

# **China's National Climate Change Programme**

**Prepared under the Auspices of  
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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.<sup>1</sup>

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<sup>1</sup> 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 (CO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O), 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 CO<sub>2</sub> equivalent (3,650 million tons of net emissions), of which 3,070 million tons of CO<sub>2</sub>, 730 million tons of CO<sub>2</sub> equivalent (tCO<sub>2</sub>e) of CH<sub>4</sub> and 260 million tCO<sub>2</sub>e of N<sub>2</sub>O. According to tentative estimates by experts from China, China's total GHG emission in 2004 is about 6,100 tCO<sub>2</sub>e (5,600 million tons of net emissions), of which 5,050 million tons of CO<sub>2</sub>, 720 million tCO<sub>2</sub>e of CH<sub>4</sub> and 330 million tCO<sub>2</sub>e of N<sub>2</sub>O. From 1994 to 2004, the annual average growth rate of GHG emissions is around 4%, and the share of CO<sub>2</sub> 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 CO<sub>2</sub> emissions from fossil fuel combustion were 79 Mt in 1950, contributing only 1.13% of the world total at that time; cumulative emissions of CO<sub>2</sub> from fossil fuel combustion accounted for only 9.33% of the world total during the period of 1950~2002, and the cumulative CO<sub>2</sub> emissions per capita are 61.7 tons over the same period, ranking the 92<sup>nd</sup> in the world. Statistics from the International Energy Agency (IEA) indicates that per capita CO<sub>2</sub> 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 CO<sub>2</sub> emission per unit of GDP declined generally. According to IEA, China's emission intensity falls to 2.76 kgCO<sub>2</sub>/US\$ (constant 2000 U.S. dollar) in 2004, as compared to 5.47 kgCO<sub>2</sub>/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 CO<sub>2</sub> emissions, using China’s 1994 emission

factor of 2.277 tCO<sub>2</sub>/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 CO<sub>2</sub> 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 CO<sub>2</sub> in the atmosphere. Estimated by relevant experts, from 1980 to 2005, a total of 3.06 billion ton CO<sub>2</sub> absorption was achieved by afforestation, a total of 1.62 million ton CO<sub>2</sub> absorption by forest management, and 430 million tons of CO<sub>2</sub> 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 CO<sub>2</sub> 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 21<sup>st</sup> 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, CO<sub>2</sub> 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 CO<sub>2</sub> 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 CO<sub>2</sub> 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 CO<sub>2</sub> 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 21<sup>st</sup> 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 21<sup>st</sup> 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 CO<sub>2</sub> 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 CO<sub>2</sub> 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 CO<sub>2</sub> 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 CO<sub>2</sub> 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 CO<sub>2</sub>e 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 CO<sub>2</sub>e 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 CO<sub>2</sub> 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 criteria 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 11<sup>th</sup> five-year plan period (2005-2010), equivalent to 550 Mt CO<sub>2</sub> 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 (SF<sub>6</sub>); 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 CO<sub>2</sub> 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.