GEF/ UNDP

National Capacity Needs Self-Assessment for Global Environmental Management - Climate Change

Assessment on Capacity for Implementing UNFCCC and China's Strategies of Capacity Building for Climate Protection

Project report

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Contents

Abbreviations

ADB	Asian Development Bank
AIT	Asian Institute of Technology
APN	Asia-Pacific Network
AMI	Agrometeorology Institute
CAAS	Chinese Academy of Agricultural Sciences
CAS	Chinese Academy of Sciences
CASS	Chinese Academy of Social Sciences
CCIR	Center for Climate Impact Research
CDI	Capacity Development Initiatives
CDM	Clean Development Mechanism
CEEC	Center for Environmental Education and Communications
CIDA	Canadian International Development Agency
CMB	China Meteorology Bureau
COP	Conference of Parties
ERI	Energy Research Institute
FEEI	Forest Ecology & Environment Institute
GCOS	Global Climate Observation System
GEF	Global Environment Facility
GHG	Greenhouse Gas
IGBP	International Geography and Biosphere Plan
IPAC	Integrated Policy Assessment model for China
IPCC	Intergovernmental Panel on Climate Change
ISCC	The International Symposium on Climate Change
MOF	Ministry of Fiance
MOFA	Ministry of Foreign Affairs
MOST	Ministry of Science and Technology
NC	National Communication

NCCCC	National Coordination Committee on Climate Change
NCCCG	National Climate Change Coordination Group
NCSA	National Capacity Needs Self-Assessment
NCC	National Climate Center
NDRC	National Development and Reform Commission
NGO	Non-governmental Organizations
NIES	National Institute for Environment Studies
NREL	National Renewable Energy Laboratory
PNNL	Pacific Northwest National Laboratory
ONCCCC	Office of the National Coordination Committee for Climate Change
RUC	Renmin University of China
SEPA	State Environmental Protection Administration
SGM	Second Generation Model
SRES	Special Report on Emissions Scenarios
TCAP	Technical Cooperation Action Plan
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
WCRP	World Climate Research Plan

Executive Summary

Background

Enhancing the capacity building for developing countries is a very important instrument to deal with climate change. This issue will be increasingly more important with the progress of international climate cooperation. The significance is evident with regard to the effective implementation of the capacity building activities and the effective evaluation on the effectiveness of the implementation. For developing countries, the appropriate identification of priority areas for their capacity building needs for climate change, in combination with the proper proposed capacity building targets and implementation measures, is the necessary basis for the Global Environment Facility (GEF), multilateral donor organization and other bilateral donor organizations.

The objectives of this GEF/UNDP sponsored project are as follows:

- To assess the existing climate-related capacity building activities in China and learn from previous experiences and lessons;
- Identify priorities of climate-related capacity building activities in the near future in China in order to provide guidance to different stakeholders; and
- Come up with strategies, guidelines, and measures to implement capacity building activities in China.

In order to reach these objectives, a steering committee was established to supervise and guide the implementation of this project. This Committee consistsof representatives from the Ministry of Finance (MOF), National Development and Reform Commission (NDRC), Ministry of Foreign Affairs (MOFA), Ministry of Science and Technology (MOST), China Meteorology Bureau (CMB), and State Environmental Protection Administration (SEPA), as well as some experts. With the leadership of MOF, the National Office of Coordinating Committee on Climate Change Policy based in NDRC coordinates the implementation of the project. Renmin University of China (RUC) is an implementing institution to provide technical support. A couple of experts from different research institutions and universities, such as China Academy of Sciences, China Academy of Social Sciences, Energy Research Institute, China Research Academy of Agricultural Science, National Centre for Meteorology, Center for Education and Public Awareness under SEPA, and Tsinghua

University, are closely involved in the process of assessment of capacity and capacity building activities.

Methodologies

The methodology, employed in this project, was based on the consideration that representatives of different kinds of stakeholders should have adequate opportunities to express their opinions on needs for and recommendations on capacity building activities in China. Communication was conducted with a broad range of stakeholder representatives. The investigation covers directly 61 institutions/organizations and 79 individuals. Officials at both national and provincial level, in charge of economic planning, spatial economic development, management in energy, the environment, forest, water resources, and meteorology, etc, were invited to participate in meetings and interviews. Managers and engineers from enterprises, as well as researchers from academic institutions were also interviewed. Representatives from associations of such industrial sectors as metallurgy, petrochemical industry, textiles and dyeing, chemical fibre, power, coal, etc, were also visited to listen to their comments. The communication was conducted in Beijing, Inner Mongolia Autonomous Region, Hunan Province, and Chongqing Municipality. In addition to meetings and interviews, questionnaires are also distributed and about 80 questionnaires were collected and analyzed. Based on the above samples and investigations, expert contributors in different areas are invited to analyze the collected information and compile the assessment report.

These expert authors cover such capacity building areas as (1) institutional and policy analysis, (2) enabling environment, (3) national communication and emission inventory, (4) national strategies/programs on climate change, (5) vulnerability and adaptation, (6) mitigation, (7) research and systematic observation, (8) development and transfer of technology, (9) Clean Development Mechanism, (10) education, training, and public awareness, and (11) database and information network. The assessment is also deployed within the above eleven areas.

With the GEF guidance, capacity is categorized at three levels: systemic, institutional, and individual. Although there is a difficulty to develop a set of indicators to reflect current status of capacity and to assess effectiveness of capacity building activities, some indicators with available data, such as financial resources, scale and numbers of projects, relevant beneficiaries, covered areas, are also observed. A strategy to combine quantitative and

qualitative analysis is introduced. The assessment of needs for capacity building in China to mitigate and adapt to climate change is mainly based on existing experiences and knowledge from experts, as well as recommendations and opinions from the above mentioned investigated sample groups.

The needs assessment process for climate change reviewed almost all relevant capacity building activities in China since the entry into force of the UNFCCC. Such capacity building activities could be classified into three categories based on the source of funding. They are the capacity building activities supported by multilateral organizations represented by GEF and UNDP, bilateral donors represented by some developed country governments, and the domestic funding from Chinese governmental departments. The previous capacity building activities - although not so sufficient, covered some areas in climate change such as institutional capacity, national communication, national strategy, evaluation on vulnerability and adaptation, development of Clean Development Mechanism (CDM) projects, and education/training and public awareness. However capacity building activities targeting at development and transfer of technologies, specific mitigation measures, research and systematic research, adaptation, human resources development, coordination and cooperation are relatively fewer and weak and need to be strengthened.

All in all, as a developing country, the capacity to deal with climate change in China is still very weak. The activities carried out are very initial and huge gaps remain when compared to the capacities and capabilities as requested by the implementation of the UNFCCC and the Kyoto Protocol.

Priorities of Climate-Related Capacity Building in China

Priority areas for the near term capacity building are identified. The most urgent capacity building needs are as follows:

- With regard to the institutional capacity building, there are limited numbers of people working for climate change in governmental organizations, academic institutions, business and industries, and non-governmental organizations. All kinds of organizations specifically working for climate change need to be generated or strengthened, particularly at the local provincial and those lower than the provincial levels. The establishment of the CDM management center will be the priority in the near term. The implementation of such an institutional capacity building includes

system construction, office facilities, personnel allocation, channeling maintenance funding, information and networking, etc. Meanwhile the indicators and methodologies need to be developed to evaluate the effectiveness of the capacity building activities.

- With regard to the national communication and the corresponding organizational, expertise and database construction and maintenance, the most urgent need is the initiation of the second national communication through which to enhance the national capacity in this regard.
- With regard to the policy-making improvements, one near term focus will be the formulation and development of the national climate change strategy or national programme. Through the policy studies in this field, further considerations will be made with the aim of integrating climate change issues into the studies on national social and economic development strategies and plans. Also the linkage between the macro economic development and the issues of climate change will be set up. Another near term focus will be the studies on the relevant laws and regulations, with the aim of recommendations for further amendments to meet the requirements of climate protection. Specifically the CDM relevant laws and regulations need to be developed further or amended.
- With regard to the CDM capacity building, more training, studies, demonstration projects are needed. Capacity in project development and management needs to be enhanced. A web-based project information inventory needs to be developed.
- With regard to the evaluation on the mitigation options, focus will be given on the development of integrated assessment models. Based on this assessment the impacts of mitigation options will be made. Also evaluation will be made on the effectiveness of the simulated policies and programmes. The assessment on the mitigation options and mitigation technologies from social, economic, environmental and technological aspects is also a near term priority.
- With regard to impact and adaptation, targeted research and studies on impacts assessment and adaptation are urgently needed. Also preliminary studies on national adaptation programme or action plans are a near term priority.
- With regard to research and systematic observation, a near term priority needs to be given to the following: survey on the overall situation of the observing stations dispersed and managed by different sectors in China; evaluation on the coverage of China's regional observing system and the completeness of the monitoring

elements; design and development on China's GCOS implementation plan; study the proper mechanism for data and information sharing; enhance and improve China's climate modeling development and application.

- With regard to public awareness for climate change, the near term focus needs to be given to the awareness raising for different stakeholders particularly at the local levels. Media, thematic workshops, focus groups, web page setup are the major means for knowledge sharing. It will be a great and long term challenge for the Chinese government to raise the awareness of many thousands of government officials, entrepreneurs, professional researchers and the general public.
- With regard to the information network and the information database, a near term priority will be the enhancement and maintenance of the already established climate specific website. Meanwhile the sources of information need to be broadened, which depends on the enhancement of the overall capacity in some way. Starting from the policy studies and the corresponding implementation, improvement and amendments to the existing statistics and indicators need to be researched. Based on this the institutional and technological arrangement for more effective information sharing needs to be developed. A specific project is urgently needed to ensure the website maintenance and hands-on daily management.

Main Measures for Capacity Building Enhancement

Based on the ongoing capacity building activities, the future objectives and possible measures, the experts identified for the different areas did the careful analysis regarding the constraints for capacity building activities in China. Four types of constraints/barriers were identified in this regard. They are organizational, financial, technological and human resource constraints. For the enhancement of climate change relevant capacity building activities, the barrier of the financial shortage outstands as the major constraint.

The capacity building needs in every specific area were identified above. The process of meeting all these needs is that of overcoming the four aspects of barriers in the meantime. Considering the barriers, the following measures for capacity building in China are elaborated.

- On the basis of improving and completing the institutional and organizational arrangements to deal with climate change, an integrated approach will be taken to consider capacity building as the key part of climate change strategies and action

plans. Partnerships and networking between different stakeholders which include governmental authorities, policy study institutions, education and training organizations, technology research/development and dissemination promoters, media, and other non-governmental organizations should be set up at both national and local levels. Some capacity building centers should be established targeting at different key sectors.

- Indicators and methodologies will be explored to evaluate the effectiveness of the capacity building activities, which will be helpful for guiding, supervising and monitoring the capacity building activities.
- Establish stable budget channels to ensure the daily management of capacity building activities. To ensure the broader scope of, long-term, and deepened capacity building activities, the measures of channeling more resources, using the existing funding in an integrated and synergy manner, leveraging more international funding and private funding are very important.
- Both international and internal cooperation will be enhanced to carry out capacity building activities by using different approaches and different means.
- Strengthening personnel training, particularly the training targeting at policy makers and the trainers, with the aim of setting up a professional team of capacity builders.
- Using the financial resources, human resources and the information in a holistic way to increase the degree of sharing and thus improve the efficiency.

1 Introduction

1.1 Background

The capacity building for developing countries is a key component of the United Nations Framework Convention on Climate Change (the Convention) and the Kyoto Protocol (the Protocol). Both Article 9 of the Convention and the 10(e) of the Protocol address the issue of capacity building. Since the independent review of capacity building for developing countries in the 11th SB meeting of the Convention and the COP5, the capacity building for developing countries has been an outstanding issue of COPs and most of the SB meetings for special review and negotiation. In the 11/CP.5 of COP5, a comprehensive approach for solving the capacity building for developing countries has been proposed and the COP5 also stipulates that it is necessary to conduct a review on the capacity building of developing countries for implementing conventions, the demands and focus of capacity building and the coordination between Capacity Development Initiatives (CDI) of GEF and other related activities. It was under such circumstances that the National Capacity Self-assessment project was initiated by GEF and implemented by UNDP.

The ideas of COP5 were further detailized and optimized to be incorporated in the Decision 2/CP.7 of Marrakesh Accord. This Decision identifies the main areas of capacity building for developing countries and requests a comprehensive review on the implementation of this Decision. This report basically focuses on the above-mentioned areas of capacity building to conduct reviews and identification based on the review of the activities, and the demands and focus of such activities. This approach can help to conform the review of the demand of capacity building to related Decisions of COP.

1.2 Project Significance and Objectives

The implementation of this NCSA project has the following significance:

- The carrying out of the actions decided by Decisions of COP is contributive to the effective implementation of the Convention;
- To provide a plan and information basis for more systematic, organized and focused capacity building activities for developing countries, which is also a very important

part for the implementation of the Convention;

- To identify the demand and focus of the capacity building in China, which can be used to guide such activities in China in the area of climate change funded by GEF acting as the funding entity of the Convention, other multi-lateral and bilateral development agencies, and also public and private entities.

The project objectives are as follows:

- To undertake reviews on the main capacity building activities in China, acquiring lessons learnt and providing a benchmark for future such activities;
- To identify the focus of capacity building to provide a guidance for the such activities supported by related stakeholders;
- To propose a basic strategy, guidance and action plan for the capacity building activities in China in the near future.

1.3 Project Organization

This project was initiated and funded by GEF, and UNDP was the international implementing agency. The governmental coordination agency of China is the International Department of Ministry of Finance, and the coordination agency for climate change project is the Office of National Climate Change Coordination Committee of National Development and Reform Commission (NDRC). A project team composed of representatives from National Development and Reform Commission (NDRC), Ministry of Finance (MOF), Ministry of Foreign Affairs (MFA), Ministry of Science & Technology (MOST), China Meteorological Administration (CMA), State Environmental Protection Administration (SEPA) and related experts was formed to be responsible for project coordination and management.

After a competitive tendering and bidding process, the Department of Environmental Economy and Management of School of Environment & Natural Resources of Renmin University of China was selected as the project management entity. Meanwhile, experts from the Energy Research Institute of National Development and Reform Commission (NDRC), Chinese Academy of Sciences (CAS), Chinese Academy of Social Sciences (CASS), National Climate Center, State Environmental Protection Administration (SEPA), Chinese Academy of Agricultural Sciences (CAAS), and Tsinghua University were invited to participate in the survey and writing of the report.

1.4 Structure of the Report

This report consists 4 chapters, among which the 1st chapter is the project background, the 2nd chapter is an introduction to methodology, and the 3rd chapter is a comprehensive and systematic review of current capacity building activities, obstacles, current status, demand for capacity building and focal areas, and the 4th chapter draws a conclusion of the report.

2 Methodologies

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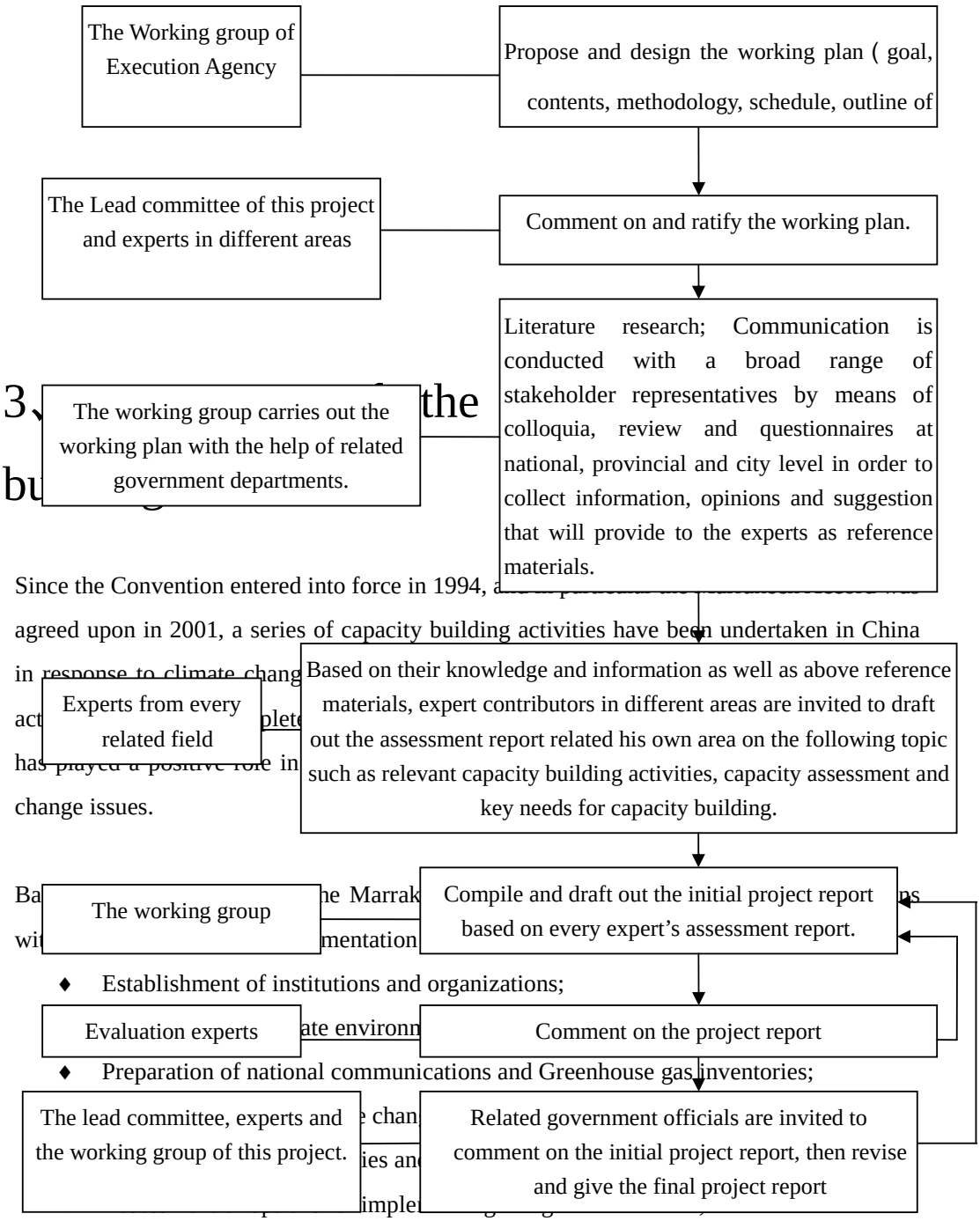
Figure 2.2.1 The Execution Flowchart of this project



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- Establishment of institutions and organizations;
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- Undertaking research and system observations;
- Promotion of technological development and transfer

- Development and implementation of CDM projects
- Education and awareness raising of the general public
- Construction and development of networking information systems

Considering the various areas and the results from interviews and investigations, this chapter first of all briefly introduces and summarizes capacity building activities undertaken in a specific area. Then an assessment is made of the capabilities in these areas for identification of barriers to capacity building. Finally, major needs and key areas are given for further capacity building activities.

3.1 Institutional and organizational capacity building

3.1.1 Relevant capacity building activities

Basic capacity building has been undertaken in the area of institutions and organization related to climate change in China. Participation in trainings sponsored by bilateral and multilateral organizations, such as UNFCCC Secretariat, World Bank and Asian Development Bank, has helped to build up and strengthen the capabilities of government officials, negotiators and researchers that are involved in climate change at central level. However, these activities do not touch upon climate change institutions. The scale and coverage of trainees are also rather limited. Therefore, there is only limited impact of these capacity building activities in China.

In the meantime, China has gradually established and improved its climate change administrative and management institutions for responding to climate change with self made efforts. A national climate change coordinating organization has been created. In 1990, the Chinese government established the National Climate Change Coordination Group (NCCCG), with Song Jian, the then State Councilor leading the Group. In 1998, NCCCG was renamed as the National Coordination Committee on Climate Change (NCCCC), with then State Development and Planning Commission as the leading organization. In 2003, NCCC was restructured, with the National Development and Reform Commission as the Committee leader and Ministry of Foreign Affairs, Ministry of Science and Technology, State Environment Protection Administration and China Meteorological Administration as deputy leader organizations. Since its establishment, NCCC has carried out a considerable amount of work on supervising China’s involvement in international negotiations on climate

change, and on making and coordinating policies and measures in response to climate change. With the making of the Rules for Responding and Addressing Climate Change and the opening of inter-ministerial communications, an initial coordinating mechanism has been established with participation by multiple ministries. In May 2004, China published its Interim Measures for Clean Development Mechanism Projects. The principle of “learning by doing” is well reflected in all these activities.

Of course, these institutions and organizations are rather weak in comparison with their counterparts in other countries, with respect to authority, manpower, routine budget that are required to take on the challenges and workload.

3.1.2 Capacity assessment

Institutional and organizational capacities are associated with the establishment and level of legislation, manpower and budget. Legislation refers to the making of laws, regulations and policies and their implementation. Manpower and budgetary issues include not only functional department and staff in the government hierarchy, but also institutions in the public service sector, such as research, education, and mass media. In addition, institutional factors are also related to social norms, such as culture, traditions, religion and ethics. As these issues are covered in other areas such as education and training, they are not included in this part of the assessment.

From a legal perspective, the commitments under UNFCCC and Kyoto Protocol are legally binding as China is a party to these international agreements. Although many laws and regulations in the areas of energy, forest, environment protection, water and other natural resources are indirectly linked to climate change issues, there have been no systematic laws, regulations and policy initiatives addressing climate change.

With respect to organizational structure, an office to serve as the secretariat of the National Committee on Coordination of Climate Change has been established within National Development and Reform Commission, with fixed staff and regular budget. In other relevant ministries, there are designated staff members responsible for climate change affairs, but they are in most cases not working full time on climate change. Climate change has not yet been on the priority agenda of many ministries.

Climate change research institutions have built up an elementary basis. They are located within research organizations under line ministries, national research academies, and universities. Regarding both administrative and research institutions, two outstanding features are worthwhile to note: (1) they are normally at national level with relatively rich resources and capacities; (2) they are largely concentrated in Beijing. Considering China's population size, sovereignty area and scale of the economy, it can be stated that institutional and organizational capabilities are in general at a relatively weak level in climate change areas. Overall assessment is given in table 3.1.1.

Table 3.1.1 Assessment of Institutional and organizational capabilities

	institutional	Organizations and manpower	
		organization	Coordination mechanism
Central government level	No climate change legislation; relevant laws on energy, environment, and natural resources, but with no stipulation on climate change; enforcement of relative laws is weak on climate change issues.	Interministerial coordination organization in existence, secretariat established, but with very limited staff numbers; few climate change divisions in relevant ministries, in most cases, no full time staff; implementation capacity weak.	Coordinating power relatively limited, some inactive.
Local government level	As above	No coordinating organization; no specific offices and staff members	none
Research, teaching and NGO	Most in national academies, research institutions under line ministries, key universities and NGOs; most located in Beijing only;	In existence, with limited number of organizations and staff; almost none outside Beijing.	Cooperation and exchange within Beijing, with no fixed mechanism, weak coordinating power.

Private sector	Companies for renewable energy development, energy efficiency; certification of energy saving, planning, no climate change measures.	No climate change professionals, no climate change division in company management	No civil societies for climate change established

3.1.3 Key needs for capacity building

With respect to institutional capacity building, major needs are as follows:

- Systematic translation, analysis, publication of international climate policies, in particular UNFCCC, Kyoto Protocol and related agreements. With all these efforts, Chinese decision makers will be able to read, understand and apply relevant international laws;
- Analysis, comparison and assessment of climate change related contents which can be either consistent or in conflict with climate policies, in existing laws, regulations and policies. In this way, relevant legislation and policies can be implemented accordingly.
- Indepth analysis and investigation of climate policy and legislation to mitigate and adapt climate change;
- Improvement of CDM implementing policy frameworks;

Regarding organizational capacity building, the following are assessed as the major capacity needs:

- Upgrading the status and functions of NCCCC; establishment of National CDM Administrative Office; Creation of national scientific advisory committee on climate change;
- Meeting the needs of officials in governments at provincial level and below; and management professionals in large companies and relevant organizations, for climate change information and management capabilities;
- Systematic training at a large scale so as to build up decision making capacity of relevant people. Sufficient training needs to be extended to relevant government officials and professionals in companies, teaching and research institutions in all the provinces;

There is also a need to strengthen the capacity for technical support systems. A number of

institutions are required to be established as major technical support units for personnel training, basic research in natural and social sciences, technological development and policy research. These technical support institutions will be distributed to different regions and sectors over the country as appropriate.

3.2 Creation and enhancement of enabling environment

3.2.1 Relevant capacity building activities

With regard to global climate protection, China has established a series of relevant policies and measures, of which some significant effects have been achieved. Some measures aiming to ensure the society mitigate and/or adapt to climate change have also been formulating. However, the system of both policies and ensuring measures is obviously to be further completed and strengthened, especially in terms of the implementing capacity. So far, few *ad hoc* capacity building activities on creating and strengthening the enabling environment have taken place in China.

3.2.2 Capacity assessment

The Chinese government sets high priority to the implementation of sustainable development strategy and acts actively on global climate change issues. From this point, it can be stated that there is a positive macro environment to carry out capacity building for creation and enhancement of enabling environment in China. However, results of the survey and interviews indicate obvious insufficiencies in the enabling environment in China, which are mainly reflected in the following aspects:

- There is no systematic planning on capacity building for climate change in China;
- There is a shortage of finance for R&D of capacity building, as well as for implementation of capacity building activities;
- There is no incentive policy system to promote capacity building;
- The expert ability for capacity building needs be improved very much, the initiative of public participation and enterprise involvement in capacity building need to be increased to a large extend.

That is, given the current status, improvement in various aspects in China is urgently required to formulate the enabling environment for climate change issues.

3.2.3 Key needs for capacity building

In accordance with reality, the creation and enhancement of enabling environment in China should focus on the following areas:

- Institutional demand: to establish a coordinating institution for planning, implementation, and management of climate change capacity building;
- Policy demand: to issue incentive policy to promote capacity building, strengthen the administrative motivation, market motivation and public awareness motivation for climate change capacity building;
- Technology demand: to design sound contents and effective activities for capacity building;
- Financial demand: to increase the financial inputs into the design, planning, and implementation of capacity building activities;
- Human resource demand: to establish and strengthen the expert and administrative team for climate change capacity building.

The major measures and approaches to meet the demands above mentioned are identified as following:

- to create and enhance the institutional environment to enable capacity building, within which a regulation system to enable capacity building is expected to be set up to fully increase the administrative ability of the government in capacity building;
- to create and enhance the policy environment to enable the capacity building, including to establish a national master plan of capacity building and its implementation strategy, to enact relevant incentive policy and mechanisms, etc.;
- to create and enhance the financial supporting environment to enable capacity building, e.g., to create and enhance international cooperation channels, to ensure enough financial input for capacity building, to attract private capital's input, etc.;
- to create and enhance the enabling environment on an information service platform covering a series of communication approaches and tools such as related database, website, magazine, newsletter, etc. to promote information sharing;
- to create and enhance the enabling environment on human resource capacity, which aims to establish an expert network specifically for capacity building; increase climate protection awareness of various stakeholders including public, enterprise,

and government, and so on.

3.3 China's Initial National Communication on Climate change and Its National Greenhouse Gas Inventory

3.3.1 Relevant capacity building activities

There are three major activities on capacity building related to the Initial National Communication on Climate Change.

- Enabling China to prepare its Initial National Communication. The project budget is US$ 3.5 million, provided by GEF. The project implementation duration is June 2001 to December 2004. The project implementation agency is the National Development and Reform Commission (NDRC) on behalf of Government of China. The Office of the National Coordination Committee on Climate Change established a Project Management Office in charge of the project administration. Hundreds of scientific organizations and more than four hundred experts were involved in this project, including contracted institutes for the national GHG inventory, namely the Energy Research Institute (ERI) of NDRC, Institute of Atmospheric Physics (IAP) of Chinese Academy of Sciences, Agrometeorology Institute of Chinese Academy of Agricultural Sciences, Forest Ecology & Environment Institute (FEEI) of Chinese Academy of Forestry, and Center for Climate Impact Research (CCIR) of Chinese Research Academy of Environmental Sciences. This project enhanced China's capacity to develop its national GHG inventory.
- Targeted Research Related to Climate Change. GEF funded US$ 1.5 million for this project. According to the schedule, this project began on June 2002 and will end in June 2005. This project aims to build up China's capacity to develop its GHG inventory and upgrade its national communication on climate change. About one hundred experts from several dozens of authorities and research institutes have been engaged in this project.
- The Canada-China Cooperation on Climate Change Project - the special project for capacity building related to national communication. This project was funded by the Canadian International Development Agency (CIDA). The main objective of this project was to support China's ongoing national communication activities and

to help Chinese experts enhance and build capacity to settle problems around data management and developing forecasting tools. This project introduced Canadian techniques, tools, models, lessons and experiences related to climate change to Chinese experts through extensive study tours, workshops, regular fora and cooperative research.

In addition to the above projects, since 1992, the Government of China and its relevant research institutes have carried out many international cooperation research projects on climate change in the form of bilateral or multilateral cooperation. With respect to GHG estimation, all these projects have simply or deeply discussed and assessed China's GHG emissions from various sectors. Specific examples of these projects included " Response Strategy on Global Climate Change in China" funded by the Asian Development Bank, "China: Issues and Options in GHG Control" funded by UNDP & GEF, "China Climate Change Country Study" funded by U.S. Department of Energy, and "Asian Least-cost Greenhouse Gas Abatement Strategy" funded by ADB, etc.

3.3.2 Capacity assessment

Capacities to develop the national communication (NC) on climate change are defined in the following three levels:

- Systemic ability: denoting the ability of the whole system framed by all the stakeholders involved in national communication activities to finish the NC report
- Institutional ability: denoting the ability of the institutes engaged in the NC activities to organize, cooperate and ensure the quality of the NC report.
- Individual ability: denoting the ability of individuals engaged in the NC activities to collect data, analyze existing information, report writing, and calculate the uncertainty.

Specific criteria for capacity assessment are preliminarily designed as follows:

- Criteria on system ability: the ability to establish a database system and manage the data and information
- Criteria on institute ability: organizing and cooperating ability, quality assurance ability
- Individual ability: data-collecting ability, information analysis & synthesis ability, writing ability, uncertainty calculation ability

In reference to China's Initial National Communication on Climate Change to the United Nations Framework Convention on Climate Change, and based on the questions and difficulties encountered in the course of developing the initial national communication, a self assessment was made using the above criterion and it was judged that China now already has the basic capacity to develop the national communication on climate change.

If comparing China's capacity in the three level abilities of system, institute and individual, it was agreed that the institutional ability is a little stronger than individual ability and system ability. And judged from the contents of the initial NC report, China is still a little weak at vulnerability assessment and adaptation capacity. Current deficiencies in national communication mainly include imperfect existing statistical system, weak ability to control the quality of NC report and the GHG inventory, and poor individual report-composing ability and uncertainty calculation ability.

3.3.3 Key needs for capacity building

In view of the preliminary assessment, focus needs for capacity building related to national communication on climate change mainly include the following respects:

- Focus needs for capacity building related to the contents of the NC report are: vulnerability assessment and adaptation capacity, as well as education, training and public awareness;
- Focus needs for capacity building related to the three levels of abilities are: system ability and individual ability;
- Focus needs for capacity building related to specific assessment criteria are: system ability on data management and database system, individual ability on information analysis and synthesis, and institutional ability on quality assurance.

It is recommended to take the following measures and activities to close the capacity gap:

- Upgrading the existing statistical system and enhancing its supporting capacity to meet the data demands of the national communication. Firstly the existing energy statistical system and indexes should be upgraded and improved. Secondly, some important indexes such as forest resources that have close relationship with the NC report should be incorporated into the national statistical system.
- Accelerating emission factors testing and measurement to better reflect China's

specific conditions. Extensive efforts will be needed to obtain China's specific emission factors, and capacity building related to emission factors testing is very urgent as China is still weak in this respect.

- Strengthening research on inventory quality control and vulnerability assessment and adaptation, which will contribute to the scientific quality of the NC report. In order to reduce the uncertainty of assessment, global climate change models and their simulating results should be modified to reflect Chinese regional features. China should develop its own regional climate change models and impact assessment models. The imported models should be thoroughly verified and modified before application.
- Strengthening the training of the research workers engaged in the national communication activities to boost up their professional qualification and standards. As UNFCCC revises its Guidelines for the preparation of national communications from Parties not included in Annex I to the Convention and IPCC revises the guidelines for national GHG inventories, China will carry on and upgrade its national communication, which demands NC researchers to have higher qualification to fulfill this job and appeals for developed countries' financial aid and technical support to help Chinese NC researchers to improve their technical level and ability through extensive training and academic exchanges.
- Carrying on studies on inventory data collection and management system to improve the management of national GHG inventory. For the effective inventory data and information management, China should strengthen relevant capacity building and accelerate the development of a national GHG inventory database management system to meet the demand of inventory data analysis and quality control.

3.4 National climate change programme

3.4.1 Relevant capacity building activities

Up to now, various activities of capacity building related to national climate change programme has been done in China, including:

- Capacity building for the preparation of the initial national communication on climate change. Through the preparation of the initial national communication, the Chinese government has gained a more systematic understanding on the climate

change related national circumstances, inventory of greenhouse gas emission sources and sinks, policies and measures for mitigation and adaptation, and other basic information for the national programme. All these efforts laid down a base for the development of the national programme and the relevant policies and measures.

- Research project for the outlines of national climate change strategy. This project is supported by the Norwegian government through UNDP. Preliminary outlines of national climate change strategy have been established through this research project, which will be a good reference for the preparation of the national climate change programme.

3.4.2 Capacity assessment

The capacity of preparing and implementing the national climate change programme can be examined qualitatively or quantitatively through capacity in the following aspects:

- Timely develop, implement, update, propagate and popularize the national climate change strategy or programme;
- Develop and implement specific programmes in energy, transportation, industry, agriculture, forestry, waste management and other sectors and promote technology transfer and cooperation on R&D activities;
- Project future greenhouse gas emissions;
- Integrated assessment on the effects of domestic policies and measures for climate change mitigation and adaptation;
- Analyze the impacts of international actions responding to climate change on the national climate change programme;
- Harmonize and coordinate policies and measures for climate change by putting them under the framework of social economic development.

Although several capacity building projects have been implemented, there are still big gaps to meet the requirement of preparing the national programme as these projects addressed some aspects but none of them could do a systematic and thorough summary for the domestic effort. In order to develop the national programme, international financial support is urgently needed. Besides, the experiences of preparing national climate change programs from foreign countries can be used as a reference for China.

Meanwhile, climate change is a global issue. For this aspect, China is lacking of global

models that are capable of analyzing the impacts policies and measures from major countries or major groups of countries on its domestic policies. Strengthening the capacity in this area is a prerequisite to meet the requirement of supporting the relevant decision-making processes of the national government.

Through our investigations, major difficulties in this field are listed as the followings:

- Shortage of funds: China is a country with huge population and big variation across its sub-regions in the levels of social economic development and technology development. China is facing big challenges in developing the national programme and action plan. Without sufficient financial and technical support, we cannot manage the development of a national programme with high quality in its systematic coverage and characteristic as guidelines.
- Insufficient capacity of science and technology to support the development and implementation of the national programme: when facing the specific national circumstances of socio-economic, technology development and ecological and environmental aspects, China will encounter more difficulties.

In a word, China has a certain base of capacity in this field. However, this capacity is still weak and it cannot fully meet the need of policy-making processes. More intensified capacity building is required, especially the capacity to assess the effects of implementing the policies and measures.

3.4.3 Key needs for capacity building

Based on the analysis, key areas of capacity building for national climate change programme including the followings:

- Systemic capacity: strengthen scientific knowledge on climate change mitigation and adaptation; establish coordination mechanism to respond to climate change under the framework of sustainable development, aiming at the inclusion of climate change aspects in the social economic development policies and plans at various levels and in various areas;
- Institutional capacity: improve the level of research of major domestic research institutions; improve the capacity of providing technical support to policy-making processes; improve the capability of scientific policy-making and effective participation in global climate change negotiations and international cooperation on

climate change from major domestic organizations of climate change policy-making;

- Individual capacity: improve public awareness on climate change and encourage their voluntary activities; improve Chinese scientists' ability to participate in relevant IPCC assessment activities.

Accordingly, the needs for capacity building (gaps between current capacity and targeted capacity) focused on the following key points:

- Use international experiences of developing national climate change programme as reference;
- Improve the capacity of integrated assessment of global and domestic climate change policies and measures. Strengthening scientific research capacity in these areas is a must to realizing scientific policy-making;
- Intensify capacity for scientific policy-making. The capacity improvement of scientific policy-making by relevant government organizations is of great importance to harmonize climate change response with social economic development plans, which is a practical way out of responding to climate change under the framework climate change.

In responding to these needs, we suggest the following measures and pathways towards a solution:

- Solving of funding issue largely depends on actively seeking opportunities of international cooperation, where multilateral cooperation is preferred, to solve the present urgent need of financial and technical support for the national climate change programme;
- Learn from international experiences, actively seeking international cooperation with research organizations with advanced level in climate change policy assessment, improve the capacity of assessing the impacts of climate change policies and measures on social economic development;
- Actively implement capacity building activities with various approaches and at different levels to further improve China's capacity of developing and implementing the national climate change programme.

3.5 Vulnerability and Adaptation (V&A)

3.5.1 Relevant capacity building activities

In the aspect of assessments on vulnerability and adaptation, the following activities have been done for capacity building in China:

National Scientific and Technological Planning Research Program: *Assessments on Impacts of, and Adaptation to Climate Change*. This program is funded with 3,500,000 RMB during 2001~2005. Organized by *Ministry of Science and Technology (MOST)*, this program has been focusing on assessing the crucial impacts of climate change on key economic sectors in China, as well as the different and crucial vulnerabilities due to their exposure and sensitivity to climate change;

China-UK Collaborative Project: *Investigating the impacts of climate change on Chinese agriculture*. This project is funded by UK *Department of Environment, Food, and Rural Affairs (DEFRA)* with £300,000 in 2001~2004. The project is undertaken by *Agrometeorology Institute (AMI), Chinese Academy of Agricultural Sciences (CAAS), Institute of Quantitative and Technical Economics, Chinese Academy of Social Sciences*, and *College of Resources and Environment, China Agricultural University* under the organization of MOST. Through the collaboration with the Hadley Centre for Climate Prediction and Research, Cranfield University, fruitful results havebeen obtained in future climate change projection under SRES scenarios, simulation on impacts of climate change on Chinese agriculture, future socio-economic scenarios, land use change scenarios, as well as integrated impacts assessments and adaptation options in China, the capacity is enhanced for quantitative assessments on projecting climate change impacts on Chinese agriculture.

China-Canada Collaborative Project: *Vulnerability and adaptation to climate change impacts*. This project is funded with C$300,000 in 2002~2004. The project is organized by *Office of the National Coordination Committee for Climate Change (ONCCCC), National Development and Reform Commission for China (NDRC)*, and undertaken by *AMI, CAAS*, and *National Climate Center (NCC)*, etc. Obvious improvements have been obtained in analyses on sensitivity and impacts, extreme events, vulnerability, and adaptive capacity, the mapping on vulnerable regions, meanwhile, knowledge and understanding on impacts of, V&A to climate change have been

increased for policy-makers in national-level and provincial-level in several provinces.

3.5.2 Capacity assessment

The historic, present, and future climate change impacts assessments are included in the assessments on vulnerability and adaptation. Monitoring is the basis of the observed impacts assessments, while modeling is the basis for future impacts assessments.

On the assessment: the assessment on future climate change impacts is still at the initial stage, the necessary methodologies for assessments were known by national and regional (provincial) academic institutions and some of the colleges and universities via implementing National Scientific and Technological Planning Research Programs, some of the simulation models used are self-developed, but the models are mainly introduced abroad or modified according to China's circumstances after introduction. In addition, little research has been done on assessments on impacts of and vulnerability to climate change of some of the important areas, such as human health, finance and insurance, even the assessments done for these areas are still preliminary, and still face a lot of uncertainties.

On the vulnerability assessment: assessments on crop yield variation and vulnerability mapping over a few sectors, e.g., agriculture, had been done by Chinese scientists combined with the climate change projections. But there is still lack of the integrated assessment on climate change impacts for ecology, resources, environment, as well as society, and the economy.

On the assessment of adaptation: there is still lack of assessment on adaptation options to climate change, therefore, the policy-makers have less understanding for the roles of adaptation options to mitigate the adverse impacts of climate change, cost of the adaptation options and the consequence to society, therefore it is hard to take effective measures to cope with the negative impacts of climate change.

3.5.3 Key needs for capacity building

When assessing the vulnerability and adaptation, we believe that the following aspects should be reinforced in China:

To strengthen the capacity for understanding and assessing the impacts of climate change, it is

needed:- to strengthen the research and application in regional-level, to enhance the research on the cross-sector impacts and cross-sector, to try to identify the impacts of climatic factors from non-climatic factors, to increase the assessments on the impacts of extreme events and coping measures, to increase the combination of impacts assessment models and policy-making techniques, therefore provide technical support to policy-makers for policy-making;

To strengthen and complete the monitoring and analyses on already occurred climate change impacts, to identify the impacts of climate change from the other factors; to introduce and develop the impacts assessment models with international comparability and suitable to China's circumstance, to continuously improve the capacity of the assessment on the future climate change impacts and reduce uncertainties;

To strengthen the capacity to implement the adaptive measures to climate change, especially to involve in implementing the following specific adaptive measures to climate change, to carry out relevant capacity building activities in planning, organization, talents, technological development and application, as well as risk management: to adjust the farming pattern and alter the crop varieties and strains in a planned way to strengthen the capacity to adapt to climate change in agriculture; to promote forestation in multi-forest, multi-tree, multi-form, and multi-level fashion to strengthen the management for present forest and heighten the quality of present forest to increase the capacity to adapt to climate change for forestry, to strengthen the construction of infrastructure for preventing floods, combating droughts, and supplying water; to strengthen the protection of sea and oceans, resources of coastal zones, and comprehensive management and capacity for disaster forecasting and warning, to enhance prevention of coastal zones and the adaptive capacity to climate change.

To meet the needs for the above-listed capacity building, we suggest that the work should be done widely and deeply in the following aspects:

To make serious plans for adaptive options for agriculture, forestry, water resources, coastal zones, and environment protection, etc., to select the 'non-regret' options and measures positive to adapt to climate change and improve economic development, and incorporate them into long-term planning for national economy and social development, to ensure China's long-term food security and ecological environment security;

To incorporate the scientific research, technical development, and construction of infrastructure

on adaptation to climate change into various national scientific and technological development programming and planning, to form a comprehensive scientific and technological supporting system to cope with climate change and implement *United Nations Framework Convention on Climate Change (UNFCCC)*;

To establish relatively steady financial ways for implementing the measures to adapt to climate change, especially accumulate funds from multi-lateral sources, to attract various kinds of foreign funds from foreign governments, international organizations, and international financial setups, to find effective cooperation mechanism for international funding, to encourage foreign and domestic private investors to be actively involved, and to raise the management level and efficiency of using foreign funds;

To strengthen international collaboration, and continue to obtain the support from GEF for target research to improve understanding of vulnerability and adaptation to climate change in China, to improve and complete the contents in the follow-up *National Communication* concerning the vulnerability and adaptation, to implement China-UK, China-Canada, China-Australia bilateral collaborative projects on China's vulnerability and adaptation to climate change.

3.6 Mitigation Policy Option Assessment

3.6.1 Relevant capacity building activities

Some research organization in China have undertaken various several studies on mitigation policy assessment with support international and domestic organizations, some achievements were reported. So far major research projects include:

- "Tenth-Five Year Plan" Key Research Project, supported by Ministry of Science and Technology(MOST). Project topic is "Global Environment Change Policy and Technology Study". This project focuses on fundamental science and mechanisms of global environment problems including global climate change, biodiversity and ozone depletion, analyze future global and domestic trend. Assessment of various impact of policies and strategies on social economy development, and important topics for international negotiation were also included. This project supported national strategy making for adaptation and mitigation of global environment change.

- Energy Research Institute (ERI) collaborated with Pacific Northwest National Laboratory (PNNL) on GHG mitigation policy assessment in China by developing SGM model for China. PNNL provide financial support with US$50,000 for this study. This project established a model database for China, the model was revised from source code to match the situation in China and made SGM models for China to be one of component of a modeling framework name Integrated Policy Assessment model for China (IPAC) developed in ERI.
- ERI collaborated with the National Institute for Environment Studies (NIES) of Japan to work on GHG mitigation technology assessment for China. This collaboration started from 1994 and continuing. After 2000, NIES provided more than 20million JPY to support this study. AIM/endues model developed by NIES was constructed for China and be renamed as IPAC-AIM/technology model, also to be one component of the IPAC modeling framework.
- ERI collaborated with the Indian Management Institute (IMI) and, Asian Institute of Technology (AIT) on the research project of Integrated Model Development in Developing Countries". This study started from 2003 and will be finished by 2006, with financial support of US$300,000 from APN. The major objectives are to develop integrated assessment model for developing countries and support international research activities.

3.6.2 Capacity assessment

In China the study for policy assessment on mitigation options already exists. However in some aspects the ability of assessment of mitigation policy options is still week, mainly on:

- Mitigation policy options for non-energy sector. There are relative few studies and needs far more research.
- Study of impact of mitigation options on economy. Many studies now focus on the technology and policy option itself, rather than integrated assessment by including social economic factors.
- Assessment for policy options under global mitigation target. So far many studies in China focus on domestic issues, not much on the global scale. There is very lack of methodology, data and financial support.
- Assessment for global response mechanisms. In China the study for global or regional collaboration mechanism is still very weak, and needs more participation.
- Modeling development ability, especially global model development and

application. This is a common problem for developing countries and recognized by IPCC. Much more effort should be put in this area to reduce the gap.

3.6.3 Key needs for capacity building

Objectives: In the area of research capacity building on assessment for mitigation policy options, the main objective is to make an in-depth study on policy options and strategy to response to climate change for China to support domestic policy making process; the long-term objective is to increase the ability for policy assessment over a wide area to reach the same level of international research association.

Countermeasures for capacity building include: i) further international research collaboration to look for financial support and research methodology; ii) More funding for domestic research to make more effort on domestic relative studies. Put climate change policy study into national research program and support the study in to the national five year key research program, also include in other domestic foundation programs such as research foundation of Chinese Academy of Science and Natural Science Fund etc. iii) more support from government ministries or local government for policy oriented research, to support policy making processes.

Possible barriers and countermeasure: i) Major barriers for assessment on mitigation policy options capacity building include funding and methodology for research projects. As a developing country, there is difficulty to provide large amounts of funds to support climate change policy research in China, it is therefore hard to make further in-depth studies. We need much more effort to catch up with developed countries, especially for modeling studies which need large amounts of investment,. ii) Major measures include to further enhance and promote international collaboration, enlarge domestic input, to establish active research groups, and in the meantime make efforts for education in universities for future research resources.

3.7 Research and Systematic Observation

A basic prerequisite for effective response to the climate change issue is to reduce or eliminate the uncertainties existing in regional climate change. Promoting the systematic observation of the climate system and developing the climate database, having a comprehensive and systematic understanding of the different spheres of climate system and their interactions through a robust systematic climate observation network, constitute a foundation for promoting the research on

climate change, choosing the response strategy to climate change and assessing the effects of adaptation and/or mitigation. These capacity building activities are also required by the UNFCCC of the parties.

3.7.1 Relevant capacity building activities

The capacity building activities in research and systematic observation mainly include:

- Scientific research on climate change got started early in China. Since the mid-1980s, Chinese scientists have taken part in major international research programs on climate change, such as the IGBP and WCRP and, to a certain extent, in the preparation of the IPCC scientific assessment reports. Some research activities were undertaken on the reconstruction of historical global and regional climate, detection of regional climate change, projection of future climate change and climate system modeling is underway;
- Since the 1980s, assessments have been made of various aspects of the climate change, including the China Climate Change Country Study, Impact of Climate Change on The Ecological Environmental And Human Health And Adaptation Strategies, Assessment on The Environment Evolution In Western China. The National Climate Change Assessment is under preparation.
- An Outline of National Climate Programme of China was developed by the China National Climate Committee in 2002.
- The International Symposium on Climate Change (ISCC) was held in China in 2003.

The capacity building activities in the systematic observation mainly include:

- There are various types of observation networks related to the climate observation in China, covering atmosphere, ocean, hydrology, cryosphere, terrestrial ecology etc. Those networks are organized and operated by various institutions such as the meteorology, ocean, water, environmental protection, agriculture, forestry and Chinese Academy of Sciences. The data collection, storage and maintenance are processed in different systems. Their staffs are also trained separately in different institutions.
- The Climate Observation Program in China was developed under the auspices of the Chinese GCOS Committee in 2002, which brought up a preliminary common framework for the climate monitoring networks.

3.7.2 Capacity assessment

(i) Research:

The questionnaires show that relevant research has played a positive role in raising the awareness of the government on the climate change. However, those researches are undertaken in the context of a single discipline and are unable to meet the requirements of the climate change response strategy for the convergence of disciplines. There is no unified long-term plan or sufficient funds for the research projects. They do not cover cutting-edge research issues, such as the biological geochemistry and the climatic effect of aerosols. The scientific questions of climate change are not well linked to the socio-economy and sustainable development. Low-level redundancies exist in the research process. The research outputs are not integrated well with the government's policy-making process on the response strategy for climate change.

China has a vast area with varied landforms. The different geographical characteristics and landforms reflect the interaction between different spheres and their effects, posing difficulties to the observation of climate system and the research on climate change. Moreover, the environmental changes caused by the increasing human activities and socio-economic development are also disrupting the processes in land—hydrology—atmosphere and their interactions in China, which makes this issue much more complicated. There are still a lot of uncertainties in the interactive process among different spheres and the impact of their changes on the regional environment and climate change in East Asia and the world. Both the integrated multi-sphere physical model for the land-atmosphere process on different landforms and its afore-mentioned parameterization are indeed theoretical difficulties and technical "bottlenecks" in the current climate change research.

The climate change research is now undertaken by different institutions in China. A high-level climate change research team mainly composed of young scientists has not been set up yet. Few innovative scientific findings have been brought up by the Chinese scientists and fewer research findings are well known in the world. The citation intensity of these findings is very low. Only a small number of experienced young scientists are capable enough to participate in major international scientific research programs.

(ii) Systematic observation:

A number of meteorological observation and remote sensing systems and agrometeorological

monitoring systems have been established in China. However, the observation and data collection in the fields of atmosphere, ocean, ecology and etc. related to the climate observation are now undertaken separately by the institutions in meteorology, ocean, water, environmental protection, agriculture, academia and etc. The elements and methodologies of the observations are established and operated out of the needs of their own sectors and disciplines and thus there is no unified design that can fully meet the needs of climate system observation.

Almost every observing network has the following problems in varying degrees. The layout is improper; there are no standardized data collection instruments and common observation practices; the observing elements do not meet the needs for climate system monitoring, prediction and research; the data processing is not well standardized; and there is an absence of any data-sharing mechanism.

The variables on the interaction among different spheres are not covered in the current observations, which are important for studying and understanding the climate change. There are few observations in the key areas that are seriously affected by the climate change or observations on the distinctive landforms such as the land-atmosphere, ecosystem-atmosphere, human activities and environment-atmosphere process etc. Therefore, the research on and assessment of climate change, to some extent, are hindered from further development, especially the improvement of the climate disaster prediction models.

Although the capability in weather observation and management has been found in China, there is a lack of cooperation and coordination among the observation systems sponsored by different institutions. The communication among different institutions on the climate change is not smooth. Therefore, a department should be designated for coordination in order to establish an effective communication mechanism. Generally speaking, the competence of those staff engaged in the climate observation should be further enhanced.

3.7.3 Key needs for capacity building

(i) Research:

As can be seen from the above analysis, climate change research in China remains at an elementary stage. At this stage, the first priority is to develop an overall design and plan for the climate change research and to propose the priority research areas taking into account the implementation of the UNFCCC commitments and the research needs required by the Chinese

government in this connection; the fragmented research resources should be integrated in order to improve the overall capability on the climate change research in China.

By using the integrated climate change prediction and impact assessment models, impact assessment and adaptation strategies could be prepared for the areas and industries that are vulnerable to climate change; scientific advices could be provided to the government for reducing the uncertainties in the economic development planning, large projects, regional development, preparation of environmental protection policies, ecosystem reconstruction etc. This will help with the Chinese government in incorporating the research results on climate change in the relevant policy making process. At present, relevant research outputs remain at an elementary stage and play a very limited role in the government's policy making process. Training of relevant technical staffs and studies and application of methodologies will contribute to the improvement of capabilities on climate change.

The young Chinese scientists are seriously expected to improve their capabilities in participating in the international scientific cooperation programs as well as the international scientific assessment activities such as IPCC; keep informed of the progress in the world sciences related to climate change; indicate the research needs on climate change in China; accumulate experience of participating in the international exchanges; reduce the incapabilities in participating in the relevant international activities on climate change.

(ii) Systematic observation:

The decentralized and non-unified climate related systems in terms of establishment and management are a big obstacle for China to effectively collect the relevant data on the climate system and systematically apply them to the scientific research and response strategies in this regard.

There is an urgent need to take a census of the climate observation networks sponsored by different institutions, to make an assessment of the coverage of the regional climate monitoring and the integrity of the observing elements, to carry out studies and simulations on how to develop a scientific layout for the climate observation networks in China. This is a fundamental task for the systematic climate observation in China.

Due to the fragmented management of the observation networks, an effective data-sharing

platform for the observation data of the climate system in China, which is easy of access by the relevant climate change researchers and institutions, has not been established. This has greatly restricted the overall benefits of the data resources and hindered the scientific communities and scientists from expanding their research on climate change. In this regard, an important aspect for the capacity building in the systematic climate observation in China is to study and investigate the data sharing mechanism and format on the climate data in order to keep the Chinese data consistent with those of the global climate observation system.

In summary, the climate observation infrastructures in China are still not advanced. Manned observations are mainly adopted in most regions. Basic observations in some remote and essential areas, such as the Tibetan Plateau, are quite inadequate. Technological transfer is seriously expected on the telemetry, remote sensing, automatic monitoring instruments and technologies as well as on the atmospheric background and atmospheric chemical composition. Improving the competence of the relevant staff is also a pressing need.

3.8 Technology development and transfer

3.8.1 Relevant capacity building activities

China has carried out a series of preliminary capacity building activities for policy practice in technology development and transfer field. These activities are centered on the legislation for promoting technology introduction, policy coordination, investment environment improvement and intellectual property protection etc. The Tentative Regulation on Directing Foreign Investment and the Guiding Catalogue for Foreign Investment Industry are the direct policy toward foreign investment in China and technology introduction.

The central and local governments have made a series of efforts to improve the environment for foreign direct investment and management of technology transfer, including safeguard the operational and management rights of foreign investor; protect the legal rights of the stakeholders; improve and consolidate the implementation of intellectual property protection regulations; increase working efficiency and reduce management procedures; improve and simplify approval procedures for foreign investment projects; accelerate the establishment of unified, open and competitive market; break the local barriers and sector monopolies and grant the national treatment to foreign investment enterprises gradually.

In order to support the Convention negotiations, the People's University and Energy Research Institute have collected and followed the relevant information and development on international technology transfer. Some issues have been studied to increase the understanding of the field.

As for technology development and transfer capacity building, some relevant international cooperation projects have been implemented such as the China Climate Change Country Study, carried out by the Ministry of Science and Technology in China and Department of Energy of the US. The project provides preliminary assessment and analysis of greenhouse gas emission reduction technologies and accumulates useful experience and information for technology need assessment. NREL and State Planning Commission etc. have been cooperating under the TCAP framework and providing useful experience on technology demand assessment methodology application, collection of special technology information and development of potential technology transfer projects.

3.8.2 Capacity assessment

It is fair to say that China has certain capacity in the aspects of macro technology demand assessment, awareness of technology transfer and expert quality. The more urgent need is the demand for technology itself. However, capacities in the areas of systematic assessment for certain sectors and technology, technology and information dissemination, development of technology transfer projects and foreign and domestic financing are weak and lack general planning and coordination. The continuity of technology transfer projects is not strong.

The barriers in implementing technology transfer capacity building activities are likely:

- Due to the slow progress of international technology transfer negotiations, technology transfer capacity building activities may not occur;
- The lack of support from the government, such as lack of policy and funding will create difficulty for preparing the capacity building activities.

3.8.3 Key needs for capacity building

According to the definition of technology transfer, its capacity building should cover the various activities ranging from institutional, organizational (including enterprises) and individuals levels. The main contents are: the identification and evaluation of environmentally friendly technology; technology information acquisition and dissemination; soft and hard technology information

need and acquisition; establishment of technology information channel; technology transfer barrier analysis and countermeasure formulation; technology exchanges and cooperation; technology research and development; technology demonstration; technology digestion and absorption; technology improvement and duplication; skills in the adaptation, installation, operation and maintenance of environmentally friendly technologies; institutional establishment; personnel, knowledge and capacity training and formulation of standards and mechanisms.

Based on the above definition and analysis, the critical needs for capacity building in technology transfer field are the following:

- Capacity in the identification and evaluation of transferred technology;
- Capacity in acquiring soft and hard technology information;
- Capacity in overcoming technology transfer barriers;
- Capacity in technology exchanges, cooperation, research and development, demonstration, digestion and absorption, improvement and duplication;
- Capacity in human resource development, knowledge and technical training and dissemination;
- Capacity in financing and mechanisms in technology transfer project development.

To meet these needs, the proposed measures are:

- Policy support from relevant government bodies;
- International cooperation and exchanges at various levels;
- Formulation of human resource development and personnel training plans;
- Establish technology transfer information centers;
- Establish national technology transfer management center;
- Establish leading institution to coordinate technology transfer matters and provide necessary funding.

3.9 Clean Development Mechanism

3.9.1 Relevant Capacity Building Activities

Since 2001, some activities with the aim of building CDM capacity have been implemented in China under the financial support of the Chinese Government as well as several foreign governments and international organizations. These include:

- Formulating and putting into effect *Interim Measures for Operation and Management of Clean Development Mechanism Projects in China*, establishing domestic CDM project approval mechanism, and thus providing a platform for CDM project application by domestic enterprises;
- Conducting CDM theoretical and case studies, with close cooperation between domestic and foreign organizations. Relevant projects include: *China CDM Study* supported by the German Government, the Swiss Government and the World Bank, *Opportunities for the CDM in China's Energy Sector* supported by the Asian Development Bank, *China-Canada Cooperation on Climate Change* supported by Canadian International Development Agency, *Building Capacity for the CDM in China* supported by UNDP, UNF, the Italian Government and the Norwegian Government, *Canada-China Pilot Project: Local CDM Capacity Building* supported Canadian Department of Foreign Affairs and International Trade, as well as many others supported by the Chinese Government. Those activities are mainly aimed at such aspects as CDM regime, international rules and methodologies, etc., and have played a crucial role in promoting the understanding of CDM by major stakeholders in China.

3.9.2 Capacity assessment

The main criterion for the assessment of current capacity is that relevant organizations and people should have the capacity to ensure the effective identification, development, implementation and management of CDM projects in China.

To be more specific, the government should formulate reasonable, efficient, transparent and fair CDM policy, establish high-efficiency management system, and the policy makers should have keen and precise understanding of CDM; relevant technical supporting organizations should possess sufficient expertise, thus could provide high-quality technical service to project developers; enterprises should have comprehensive understanding of the CDM rules, benefits and risks associated with CDM; the financial sector has deep understanding of the CDM and thus could provide necessary financial services to project developers; the media and the public have basic understanding of the CDM, and could thus participate actively in the evaluation of potential CDM projects and support eligible ones; and other relevant organizations have necessary CDM capacity consistent with their functions.

Currently, Chinese policy makers in charge of the climate change issue have rather deep understanding of the CDM and have already formulated China's interim CDM rules, but those in charge of the industry and the energy issue have very limited understanding of the CDM. A symposium was conducted in Inner Mongolia Autonomous Region with participants from the regional and local governments as well as the industrial enterprises, and it was found that even in such an area with many energy-intensive industries, the officials from the regional government who are in charge of the industry and the energy issue know little about the CDM, not to mention the use of CDM to improve the energy efficiency in the region's industries and thus to promote local sustainable development.

In the questionnaire designed specifically for this project, one question is about the main barrier for fulfilling China's obligations under the United Nations Framework Convention on Climate Change. "Lack of financial resources" is seen as the main barrier, accounting for 38.8% of the total responses. However, in a following question which is "what kinds of financial resources could be utilized to deal with climate change", no one has mentioned CDM as a possible financial channel. In China, only a very limited number of experts and enterprises have very good understanding of CDM, some enterprises still doubt the value of participating in CDM cooperation due to lack of understanding and some with large emission reduction potential are not very active towards CDM. The financial sector lacks knowledge about CDM and thus cannot provide necessary financial services to CDM project developers. No organization in China has so far applied for operational entity, and the number of qualified experts that could help enterprises to develop CDM projects is still very limited. The public and the media have little understanding of the CDM. Currently, one can get access to the China CDM Website through a direct link on the China Climate Change Website. From a questionnaire survey, it was found that only 25% of the interviewees are familiar with or know the China Climate Change Website.

In brief, what has been done by now is very preliminary, both the expertise necessary for developing, implementing and managing CDM projects, and the knowledge about the CDM of the public is very limited, considering the significant CDM project potential in China as well as the wide distribution of these projects in different areas and sectors.

3.9.3 Key needs for capacity building

It can be concluded from the study that the urgent CDM capacity building needs are mainly concentrated in the following aspects:

- Promote and support the application of operational entity by Chinese organizations and support their future operation, thus improving the technical service capacity regarding CDM of Chinese organizations;
- Train policy makers in charge of industry and energy issues at various levels, with the main focus on basic concept of CDM and possible benefits of developing CDM projects, and consider the possible integration of CDM project development and relevant programs of these governmental agencies;
- Enlarge domestic CDM experts teams, especially eligible expert teams at the provincial level, and establish provincial level CDM expert networks, through more local CDM capacity building activities, with the experiences gained from relevant past activities taken fully into consideration;
- Train representatives from industries with significant emission reduction potential, identify a large number of potential CDM projects and promote participation in CDM of enterprises through some successful cases;
- Provide legal, technical and financial assistance to Chinese organizations applying for operational entity and support their applications, thus hopefully reducing the transaction costs of developing CDM projects and promoting CDM project development in China;
- Promote direct contact and cooperation between domestic enterprises and foreign investors through various means and channels;
- Develop a national database for potential CDM projects, thus reducing project searching and identification costs for international investors;
- Strengthen public awareness of CDM and obtain their support to CDM project development.

In conclusion, CDM capacity building activities in the next phase should aim mainly at speeding up the development of specific CDM projects, not methodological or policy study. Furthermore, sufficient financial resources should be provided to these activities, considering the risks associated with CDM project development. Risks of domestic enterprises in developing CDM projects could be reduced by various means such as providing them with funds for the feasibility studies of CDM projects.

3.10 Education, Training and Public Awareness

3.10.1 Relevant Capacity Building Activities

Centring on climate change, those educational and outreaching activities carried out in China include:

- Research on *The National Strategy on Climate Change Awareness and Outreaching*: From 2002 through 2003 the Office of National Coordination Committee on Climate Change has organized experts in compiling *The National Strategy on Climate Change Awareness and Outreaching*. *The Strategy* defines goals and guidelines of education and outreaching in the field of climate change in China. It describes priority groups, measurements and the guarantee mechanisms needed for *the strategy*.
- Training materials and training programs: From 2002 through 2003, Initiative National Information Report Group, Renmin University of China and Nanjing University had respectively compiled training materials on the knowledge of climate change, policy information and skills of project development. These materials have been applied in training programs for decision makers, local experts, researchers, trainers and journalists from provincial and municipal departments of planning, energy, agriculture, forestry, environmental protection, and water conservancy.
- Research on public awareness promoting of specific topics: Under the framework of C5, CEEC has conducted specific research on awareness and outreach.
- Nationwide surveys on public awareness of climate change: From 2003 through 2004, surveys on public awareness of climate change had been carried out twice by Research Centre for Public Policy of China Academy of Social Science, focusing on people's knowledge, recognition, means of information access, extent of concern and willingness to take actions regarding issues of climate change. This has provided primary data for understanding the baseline of public awareness on climate change, evaluating works carried out in this areas and figuring out outreaching countermeasures.
- Pilot projects on climate change awareness and outreaching: Since 2002, series of pilot projects facing various stakeholders have been carried out by governmental departments and NGOs through community campaigns, mass media and internet

dissemination, school activities, conferences and workshops. The survey in 2004 shows a trend of improving people's knowledge, recognition and willingness to take actions by the public. People's understanding of the cause and effect of climate change is shifting from experiential to rational style.

3.10.2 Capacity assessment

Having done a lot through middle school and university education, China has gradually built up the capability of enhancing people's awareness on global climate change. However, that of decision makers from local governments, enterprises and the public still remains weak. Furthermore, there exist big problems in fostering senior expertise, professional training and communication regarding international training.

For example, in the survey, 27% respondents hold the opinion that information exchange in the Protocol implementation is not effective while answering the question "what is the obstacle regaring capability in the implementation of UNFCCC". Some hold the opinion that people's understanding of climate change is still at the fundamental stage and research on dissemination and countermeasures should be strengthened. Due to the constraints of budget, experience and capability of outreaching, the coverage and extent of educational activity on climate change is still limited.

There has been no awareness and outreach strategy or plan on climate change existing in China, neither in the form of legislation nor regulatory document by the government. Adaptation to climate change is a new topic in China. This is reflected in the unclear division of responsibility and entitlements of governmental department. The survey shows the lack of knowledge and expertise on climate change among departments of macro economy management and decision making, environmental protection and natural resource management. There exists a huge shortage of investment for awareness and outreach to achieve the goals set by the National Strategy, facing the reality of 1.3 billion Chinese people and varieties of target groups with different background. The scope of international cooperation on climate change education and outreach is still limited.

It is discovered from the survey that 'lack of awareness' is the most common problem reflected. People expressed their opinions such as, 'need to strengthen the education on climate change from both institutional and technical sides' and 'key tasks being training and awareness

improving'. While answering the question 'whether there was enough opportunity to obtain skills coping with climate change', only 32.9% respondents said 'yes'. It can be seen from the answer the urgent need of awareness and capability improving. Therefore, in the area of awareness raising, China needs professional institutions with expertise of climate change knowledge, public education and media experience. Broad and in-depth cooperation with developed countries in this area is also required.

3.10.3 Key needs for capacity building

Based on the above analysis, the difficulties and obstacles confronted in the area of awareness raising and outreaching covering the following issues:

- Lack of regulative base
- Weak network system and unclear responsibility division among awareness and outreaching professional institutions for climate change
- Lack of human resources
- Lack of financial support and
- Weak international communication.

Based on the above evaluation, we may conclude the priority goals include:

- Draw regulations, policies and mid and long-term plans
- Set up network system in compliance with international trends and foster expertise
- Conduct various educational and awareness-raising activities focusing on stakeholders with different backgrounds: professional training directed at technician and management people in the area of climate change; integrating the topic into mainstream education system, i.e. primary and secondary schools, and university; produce educational materials through media and publishing houses; and training programs directed at decision makers and trainers.

The following counter-measures are suggested for achieving the above mentioned goals:

- Take awareness-raising into the working scope of the government
- Integrate climate change into the syllabus of formal educational system, making climate change a part of ethics education; develop studies related to the topic, fostering high level professionals
- In the area of non-formal education, develop training regarding knowledge and skills dissemination and awareness-raising, starting from decision makers,

entrepreneurs, journalists and teachers; try to put the topic of climate change into training for civil servants and other types of non-formal education

- In the area of awareness raising, conduct education and communication activities among various target groups through radio, television, newspapers, internet, symposia, and publications etc.; explore the way of awareness-improving suitable for the situation of China
- Improve investment to education of climate change by the government and Develop international cooperation on awareness and outreaching of climate change

Obstacles such as lack of investment, weak support from the legal system and misunderstanding from the public might be encountered in practice. Solutions are expected from international cooperation, legislation and supports by mass media.

3.11 Information Network and Database

3.11.1 Relevant Capacity Building Activities

The climatic change information mainly includes the information necessary for understanding climatic change mechanisms and impacts, information necessary for adaptation activities to climatic change, information necessary for mitigating climatic change and information necessary for carrying out the international cooperation on climatic change.

The capacity building in respect of climatic change information will directly serve the country in understanding climatic change mechanisms, coping with the impacts brought about by climatic change, enhancing capacity building for and taking actions for adapting to and mitigating climatic change, and will promote the country to take part in widespread international cooperation. The weak capacities in respect of climatic change information will directly result in the obvious reduction of the country's sustainable development capacities and bring about big negative influences to the international cooperation on climatic change. It is, therefore, very important to strengthen the capacity building in respect of climatic change information.

The capacity building in respect of climatic change information is closely linked with other aspects of climatic change capacity building activities and is a part of basic capacity building.

Up to now, there is almost no support from specific capacity building projects in respect of

climatic change information. As said in the previous sections, the capacity building in this regard is interspersed among the capacity building activities dealt with in other sections.

3.11.2 Capacity assessment

China already has a certain degree of climatic change information base. A domestic climatic change observation network has been established to some extent. Scientific data involves in international exchanges within a given scopes. Government sectors, research institutions, administrative bodies and some individuals have accumulated a wide scope of climatic change information, and much of the information is reserved in databases. The social and economic development has advanced requirements for the climatic change information, and industrialized information services for public benefits have preliminarily been developed.

As a developing country, however, China is still weak in the overall climatic change information groundwork (e. g., database, information network, information service and etc.) that has to be strengthened in a systematic way. Furthermore, it need be specifically pointed out that China lags far behind in the climatic change information service and application. Even so, the information service based on the existing information base is still confronted with the shortage of long-term and stable support. For example, although China has set up a Climatic Change Information Website and a China Clean Development Mechanism Website, she still lacks continuously updated and replenished information and financial support for long-term maintenance of those websites. Another example is that a great deal of information gathered, compiled and produced during the process of working out the national communication wants a supportive mechanism for information management.

China faces the following major barriers in enhancing climatic change information capabilities:

- Understanding on the importance about climatic change information is insufficient;
- Information sharing mechanisms, related laws, policies, standards and platforms have not been established. A mass of climatic change information is controlled by sectors, institutions and individuals, and therefore, it is difficult to disseminate and share the information;
- Information services and applications are at low level. There exists a serious situation of disconnection between and among the information about the climatic change policies, science, technology, industries and markets, as well as the social support and service. There is a shortage of good links and channels between the

information provider, information demander and information service provider. The information emerges mostly in the form of primary products.

- Public benefit information and commercial service information are not well differentiated for climate change information. Such a situation has exerted negative influences for climatic change information service to develop in an industry approach. The influence gives those information exchange platforms a direct expression of their difficult maintenance and development;
- The international cooperation capability in the field of climatic change information is low.

3.11.3 Key needs for capacity building

The overall objectives for climatic change information capacity building are:

- Set up complete climatic change information systems and information service systems, the systems with databank and information flow supports and oriented by information applications;
- Make it easier for people to acquire climatic change information; and
- Support governments, industrial sectors, research institutions and social public work together to seek ways to cope with, adapt to and mitigate climatic change and take actions to this end.

The key areas of climatic change information capacity building are to reinforce the flow and application services of climatic change information, mainly include (1) information collection, compilation, storage and updating; (2) information processing and upgrading; (3) information dissemination, and (4) information application.

The requirements for climatic change information capacity building are principally related to three aspects:

- Foster the enabling environment for climatic change information flow and sharing, including (1) to urge governments at all levels, all social organizations, enterprises and general public to understand the importance of climatic change information; (2) to develop policies and standards for climatic change information sharing; (3) to develop and improve the distributed databanks and to establish integrated Meta-data databanks for climatic change information, and to establish network-based climatic change information sharing platforms;

- Build up application oriented climatic change information systems and information service systems, aimed at (1) strengthening the processing capabilities of climatic change information to facilitate the formation of information products easily acceptable to all sorts of clients; (2) developing the public benefit oriented and industrialized information service systems, and reinforcing information dissemination to policy-makers and general public and information services for industries and markets, so as to boost up the climatic change related policy-making capabilities and public awareness, as well as to lead and support the development of climatic change-related industries (especially those for energy-conservation, new energy and renewable energy); (3) promoting climatic change information dissemination to financial and investment sectors, organizations and enterprises to reinforce the financing capabilities for climatic change actions; (4) propelling climatic change information dissemination to the social support and service systems and industries (e.g., those for disaster reduction, public sanitation and of insurance) to enhance the capabilities to cope with climatic change and its impacts, especially climate disasters; (5) strengthening the linkage among all aspects of climatic change information and avoiding their disconnection, especially information about climatic change policies, science, technology, industries and markets as well as social support and service;
- Strengthen China's capabilities of participating in international information cooperation on climatic change, especially in the international actions for climatic change observations.

4. Conclusions: Priority Areas and the Corresponding Securing Measures

Enhancing the capacity building for developing countries is a very important instrument to deal with climate change. This issue will be increasingly more important with the progress of international negotiations. The significance is evident with regard to the effective implementation of the capacity building activities and the effective evaluation on the effectiveness of the implementation. For developing countries, the appropriate identification of priority areas for their capacity building needs for climate change, in combination with the proper proposed capacity building targets and implementation measures, is the necessary basis for GEF, multilateral donor

organization and other bilateral donor organizations.

This report overviewed almost all relevant capacity building activities in China since the entry into force of the UNFCCC. Such capacity building activities could be classified into three categories based on the source of funding. They are the capacity building activities supported by multilateral organizations represented by GEF and UNDP, bilateral donors represented by some developed country governments, and domestic funding from Chinese governmental departments. The previous capacity building activities rather insufficiently covered some areas of climate change such as institutional capacity, national communication, national strategy, evaluation on vulnerability and adaptation, CDM, and education/training and public awareness. However capacity building activities targeting at development and transfer of technologies, specific mitigation measures, research and systematic research, adaptation, human resources development, coordination and cooperation are relatively few and weak and need to be strengthened.

All in all, as a developing country, the capacity to deal with climate change in China is still very weak. The carried-out activities are very initial and huge gaps exist comparing to the capacities and capabilities as requested by the implementation of the UNFCCC and the Kyoto Protocol.

4.1 Priority areas needed for the near term capacity building

The most urgent capacity building needs are as follows:

- With regard to the institutional capacity building, the establishment of the CDM management center will be the priority in the near term. The implementation of such an institutional capacity building includes system construction, office facilities, personnel allocation, channeling of maintenance funding, information and networking, etc. Meanwhile the indicators and methodologies need to be developed to evaluate the effectiveness of the capacity building activities.
- With regard to the national communication and the corresponding organizational, expertise and database construction and maintenance, the most urgent need is the initiation of the second national communication through which to enhance the national capacity in this regard.
- With regard to the policy-making improvements, one near term focus will be the formulation and development of a national climate change strategy or national programme. Through the policy studies in this field, further considerations will be

made with the aim of integrating climate change issues into the studies on national social and economic development strategies and programs. Also the linkage between the macro economic development and the issues of climate change will be set up. Another near term focus will be the studies on the relevant laws and regulations. Specifically laws and regulations relevant to CDM need to be further developed or amended.

- With regard to the CDM capacity building, more training, studies, demonstration projects are needed. Capacity on the project development and management needs to be enhanced. The web based project information inventory needs to be developed.
- With regard to the evaluation of mitigation options, focus will be given on the development of integrated assessment models. Based on this the assessment on the impacts of mitigation options will be made. Also evaluation will be made on the effectiveness of the simulated policies and programmes. The assessment on the mitigation options and mitigation technologies from social, economic, environmental and technological aspects is another near term priority.
- With regard to impact and adaptation, targeted research and studies on impacts assessment and adaptation are urgently needed. Also preliminary studies on a national adaptation program are a near term priority.
- With regard to research and systematic observation, near term priority needs to be given to the following: survey on the overall situation of the observing stations dispersed and managed by different sectors in China; evaluation on the coverage of China's regional observing system and the completeness of the monitoring elements; design and development on China's GCOS implementation plan; study the proper mechanism for data and information sharing; enhance and improve China's climate modeling development and application.
- With regard to public awareness for climate change, near term focus needs to be given to the awareness raising for different stakeholders particularly at the local level. Media, thematic workshops, focus groups are the major means for knowledge sharing. It will be a great and long term challenge for the Chinese government to raise the awareness of many thousands of government officials, entrepreneurs, professional researchers and the general public.
- With regard to the information network and the information database, near term priority will be the enhancement and maintenance of the already established climate specific website. Meanwhile the sources of information need to be broadened,

which depend on the enhancement of the overall capacity in some way. Starting from the policy studies and the corresponding implementation, improvement and amendments to the existing statistics and indicators need to be researched. Based on this the institutional and technological arrangement for more effective information sharing needs to be developed.

4.2 Main measures for capacity building enhancement

Based on the ongoing capacity building activities, the future objectives and possible measures, the experts identified for the different areas did careful analysis regarding the constraints for capacity building activities in China. Four types of constraints were identified in this regard. They are organizational, financial, technological and human resource constraints. For the enhancement of climate change relevant capacity building activities, the barrier of the financial shortage stands out as the major constraint.

The capacity building needs in each specific area were identified above. The process of meeting all these needs is that of overcoming the four aspects of barriers in the meantime. Considering the barriers, the following measures for capacity building in China are elaborated.

- On the basis of improving and completing the institutional and organizational arrangement to deal with climate change, an integrated approach will be taken to consider capacity building as the key part of climate change strategies and action plans. Partnerships and networking between different stakeholders which include governmental authorities, policy study institutions, education and training organizations, technology research/development and dissemination promoters, media, and other non-governmental organizations should be set up at both national and local levels. Some capacity building centers should be established targeting at different key sectors.
- Indicators and methodologies will be explored to evaluate the effectiveness of the capacity building activities, which will be helpful for guiding, supervising and monitoring the capacity building activities.
- Establish stable budget channels to ensure the daily management of capacity building activities. To ensure the broader scope of, long term, and deepened capacity building activities, the measures of channeling more resources, using the existing funding in an integrated and synergic manner, leveraging more

international funding and private funding are very important.

- Both international and internal cooperation will be enhanced to carry out capacity building activities by using different approaches and different means.
- Strengthen personnel training, particularly the training targeted at policy makers and the trainers, with the aim of setting up a professional team of capacity builders.
- Using the financial resources, human resources and the information in a holistic way to increase the degree of sharing and thus improve the efficiency.

5. Appendix

List of interviewees and their organizations

Location of interview: Beijing City			
Type of organizations	**No.**	**Name of organizations**	**Name of interviewee**
Governmental sectors	1	Department of Pollution Control, SEPA	Yang Kai
	2	Office of Coal Industrial Environmental Protection	Li Zhonghe
	3	Office of National Climate Change Coordination Committee, NDRC	Gao Guangsheng
Associations	4	Department of Environmental Protection of Beijing Chemical Industry Research	Yang Zaipeng
	5	China Dyeing and Printing Association	Liu Zunxian
	6	Department of Environmental Protection and Resources Conservation, China Electric Power Enterprise Union	Wang Zhixuan
	7	China Iron & Steel Association	Huang Dao
	8	China Non-ferrous Metal Association	Qiao Shutan
	9	China Chemical Fiber Association	Bo Guangming
Total: 9 interviewees, 9 organizations			

Location of interview: Chongqing City			
Type of organizations	**No.**	**Name of organizations**	**Name of interviewee**
Governmental sector	1	Economic Commission of Chongqing City	Pang Ke, Wang Jiong
Enterprises	2	Chongqing Fire Gas Co. Ltd	Yang Ying, Wu Yong

	3	Chongqing Technical Service Center for Energy Conservation	Wang Huixia
	4	Chongqing Spin & Weave Holding Company (Group)	Wan Long
	5	Chongqing Changan Automobile Co. Ltd	Deng Wanxian
	6	Chongqing International Multiple Material Co. Ltd	Yuan Anjin, Zhu Yinglai
	7	Chongqing Zhongliangshan Coal Gasification Co. Ltd	Hu Yuedong, Ding Xueping, Long Wensheng, Li Minggui, Zhou Yong, Zhou Qiang
	8	Chongqing Kaiyuan Petroleum & Natural Gas Co. Ltd	Zhang Ruizhong, Yi Lihua, Shu Dan
	9	Chongqing Power Plant	Ou Daoshun, Yu Hongzhong, Li Pingchuan, Jiang Xuequn
Institute	10	University of Electronic Science & Technology of China	Li Zhiqiang
Total: 22 interviewees, 10 organizations			

Location of interview: Huhehaote, capital of Inner Mongolia Autonomous Region			
Type of organizations	**No.**	**Name of organizations**	**Name of interviewee**
Governmental sectors	1	Development & Reform Commission of Inner Mongolia Autonomous Region	An Junyi
	2	Regional Economy Division, Development & Reform Commission of Inner Mongolia Autonomous Region	Ding Shenglian
	3	Division of Industry, Development & Reform Commission of Inner Mongolia Autonomous Region	Mei Tianlin

	4	Inner Mongolia Autonomous Region Department of Land & Resources	Wang Jianmin
	5	Climate Center of Inner Mongolia Autonomous Region Meteorological Bureau	Bai Meilan
	6	Inner Mongolia Autonomous Region Department of Science & Technology	Wen Qi
	7	Inner Mongolia Autonomous Region Department of Water Resources	Wang Xuedong
	8	Inner Mongolia Autonomous Region Department of Forestry	Hu Shucai
	9	Inner Mongolia Autonomous Region Environmental Protection Bureau	Wang Jingren
Enterprises	10	The First Mechanical Manufacture Corporation of Inner Mongolia Autonomous Region	Li Aihuai
	11	The North Heavy Industry Corporation of Inner Mongolia Autonomous Region	Zhang Baoping
Total: 11 interviewees, 11 organizations			

Location of interview: Baotou, Inner Mongolia Autonomous Region			
Type of organizations	**No.**	**Name of organizations**	**Name of interviewee**
Governmental sectors	1	Baotou Development & Reform Committee	Wang Rongjie, Wang Xiaoping
	2	Baotou Office of Informationalization Work	Xu Qiang
	3	Baotou Environmental Protection Bureau	Hou Yonggang, Wang Wei, Ren Deqiang, Zhang Shangli, Sunyang

	4	Baotou Environmental Protection Bureau Environmental Monitoring Branch	Zhu Ziye
	5	Baotou Environmental Monitoring Station	Fan Qingyun
	6	Baotou Meteorological Bureau	Wang Mingli
	7	Baotou Water Service Bureau	Ma Li
	8	Baotou Economic Commission	Bao Jinlan
Enterprises	9	Baotou Management Committee of Region for Advanced and New Technologies on Lanthanide	Feng Shuzhen
	10	Baotou Aluminum Industry Corporation	Liu Yu
	11	Jiyu Steel Co. Ltd	Wang Jun
	12	Baotou Copper Smelt Plant	Liu Zhe
	13	Comprehensive Utilization Division, Department of Safety and Environment of Baotou Steel Plant	Ning Huidong, Li Fuzhu
	14	Baotou Mining Service Bureau	Zhang Tianjie
	15	The third Thermal Power Plant of Baotou	Chan Jianguo
Institute	16	Baotou Research Institute of Environmental Science	Shi Hui
Total: 22 interviewees, 16 organizations			

Location of interview: Changsha, Hunan Province			
Type of organizations	**No.**	**Name of organizations**	**Name of interviewee**
Governmental sectors	1	Hydrological Bureau of Department of	Gu Qingfu
	2	Division of Environment & Resources, Economic Committee of Hunan Province	Kui Shanlin
	3	Changsha Environmental Monitoring Central Station	Long Jiahong

	4	Division of Planning & Finance, Department of Agriculture of Hunan Province	Huang Yuzhong
	5	Division of Operation, Meteorological Bureau of Hunan Province	Li Wenhua
	6	Division of Pollution Management, Environmental Protection Bureau of Hunan Province	Tang Yuecheng
	7	Division of Geographic Environment, Department of Land & Resources of Hunan Province	Yang Shunquan
	8	Department of Science & Technology of Hunan Province	Rong Cheng
	9	Meteorology Research Institute of Hunan Province	Wang Kuojun
	10	Division of Planning & Finance, Meteorological Bureau of Hunan Province	Wang Zhichong
	11	Head Station of Geologic & Environmental Monitoring of Hunan Province	Chen Ping
Enterprise	12	Division of Scientific Research, Department of Forestry of Hunan Province	Yao Xianqing
	13	Electric Power Corporation of Hunan Province	Chen Bo, Hu Weiguang
Institute	14	Forestry Academy of Hunan Province	Li Xiquan
Total: 15 interviewees, 14 organizations			
Total in all: 79 interviewees, 61 organizations			