability of advanced technologies and financial resources, and its coal-dominated energy resources and consumption structure will not change substantially for a long-term period in the future.

2.3.3 Great challenge to China's independent innovation on energy technologies

One of the main reasons for China's low energy efficiency and high GHG emission intensity is the backward technologies of energy production and utilization in China. On one hand, there are relatively large gaps between China and the developed countries in term of technologies of energy exploitation, supply and transformation, transmission and distribution, industrial production and other end-use energy; on the other hand, out-of-date processes and technologies still occupy a relatively high proportion of China's key industries. For example, the overall energy consumption per ton of steel in large-scale iron & steel enterprises is about 200 kgce lower than that in small enterprises, and the overall energy consumption per ton of synthetic ammonia in large or medium enterprises is about 300 kgce lower than in small enterprises. Owing to the lack of advanced technologies as well as the large proportion of out-of-date processes and technologies, China's energy efficiency is about 10% lower than that of the developed countries, and its per unit energy consumption of energy-intensive products is about 40% higher than the advanced international level. Science and technology are the ultimate resort for humankind to tackle climate change. As China is now undergoing large-scale infrastructure construction for energy, transportation and buildings, the features of intensive emissions associated with these technologies will exist for the next few

decades if advanced and climate-friendly technologies could not be made timely available. This poses severe challenges to China in addressing climate change and mitigating GHG emissions.

2.3.4 Challenges on the conservation and development of forest and other natural resources

To combat climate change, it is necessary for China, on one hand, to strengthen forest and wetland conservation to enhance capacities for climate change adaptation; and on the other hand, to strengthen forest and wetland restoration and afforestation to enhance capacities for carbon sequestration. Forest resources in China are far below the needs for social and economic development. With the acceleration of industrialization and urbanization, the quest for forest and wetland conservation is increasing. Aridification, desertification, soil erosion, and wetland degradation remain as severe environmental problems. Lands available for afforestation/reforestation are mostly located in areas suffering from sandy or rocky desertification, which pose a great challenge to forestation and ecological restoration.

2.3.5 Long-term challenges on adaptation to climate change in China's agricultural sector

China not only encounters frequent agricultural meteorological disasters that cause longtime instability in agricultural production, but also features low per capita cultivated land, a less developed agricultural economy and a very limited capacity for adaptation. In coping with the climate change, how to rationally adjust agricultural production distribution and structure, improve agricultural production conditions, control the prevalence of plant diseases and pests/insects and spread of weeds, reduce production cost, prevent the potential desertification expansion, and ensure sustainable development of China's agricultural production are some of the aspects that pose long-term challenges for China agricultural sector in terms of improving its capacity of adapting to climate change and resisting climatic disasters.

2.3.6 New challenges on China's water resources development and

conservation in terms of adapting to climate change

There are two objectives for development and conservation of water resources in adapting to climate change in China: to promote sustainable development and utilization of water resources; and to enhance adaptive capacity of water resource system to reduce its vulnerability to climate change. How to enhance water resources management, optimize water resources allocation, strengthen infrastructure construction, ensure the anti-flood safety of large rivers, key cities and regions, promote nationwide water-saving program, guarantee safe drinking water and sound social and economic development, and make a good use of river functions while protecting aquatic ecosystem are the long-term challenges on water resources development and conservation in terms of enhancing climate change adaptation capability.

2.3.7 Challenges on China's coastal regions in terms of adapting to climate change

The coastal regions in China are characterized by dense population and most active economic activities. Since most of these coastal areas are low and flat, they are vulnerable to marine disasters caused by sea level rise. At present, China clearly lacks capacity in marine environment monitoring, resulting in insufficient capacity of early warning and emergency response to ocean disasters associated with climate change. Lower standards for coastal anti-tide engineering also weaken the ability to resist ocean disasters. In the future, coastal erosion, seawater intrusion, soil salinization and back flow of seawater into the river estuaries caused by sea level rise will be among realistic challenges in coping with climate change in China's coastal areas.

Part 3 Guidelines, Principles and Objectives of China to Address Climate Change

China's social and economic development is now at the stage of important strategic opportunity. China will implement its fundamental national policy of resources conservation and environmental protection to develop a circular economy, protect ecological environment and accelerate the construction of a resource-conservative and environmentally-friendly society. In order to actively fulfill its international commitments under the UNFCCC, China will strive to control its greenhouse gas emissions, enhance its capacity to adapt to climate change and promote the harmonious development between economy, population, resources and the environment.

3.1 Guidelines

To address climate change and to make further contributions to protect global climate, China will be guided by the following:

- To give full effect to the Scientific Approach of Development;
- To promote the construction of socialist harmonious society;
- To advance the fundamental national policy of resources conservation and environmental protection;
- To control GHG emission and enhance sustainable development capacity;
- To secure economic development;
- To conserve energy, to optimize energy structure, and to strengthen ecological preservation and construction;
- To rely on the advancement of science and technology;
- To enhance the capacity to address climate change.

3.2 Principles

To address climate change, China will be guided by the following principles:

- To address climate change within the framework of sustainable development. It is not only the important common understanding of the international community, but also the basic option of all the parties to the Convention to address climate change. As early as in 1994, the Government of China formulated and published its sustainable development strategy --- *China's Agenda 21 --- A White Paper on Population, Environment and Development in the 21st Century*. Later in 1996, the Government of China, for the first time, adopted sustainable development as the key guideline and strategic goal for its national social and economic development. In 2003, the Government of China further formulated the *Programme of Action for Sustainable Development in China in the Early 21st Century*. China will continue to actively tackle climate change issues in accordance with its national sustainable development strategy in the future.
- To follow the principle of “common but differentiated responsibilities” of the UNFCCC. According to this principle, developed countries should take the lead in reducing greenhouse gas emissions as well as providing financial and technical support to developing countries. The first and overriding priorities of developing countries are sustainable development and poverty eradication. The extent to which developing countries will effectively implement their commitments under the Convention will depend on the effective implementation by developed country of their basic commitments.
- To place equal emphasis on both mitigation and adaptation. Mitigation and adaptation are integral components of the strategy to cope with climate change. For developing countries, mitigation is a long and arduous challenge while adaptation to climate change is a more present and imminent task. China will strengthen its policy guidance for energy conservation and energy structure optimization to make efforts to control its greenhouse gas emissions. Meanwhile, China will take practical measures to enhance its capacity to adapt to climate change via key projects for ecosystem protection, disaster prevention and

reduction and other key infrastructure construction.

— To integrate climate change policy with other interrelated policies. Since adaptation to climate change and mitigation of greenhouse gas emissions involve many aspects of the social and economic sectors, policies to address climate change and other related ones will only be effective if they are integrated. China will continue to consider energy conservation, energy structure optimization, ecological preservation and construction, and overall agricultural productivity advancement as important components of its national climate change policy. Therefore, China will give full consideration to climate change issues by integrating the policy of climate change mitigation and adaptation into its national social and economic development programme and pushing forward the policy in a coordinate way.

— To rely on the advancement and innovation of science and technology. Technological advancement and innovation are the effective way to mitigate greenhouse gas emissions and enhance the capacity of adaptation to climate change. Realizing the leading and fundamental function of scientific and technological advancement in mitigation and adaptation to climate change, China will make great efforts to develop new and renewable energy technologies and new technologies of energy conservation, to promote carbon sink technologies and other adaptive technologies, to accelerate scientific and technological innovation and importation, and to provide a strong scientific support to address climate change and promote the capacity of sustainable development.

— To participate in international cooperation actively and extensively. Global climate change is a serious common challenge to the international community. Though countries differ in the understanding of climate change and in ways and means of addressing this issue, they share a basic consensus for cooperation and dialogue to jointly address the challenges of climate change. China will continue to actively participate in the international negotiations of the UNFCCC and relevant activities of the IPCC. China is ready to strengthen international cooperation of addressing climate change, including cooperation of clean development mechanism and technology transfer, to join efforts with the international

community to tackle global climate change.

3.3 Objectives

The strategic goal of China to respond to climate change is to make significant achievements in controlling greenhouse gas emissions, to enhance the capability of continuous adaptation to climate change, to promote climate change related science, technology and R&D to a new level, to remarkably raise public awareness on climate change, and to further strengthen the institutions and mechanisms on climate change. According to this strategic goal, China will make great efforts to achieve the following specific objectives by 2010.

3.3.1 To control greenhouse gas emissions

- Accelerating the transformation of economic growth pattern; strengthening the policy guidance on energy conservation and efficient utilization; reinforcing governmental supervision and administration on energy conservation; expediting R&D, demonstration and deployment of energy conservation technologies; bringing new market-based mechanisms for energy conservation into full play; raising public and social awareness on energy conservation; speeding up the building-up of a resource-conserving society. By all these means, China will achieve the target of about 20% reduction of energy consumption per unit GDP by 2010, and consequently reduce CO₂ emissions.
- Optimizing energy consumption structure. Measures in this regard include: vigorously developing renewable energy; actively promoting nuclear power plant construction; and speeding up utilization of coal bed methane. The target is to raise the proportion of renewable energy (including large-scale hydropower) in primary energy supply up to 10% by 2010, the extraction of coal bed methane up to 10 billion cubic meters.
- Reinforcing industrial policy governing metallurgy, building materials, and chemical industry; developing a circular economy; raising resource utilization efficiency, and strengthening emission control of nitrous oxide. By 2010, the emissions of nitrous oxide from industrial processes will remain stable as that in

2005.

- Promoting the adoption of low-emission and high-yield rice varieties, the rice cultivation technique of semi-drought, and scientific irrigation technology; strengthening the R&D on outstanding ruminant animal breeds and large-scale breeding and management techniques; reinforcing the management on animal wastes, wastewater and solid wastes, and promoting biogas utilization to control the growth rate of methane emissions.
- Increasing the forest coverage rate to 20% and realizing the increase of carbon sink by 50 million tons over the level of 2005 by 2010. Measures in this regard include: continuously carrying out the policies and measures on afforestation, returning farmland to forest and grassland, and natural forest protection, and basic construction for farmland and other key engineering construction.

3.3.2 To enhance capacity of adaptation to climate change

- Through strengthening farmland infrastructure, adjusting cropping systems, selecting and breeding stress-resistant varieties and developing bio-technologies and other adaptive countermeasures, the targets by 2010 are to increase the improved grassland by 24 million hectares, restore the grassland suffering from degradation, desertification, and salinity by 52 million hectares, and strive to increase the efficient utilization coefficient of agricultural irrigation water to 0.5.
- Through strengthening the natural forest conservation and nature reserve management and continuously implementing key ecological restoration programmes, establish key ecological protection area and enhancing natural ecological restoration. By 2010, 90% of typical forest ecosystems and national key wildlife are effectively protected and nature reserve area accounts for 16% of the total territory; and 22 million hectares of desertified lands are under control.
- By 2010, the vulnerability of water resources to climate change would be reduced by effective measures, such as rational exploitation and optimized allocation of water resources, building-up of new mechanism for infrastructure construction and popularization of water-saving. At that time, the anti-flood

engineering systems in large rivers and the high standard for drought relief in farmland will be completed.

— By 2010, the construction and expansion of mangroves will be realized, the capability to resist marine disasters will be raised remarkably, and the social influence and economic losses caused by sea level rise will be reduced in maximum through scientific monitoring of sea level change and regulation of the ecosystem of marine and coastal zone areas and through taking the measures of rationally exploiting the coastline and coastal wetland and construction of coastal shelterbelt system.

3.3.3 To enhance R&D

— China will work hard to keep up with international advanced research on climate change in some fields by 2010, so as to provide an effective and scientific basis for the development of national strategy and policy on climate change, and scientific guidance for participation in international cooperation on climate change. Measures in this regard include strengthening basic research on climate change, further developing and improving research and analytical methodology, intensifying the training and capacity building for professionals and decision-makers on climate change.

— In order to build up a strong scientific support to address climate change, China will work hard to build up its independent innovation capacity, to promote international cooperation and technology transfer, to achieve breakthrough in R&D on energy development, energy conservation and clean energy technology, and to significantly enhance the adaptation capacity of agriculture and forestry by 2010.

3.3.4 To raise public awareness and improve management

— By means of modern information dissemination technologies, to strengthen communication, education and training to raise public awareness and participation in climate change. China will work hard to transfer the knowledge of climate change to all residential communities by 2010, to raise the whole society's awareness, and to create a friendly social environment to address climate change.

— To further improve the inter-ministerial decision-making and coordination

mechanism on climate change, and to establish an action mechanism for response to climate change involving a wide range of enterprise and public participation. By 2010, China will establish a suitable and high-efficient institutional and management framework to address climate change in the future.

Part 4 China's Policies and Measures to Address Climate Change

In accordance with the requirement of carrying out the Scientific Approach of Development, China will combine its efforts to address climate change with the implementation of sustainable development strategy, the acceleration of building-up a resource-conserving and environmentally-friendly society, and an innovative country, which will be integrated into the overall national economic and social development plan and regional plan; and China will mitigate greenhouse gas emissions and in the meantime improve its capacity to adapt to climate change. China will make its efforts to realize the objectives and tasks presented in this program through adopting a series of institutional, legal, economic and technological instruments in order to strengthen energy conservation, optimize energy mix, improve ecological environment, enhance adaptation capacity, intensify research and development and improve research capacity, raise public awareness and improve mechanisms for climate change administration.

4.1 Key Areas for GHG Mitigation

4.1.1 Energy production and transformation

(1) Formulate and implement relevant laws and regulations

Vigorously strengthen energy legislation to establish and improve energy legal system, promote the implementation of China's national energy development strategy, establish the legal status of medium and long term energy program, promote the optimization of energy mix, mitigate GHG emissions from energy production and transformation. Major policies and measures are as the following:

- Expedite the constitution and amendment of laws and regulations that are favorable to GHG mitigation. According to the requirement of China's social and economic sustainable development on establishing a stable, economic, clean and secure system for energy supply and service, constitute and promulgate national *Energy Law of the People's Republic of China* as early as possible, amend Law on

the *Coal Industry and Electric Power of the People's Republic of China*, and further intensify preferential policies to develop and utilize clean and low carbon energy.

— Strengthen research and formulate energy strategy program. Through preparing national medium- and long-term energy strategies, preparing or improving national energy program and special programs for coal, electricity, oil and natural gas, nuclear energy, renewable energy and oil repertory, China's capability in sustainable energy supply and clean development of energy shall be improved.

— Implement the *Renewable Energy Law of the People's Republic of China* in a comprehensive manner. Develop supportive regulations and policies, prepare national and local programs for renewable energy development, identify development objectives and integrate renewable energy development into assessment indicator systems for the construction of resource-conservative and environmentally-friendly society. Through legislation and other approaches, domestic and international economic entities will be guided and encouraged to participate in renewable energy development and utilization, and clean energy development will be pursued.

(2) Strengthen institutional innovation and mechanism construction

— Accelerate China's institutional reform in energy sector. Pushing the progress on reform of energy management institution, further optimize energy mix by market mechanism and government promotion, actively and carefully promote energy price reform and gradually formulate pricing mechanism that can reflect resource scarcity, market demand and supply and cost for pollution control, establish pricing system that helps to realize energy mix adjustment and sustainable development; deepen institutional reform of foreign trade in controlling export of energy-intensive, pollution-intensive and resource-intensive products, so as to formulate an import and export structure favorable to promote a cleaner and optimal energy mix.

— Further promote mechanism construction for renewable energy development. Based on the principle of integrating government guidance, policy support and

market force, stable mechanism for investment will be established through government investment, government concession and other measures. A sustainable and stably expanding market for renewable energy will be fostered, market environment for renewable energy will be improved and obligation of national electricity grids and petroleum sales enterprises under the renewable energy law to purchase renewable energy products will be implemented.

(3) Intensify relevant policies and measures in energy industry

— Properly develop hydropower on the precondition of protecting the ecosystem. Hydropower development should be regarded as an important countermeasure to promote a cleaner and less carbon intensive energy mix in China. On the precondition of environmental protection and proper migrants relocation, sufficiently develop and utilize the abundant hydropower resources, expedite the development of hydropower, with an emphasis on the development in western regions and the development of small-scale hydropower. Through the countermeasures mentioned above, it is expected that the GHG emissions can be reduced by about 500 Mt CO₂ by 2010.

— Actively promote the development of nuclear power. Nuclear power should be regarded as an important component of national energy strategy, hence the proportion of nuclear power in China's national primary energy supply will increase gradually, and construction of nuclear power stations in the coastal regions with faster economic development and heavy electricity load should be expedited; unify technology approach and adopt advanced technology to realize independent and domestic construction of large-scale nuclear power stations and improve the overall capacity of nuclear power industry by the principle of self-dependence, international cooperation, technology transfer and promoting independence. Through the countermeasures mentioned above, it is expected that the GHG emissions can be reduced by about 50 Mt CO₂ by 2010.

— Expedite technology advancement in thermal power generation. Optimize the mix of thermal power generation through phasing out small-scale backward units, properly develop small-scale distributed natural gas or coal bed methane electric

power generation. Develop 600MW or above supercritical (ultra-supercritical) units and large combined-cycle units and other high efficient and clean power generation technologies; develop heat and power cogeneration, cogeneration of heat, power and cool, and combined heat-electricity-coal gas multiple supply; strengthen power grid construction through adopting advanced power transmission, transformation and distribution technologies, and decreasing losses of power transmission, transformation and distribution. Through the countermeasures mentioned above, it is expected that the GHG emissions can be reduced by about 110 Mt CO₂ by 2010.

— Vigorously develop coal-bed methane (CBM) and coal-mine methane (CMM) industry. Coal-bed methane exploration, development and utilization should be adopted as important instruments to expedite the structural optimization of coal industry, reduce accidents of coal production, improve rates of resources utilization and prevent environmental pollution. Minimize energy wastes and methane emissions in coal mining processes. Major incentive policies include: surface extraction and exploring projects are exempted or partly exempted from utilization fees for prospecting and mining rights; adopt preferential tax policies for coal-bed methane exploration and utilization projects and other comprehensive CBM and CMM utilization projects; apply preferential policies as defined in *Renewable Energy Law of the People's Republic of China* to CBM and CMM power generation; CBM and CMM price for industrial and residential use should not be lower than the price of natural gas with the same calorific value; encourage the cooperation of CDM (clean development mechanism) projects. Through the abovementioned countermeasures, it is expected that the GHG emissions can be reduced by about 200 Mt CO₂e by 2010.

— Promote the development of bio-energy. Vigorously promote biomass energy development and utilization by attaching significant importance to bio-energy based power generation, marsh gas, biomass briquette and biomass liquid fuel. Construct or reconstruct straw-fired power plants and small to medium scale boilers in major crop production areas where biomass energy resources are abundant. Construct garbage-burning power plants in the areas with relatively

more developed economy but scarce land resources. Construct marsh gas projects and appropriately install power generation facilities at large-scale livestock or bird farms and sewage treatment plants for industrial wastewater and urban residential wastewater. Vigorously promote marsh gas and gasification technologies for agricultural and forestry wastes, aiming at increasing the percentage of gas in rural residential energy consumption and using biomass gasification technology as an important instrument to abate environmental problems caused by rural residential and industrial wastes. Make efforts to develop biomass solid briquette and liquid fuels, and put forward economic policies and preferential measures in favor of bio-ethanol and other biomass fuels to promote biomass energy development and utilization to a considerable level. Through the abovementioned countermeasures, it is expected that the GHG emissions can be reduced by about 30 Mt CO₂e by 2010.

— Actively support the development and utilization of wind, solar, geothermal and tidal energy. Through the development and construction of large-scale wind power farms, promote technology improvement and industry development for wind power, and realize domestic manufacturing of wind power equipments to reduce costs and improve the market competitiveness of wind power as early as possible; actively develop solar power and solar heating, including popularizing family-use photovoltaic power system or small-scale photovoltaic power plants in remote areas; disseminating integrated solar energy building, solar energy based hot water supply, space heating and cooling pilot projects in urban areas and popularizing household solar water heater, solar greenhouse and solar stove in rural areas; actively promote the development and utilization of geothermal energy and tidal energy through popularizing geothermal space heating, hot water supply and geothermal heat pump technologies that meet the requirements of environmental and water resource protection, and develop tidal power generation technology in Zhejiang, Fujian, Guangdong and other provinces while conducting research on power generation based on wave energy and other oceanic energy. Through the abovementioned countermeasures, it is expected that the GHG emissions can be reduced by about 60 Mt CO₂ by 2010.

(4) Strengthen the development and dissemination of advanced and suitable technologies

Vigorously improve technology self-innovation capacity for the development and utilization of conventional energy, new energy and renewable energy. Promote the sustainable development of energy industries and improve the capacity to address climate change.

— Technologies for the clean and efficient development and utilization of coal. Emphasize the research and development of highly-efficient coal mining technologies and supporting equipments, efficient power generation technologies and equipments such as heavy-duty gas turbines, integrated gasification combined cycle (IGCC), high-pressure, high-temperature ultra supercritical unit, and large-scale supercritical circulation fluid bed boilers; vigorously develop coal liquefaction, gasification and coal-chemistry and other technologies for coal conversion, coal gasification based multi-generation systems technology, and carbon dioxide capture, utilization, and storage technologies.

— Exploration, exploitation and utilization technologies of oil and gas resources. Focus on the technology development for oil and gas exploration in intricacy fault block and lithology stratum, and highly-efficient technology for the development of low-grade oil and gas resources. Improve oil recovery ratio technology, and deep oil and gas exploration and development technologies. Prioritize the research and development of deep-sea oil gas pool exploration technology and heavy oil reservoirs to enhance integrated recovery ratio technology.

— Nuclear power generation technology. Research and master fast reactor design and its core technology, including nuclear fuel and structural material related technology. Make breakthrough sodium circulation and other key technologies. Actively participate in the construction of and research on international thermonuclear fusion experiment reactor.

— Renewable energy technology. Prioritize the development of low-cost and scale exploitation and utilization technologies, including the development of large-scale wind-power generation equipments, high performance and low-cost

photovoltaic battery technology, solar thermal power generation, integrated solar energy building technology, and biomass and geothermal energy development and utilization technologies.

— Power transmission and distribution and grid safety technologies. Prioritize the research and development of large-capacity long-distance DC transmission technology and super high voltage transmission technology and equipment, grid transmission and distribution technology for intermittent power sources, quality monitoring and quality control technology for electric power, large-scale interconnected grid security technology, key technologies in West - to-East Power Transmission Project, grid management automation technology, information technology and efficient management of supply and distribution system.

4.1.2 Energy efficiency improvement and energy conservation

(1) Accelerate the formulation and implementation of related laws and regulations

— Improve exiting energy-saving regulations and standards. Amend and improve the *Energy Conservation Law of the People's Republic of China*, establish strict energy-saving management system, further clarify each entity's responsibility, intensify policy incentives, identify the legal executants, intensify efforts to discipline; constitute necessary supporting regulations such as *Electricity-saving Management Regulation*, *Petroleum-saving Management Regulation*, and *Building Energy-saving Management Regulation*; formulate and improve energy efficiency standards for main energy-consuming industrial equipments, domestic appliances, lighting appliances and motor vehicles, amend and perfect energy-saving design criterions of main energy-consuming industries, energy-saving standards for buildings, and accelerate the formulation of temperature control standards on building refrigeration and space heating.

— Strengthen supervision and monitoring on energy conservation. Improve institution of compelling phasing out of energy intensive and backward processes, technologies and equipments. Phase out backward and energy intensive productions and equipments according to the law; improve market entrance

institution of key energy-consuming products and new buildings, prohibit producing, importing and selling products that fail to meet the lowest energy efficiency standards, and forbid selling and using buildings that fail to meet the energy-saving building design standards; strengthen the supervision and monitoring of energy utilization status of key energy consumer entities; strengthen supervision of energy utilization status of energy intensive industries, government office buildings and large-scale public buildings; strengthen the inspection of the implementation of energy efficiency standards for products, building energy-saving design standards and industry design criterions.

(2) Strengthen institutional innovation and mechanism construction

- Establish target-oriented responsibility and assessment systems for energy conservation. Implement energy consumption per unit of GDP communiqué system, improve information dissemination system on energy conservation, timely publicize all kinds of energy consumption information by utilizing modern information dissemination technology, and guide local government and enterprises to strengthen energy conservation.
- Carry out comprehensive resource planning and electric power demand side management, integrate amount of energy saving as a kind of resource into overall planning so as to guide reasonable resource allocation, adopt effective measures to enhance end-use efficiency of electricity utilization, optimize electricity use pattern and save electricity.
- Actively promote the authentication of energy-saving products and implement energy-efficient labeling management system. Apply market mechanism to encourage and guide consumers to purchase energy-saving products.
- Put forward contract-based energy management to overcome market barriers in promoting new energy-saving technologies, and to promote industrialization of energy-saving practices, aiming at providing all-around services such as diagnosis, design, financing, renovation, operation and management for enterprises to implement energy-saving renovation.
- Establish for energy-saving investment assurance mechanism to promote the

development of energy-saving technological service system.

- Popularize energy-saving voluntary agreements to motivate enthusiasm from enterprises and industrial societies to save energy.

(3) Strengthen relevant policies and measures

- Vigorously adjust industrial structure and its regional distribution. Promote the development of service industry and increase its proportion in national economy. Integrate energy conservation, environmental protection and control of greenhouse gas emissions into regional economic development. According to the carrying capacity and development potential of the environment and resources, and in the light of the requirements for main function zones, determine the functions of different regions and promote diversified regional development pattern.

- Strictly implement the *Industrial Restructuring Guiding Catalog*. Control the scale of energy-intensive and pollution-intensive industries and reduce their proportion. Encourage the development of new and high-tech industries. Give priority to the development of information industry that plays a leading role in the economic growth with lower energy consumption. Develop and implement development plans and industrial policies for steel, non-ferrous metals, cement and other energy-intensive industries. Raise sectoral entrance thresholds. Develop and improve policies governing the export of domestically-scarce resources and energy-intensive products.

- Formulate preferential policies for energy-saving products. Focus on end-use equipments, including highly-efficient electric motors, fans, pumps, transformers, appliances, lighting products and energy-saving building products. Implement incentive policies for the production and utilization of energy-saving products included in the *Catalog*, and list energy-saving products in the government procurement inventory, support key energy saving projects and key energy-saving technology development and demonstration projects with investment and financial assistance or loan interest subsidies. Study and formulate economic incentive policies for the development of energy-saving and land-saving buildings and green

buildings.

— Study financial and tax policies to encourage the development of energy-saving and environmentally-friendly vehicles, and to speed up the elimination of fuel-inefficient vehicles. Implement fuel tax reform policy in an appropriate time. Formulate industrial policies to encourage the development of energy-saving and environmentally-friendly vehicles with low emissions, and develop consumer policy measures to encourage energy-saving and environmentally-friendly vehicles with small displacement, abolish various restrictions on energy-saving and environmentally-friendly vehicles with small displacement, and guide the public to embrace the idea of conservation-oriented automobile purchase and maintenance. Vigorously develop public transport system and improve the proportion of rail transport in urban areas. Study policies of encouraging the production and consumption of hybrid vehicles and electric vehicles.

(4) Strengthen the development and dissemination of energy conservation technologies in key sectors

— Iron and steel industry: coke ovens should be equipped with coke dry quenching facilities, and new constructed blast furnace should be equipped with furnace top pressure differential power generating equipment (TRT); apply advanced technologies and equipments such as beneficiated material feeding, rich oxygen coal spurt, molten iron pretreatment, large-scale blast furnace, converter, and super power electric arc furnace, external furnace refining, continuous casting, continuous rolling, controlled casting and controlled cooling.

— Nonferrous metal industry: mines should be required to mainly use large, highly-efficient and energy saving equipment. In copper smelting process, adopt advanced oxygen-enriched flash and oxygen-enriched bath smelting processes. In electrolytic aluminum smelting process, adopt large pre-baking electrolytic cell; In lead smelting process, adopt the new lead smelting process by oxygen bottom blowing and other technologies of direct lead smelting by oxygen; In zinc smelting process, develop new wet process.

— Oil and petrochemical industry: oil and natural gas exploitation should apply the systematic optimization technology for oil exploitation, energy saving supplementary technology for thick oil hot exploitation, optimized operation technology for water filling system, comprehensive energy saving technology for oil and gas enclosed collection and transmission, and recovery and reutilization technology for discharged natural gas. In the process of ethylene production, the raw material structure should be optimized and ethylene cracking furnace with advanced technology shall be retrofitted. Large-scale synthetic ammonia plants should deploy advanced energy saving technical processes, new catalyst and highly-efficient energy saving equipment, promote technology of recovering residual heat from flue gas of one-section furnace for gas-based synthetic ammonia, accelerate retrofit of replacing fuel oil with clean coal or natural gas for oil-based synthetic ammonia. Apply energy saving equipment and variable pressure absorption recovery technology to medium- and small-scale synthetic ammonia, employ the coal water slurry or advanced pulverized coal gasification technology to replace traditional fixed bed coal gasification technology. In the production of caustic soda, graphite anode diaphragm process should be gradually eliminated, and the proportion of ion membrane method should be increased.

— Building material industry: in cement industry, new dry process kiln with precalcinator technology should be developed; promote energy efficient grinding equipment and power generating technology by using waste heat recovered from cement kiln; improve the performance of existing large-and medium-size rotary kiln, mills and drying machines for the purpose of energy conservation; gradually phase out mechanized vertical kiln, wet process kiln and long dry process kiln and other backward cement production technologies. In glass industry, advanced float process shall be developed; backward Fourcault and Colburn processes shall be eliminated; and technologies of overall heat insulation for furnace and kiln and enriched oxygen and full oxygen combustion shall be promoted. In architectural ceramics industry, backward kilns of down draft kiln should be discarded, slab kiln, multi-hole kiln, and roller kiln technology should be promoted. In sanitary ceramics,

fuel composition shall be changed and the clean gas fuel shall be used so as to apply sagger-free burning technology. Further promotion activities should include application of new wall materials and thermal insulation and high-quality, environmentally-friendly and efficient sound insulation material, waterproof material and sealing material; increase the proportion of high performance concrete application and extend the life span of buildings.

— Transportation: speed up the elimination of old energy intensive automobiles and development of diesel automobile, heavy-duty and special vehicle. Popularize Vans, special transport vehicles such as container vehicle; promote the implementation of national standard on vehicle fuel consumption limit to constrain the development of low fuel economy vehicles. Accelerate the development of electrified railway; develop AC-DC-AC high efficient electric locomotive; promote pulling power factor compensation technology for electrified railways and other power saving measures, so as to improve electric power utilization efficiency; develop the technology of locomotive supplying power to passenger carriage; promote application of passenger carriage power supply and gradually reduce and eliminate diesel-fueled locomotive; adopt energy saving airplane, improve carriage rate, attendance rate and transportation turnover capability, improve fuel oil efficiency and reduce oil consumption. Accelerate the elimination of old ships by formulating technical standard on ships and introduce new types of ships and advanced power system.

— Agricultural machinery: phase out backward agricultural machineries; apply advanced energy-saving diesel engine technology so as to reduce diesel consumption by engines; promote advanced mechanized farming technology such as non-tillage and combination processes; adopt more electric motors in fixed production sites; apply renewable energy such as hydro, wind and solar energy to agricultural machineries. Improve the utilization efficiency and reduce and fishery oil consumption by phasing out backward fishing ships.

— Building: give priority to the development of green building design technology, building energy saving technology and equipment, integrated renewable energy device in buildings, fine construction and environmental friendly technology and

equipment for construction, energy saving and environmentally-friendly building materials, energy saving technical standards, energy saving improvement technologies and standards for existing buildings.

— Commercial and residential energy conservation: promote household and office electric appliances such as highly-efficient energy saving refrigerator, air conditioner, television, and washing machine; reduce energy consumption of stand-by appliance; implement energy efficiency standard and labeling; and standardize market of energy saving products. Promote highly-efficient fluorescent lamp products such as phosphorus energy saving lamp, high intensity gas discharge lamp and electronic ballast, decrease the use of incandescent lamp, gradually eliminate high pressure mercury vapor lamp, implement energy efficiency standard on lighting product, increase the proportion of high-efficiency energy saving fluorescent lamp.

(5) Further carry out the 10 key energy conservation priority programmes in the Medium-and-Long-Term Energy Conservation Plan

Actively promote the implementation of the 10 key energy conservation programmes, namely the Upgrading of Low-efficiency Coal-fired Industrial Boiler (Kiln), District Heat and Power Cogeneration, Recovery of Residual Heat and Pressure, Oil Saving and Substitution, Energy Conservation of Motor System, Optimization of Energy System, Energy Conservation in Buildings, Green Lighting, Energy Conservation in Government Agencies, Building the Energy Conservation Monitoring, and Technological Support System. Ensure the progresses and effects of these key programmes to realize stable capacity for energy conservation as early as possible. Through the implementation of these ten programmes, it is estimated that 240 Mtce can be conserved during the 11th five-year plan period (2005-2010), equivalent to 550 Mt CO₂ reductions.

4.1.3 Industrial processes

— To develop circular economy vigorously and follow the pattern of new industrialization. According to the principle of “reduction, reuse and recycle of waste” and the requirement of new industrialization, China will take various

effective actions and measures to further promote the development of clean production and circular economy in industrial sector, to accelerate the building-up of a resource-conserving and environmentally-friendly society. In order to reduce greenhouse gas emissions from the production and use of industrial products, China will work hard to save the use of cement, lime, iron and steel, calcium carbide and other raw materials to the uttermost while satisfying the necessary demand of these industrial products for the legitimate social and economic development.

— To encourage the saving of iron and steel, and restrict the export of steel products. For this purpose, China will further carry out the *Development Policy for Iron and Steel Industry*, encourage substitution of renewable materials for iron and steel and recycle of waste steel to reduce steel use; encourage the application of the short-flow process technique using waste steel as material for steel production; organize the revision and improvement of the *Standard for Constructional Steel Design and Utilization* to reduce steel service factor on the precondition that safety is ensured; encourage the research, development, and deployment of high-performance, low-cost and low-consumption new materials as substitute for steel; encourage iron and steel plants to produce high-strength steel and corrosion-resistant steel to enhance steel's strength and service life; restrict the export of ferroalloy, pig iron, waste steel, steel billet and ingot, rolled steel and other steel products; abolish the export tax rebate policy or at least lower the rebate rate for export of steel products.

— To further promote the production of bulk cement and slag cement. China will follow up the guideline of “discourage the production of bagging cement and encourage the development of bulk cement”; further strengthen the policy of collecting special fund for the development of bulk cement on selling and using of bagging cement from the producers and users; continue to implement tax concession and other preferential policies for slag cement and its products; further promote the process technique of premixed concrete and ready-mixed mortar, so as to maintain the fast growth momentum of bulk cement.

— To vigorously launch the campaign of building materials conservation.

Measures in this regard include: further promoting the construction of, namely, four-saving buildings characterized by energy conservation, water saving, material saving and land saving; put forward the new building system; promoting the application of high-performance, low-consumption, renewable and recoverable building materials; promoting the application of high-strength and high-performance concrete; promoting the recovery and utilization of construction rubbish and waste; making full use of straw to produce plant fiber board; fulfilling the regulations on design, construction, material use accounting and other requirements; revising the relevant standard for material consumption of engineering project to guide enterprises to put forward material-saving technology progress.

– To strengthen the emission control of nitrous oxide and other kinds of greenhouse gases. Measures in this regard include: Further promoting the development of CDM projects and other kinds of international cooperation in the sector of adipic acid production; actively seeking necessary financial resources and technical assistance for the emission control of nitrous oxide, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆); renovating the facilities of off-gas recovery in nitrous oxide production plants to update the emission control techniques; taking various measures to reduce the emissions of these gases.

4.1.4 Agriculture

– Strengthen the establishment and implementation of laws and regulations. Gradually establishing and improving the system of laws and regulations based on *Law of Agriculture of the People's Republic of China*, *Law of Grassland of the People's Republic of China* and *Law on Land Management of the People's Republic of China*, together with administrative rules and regulations, that can lead to improved agricultural production and increased agricultural ecosystem carbon storage; developing farmland and pasture protection construction plans, strictly controlling land reclamation in areas with fragile ecosystems, and forbidding any destruction of pasture or waste of land.

- Intensify the construction of ecological agriculture in highly-intensive production areas. Implementing projects on prevention and control of agriculture non-point source pollution, extending technologies concerning reasonable use of chemical fertilizers and pesticides to improve the farmland quality; implementing a new round of fertile soil programme, scientifically applying chemical fertilizers and guiding the increased use of organic fertilizer to promote soil fertility and reduce emission of nitrous oxide from the croplands.
- Further enhance technology development and transfer. Selecting and breeding rice varieties with high yields and low (GHG) emission rates, promoting semi-dry rice cultivation technology, scientific irrigation, research and development of microorganism technology, reducing methane emission from rice paddies; research and development of technologies to breed fine ruminant varieties, improving management practices for intensive livestock operations, and reducing methane emission from livestock; further promoting straw treatment technology, and enhancing/refining the technologies for household-type biogas digesters; developing and transfer of key technologies to produce environmentally sound fertilizers and to reduce nitrous oxide emissions from croplands; vigorously promote the return of straws to croplands and non-tillage technologies to increase carbon sink in croplands.

4.1.5 Forestry

- Improve formulation and implementation of laws and regulations: to accelerate the formulation, amendment, and streamline of forestry related laws and regulations, including development of regulations on conservation of natural forests, regulations on transfer rights of forests, forest products, and forest land use, etc.; and to enhance the implementation of laws and regulations, by means of improving the system, strengthening inspection, and expanding social supervision of law enforcement.
- Reform and optimize current industrial policies: to optimize target-oriented management responsibility system for afforestation by governments at all levels and forestry sectors, to probe ways of national voluntary tree-planting under

market economy, and to establish related policies to promote voluntary planting and governmental afforestation, so as to increase forest resources and carbon sequestration.

— Strengthen key forestry ecological programs: to continuously implement key forestry programs, such as the Natural Forest Protection Program (NFPP), the Conversion of Cropland to Forest Program (CCFP), the Sandification Control Program for Areas in the Vicinity of Beijing & Tianjin, Key Shelterbelt Development Program in Such Regions as the Three North & the Middle and Lower Reaches of the Yangtze River, the Wildlife Conservation & Nature Reserve Development Program, so as to protect existing forest carbon stock and enhance carbon sequestration.

4.1.6 Municipal wastes

— Strengthen the implementation of relevant laws and regulations, including, inter alia: *Law on Prevention of Environmental Pollution Caused by Solid Waste of the People's Republic of China*, *Regulations on the Management of City Appearance and Sanitation*, and *Measures for the Management of Municipal Domestic Waste*. The management focus will be shifted from the current end management to whole-process management, i.e. reduction of wastes from the source, recovery and utilization, and non-hazardous disposal. The processes of waste production and disposal will be normalized to the greatest possible extent, and the disposal of municipal domestic waste will be incorporated into the overall planning of the city.

— Further improving relevant sectoral standard. According to the evolving requirement, compulsory standards for wastes classification and recovery shall be formulated, so as to improve the comprehensive utilization of wastes resource and to reduce the amount of wastes from the source. The currently valid sectoral standards such as *Standards for the Classification and Assessment of Municipal Domestic Wastes*, *Technical Norms on Sanitary Landfill of Domestic Wastes*, *Standards for the Assessment of Non-hazardous Landfill of Domestic Wastes*, will be implemented more strictly and further revised, so as to improve the recovery

and utilization of combustible gas from the landfills and to reduce the emissions of methane from landfills.

— Reinforcing technological development and deployment. Great efforts will be made on the development and dissemination of advanced waste incineration technology, on the localization of relevant technologies, in order to decrease the cost and promote the industrialization of waste incineration technology. Research will be carried out on landfill gas recovery and utilization technologies and composting technologies suitable for China's circumstances and of suitable scale, and thus provide small and medium cities as well as rural areas with waste disposal technology which is of urgent need. Greater support will be provided to the research, development, demonstration and dissemination of relevant technologies, and the development of waste disposal and comprehensive utilization technologies will be accelerated.

— Making full use of the guiding function of the industrial policy. Guided by the industrial policy, charging system for disposal of domestic waste will be established, and measures such as charging fee for sanitary service, system of contracted economic responsibilities and enterprise management of public entities, will be implemented. These will promote the reform of the waste disposal system, improve the current dispersed wastes collection and utilization approaches, and thus promotes the industrial development of waste disposal.

— Formulating incentive policy for the recovery and utilization of landfill gas. Enterprises will be encouraged to construct and operate landfill gas collection and utilization facilities. The fee level for waste disposal will be increased, landfill gas power and waste incineration power projects will enjoy preferential feed-in tariff, and landfill gas recovery and utilization projects will enjoy preferential value-added tax and enterprise income tax relief and reduction within a certain period of time.

4.2 Key Areas for Adaptation to Climate Change

4.2.1 Agriculture

— Continue to improve agricultural infrastructures. Accelerate the construction of

supporting facilities of large-scale, water-saving irrigation areas; maintain/promote field engineering quality; upgrade aging electromechanical equipment; and improve irrigation and drainage systems. Continue to expand demonstration on water-saving irrigation, build pilot projects in the main grain production area, develop dryland water-saving agriculture and build demonstration projects on dryland farming in arid areas. Conduct small-scale hydraulic engineering focused on field irrigation and drainage projects, small-scale irrigation areas and watershed projects in the non-irrigation area for fighting drought. Strengthen the control and restoration of middle-and-low yield fields subject to salinization and alkalinization in the main grain production areas. Accelerate the construction of water collection and utilization engineering in hill mountain areas and other arid areas.

— Promote adjustment of agricultural structure and cropping systems. Optimize regional arrangement of agriculture. Promote the centralization of preponderant agro-products to preponderant production areas in order to form the industrial zones of preponderant agricultural products and to increase agricultural productivity. Extend the planting areas of economic and forage crops, and promote the shift of the structure of cropping systems from dual structure with food crop and cash crop to ternary structure with food crop, cash crop and forage crop. Adjust cropping systems, develop multiple cropping and raise multiple cropping indexes.

— Breed stress-resistant varieties. Select and cultivate new well-bred animal and crop varieties with high yield potential and quality, superior integrative stress resistance and wide adaptability. Improve crop and variety arrangement. Select and cultivate stress-resistant varieties with specific abilities of resistance to drought, waterlogging, high temperature, diseases and pests.

— Prevent aggravation of grassland desertification. Prevent further development of desertification by building artificial grassland, controlling grazing intensity, recovering vegetation, and increasing vegetation coverage of grassland. Strengthen the development of animal husbandry in the farm belt to improve the productivity of animal husbandry.

— Strengthen research and development of new technologies. Develop new technologies and strive to make greater progress in the areas of photosynthesis, biological nitrogen fixation, bio-technology, prevention of diseases and pests, stress resistance, and precision agriculture. Continue to implement “seed project” and “well-bred species project for animal and fishery”. Promote the construction of well-bred species bases for main crops, livestock and poultry. Enhance agricultural technology extension, and increase agriculture’s ability to adopt new technologies.

4.2.2 Forests and other natural ecosystems

— Formulate and implement laws and regulations relevant to climate change adaptation. Accelerate the amendment of *Forest Law of the People’s Republic of China* and *Law of the People’s Republic of China on the Protection of Wildlife*. Draft *Law of Nature Reserve and Regulations on Wetland Protection of the People’s Republic of China*, etc. Add and/or strengthen articles relevant to climate change adaptation to provide a legal guarantee for improving the capacity of forests and other natural ecosystems to adapt to climate change.

— Strengthen the effective protection of existing forest resources and other natural ecosystems. Strictly protect natural forests in logging ban areas to convert natural forest ecosystems from degradation to progressive succession. Conduct wetland conservation by effectively reducing human disturbance and damage to stop the declining trend of wetland area. Expand total area and improve the quality of nature reserves and develop bio-corridors among reserves. Strengthen forest fire control by establishing perfect systems for forest fire forecasting, monitoring, suppressing, saving, fuelbreaking and hazard assessing. Effectively integrate existing forestry monitoring systems into a comprehensive one for forest resources and other ecosystems. Enhance forest insect and disease control by improving systems for forecasting, early-warning, monitoring, quarantining of forest insect and disease, enhancing comprehensive control, and enlarging biological control.

— Strengthen technology development and extension. Research and develop technologies for forest fire control and forest insect and disease control. Select

and breed tree species with high cold-resistance, drought-resistance and pest and disease-resistance to enhance the adaptation capacities of forest vegetations to climate change. Develop technologies for biodiversity conservation and restoration, particularly those technologies related to management of forest and wildlife nature reserves, wetland conservation and restoration, and conservation of endangered wild animals and plants to alleviate the impact of climate change on biodiversity. Promote technologies for monitoring forest resources and forest ecosystems, including those for forest environments, desertification, wild animals and plants, wetlands, forest fire, forest pest and disease. Improve monitoring network and management system to enhance forecasting, early-warning, and emergency responding capacities.

4.2.3 Water resources

— Enhance water resources management. Adopting the principle of harmony between human and nature in water resource management, to take more effort to convert farmland back into lake or river course, remove polder dikes for flood way, dredge river channel and lake, and rehabilitate and protect rivers with serious ecological problems while strengthening dike construction and key water control projects. Enhance unified management of water resources through basin-wide integration of water resource planning, allocation, and management. Pay more attention to saving, protection, and optimizing the allocation of water resources. Change people's traditional way of considering water resource as inexhaustible. Convert water resource allocation approach from demand-based supply to supply-based demand. Establish national initial water right allocation and water right transfer systems. Develop investment and financing system and management system for key water conservancy projects consistent with the socialist market economy.

— Strengthen infrastructure planning and construction. Speed up building of the Project of South-to-North Water Diversion, and gradually generate the new pattern of optimized water resources allocation by three water diversion lines linking the Yangtze River, Yellow River, Huaihe River, and Haihe River, characterized by “four horizontal and three vertical lines”. Enhance the construction and improvement of

key water control projects (reservoirs, etc) and infrastructures in irrigation areas. Continue the construction of regional water storage and water diversion projects.

— Promote the development and extension of technologies for water allocation, water-saving, and sea water utilization. Focus the researches on the mechanisms of water exchange among atmosphere water, surface water, soil water, and groundwater, and technologies for optimizing water resource configuration, wastewater and rainfall utilization, and artificial rainfall enhancement. Exploit technologies for industrial water recycling, water saving irrigation, dryland farming and biological water saving, especially technologies and equipments for precise irrigation and intelligent management for water use in agriculture. Develop and extend technologies of domestic water saving and sea water utilization.

4.2.4 Coastal zones and coastal regions

— Establish and improve relevant laws and regulations. Formulate regional management regulations and detailed rules in accordance with *Marine Environment Protection Law of the People's Republic of China*, *Law of the People's Republic of China on Administration of Sea Areas*, etc., and characteristics of the specific localities in the coastal areas. Establish integrated coastal zone management (ICZM) system, the comprehensive decision-making mechanism and effective coordination mechanism. Handle timely various issues occurred in the development and protection of coastal zones. Establish demonstration sites of integrated management.

— Promote technology development and extension. Strengthen research and development of technologies for protection and restoration of the marine ecosystems, with emphasis on cultivation, transplanting, and recovery of coastal mangroves, protection and restoration of coral reefs and coastal wetlands to reduce the vulnerability of ecosystems in coastal zones. Accelerate the construction of the designated marine natural reserves, such as coral reef reserves, mangrove reserves, etc. Improve capability of protection of marine biodiversity.

— Improve the capability in marine environmental monitoring and early-warning.

Set up more observation sites and networks in coastal areas and on islands. Construct high-tech observation systems. Improve the capability of aerial remote sensing and telemetering of marine environments, especially capability of monitoring sea level change. Build early-warning and response system for tidal disasters in coastal areas. Promote comprehensive supporting capability of early-warning, strengthen service capability of early-warning systems and capability of production and distribution of early-warning products to increase the capability for early-warning against marine disasters.

— Strength adaptation strategies to address sea level rise. Adopt measures of combining slope protection with shore protection, combining engineering measures with biological measures. Raise design standards of sea dike height, heighten and consolidate existing sea dike engineering works to enhance the capacity of dealing with sea level rise. Prevent over exploitation of groundwater and land subsidence in coastal areas, by taking measures of artificial groundwater recharge in the areas where groundwater funnel and land subsidence occurred. Take countermeasures such as using fresh water from rivers or reservoirs to dilute and restrain brackish water against sea water intrusion in the estuaries. Raise protection standard for coastal cities and major projects, raise standard for designed height of port docks, and adjust outlet depth. Make efforts to construct coastal shelterbelt systems with multi-species, multi-layer, and multi-function of forests.

4.3 Climate Change Science and Technology

— To strengthen the macro-management and coordination for climate change related scientific research. Measures in this regard include: further understanding the significance of climate change related scientific and technological research; complying with the guiding principle of “making independent innovation, achieving breakthrough in key areas, supporting the development, and guiding the future trend” for scientific research; meeting the requirements of *Framework of National Program for Medium-to-Long-Term Scientific and Technological Development* on climate change related scientific research; strengthening the macro management

and policy guidance for scientific and technological research on climate change; refining the leadership and coordination mechanism for scientific and technological research on climate change; improving the regional and sectoral allocation of climate change related scientific research; further reinforcing the support to climate change related scientific research; speeding up the integration of climate change science and technology resources; encouraging and supporting innovation of climate change science and technology; and bringing science and technology into full play as the basic supporting force in response to climate change.

— To promote scientific research and technological development in key areas of climate change. Measures in this regard include: strengthening the research on scientific facts and uncertainty, impacts of climate change on social economy, analysis of the effectiveness of socioeconomic benefits and costs in response to climate change, technological options in response to climate change and effectiveness assessment; strengthening observation on climate change, R&D on global climate change monitoring technology, technology for reduction of greenhouse gas emissions and adaptation technology to enhance China's capacity in response to climate change and implementing the UNFCCC; paying special attention to the research and development of large-scale and precise climate change monitoring technology, energy efficiency and clean energy technology, emission control and utilization technology for carbon dioxide, methane and other greenhouse gas emissions in key sectors, biological carbon-capture technology, and carbon sequestration technology.

— To strengthen the construction of talents in the area of climate change science and technology. Measures in this regard include: strengthening personnel training; establishing effective incentive and competition mechanism and a favorable academic environment for talent development; paying special attention to foster academic leaders and eminent candidates with international vision and the ability to lead climate change studies, and encouraging young talents to distinguish themselves; strengthening the disciplinary development of climate change science; speeding up the construction and integration of talent teams; establishing the

“opening, flowing, competitive, cooperative” operation mechanism for climate change research institutes; making full use of various channels and approaches to enhance the research ability and independent-innovation capacity of China’s scientists and research institutions; building up a climate change science and technology management team and R&D team in the context of China’s national circumstances; encouraging and recommending China’s scientists to participate in international R&D programs on global climate change and get positions in international research institutions.

— To increase the financial support to climate change related scientific and technological research. Measures in this regard include: establishing relatively stable governmental-funded channels as the main financing sources to enlarge the official financial support to climate change related scientific and technological research; taking measures to ensure the full allocation and efficient utilization of governmental investment; raising fund through various channels and by various means from all circles of the society to support climate change scientific and technological research; introducing venture capital investment in the area of climate change study; guiding business and enterprises to increase their investment in R&D on climate change science and technology and giving them the role as the major body of technology innovation; utilizing the bilateral and multilateral funds from foreign governments and international organizations to assist China’s R&D on climate change science and technology.

4.4 Public Awareness on Climate Change

— Fully utilizing the promotion function of the government. All levels of government should regard raising public awareness as an important work to address climate change and carry out it with care. For this purpose, China will take various measures to promote the climate change awareness of all level of government officials and decision-makers of enterprises and institutions, to build up a high-quality leadership team with strong awareness of global climate change step by step. Furthermore, all walks of life of the society will be fully employed to disseminate China’s efforts and policies for response to climate change and to

promote public awareness of climate change.

— Reinforcing the publicity, education and training on climate change. Measures in this regard include: making full use of mass media such as books, newspapers, periodicals, audio and video products to disseminate knowledge of climate change to stakeholders in all walks of life; advocating sustainable life style including electricity-saving, water-saving, garbage classification, reduction, recycling and reuse; incorporating climate change publicity and education into the framework of basic education, adult education and higher education as an important component of China's overall quality education; holding various thematic training seminars targeting at different audiences and organizing different workshops on both popular and professional climate change science; taking full advantage of information technology to enrich the contents and functions of the government's climate change information websites and building them up into real, quick-response and effective platforms for information dissemination and communication.

— Encouraging public participation. Measures in this regard include: Incentive mechanism should be established to encourage the public and enterprise participation in the climate change issue and public supervision will be fully utilized; improving information publicity channels and regulations on climate change issues; widening the channels for public participation and supervision; giving full play to the media's supervision and guidance function on public opinion; increasing the transparency of decision-making on climate change issues; promoting the science and democracy in the area of climate change administration; giving full play to the initiative of social communities and non-governmental organizations.

— Reinforcing international cooperation and communication. Measures in this regard include: strengthening international cooperation on promoting public awareness on climate change issues; utilizing the experience of international good practice on climate change publicity and education; actively carrying out information exchange with foreign countries and exchanging publications, movies, televisions, audio and video tapes and other literature works on global climate change; building up open database on climate change and providing inquiry and

information retrieval services for domestic agencies, research institutions, and schools.

4.5 Institutions and Mechanisms

— Strengthening the leadership on addressing global climate change. The response to climate change correlates with economic, social, domestic and foreign issues. Therefore, the State Council decides to establish the National Leading Group to Address Climate Change headed by Premier Wen Jiabao, with Vice Premier Zeng Peiyan and State Councilor Tang Jiaxuan serving as the Deputy Directors of the Group. The Leading Group will be responsible for deliberating and determining key national strategies, guidelines and measures on climate change, as well as coordinating and resolving key issues related to climate change. The Office of the Leading Group, whose capacity shall be strengthened, is established within the National Development and Reform Commission. Relevant ministries and departments of the State Council shall seriously fulfill their responsibilities, and strengthen coordination and cooperation, so as to achieve synergies to address climate change. Local governments at different levels shall enhance the organization and leadership on local responses to climate change, and formulate and implement local climate change programmes as a matter of priority.

— Establishing a regional administration system for coordinating the work in response to climate change. Measures in this regard include: establishing regional administration agencies to fulfill and implement the national program, to organize and coordinate local activities and actions in response to climate change; building up local expert group on climate change and initiating proper climate change policy and measures according to local conditions such as geographical environment, climatic conditions and economic development level; meanwhile, strengthening the coordination between national and local governments to ensure the smooth implementation of relevant policy and measures in response to climate change.

— Making effective use of the Clean Development Mechanism Fund (CDMF). According to the pertinent articles of *Measures for Operation and Management of*

Clean Development Mechanism Projects, the Government of China will levy a certain proportion of the certified emission reductions (CERs) transfer benefits from CDM projects, and the revenue collected upon CERs transfer benefits from CDM projects will be used to establish the Clean Development Mechanism Fund to support the country's activities on climate change such as climate change related science and technology research, and raising national adaptation and mitigation capacity. The establishment of the Clean Development Mechanism Fund will also play an active role in relieving the pressure of demand for fund in response to climate change, and guaranteeing the effective implementation of this national program.

Part 5 China's Position on Key Climate Change Issues and Needs for International Cooperation

Climate change, the impacts of which have been felt all over the world, was mainly caused by the massive emissions of CO₂ and other greenhouse gases originated from developed countries since industrial revolution. Broad international cooperation is necessary to address climate change. In order to effectively address climate change and implement this national programme, China is ready to strengthen international cooperation with all countries. Meanwhile, China would like to appeal to the developed countries to sincerely fulfill their commitments under the Convention to provide financial assistance and transfer technology to developing countries so as to enhance their capacity to address climate change.

5.1 China's Position on Key Climate Change Issues

5.1.1 Mitigation of greenhouse gas emissions

Mitigating greenhouse gas emissions is one of the important components in addressing climate change. According to the principle of “common but differentiated responsibilities” of the UNFCCC, the Parties included in Annex I to the Convention should take the lead in reducing greenhouse gas emissions. For developing countries with less historical emission and current low per capita emission, their priority is to achieve sustainable development. As a developing country, China will stick to its sustainable development strategy and take such measures as energy efficiency improvement, energy conservation, development of renewable energy, ecological preservation and construction, as well as large-scale tree planting and afforestation, to control its greenhouse gas emissions and make further contribution to the protection of global climate system.

5.1.2 Adaptation to climate change

Adaptation to climate change is an integral part of addressing climate change. In the past, sufficient attention was not given to adaptation, but it is now required a shift in direction. When formulating further legal documents to address climate

change in the future, the international community should give full consideration to adaptation to the climate change already under way, especially the promotion of developing countries' capacity against extreme climatic events. For this purpose, China is ready to cooperate with the international community to actively participate in activities for climate change adaptation and formulation of relevant legal documents.

5.1.3 Technology cooperation and transfer

Technology will play the central role in addressing climate change. International technology cooperation and transfer should be strengthened to share the benefit of technological development worldwide. Measures in this regard should include the following: establishing an effective technology cooperation mechanism to promote R&D, deployment and transfer of technology of addressing climate change; eliminating obstacles to technology cooperation and transfer in terms of policy, institution, procedures, financial resources and protection of intellectual property rights; initiating incentive measures for technology cooperation and transfer to ensure its occurrence in reality; establishing a special fund for international technology cooperation so that environment-and-climate-friendly technologies are accessible and affordable to developing countries.

5.1.4 Full implementation of commitments under the Convention and the Kyoto Protocol

The UNFCCC has provided the objectives, principles and commitments to address climate change, based on which the Kyoto Protocol further set up the specific greenhouse gas reduction targets for Annex I country Parties for the period from 2008 to 2012. All parties are supposed to faithfully implement their respective commitments under the Convention and the Kyoto Protocol. The developed countries should fulfill their commitments of taking the lead to reduce their greenhouse gas emissions and providing financial assistance and technology transfer to the developing countries. As a country of responsibility, China will seriously fulfill its commitments under the Convention and the Kyoto Protocol.

5.1.5 Regional cooperation on climate change

The UNFCCC and the Kyoto Protocol are the major legal frameworks for the international community to address climate change, which do not close the door to regional cooperation on climate change. Regional cooperation on climate change, in any form, should function as a helpful complement to the UNFCCC and the Kyoto Protocol rather than replacing or weakening them. The purpose of regional cooperation should be to stimulate all efforts to address climate change and to boost practical international cooperation. China will participate in regional cooperation on climate change in this way.

5.2 Needs for International Cooperation on Climate Change

5.2.1 Needs for technology transfer and cooperation

— Technology need for observation and monitoring of climate change. Technology need for this purpose mainly are atmospheric observation, marine observation, terrestrial eco-observation, satellite technology on meteorological, marine and terrestrial resources, climate system simulation and calculation technology, etc. Among these needs, technology for manufacturing of advanced observation equipments, the high-resolution and high-precision satellite technology, technology for satellite data acquirement & remote-sensing information collection & reviewing, and high-performance climate change simulation techniques are on top of the list for China to establish its own climate observation system, and are the priorities of the country's need for technology transfer and cooperation.

— Technology need for mitigation of climate change. China is at the stage of large-scale infrastructure construction, and is in urgent need of technology for reducing greenhouse gas emissions. China's technology need for mitigation of climate change mainly covers advanced energy production and utilization technology, environmental protection and resource comprehensive utilization technology, high-efficiency transportation technology, new material technology, new-style building material technology, etc. Among these needs, the high-efficiency, low-pollution coal-burning power generation technology, large hydropower generation unit technology, new generation nuclear technology,

renewable energy technology, building energy conservation technology, clean fuel vehicle technology, hybrid vehicle technology, urban rail-based traffic technology, fuel cell and hydrogen technology, oxygen-rich coal-spray blast furnace & long-life span technology, comprehensive technology for transformation and expansion of medium and small nitrogenous production facilities, new paving material technology, and new-type wall-body material technology are the priorities. Introduction and diffusion of these technologies in China will make significant difference to the country's efforts to control greenhouse gas emissions.

— Technology need for adaptation to climate change. China's technology need for adaptation to climate change mainly includes high-efficiency water-saving agro-technologies such as spray & drip irrigation, water-saving and reusing technology of industrial water, treatment technology of industrial and household wastewater, household water-saving technology, high-efficiency flood-controlling technology, agro-biological technology, agricultural breeding technology, production technology for new-type fertilizers, disease and pest control technology for cropland, forest, and grassland, cultivation technology of fast-growing high-yield forest and high-efficiency firewood forest, technology for recovery and reconstruction of wetland, mangrove and coral reef ecosystems, technology for observation and pre-warning of flood, drought, sea level rise, agricultural disasters, etc. Timely-acquisition of these technologies can greatly help China reinforce its capacity for adaptation to climate change.

5.2.2 Needs for capacity building

— Development of human resources. Capacity building needs for development of human resources mainly include personnel training, international exchange program, discipline development and professional training in the area of fundamental research on climate change, policy analysis on mitigation and adaptation, information system development and CDM project management.

— Adaptation to climate change. Capacity building need for adaptation to climate change mainly includes development of adaptation projects, case studies on extreme climatic events, improvement of climate observation systems,

enhancing the adaptation capacity of coastal areas, water resource and agriculture sectors, etc.

– Technology transfer and cooperation. Capacity building need for technology transfer and cooperation mainly include following new progress and trend of international technology development, effective identification and assessment of advanced adaptation technology, analysis on barriers to international technological transfer and cooperation, improving the ability to adapt to and assimilate transferred technologies, etc.

– Public awareness. Capacity building needs for public awareness include developing medium-and-long term program and policy to enhance public awareness of climate change, establishing professional publicity and education network and institutions in line with international standards, training people working in media and climate change education, launching public campaigns for stakeholders from different regions and groups to disseminate the knowledge of climate change, and guiding the public consumption patterns in favor of the protection of global climate system.

– Information system development. Capacity building needs on information system development include distributed databases on climate change, internet-based climate-change-information sharing platforms, application-oriented information system and information service system, public information service system and industrial information service system, international information exchange and cooperation, etc.

– National communications. Capacity building needs for national communications include the establishment of statistical system catering to the compilation of emission inventory, collection of testing and monitoring data for emission factors,, methodologies for inventory quality control, assessment of climate change impact and adaptation, projection of future emissions, and the development and management of national greenhouse gas emission database.

China's Scientific & Technological Actions on Climate Change

Jointly Issued by

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Climate change has an increasingly significant and far-reaching impact on all nations in the world. It therefore becomes a focus of attention by international communities. China, as a developing country that is vulnerable to the impacts of climate change, attaches great importance to the issue of climate change, and China has adopted a number of active measures to address it. The Outline for National Medium- and Long-term Plans for Science & Technology Development (2006-2020) (hereafter referred to as the Outline for S&T Development) has listed energy and environment as priority areas, in which the global environmental change monitoring and response measures are identified as one of the priority themes. The China's National Climate Change Programme (hereafter referred to as the CNCCP Programme) clearly states that climate change issue shall be addressed through S&T advances and innovations, and that strengthening S&T is a major initiative in response to climate change at the national level. In order to implement the key tasks identified in the Outline for S&T Development, to provide S&T support to the CNCCP Programme, to coordinate climate change-related scientific research and technological development, and to enhance the comprehensive S&T capacity in response to climate change, the China's Scientific & Technological Actions on Climate Change (hereafter referred to as the China's S&T Actions) is hence formulated as follows:

I. Current Status of Climate Change and Urgent Demands for S&T

1. Climate change is an increasingly prominent issue that brings about profound impacts on human societies

Research shows that human activities have led to the climate change characterized with global warming over the past five decades. It is expected that by the end of this century, the global average surface temperature will increase by 1.1-6.4 °C. This change has affected and will continue to affect the natural ecosystem and human socio-economic systems in an adverse manner, posing one of the most critical challenges to mankind in his effort to pursue sustainable development.

Due to global climate change, the climate in China has experienced significant changes in recent years. During 1986-2006, China experienced 21 warm winters nationwide in succession. Consequently there was a marked increase in the frequency and intensity of extreme weather/climate events and associated disasters all causing increased losses, such as shortage of water resources and a sharp imbalance between regions, a deterioration in ecology and environment, a tremendous loss in agricultural production, a heavier pressure on food security, a rising sea level, and a threat to coastal economic and social development.

2. An appropriate response to climate change would be very much related to China's economic and social development

In the next 15 to 20 years, China will continue to register a rapid economic growth, which means a rising demand for and consumption of energy. The Chinese Government is active in fulfilling its UNFCCC commitments as evidenced by issuance of the CNCCP Programme, and in achieving the target to reduce energy consumption per unit GDP by 20% by 2010 against the 2005 level. In spite of the fact that the China's energy consumption per unit GDP and GHG emission intensity suggest a decline in general, it would be difficult to reverse the trend of rising energy consumption and total GHG emission in a short period of time. Climate change and related international treaties are regarded as a special international environment encountered in the process of China's peaceful development and shall be dealt with appropriately.

3. Addressing climate change calls for urgent S&T activities

Responses to and solutions of the climate change issue, after all, depend on the advances in S&T. Strong S&T supports in connection with climate change are required to better understand the behavior of climate change, to

identify its impacts, to develop its adaptation and mitigation technologies, and to formulate climate change response policies and measures.

Since the 1990s, climate change has become an important leading-edge discipline. Major developed countries that have invested huge financial resources in research are now in a leading position in climate change-related S&T. The climate change-related S&T projects, which China has accomplished, have provided strong supports to its internal and foreign affairs in the field of climate change. But the fact that related S&T activities in China are still lack of a medium- and long-term strategies and they are met with inadequate funding, makes it difficult to adapt itself to the rapid developments in climate change or to meet the needs in formulation and implementation of national climate change-related policies and actions, and in participation in negotiations and international cooperation. It is of imperatively urgency to reinforce China's climate change-related S&T.

II. China's S&T Achievements in Climate Change

1. Scientific research and technological development

Since 1990, China has carried out a series of climate change-related S&T projects under framework of national S&T programs, such as National Hi-tech R&D Program (863 Program), National Basic Research Program (973 Program) and National Key Technologies R&D Program, focusing on global climate change prediction and its impacts, future trends of the living environment changes in China, global environmental change, response strategy and technologies in response to climate change, genesis mechanism of and prediction theory on major climate- and weather-induced disasters in China, technologies for use of clean and efficient energies, for energy saving and efficiency, for exploitation of new and renewable energies, and etc.

Meanwhile, China is also actively involved in the international S&T cooperation on the issues of global environmental changes, such as the four international research programmes under the framework of Earth Science Systems Partnership (ESSP): World Climate Research Programme (WCRP), International Geosphere-Biosphere Programme (IGBP), International Global Change Human Dimension Programme (IHDP) and International Biodiversity Programme (DIVERSITAS), and the Intergovernmental Coordination Organization on Global Earth Observation (GEO) and the Global Climate Observing System (GCOS). China's participation in the global change research initiatives are marked with both Chinese characteristics and global significance.

Thanks to the above-mentioned national programmes and international cooperation in S&T, China has made achievements in climate change-related research and technologies development in the following four aspects:

(1) Basic Research on Climate Change

With established atmospheric background observatories, some significant findings have been made on GHG observations, especially CO₂ concentration. Methane emission data from paddy field in China have been collected. The study on China's paleo-climate research based on loess, stalagmite, ice core, lake core data and historical literatures keeps the same pace as the rest of the world research communities. The temperature change curve depicting climate change over the past 100 years in China has been established. The global and regional climate models Chinese owning Intellectual Property Rights (IPR) have been developed, which were widely recognized and honored with a National First Award for Advances in S&T and they have been applied to operational climate predictions. Some modeling findings from the global climate model have been incorporated in the Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change (IPCC). The study of Asian monsoon activity and variability and their contributions to drought and flood in China was concluded with important findings that draw the world's attention. The regional climate change scenarios for future China have been produced on a preliminary basis.

(2) Impacts of Climate Change and Response Measures

An important conclusion has been reached that agricultural farmlands fall into the category of "weak carbon sinks". The Daily Weather Generator based stochastic numerical weather model and the Chinese Regional

Agricultural Impact Assessment Model have been developed. A database system has been created to support research on impacts of climate change; the Knowledge Database of Major Policies and Action Plans in response to climate change in Agriculture, Forestry and Water Resources has been developed. Cost-benefits analysis of response strategies for areas most vulnerable to sea level rise has been made; and research methods on risk levels of climate change in line with international practices have been developed.

(3) Development and Application of GHG Emission Control and Climate Change Mitigation Technologies

Major advances have been made in developing efficient coal-burning power generation technology, heat-power co-generation technology, clean coal power generation technology, utilization technology of oil field torch gas, and etc. Energy efficient and saving technologies have been widely used in building materials, steel, chemicals, construction, transportation (electric vehicles), mining and other sectors. Research and development of renewable and new energies like wind power, bio-energy, solar energy, hydro power, thermal power and fuel cells have been witnessed substantial progress.

(4) Social and Economic Impact Analysis and Mitigation Measures

A preliminary analysis of the present status and future trend of GHG emissions and sinks in China has been made. The potential and cost of CO₂ reduction in energy, industry and transportation sectors has been studied. The impacts of different GHG emission limitations on China's emission control have been compared. The possible effects of developed countries' GHG emission reduction policies and measures on China have been studied.

On the basis of all of the achievements, the National Assessment Report on Climate Change was formulated and published.

2. Infrastructure buildup for Scientific Research

Large-scale observation networks have been put in place, including the national climate monitoring network, national weather observation network, national specialized meteorological observation network, national ecological observation network and CO₂ flux observation network. A number of key national laboratories and sectoral labs run used to study the global changes have been set up. With independent research efforts and through international cooperation, large equipments and facilities for climate change studies have been developed or introduced from overseas.

3. Human Resources Development and Research Structural Buildup

With about two decades' efforts, one core climate change expert team has been formed in China with expertise in economics, social sciences, energy, meteorology, ecology, environment and other disciplines. And now over 1,000 researchers and experts are working in the scientific and application fields of climate change.

Through participating in international negotiations and relevant international cooperative activities for long time, a number of experts both full of scientific knowledge and familiar with international instruments and negotiation procedures are available.

A number of national climate change research institutes have been set up. Training courses on climate change have been provided by many universities and colleges. Provincial technical service centers on Clean Development Mechanism have also been created.

III. Guidelines, Principles and Targets

1. Guidelines

With “Scientific Approach of Development” as guidance, science & technology shall play a basic and leading role in response to climate change for the implementation of the Outline for S&T Development and the CNCCP Programme. To this end, S&T innovations and advances shall be promoted; emissions of GHG shall be controlled through S&T solutions; and China’s adaptation capacities shall be enhanced, with the aims that strong S&T supports shall be provided to maintaining sustainable socio-economic development, safeguarding the national interests, and fulfilling the international commitments.

2. Principles

(1) Combining government leadership with enterprise participation

Based on national demands, emphasis shall be given to solving major S&T issues related to climate change. Governments should play a leading role in this process. At the same time, through policy and system innovations and by making use of the market mechanism, enterprises shall be encouraged to participate in key technologies R&D, including wider dissemination and application of research findings, by rousing their initiatives and enthusiasm in pursuing S&T innovation and advances.

(2) Combining technological researches with policy studies

On the basis of independent innovations and aiming at future trends of climate change-related S&T, the efforts shall focus on solving key issues and on developing key technologies so as to bring China’s climate change research to a new level. At the same time, by centering on national demands for social and economic development and on the strategy for peaceful development, and taking into consideration the international political, economical, commercial and diplomatic situations, policies related to domestic and international affairs should be advised in active response to climate change.

(3) Combining short term demands with long term objectives

Technical solutions and response strategies shall be provided, which should be effective and scientifically based to tackle the practical and emerging issues encountered in international climate change cooperation and in domestic demands for energy saving and pollutants emission reduction technologies. At the same time, the technological supporting system with strong independent innovative potentials shall be set up to meet medium- and long-term national strategic targets.

(4) Combining overall planning with separate implementation

Taking into consideration the current S&T funding channels and division of responsibilities of agencies as well as the necessity to integrate the available resources, an overall planning and layout of climate change S&T shall be made. At the same time, the tasks as set out in the China’s S&T Actions shall be implemented in all national S&T programs according to their respective functions.

3. Targets

Targets to be met by 2020 are:

- (1) To significantly improve the capability for making independent innovations in the research on climate change;
- (2) To make breakthroughs in and wider applications in social and economic sectors of key technologies related to GHG emission control and climate change mitigation;
- (3) To notably enhance the adaptive capacity of key sectors and typical vulnerable areas in response to climate

change;

(4) To markedly improve the ability of S&T support to international cooperation, engagement and decision making on climate change;

(5) To make substantial progress in building up the climate change disciplinary, and in improving S&T infrastructure, research conditions and qualification of research teams;

(6) To noticeably increase the public's awareness of climate change and related scientific knowledge.

And the near term objectives during the 11th Five-year Plan period (2006-2010) are

(1) To put in place a national S&T policy framework and coordination mechanism in response to climate change and to further improve the capacity of integrating S&T resources;

(2) To achieve internationally recognized research findings in key climate change areas;

(3) To develop and improve Chinese prediction, analysis, assessment and decision-making models on climate change;

(4) To advance research on key technologies for climate change mitigation and to launch pilot projects at local level and in industrial sectors;

(5) To make breakthroughs in the studies on the impacts of climate change on agriculture, water resources, coastal areas, forestry, fishery, bio-diversity, desertification and human health and to implement demonstration projects on adaptation in typical vulnerable areas;

(6) To formulate the National Adaptation Strategy on Climate Change;

(7) To make China's contributions to the design of international climate change regime;

(8) To build up highly professional research teams as well as research bases on climate change.

IV. Key Tasks

1. Scientific aspects of climate change

New climate system models: to develop the new climate system models, which will depict carbon cycle process, the earth's physical and biochemical processes, land surface, ice sheets and eco-system, as well as high resolution numerical model of sea and atmospheric circulations; and etc.

Detection and attribution of climate change: to reconstruct the high resolution paleo-climate change series in China over the past 2,000 years; to conduct sensitivity experiments on impacts of natural and anthropogenic factors with climate models; to determine the dominant factors affecting climate change in different historical periods; and etc.

Monitoring, prediction and early warning of climate change: to develop technologies of climate change monitoring, prediction and early-warning; to monitor the process, elements and factors of climate change; to simulate and predict future global climate change under various GHG emission scenarios; to predict future climate change in major regions of the globe under the influence of human activities; to provide early warning of extreme weather/climate events, associated disasters as well as risk assessment; and etc.

Asian monsoon system and climate change: to study changes of Asian monsoon system and its role in global climate change; to analyze the impact of human activities on Asian monsoon system and climate change; to study the sea-land-air interactions and their role in global climate anomaly; and etc.

Genesis mechanism of extreme weather/climate events and associated disasters in China: in the context of global warming, to study changes and trend of frequency, intensity and spatial distribution of extreme weather/climate events and associated disasters; to understand changes of energy and water cycle in Asia and China as well as their relationship with drought and flood; to study coastal sea level variation characteristics; and etc.

Changes and trends in cryosphere: to study inter-effects between cryosphere and such aspects as climate, hydrology, ecology, environment, and etc.; to study impact mechanism of snow cover changes of Qinghai-Tibet Plateau on climate of the middle and lower reaches of the Yangtze River as well as its response to global climate change; to study Polar and Eurasia snow covers' effects on China's climate change; and etc.

Responses of physical cycles to climate change: to study carbon, nitrogen and water cycles as well as their coupling mechanism in the context of climate change, to study the response of components and processes of ecosystems to climate change; and etc.

2. Technological development for GHG emission controls and climate change mitigations

Energy saving and energy efficiency technologies: to develop energy saving and energy efficiency technologies and equipments for such energy-intensive sectors as electricity, metallurgy, petrochemical and chemical industry, building materials, transport and construction, and etc. and of electromechanical machinery; to develop commercial and civilian energy-saving techniques and equipments; to study integrated cascade use of energy; and etc.

New and renewable energy technologies: to develop low-cost, large-scale renewable energy development and utilization technologies, large-scale wind power generation equipments; to develop technology of photovoltaic cells with high cost-effect ratio and its utilization; to develop solar power generation technology and study integration of solar powered building; to develop technologies of fuel cells, hydropower, biomass energy, hydrogen energy, geothermal energy, ocean energy, biogas, and etc.

Clean and efficient coal exploitation and utilization technologies: to develop efficient coal mining technologies and related equipments; to develop such efficient power-generation technologies and equipments as heavy-duty gas turbines, integrated gasification and combined cycle (IGCC), high steam condition supercritical (ultra-supercritical) units, and large-scale supercritical circulating fluidized bed; to develop technologies of coal liquefaction or gasification with poly-generation system; to develop conversion technologies of coal liquefaction, gasification and coal chemical industry; and etc.

Exploration and clean/efficient development and utilization technologies of Petroleum, natural gas and coal bed/mine methane. To develop exploration technologies of complicated fault-block, lithologic stratum, and deep-sea and deep-reservoir petroleum and natural gas resources; to develop technologies for improving recovery efficiency of heavy oil pool and low-grade petroleum resources; to develop technologies for clean and efficient development and utilization of petroleum, natural gas and coal bed/mine methane resources; and etc.

Advanced nuclear technologies: to develop and acquire fast reactor designing and related core technologies, nuclear fuel and constructional materials-related technologies; to make breakthroughs in such key technologies as sodium cycle; to actively participate in the development and research on International Thermonuclear Experimental Reactor (ITER); and etc.

CO₂ capture, utilization and storage technologies: to develop key technologies and measures for capturing, using and storing CO₂; to design the technical road map for CO₂ capture, utilization and storage; to carry out related capacity building and engineering and technical demonstration project; and etc.

Biological and engineering carbon sequestration technologies: to develop biological carbon sequestration technologies in such sector as forestry; to develop all kinds of engineering carbon sequestration technologies;

and etc.

GHG emission control technologies through good agricultural and land-use practices: to develop technologies of improving agricultural productive practice and of improving land-use, for GHG emissions control, and etc.

3. Climate change adaptation technologies and measures

Climate change impact assessment models: to develop impact assessment tools and integrated assessment models based on existing climate change impact assessment models and according to characteristics and demands in making regional impact assessments in China; and etc.

Adaptation technologies & measures to impacts of climate change on China's major vulnerable sectors: to study impacts of climate change on China's such aspects as agriculture, water resources, coastal zone, forests, grassland, wetland and other ecosystems, human health and public sanitation, unique eco-system and endangered species; to develop corresponding adaptation technologies and measures; and etc.

Adaptation technologies & measures to the impacts of extreme weather/climate events and associated disasters: to study impacts of extreme weather/climate events and associated disasters on human society and ecosystem, and study technical measures for disaster mitigation; to develop technologies and corresponding response mechanisms for prediction, early warning and adaptation; and etc.

Development of risk management system for climate change impacts in vulnerable regions: to identify areas sensitive and vulnerable to climate change via impact assessments; to evaluate risk level of climate change impacts on various sensitive and vulnerable areas; to study on the establishment of climate change risk management system in China; and etc.

Climate change impacts on major construction projects and corresponding adaptation measures: to assess climate change impacts on China's major projects' construction and operations as well as the counter-actions, and propose corresponding response measures; and etc.

Interactions of climate change with other global environmental issues and adaptation measures: to study interactions of climate change with other global environmental issues such as biodiversity, desertification and environmental pollution, to develop response mechanism, adaptation technologies and measures; and etc.

Dangerous levels of climate change impacts and adaptation capabilities: to study dangerous levels of climate change impacts; to assess adaptation capabilities of different sectors and regions to climate change dangerous levels, and etc.

Case studies on adaptation: to carry out case studies in chosen sectors/regions on adaptation, to propose practical adaptation policies and measures via cost effectiveness analysis; and etc.

4. Key strategies and policies on climate change

Climate change and China's energy security strategies: to analyze medium- and long-term trends of China's energy demands; to study the relationship between GHG emission control and China's energy supplies/demands; to assess the economic and technological potentials of diversifying energy supplies and of energy saving and pollutants emission reduction; and etc.

Future international regime on climate change: to study development tendencies of international regime on climate change and analyze the potential impacts on China of various possible options; to make China's contributions on the design of international climate change regime; and etc.

China's future energy development and GHG emission scenarios: to study China's future energy demand scenarios and GHG emission scenarios; to study relationships between global GHG emission, stabilization of

GHG concentration and climate change; and to assess potentials of energy saving and emission reductions of China's industrial sectors and regions, and their macroeconomic costs; and etc.

Clean development mechanism and carbon trading system: to study impacts of climate change international regime on global carbon markets; to study the appropriate domestic policies matching CDM; to study the possible components and structure of the future China's carbon market system cored by CDM; and etc.

Addressing Climate change in relationship with low-carbon economic development: to assess policies and institutional structures of developed countries in development of low-carbon economies; to analyze possible approaches and potentials for China to develop low-carbon economy; and to study institutional frameworks, mechanisms and management models that facilitate low-carbon economy development in China; and etc.

International commodity trade and GHG emission: to study relationship between traded commodity and its GHG emissions; to evaluate in a comprehensive manner the impacts of global responsive actions to climate change on overseas transfer and division of manufacturing industries; and etc.

S&T response strategies in response to climate change: to study trend of climate change S&T development; to study the establishment of a mechanism of introduction, assimilation and re-innovation of technologies; to develop China's S&T development strategies in response to climate change, combining independent innovation with international cooperation; and etc.

V. Measures to Enforce the Implementation of the China's S&T Actions

1. Strengthening leadership and coordination for jointly promoting S&T research progress on climate change

Recognizing the significance of S&T on climate change, the Government should strengthen the macro management and policy guidance. To this end, a full play should be given to the Leading Coordination Committee on Global Environmental S&T (LCGEST) in leading, supervising and coordinating national S&T activities on climate change. The overall layout of S&T on climate change should be optimized, in order to closely coordinate such program, fund as National Basic Research Program (973 Program), Hi-tech R&D Program (863 Program), Key Technologies R&D Program, Technological Basic Infrastructure and Platform Program, International S&T Cooperative Protocols, and programs under National Natural Science Foundation, as well as scientific resources of academic institutions, universities and enterprises. All local, departmental and sectoral resources should be mobilized and integrated, in order to jointly promote climate change S&T.

The functions of Expert Committee and the Expert Groups under LCGEST should continuously be strengthened, by giving full play to the Expert Committee on major issues of climate change and to the Expert Groups in taking the lead of specific research topics. A standing interdisciplinary working mechanism for the committee and groups should be set up and further improved. The universities and research institutions should be encouraged and guided to conduct comprehensive crosscutting studies.

The Office of Global Environmental Affairs under the Ministry of Science and Technology (MOST) as the Secretariat of LCGEST should be further strengthened to better coordinate and communicate on the climate change issues.

2. Mobilizing more financial resources from diverse channels to support scientific research and technological development on climate change

The Government should be the main source of S&T resources for the research on climate change, and all national S&T programs should strengthen their supports to climate change, and promote the implementation of

the China's S&T Actions. At the same time, agencies, local governments, associations and business sectors should be guided to increase their financial support.

More resources should be mobilized from diverse and different channels to support climate change S&T. Enterprises should be encouraged to be a major player in tech-innovations and to increase their financial support in R&D. The financial and capital markets should be effectively utilized for technology development of mitigation climate change, and the venture investment should be introduced. All social circles should be encouraged to provide financial support to climate change S&T activities, international funding channels should be further explored and funding mechanisms under international treaties should be fully utilized.

3. Strengthening human resources development and its introduction from overseas and enhancing disciplinary build-up in the field of climate change

Efforts should be strengthened, especially for the availability of qualified academic team leaders, middle-aged and young talents with an international vision, and capable to steer the development of their own disciplines. Effective incentive and competitive mechanisms should be set up. The engagement of local and sectoral teams should be enlarged. Special efforts should be made to train and build up such research teams that have strong innovative capabilities, outstanding professional knowledge, and international reputations in the field of climate change studies, so as to build up an advanced, highly professional and well-reserved climate change research team.

Recruiting overseas talents and introducing foreign intelligence should be strengthened, and accordingly the policies on recruitments, incentive mechanism and evaluation system should be well established. A resilient mechanism in talent recruitment, intelligence attraction and project operation should be improved. Flexible approaches should be encouraged to attract foreign talents for consulting, lectures and technical cooperation.

Climate change disciplinary build-up should be strengthened, interdisciplinary research and cross-cutting with social sciences should be advocated and teaching programs of universities and research institutes should be optimized, so as to establish a multidisciplinary and well-structured framework of climate change S&T.

4. Strengthening S&T basic infrastructures and platforms in support to research on climate change.

A bunch of interdisciplinary, comprehensive and innovative research bases and laboratories on climate change should be established, improved and integrated at the national level, to put in place a well distributed national climate change research network. All available conditions should be fully utilized to strongly strengthen such S&T infrastructures as climate monitoring system, observational networks of agriculture, water resource, sea level rise, ecological system, and etc.

The construction of platforms for sharing the climate change data should be strengthened. And priorities should be given to data sharing and system integration. In particular, efforts should be made in network-based resource sharing system and related mechanism should be promoted. Widely sharing of large scientific equipment should be strengthened. Local governments and sectors should facilitate the construction of technical service networks in response to climate change and create technical support platforms, contributing to form a national technical service system to address climate change.

5. Strengthening popularization of scientific knowledge, and increasing public awareness of climate change

A communication mechanism involving governments, media, enterprises and the public should be established. Newspapers, television, radio and Internet should be used to disseminate scientific knowledge of climate

change, response measures, current status and research findings on climate change both in China and around the world. And mass media should become an effective way to provide guidance from governments, to call for actions by enterprises and to increase public awareness of climate change.

A series of popular readings and outreaching materials on climate change should be published. Climate change knowledge popularization activities in different forms with rich information should be organized for young students at primary and middle schools. Institutes and universities are encouraged to set up student organizations and forums on climate change. Researches in institutes and universities should be integrated with the science popularization activities.

The topic of climate change should be an important component of all science popularization activities. Centralized training, outreach and demonstration activities should be well enhanced. Appropriate but differentiated outreach and knowledge popularization activities should be conducted in large, medium-sized and small cities and in rural areas.

6. Strengthening international S&T cooperation and promoting international technology transfer

S&T cooperation on climate change should be incorporated into bilateral and multilateral intergovernmental S&T cooperation agreements, in order to enhance the scope and in-depth of the international S&T cooperation on climate change.

The national, local, institutional and sectoral S&T programs can be further open to the international, according to the principle of “Mutual benefit and win-win outcome and promoting independent innovations”. It is encouraged to take the lead in launching international cooperative programs in a given field of climate change as appropriate to enhance the climate change research capabilities.

Greater efforts should be made to promote and participate in the establishment of effective technology transfer mechanism for the affordable, applicable, advanced and environment-friendly technologies to address climate change, and to encourage introduction, assimilation and re-innovation of the foreign technologies on mitigating climate change.

The Chinese scientists, research institutions and enterprises should be encouraged and supported to initiate and participate in international and regional scientific research and technological development programs on climate change. The Chinese scientists and officials should also be encouraged to compete for senior posts of international organizations. Foreign institutions and international organizations should be encouraged and welcomed to organize important international symposiums and workshops on climate change in China. Efforts should be made to attract important international S&T organizations to locate their headquarters or branches in China. A “Forum on Climate Change and Science and Technology” will be initiated by the Ministry of Science and Technology of China to promote international dialogues and exchanges of views on climate change.

China's Policies and Actions for Addressing Climate Change

The Information Office of China's State Council on Oct 29,2008 issued a white paper titled "China's Policies and Actions for Addressing Climate Change". Following is the full text of the document:

China's Policies and Actions for Addressing Climate Change

Information Office of the State Council of the People's Republic of China

October 2008, Beijing

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Foreword

Global climate change and its adverse effects are a common concern of mankind. Ever since the industrial revolution, human activities, especially the massive consumption of energy and resources by developed countries in the process of industrialization, have increased the atmospheric concentrations of greenhouse gases, produced conspicuous impacts on the

natural ecosystems of the Earth, and posed severe challenges to the survival and development of human society.

As a developing country with a large population, a relatively low level of economic development, a complex climate and a fragile co-environment, China is vulnerable to the adverse effects of climate change, which has brought substantial threats to the natural ecosystems as well as the economic and social development of the country. These threats are particularly pressing in the fields of agriculture and livestock breeding, forestry, natural ecosystems and water resources, and in coastal and eco-fragile zones. Therefore, China's priority task at present is to adapt itself to climate change. The multiple pressures of developing the economy, eliminating poverty and mitigating the emissions of greenhouse gases constitute difficulties for China in its efforts to cope with climate change, since the country is undergoing rapid economic development.

A responsible developing country, China sets great store by climate change issues. Fully aware of the importance and urgency of addressing climate change, following the requirements of the Scientific Outlook on Development, and taking into overall consideration of both economic development and ecological construction, domestic situation and international situation, and present and future, China has formulated and implemented a national plan for coping with climate change, and adopted a series of policies and measures in this regard. China combines the handling of climate change with its execution of its sustainable development strategy, acceleration of building a resource-conserving and environmental-friendly society and construction of a country of innovation. Taking economic development as the core objective, and placing emphasis on energy conservation, optimization of the energy mix, reinforcement of ecological protection and construction, and scientific and technological progress as backup, China strives to control and mitigate the emission of greenhouse gases and continuously enhance the capability of adapting itself to climate change.

China actively participates in worldwide efforts to address climate change, earnestly observes the United Nations Framework Convention on Climate Change (hereinafter referred to as the UNFCCC) and the Kyoto Protocol, and plays a constructive role in international cooperation in this regard.

I. Climate Change and China's Situation

The latest scientific research findings show that the average temperature of the Earth's surface has increased by 0.74 degree Celsius over the past century, from 1906 to 2005, and is expected to further rise by 1.1 to 6.4 degrees Celsius by the end of the 21st century. The rise of global average temperatures since the mid-20th century is mainly caused by the increasing atmospheric concentrations of greenhouse gases, chiefly consisting of carbon dioxide, methane and nitrous oxide, emitted as a result of human activities, such as the burning of fossil fuels and changes of land use.

China's temperature rise has basically kept pace with global warming. The latest information released by the China Meteorological Administration shows that the average temperature of the Earth's surface in China has risen by 1.1 degrees Celsius over the past century, from 1908 to 2007, and that China experienced 21 warm winters from 1986 to 2007, the latter being the warmest year since the beginning of systematic meteorological observations in 1951. The national distribution of precipitation in the past half century has undergone marked changes, with increases in western and southern China and decreases in most parts of northern and northeastern China. Extreme climate phenomena, such as high temperatures, heavy precipitation and severe droughts, have increased in frequency and intensity. The number of heat waves in summer has grown, and droughts have grown worse in some areas, especially northern China; heavy precipitation has increased in southern China; and the occurrence of snow disasters has risen in western China. In China's coastal zones, the sea surface temperature and sea level have risen by 0.9degree Celsius and 90 mm, respectively, over the past 30 years.

Scientific research predicts that climate warming trend in China will further intensify; frequency of extreme climate events is likely to wax; uneven distribution of precipitation will be more visible than before and the occurrence of heavy precipitation will increase; drought will expand in scope; and the sea level will rise faster than ever.

The basic conditions of China present the country with great challenges in addressing issues regarding climate change.

A complex climate and a fragile eco-environment determine that China's task of adapting itself to climate change is arduous. China is characterized by a continental monsoon climate, and most parts of China have a wider range of seasonal temperature change compared with other continental areas at the same latitude. Many places in China are cold in winter and hot in summer, and high temperatures generally prevail in the country at large in summer. Precipitation is unevenly distributed in time and space, concentrating in the flood season, and annual precipitation decreases from the southeast coast to the northwest interior. China has a fragile eco-environment, with serious soil erosion and desertification and a forest coverage rate of 18.21 percent, only 62 percent of the world's average. The area of natural wetlands is comparatively small; most grasslands are highly frigid meadows and desert steppes; temperate grasslands in northern China are in danger of degeneration and desertification due to the impacts of drought and deterioration of the eco-environment. With a coastline over 18,000 km long, China is vulnerable to the adverse effects of sea level rises.

A large population and a relatively low level of economy determine that China's development task is a formidable one. The population of the mainland of China reached 1.321 billion at the end of 2007, accounting for 20 percent of the world's total. China has a comparatively low level of urbanization, with an urbanization rate of 44.9 percent in 2007, lower than the world's average. The large population also brings huge employment pressure. New urban labor force entrants of 10 million and above need jobs every year; as the urbanization process moves forward, tens of millions of rural laborers transfer to the urban areas every year. Statistics from the International Monetary Fund show that the per-capita GDP (gross domestic product) of

China in 2007 was 2,461 U.S. dollars, ranking 106th, a low-to-middle place, among 181 countries and regions. China is characterized by unbalanced regional economic development and is still nagged by a large income gap between urban and rural residents. The country is still troubled by poverty, with an impoverished rural population of 14.79 million inadequately fed and clad. Those who just have enough to eat and wear and earn an unstable, low income number 30 million nationwide. Moreover, China has a relatively low level of science and technology and weak capacity of independent innovation. Developing the economy and improving people's lives are imperative tasks currently facing China.

China's ongoing industrialization process and its coal-dominated energy mix determine that its task of controlling greenhouse gas emissions is a tough one. Historically, China's greenhouse gas emissions have been very low. According to data from relevant international research institutions, from 1904 to 2004, carbon dioxide emissions from fossil fuel burning in China made up only 8 percent of the world's total over the same period, and cumulative emissions per capita ranked 92nd in the world. China's carbon dioxide emissions from energy consumption in 2004 totaled 5.07 billion tons. As a developing country, China still has a long way to go in its industrialization, urbanization and modernization. To advance further toward its development objectives, China will strive for rational growth of energy demand, which is the basic precondition for the progress of all developing countries. However, its coal-dominated energy mix cannot be substantially changed in the near future, thus making the control of greenhouse gas emissions rather difficult.

II. Impact of Climate Change on China

China is one of the countries most susceptible to the adverse effects of climate change, mainly in the fields of agriculture, livestock breeding, forestry, natural ecosystems, water resources, and coastal zones.

Impact on Agriculture and Livestock Breeding

Climate change has already produced visible adverse effects on China's agriculture and livestock-raising sectors, manifested by increased instability in agricultural production, severe damages to crops and livestock breeding caused by drought and high temperatures in some parts of the country, aggravated spring freeze injury to early-budding crops due to climate warming, decline in the output and quality of grasslands, and augmented losses caused by meteorological disasters.

The impact of future climate change on agriculture and livestock breeding will still be mainly adverse. It is likely there will be a drop in the yield of the three major crops wheat, paddy rice and corn; changes in the agricultural production layout and structure; accelerated decomposition of organic elements in the soil; enlarged scope of crop diseases and insect pests; accelerated potential desertification trend of grasslands; rising frequency of natural fire disasters; sagging livestock production and reproductive ability; and growing risk of livestock

epidemics.

Impact on Forestry and Other Natural Ecosystems

The impact of climate change on China's forestry and other natural ecosystems are mainly manifested in the following aspects: the northward shift of the northern boundaries of eastern subtropical and temperature zones and early phenophase; upward shift of the lower boundaries of forest belts in some areas; elevation of lower line of highland permafrost and decreased area of permafrost; rising frequency of animal and plant diseases and insect pests with marked changes in the distribution of regions; reduced area and overall shrinking trend of glaciers in northwestern China; and threat to the oasis ecosystem posed by accelerated melting of glaciers and snow cover.

Future climate change will further increase the fragility of ecosystems, diminish the distribution areas of main afforestation and rare tree species, enlarge the outbreak scope of forest diseases and insect pests, and increase the frequency of forest fires and fire-vulnerable areas, shrink inland lakes and cause the decrease and functional degeneration of wetland resources, speed up the reduction of the area of glaciers and permafrost, and significantly alter the spatial distribution pattern of permafrost on the Qinghai-Tibet Plateau, and damage bio-diversity.

Impact on Water Resources

Climate change has already caused changes in the distribution of water resources all over China. Over the past two decades, the gross amount of water resources of the Yellow, Huaihe, Haihe and Liaohe rivers in northern China has been visibly reduced, whilst that of rivers in southern China has slightly increased. Floods happen more frequently, droughts get worse, and extreme climate phenomena show a conspicuous rise.

It is predicted that future climate change will have a great impact on the temporal and spatial distribution of water resources in the following ways: augmenting annual and inter-annual changes and boosting the occurrence of extreme natural disasters, including flood and drought. In particular, accelerated melting of glaciers in western China owing to climate warming will further lessen the area of glaciers and glacier ice reserves, thus having significant impacts on rivers and runoffs with sources in glacier melt water. Climate warming will possibly reinforce the drought trend in northern China, and intensify water scarcity and contradiction between water supply and demand.

Impact on Coastal Zones

The past 30 years have witnessed in China an accelerating trend of sea level rise, which has caused seawater intrusion, soil salinization and coastal erosion, damaged the typical marine ecosystems of coastal wetlands, mangrove swamps and coral reefs, and diminished the service functions and bio-diversity of coastal zones. Sea temperature rise and seawater acidification

resulting from climate change have given rise to a lack of oxygen in some maritime areas, the degradation of marine fishing resources and the survival of rare and endangered species.

It is predicted that the sea level in the coastal zones of China will continue to rise. Sea level rise will undermine the capacity of public drainage facilities in coastal cities, and impair the functions of harbors.

Impact on Society, Economy and Other Fields

Climate change will also produce far-reaching impacts on society, economy and other fields, and cause huge losses to the national economy. Corresponding economic and social costs will have to be paid for addressing climate change. In addition, there will be increased chances of disease occurrence and spread, ensuing dangers to human health, rising possibilities of geological and meteorological disasters and consequent threats to the security of major projects. The eco-environment and bio-diversity of nature reserves and national parks will be affected, accompanied by adverse effects on natural and cultural tourism resources, and augmented threats to the safety of life and property, and to the normal order and stability of social life.

III. Strategies and Objectives for Addressing Climate Change

To address climate change, China adheres to the following guidelines: To give full effect to the Scientific Outlook on Development, adhere to the fundamental state policy of resources conservation and environmental protection, control greenhouse gas emissions and enhance the country's capacity for sustainable development, center on securing economic development and accelerate the transformation of the pattern of economic development, focus on conserving energy, optimizing the energy structure and strengthening eco-preservation and construction, and rely on the advancement of science and technology, increase international cooperation, constantly enhance the capability in coping with climate change, and make new contribution in protecting the world environment.

To address climate change, China sticks to the following principles:

To address climate change within the framework of sustainable development. Climate change arises out of development, and should thus be solved along with development. It is necessary to promote sustainable development amidst efforts to address climate change, and strive to achieve the goal of win-win in both.

To uphold the principle of "common but differentiated responsibilities," which is a core principle of the UNFCCC. Both developed and developing countries are obligated to adopt measures to decelerate and adapt to climate change. But the level of their historical responsibilities, level and stage of development, and capabilities and ways of contribution vary. Developed countries should be responsible for their accumulative emissions and current high per-capita emissions, and take the lead in reducing emissions, in addition to providing financial support and transferring technologies to developing countries. The developing countries, while

developing their economies and fighting poverty, should actively adopt adaptation measures, reduce their emissions to the lowest degree and fulfill their duties in addressing climate change.

To place equal emphasis on both deceleration and adaptation. Deceleration and adaptation are integral components of the strategy for coping with climate change. Deceleration is a long and arduous challenge, while adaptation is a more present and imminent task. The latter is more important for developing countries. The two must be well coordinated, and with equal stress placed on them.

The UNFCCC and the Tokyo Protocol are the main programs for addressing climate change. The two documents lay the legal foundation for international cooperation in dealing with climate change, and reflect the common understanding of the international community. They are the most authoritative, universal and comprehensive international framework for coping with climate change. Their status as the kernel mechanism and leading programs should be unswervingly upheld, and other types of bilateral and multilateral cooperation should be supplementary.

To rely on the advancement and innovation of science and technology. Technological advancement and innovation are the basis and support for tackling climate change. While promoting their own technological development and application, developed countries are obligated to promote international technological cooperation and transfer, and concretely materialize their promises to provide financial and technological support to developing countries, so that the latter can get the funds needed, apply climate-friendly technologies, and build up their capacity to decelerate and adapt to climate change.

To rely on mass participation and extensive international cooperation. Dealing with climate change requires changes in the traditional ways of production and consumption, and the participation of the whole of society. China is working to build a resources-conserving and environmental-friendly society, foster a social atmosphere in which the enterprises and the public participate on a voluntary basis under the guidance of the government, and raise enterprises' awareness of corporate social responsibility and the public's awareness of the necessity of care for the global environment. A challenge faced by the entire world, climate change cannot be solved without global cooperation and concerted efforts. China will, as always, participate in all modes of international cooperation that are conducive to tackling climate change.

China National Plan for Coping with Climate Change, released by the Chinese government in June 2007, set the following objectives to be met by 2010: Policies and measures concerning control of greenhouse gas emissions should achieve significant results, the capability of adaptation to climate change should be relentlessly enhanced, climate-change-related research should be promoted and new development should be made in scientific research related to climate change. In addition, the public awareness of the importance of tackling climate change should be enhanced, and the institutions and mechanisms for dealing with climate change should be further strengthened.

Control of Greenhouse Gas Emissions

Striving to mitigate greenhouse gas emissions through accelerating the transformation of the country's economic development pattern, strengthening policy guidance concerning energy conservation and efficient utilization, intensifying administration of energy conservation in accordance with the law, speeding up development, demonstration and application of energy conservation technologies, giving full play to the role of new market-based mechanisms for energy conservation, enhancing public awareness of the importance of energy conservation, and accelerating the building of a resource-conserving society. Through these measures, the energy consumption per-unit GDP is expected to drop by about 20 percent by 2010 compared to that of 2005, and carbon dioxide emissions will consequently be reduced.

Optimizing the energy consumption structure through developing renewable energy, boosting nuclear power plant construction and speeding up the development and utilization of coal-bed gas. The target by 2010 is to raise the proportion of renewable energy (including large-scale hydropower) in the primary energy supply by up to 10 percent, and the extraction of coal-bed gas up to 10 billion cu m.

Controlling greenhouse gas emissions generated by industrial production through reinforcing industrial policies concerning the metallurgy, building materials and chemical industries, developing a recycling economy, raising resources utilization efficiency and strengthening control of emissions of nitrous oxide. By 2010, the emissions of nitrous oxide from industrial production should be no higher than in 2005.

Striving to control emissions of methane by continuously spreading low-emission and high-yield rice varieties, semi-drought rice cultivation, scientific irrigation and the technology of application of fertilizers according to the results of tests of local soil, and strengthening R&D on fine ruminant animal breeds, large-scale breeding and management techniques, strengthening management of animal waste, waste water and solid waste, and expanding the utilization of methane.

Striving to realize the target of a 20-percent increase in the forest coverage rate by 2010, and an increase of annual volume of carbon dioxide in carbon sinks by 50 million tons compared to that of 2005 through continuing key projects in afforestation, returning farmland to forest and grassland, and farmland capital construction, and implementing relevant policies.

Enhancing the Capacity of Adaptation to Climate Change

Through improving the multi-disaster monitoring and early warning mechanisms, the policy-making and coordination mechanisms with more than one department involved, the action mechanism with extensive public participation, the capability of monitoring and forecasting meteorological disasters will be strengthened. By 2010, a number of meteorological disaster prevention projects will be completed and play a fundamental, overall and vital role in the economy and society, so as to enhance the country's comprehensive capacity to monitor,

warn about and cope with meteorological disasters, and reduce the damage from them.

Through shoring up farmland capital construction, adjusting cropping systems, breeding stress-resistant varieties, developing bio-technologies and other adaptive measures, by 2010 some 24 million ha of grassland will be improved, 52 million ha of grassland suffering from degradation, desertification and salinity will be restored, and the efficient utilization coefficient of agricultural irrigation water will be raised to 0.5.

Through strengthening natural forest conservation and nature reserve management, continuing key eco-protection projects, establishing important ecosystems, and stepping up natural ecological restoration, by 2010 some 90 percent of typical forest ecosystems and key national wildlife species will be under effective protection; nature reserves will account for 16 percent of the national territory; 250,000 sq km of land suffering from water and soil erosion will have been improved; 300,000 sq km of land will have been ecologically restored; and 22 million ha of decertified land will have been put under control.

Through rational development and optimized allocation of water resources, improving new mechanisms for farmland water conservancy, strengthening measures for water conservation and hydrological monitoring, by 2010 the vulnerability of China's water resources to climate change will have been alleviated; concrete progress will have been made to build a water-conserving society; an anti-flood system of large rivers will be in place; and the standard for drought resistance of farmland will have been raised.

Through scientifically monitoring the trend of sea level change, controlling marine and coastal ecosystems, rationally exploiting the coast, protecting coastal wetlands and planting coastal shelterbelts, China aims to restore the mangrove swamps by 2010, and raise the coastal areas' capability to resist marine disasters. Strengthening R&D

Through strengthening basic research on climate change, further developing and improving research and analytical methods, and intensifying the training of professionals and decision-makers in relevant fields, China aims to keep up with international advanced level in fields related to climate change by 2010, so that it will have solid scientific ground for drafting national strategies and policies on climate change, and in participating in international cooperation in this regard.

Through building up its innovation capacity, and promoting international cooperation and technology transfer, by 2010 China will make big breakthroughs in technologies of energy development and conservation, and clean energy; quicken the industrial application of advanced technologies; enhance the technological capacity of agriculture, water conservancy and forestry sectors to adapt to climate change; and provide strong scientific support for efforts to address climate change.

Enhancing Public Awareness and Improving Management

Through more publicity, education and training by means of modern information

dissemination technologies to encourage public participation, by 2010 it is expected that public awareness of the problem of climate change will have been made universal, and a social environment conducive to addressing climate change will be in place.

Through improving the multi-ministerial decision-making coordination mechanism and building an action mechanism involving a wide range of enterprise and public participation, China aims to establish an efficient institutional and management framework commensurate with the work to address climate change.

IV. Policies and Actions to Decelerate Climate Change

China has adopted proactive policies and taken active actions to slow the process of climate change. It has adopted a number of policies and measures to adjust the economic structure, change the development patterns, save energy and raise the efficiency of energy use, and optimize energy mix and promote afforestation. Marked achievements have been made.

Adjusting the Economic Structure to Promote the Optimizing and Upgrading of the Industrial Structure

The Chinese government attaches great importance to the adjustment of the economic structure and the transformation of the economic development patterns, and has formulated and implemented a series of industrial policies and special programs to make the reduction of resources and energy consumption an important part of its industrial policies. By promoting the optimizing and upgrading of China's industrial structure, it aims to form a mode of economic growth featuring "less input, less consumption, less emission and high efficiency."

Accelerating the development of the service sector. The government issued Opinions on the Acceleration of the Development of the Service Sector in 2007, in which it sets the goal of raising the proportion of added value from the service sector in the GDP by three percentage points from 2005 to 2010. It has also made clear policies that provide support to key areas, weak links and new fields of the service sector. As a result, modern services such as tourism, finance and logistics are booming.

Making high-tech industry larger and stronger. In 2007, the government issued the 11th Five-year Plan (2006-2010) for such industries as high-tech, e-commerce and information technology, suggesting that the proportion of added value of high-tech industry in the total industrial added value be raised by five percentage points from 2005 to 2010. The government has formulated and implemented policies and measures conducive to the development of such high-tech industries as digital television, software, integrated circuits and bioengineering. It has quickened the fostering of newly emerging industries that conform to the requirements of saving energy and reducing emissions. High-tech industries, including information technology, bioengineering, aeronautics, space flight, new energy, new materials and marine industries are developing rapidly. The revitalization of high-tech manufacturing industry has been effective, while construction of infrastructure and basic industries has made great progress.

Accelerating the pace of eliminating backward production capacity. In 2007, the government announced a timetable for different areas to close down their backward production facilities in 13 industries during the latest Five-year Plan period. Last year saw the stoppage of 14.38 million kw of small thermo-power generating units, and the reduction of 46.59 million tons of iron-smelting capacity, 37.47 million tons of steel making capacity and 52 million tons of cement production capacity. More than 2,000 heavily polluting papermaking plants, chemical plants, and printing and dyeing mills were ordered to close down, as were 11,200 small coal mines.

Limiting the excessively rapid expansion of industries that consume a large amount of energy and discharge heavy emissions. Relevant policies have been promulgated to control new projects. Standards of market entry for high-energy-consuming industries have been promulgated. By raising the standard of entry of industry for high energy consumption, enhancing the entry threshold of energy conservation and environmental protection, and by adjusting tax rebates for exports and customs duties, the government is working to restrain the export of commodities that consume large amounts of energy, discharge large quantities of emissions and use precious raw materials. The expansion of high-energy-consuming industries is being slowed.

Making Great Efforts to Save Energy and Raise Energy Efficiency

The Chinese government attaches great importance to energy conservation, and has made it a fundamental state policy. For a long time it has pursued a policy of putting equal emphasis on both development and energy conservation with priority being given to conservation. The Outline of the 11th Five-year Plan for National Economic and Social Development (2006-2010) considers it a major strategic task for China to build an energy-conserving and environmental-friendly society. It stipulates that the energy consumption per-unit GDP in 2010 should be 20 percent lower than that in 2005, and that this goal is binding.

Placing energy conservation and emission reduction in a more prominent position. The State Council has set up a leading group on energy conservation and emission reduction, and issued the Comprehensive Work Plan for Energy Conservation and Emission Reduction to guide work in this field.

A responsibility system is in place, establishing goals for energy conservation and emission reduction. The State Council has issued the Plan and Method Regarding the Monitoring of Energy Conservation, Emission Reduction and Evaluation, stating clearly that leading cadres in all provinces (autonomous regions and municipalities directly under the central government) and key enterprises will be appraised by their performance in achieving the goals for energy conservation and reduction of emission of major pollutants. Those who fail in this task will be held responsible.

Accelerating the construction of major energy conservation projects. In 2006, the state supported 111 key energy-conservation projects by using funds raised from issuing treasury bonds and investment within the central budget, resulting in an energy-conservation capacity of 10.1 million tons of standard coal. In 2007, the state supported 681 key energy-conservation

projects by using funds raised from issuing treasury bonds, investment within the central budget and central treasury capital, resulting in an energy-conservation capacity of 25.5 million tons of standard coal. Technological transformation conducted by enterprises under the direction of local governments resulted in an energy-conservation capacity of 60 million tons of standard coal. It is expected that an energy-conservation capacity of 240 million tons of standard coal will be created after ten major energy-conservation projects are implemented from 2006 to 2010. With subsidies from the government, 50 million energy-saving bulbs are now being distributed to households all over the country, and within the coming three years more than 150 million energy-saving bulbs will be distributed.

Promoting energy conservation and emission reduction in key fields. An energy-conserving campaign has been launched among more than 1,000 enterprises to encourage them to conduct auditing on their energy use, formulate energy-saving plans, and make public their energy use situation. A campaign has also been launched in major energy-consumption enterprises to check their compliance with the energy efficiency indicators. The government is earnestly promoting "green" and environmental-friendly buildings that save energy and land. Newly constructed buildings must meet the compulsory energy-saving standards. Energy-saving renovations to existing buildings are carried out, and the task has been assigned to different regions to install measured heating equipment and complete energy-saving renovation to a total of 150 million sq m of floor space. Pilot work has been launched to set up a monitoring system on energy conservation in office buildings of state agencies and large public buildings in 24 provinces and cities. The government will continue to improve the fuel consumption restriction standard for motor vehicles, and enforce the standard strictly. State agencies at the central level have checked and remodeled their air-conditioning, lighting and boiler systems for energy-conservation purposes. They have also installed energy-conservation lighting in all their office buildings.

Raising the efficiency of energy development and conversion. More high-efficiency, energy-conservation equipment is used in the power-generating and coal-producing sectors, and the government has quickened its pace to eliminate small thermo-power stations and coal mines. In 2007, electricity generating units of 6,000 kw or above saw their coal consumption drop from 448 g of standard coal per kwh in 1980 to 370 g. Energy and electricity consumed per production unit of raw coal in 2007 dropped by 5.9 percent and 5.1percent, respectively, as compared with the previous year.

Implementing economic policies conducive to energy conservation. The resources tax for some mineral products has been readjusted, and prices for refined oil and natural gas have also been readjusted in a timely fashion. Policies aimed at saving energy in power generating and distribution have been adopted. The prices for electricity generated by small thermo-power plants transmitted by the state power grid have been lowered, and electricity price differentials have been adopted more broadly. Regulations have been promulgated regarding capital management that supports enterprises in making energy-saving technological transformation, popularizing high-efficiency lighting products, installing monitored heating systems in buildings and making energy-conservation renovations. Policies have also been introduced to encourage the production and use of environmentally-sound motor vehicles with small displacement and to

restrict the use of plastic shopping bags. A compulsory government energy-saving products procurement system has been put into place.

Strengthening the construction of the legal system. The Energy Conservation Law has been amended. The General Office of the State Council has issued the Circular on Strictly Following the Temperature Control Standards for Air-conditioners in Public Buildings. Since 2007, national compulsory standards have been promulgated to restrict energy consumption for the making of 22 products (including thermo-power and sodium hydroxide) that consume excessive energy. Supervision and spot checks are now conducted on 16 categories of products, including motors and energy-saving bulbs, that are end-users of energy. Government departments in charge of energy conservation and supervision enforce the energy-conservation administrative regulations in accordance with the law. Thanks to all these efforts, energy consumption per-unit GDP in 2006 and 2007 across China was lowered by 1.79 percent and 3.66 percent, respectively. In 2007, key enterprises in the power-generating, iron and steel, building materials and chemicals industries which consume 10,000 tons of standard coal or more annually saw energy consumption of 33 of their 35 major products drop, with energy consumption rising for only two products. The energy thus saved was equivalent to 38.3 million tons of standard coal. The energy saved in 2006 and 2007 by these enterprises equaled 147 million tons of standard coal.

Developing Renewable Energy and Optimizing Energy Mix

The Law on Renewable Energy and related policies were enacted in 2005 to give priority to renewable energy when transmitted on the state power grid, to purchase renewable energy at full price, to give users of renewable energy price discounts and to share the utilization of renewable energy among the whole society. A dedicated fund was created for developing renewable energy to support the evaluation and investigation of renewable energy resources, related technological research and development, construction of pilot and demonstration projects, and the development and utilization of renewable energy in the countryside. By the end of 2007, the annual installed capacity of hydropower in China was 145 million kw, generating 482.9 billion kwh of electricity, ranking first in the world in both installed capacity and power so generated. An average of 26 million kw of installed capacity was added in 2006 and 2007, with an average increase of 12 percent in each year. The scale of wind power increased several-fold. Currently, with installed capacity of more than 6 million kw, China ranks fifth in the world. In 2006 and 2007, some 3.05 million kw of installed capacity was added, an average annual increase of 148 percent. The area of solar energy collectors has reached 110 million sq m, keeping China the world leader in this field for many years. The installed power generating capacity using biomass is 3 million kw, and the annual production capacity of ethanol as biofuel is more than 1.2 million tons. The installed capacity of nuclear power is 9.06 million kw, an increase of 30.5 percent over 2006. The proportion of coal in the consumption of primary energy dropped from 72.2 percent in 1980 to 69.4 percent in 2007. The proportion of hydropower, wind power and nuclear power combined was raised from 4 percent to 7.2 percent in the same period. The total amount of renewable energy available for use is approximately 220 million tons of standard coal (including large hydropower facilities).

According to the Mid- and Long-term Plan for the Development of Renewable Energy and Mid- and Long-term Plan for the Development of Nuclear Power, China will continue to promote the comprehensive cascading development of water-power-rich river valleys. It will quicken the pace of constructing large hydropower stations on the precondition that the environment is well protected and adequate relocation of the local residents is ensured. Medium and small hydropower stations will also be developed where local conditions permit. China is determined to develop rapidly more of its wind-power potential to the scale that industrialization can be achieved. It will raise its capacity for developing and manufacturing wind-power equipment and make every effort to construct several wind-power farms of one million kw and wind-power bases of 10 million kw. China will energetically push forward the development and utilization of biomass energy, with emphasis on marsh gas, and solid and liquid biofuel, and on the use of biomass to generate electricity. China will actively take advantage of solar power to generate electricity and use it for heating while strengthening the research, development and utilization of new energy and alternative energy. It will make better use of coal-bed gas and gas in mines, and develop small and scattered sources of electricity with coal-bed gas as fuel. China enthusiastically develops nuclear power, is working hard to reform the nuclear power system and spur mechanism innovation in an attempt to establish a market-oriented nuclear power development mechanism. It will strengthen its capacity for developing and manufacturing nuclear power equipment, and raise its ability to absorb imported technology and make new innovations on this basis. It will strengthen the construction of nuclear power transmission and related technical services, as well as the training of qualified personnel. It will implement preferential policies on taxation and investment that will promote the development of nuclear power, improve nuclear power safety, and quicken the enactment of laws and regulations in this field. Finally, China will push forward the use of clean coal and develop efficient and clean power generating technology, such as large-scale combined cycle units and poly-generation, and promote technology for carbon dioxide sequestration.

Developing a Recycling Economy to Reduce Greenhouse Gas Emissions

Attaching great importance to developing a recycling economy, the Chinese government is doing its best to reduce the amount of resources consumed, and reuse and recycle items so as to reduce greenhouse gas emissions from their sources and in the course of production. In recent years, a recycling economy is turning from an idea to action, and developing rapidly across the country. The state has enacted laws and regulations such as the Clean Production Promotion Law, Law on the Prevention of Environmental Pollution by Solid Wastes, Law on a Recycling Economy and Methods on Management of Urban Garbage. It has promulgated the Opinions on Accelerating the Development of a Recycling Economy, setting forth the general strategy, short-term goals, basic means, and policies and measures for the development of a recycling economy. It has also promulgated an evaluation index system for a recycling economy. In addition, the Regulations Regarding the Management of the Recycling and Treatment of Discarded Electrical Equipment is to be promulgated soon.

Two batches of demonstration pilot projects have been carried out, resulting in a recycling economy development model at three levels, i.e., enterprises, between enterprises or industrial parks, and in society in general. Pilot projects featuring recycling and treatment of old and

useless household electrical appliances and remanufacturing of automobile parts have made satisfactory progress. Preferential policies concerning taxation on the comprehensive utilization of disposables and the recycling and utilization of renewable energy have been improved. More support is being given to key projects in the recycling economy by treasury bonds and investment within the central budget. Through importation, absorption, digestion and self-innovation, some advanced technologies with proprietary intellectual property rights have emerged, in particular, a group of key technologies which play a leading role in respective sectors have been developed, demonstrated and popularized. Applicable technologies, such as low-temperature power generation by waste heat, coke dry-quenching, power generation by differential pressure at blast furnace top, cement produced using calcium carbide slag in the drying process, and disposal of garbage in blast furnaces and rotary kilns, are now widely used. In 2005, nearly one third of the raw materials for China's steel, nonferrous metals and pulp industries came from renewable resources, while 20 percent of the raw materials for cement and 40 percent of the raw materials for walls came from industrial solid waste. Marked progress has been made in reducing greenhouse gas emissions during the production of semiconductors, including sealing and packaging. The level of greenhouse gas emissions during the making of electronic information products remains low.

The state has formulated policies that encourage the recycling and utilization of landfill gas, and has promulgated industrial standards such as the Policies on Technologies for the Treatment of Urban Garbage and Pollution Prevention, and Technical Standards on Sanitary Landfill of Garbage, which promote the retrieval and utilization of landfill gas and reduction of emissions of methane and other greenhouse gases. Meanwhile, China is carrying out research into and popularizing advanced technologies for garbage burning and recycling, and utilization of landfill gas. Relevant technological standards are being promulgated, and the garbage collection and transportation system is being improved. Garbage classification has begun in some areas; comprehensive utilization of garbage as a resource has been raised to promote the industrialization of the treatment of garbage. Supervision is being tightened on enterprises engaged in garbage treatment. As a result, the detoxification rate of garbage was raised from 2.3 percent in 1990 to 52 percent in 2006.

Reducing Greenhouse Gas Emissions in Agriculture and the Countryside

China has witnessed great progress in the reduction of greenhouse gas emissions in agriculture and the countryside in recent years. In 1,200 counties across the country, fertilizers are applied according to the results of tests of local soil. Guidance is given to farmers for the scientific application of fertilizers and to reduce the emission of nitrous oxide. Protective farming featuring mainly crop stalk coverage and non-tillage are being popularized. Crop stalks are also used to feed domestic animals, the manure and urine of which are then applied to fields to add organic carbon to the soil. A compensatory mechanism for grassland ecology has been created: a balance is maintained between the grass and livestock; a system is adopted to prohibit grazing, to have a stretch of grassland rest or grazed in rotation; and the numbers of livestock grazing are controlled to prevent it from deteriorating. Meanwhile, renewable energy technologies are being vigorously developed in the countryside, such as the use of marsh gas, solar energy and stoves that save on firewood and coal. By the end of 2007, there were over

26.5 million households in China using marsh gas, saving 16 million tons of standard coal annually, tantamount to a reduced emission of 44 million tons of carbon dioxide. China has constructed 26,600 breeding farm marsh gas projects, and installed 42.86 million sq m of solar-powered heaters in the countryside, 14.68 million sq m of solar energy houses, 1.12 million solar energy stoves and more than 200,000 small wind-driven generators. China has established some demonstration spots for the gasification and solidification of crop stalks. It has installed firewood- and coal-saving stoves in 151 million households and energy-saving stoves in 34.71 million households.

Promoting Afforestation and Strengthening the Capacity of Carbon Sinks

In the past 20-odd years, some four million ha of trees have been planted every year with the help of continuously increasing investment from the central government. Meanwhile, the state also encourages citizens to take part in tree planting. By the end of 2007, millions of people had planted 51.54 billion trees all over China. In recent years, through the reform of the collective forest right system, farmers' enthusiasm for tree planting and forest protection has been aroused. At present, China has 54 million ha of man-made forest, its timber volume reaching 1.505 billion cu m, with the country's rate of forest coverage going up from 12 percent in the early 1980s to 18.21 percent now. In 2006, some 35.1 percent of China's urban areas, or 1.32 million ha, were covered with grass or trees. It is estimated that tree-planting activities in China between 1980 and 2005 effectively absorbed 3.06 billion tons of carbon dioxide, that forest management absorbed 1.62 billion tons of carbon dioxide, and that carbon dioxide emission was reduced by 430 million tons because of improved forest protection. All this has further enhanced the capacity of forest as the sinks of greenhouse gas.

Intensifying R&D Efforts to Deal with Climate Change Scientifically

Including response to climate change in the plan for scientific development. The Outline of China's Mid- and Long-term Development Plan for Science and Technology promulgated in 2006 made energy and environment priority fields in the development of science and technology. It listed the observation and monitoring of global climate change and countermeasures as priority issues in the field of environmental protection. China's Special Sci-Tech Campaign to Cope with Climate Change enacted in 2007 set forth phased goals for scientific work as a response to climate change during the 11th Five-year Plan period (2006-2010) and long-term goals up to the year 2020. It mainly discusses the following topics and makes relevant countermeasures: the scientific explanation of climate change, research and development of technologies that can be used to control greenhouse gas emissions, technologies and measures that help adapt to climate change, and major strategies and policies to cope with climate change.

Strengthening the cultivation of personnel and construction of research bases. Thanks to efforts made over the past 20 years or so, a contingent of specialists has been formed in the field of climate change who are doing basic and applied research across fields and disciplines. They have made pioneering research achievements, providing important scientific support for China to cope with climate change. A batch of national-level scientific research bases has been

established, and a large observation network system, including the National Climate Monitoring Network, has basically been set up. China has strengthened research into and development of advanced technologies dealing with climate change, as well as their demonstration. The integration of research, teaching and production has accelerated the industrialization process of advanced technologies.

Continuously increasing investment in scientific and technological work related to climate change. While sources of funds from the government remain relatively stable, efforts are being made to raise money from other sources, attracting funds from society at large for scientific and technological research and development concerning climate change. During the 10th Five-year Plan period (2001-2005), the government invested more than 2.5 billion yuan in scientific and technological research dealing with climate change through national science and technology plans such as the Gongguan Plan¹, 863 Plan² and 973 Plan³. By the end of 2007, the National Science and Technology Plan for the 11th Five-year Plan period (2006-2010) had appropriated more than seven billion yuan for scientific research into energy conservation and emission reduction. In addition, the state, through other channels, has invested large amounts of funds for scientific research into climate change.

Key areas of scientific research. China has decided to place the emphasis of its research on technologies that can reduce greenhouse gas emissions or slow the process. These include technologies that save energy and enhance its efficiency; technologies for renewable energy and new energy; technologies that can control, dispose of or utilize greenhouse gases, such as carbon dioxide and methane in major industries; biological and engineering carbon fixation technology; technologies for the clean and efficient exploitation and utilization of coal, petroleum and natural gas; technologies for manufacturing advanced equipment for coal- and nuclear-generated power; technologies for capturing, utilizing and storing carbon dioxide; and technologies that control greenhouse gas emissions in agriculture and how land is used.

Notes:

1. The "Gongguan Plan" is a national plan aimed at tackling key and difficult scientific and technological problems facing China's economic construction and social development. It was first implemented in 1982, and has been linked with China's Five-year Plans since then.

2. The "863 Plan" is a plan initiated by the Chinese government in March 1986 for the development of high-tech industries.

3. The "973 Plan" refers to the National Plan of Basic Research for Some Key Areas initiated by the government in 1997.

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Raising the efficiency of energy development and conversion. More high-efficiency, energy-conservation equipment is used in the power-generating and coal-producing sectors, and the government has quickened its pace to eliminate small thermo-power stations and coal mines. In 2007, electricity generating units of 6,000 kw or above saw their coal consumption drop from 448 g of standard coal per kwh in 1980 to 370 g. Energy and electricity consumed per production unit of raw coal in 2007 dropped by 5.9 percent and 5.1 percent, respectively, as compared with the previous year.

Implementing economic policies conducive to energy conservation. The resources tax for some mineral products has been readjusted, and prices for refined oil and natural gas have also been readjusted in a timely fashion. Policies aimed at saving energy in power generating and distribution have been adopted. The prices for electricity generated by small thermo-power plants transmitted by the state power grid have been lowered, and electricity price differentials have been adopted more broadly. Regulations have been promulgated regarding capital management that supports enterprises in making energy-saving technological transformation, popularizing high-efficiency lighting products, installing monitored heating systems in buildings and making energy-conservation renovations. Policies have also been introduced to encourage the production and use of environmentally-sound motor vehicles with small displacement and to restrict the use of plastic shopping bags. A compulsory government energy-saving products procurement system has been put into place.

Strengthening the construction of the legal system. The Energy Conservation Law has been amended. The General Office of the State Council has issued the Circular on Strictly Following the Temperature Control Standards for Air-conditioners in Public Buildings. Since 2007, national compulsory standards have been promulgated to restrict energy consumption for the making of 22 products (including thermo-power and sodium hydroxide) that consume excessive energy. Supervision and spot checks are now conducted on 16 categories of products, including motors and energy-saving bulbs, that are end-users of energy. Government departments in charge of energy conservation and supervision enforce the energy-conservation administrative regulations in accordance with the law. Thanks to all these efforts, energy consumption per-unit GDP in 2006 and 2007 across China was lowered by 1.79 percent and 3.66 percent, respectively. In 2007, key enterprises in the power-generating, iron and steel,

building materials and chemicals industries which consume 10,000 tons of standard coal or more annually saw energy consumption of 33 of their 35 major products drop, with energy consumption rising for only two products. The energy thus saved was equivalent to 38.3 million tons of standard coal. The energy saved in 2006 and 2007 by these enterprises equaled 147 million tons of standard coal.

Developing Renewable Energy and Optimizing Energy Mix

The Law on Renewable Energy and related policies were enacted in 2005 to give priority to renewable energy when transmitted on the state power grid, to purchase renewable energy at full price, to give users of renewable energy price discounts and to share the utilization of renewable energy among the whole society. A dedicated fund was created for developing renewable energy to support the evaluation and investigation of renewable energy resources, related technological research and development, construction of pilot and demonstration projects, and the development and utilization of renewable energy in the countryside. By the end of 2007, the annual installed capacity of hydropower in China was 145 million kw, generating 482.9 billion kwh of electricity, ranking first in the world in both installed capacity and power so generated. An average of 26 million kw of installed capacity was added in 2006 and 2007, with an average increase of 12 percent in each year. The scale of wind power increased several-fold. Currently, with installed capacity of more than 6 million kw, China ranks fifth in the world. In 2006 and 2007, some 3.05 million kw of installed capacity was added, an average annual increase of 148 percent. The area of solar energy collectors has reached 110 million sq m, keeping China the world leader in this field for many years. The installed power generating capacity using biomass is 3 million kw, and the annual production capacity of ethanol as biofuel is more than 1.2 million tons. The installed capacity of nuclear power is 9.06 million kw, an increase of 30.5 percent over 2006. The proportion of coal in the consumption of primary energy dropped from 72.2 percent in 1980 to 69.4 percent in 2007. The proportion of hydropower, wind power and nuclear power combined was raised from 4 percent to 7.2 percent in the same period. The total amount of renewable energy available for use is approximately 220 million tons of standard coal (including large hydropower facilities).

According to the Mid- and Long-term Plan for the Development of Renewable Energy and Mid- and Long-term Plan for the Development of Nuclear Power, China will continue to promote the comprehensive cascading development of water-power-rich river valleys. It will quicken the pace of constructing large hydropower stations on the precondition that the environment is well protected and adequate relocation of the local residents is ensured. Medium and small hydropower stations will also be developed where local conditions permit. China is determined to develop rapidly more of its wind-power potential to the scale that industrialization can be achieved. It will raise its capacity for developing and manufacturing wind-power equipment and make every effort to construct several wind-power farms of one million kw and wind-power bases of 10 million kw. China will energetically push forward the development and utilization of biomass energy, with emphasis on marsh gas, and solid and liquid biofuel, and on the use of biomass to generate electricity. China will actively take advantage of solar power to generate electricity and use it for heating while strengthening the research, development and utilization of new energy and alternative energy. It will make better use of coal-bed gas and gas in mines,

and develop small and scattered sources of electricity with coal-bed gas as fuel. China enthusiastically develops nuclear power, is working hard to reform the nuclear power system and spur mechanism innovation in an attempt to establish a market-oriented nuclear power development mechanism. It will strengthen its capacity for developing and manufacturing nuclear power equipment, and raise its ability to absorb imported technology and make new innovations on this basis. It will strengthen the construction of nuclear power transmission and related technical services, as well as the training of qualified personnel. It will implement preferential policies on taxation and investment that will promote the development of nuclear power, improve nuclear power safety, and quicken the enactment of laws and regulations in this field. Finally, China will push forward the use of clean coal and develop efficient and clean power generating technology, such as large-scale combined cycle units and poly-generation, and promote technology for carbon dioxide sequestration.

Developing a Recycling Economy to Reduce Greenhouse Gas Emissions

Attaching great importance to developing a recycling economy, the Chinese government is doing its best to reduce the amount of resources consumed, and reuse and recycle items so as to reduce greenhouse gas emissions from their sources and in the course of production. In recent years, a recycling economy is turning from an idea to action, and developing rapidly across the country. The state has enacted laws and regulations such as the Clean Production Promotion Law, Law on the Prevention of Environmental Pollution by Solid Wastes, Law on a Recycling Economy and Methods on Management of Urban Garbage. It has promulgated the Opinions on Accelerating the Development of a Recycling Economy, setting forth the general strategy, short-term goals, basic means, and policies and measures for the development of a recycling economy. It has also promulgated an evaluation index system for a recycling economy. In addition, the Regulations Regarding the Management of the Recycling and Treatment of Discarded Electrical Equipment is to be promulgated soon.

Two batches of demonstration pilot projects have been carried out, resulting in a recycling economy development model at three levels, i.e., enterprises, between enterprises or industrial parks, and in society in general. Pilot projects featuring recycling and treatment of old and useless household electrical appliances and remanufacturing of automobile parts have made satisfactory progress. Preferential policies concerning taxation on the comprehensive utilization of disposables and the recycling and utilization of renewable energy have been improved. More support is being given to key projects in the recycling economy by treasury bonds and investment within the central budget. Through importation, absorption, digestion and self-innovation, some advanced technologies with proprietary intellectual property rights have emerged, in particular, a group of key technologies which play a leading role in respective sectors have been developed, demonstrated and popularized. Applicable technologies, such as low-temperature power generation by waste heat, coke dry-quenching, power generation by differential pressure at blast furnace top, cement produced using calcium carbide slag in the drying process, and disposal of garbage in blast furnaces and rotary kilns, are now widely used. In 2005, nearly one third of the raw materials for China's steel, nonferrous metals and pulp industries came from renewable resources, while 20 percent of the raw materials for cement and 40 percent of the raw materials for walls came from industrial solid waste. Marked progress

has been made in reducing greenhouse gas emissions during the production of semiconductors, including sealing and packaging. The level of greenhouse gas emissions during the making of electronic information products remains low.

The state has formulated policies that encourage the recycling and utilization of landfill gas, and has promulgated industrial standards such as the Policies on Technologies for the Treatment of Urban Garbage and Pollution Prevention, and Technical Standards on Sanitary Landfill of Garbage, which promote the retrieval and utilization of landfill gas and reduction of emissions of methane and other greenhouse gases. Meanwhile, China is carrying out research into and popularizing advanced technologies for garbage burning and recycling, and utilization of landfill gas. Relevant technological standards are being promulgated, and the garbage collection and transportation system is being improved. Garbage classification has begun in some areas; comprehensive utilization of garbage as a resource has been raised to promote the industrialization of the treatment of garbage. Supervision is being tightened on enterprises engaged in garbage treatment. As a result, the detoxification rate of garbage was raised from 2.3 percent in 1990 to 52 percent in 2006.

Reducing Greenhouse Gas Emissions in Agriculture and the Countryside

China has witnessed great progress in the reduction of greenhouse gas emissions in agriculture and the countryside in recent years. In 1,200 counties across the country, fertilizers are applied according to the results of tests of local soil. Guidance is given to farmers for the scientific application of fertilizers and to reduce the emission of nitrous oxide. Protective farming featuring mainly crop stalk coverage and non-tillage are being popularized. Crop stalks are also used to feed domestic animals, the manure and urine of which are then applied to fields to add organic carbon to the soil. A compensatory mechanism for grassland ecology has been created: a balance is maintained between the grass and livestock; a system is adopted to prohibit grazing, to have a stretch of grassland rest or grazed in rotation; and the numbers of livestock grazing are controlled to prevent it from deteriorating. Meanwhile, renewable energy technologies are being vigorously developed in the countryside, such as the use of marsh gas, solar energy and stoves that save on firewood and coal. By the end of 2007, there were over 26.5 million households in China using marsh gas, saving 16 million tons of standard coal annually, tantamount to a reduced emission of 44 million tons of carbon dioxide. China has constructed 26,600 breeding farm marsh gas projects, and installed 42.86 million sq m of solar-powered heaters in the countryside, 14.68 million sq m of solar energy houses, 1.12 million solar energy stoves and more than 200,000 small wind-driven generators. China has established some demonstration spots for the gasification and solidification of crop stalks. It has installed firewood- and coal-saving stoves in 151 million households and energy-saving stoves in 34.71 million households.

Promoting Afforestation and Strengthening the Capacity of Carbon Sinks

In the past 20-odd years, some four million ha of trees have been planted every year with the help of continuously increasing investment from the central government. Meanwhile, the state also encourages citizens to take part in tree planting. By the end of 2007, millions of people had

planted 51.54 billion trees all over China. In recent years, through the reform of the collective forest right system, farmers' enthusiasm for tree planting and forest protection has been aroused. At present, China has 54 million ha of man-made forest, its timber volume reaching 1.505 billion cu m, with the country's rate of forest coverage going up from 12 percent in the early 1980s to 18.21 percent now. In 2006, some 35.1 percent of China's urban areas, or 1.32 million ha, were covered with grass or trees. It is estimated that tree-planting activities in China between 1980 and 2005 effectively absorbed 3.06 billion tons of carbon dioxide, that forest management absorbed 1.62 billion tons of carbon dioxide, and that carbon dioxide emission was reduced by 430 million tons because of improved forest protection. All this has further enhanced the capacity of forest as the sinks of greenhouse gas.

Intensifying R&D Efforts to Deal with Climate Change Scientifically

Including response to climate change in the plan for scientific development. The Outline of China's Mid- and Long-term Development Plan for Science and Technology promulgated in 2006 made energy and environment priority fields in the development of science and technology. It listed the observation and monitoring of global climate change and countermeasures as priority issues in the field of environmental protection. China's Special Sci-Tech Campaign to Cope with Climate Change enacted in 2007 set forth phased goals for scientific work as a response to climate change during the 11th Five-year Plan period (2006-2010) and long-term goals up to the year 2020. It mainly discusses the following topics and makes relevant countermeasures: the scientific explanation of climate change, research and development of technologies that can be used to control greenhouse gas emissions, technologies and measures that help adapt to climate change, and major strategies and policies to cope with climate change.

Strengthening the cultivation of personnel and construction of research bases. Thanks to efforts made over the past 20 years or so, a contingent of specialists has been formed in the field of climate change who are doing basic and applied research across fields and disciplines. They have made pioneering research achievements, providing important scientific support for China to cope with climate change. A batch of national-level scientific research bases has been established, and a large observation network system, including the National Climate Monitoring Network, has basically been set up. China has strengthened research into and development of advanced technologies dealing with climate change, as well as their demonstration. The integration of research, teaching and production has accelerated the industrialization process of advanced technologies.

Continuously increasing investment in scientific and technological work related to climate change. While sources of funds from the government remain relatively stable, efforts are being made to raise money from other sources, attracting funds from society at large for scientific and technological research and development concerning climate change. During the 10th Five-year Plan period (2001-2005), the government invested more than 2.5 billion yuan in scientific and technological research dealing with climate change through national science and technology plans such as the Gongguan Plan¹, 863 Plan² and 973 Plan³. By the end of 2007, the National Science and Technology Plan for the 11th Five-year Plan period (2006-2010) had appropriated

more than seven billion yuan for scientific research into energy conservation and emission reduction. In addition, the state, through other channels, has invested large amounts of funds for scientific research into climate change.

Key areas of scientific research. China has decided to place the emphasis of its research on technologies that can reduce greenhouse gas emissions or slow the process. These include technologies that save energy and enhance its efficiency; technologies for renewable energy and new energy; technologies that can control, dispose of or utilize greenhouse gases, such as carbon dioxide and methane in major industries; biological and engineering carbon fixation technology; technologies for the clean and efficient exploitation and utilization of coal, petroleum and natural gas; technologies for manufacturing advanced equipment for coal- and nuclear-generated power; technologies for capturing, utilizing and storing carbon dioxide; and technologies that control greenhouse gas emissions in agriculture and how land is used.

Notes:

1. The "Gongguan Plan" is a national plan aimed at tackling key and difficult scientific and technological problems facing China's economic construction and social development. It was first implemented in 1982, and has been linked with China's Five-year Plans since then.

2. The "863 Plan" is a plan initiated by the Chinese government in March 1986 for the development of high-tech industries.

3. The "973 Plan" refers to the National Plan of Basic Research for Some Key Areas initiated by the government in 1997.

V. Policies and Actions to Adapt to Climate Change

China actively applies policies and take actions to adapt to climate change in natural ecological systems such as agriculture, forestry and water resources, as well as ecologically fragile areas like coastal zones and regions, and has achieved positive effects.

Agriculture

The state has made great efforts to establish and improve a law regime for agriculture to adapt to climate change, including the Agriculture Law, Grassland Law, Fisheries Law, Law on Land Management, Regulations of Responses to Major Emergent Animal Epidemics, and Regulations on Grassland Fire Prevention. The state has strengthened construction of agricultural infrastructure and capital construction of farmland water conservancy, enlarged irrigation areas, improved farmland irrigation and drainage efficiency and capability, and promoted dry farming and water-saving technologies, making agriculture better able to deter and mitigate natural disasters and increasing overall agricultural productivity. Through the "Seed Project," China is cultivating stress-resistant varieties of seeds with high yield potential,

high quality and specific abilities of resistance to drought, water logging, high temperature, diseases and pests.

China will further extend superior strains of livestock to larger areas and increase the acreage sown with such strains; enhance the prevention and control of major animal epidemic diseases, establish and improve the monitoring and early-warning systems and enhance capability in this regard; protect and improve the grassland ecosystem through turning grazing area back to grassland, constructing meadow enclosures, artificial grasslands and grassland fire-prevention facilities; and launch activities for aquatic life conservation and protect aquatic life resources and the aquatic eco-environment.

Forests and Other Natural Ecosystems

For years, China has made great efforts to protect forests and other natural ecosystems by formulating and enforcing relevant laws and regulations, such as the Forest Law, Law on the Protection of Wildlife, Law on Water and Soil Conservation, Law on Prevention and Control of Desertification, Regulations on Conversion of Farmland to Forests, Forest Fire Prevention Regulations, and Regulations on Forest Diseases and Insect Pest Prevention and Control. The state is now working hard to draw up laws and regulations on the protection of nature reserves, wetlands and natural forests, and pushing forward the all-round implementation of a national program of eco-environment development and protection.

China will further strengthen the protection and management of forest land, forests and wildlife resources, continue projects for the protection of forests, conversion of cropland to forest and grassland, wildlife conservation and nature reserve development and wetland protection, so as to push forward the sustainable development and management of forests, and intensify efforts in ecological water and soil conservation. The government has established a comprehensive monitoring system for forest resources and ecosystem conditions; improved a forest fire, pest and disease evaluating system and an emergency-response system, as well as the training of professionals in this field; carried out a nationwide medium- and long-term program for the prevention of forest fires, pests and diseases, enhanced the protection of endangered species and their habitat ecosystems; and restored the functions of eco-fragile areas and ecosystems.

Water Resources

China has worked out and enforced laws and regulations in this regard, including the Water Law, Flood Control Law, and Regulations on River Administration. It has formulated and completed the program of flood control on major rivers and other water-conservancy programs, and has set up an elementary law regime and a program on water conservancy commensurate with China's conditions, and established an elementary flood-control and disaster-alleviation system for major rivers and a water-resource allocation and protection system. Meanwhile, great efforts have been made to control soil erosion. By the end of 2007, China had made efforts to bring soil and water erosion under control over an area of one million sq km, thus effectively

protected the soil and water resources and improved its eco-environment.

China will accelerate the pace of formulating nationwide comprehensive plans for water resources and river basins, drawing up a water-allocation plan for major rivers, speeding up the construction of the south-to-north water-diversion and other water-diversion projects, so as to optimize the water resource allocation pattern, and increase the water supply capability for drought emergencies. Efforts are being made to enhance unified water resources management and allocation, and establish national water-right distribution and transfer systems as well as a water resources conservation and protection system. The state will strengthen the construction of projects to control floods on major rivers as well as a system to control floods caused by mountain torrents, thus basically establishing a flood-control and disaster-alleviation system mainly formed by reservoirs, river channels, dykes and a mountain flood-control system. Further efforts are being made to improve the national commanding system in control and prevention of floods and droughts, establish a flood-risk management system, so as to enhance the country's capability in controlling floods and droughts. In river basins with serious ecological deterioration, China will set the cap on extraction of groundwater, strictly control excessive extraction of groundwater and adopt active measures to rehabilitate and protect water resources. Research will be strengthened into the impact of climate change over China's water resources and into the mechanisms of water conversion between atmospheric water, surface water, soil water and groundwater as well as related technologies for optimizing water-resource configuration. China is also strengthening study, development and popularization of technologies relating to reuse of wastewater and desalinization of seawater.

Coastal Zones and Coastal Regions

In accordance with the Marine Environment Protection Law, Law on the Use and Administration of Sea Areas, General System Development Plan for the Air-Sea Interaction, among others, China has worked out the objects and contents of a system to deal with climate change in marine areas, established a decision-making mechanism and a coordination mechanism of comprehensive management, thereby striving to slow down and adapt to the adverse impacts of climate change. Work is also done to increase the capability of the coastal zones and coastal regions to adapt to climate change. Through investigations and researches, China has strengthened study on air-sea interaction to deepen the understanding of air-sea interaction, and has initially formed an all-dimensional observation network pertaining to the marine environment, thus improving its capability to control and prevent marine disasters.

The country will further improve its all-round capability to control and prevent marine disasters in coastal regions through establishing and further improving an emergency response system for marine disasters. It will set up observation and service networks to analyze, evaluate and forecast climate change in coastal areas, establish a system to monitor, forecast, analyze and evaluate sea level change and do a better job in this regard, and improve the capability of the marine ecosystem and coastal region ecosystem to cope with and adapt to climate change. The state is promoting R&D of technologies for marine ecosystem protection and restoration, popularizing the research results, reinforcing the construction and management of marine reserves, carrying out restoration work in coastal wetlands and marine eco-environment, setting

up demonstration areas with typical marine ecosystems, and building coastal protection forest belts with every effort. China will enhance the management of coastal zones, raise protection standards of coastal cities and major engineering projects, prevent excessive exploitation of groundwater and take measures against land subsidence in coastal areas. As one of such steps, fresh water will be taken from rivers or reservoirs to dilute brackish water and deter seawater intrusion in estuaries.

Other Fields

China has enhanced its capability of monitoring and issuing early warning over extreme climate events, and basically established mechanisms to deal with extreme meteorological emergencies, including their derivative and secondary effects. Great progress has been made in countering the effects of extreme climate phenomena like typhoons, regional intense thunderstorms and floods, and a comprehensive monitoring system for climate and climate change has taken initial shape.

To counter the expansion of epidemic-infected area caused by climate change, the state will further build up its monitoring and control network, and establish a health-guarantee system. The government has worked out a city flood control and water drainage plan, and raised the design standards for city flood control projects. In the design, construction and operation of major projects, the factor of climate change has been taken into full consideration, and new standards have been established for adaptation to future climate change.

VI. Enhancing Public Awareness in Addressing Climate Change

China has all along attached great importance to education and publicity concerning the environment and climate change, as well as public participation in relevant activities. In recent years, the government has constantly guided the public in enhancing its awareness of climate change, and advocated the concept of harmonious development between man and Nature through publicizing and implementing such advanced ideas as the Scientific Outlook on Development, establishing a harmonious society and sticking to the sustainable development road. The Politburo of the Communist Party of China particularly held a study session on global climate change and enhancement of the capability to cope with it. It stresses on vigorous enhancement of public awareness and capability in participation of addressing of climate change, and on the building of a good social atmosphere to this end. The state makes the concept of building a resource-saving and environmental-friendly society an important component of school education and the mass media, and disseminates knowledge about climate change by all ways and means to sharpen the concern of the whole society about global environmental issues.

China has produced large numbers of publications and audio-video products on climate change, set up dedicated TV weather channel and an information database to disseminate knowledge about climate change through the mass media. It has held the "International Forum on Climate Change and Science & Technology Innovation," and hosted many large-scale international seminars with topics such as "Climate Change and Ecosystems" and "Bio-diversity

and Climate Change." Since 1992, China has staged 18 sessions of National Energy Conservation Publicity Week in succession. The Chinese government issued the Public Action Plan on Energy Conservation and Emission Reduction, carried out relevant activities throughout the country, with the participation of communities, young people, enterprises, schools, servicemen, government agencies, scientific and technological circles, popular science circles, and the mass media. As a result, a mechanism of energy conservation and emission reduction has been formed with the government taking the lead, enterprises as actors and everyone as participant. China fully utilizes the exemplary roles of government agencies and officials through a campaign to establish a "conservation-minded government." It carries out publicity and education of energy conservation and emission reduction in enterprises, mobilizes employees to participate in the management of energy conservation and emission reduction in enterprises. It encourages citizens to remold lifestyles and consumption patterns in their families, creates a platform for energy conservation and emission reduction in communities. It actively encourages citizens and social groups to plant trees voluntarily, and launches actions like restricting free use of plastic bags by charging fees so as to enhance their awareness of energy conservation and emission reduction. It fosters students' awareness of the importance of energy conservation and emission reduction through school education and practical activities. In recent years, many social groups and NGOs have participated in the campaign for energy conservation and emission reduction in various ways and played an active role.

Recycling economy represents the future trend of economic development. The Chinese government attaches great importance to the development of a recycling economy, and advocates such economy throughout the country. In recent years, with vigorous development of the recycling economy as focus, the government has launched a series of educational and publicity activities in order to root the idea of a recycling economy deeply in the people's minds and create a sound social atmosphere.

China will further enhance education and training in order to better deal with climate change. Knowledge about climate change will be included in basic education, higher education and adult education, with the focus being placed on fostering among youngsters the awareness of climate change and a sense of participation in relevant activities. It will conduct training courses and seminars on climate change for government agencies, enterprises, consultation institutes, scientific research staff and communities, so as to improve their understanding of the importance and urgency in dealing with climate change, and encourage them to undertake their social responsibilities in an active manner.

VII. Enhancing International Cooperation on Climate Change

Based on the "mutually beneficial, pragmatic and effective" principle, China actively participates in and promotes international cooperation in the field of climate change, playing a positive role. In recent years, China's president and premier have both stated China's position on international cooperation on climate change at multilateral and bilateral exchanges, including the outreach session of the G8 summit, Asia-Pacific Economic Cooperation (APEC) meeting, East Asia Summit (EAS) and Boao Forum for Asia, energetically promoting global

action to cope with climate change.

Over a long period of time China has actively participated in and supported the activities of the United Nations Framework Convention on Climate Change (UNFCCC) and Kyoto Protocol, working hard to accelerate the effective implementation of the two documents. Chinese experts have energetically taken part in the activities of the Intergovernmental Panel on Climate Change (IPCC), making contributions to the composing of relevant reports. China earnestly performs its duties stipulated by the UNFCCC and Kyoto Protocol, released China Initial National Communications on Climate Change in 2004, and issued the National Plan for Coping with Climate Change and China's Special Sci-Tech Campaign to Cope with Climate Change in June 2007.

As to multilateral cooperation, China is an official member of the Carbon Sequestration Leadership Forum, Methane-to-Market Partnership and Asia-Pacific Partnership on Clean Development and Climate. It is also a participant in the meetings of the leaders of the G8 and the five major developing countries on climate change, and Major Economies Meeting on Energy Security and Climate Change. At the APEC meeting, China moved the proposal of the Asia-Pacific Network for Sustainable Forest Management and Rehabilitation, and hosted the International Forum on Climate Change and Sci-Tech Innovation. China strives for the enhancement of international exchanges and mutual trust in the sphere of climate change, as well as the establishment of an impartial and effective global mechanism to cope with climate change.

In bilateral exchanges, China has set up a dialogue and cooperation mechanism on climate change with the European Union, India, Brazil, South Africa, Japan, the United States, Canada, the United Kingdom and Australia, focusing on cooperation in the field of climate change. China has all along helped African countries and small developing island states to improve their ability to cope with climate change. China's African Policy makes it clear that China will actively promote China-Africa cooperation in climate change. The Chinese government has sponsored two study courses on the Clean Development Mechanism (CDM), aiming to improve the abilities of African and Asian developing countries to carry out CDM projects.

China energetically develops cooperation in research on climate change with foreign governments, international organizations and research institutes, covering scientific problems, deceleration and adaptation, policies and measures to cope with climate change, including China's trend of climate change, impacts of climate change on China, adaptation measures and actions adopted by China's farming and forestry departments, China's water resources management, and China's comprehensive management of coastal zone and marine eco-systems. This cooperation extends to the cost for China to reduce greenhouse gas emissions and China's potential capability in reducing greenhouse gas emissions, China's laws and regulations and policy research to cope with climate change, as well as studies, development and demonstrations of technologies regarding low-carbon energies. China actively participates in corresponding international scientific and technological cooperation programs, including the World Climate Research Programme (WCRP) under the framework of the Earth System Science Partnership (ESSP), International Geosphere-Biosphere Programme

(IGBP), International Human Dimensions Programme on Global Environmental Change (IHDP), intergovernmental Group on Earth Observations (GEO), Global Climate Observation System (GCOS), Global Ocean Observation System (GOOS), Array for Real-Time Geostrophic Oceanography (ARGO), and International Polar Year. In addition, China enhances information exchanges and resource sharing with relevant international organizations and institutes.

China energetically impels and participates in technology transfer under the UNFCCC framework, works hard to build a favorable domestic environment for international technology transfer, and has submitted a technological demand list. China believes that technology transfer under the UNFCCC framework should not solely rely on the market. The key is for the governments of developed countries to make efforts to reduce and eliminate obstacles to technology transfer, and adopt pilot and incentive policies and measures, thus playing an effective role in the promotion of technology transfer. For key technologies under study concerning climate change, it is necessary to take advantage of the joint efforts of the international community and lose no time in making breakthroughs, and such technologies should be shared by all countries in the world.

China attaches importance to the CDM's active role in facilitating its own sustainable development, and is willing to make contributions to reduce greenhouse gas emissions by joining CDM programs. Through international cooperation, China has conducted systematic research on CDM, providing a scientific base for the making of international rules and domestic policies, as well as providing valuable information for the benefit of all sides. China has carried out a host of activities to improve the abilities of government departments, enterprises, academic institutions, advisory bodies and financial institutions to develop CDM projects. It has improved the relevant domestic rules, and promulgated the Measures for the Operation and Management of Clean Development Mechanism Projects in China. Up to July 20, 2008, China had had 244 CDM cooperation projects successfully registered with the United Nations, which were expected to reduce carbon dioxide emission by 113 million tons annually. CDM projects have effectively boosted the development of China's renewable energy, accelerated the improvement of energy intensity, and greatly enhanced the awareness of the seriousness of climate change on the part of relevant government departments, enterprises, organizations and individuals. China holds that CDM, as a comparatively effective and successful cooperation mechanism, should continue to be implemented after 2012. However, efforts should be made to promote fairness, transparency, simplicity, certainty and environmental completeness during the implementing of projects, and to encourage the transfer of advanced technology to developing countries. The host country should play a more important role in developing CDM projects.

VIII. Institution and Mechanism Building for Coping with Climate Change

The Chinese government set up special institutions to deal with climate change in 1990, and established the National Coordination Committee on Climate Change (NCCCC) in 1998. In order to further enhance the leadership of the work on climate change, the National Leading Group to Address Climate Change, headed by the Chinese premier, was set up in 2007 to draw up important strategies, policies and measures related to climate change, and coordinate the

solving of major problems in this regard. During the institutional reform in 2008, the number of member units of the National Leading Group increased from 18 to 20. The National Development and Reform Commission (NDRC) was vested to undertake the general work in respect of climate change, and the general office of the National Leading Group was set up and placed in the NDRC. And a special institution was established in the NDRC responsible for organizing and coordinating work on climate change all over the country. The Experts Committee for Climate Change has been set up to improve scientific decision-making on climate change, and this committee has done a great deal of work in supporting government decision-making and boosting international cooperation and nongovernmental activities.

In 2007, the State Council called on all regions and departments to strictly implement the National Plan for Coping with Climate Change in the light of their actual conditions. They were required to build and improve management systems, coordinating mechanisms and special institutions on climate change, organize teams of local experts to deal with climate change, make corresponding policies and measures in light of the local geographic environment, climate conditions and economic development level, set up statistical and monitoring systems on climate change, and organize and coordinate local actions to slow climate change.

In order to facilitate the implementation of the National Plan, governments at all levels will further improve industrial, financial, taxation, credit and investment policies, make full use of price leverage, form institutions and mechanisms conducive to reducing greenhouse gas emissions, increase financial input and improve corresponding rules conducive to decelerating and adapting to climate change, thus enhancing work on climate change in accordance with the law.

Conclusion

China is now in a crucial period in the building of a moderately prosperous society in all respects, and at an important stage for speeding up the country's industrialization and urbanization. It has onerous tasks to develop the economy and improve the people's livelihood, and faces a more severe challenge of climate change than developed countries do. China will continue to follow the guidance of the Scientific Outlook on Development, unswervingly stick to the road of sustainable development, and adopt more powerful policies and measures to strengthen the ability to deal with climate change in an all-round way.

The whole world, without exception, faces the challenge of climate change. The solution demands the joint efforts of all countries and the entire international community. China will work unremittingly for global sustainable development with other countries and continuously make new contributions to the protection of the climate system which is the common wealth of mankind.

Source:Xinhua

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