Study on the Paths of Chinese Chemical Industry against Global Climate Change

—Exampled by Clean Development Mechanism (CDM) [1]

ÉTUDE SUR LES CHEMINS DE L'INDUSTRIE CHIMIQUE CHINOISE CONTRE LE CHANGEMENT MÉTÉOROLOGIQUE MONDIAL

EXEMPLE FAIT PAR LE MÉCANISME DU DÉVELOPPEMENT PROPRE(MDP)

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Abstract: As concerned by the international society, climate change is now overshadowing anti-terrorism, nuclear proliferation to become the issue most concerned in the world. by introducing the effects of climate change to human being in economical and social fields and the essence of seizing superior place for energy development and economic competition in the future, the paper analyses the attitudes and measures of developed and developing countries against climate change. From the perspectives of clean development mechanism (CDM), voluntary carbon market (VCM), energy audits and potential carbon asset investment, this paper discusses the feasible paths to fight climate change for Chinese chemical industry and summarizes the main areas in which Chinese chemical industry carries out CDM projects, such as direct greenhouse gas emission reduction, energy conservation and energy efficiency improvement, fuel and raw material substitute, and carbon capture and sequestration. It provides effective technical paths and policy-making reference to the developing countries represented by China on how to fight climate change in chemical field.

Key words: Climate Change, Chinese chemical industry, Clean Development Mechanism

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Résumé: Comme concerné par la société international, le changement météorologique assombrit maintenant l'anti-terrorisme, la prolifération nucléaire de sorte à devenir le problème le plus concerné dans le monde. Par l'introduction des effets du changement météorologique à l'être humain dans les champs économique et social et l'essence de la place supérieure prise pour le développement d'énergie et la compétition économique à venir, cette mémoire analyse les attitudes et les mesures des pays développés et en voie de développement contre le changement météorologique. De la perspectives du mécanisme du développement propre(MDP), du marché de carbone volontaire(MCV), des audits d'énergie et de l'investissement de l'actif de carbone potentiel, cette mémoire discute des chemins possibles vers la lutte contre le changement météorologique en faveur de l'industrie chimique chinoise et résume les principales zones dans lesquelles l'industrie chimique chinoise exécute les plans du MDP, tels que la réduction de l'émission de gaz de serre directe, la conservation de l'énergie, et l'amélioration efficience de l'énergie, les remplaçants du carburant et de matière brute, et la capture et la mise sous séquestre du carbone. Elle propose des chemins techniques effectifs et des références qui formulent des politiques pour les pays en voie de développement représentés par la Chine sur la lutte contre le changement météorologique dans le champs chimique.

Mots-Clés: changement météorologique, industrie chimique chinoise, mécanisme du développement propre

1. EFFECTS AND ESSENCE OF CLIMATE CHANGE

On Feb. 2, 2007, Intergovernmental Panel on Climate Change (IPCC) published the part of *the Fourth Assessment Report on Climate Change* done by First Working Group (IPCC, 2007). It is said in the report that the average surface temperature on the earth at present has been 0.74℃ higher than that before Industrial Revolution; by the end of 21st century, the average surface temperature on the earth will have risen by 1.8～4℃ and the sea level will have risen by 18～59cm. The 20th century was the warmest 100 years in the last 1,000 years and the last 50 years was the warmest period during the last 1,000 years. The phenomenon of global warming has been confirmed by the observational facts.

What climate change brings is not only snow melting or sea level rising, but also challenges in all economical and social fields to humans. As defined in Article 1 of *United Nations Framework Convention on Climate Change* (UNFCCC), climate change is a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods. Therefore, the essential measure of solving the problems of climate change is to reduce the anthropogenic emission of greenhouse gas.

Main source of greenhouse gas emission is production and consumption of energy and CH_4 and N_2O generated during agricultural production. Energy and agriculture are fundamental for national economy and social development. Reduction or limitation of greenhouse gas emission in these fields is related to economic interests and development space of a country. Compared with common environmental problems, climate change extends from the filed of environment or climate to economic development patterns such as energy use, agricultural production, etc. Therefore, the essence of disputes in international climate change negotiation is to seize superior place for energy development and economic competition in the future.

2. ATTITUDES AND MEASURES OF INTERNATIONAL SOCIETY AGAINST CLIMATE CHANGE

2.1 Attitudes and Measures of Developed Countries against Climate Change

Since early of 1990s, threats of environmental pollution and climate change have gradually become political topics and changed conventional safety concept of people. In the past decade, environment problem has become a part of political conflicts between countries. In the year 2007, under the severe situation of global climate change and pushed by EU countries represented by UK, climate change drew all-time attentions from international society.

On Jan. 24, 2007, World Economic Forum (WEF) Annual Conference 2007 was held in Davos, Switzerland. More than 2400 leaders in different fields from 90 countries took part in this forum, including 24 state or government leaders and more than 800 directors or CEOs of world-famous companies. There were 17 subjects related to climate change in this forum. On March 8, 2007, Spring European Council was held in Brussels, Belgium. The leaders of EU members unanimously agreed and promised in the conference that the amount of greenhouse gas emission generated by EU will be reduced by at least 20% by 2020 than that in 1990; the proportion of renewable energy in the total energy consumption will be increased to 20%; energy efficiency will be increased by 20% than that in 1990, that is usually called “three 20%”. On April 7, 2007, UN Security Council for the first time discussed the problem of climate change in the aspects of international security. In May of 2007, as the uppermost topic, the issue of climate change was discussed and negotiated by United Nations Commission on Sustainable Development. Not only UNFCCC is focusing on the problem of climate change, but also many forums are taking actions to fight the global climate. On June 8, 2007, G8 Summit was held in Heiligendamm, Germany. Climate policies, energy, intellectual right protection, investment liberalization and African development were five subjects in this summit, of which climate change and African development were considered as the top priorities. Considering that the host country, Germany, took climate change as key subject, this summit was vividly nicknamed as “climate summit” by western media.

UK is the most active advocator and performer on fighting climate change in the world. Therefore, taking climate policies of UK as an example, understand the successful experience of developed countries to deal with climate change.

On Feb. 24, 2003, UK published *Energy White Paper*(Department of Trade and Industry, 2003), proposing that in order to realize low carbon economy, CO_2 emission will be reduced by 20% by 2010 and 60% by 2050. To realize the goal, UK has stipulated a series of climate policies to promote energy efficiency and to reduce the amount of greenhouse gas emission, such as Carbon Trust, Emissions Trading Scheme (ETS) of UK and EU (Ying Chen, 2006).

Carbon Trust, established in 2001, is an independent company invested by the government and is managed according to enterprise pattern. The goal of Carbon Trust is to help business and public departments to reduce CO_2 emission, seize business opportunities to develop low carbon technology and help UK enter into low carbon economic society. The main sources of Carbon Trust are UK climate change levy and government donation.

Climate Change Levy (CCL) is a kind of energy tax levied on industry, business and public sectors (except residence and traffic departments, residents) and has been implemented since April 1, 2001. About 66,000,000 pounds of climate change levy is appropriated to Carbon

Trust for its management and usage every year.

Compared with the upper limit of compulsory emission and severe punishment measures of EU-ETS, UK-ETS is based on voluntary principle and encourages enterprise's participation through economic motivation and the punishment measures are not severe. The measure of economic motivation and flexibility of participation forms attract more enterprises without high energy intensity. This is helpful for enterprises to increase sense of social responsibility and for the whole society to enhance the awareness of energy-saving and emission deduction.

2.2 Attitudes and Measures of Developing Countries against Climate Change

Developing countries represented by China stick to the principle of "mutual but different responsibilities". Emphasizing economic development and eliminating poverty are the overwhelming tasks for developing countries. Developed countries shall play leading role in reducing greenhouse gas emission and provide capital and technology support for developing countries. The degree of developing countries implementing the convention depends on whether developed countries have fulfilled their commitment effectively on these aspects.

Under the framework of sustainable development, China has actively fought climate change. Chinese government constituted *China's Agenda in the 21st Century - White Paper on China's Population, Environment and Development in the 21st Century* and carried out a series of policies and measures based on national situation (Lü Xuedu, LIU Deshun, 2005) after UN Environment and Development Conference in 1992.

It is especially notable that China stipulated specific goals for energy conservation and greenhouse gas emission reduction for "Eleventh Five-Year" period, i.e., unit GDP consumption in 2010 will be reduced by 20% than that of 2005.

However, *National Economic and Social Development Statistics Report* published by National Statistics Office on March 16, 2007 (National Bureau of Statistics, P. R. China, 2007) shows that China' s GDP of 2006 has increased by 10.7%, which is 2.7% higher than that planed by the government (increase by 8%); energy consumption per RMB 10,000 Yuan GDP has been reduced by 1.2%, which is 2.8% lower than that planed by the government (decrease by 4%); emission amount of SO_2 has increased by 1.8%, 3.8% higher than that planed by the government (decrease by 2%); oxygen required amount and emission amount have increased by 1.2%, 3.2% more than that planed by the government (decrease by 2%).

The Chinese government established National Climate Change Coordination Organization composed of 17 departments and set up National Leading Group on Fighting Climate Change led by Premier of the State Council to strengthen leadership on climate change, energy conservation and emission reduction on June 12 of 2007.

On June 4, 2007, *China's National Program on Fighting Climate Change* (hereinafter referred as *National Programme*) prepared by National Development and Reform Commission (National Development and Reform Commission, P. R. China, 2007) was published formally. This is the first policy document in regard to China's coping with climate change and also the first national program of developing countries in this aspect. According to this program, the overall goal for our country to tackle climate change is to obtain obvious achievements on control of greenhouse emission, to enhance adaptability to climate change, to get new development of technology and research related to climate change, increase awareness of public about climate change and to further strengthen the organizational and system construction regarding climate change. Publication and implementation of *National Program*

demonstrates China's attitude of being a responsible major country, have active effects on China's dealing with climate change and add new contribution to the worldwide efforts on solving problem of climate change.

3. ANALYSIS ON PATHS OF CHINESE CHEMICAL INDUSTRY AGAINST GLOBAL CLIMATE CHANGE

Chinese chemical industry can make use of Clean Development Mechanism (CDM), Voluntary Carbon Market (VCM), etc. based on international cooperation mechanism to realize goals of energy conservation and emission reduction.

3.1 Clean Development Mechanism (CDM)

Clean Development Mechanism is a cooperation mechanism in the twelfth clause of *Kyoto Protocol*. The main content is that by means of providing funds and technology, developed countries cooperate with developing countries on projects. Developed countries can fulfil their commitment under the third clause of *Kyoto Protocol by* realizing the reduction amount of greenhouse gas emission in these projects. CDM is a mechanism with mutual benefits: on one hand, developing countries can obtain funds and technology through cooperation, which is beneficial to their sustainable development; on the other hand, through such cooperation, developed countries can reduce the expense required by emission reduction in their own countries (ZENG Shaojun, LIU Sai, 2007) to the great extent. The number of CDM projects approved by National Development and Reform Commission has reached up to 1337 as of May 28, 2008, mainly including the projects related with new energy and renewable energy, energy conservation and efficiency improvement, methane recovery and utilization and greenhouse gas decomposition.

3.2 Voluntary Carbon Market

When some projects with potential emission reduction ability can not pass redundant and complicated CDM application processes, the amount of carbon emission reduction can be sold in voluntary carbon market. Projects in the following situations usually can be traded in the voluntary carbon market.

1st. The application for emission reduction misses the deadline of CDM registration.

2nd. Although the project has passed additionality demonstration, it can not be registered as CDM project because of other reasons.

3rd. Methodology is not approved by EB.

4th. The client is reluctant to invest large amount of time and energy into the application and assessment for CDM.

5th. Small scale project (without enough time or capital to deal with complicated CDM application).

3.3 Energy Audit

Energy audit means that audit units carry out supervision, check, analysis and evaluation on physical process and financial process of energy use of enterprises according to relevant national laws and regulations, technical standards, consumption rating, etc. Audit units search for energy conservation potential, put forward correction suggestions and measures, prepare programs and plans on energy conservation through inspection, test, diagnosis, consultation and evaluation of energy consumption, management level, consumption indices, financial process, integrated use, environmental effects to make enterprises reduce energy consumption and increase energy efficiency.

On April 7, 2006, five departments including National Development and Reform Commission, National Energy Resource Office, etc. advocated *Programs for Saving Energy of Thousands of Enterprises* and clearly required enterprises to carry out energy audits and prepare energy conservation plans, which are the most basic requirements and important monitoring means for energy conservation of the thousand enterprises.

3.4 Potential Carbon Asset Project Investment

Investment into potential carbon asset projects can not only get benefits from the projects, but also brings additional carbon asset profits. For example, a straw combustion power generation factory with annual power generation capability of 120 million kWh can get RMB 72 million Yuan of income every year by selling electricity, if the electricity price is RMB 0.6 Yuan /kWh while carbon asset profit is about RMB 7.2 million Yuan (calculated as per 10 dollars/tCO_2e), which is 10% of annual electricity sales revenue, through which investors can get double profits. The projects suitable for carbon asset investment include industrial waste energy recycling, power generation through methane and renewable energy resources, etc, except biological material combustion power generation project.

4. MAIN FIELDS FOR CDM ACTIVITIES OF CHINESE CHEMICAL INDUSTRY

Combined with current conditions of domestic and foreign CDM projects and hot research topics of greenhouse gas emission reduction technology, the main fields of CDM activities of Chinese chemical industries can be concluded as follows:

4.1 Direct Greenhouse Gas Emission Reduction

This activity mainly refers to directly destroy or replace greenhouse gases generated from chemical process, such as N_2O, PFC, HFC and SF_6 except CO_2. Since greenhouse effect potential of these greenhouse gases is very high and additionality of the projects that directly destroy the green house gases is relatively obvious, this kind of projects is widely developed in China. The proportion of average emission reduction amount achieved by this kind of project registered in EB is 53% of the total amount of emission reduction, which has great effect on CDM market.

4.2 Energy Conservation and Efficiency Improvement

This kind of projects mainly includes efficiency improvement for energy production and conversion, energy conservation technology and equipment application. The number of CDM projects of this kind approved by China DNA has reached 215. It is estimated that annual emission reduction quantity exceeds 61.25 million tCO_2e, equal to saving 25 million tons of standard coal every year. These projects are mainly from industries with high energy consumption such as cement and steel, and less from chemical industry.

4.3 Substitution of Fuel and Raw Materials

Substitution of fuel means to use fuel with low carbon emission strength or neutral fuel such as natural gas/ coal gas or chemical substance to replace formerly used fuel with high carbon emission strength such as coal or heavy petroleum as fuel for chemical production or power generation. At present fuel replacement projects in the country are mainly distributed in the places near natural gas sources and transfer pipelines. Substitution of raw materials is the replacement of chemical raw materials, including using raw materials with low carbon content to replace chemical raw materials with high carbon content or using biological renewable raw materials to replace non-renewable raw materials. There are fields that develop CDM such as AOS, synthetic coal gas and synthetic ammonia, etc. Besides, Replacement of raw materials also includes use of carbon waste generated from industrial production as chemical raw materials to secure and conserve carbon in chemical products, such as use coke-oven gas to synthesize dimethyl ether directly.

4.4 Carbon Capture and Sequestration (CCS)

CCS requires capturing and collecting CO_2 generated from power generation by fossil fuel or petroleum natural gas and to have collected CO_2 solidified or conserved in rock stratum with a depth of thousands of meters or under the sea. International Energy Agency and Carbon Sequestration Leadership Forum hosted an international seminar “Recent Opportunity of CCS” in U.S.A. on Aug 22, 2006, which attracted 120 officers, experts and multinational-energy-enterprise delegates from 15 countries and World Bank and many international organizations. Chinese delegates showed a willing to join hands with international society to make contribution for the development of CCS and promised to offer certain support to domestic research. But CCS is not current preferential technology choice for China to fight climate change. Recently, depths and extents of CCS-related activities in China should depend on international capital support.

The 2nd Conference of Parties under Kyoto Protocol, held in Kenyan capital Nairobi in November, 2006, has consented to have CCS included in CDM in principal, but there were some specific technical issues needing further research, therefore the final decision about the plan would be made at the 3rd Conference of Parties.

5. CONCLUSION

As climate change has got the attention of the whole world, more and more countries both developed countries and developed countries, including China, entered the field of mitigating climate change. Chinese enterprises, especially the enterprises featured by high energy

consumption, high pollution and high emission, like chemical industry, shall continue to explore paths of carbon emission reduction, make full use of emission-reduction promotion policies and mechanisms, to make contributions to energy saving and emission reduction as well as mitigation of global climate change.

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