THE CARBON MARKET IN CHINA

UNDERGOING AND UPCOMING

December 2009

gtz

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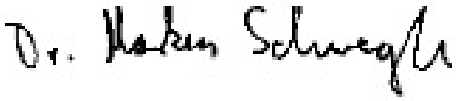
PREFACE

Considering that the small and medium-sized enterprises (SME's) that participate in the EU emission trading scheme in Germany still lack information about CDM and JI project implementation and relevant networks in host countries – information that they would need to conclude emission trading agreements or to invest in such projects – the German Federal Ministry of the Environment, Natural Conservation and Nuclear Safety (BMU) decided to launch the CDM/JI Initiative. It will boost the use of the flexible mechanisms established by the Kyoto Protocol – specifically the Clean Development Mechanism (CDM) and Joint Implementation (JI).

BMU CDM Units have been established in each of the following selected host countries and regions where large CDM potential exists and that play a key role in international climate policy negotiations or that have numerous sectors not yet tapped for CDM project development. Project selected countries and regions are China, India, Brazil and MENA (Middle East and North Africa) Region – Tunisia, Egypt and Morocco.

BMU CDM units founded in the context of GTZ programmes could be in cooperation with local experts and/or collaborate with local organizations. The main objectives of BMU CDM Service Unit China are to facilitate market players to make the fullest use of the opportunities presented by the CDM and bring together German companies, financial providers, technical suppliers and project developers, allow them to better access to Certified Emission Reductions (CERs) from CDM host countries, meanwhile promoting CER trading among German companies and partners in the individual countries and for gaining access to certified emission reductions generated by CDM projects from China, through forming and reinforcing existing networks and organising contact-brokering events throughout the process.

BMU CDM Service Unit China's office sits in the headquarter office of GTZ Beijing, leading by Dr. Markus Schwegler as the Country Manager, Ms. Li Min as the Project Coordinator. The aim of the country study is to provide German companies with profound knowledge about the Chinese CDM market which forms the general outlook of CDM projects in China, so as to identify the gaps between Chinese owners, project developers and German contributions. This will also be the overall direction and guidance for the project activities design of CDM Service Unit China as well as basic knowhow for German companies that are interested in the Chinese CDM projects. We wish all the information about the Chinese CDM market is useful to all the readers. Your comments and suggestions are highly welcome!



EXECUTIVE SUMMARY

Whether measured by scale or by speed of growth, the Chinese carbon market is one of most important aspects of the global carbon market and its expansion has far-reaching implications both for global climate change mitigation and domestic sustainable development. Although the Copenhagen Climate Change Conference did not reach a post 2012 deal, it is still crucial to review and forecast the development of the Chinese carbon market at this moment because there is no doubt that combating climate change will continue and market mechanisms will be one of the future major policy instruments.

The launch of the Chinese carbon market is due to China's active engagement in international efforts to address climate change and international cooperation on capacity building. China has put great emphasis on climate change issues. Since 1992, China has been committed to the United Nations Framework Convention on Climate Change (hereinafter referred to as the UNFCCC), the Kyoto Protocol and all international climate accords. It has been playing a constructive role in international cooperation, which provides a foundation and an institutional environment for the birth of the carbon market in China. However, since China is a developing and transitional country, awareness of climate change and market mechanisms was very limited at the beginning. Many international cooperation projects on capacity building have played a significant role in catalyzing the growth of the Chinese carbon market.

Establishment of institutions and regulations is a basis for the development of the Chinese carbon market. China established a National Leading Group on Climate Change, headed by Premier Wen Jiabao, to tackle climate change issues, including the carbon market. In order to foster and manage CDM development, China established a set of management systems including the Designated National Authority (DNA), the National CDM Board and the CDM Project Management Center, the National CDM Fund Board and the CDM Fund Management Center. China has also established a series of regulations including 'Measures for Operation and Management of Clean Development Mechanism Projects in China', which stipulates priority areas, collection of national benefits and requirements for eligibility and domestic procedures for implementation of CDM projects in China. These institutions and regulations promote the rapid development of the CDM market. However, the legal system and governance for the Chinese carbon market are still incomplete - especially for voluntary carbon trade.

The Chinese carbon market has experienced quick growth and made significant contributions to climate change mitigation. However, China faces more and more barriers in further development of its carbon market. Since 2006, the implementation of CDM projects in China has entered a fast-growing stage and China has become the largest country for the development of CDM projects in the world. As of July 1, 2009, China's DNA had approved 2,063 CDM projects, and 579 projects have been registered with the UN CDM Executive Board. These account for about 34% of registered projects and therefore rank first in the world. The annual emissions reduction of these projects is estimated to be 180 million tons of CO_2e, which accounts for about 58% of the annual emissions reduction generated by all CDM projects in the world. Furthermore, 120 projects totalling 141 million tons of CO_2e have been approved by the UN. The extensive implementation of CDM projects in China has played an important role in combating global climate change, domestic energy conservation, emissions reduction, and sustainable development. Meanwhile, the voluntary carbon trade is very active and the volume of VER exchanges has quickly increased. China has now set up three emissions trading platforms. The Panda Standards for voluntary emissions trading was also released. However, due to weaknesses in international and domestic institutions and management, the uncertainty of post 2012, rising transaction costs and risk, and the drop in demand, further development of the Chinese carbon market faces great challenges.

China's domestic policies to address climate change were and will still be a major driving force for development of the Chinese carbon market. In recent years, China has formulated a series of policies, regulations, planning and standards to address climate change, including energy saving, emissions reduction and development of renewable energy. These policies and measures benefit domestic sustainable development and mitigation of global climate change, and they are also an impetus for development of the Chinese carbon market. Since the revenue from CERs is quite limited and risky, CDM plays only a marginal role on the improvement of energy efficiency and development of sustainable energy. Domestic policies have created a good environment for the Chinese carbon market and CDM has scaled up the effects of China's domestic policies. The rapid development of the Chinese carbon market is the result of international mechanisms and domestic policies. Currently, China is launching more ambitious policies for combating climate change which will unlock significant potential for the carbon market.

China is actively participating in the construction of a post 2012 climate regime, which will help forge a reasonable future carbon market. China insists that climate change is one of its most serious challenges, that UNFCCC and its Kyoto Protocol constitute the basic framework and legal basis for international cooperation to address climate change, and that the principle of common but differentiated responsibilities should be insisted upon. Developed countries should undertake measurable, reportable and verifiable legally-binding deeper quantified emissions reduction commitments, and should take Nationally Appropriate Mitigation Actions (NAMAs) in the context of sustainable development. In order to reach a new global deal, before the Copenhagen Climate Change Conference, China announced its own domestic goal of reducing carbon dioxide emissions per unit of GDP in 2020 by 40 to 45 percent compared that of 2005. China's position and actions will promote international efforts which will scale up the flow of climate capital and the carbon market.

Both international and domestic emissions trading in China will increase in the future. For international emissions trading, China will still be an active participant in the global carbon market no matter what the post 2012 climate agreement is. For the domestic emissions trade, as the three emissions exchanges have been set up and many domestic companies have shown interest in participating, voluntary emissions trading will enter a fast-growing phase. Meanwhile, since domestic goals for carbon intensity reduction have been announced and the Chinese government has recognized the role of the market mechanism, China's domestic compliance market will be set up soon. However, because of the shortage of market infrastructure such as measuring, monitoring and a verification system, capacity building is urgently needed.

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3R	Reduce, Reuse and Recycle	**G8**	Group of Eight
AAU	Assigned Amount Units	**$GtCO_2$**	Gigaton CO_2
AF	Adaptation Fund	**GHGs**	Green House Gas
AR4	the IPCC Fourth Assessment Report	**IEA**	International Energy Agency
AR5	the IPCC Fifth Assessment Report	**IPCC**	Intergovernmental Panel on Climate Change
AWG	Ad Hoc Working Group	**JI**	Joint Implementation
AWG-KP	Kyoto Protocol of the Ad Hoc Working Group	**LULUCF**	Land use, land use change and forestry
AWG-LCA	Long-term cooperative action to the Ad Hoc Working Group	**MDG**	Millennium Development Goals
BAU	Business As Usual	**MEM**	Major Economies Meeting
BRICs	Brail,Russia,India and China	**MOC**	Ministration of Construction
CCS	Carbon Capture and Storage	**COP/MOP**	National Coordination Committee on Climate Change
CDM	Clean Development Mechanism	**(CMP)**	Conference of the Parties serving as meeting of the parties to the Kyoto Protocol
CDMEB	Clean Development Mechanism Executive Board	**MoU**	Memorandum of Understanding
CER	Certified Emission Reductions	**MOHURD**	Ministration of Housing and Urban-Rural Development
GDP	Gross Domestic Product	**MRV**	measurable, reportable and verifiable
CIF	Climate Investment Fund	**NAMA**	Nationally Appropriate Mitigation Actions
CO_2e	Carbon Dioxide Equivalent	**NAPAs**	National Adaptation Plan of Action on Climate Change
COP	Conference of Parties	**NDRC**	National Development and Reform Commission
CTF	Clean Technology Fund	**NGO**	Non-Governmental Organization
DOE	Designated Operation Entity	**PDD**	Project Design Document
DNA	Designated National Authority	**PFCs**	Perfluorocarbons
EEB	Energy Efficiency in Buildings	**POPs**	Persistent Organic Pollutants
EIA	Environmental Impact Assessment	**ppm/ppmv**	parts per million /parts per million volume
ERU	Emissions Reduction Unit	**REDD**	Reducing Emissions from Deforestation and Forest Degradation
ET	Emissions Trading	**RMU**	Removal Units
EU	European Union	**SB (SBI, SBSTA)**	Subsidiary Body for Implementation, Subsidiary Body for Scientific and Technological Advice
EUA	European Union Allowance	**UNDP**	United Nation Development Programme
EU-ETS	European Union Emission Trade Scheme	**UNFCCC**	United Nation Framework Climate Change Convention

1. Background and Development of the Carbon Market

1.1 Climate Change Challenges Facing China

Climate change is a universal challenge that threatens the stability of the global ecosystem and demands a joint effort by the entire international community. China will work with other countries relentlessly for global sustainable development and contribute to the protection of the climate system. With the largest population in a developing country, China has relatively insufficient resources and a fragile ecological environment that must support its process of industrialization and modernization. While striving to attain a basic standard of living they must simultaneously resolve long-existing problems such as an imbalanced economic structure and low efficiency in resources utilization.

Actively adapting to climate change is consistent with the trend toward global development while also serving China's domestic needs for realizing sustainable development and presenting an historical opportunity for low carbon development. To be truly responsible for the long-term sustainable development of China and that of the whole of mankind, it is imperative to further raise awareness of climate change, so as to ensure sound and fast economic and social development of China in the context of internal and external environment and conditions.

China has ratified the primary international accord on climate change—the Kyoto Protocol—but, as a developing country, China has no binding emissions limits under the accord. It is an active participant in the CDM established under the protocol which grants emissions credits for verified reductions in developing countries and which can be used by developed countries toward meeting their Kyoto targets. The fulfilment of commitments by developed countries to provide funding, technology transfer and capacity building support is a pre-condition for developing countries to effectively mitigate and adapt to climate change. It is their obligation under the UNFCCC. Developed countries should take responsibility for their historical cumulative emissions and current high per capita emissions by changing their current unsustainable lifestyles.

1.2 China's Attitude towards CDM

The Clean Development Mechanism (CDM) is one of the three flexible mechanisms established by the Kyoto Protocol that enables the countries listed under Annex I in the UNFCCC to invest in greenhouse gas emission reduction projects in non-Annex I developing countries. The mechanism enables the developed countries to receive credits in the form of certified emission reductions (CERs) to achieve compliance with their national quantified emission limitation (cap) and reduction commitments. Thus the CDM provides a flexible mechanism for developed countries to reduce the cost of GHG emission reductions through investment in developing countries. Developing countries benefit by receiving capital assistance and advanced technology, which is helpful for realizing the objectives of the United Nations Framework Convention on Climate Change (UNFCCC). CDM is an innovative regime and a measure for the international community to counter climate change. It plays a very constructive role in both promoting the sustainable development in developing countries and assisting the developed countries to fulfil their GHG emissions reduction targets.

China initially viewed the flexible mechanism as an instrument for developed countries to escape their responsibilities and was therefore sceptical of the real intentions. Although CDM projects became eligible for crediting in 2000, China did not ratify the treaty until August 2002. Its designated national authority overseeing CDM projects was not established until June 2004. China's stance on CDM began to change after the COP5 meeting in Bonn in 1999. China gradually changed its hesitant position on CDM to one that supports it.

China now attaches great importance to the active role of CDM in promoting sustainable development, and is willing to make contributions to greenhouse gas mitigation through participating in the mechanism. Through international cooperation, China has conducted systematic research on the CDM, providing a scientific basis for formulation of relevant international rules and domestic policies, as well as providing valuable information for all stakeholders.

China also carried out many capacity building activities aimed at improving the capabilities of government departments, enterprises, academic institutions, consulting agencies and financial institutions to develop CDM projects. It has improved relevant domestic rules, and formulated and released the *'Measures for the Operation and Management of Clean Development Mechanism Projects in China'*. CDM projects have effectively promoted the development of renewable energy in China, accelerated the improvement of energy efficiency, and greatly enhanced the climate change awareness by relevant government departments, enterprises, organizations and individuals. China views CDM as a rather effective and successful international cooperation mechanism and seeks its continuance after 2012. However, efforts should be made to improve equity, transparency, simplification, certainty and environmental integrity related to the implementation of CDM projects and to promote the transfer of advanced technology to developing countries.

1.3 China's Expectation for CDM Implementation

1.3.1 Promotion of Renewable Energy Development and Energy Efficiency

CDM project activities, in addition to realizing GHG emission reductions, can also address the energy challenges facing China through energy conservation boosting the development of renewable energy and utilizing methane in energy. The expectations of the Chinese government for CDM in this aspect is highlighted in their priority area selections: energy efficiency improvement, renewable energy promotion, energy utilization and coal bed methane capture, etc.

1.3.2 Additional economic income

In addition to traditional product sales revenue, project proponents can receive some additional income from the transfer of emission reduction credits from their project activities. Due to the additional income, projects that are economically unfeasible can become feasible; the risks involving the adoption of technologies that are not yet commercialized can be covered. Because abatement costs are thought to be lower in transition economies and developing countries, the carbon market not only provides an opportunity for global efficiency gains, but also contributes to sustainable development by bringing new public and private investment in clean technologies to these countries.

1.3.3 Getting technology transfer

The key barrier to sustaining the same level of production and living standards with lower consumption and to increasing energy supplies from clean sources is in technology transfer. Independent development of these clean technologies takes invaluable time and has a tremendous cost. CDM offers a good solution to this: its modalities require that developed Annex I country parties transfer environmental friendly technologies to developing countries and costs related to the technology transfer can be partially or completely covered with CER sales revenue funded from developed countries. China still lags behind many Annex I countries in terms of energy conservation and renewable energy utilization technologies. The Chinese government sees one attractive benefit of CDM is that it can lead to the transfer of high-energy efficient and renewable energy utilization technologies. Therefore, the Chinese government has made the transfer of environmentally friendly technologies one requirement for CDM project activities in the country.

1.3.4 Environmental Protection

In China, rapid industrialization and urbanization have caused severe water and air pollution and generated enormous solid, liquid, and gaseous waste. CDM projects can lead to less SO_2, N_xO, and particulate emissions. Projects based on wastewater treatment plants and landfills can help reduce harmful odour and emissions, contributing to harmless treatment of waste and benefiting the protection of the environment. In addition to afforestation and reforestation projects, solar, wind power, hydropower, and biogas utilization projects in regions of vulnerable ecological systems are expected to alleviate the pressure on local ecological systems reducing soil erosion, land degradation and desertification.

2. China's Management System and Policies on Carbon Market

The Clean Development Mechanism (CDM) is one of the three flexible mechanisms established by the Kyoto Protocol that enables the countries listed under Annex I in the UNFCCC to invest in greenhouse gas emission reduction projects in non Annex I developing countries. Under this mechanism, developed countries can receive credits in the form of certified emission reductions (CERs) to achieve compliance with their national quantified emission limitation and reduction commitments. Therefore the CDM provides a flexible mechanism for developed countries to reduce the cost of GHG emissions reductions through investment in developing countries. Developing countries benefit from receiving the capital assistance and advanced technology - all of which is helpful for realizing the objectives of the United Nations Framework Convention on Climate Change (UNFCCC).

At the center of the mechanism is an intricate regulatory system that ensures project quality. Getting projects registered through the CDM process requires the support of both the developed and developing country host parties, verification by a certified third-party standards body and the ultimate approval of the United Nations. In terms of CDM implementation, CDM Projects are subject to a wide variety of laws and regulations. The most important are those on energy conservation, renewable energy development and environmental impact assessment - especially those on the operation and management of CDM projects. This section will examine the existing administrative architecture and regulations on CDM projects in China.

2.1 China's CDM Project Management System

The Measures for Operation and Management of Clean Development Mechanism Projects in China ("the Measures") currently in force in China stipulates that China's CDM institutional bodies include the National Leading Group on Climate Change, the National CDM Board, the National Development and Reform Commission (NDRC), the CDM Project Management Center and the CDM Fund Management Center. NDRC is China's Designated National Authority (DNA) for CDM.

2.1.1 National Leading Group on Climate Change

The National Leading Group on Climate Change is in charge of review and coordination of CDM policies. It is responsible for reviewing national CDM policies, rules and standards, for approving members of the National CDM Board and for reviewing other issues that need to be decided by the Leading Group.

2.1.2 National CDM Board

As specified in the Measures, the National CDM Board ("the Board") has been established under the National Leading Group on Climate Change. The National Development and Reform Commission (NDRC) and the Ministry of Science and Technology (MOST) serve as co-chairs and the Ministry of Foreign Affairs (MFA) serves as the vice chair of the Board. Other Board members are the Ministry of Environmental Protection, the China Meteorological Administration, the Ministry of Finance and the Ministry of Agriculture. The Board is responsible for reviewing CDM project activities and reporting the overall progress of CDM project activities, emerging issues and further recommendations to the National Leading Group on Climate Change. It also makes recommendations on amendments to the Measures.

2.1.3 Designated National Authority

At present, NDRC is China's Designated National Authority (DNA) for CDM with responsibility for accepting CDM project applications and approving CDM project activities jointly with MOST and MFA based on the conclusions reached by the Board, issuing written CDM approval letters on behalf of the Government of China, supervising the implementation of CDM project activities, establishing the CDM project management institute, in consultation with other departments, and dealing with other relevant foreign affairs.

2.1.4 CDM Fund

The Measures specifies that emission reduction resources are owned by the Government of China and emission reductions generated by specific CDM projects belong to the project owners. Revenue from the transfer of CERs is owned jointly by the Government of China and the project owner. The Government of China will collect national benefits from CDM projects by type. The Measures also states that the revenue collected from CER transfers will be used in supporting activities on climate change. Currently, such revenue is collected and managed by the China CDM Fund.

Established with the approval of the State Council of the People's Republic of China, the China CDM Fund serves as the policy and development, long-term, open, non-profit state-owned fund. Its assets are owned by the State and protected by the Constitution of the People's Republic of China and its laws. No organizations or individuals are allowed to infringe upon such assets. The Ministry of Finance is in charge of the Fund which is designed, under the direction of the national strategy of sustainable development, to support and promote domestic activities to address climate change. The objective of fund management is to give long-term financial support to China's activities against climate change and achieve value preservation and appreciation of the Fund. The principles of fairness, justness, openness, efficiency, risk control and cost benefit apply to the management and use of the Fund. In this context, the MOF took the initiative in creating the CDM Fund Management Center in order to manage the China CDM fund.

The CDM Fund works under the direction of the National CDM Fund Board. Members of the National CDM Fund Board are: the National Development and Reform Commission (NDRC), the Ministry of Finance (MOF), the Ministry of Foreign Affairs (MFA) and the Ministry of Science and Technology (MOST). Detailed rules on the raising and use of the fund are prepared jointly by the MOF, NDRC and other related authorities. Key responsibilities of the CDM Fund include: executing the resolutions of the National CDM Fund Board, organizing and carrying out fund operations under the supervision of fund authorities, proposing schemes for significant issues such as fund management and the use and implementation of such schemes with the approval of the National CDM Fund Board, establishing fund management rules and regulations in order to standardize fund operations, relevant financial management and accounting activities, supervising and managing the whole process of funding projects, organizing the development and implementation of CDM Fund projects, initiating international, domestic and local cooperation, formulating reports on annual financial budgets and the final accounting of the Fund.

2.1.5 CDM Project Management Center

NDRC authorized its Energy Research Institute to establish a national CDM project management center in order to promote the development of CDM and international cooperation in climate change. The Center mainly performs the following functions: organizing experts for review of CDM projects and provision of comments, establishing the CDM project management database, providing information on the development and management of CDM projects, registering and recording CERs in the information system, monitoring and supervising the implementation of CDM projects, carrying out CDM-related capacity building activities, providing management and technical consultation services, managing and coordinating international cooperation implemented by the NDRC Department of Climate Change, collecting information on the projects financed by the China CDM Fund under the direction of the NDRC Department of Climate Change, undertaking related research entrusted by the (NDRC) Department of Climate Change and managing and implementing other international cooperation projects as entrusted by other organizations and authorities.

The figure below illustrates China's CDM project management system:

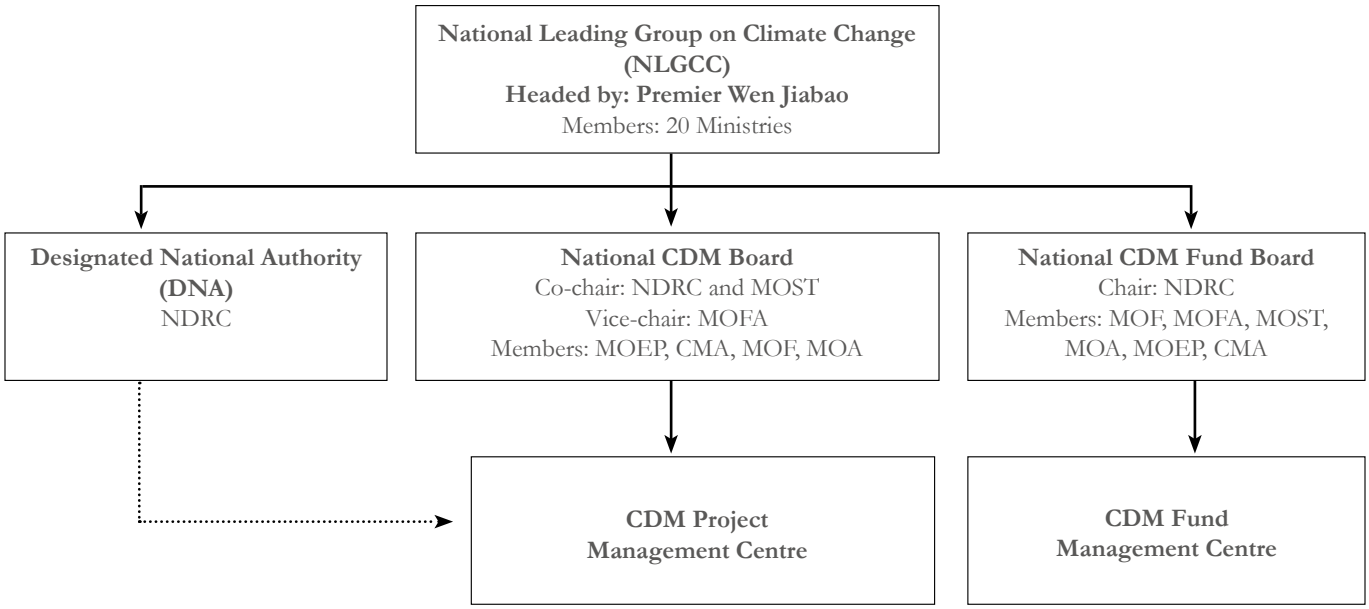

Figure 1: China's CDM Project Management System

2.2 China's Key CDM Policies

China's key CDM policies are defined in the Measures for Operation and Management of Clean Development Mechanism Projects in China. It includes priority areas for CDM projects in China, collection of national benefits, requirements for eligibility of CDM projects in China and domestic procedures for implementation of CDM projects. In addition, the Board will also formulate supplemental regulations in respect of the common issues in the operation of CDM projects.

2.2.1 Priority areas for CDM projects in China

The priority areas for CDM projects in China are energy efficiency improvement, development and utilization of new and renewable energy technologies and methane recycling and use, as specified in the Measures.

2.2.2 Collection ratio of national benefits

The Government of China will collect national benefits from CDM projects by type, with CDM projects within priority areas enjoying minimum ratios as follows:

- The Government of China will receive a 65% CER transfer benefit from HFC and PFC projects;
- The Government of China will receive a 30% CER transfer benefit from N2O projects and
- The Government of China will receive a 2% CER transfer benefit from CDM projects in priority areas defined in the Measures and forestation projects.

2.2.3 China's requirements for eligibility of CDM projects

The Measures define specific requirements for the eligibility of CDM projects in China which are consistent with the Protocol and relevant international rules. Details are as follows:

- CDM project activities must be consistent with China's laws and regulations, sustainable development strategy and policy and its overall requirements for national economic and social development planning;
- The implementation of CDM project activities must conform to the requirements of the Convention, the Protocol and relevant decisions by Conference of the Parties;
- The implementation of CDM project activities cannot introduce any new obligation for China other than those under the Convention and the Protocol;
- Funding for CDM projects from developed country Parties must be additional to their current official development assistance and their financial obligations under the Convention;
- CDM project activities should promote the transfer of environmentally sound technology to China and
- Chinese funded or Chinese-holding enterprises within the territory of China are eligible to conduct CDM projects with foreign partners.

2.2.4 Domestic procedures for implementation of CDM projects

According to the Measures, the implementation of CDM projects in China should, on the premise of compliance with international procedures and rules with regard to CDM, go through domestic procedures for approval of CDM projects, in addition to those for approval of specific construction projects in China (see Figure 2):

- Chinese funded or Chinese-holding enterprises applying for implementation of CDM projects within the territory of China, together with its foreign partner, must submit the project application, as well as the CDM project design document, certificate of enterprise status, general information on the project and a description of the project financing to the National Development and Reform Commission (NDRC). Relevant departments and local governments may facilitate such project applications;
- NDRC entrusts relevant organizations for expert review of project applications, which must be concluded within 30 days;
- NDRC submits those project applications reviewed by the experts to the National CDM Board;
- NDRC approves, jointly with the Ministry of Science and Technology (MOST) and the Ministry of Foreign Affairs (MFA), projects based on the conclusions reached by the National CDM Board, and issues approval letters accordingly;
- NDRC will make decisions on project applications within 20 days (excluding the expert review time) as the date of accepting the applications. The time limit for decision-making may be extended to 30 days if a decision cannot be made within 20 days, with the approval of the Chair or the Vice-chair of the NDRC. The project applicant should be informed of the decision and the reasons and
- Project owners must report the approval decision made by the CDM Executive Board to the NDRC within 10 days of the notice.

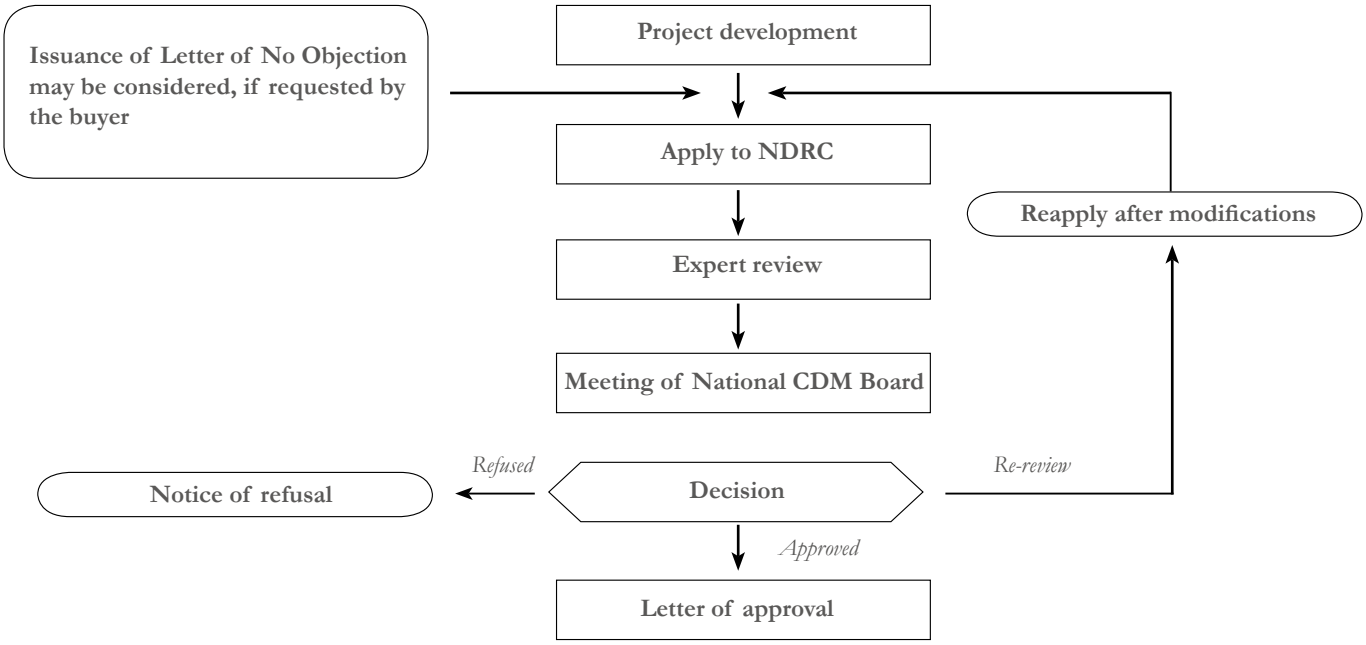

Figure 2: Domestic Procedures for Approval of CDM Projects in China

2.2.5 Supplemental regulations

The Board has issued supplemental regulations to further improve China's CDM project management system. For example, the CDM project owner must submit to the NDRC documents such as: the CDM project design document, the certificate of enterprise status (business license), general information about the project, the letter of approval for a feasibility study of the project issued by NDRC or the local Development and Reform Commission and the certificate of the environmental impact assessment issued by the national or local authority for environmental protection. In addition to these, the project owner must also submit the emission reduction purchase agreement (ERPA) or letter of intent to purchase, as well as the consultation service contract, to the Board.

3. Current Status of and Barriers to the Carbon Market in China

The vast majority of CDM projects will make long term contributions to curbing China's emissions growth. Most projects generate electricity through renewable sources such as hydro and wind power. The electricity generated by these sources can reduce the use of coal producing electricity. Some projects generate electricity from waste heat recovered from industrial processes, while other projects capture methane gas emitted from working coal mines and utilize it to generate electricity. The owners of these projects still require financial support regardless of how committed they are to tackling climate change. The carbon market, through CDM, provides part of the funds. This CDM funding gives China concrete incentives to develop the technology and capacity building of the technical workforce needed. Once up and running, companies gain valuable experience which can be reapplied to more clean energy projects. CDM programs not only bring Chinese energy enterprises financial and technical assistance in producing clean energy, but also help to promote awareness of climate change to enterprises in China.

This section will start by analyzing the current status of CDM project activity implementation in China and will address each of these observations in more detail in terms of the distribution of project types, industrial distribution of different project types and region specific observations. The barriers to the development of the Chinese Carbon Market are also discussed in later chapters.

3.1 Overview of the Chinese Carbon Market

Since the adoption of the Kyoto Protocol in 1997 and its ratification in 2005, the carbon market has enjoyed steady and consistent expansion. Since the Protocol's entry into force, CDM projects have developed fast in lots of developing countries and become the key contributor to the global carbon market. Since 2006 the development of CDM projects in China has entered a fast-growing stage and China has become the country with the largest share of CDM projects in the world. By July 1, 2009, as the biggest CERs supplier in the global carbon market, China's DNA had approved 2,063 CDM projects and 579 projects have been registered with the UN CDM Executive Board, accounting for about 34% of the total number of registered projects. The generated annual emission reduction of these projects is predicted to be 0.18 billion tons of CO_2e, which accounts for about 58% of the annual emission reduction generated by the entire carbon market[1].

The extensive implementation of CDM projects in China has played an important role in global response to climate change, domestic energy conservation and emission reduction and sustainable development. First, CDM would be a crippled mechanism without China's participation and active implementation, because China is the largest developing country with the most potential in the implementation of CDM projects. At present, the annual emissions reduction generated by the projects registered in China amounts to 0.18 billion tons, which greatly reduces the cost for the fulfilment of quantitative emission reduction for the developed countries in the first commitment period. At the same time, the successful implementation of CDM projects in China has set an example for other developing countries and provided valuable experience.

Second, CDM has played a crucial role for the accelerated development of renewable energy and the promotion of energy efficiency in China. according to the Kyoto Protocol, through 2012 signatories in the developed world are to reduce total greenhouse gas discharge by approximately 5 billion MT, half of which will be found outside of signatory countries. Based on an average price per MT of CER of $10 dollars U.S. and an obligation to reduce emissions by 2.5 billion MT, the market for clean energy in the developing world through 2012 is approximately US$25 billion and China's potential share is US$10 billion, based on a 40% share of the total market[2]. The investment from registered CDM projects will play a leveraging role in China's energy conservation and emissions reduction, which can attract up to ten times capital into fields of renewable energy and energy conservation.

Third, CDM has created a new service industry in China. Driven by CDM capacity building and interest, large numbers of technicians and market developers are devoting their time on energy efficiency and renewable energy exploitation. Therefore, enormous technical consulting and market development teams have formed and this new industry will play an important role in facilitating the smooth development of energy efficiency and renewable energy projects in China.

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[1] Data source: Statistics of Risoe Center, UNEP

[2] China Renewable Energy and Sustainable Development Report, http://www.chinastrategiesllc.com/reports/07_february_development_report.htm

	CDM Projects in Pipeline					Registered CDM Projects				
Type	No	% in Total	Annual CER ($ktCO_2e/yr$)	% in Total	Average annual CER ($ktCO_2e/yr/Project$)	No.	% in Total	Annual CER ($ktCO_2e/yr$)	% in Total	Average annual CER ($ktCO_2e/yr/Project$)
Hydro	762	47.63%	78778	23.89%	103.38	140	39.77%	12195	9.25%	87.11
Wind	303	18.94%	38356	11.63%	126.59	91	25.85%	10106	7.66%	111.06
EE own generation	239	14.94%	44588	13.52%	186.56	40	11.36%	12347	9.36%	308.68
Biomass energy	61	3.81%	11475	3.48%	188.11	11	3.13%	1605	1.22%	145.92
Coal bed/mine methane	60	3.75%	26990	8.19%	449.84	14	3.98%	7612	5.77%	543.7
Landfill gas	51	3.19%	7953	2.41%	155.94	16	4.55%	3271	2.48%	204.44
Fossil fuel switch	31	1.94%	27993	8.49%	902.99	9	2.56%	7827	5.94%	869.65
N_2O	28	1.75%	21753	6.60%	776.88	19	5.40%	18965	14.38%	998.13
Biogas	24	1.50%	1388	0.42%	57.85	1	0.28%	110	0.08%	110.46
HFCs	11	0.69%	65650	19.91%	5968.22	10	2.84%	57785	43.83%	5778.55
EE Industry	9	0.56%	1128	0.34%	125.29	0	0.00%	0	0.00%	0
Cement	6	0.38%	1330	0.40%	221.7	0	0.00%	0	0.00%	0
EE Supply side	6	0.38%	2038	0.62%	339.66	0	0.00%	0	0.00%	0
Reforestation	5	0.31%	164	0.05%	32.84	1	0.28%	26	0.02%	25.8
Solar	4	0.25%	143	0.04%	35.77	0	0.00%	0	0.00%	0
Total	1600	100.00%	329727	100.00%	9671.63	352	100.00%	131849	100.00%	9183.48
Source of Data: UNEP Risoe Center, CDM pipeline statistic, 1 January 2009										

Unit: thousand tons (KT)

Table 1: Chinese CDM Projects and Annual CER Volume by Project Type

3.2 Regional Distribution of CDM Projects in China

Chinese CDM projects are widely distributed across the country. By July 1, 2009, DNA has approved 2,063 CDM projects in provinces, municipalities and autonomous regions except for Tibet due to special reasons (see Table 2). Among these projects, those in Yunnan and Sichuan account for the most, with 251 and 210 projects respectively, 12.15% and 10.17% of the total in China. Inner Mongolia and Hunan have the next highest project numbers reaching 133 and 121. Moreover, there are 15 regions where there are 50 to 100 projects: Gansu, Shandong, Shanxi, Zhejiang, Hebei, Hubei, Guizhou, Guangxi, Jiangsu, Henan, Heilongjiang, Guangdong, Liaoning and Jilin.

Regional differences in project distribution are mainly determined by the regional resource differences. For example, among these projects in China, most are hydro and wind power because of the hydro and wind resources in provinces and municipalities such as Yunnan, Sichuan, Inner Mongolia and Hunan. Viewed from the anticipated emissions reduction generated by approved projects, anticipated emissions reductions from projects in Shanxi (second), Zhejiang (fifth), Jiangsu (sixth) and Shandong (seventh) are more than from other regions aside from Sichuan, Yunnan and Inner Mongolia. This shows that the average scale of a single CDM project in developed regions is generally larger than that in central and western China.

A total of 579 CDM projects approved by the Chinese DNA have been registered in EB. With respect to regional distribution, there are projects registered in EB in 30 other provinces, municipalities and autonomous regions except for Tibet. The top five cities holding registered projects are as follows: Yunnan (73), Sichuan (53), Inner Mongolia (43), Hunan (41) and Gansu (33). Moreover, there are 20 to 30 registered projects each in Shandong, Guizhou, Henan, Jiangsu, Hebei and Shanxi. As for the proportion of registered projects to projects approved by DNA, examples are Beijing (45.45%), Ningxia (40.91%), Guizhou (37.68%), Hunan (33.88%), etc. CDM projects started early in these provinces; therefore these provinces generally have comparatively good consulting services and technical support institutions.

Region	Number of Projects Approved by DNA	Proportion (%)	Anticipated Annual Emission Reduction of Approved Projects	Proportion (%)	Number of Registered Projects	Proportion (%)	Proportion to
Heilongjiang	54	2.62	9572876.92	2.87	14	2.42	25.93
Jilin	50	2.42	6895462.82	2.07	13	2.25	26.00
Liaoning	52	2.52	11783992.1	3.54	14	2.42	26.92
Inner Mongolia	133	6.44	23066956.8	6.93	43	7.43	32.33
Shanxi	87	4.21	32105662	9.64	20	3.45	22.99
Beijing	11	0.53	3879461	1.16	5	0.86	45.45
Hebei	76	3.68	11604667.4	3.48	20	3.45	26.32
Tianjin	1	0.05	48597	0.01	1	0.17	100.00
Shandong	92	4.46	15937958	4.79	30	5.18	32.61
Qinghai	19	0.92	1779359	0.53	4	0.69	21.05
Xinjiang	42	2.03	7967958.6	2.39	11	1.90	26.19
Ningxia	22	1.07	2879902	0.86	9	1.55	40.91
Gansu	99	4.79	11442802	3.44	33	5.70	33.33
Shaanxi	42	2.03	4311018	1.29	10	1.73	23.81
Anhui	48	2.32	8614976	2.59	12	2.07	25.00
Jiangsu	68	3.29	16607767	4.99	20	3.45	29.41
Zhejiang	83	4.02	22474978.37	6.75	15	2.59	18.07
Shanghai	12	0.58	5333928.68	1.60	1	0.17	8.33
Jiangxi	41	1.99	3173407	0.95	10	1.73	24.39
Fujian	64	3.10	9460632.9	2.84	19	3.28	29.69
Henna	61	2.95	8883214.23	2.67	20	3.45	32.79
Hubei	75	3.63	8382995.977	2.52	16	2.76	21.33
Hunan	121	5.86	12597301.5	3.78	41	7.08	33.88
Guangdong	53	2.57	10479433	3.15	17	2.94	32.08
Guangxi	69	3.34	10289528.5	3.09	17	2.94	24.64
Hainan	14	0.68	706797	0.21	4	0.69	28.57
Sichuan	210	10.17	33098184.2	9.94	53	9.15	25.24
Chongqing	44	2.13	8342329	2.51	8	1.38	18.18
Yunnan	251	12.15	25303250.51	7.60	73	12.61	29.08
Guizhou	69	3.34	6000640	1.80	26	4.49	37.68
Total	2063	99.90	333026037.5	100.00	579	100.00	28.07
Data source: Statistics from the CDM Project Management Centre of China and UNFCCC							

Table 2: Regional Distribution of CDM Projects in China

3.3 Sectoral Distribution of CDM Projects in China

Based on the industrial classification of UNFCCC on CDM projects, the CDM projects in China are divided into 15 categories of industries (see Table 3). We obtained the following conclusions through data analysis on industrial distribution of CDM projects in China.

First, the dominant projects in China utilize wind and hydro power. These two kinds of projects are predominant among the number of projects approved by DNA or from the number of projects registered in EB. There are 1,335 projects approved by DNA, of which 402 projects are registered in EB and separately account for more than 60% of the number of projects approved by DNA and the number of projects registered in EB. The anticipated annual emissions reduction of the 1,335 projects approved by DNA accounts for nearly 45% of the total number of approved projects in China. There are two reasons behind the high percentages of projects for these two types: first, the hydro and wind power resources in China are abundant and the development of hydro and wind power resources witnessed exponential development in recent years through the stimulation of national policies for the development of renewable resources and CDM; second, the CDM methodologies for these two kinds of projects are comparatively simple, which make it easier to gain approval from the DNA and EB, resulting in various consulting institutions putting vigorous effort in these projects.

Second, the registration rate of HFCs and N_2O decomposition projects is very high - nearly 100%. In total, 38 of these projects have been approved by DNA and 37 are registered in EB with only one N_2O decomposition project having been rejected. In addition, the average size of these two kinds of projects is comparatively large - especially the HFCs decomposition projects in which the project numbers only account for 0.53% of the total while the anticipated annual emissions reduction accounts for 6.25%. These two kinds of projects are the earliest ones in China and Chinese project developers have seized the opportunity for timely implementation. Because of this, project potential has been fully exploited.

Third, new projects such as the recycling of sulphur hexafluoride and substation of concrete material and landfill incineration for power generation all have long development cycles. Although the registration rate is not high at present, the potential is significant; therefore, they deserve close attention.

Type	Number of Projects Approved by DNA	Proportion (%)	Anticipated Annual Emission Reduction of Approved Projects	Proportion (%)	Number of Projects Registered in EB	Proportion to the Total Registered Ones (%)	Proportion to the Total Approved Ones (%)
Hydraulic power	991	48.04	107797685.7	32.53	275	47.50	27.75
Wind power	344	16.67	39726041.24	11.99	127	21.93	36.92
Biomass energy	81	3.93	14970808.57	4.52	12	2.07	14.81
Solar energy	4	0.19	143184	0.04	2	0.35	50.00
Coal-bed gas	73	3.54	36168527.7	10.92	22	3.80	30.14
Methane utilization	31	1.50	2163885	0.65	3	0.52	9.68
Garbage landfill gas	38	1.84	4303579	1.30	18	3.11	47.37
Burning of garbage for power	17	0.82	1793116.7	0.54	0	0.00	0.00
Energy conservation and promotion of energy efficiency	381	18.47	58107740.94	17.54	64	11.05	16.80
Conversion of fossil energy	41	1.99	30033703.68	9.06	14	2.42	34.15
Substitution of concrete material	18	0.87	3221854	0.97	4	0.69	22.22
HFCs decomposition	11	0.53	20692713	6.25	11	1.90	100.00
N_2O decomposition	27	1.31	11969229	3.61	26	4.49	96.30
Recycle of sulphur hexafluoride	1	0.05	156465	0.05	0	0.00	0.00
Re-afforestation	5	0.24	98520	0.03	1	0.17	20.00
Total	2063	100.00	331347053.5	100.00	579	100.00	28.07
Data source: statistics from the CDM Management Centre of China and UNFCCC							

Table 3: Sectoral Distribution of CDM Projects in China

3.4 Voluntary Emissions Trading

The Beijing Environment Exchange (BEE), Shanghai Environment and Energy Exchange (SEEE) and Tianjin Climate Exchange (TCE) were officially established on August 5, 2008. BEE and SEEE focus on the trading of energy efficiency and environmentally friendly technologies and emissions rights. The Tianjin Climate Exchange was established as China's first comprehensive platform for trading carbon credits under the Clean Development Mechanism and will promote environmental protection and emissions reduction by means of market and financial measures. These exchanges will eventually engage in the trading of GHG emissions, such as sulphur dioxide, COD and carbon dioxide. Currently, their business scope is limited to the trading of environmentally friendly technologies.

On August 5, 2009 a Shanghai-based insurance company purchased 8,026 tons of carbon credits generated from a public green-commuting campaign carried out during the Beijing Olympics - sealing the first domestic voluntary emissions trading in China's burgeoning voluntary carbon trading market. As a developing country, China is not subject to any obligations to reduce its greenhouse gas ("GHG") emissions under the Kyoto Protocol. The current carbon trading, as well as some domestic exchanges to promote the carbon trading market, in fact, belongs to a 'voluntary emissions reduction market' outside the conventional market. In other words, there are no emission reduction obligations for enterprises, but in order to achieve zero emission businesses they purchase emissions reductions in response to global warming.

The French company, BlueNext, and the China-Beijing Environment Exchange (CBEEX) created the standard which they hope to eventually expand to cover voluntary emissions reductions in Chinese transportation, construction and manufacturing. This marks a milestone in China's voluntary emissions reduction development. This standard will be developed in accordance with global requirements, rely on current methodology and focus on large-scale agricultural carbon emissions reduction programs of China and other countries. The Beijing Environmental Exchange and BlueNext will strive to create a standard that is widely accepted by both domestic and international communities in a couple of years. Voluntary carbon standards provide a framework for developers of clean projects to get emissions reductions verified e.g. reducing deforestation or storing carbon in soil through no-till farming. They can also lead to the creation of credits that can be sold in voluntary emissions markets.

In the emerging global carbon trading market, China should actively participate in building carbon markets and to seek rights for carbon pricing; otherwise, China, at the bottom of the global carbon trading chain, will become powerless in negotiating carbon pricing, for instance, in the international oil market. The absence of a national law or regulation governing the operation of an emissions trading market has led to the mushrooming of local emissions trading platforms in the rest of China.

3.5 Barriers to the Chinese Carbon Market

There are many barriers to the development of the Chinese Carbon Market.

3.5.1 Disputes about the Additionality of Chinese CDM Projects

Some environmentalists argue that some Chinese wind and hydropower projects have improperly received foreign investment without showing that they would not have been built without the financial support - a requirement known as "additionality". The CDM Executive Board has suspended approvals for dozens of Chinese wind farms amid questions over the country's use of industrial policy to obtain money under the scheme. In fact, the Chinese government had other goals such as limiting overcapacity in the wind turbine sector by setting subsidies.

The Chinese government wouldn't adjust subsidies just to get CDM money. It should be noted that China's attitudes toward CDM are complicated. China is one of the countries that demand strict CDM criteria to guarantee the integrity of Annex-I country commitment. China once took a very prudent position toward CDM project implementation yet the benefit of CDM in bringing additional foreign direct investment was not taken seriously in China.

3.5.2 High uncertainty beyond 2012

Delegates at the Bali 2007 Conference agreed that an international agreement for carbon markets post 2012 should be signed at the UNFCCC Conference of Parties in Copenhagen in December, 2009. So far, most CER sales contracts are for the period up to 2012. Even though some buyers have promised to buy CERs from relevant CDM projects after 2012, the purchase price is set at a much lower rate. The uncertainties about the market for CERs beyond 2012 have become the top barrier to CDM project development. This directly determines whether a project can gain CER sales revenue over the 10 or 21 year crediting periods. The different positions and disagreements among major players in the post 2012 international climate regime negotiations make the fate of the Kyoto Protocol very doubtful. No one can say for sure whether the first commitment of the Kyoto Protocol will become the last one or not and whether the Cap and trade mode under the Kyoto Protocol will be continued after 2012 or not, and these will determine whether there is a market and buyers for CERs.

While there is a high level of uncertainty surrounding emissions trading, some rough figures indicate the relative importance of different sources of supply and demand and total volume for the pre 2012 carbon market. This is shown below (Table 4).

EU ETS	0.5 - 1.5
Other Private Japan/CAN/NZ (incl. AAU)	0.0 - 0.5
Total Demand	3 – 5
Governments (UNFCCC)	2.5 - 3.0
ERU+CERs (CDM/JI)	1.0 - 3.0
Potential Gov. AAUs	7.0 - 8.0
Total Potential Supply	8 – 11
Source: Carbon point, 2008.	

Table 4: Total Volume for the Pre 2012 Carbon Market

3.5.3 Overcomplicated regulations

The CDM examines, approves, funds and verifies projects. The rules are too complicated and the regulations have been modified too frequently, which represents high risk for investment. Under the current system, the Methodology Panel assesses the submitted new methodologies which are then discussed by the EB.

The delay in considering and approving new methodologies from the Methodology Panel and the EB has recently been highly conspicuous. This is mainly due to the heavy work load imposed on them and partly because many of the methodologies needed to be revised, resubmitted and re-examined by the Methodology Panel before being forwarded to the CDM EB. The reluctance to be the first one to submit a new methodology is the result of the amount of time and effort to obtain the approval and the high possibility of refusal. As a result, fewer methodologies have been approved for the complicated and controversial projects. It is the role of the public sector to invest in developing the methodologies where private sector alone tends to under invest.

There are certain limitations in the CDM mechanism - the market mechanism design using a single project as the foundation for each methodology cannot ensure the dissemination and commercialization of climate-sound technology from developed countries to developing countries.

3.5.4 High transaction costs

The current barriers are the high transaction costs. The transaction costs for CDM are estimated in Table 5. There is a cost involved in each step of the CDM procedure. The total, up-front cost to prepare, register and validate a CDM project is in the 50,000-100,000 EUR range. Besides the up-front cost, a small fraction of the value of the CERs generated will be used to cover CER sales costs as well as the monitoring and verification of the project's emissions reductions. These 'operational costs' would typically amount to up to a few percentage points of the value of the generated CERs. For a small project, the transaction costs tend to be prohibitively high.

Pre-operational phase Design	Preparation and Review		**Operational Phase Design**	Sale of CERs	5%-15% of CER Value
	Baseline Study	12,000-15000		Adaptation Levy	2% of CER Value Annually
	Monitoring	5,000-10,000		Risk Mitigation	1%-3% of CER Value Annually
	Environmental Assessment			Verification	5,000 per Audit
	Stakeholder Consultation				
	Approval				
	Validation	10,000-20,000		Executive Board Administration	To be Determined (X% of CER value)
	Consultation and Project Appraisal				
	Legal and Contractual Arrangement	15,000-25,000			
Source: http://www.windpower-china.cn/files/CDM.pdf					

Table 5: Transaction Costs for CDM

3.5.5 Long approval duration for project registration and issuance

The market was hampered by supply constraints in CDM projects caused by delays in registration and issuance, as well as the uncertainty of post 2012 arrangements. The part-time functioning mode of the CDM EB and methodology panel means that a long waiting list for project applications and proposed methodologies tends to mean years of postponement and even years before final approval. At COP10, it has been proposed that sector-based and policy-based CDM have to be introduced to simplify the procedures, lower transaction costs and encourage wide participation from the developing world.

3.5.6 Sharply reduced demand

As is the current financial market, the carbon market is shaky. The global financial crisis led to a drop in international carbon trading prices which has created an adverse effect on the development of CDM projects. Declines in industrial output engendered by the financial crisis led to reduced emissions from European manufacturers, putting most of them well within their carbon quotas. This, combined with excess carbon credit allowances, pulled the price of CERs down by over two-thirds. CERs on the European Climate Exchange dropped from as high as US$47 per ton to as low as US$11. Since 2007, the prices for Certified Emissions Reductions (CERs) have fallen sharply by 60%. This reduction has made CDM projects look less attractive and investment is decreasing dramatically resulting in a drop of more than 30% in trade volume of Certified Emissions Reductions (CERs). Due to fears that CDM might be substituted or replaced after 2012 and that China may take responsibility for emissions reductions by 2012, a great number of CDM projects were developed in recent years, which also raised the price of CERs. There is a significant risk that competition between domestic players puts Chinese interests at a disadvantage in the bargaining process. This is compounded by information asymmetry, namely the lack of experience of domestic firms in the CDM process and limited knowledge of the international carbon market.

3.5.7 Decrease in 'low-hanging fruit' projects

Most high-quality, large-scale and low cost CDM projects have already been developed. HFC and NO2 projects enjoy low cost and risks while generating large amounts of CERs, shortening the period for investment return. Industrial gas destruction CDM projects, such as HFC and NO2 have been controversial because of the low investment cost and the large amount of CERs generated. Despite the fact that large shares of CERs were generated from a small number of HFC projects in the past, the share of these projects based on total annual CERs in the pipeline has actually decreased from 52.9% to 25.5% from December 2006 to May 2008. Likewise, EB-registered projects decreased from 89.9% to 56.7%. This is because HFC destruction potential in the Chinese market has, to a large extent, been exhausted and because of the income-sharing CDM management measure (taxation of 65% for HFC projects). Previously there was anticipation that projects from energy conservation in the construction and communications industries for enhancing energy efficiency would also become the most important fields for CDM implementation; however, the end result was quite different. This is mainly because these fields are hard to measure and monitor (additionality is difficult to prove), and the project implementation is too complicated which, in turn, results in excessively high cost and greater risk during project implementation.

3.5.8 Technology transfer or technology trade

Although China has had achievements in the implementation of CDM projects, we should note that the CDM projects in China still have not met the goal of 'helping developing countries to realize their sustainable development' as stated in the Protocol, especially in the area of technology transfer. In other words, China has not fully received the benefit of technology transfer for its CDM projects registered at EB.

As for the CDM projects that have been carried out, most of the 'technology transfer' mentioned refers only to the transfer of technology carriers - the equipment - which in some sense should be referred to as the 'trading' of technology and related products. Among the three criteria used to evaluate a technology transfer, only 'foreign' (equipment and design made outside China) and 'new' (advanced and new for China) can be met, but the criterion for 'capacity' (to obtain the ability and knowledge to operate and maintain relevant equipment) is still out of reach. First, from the description of PDD, it is evident that the CDM projects that include technology transfer account for less than 40% of total projects. Second, even among these projects referred to by the PDD as having technology transfer, field research has shown that 2/3 of the transfer acts only as equipment input, and the equipment is actually purchased at market price with basically no discount offered. Third, there is a clear gap in the transfer of the maintenance training for ordinary equipment and often these services need to be 'purchased'. These actualities have directly limited the effectiveness of CDM projects in contributing to a low carbon future.

4. China's Strategies and Policies to Address Climate Change

As the largest developing economy, China is faced with the dual pressures of economic development and climate change. Based on 'common but differentiated responsibilities' and consistent with the basic national situation, China is adhering to her framework of sustainable development to cope with climate change.

In recent years, China has formulated a series of policies, regulations, planning and standards to mitigate global climate change. These include energy saving, emissions reduction and development of renewable energy. These policies and measures are playing an active role in addressing climate change.

The economic incentives, financial instruments, renewable energy and energy efficiency policies formulated by the Chinese government to adapt to a low carbon economy laid a foundation for attracting foreign investment and cooperation in the carbon market. The central government poured in enormous sums of funding to help initiate project development - particularly in hydro, wind and solar renewable energy and energy efficiency projects. It was the vision of the central government that opened the gateway to the carbon market and spurred the 'chain-reaction' response for foreign investors to take part in CDM project development in China. Through measures such as financial subsidies, partial and total funding support and tax levies reduction to ensure the completion of projects construction and operations, the central government successfully created an optimal environment and conditions for the development of renewable energy and energy efficiency projects.

In effect, along with the additional financial incentives from selling CERs in the carbon market through CDM and the process of technological advancement through technology transfer from Europe and Japan, the carbon market in China was expanded at an exponential rate realizing over half of the projects in the world. Therefore, the national policies triggered the development of CDM projects by providing financial support; but foreign investment and CDM played an important role in stimulating the rapid expansion of the carbon market which has contributed to the low carbon development in China. The relationship between Chinese national policies and CDM is like water and soil - the pillars of low carbon future.

4.1 A contextual review

Although the goal of 'building a resource-efficient and environmentally-friendly society' is prominent in China's current five-year plan, many obstacles must be overcome before achieving it. These challenges shape the way in which China is approaching climate mitigation at the domestic level, as well as its position in international negotiations.

A look at the Chinese institutions that have been responsible for climate change policy is one way to understand how the government has approached this issue over time. Starting in the 1980s, China treated climate change as a scientific issue and gave the State Meteorological Administration the responsibility for advising the government on policy options in international negotiations surrounding the UN Framework Convention on Climate Change (UNFCCC).
As political awareness and sensitivity surrounding climate change increased in the late 1990s, this role shifted to the more powerful State Development and Planning Commission, which has since evolved into the National Development and Reform Commission (NDRC). The move indicated a shift in the relative value given to the issue, as well, as perhaps, a shift in perspective from a scientific issue to predominantly a development issue.

The NDRC also serves as the primary energy policy decision-making authority in China, and this move may have reflected the clear need for climate priorities to be coordinated better with energy decisions. It is now home to the National Coordination Committee on Climate Change, which oversees climate activities within the NDRC, the Ministry of Foreign Affairs, the Ministry of Science and Technology, and the State Environmental Protection Administration (SEPA). Today, the NDRC and the Foreign Ministry are responsible for formulating China's international negotiation positions.

Further institutional change came recently with the release of China's national climate change plan in June 2007, announcing a high-level leading group on climate change chaired by Premier Wen Jiabao and reporting to the State Council. Subsequently, the Foreign Ministry announced that it had also established a leading group in charge of international work on climate change, headed by Foreign Minister Yang

Jiechi. Then in early September, Ambassador Yu Qingtai was appointed China's new special representative of the Foreign Ministry for climate change negotiations. The role of this new special representative is to help implement China's domestic action plan to respond to climate change and to demonstrate 'the government's active participation in international cooperation on responding to climate change'.

The establishment of these two high-level leading groups and the appointment of a special representative on climate change in 2007 are positive signs that the Chinese leadership is focusing new attention on the issue. It is also apparent that leading Chinese research organizations that often provide analytical input to shape government policy decisions are increasing their work in this area.

The government released its first *"National Assessment Report on Climate Change"* in late 2006, conducted as a collaborative effort among more than 20 government departments and taking four years to complete. Structured similarly to the Intergovernmental Panel on Climate Change reports, the Chinese assessment consists of three parts: climate change history and trends, impacts and adaptation, and mitigation and socioeconomic evaluation. Subsequently, China released its much anticipated National Climate Change Program report on June 4, 2007. Referred to as China's climate change plan, the report has provided a comprehensive synthesis of the policies that China currently has in place that are serving to moderate its GHG emissions growth and to help the country adapt to climate impacts.

The majority of the policies and programs mentioned in the plan are not climate change policies but policies implemented throughout the economy, particularly in the energy sector that have the effect of reducing GHG emissions. Many of these policies have been enacted to help the country meet its broader economic development strategies and, if implemented effectively, will also serve as policies to mitigate China's GHG emissions. Two key policy areas are energy efficiency and renewable energy.

4.1.1 Energy efficiency

With the hope of achieving energy intensity improvements between 2000 and 2020 similar to what it had done in the previous two decades, China has a broad national goal of quadrupling economic growth while doubling energy consumption. Beijing's eleventh five-year plan includes a near-term goal of reducing national energy intensity 20 percent below 2005 levels by 2010. Implementation of such centrally administered government targets has proven challenging, particularly at the local level. In an attempt to improve local accountability, the NDRC is allocating the targets among provinces and industrial sectors and energy efficiency improvement is now among the criteria used to evaluate the job performances of local officials. These elevated implementation efforts appear to be having some impact.

Following increases in energy intensity each year from 2003 to 2005, the trend was reversed in 2006, although the intensity decline achieved was short of the goal for that year. Supplementary programs have been established to encourage specific actors to help meet this national intensity goal, including a program established in 2006 to improve energy efficiency in China's largest enterprises. Another government effort targets the elimination by 2010 of a number of small, inefficient power plants that total around 8 percent of China's generating capacity. Similar plant closings are planned across the industrial sector, including inefficient cement, aluminum, ferroalloy, coking, calcium carbide and steel plants.[3]

In addition, the 1997 Energy Conservation Law initiated a range of programs to increase energy efficiency in buildings, industry, and consumer goods. China has efficiency standards and labeling programs in place for many key energy-consuming appliances and is adopting energy standards for buildings in regions with high heating and cooling demands. In the transport sector, China's fuel economy standards for its rapidly growing passenger vehicle fleet are more stringent than those in Australia, Canada, and the United States (although less stringent than those in the EU and Japan) and the average fuel economy of new vehicles is projected to reach 36.7 miles per gallon in 2008[4].

4.1.2 Renewable energy

Under the National Renewable Energy Law adopted in 2005, China has set a target of producing 16 percent of its primary energy from renewable sources by 2020, up from about 7 percent at present. For the electricity sector, the target is 20 percent of capacity from renewables by 2020, which will require substantial increases in the use of wind power, biomass power, solar power and hydropower.

This law offers financial incentives such as a national fund to foster renewable energy development and discounted lending and tax preferences for renewable energy projects. Although increases in wind power in particular have been impressive in recent years, this energy source is still dwarfed by large-scale hydropower. Hydropower capacity is projected to more than double by 2020, requiring the equivalent of a new dam the size of the Three Gorges Project every two years.

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[3] "China to Require Swap of Old Coal Plants for New," Reuters,http://www.planetark.com/dailynewsstory.cfm/newsid/40107/newsDate/1-Feb-2007/story.htm ; "China to Shut Old Steel, Power Plants in 2007 – Wen," Reuters http://www.planetark.com/dailynewsstory.cfm/newsid/40654/newsDate/5-Mar-2007/story.htm.

[4] An Feng and Amanda Sauer, "Comparison of Passenger Vehicle Fuel Economy and GHG Emission Standards Around the World," Pew Center on Global Climate Change, December 2004, http://www.pewclimate.org/global-warming-in-depth/all_reports/fuel_economy.

Policies to promote renewable energy also include mandates and incentives to support the development of domestic technologies and industries, for instance, by requiring the use of domestically manufactured components. Spurred by a requirement that newly installed wind turbines contain 70 percent local content, Chinese manufacturers are now producing about 40 percent of the wind turbines being sold in China and 3 percent of the wind turbines being sold globally. Tax and other incentives have targeted the solar photovoltaic (PV) industry, stimulating a six-fold growth in PV production from 2004 to 2005. A recent market study estimates that the Chinese PV industry will dominate the global market within five years; China is currently the third-largest producer of solar PVs for the global market.

4.2 The Principles and Objectives of China's Response to Climate Change

China's response to climate change and the overall objectives are: to control GHG emissions and achieve significant emissions reduction results; to brace the ability to adapt to climate change; to advance in climate change related scientific knowledge and technology and to achieve new progress on research and public awareness of climate change levels.

In the sixth section of the 'Eleventh Five-Year Plan' - Building a Resource-efficient and Environmentally-friendly Society, Chapter 22, 'Developing a Circular Economy', emphasized the objectives in addressing climate change - to strengthen energy conservation efforts and enhance efficient utilization of policy guidance.

The approach for the planning processes emphasizes three aspects: First, by optimizing the industrial infrastructure - in particular reducing the proportion of high energy-consuming industries to achieve energy-saving; second, through the development and promotion of energy efficient technologies to achieve utilization of energy efficient technologies in rural and urban environments; and third, through supervision and management of energy production systems, thereby increasing the efficiency of primary energy production, transportation and consumption.

Optimization of key industries must give prominence to the iron and steel, nonferrous metals, coal, electricity, chemical, building material and construction industries. In addition, focus should be on increased enforcement of vehicle fuel economy standards, accelerated elimination of old transportation equipment and active development of oil alternative transportation and encouraging the production and efficient use of energy-saving products.

From an implementation perspective, planning will mobilize all social forces so that the central government, local governments, large corporations and the public can play their respective roles. The central government would lead by developing national goals and disseminating them to the provinces, municipalities and autonomous regions. Meanwhile, setting energy-saving emissions reduction targets for energy intensive industries and large enterprises can be the key to encourage society as a whole to participate in building a resource-saving and environmentally friendly society.

The following sections will examine closely the newly adopted policies that are aimed at strengthening the development of the carbon market.

4.3 New Energy Policies

4.3.1 Renewable energy policies

The 'Renewable Energy Law' was implemented in February, 2005. The *"Long-term Plan for Renewable Energy"* (hereinafter referred to as "long-term planning") was issued in September, 2007. In March 2008, the implementers of the long-term planning released "Renewable Energy Development Eleventh Five-Year Plan" (hereinafter referred to as the "development plan") to promote renewable energy development and provide effective legal protection. These laws and regulations provide a powerful legal guarantee for the development and utilization of renewable energy technologies.

According to the development plan, the national share of power input from renewable energy will reach the 10% mark by 2010; the consumption of power generated from renewable energy will be equivalent to 300 million tons of standard coal. The total installed capacity of hydropower will reach 190 million kilowatts, wind power capacity will reach 10 million kilowatts, a total installed capacity of biomass power generation will reach 5.5 million kilowatts and solar power generation will reach 300,000 kilowatts. In addition, the utilization of biogas will reach 19 billion cubic meters, non-grain feedstock ethanol will reach two million tons and bio-diesel 200,000 tons. The total collector area of solar water heaters will reach 150 million square meters and geothermal energy usage will reach 4 million tons of the standard coal equivalent[5].

[5] http://www.sdpc.gov.cn/zcfb/zcfbtz/2008tongzhi/W020080318381136685896.pdf

"Long-term planning" announced the overall goals for the next decade (until 2020) for China's renewable energy development:

- Increase the proportion of energy consumption from renewables, particularly in rural and remote regions such as Xinjiang and Inner Mongolia, to improve basic amenity infrastructures and life quality of their residents.
- Promote the utilization of organic waste bio-energy and renewable energy technologies for industrial development. China will endeavor to attain 15% of its total energy consumption from renewable energy by 2020 - of which hydropower will reach 300 million kilowatts installed capacity, biomass power generation will reach 3,000 MW, total installed capacity of wind power will reach 30 million kilowatts and solar power total installed capacity of 1.8 million kilowatts[6].
- In addition, by 2020, utilization of methane gas will reach 44 billion cubic meters, bio-fuel ethanol consumption will reach 10 million tons, bio-diesel usage 200 million tons, geothermal energy to reach 12 million tons of the standard coal equivalent, tidal power plants will reach 100,000 kilowatts and the total collector area of solar water heaters will reach about 300 million square meters,[7].

Table 6 shows the different targets of renewable energy scale in 2010 and 2020.

Content	Scale of RE Utilization			
	2010	Unit	2020	
	Quantity		Quantity	Unit
Generation	205800	MW	205800	MW
Hydropower	190000		190000	
Biomass Power	5500		5500	
Wind Power	10000		10000	
Solar	300		300	
Air supply	15	Billion m^3	15	Billion m^3
Methane				
Heating				
Solar water heater	1.5	Billion m^2	1.5	Billion m^2
Geothermy	4	Million tce	4	Million tce
Fuel	3.2	Million ton	3.2	Million ton
Biomass Briquette	1		1	
Bio-fuel ethanol	2		2	
Biodiesel	0.2		0.2	
Source: Long-term Plan for Renewable Energy				

Table 6: Scale of Renewable Energy Utilization Expected in 2010 and 2020

On May 9, 2008, the Ministry of Finance and the National Development and Reform Commission jointly issued the *"Financial Subsidies to Promote Efficient Lighting Products Fund Management Interim Measures"* (Finance Construction [2007] No. 1027, hereinafter referred to as the "measures"). Based on this approach, for commercial buildings, the central government will subsidize the price of efficient lighting products by 30%; for urban and rural residential consumers, the central government will subsidize 50% of the price of efficient lighting products.

The National Development and Reform Commission published *"October 2007 to June 2008 Subsidies for Renewable Energy Tariff and Quota Trading Notification Program"*. The scope of subsidies covers the direct combustion of straw power generation projects with the standard rate for subsidies being set at 0.1 RMB per kWh[8].

In August 2008, the Ministry of Finance issued the *"Interim Measures for the Administration of the Special Funds for the Industrialization of Wind Power Generation Equipment"*. The subsidy standard is 600 RMB/kW, which is equivalent to about 10% of the total operational cost of wind farms[9].

On July 20, 2009, the National Development and Reform Commission released the *"Notice of Improving the Electricity Price of Wind Power Policy "*. It divides the wind energy resource zone in the entire nation into four parts with benchmark prices of wind power of 0.51 RMB/kWh, 0.54 RMB/kWh, 0.58 RMB/kWh and 0.61 RMB/kWh for each zone.

These policies are intended to subsidize the total cost of these projects resulting in reduced pay-back time of their investments. It is clear that these policies are the pre-emptive measures for the decline in renewable activities, contributing to the development of the carbon market in China.

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[6] http://www.sdpc.gov.cn/zcfb/zcfbtz/2008tongzhi/W020080318381136685896.pdf
[7] http://www.sdpc.gov.cn/zcfb/zcfbtz/2008tongzhi/W020080318381136685896.pdf
[8] http://www.ccchina.gov.cn/cn/NewsInfo.asp?NewsId=15440
[9] http://www.investzj.gov.cn/wjc/212.doc

4.3.2 Nuclear energy policy

In October 2007, the State Council's *"Long-term Nuclear Power Development Plan (2005-2020)"* specifically stated that nuclear power capacity will increase from the current 7 GW to 40GW by 2020[10].

To achieve these goals in the coming decade, three nuclear power plants will be constructed each year, with an annual generation of 260 - 280 billion kWh by 2020. Based on the newly built and existing nuclear capacity of 17GW, by the end of 2020, the total nuclear capacity will reach 18GW.

Period	Planned Additional Capacity for the Next Five Year Period	Existing Capacity during Five Year Period	Total Operational Capacity by the End of Five Year Period
Before 2000			226.8
During the 10th Five-years	346	468	694.8
During the 11th Five-years	1244	558	1252.8
During the 12th Five-years	2000	1244	2496.8
During the 13th Five-years	1800	2000	4496.8
Note: Due to potential fluctuations in each plant's capacity, existing capacity from completed plants will vary from the planned additional capacity.			

Unit: MW

Table 7: Estimated Progress of Nuclear Construction

4.4 Energy Efficiency Policies and Projects

4.4.1 Renovation of coal-burning industrial furnaces (kilns)

There are approximately half a million units of medium and small boilers in China. The average unit capacity is only 2.5t/h, the design efficiency 72-80%, an actual operating efficiency of about 65% of which 90% are coal-fired boilers, the annual consumption of coal is between 0.35 – 0.4 billion tons with a coal saving potential of about 70 million tons.

During the "Eleventh Five-Year" period, coal-fired industrial boiler efficiency increased by 5% and coal-fired furnace efficiency increased by 2%, saving 25 million and 10 million tons of coal respectively, because of the replacement of the existing small coal-fired boilers (kilns) with circulating fluidized bed, pulverized coal combustion and other advanced technologies which complemented the establishment of scientific management and operation mechanisms[11].

4.4.2 Projects to utilize waste heat and residual pressure)

During the "Eleventh Five-Year" period, the iron and steel industries will implement CDQ, TRT blast, full-blast furnace gas power generation transformation, as well as gas converter recovery and utilization. This should achieve an annual energy savings of 2.66 million tons of standard coal. With daily production of more than 2,000 tons of cement, they expect to install 30 sets of the low-temperature waste heat power generation units a year to create annual energy savings of 3 million tons of standard coal[12].

4.4.3 Petroleum conservation and substitution projects

The implementation of motor vehicle fuel economy standards and supporting policies to adopt various measures to save petroleum as well as the implementation of the "Clean Vehicle Action Plan", promoted the development of hybrid cars in urban public transportation including buses, taxis and other vehicles and accelerated the promotion of alcohol fueled vehicles and coal liquefaction projects. The development of alternative fuels can result in savings of up to 38 million tons of oil equivalency.

4.4.4 Electrical motor energy conservation

At present, the total capacity of various types of electric motors is about 420 million kilowatts. The 'Eleventh Five-Year' period is focused on promoting energy-efficient motors and permanent magnetic motors. Installation of energy-efficient fans, pumps, compressors, system optimization transformers and automatic system control technologies in the coal, electric power, and nonferrous metals, petrochemical and other industries have achieved annual savings of 20 billion kWh[13].

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[10] http://www.ccchina.gov.cn/WebSite/CCChina/UpFile/2007/2007112145723883.pdf
[11] http://www.sdpc.gov.cn/zcfb/zcfbtz/tz2006/t20060802_78934.htm
[12] http://www.sdpc.gov.cn/zcfb/zcfbtz/tz2006/t20060802_78934.htm
[13] http://www.sdpc.gov.cn/xwfb/W020050707568608679047.doc

4.5 EEB Policies

With the rise in living standards, energy consumption in buildings is expected to increase rapidly. Energy efficiency in buildings has therefore attracted more and more attention from the Chinese government, research institutions and the general public. China's annual increase in building area is averaging 18 - 20 million square meters and building energy consumption now accounts for 20.1% of total energy consumption[14]. In recent years, the National Development and Reform Commission (NDRC) and the Ministry of Construction (MOC) have promoted a series of building energy saving policies and regulations.

In 1996, China issued a mandatory design standard for building energy efficiency with the target of a 50% energy-savings compared to 1980. For new buildings in the four municipalities and the northern cold regions, the state even requires the implementation of 65% energy efficiency standards from those in 1980. Since then many laws, regulations and standards have been issued to enforce energy efficiency in buildings.

The Energy Conservation Law came into effect on the January 1, 1998. According to Article 1, the law stipulates that every entity or individual has an obligation to save energy and the right to be informed about energy-related issues such as energy-saving behavior. Article 37 directly refers to buildings stating that "Building designs and construction shall employ energy-saving types of construction structures, materials, facilities and products that improve heat insulation and reduce energy consumption for space heating, cooling and lighting".

The law was revised in 2007 to further include energy efficiency in buildings. The main amendments related to buildings are the renaming of the Ministry of Construction (MOC) to Ministry of Housing and Urban-Rural Development (MOHURD) and the determination of penalties for non-compliance with energy efficiency standards. It also explicitly states that the fulfillment of energy conservation targets is taken into consideration when evaluating the performance of local government officials.

In July 2008, China promulgated the "Civil EEB Regulations". The implementation of these regulations has made "reduction of building energy consumption by 50%", the signature building energy efficiency target. To ensure strict energy-saving management, from 2008 onwards, all newly-built residential housing is required to state energy standards and energy efficient measures in their contract documents. According to the building energy efficiency target set by the MOC to be achieved by 2010, building energy-savings must reach 110 million tons of a standard coal equivalent; renewable energy applications will occupy all new building area ratios of up to 25%. By 2020 the design standards of 50% energy efficiency will be strictly enforced in all new buildings nationwide. Municipalities and some big cities will take the lead in implementing the standard of a 65% energy-savings[15].

To promote the application of renewable energy technologies in the building sector in order to improve building energy efficiency, in September, 2006 the Ministry of Finance and the Ministry of Construction jointly issued the "Interim Measures for Management of Renewable Energy Applications in Buildings Fund". The term 'renewable energy applications in buildings' refers to the use of solar energy, shallow geothermal energy, waste water heat utilization, wind and biomass, etc. for heating and cooling of the buildings, hot water supply, power supply, lighting and cooking energy use.

In March 2009, the Ministry of Finance developed *"Interim Measures for the Administration of the Subsidy Funds from Public Finance for the Application of Photovoltaic Solar Energy in Buildings"*. The granted fund is part of the fund from "Renewable Energy Applications in Buildings Fund Management Interim Measures" which supports solar photovoltaic applications in the rural and urban construction sectors. In principle, the subsidized rate in 2009 set the standard at 20 RMB /W[16], so that the cost of generation will be 1 RMB/kWh.

At the same time, the Ministry of Finance and Ministry of Housing and Urban Rural Development issued *"Accelerating the Applications of Solar PV Building Implementation Views"*. It states that the central government will arrange funds for a photovoltaic building demonstration project and will provide subsidies and financial priority to supporting advanced technology and encouraging local governments to introduce relevant fiscal policies.

In July 2009, the Ministries of Finance and Housing and Urban Rural Development jointly issued *"Accelerate the Construction of Renewable Energy Applications in Rural Areas Program"*. The program set the renewable energy subsidy standards for architectural applications for rural areas in 2009: ground-source heat pump technology at 60 RMB /m^2 and integration of solar thermal applications at 15 RMB /m^2. Grants for each demonstration province are a maximum of 18 million RMB[17].

Concurrently, both ministries jointly promulgated the *"Renewable Energy Applications in Buildings Demonstration Cities"* (hereinafter referred to as "urban demonstration"). Urban demonstration pointed out the following: the central government finance will provide grants to the chosen demonstration cities. Each model city will receive 50 million RMB with a maximum of no more than 80 million RMB. In principle, 90% of the received fund should only be used for energy efficiency construction in buildings.

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[14] Building Energy Research Center of Tsinghua University, Annual Development Report on China Building Energy Efficiency 2008, P244
[15] http://www.shghj.gov.cn/News_Show.aspx?id=6868
[16] http://www.fdi.gov.cn/pub/FDI/zcfg/zh/zmgz/P020090327332925008488.pdf
[17] http://jjs.mof.gov.cn/jinjijianshesi/zhengwuxinxi/zhengcefagui/200907/t20090708_177415.html

4.6 Transport energy policy and planning

In January 2009, the Ministry of Science and Technology and the Ministry of Finance jointly issued the *"Alternative energy vehicles demonstration and extension of the experimental work notice"* (hereinafter referred to as "Notice"). It pointed out that in China, energy efficient and alternative energy vehicle demonstration and extension pilot projects will receive a one-time fixed subsidy, matching subsidies to local governments to encourage Beijing, Shanghai and other 13 cities to promote the use of energy efficient and alternative energy buses, taxis, totaling no less than 60,000 vehicles by 2012.

On 9th February 2009, the General Office of the State Council issued the *"Automobile Industry Restructuring and Revitalization Plan"* which focuses on prioritizing the development of alternative energy vehicles. Concrete policies and measures are as follows:

- Car purchase tax reduction: From January 20, 2009 to December 31, 2009 vehicles of 1.6 liters and below are entitled to the reduced rate of 5% purchase tax levy;
- Car Subsidy Program for Rural Areas: From March 1, 2009 to December 31, 2009 5 billion RMB will be available from central government and will be allocated to farmers in many ways, such as subsidizing the purchase of low emission minibuses that are 1.3 Liters and below;
- Provide financial subsidies to accelerate the process of replacing old vehicles with new ones; increase the subsidy funds from 0.6 billion RMB in 2008 to 1 billion in 2009;
- 10 billion RMB will be allocated for funding enterprises for technology advancement and transformation and the production of energy efficient products and
- Start demonstration projects for the development of energy efficient and new energy vehicles. The financial subsidies will support the popularization of new energy vehicles such as hybrid vehicles, pure electric vehicles and fuel cell vehicles in medium and large cities.

4.7 Low Carbon Development in China

The path of developing a low-carbon economy has achieved global consensus, but is also in full compliance with China's national interests; a low-carbon economy is an inevitable choice for China's future development. The NDRC is currently drafting guidance on a low-carbon economy and to define the concept of a low-carbon economy.

The Chinese Academy of Sciences published the *"2009 China's Sustainable Development Strategy Report"*, which suggested that the Chinese should place 'low-carbon' as a national strategy for socio-economic development objectives, strive to achieve energy intensity of 40% to 60% reduction by 2020 compared with 2005 levels and reduce carbon dioxide emissions per unit GDP by 50% or so. However, those targets are too ambitious. A reasonable expectation should be that 30% - 40% energy intensity reduction and 30% reduction in CO_2 emission per unit GDP by 2020 compared with 2005 levels.

The development of a low carbon energy strategy for China must be supported by three sub-strategies: First, enhance energy conservation, energy efficiency and overall control; second, ensure clean and efficient use of fossil fuels, gradually turning fossil 'black' fuel into clean energy; and third, accelerate the development of nuclear energy and renewable energy, gradually transforming it into the pillar of China's green energy.

In January 2008, the World Wide Fund for Nature (WWF) and the Ministry of Construction launched 'low-carbon city' development demonstration projects, using Baoding in Hebei Province and Shanghai as the pilot cities. The construction of a low-carbon city began officially in China. Since then, Zhuhai, Hangzhou, Guiyang, Jilin, Nanchang, Guangyuan, Ganzhou, Wuxi and other cities have proposed the concept of building a 'low-carbon city'.

For example, the Baoding city government had put forward the "Solar City" concept early in 2007 and planned a large scale application of solar-based renewable energy in the whole city to reduce carbon emissions. The government planned to build Baoding as the first city in China with a large-scale application of solar energy in lighting, heating and other aspects in 2 to 3 years. By 2010, the city will annually save 430 million degrees of electricity which is equivalent to 118,000 tons of standard coal, with reduction of 12,900 tons of SO_2 and 428,000 tons of CO_2[18].

[18] Wang weiguang, Zheng guoguang, Annual Report on Climate Change Actions 2009, P237, Social Science Academic Press

5. China's Position on the Copenhagen Climate Conference and Opinions on Key Issues

5.1 China's position on climate negotiation

Climate change is one of the most serious challenges to humanity in the 21st century and requires cooperation and joint effort by the international community under the conditions of common but differentiated responsibility.

The objective of the Copenhagen Climate Conference is to further enhance the full, effective and sustained implementation of the UNFCCC and its Kyoto Protocol and to reach a positive outcome. Focus will be on making concrete arrangements for mitigation, adaptation, technology transfer and financial support.

As a party to the United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol, China is always committed to having the UNFCCC and its Kyoto Protocol implemented and is very serious about honoring its commitments. Furthermore, China will continue to play an active and constructive role in the Copenhagen negotiations[19].

In accordance with the convention, the shared vision must promote the right to development and integrate the legitimate priority of sustainable development and poverty eradication in non-Annex I countries, and is composed of the four building blocks of the Bali Action Plan (BAP). China's position is that any climate negotiation will not be a successful one in the absence of BAP and the Kyoto Protocol.

5.1.1 Emission reduction targets for the medium- and long-term periods

For emission reduction targets, China accepts the target of the global temperature being no more than 2 Degrees Celsius (2°C) above pre-industrial levels. IPCC AR4 shows that the limitation of a global temperature increase to 2°C above pre-industry levels will decrease risks associated with climate change. Alternatively, if the global temperature increase is higher than the limit, the possibility of an irreversible catastrophe is likely to be triggered. To reach the target, a possible pathway of emissions reduction is to stabilize the GHG concentration in the atmosphere at lower than 450ppm or even more.

5.1.2 Mitigation

To apply the principle of 'historical responsibility accumulated GHG emissions' and the principle of 'common but differentiated responsibility', all parties should actively participate in greenhouse gas emissions reduction. Developed countries should take responsibility for their historical cumulative emissions and their current high per capita emissions. Developed countries should reduce emissions first as a demonstration for developing countries. China requires that, by 2020, developed countries cut their emissions by at least 40% compared to their 1990 levels. Additionally, developed countries should provide finance and environmentally sound technologies to developing countries to help them do better in Nationally Appropriate Mitigation Actions (NAMAs) as well as in economic development. Developing countries should pursue economic development and poverty eradication and take proactive measures to adapt to and mitigate climate change.

5.1.3 Adaption

Adaption of climate change is as important as mitigation for developing countries, since these countries are vulnerable and prone to suffer significant impact from climate change because of their poor economies and weak infrastructure facilities. Sustainable development is a means for effectively addressing climate change; addressing climate change is a means for promoting sustainable development, and adaption of climate change is a part of addressing climate change. To help developing countries - especially the least developed countries (LDCs) and small island developing states (SIDS) - to adapt to the impact of climate change is a moral issue and an obligation of developed countries. Therefore, developed countries should provide additional support through finance, technology and capacity building to help developing countries in adapting climate change.

[19] The website of Permanent Mission of the P.R.C. to the UN: www.fmprc.gov.cn/ce/ceun/eng/gdxw/t568959.htm

5.1.4 Funding

There is a need to create an adaptation fund, a mitigation fund, a multilateral technology acquisition fund and a capacity building fund. All funds should be new and additional - that is to say that no fund should include the existing ODA and current obligations of donor countries. The funds should be governed with equitable and balanced representation by all parties.

As for the scale of funding, developed countries should contribute 1% of their annual GDP to the fund based on common but differentiated responsibilities. The primary financing would be public funding from developed countries, with complementary private sector funding. Developing countries would adopt a series of NAMAs together with technology, finance and capacity building support to match the financial and technological support from developed countries.

5.1.5 Technology transfer

Technology development and transfer is critical in combating climate change in developing countries. The priority is to establish appropriate institutional arrangements to ensure obligations of developed countries under the UNFCCC are implemented. Annex I parties develop incentive mechanisms to facilitate the transfer and diffusion of environmental sound technologies to developing countries. Progress in technology transfer including range, scale and effectiveness should be regularly monitored and assessed.

5.1.6 Summary

Financing and technology are indispensable means of achieving mitigation and adaptation. The fulfillment of commitments by developed countries to provide financing, technology transfer and capacity building support to developing countries is a condition for developing countries to effectively mitigate and adapt to climate change. In fact, the provision of technology, financing and capacity building support to developing countries is the obligation of Developed Country Parties under the UNFCCC, and the governments of developed countries should play central roles and not evade their obligations.

5.2 China's Requirements or Expectations of Developed Countries

5.2.1 Identification of medium-term emission reduction target for annex I parties

Developed country parties have pledged their long term (by 2050) emission reduction targets, yet they are reluctant to commit to medium-term emission reduction targets consistent with their long term goals. However, the Bali Action Plan requires more medium-term pledges from developed countries since medium-term emission reduction targets are a fundamental guarantee to the implementation of long term targets. As such a medium-term target is practicable and meaningful.

It is necessary to identify medium-term emission reduction targets for Developed Country Parties. Any long-term global goals should be based on sound science. To keep the temperature increase below 2 C above pre-industrial levels and to stabilize the GHG concentration below 450 ppm by 2020, Annex I parties' emissions should be reduced 25% - 40% from their 1990 levels. To ensure the targets are met, China insisted that Annex I parties as a whole should reduce emissions by at least 40% by 2020 compared to 1990 levels. Each individual country may not have the same reduction commitment, but the collective effort from Annex I countries as a whole should meet the target reduction.

5.2.2 Deeper quantified emission reduction targets

For the medium-term emission reductions targets, the developed countries are using different baseline years, which might lead to bigger recorded differences compared to their actual emissions reductions. In addition, the nature of the carbon trade is to offset carbon emissions at a lower cost in developing countries, lowering the economic incentives to reduce emissions in Annex I countries. The low ambition or high ambition pledge for Annex I countries is shown in Table 8; pledges with additional conditions will be harmful to all parties in addressing climate change. Table 9 shows the medium and long-term emissions reductions targets of some Annex I parties.

Country	Low Pledge (%)	High Pledge	Total Operational Capacity by the End of Five Year Period			
(%)	Reference Year	Inclusion of LULUCF	Inclusion of Mechanism	Status		
USA	0	−17 to −23	1990	Y	Y	Waxman & Markey bill as of May 19
Australia	-5	−25	2000	Y	Y	Officially announced; Rudd 4 May 2009
Canada	-20	-20	2006	TBD	TBD	Officially announced
Japan	-15	-25	2005	N	N	Under consideration
EU-28	-20	-30	1990	Y	Y	Adopted by legislation.
Russia	-10	-15	1990	TBD	TBD	Officially announced
Ukraine	-20	-20	1990	TBD	Y	Under consideration
New Zealand	-10	-20	1990	Y	Y	Officially announced
Norway	-30	-30	1990	Y	TBD	Officially announced
Iceland	-15	-15	2005	Y	TBD	
Abbreviations: TBD = to be determined						

Table 8: Low and High Pledges of Individual Annex I Countries for the year 2020[20]

Country	Reference year	Target year	Emission reduction Target(%)
USA	2005 / 1990	2020 / 2050	-17 / -80
Australia	2000	2020 / 2050	-25 / -60
Canada	2006	2020 / 2050	-20 / -60~-70
Japan	1990 / Current	2020 / 2050	-25 / -60~-80
EU-28	1990	2020 / 2050	at least-20 / at least-80
Russion	1990	2020	-10~15
Ukraine	1900	2020 / 2050	-20 / -50
New Zealand	1900	2020 / 2050	-10~20 / -50
Norway	1990	2020	-30
Iceland	1990	2020	-15

Table 9: Medium- and Long-term Emission Reductions Targets of Some Annex I Parties

Considering the existing emission reduction programs in Table 2.2, Annex I country emissions reductions by 2020 are only about 10% - 16% compared to 1990, which is lower than the 25% - 40% set by the IPCC to control the 2C temperature increase. But it is also far lower than the 40% emissions reductions required by developing countries.

Obviously, the emission reductions targets of Annex I parties is contrary to the target of stabilizing global GHG concentrations. Developed countries should indeed do more than the current trend.

5.2.3 Technology, financing and capacity building support to developing countries

At this point, not a single developed country has financed any developing countries substantially. During the Copenhagen conference and post Kyoto Protocol, China is eager to see the Bali roadmap implemented and that Annex I parties will take active action to support developing countries in their mitigation and adaption of climate change.

[20]"Climate change scientific assessment and policy analysis" issued bye Netherlands environmental assessment agency.

5.3 China's Opinions on Key Issues

5.3.1 CDM Mechanism

By August 1, 2009 the total number of CDM projects in China was 1931 and the total volume of CERs was 375.56mt, accounting for 37.01% and 55.11% of the global share respectively. Of these, there are 599 registered projects with total CERs of 182.21 mt. Though the revenue from CDM projects is very small compared to the total investment, the CDM mechanism plays a very important role in China, brings some degree of capital for the projects and facilitates the transfer and diffusion of some low-carbon technologies. For instance, the Ningguo Cement Plant 9100KW Waste Heat Recovery and Utilization for Power Generation Project, Anhui Conch Cement Co., Ltd. has boosted the recovery and utilization of waste heat in the cement sector in China significantly. Based on this project, the company, Conch-Kawasaki Energy-saving Equipment Manufacturing Co., Ltd. was established in January 2005. Since then, the investment cost has halved and the construction period has also shortened in this sector in China.

Since the global financial crisis, the development of CDM projects in China has suffered dramatically both in numbers and progression. Fewer CERs buyers or lower CERs prices resulted in the delay and/or cancellation of some CDM projects, effectively holding back the transfer and diffusion of some low-carbon technology into China. Post Kyoto Protocol, China hopes that the CDM mechanism will still play an important role in promoting global cooperation in emission reductions.

5.3.2 CCS

As an important and potential emission reduction technology, China attaches great importance to the research and development (R&D), demonstration and deployment of CCS. In recent years, China has implemented CCS demonstration projects in some regions. Fossil fuel coal is still the main energy resource in China. The latest data shows that coal accounted for a 68.7% share of total energy consumption and the proportion of coal-fired power is about 80% of the total power supply. China will need CCS technology in the coming future but the cost of CCS is too high at present.

CCS technology will decrease energy efficiency and increase electricity production cost. At present, the cost of emission reductions in CCS is more than 20US$/t$CO_2$e, which is much higher than the current price of CERs 10US$/t$CO_2$e. Furthermore, CCS requires about 20% additional energy to run the system and China has a significant shortage in its energy supply. Obviously, CCS in China is just an optional technology rather than an obligatory mitigation technology. Compared to CCS, China has more economically viable mitigation technologies such as increasing energy efficiency and renewable energy utilization.

CCS in China is presently at the demonstration stage. The commercial application of CCS is not only constrained by high financial and energy cost, technology immaturity or uncertainty, but is also affected by resource endowment of the high proportion of coal and coal-fire power in the energy supply. Without an additional finance or technology supply, CCS will hardly become the priority technology of mitigation for China in the short-term. To promote R&D and the demonstration and deployment of CCS in China, developed countries and China should join forces and cooperate and decrease the cost of CCS by means of carbon trading. Only this can make it possible for CCS to be commercialized in China.

5.3.3 NAMAs

China has established the National Programme on Climate Change and National Communication to fulfill its commitments to the Parties. At the Copenhagen climate conference, China will agree to NAMAs as a course of action to mitigate climate change.

However, NAMAs by developing countries should be considered in the context of sustainable development and in line with the legitimate priority needs of developing countries for development and poverty eradication. NAMAs in developing countries should be in line with their national circumstances and sustainable development strategies, with priorities identified by themselves, and are concrete mitigation policies, actions and projects. This is very distinct from the quantified emissions reduction commitments and targets set by the developed countries. NAMAs by developing countries should be supported and enabled by technology, funding and capacity building provided by developed countries in a measurable, reportable and verifiable way under UNFCCC. At the same time, developing countries should establish and request an appropriate mechanism to match NAMAs with technology, financing and capacity building support. The finance and technology support from developed countries must be measurable, reportable and verifiable, in order for the NAMAs to be measurable, reportable and verifiable accordingly.

5.3.4 REDD

REDD is an important way to enhance forest carbon stocks through conservation. Sustainable management of forests and incremental change of forest cover in developing countries are important measures in promoting sustainable development and poverty eradication to combat climate change in developing countries.

In accordance with the provisions of the UNFCCC, developed countries should provide adequate financing, technology and capacity building support to enable developing countries to take voluntary actions to reduce emissions from deforestation and forest degradation, and enhance forest carbon stocks through conservation, sustainable management of forests and incremental change of forest cover.

Only a very small percentage of the emission reduction from REDD can be used to offset developed countries' emission reduction targets; for example, no more than 10%.

5.4 Carbon Budget

Carbon budget was based on the idea that the fundamental need for human development is limited as is the bearing capacity of the earth system. However man's desire for material goods is infinite. Carbon budgets insisted that the international climate regime should guarantee to meet fundamental human needs first, then promote low-carbon development and control extravagant materialistic societies, so as to achieve the dual goals of equitable sharing of emissions reduction obligations and addressing global climate change.

Global greenhouse gas emissions must be controlled within the limitation of global carbon budgets to stabilize the GHG concentrations and to protect global environments. All national balanced carbon budgets will lead to a global total balanced budget. If there is a deficit in carbon budgets in some countries, then the deficiency parts have to be off-set through surplus carbon budgets from other countries. Maintaining the balance of carbon budgets at national levels will achieve the target of a global carbon budget balance. This means that the transfer payment of carbon budgets can be implemented among all nations.

Of course, the trading of carbon budgets can also be implemented within a country. The government can auction the carbon budget or allocate it to enterprises or to consumers, and then the carbon budget market will be formed. Currently, emission trading is mainly implemented among enterprises. Actually carbon trading can be implemented among consumers. Since consumers have different preferences, some consumers can transform the surplus budget to those in need; accordingly, carbon trading will be formed among the consumers.

The Carbon budget has established a long-term global goal to identify the standards of per capita cumulative emissions with national differences in a fair way. Each global resident should control its 'carbon footprint' below a rational limitation, and all countries should establish appropriate policies and measures to protect their basic needs, to curb extravagance and to encourage sustainable consumer behavior. Only in this way can we make full use of limited resources and achieve equal resource distribution.

5.5 China's Possible Commitments

Any commitment on mitigation is based on national circumstances. First, China is in the process of urbanization. Currently, the ratio of urbanization is only 45%; 30 years later it will be 75% with an annual growth of 1%. That is to say, the urban population will increase 450 million between now and 2040, which is equal to the total population of EU-27. Demands for urban infrastructure, housing, employment, consumption and energy for new urban citizens will be significant and will lead to an increase in emissions. Second, China's coal-dominated energy structure is difficult to change significantly in the short term. Even in developed countries, it is impossible for renewable energy to be commercialized large-scale. Without revolutionary breakthrough of renewable energy technology, China cannot reduce its emissions sharply. Third, it is difficult to conduct afforestation in China's Qinghai-Tibet Plateau, Loess Plateau and desert area. For 1.3 billion people to survive, the limitation of land and water resources makes it impossible for China to develop forest carbon sinks in large quantity. Fourth, China's economic transformation and energy-saving and emissions reduction is becoming more difficult. During the 'Eleventh Five-Year Plan' period, China shut down a large number of small thermal power plants, small steel plants and cement plants, and decreased the energy consumption per unit GDP by 20%. Therefore, during the 'Twelfth Five-Year Plan', space for energy-saving will be minimal. For the 'Thirteenth Five-Year Plan', the potential of energy-saving will be even smaller because of the marginal decreasing emissions reductions.

To address climate change and lower CO_2 emissions, China is firmly committed to sustainable development and has formulated and implemented its National Climate Change Programme, taking a series of strong policies, measures and actions[21] and making unremitting efforts for commendable contributions. For these reasons, we drew conclusions that China may make commitments as follows: the carbon intensity per unit GDP will drop significantly - this is to say the carbon intensity is likely to reduce 30% or more by 2020 compared to 2005. If the finance and technology support entitled by the Bali Action Roadmap are entirely achieved, China might reduce carbon intensity as much as 40%[22]. With regard to the share of non-fossil energy in the total energy resources, it is related to the share of climate-friendly technologies and international trade in uranium resources. The technologies of China's solar water heaters, rural biogas and circular economy can be a part of the content of South-South cooperation to address climate change.

5.6 The Impact of International Negotiations on China's Future Carbon Market

As the biggest CERs supplier in the global carbon market, China accounts for more than 50% of the total CERs supply. However, China's future carbon market will be greatly affected by international climate negotiations, especially by the commitments of emission reduction for all parties.

The Chinese government has recently announced its domestic binding emissions reduction target. The carbon intensity per unit GDP will decrease 40% - 45% by 2020 compared to the 2005 level. However, the emissions reduction target is only China's domestic binding target of emissions reduction rather than its obligatory target so China is unlikely to take this as its obligation of emissions reduction in the absence of any addition in the upcoming Copenhagen climate negotiations. Without any emissions reduction obligations, China will supply more carbon credits than before because of the great abatement of carbon intensity. On the other hand, if the developed parties supply financing and technology to the developing parties, China may commit to obligations of emissions reduction to some extent. If this does happen, the emissions reduction in China must be measured and verified to meet its commitment. China will have to own more reduction credits and supply less or even none carbon credits to the globe.

The developed countries have committed to their obligations of emissions reduction for the next commitment period. Some developed countries like the USA, Australia and EU, will achieve their emissions reductions by means of the market mechanism. This means the carbon market may still exist during the second commitment period. Of course, its mode may change to some extent, such as REDD or a sectoral approach may be included. To achieve emissions reduction commitments through the carbon market, the developed countries need to buy a lot of carbon credits, and the global carbon market will enlarge accordingly. As a result, it will promote the development of China's future carbon market.

At present, how the international climate negotiations will impact China's future carbon market remains uncertain, because it depends greatly on the commitment of all parties.

[21] China has issued a series of policies or methods like "medium- and long-term nuclear power development plan" and "Renewable energy and long-term development plan". In recent years, China has made great achievements in energy-saving and emission reduction.

[22] The commitment of China is not from Chinese government and has nothing to do with Chinese government, it is just the view and opinion of the researcher groups.

6. Prospects for China's Future Carbon Markets

As the biggest emerging economy and emitter, China faces increasing pressure to reduce emissions both for its sustainable development and in international climate negotiations. During the first commitment period, CDM played the most important role in China's carbon market. With CDM, China has supplied a large number of CERs for developed countries to achieve their targets for emissions reductions. As a result, China received finance and technological support from developed countries. However, with the coming of the second commitment period, whether CDM will remain is hard to say and China's carbon market may experience fundamental changes.

6.1 Compliance market based on energy intensity or carbon intensity

China's 'Eleventh Five-Year Plan' established binding targets of decreasing energy consumption per unit GDP by 20%, which means that by 2010 energy consumption per unit GDP will be 20% lower than that of 2005. On November 25, 2009 the Chinese government announced a binding domestic emissions reduction target decreasing the carbon intensity per unit GDP by 40% - 45% by 2020 compared to the 2005 level. During the 'Twelfth Five-Year Plan' period, China will enhance its input on research and development for energy saving, energy efficiency, clean coal technology, CCS and so on.

To achieve this target of cutting carbon intensity by 40% - 45% by 2020, the compliance market may provide potential for future emissions reductions in China. Through a rational approach to limit carbon or energy intensity, or to set the target for the growth rate of carbon emissions, the energy-saving targets or caps can be assigned to provinces or to enterprises. Those not meeting the limitations of the cap could buy a 'quota' to offset the gap in the compliance market. This model of the compliance market in China is just like the European Emissions Trading Scheme.

It is mandatory that, for the carbon market, a total emissions cap should be set by the government first. Without cap limitations, the demand for carbon cannot be guaranteed. Therefore the carbon price will not be determined by the market. A carbon market with the absence of a mandatory cap will not last. Currently, implementation of a compliance carbon market in China is still immature and it there may be a long way to go to transform the idea into reality. However, the compliance market is still more important than the voluntary carbon market in promoting emissions reductions in China.

6.2 Voluntary carbon market

There are two types of carbon trading models in the international carbon market: mandatory and voluntary carbon trading. China has no obligation to meet global emissions reductions and has no system for setting caps and trading in its domestic system. Currently the only public carbon trading in China is voluntary. The establishment of voluntary carbon trading has stimulated more and more enterprises to participate in the voluntary carbon market in an effort to bear social responsibility.

Voluntary carbon trading has only just begun in China. Some enterprises and institutions are exploring efficiency standards, rules and regulations for the voluntary carbon market.

The China Beijing Environment Exchange plans to publish its "Panda Standard" during the Copenhagen climate conference in December, 2009. China is still largely an agricultural country. Focusing on carbon emissions reduction projects in the agriculture sector can not only promote the optimization of the ecological environment, but also improve the quality of for rural residents. The 'Panda Standard' is aimed at creating a standard system for the verification and registration of voluntary emissions reduction projects, and hopes to promote the implementation of 'industry financing agriculture, cities financing rural areas, and higher level emitters financing lower level emitters'.

Meanwhile, the Tianjin Climate Exchange is organizing enterprises to participate in 'the initiative of voluntary emission reductions among enterprises'. In other words, in the current absence of absolute targets for emissions reduction, all participants would hold the principles of voluntary design, voluntary establishment of emission reduction targets and voluntary emission trading to join in the initiative. Furthermore, participants must sign a legally binding reduction agreement and do carbon trading through the Tianjin Climate Exchange agency. Additionally, the Tianjin Climate Exchange is about to launch a document called the "Tianjin Protocol" - a guideline for domestic emission reductions among the enterprises.

6.3 Sectoral CDM

Sectoral CDM is directed toward specific sectors such as the transportation sector, agriculture sector or industry sector; for each sector, one sector benchmark will be determined and this will allow carbon crediting of any projects below the benchmark without any further additionality check.

Sectoral CDM benefits the development of CDM projects because it can simplify basic criteria, shorten registration periods and lower transaction costs. However, the sectoral approach is still only a concept without any details or operability on the implementation of CDM projects. For sectoral CDM, to set a sectoral benchmark is very difficult since conditions in different countries or regions vary greatly; yet without a defined and reliable benchmark, it is hard to identify whether carbon crediting has occurred. For these reasons, it is unlikely that a concrete consensus on sectoral CDM will be reached. At present, the implementation of sectoral CDM may be more complicated and unrealistic.

6.4 Size of the future carbon market

During the first commitment period, the United States didn't sign the Kyoto Protocol and made no commitments for emissions reductions, so China's carbon trading was mainly targeted to the EU and Japan. During the next commitment period, this situation is very likely to change. The American Clean Energy and Security Act identified targets of emission reductions: that of cutting emissions 17% by 2020 and by 83% by 2050 of the 2005 levels.

An American scholar once predicted that if the American Clean Energy and Security Act were to be authorized by congress, the global carbon market would increase from 110 billion USD in 2008 to 500 billion USD in 2012. By 2020, the total global carbon market could reach as high as 3,000 billion USD, which is about 300 times that of 2008[23].

By December 1, 2009 the total number of CDM projects in China was 2082 (excluding 2 PCDM projects). Their aggregate emission reductions will reach 1662.88 $mtCO_2e$ by 2012 and 4699.71 $mtCO_2e$ by 2020. More CDM projects will continue to be developed (assuming that the carbon market still exists) since China has set its domestic binding targets for emission reductions. By 2020, the carbon intensity per unit GDP will be cut 40% - 45% compared to the 2005 level. If energy intensity is equivalent to carbon intensity, then it is easy to estimate that by 2020, the aggregate emissions reduction of the new CDM projects is about the same as that of the existing CDM projects. That is to say, the total emission reductions supplied for the global carbon market will be 9.4 billion tCO_2e or so by 2020.

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