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Climate Change: National and Local Policy Opportunities in China

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Abstract

Climate Change poses a wide range of potentially very severe threats in China. This aggravates the existing vulnerability of China and is one of the big challenges faced by the Chinese government. Adaptation programmes and projects are being developed and implemented at national and local level. As China is engaged in heavy investment in infrastructure development as a consequence of the rapid process of development and urbanization, mainstreaming adaptation into such development process is a priority for China. China has also made positive contributions to reducing greenhouse gas emissions through participations in the CDM under the Kyoto Protocol framework. Although mitigation is not a priority at national or local level, it has been integrated into national and local development plans explicitly. This paper addresses the following questions: What is the policy space for climate change mitigation and adaptation policy at national and local level and what is already being done? The three case studies at local level - Beijing, Guangdong and Shanghai – presented here, highlight the local benefits in terms of local pollution of integrating mitigation policies into local development. However, financial constraints usually prevent such a positive policy integration. National policies and international cooperation aiming at bridging the financial gap and promoting technology transfer would help in integrating local pollution control and mitigation efforts in China today.

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Summary

Climate Change poses a wide range of potentially very severe threats in China. This aggravates the existing vulnerability of China and is one of the big challenges faced by the Chinese government. Adaptation programmes and projects are being developed and implemented at national and local level. As China is engaged in heavy investment in infrastructure development as a consequence of the rapid process of development and urbanization, mainstreaming adaptation into such development process is a priority for China. China has also made positive contributions to reducing greenhouse gas emissions through participations in the CDM under the Kyoto Protocol framework. Although mitigation is not a priority at national or local level, it has been integrated into national and local development plans explicitly. This paper addresses the following questions: What is the policy space for climate change mitigation and adaptation policy at national and local level and what is already being done? The three case studies at local level - Beijing, Guangdong and Shanghai – presented here, highlight the local benefits in terms of local pollution of integrating mitigation policies into local development. However, financial constraints usually prevent such a positive policy integration. National policies and international cooperation aiming at bridging the financial gap and promoting technology transfer would help in integrating local pollution control and mitigation efforts in China today.

Keywords: Climate Change, Local Policy, National Policy, Mitigation, Local Pollution

JEL Classification: H7, Q54, Q56, O53

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1 Introduction

Global climate change is one of the key common concerns of international community, which has and will continue to have significant negative impact on the global, national and local ecosystem and social-economic development. Developing countries and poor people living in developed countries will be hit hardest by the negative effects of climate change. Although climate change is already an urgent issue, China is facing other serious challenges as a consequence of its rapid economic growth. Among them bottlenecks in energy supply and local environmental degradation rank highest. Although energy efficiency and environmental protection are priority concerns of the Chinese government, the efforts to prompt energy conservation and reduce pollutions also lead to reduced greenhouse gases (GHGs) and thereby contribute to the global GHGs reduction efforts. The central government of China has set ambitious targets on energy efficiency and on environmental quality that above mentioned large positive spillovers on mitigation efforts, but inconsistent activities of local government may prevent the attempt from succeeding

It is thus crucial to understand how national and local policies can be integrated in a coherent, unified framework so that energy efficiency is increased, local pollution is reduced and global climate mitigation effort enhanced. In order to address this issue, the paper surveys the existing literatures on national and local policies that, despite being primarily addressed to achieve national priorities, have also strong impact on carbon emissions of China. Opportunities for further actions and greater coordination are identified and discussed.

The rest of the paper is organized as follows. Section 2 provides a brief overview of China's climate policy at national level. Section 3 describes the institutional arrangement and division of responsibilities between the central and local government. Section 4, section 5 and section 6 provide three case studies about policies at local level with strong relevance for climate change in the areas of Beijing city, Guangdong province and Shanghai city. Section 7 offers concluding observations and policy suggestions.

2 China's national policies to cope with climate change

The trend of climate change in China in the past century is corresponding to the general trend of global climate change. The average surface air temperature in China has increased by between 0.5 and 0.8 °C over the 20th century, with a more marked temperature rise in North China and Tibetan Plateau compared to southern regions [1]. In China, adaptation to climate change is a priority because the threats from climate change in the short term are serious. China has also made positive contributions to relieving the increase of greenhouse gas emissions and protecting global climate by adjusting its economic structure, improving its energy efficiency, developing and

using hydropower and other renewable energy and strongly implementing total pollutants amount control policies and measures. Although most of the efforts are driven by energy efficiency and environmental consideration, large co-benefits in terms of mitigation have been achieved. Through clean development mechanism (CDM), China is also the largest Certified Emission Reductions (CERs) supplier in the World.

Adaptation

Adaptation is one of the big challenges faced by the Chinese government, not only because of its heavy investment in infrastructure as part of its development process, but also because of the growing water shortages caused by temperature increase in its north region which require investment in reservoirs and diversion system to manage the dwindling water resources. Despite at this time there is still no systematic strategy for adaptation to climate change at the national level in China, some adaptation activities have been partly integrated into development policy and planning at country level.

In 2005, China invested around 48% of its Gross Domestic Product (GDP) or roughly 8860 billion RMB in fixed capital, of which 17.7% was invested in buildings and 3.5% in transportation infrastructures [2]. Assuming a 10-20% adaptation cost for making buildings and infrastructures more able to adapt to the changing climate [3], the additional costs would amount to 188-376 billion RMB each year (1%-2% of GDP). Compared with China, the additional cost of adapting in OECD is only 0.05-0.5% of GDP [4]. For example, the recent Qinghai-Tibet railway tracks cross 550km of permafrost and are highly vulnerable to even moderate warming. During the construction of Qinghai-Tibet railway, the impact of global warming in the coming 50 years was taken into account. Contingency measures were put in place to protect the track from the negative effects of global warming including changing routes, building railway bridges and roadbed cooling systems. According to the estimation, the ventilated sheet-stone roadbed, only one of many roadbed cooling systems put in place, cost more than 300 million RMB (1% of the total cost) [5].

Hydro projects form another significant part of extra spending for adaptation. For example, the South-North Water Diversion Project (SNWDP) has been launched in 2002 to alleviate the lack of water resources in North China. As the largest project of its kind, SNWDP will cost about 500 billion RMB. Moreover, stronger flood defenses to protect infrastructures from flooding account for about 40% of the total hydro investment or about 30 billion RMB in 2005 [6]. Regarding other adaptation activities in agriculture, terrestrial ecosystems and coastal zones, the adaptation cost for developing countries like China is going to be substantial.

Energy Intensity target

China has taken actions and ambitious policies that will reduce the rate of growth of GHGs. For a long time, the government of China has persisted in the principle of “developing and conserving energy simultaneously, with conservation put in the first

place" [1]. After the 1980s, the State Council and government departments in charge at various levels formulated and implemented a series of energy conservation rules and regulations, set up a three-tier energy conservation management system at the central, local/industrial and enterprise levels and implemented a series of policies on energy conservation technologies. From 1990 to 2002, China's energy intensity of GDP went down by an average annual rate of 5.6% [7].

The new National 11^{th} Five-Year Plan (2006-2010) [8] aims to ensure that energy consumption per unit of GDP will decrease by 20% within 5 years. It gives a quantified target on energy efficiency for the first time in five-year plans and divides the total target among provinces, large industrial groups, cities and large energy consumers. Those target groups are expected to implement these policies.

In June 2006, the National Bureau of Statistics of China released provincial data of energy consumption in 2005. This could be used as a baseline for calculating provincial energy consumption reduction rate per unit of GDP during the 11th five-year period. The national energy intensity per 10^4 yuan RMB is 1.22 tce in 2005 (based on year 2005 price), which means national target of energy consumption per 10^4 yuan RMB GDP will be 0.976 tons in 2010 (based on year 2005 price).

Currently, there are 10 provinces whose energy consumption per unit of GDP are lower than national level (see Figure 1). Most of these provinces are located in East China. Most of them have a high economic growth rate and can adopt advanced technology to adjust energy mix and promote energy efficiency.

[Figure 1 here]

Total amount control of pollutants

In the national 11^{th} five year plan, the Chemical Oxygen Demand (COD) and SO_2 also have been identified as two major pollutants which will be reduced 10% compared with year 2005 level [8]. Almost half SO_2 emissions come from coal-fired power plants in China. The total amount control of SO_2 can be achieved partly through fuel switching and by replacing small units with larger ones, which offers an opportunity to reduce carbon emission at the same time, leading to co-benefits.

Clean development mechanism

With 37 registered projects and more than 40 million tonnes of CO_2e reduction per year, China has become the biggest CERs suppliers in the World. To prompt the CDM at national level, the policy document, "Measures for the Operation and Management of CDM Projects", was released first in June 2004 and then amended in October 2005 [9]. In the Measures, the priority areas for CDM projects are energy efficiency improvement, development and utilization of new and renewable energy and methane recovery and utilization. National Development and Reform Committee (NDRC) is the Designated National Authority (DNA) in China responsible for the approval of CDM project applications. The Chinese government also collects a levy on the CER revenue of CDM projects (65% for HFC23 project, 30% for NO_2 and 2% for others)

[9]. The charge collected from CDM project will be transferred to a CDM fund aiming at helping and financing national wide actions to address climate change. The detailed enforcement rules for CDM fund are being developed.

Policy instruments at national level: legislation, plans and incentive-based policy

The present energy law system in China consists four major laws ("Renewable Energy Law" (2005), "Energy Conservation Law" (2000), "Electricity Law" (1995) and "Law on Coal Industry" (1996) and other corresponding auxiliary regulations. For examples, China's renewable energy legal framework include the following regulations: "Regulation on Power Generation by Renewable Energy" (by NDRC), "Tentative Management Measures for Price and Sharing of Expenses for Electricity Generation from Renewable Energy" (by NDRC) and "Circular on the Catalog Issue for the Guidance on Industrial Development of Renewable Energy" (by NDRC)

Nevertheless, China lacks a basic energy law which reflects the national energy strategy and policy, and coordinates ties between energies and energy-related activities compressively. More over, there are still not specific laws for oil, natural gas and atomic energy. The Chinese government has realized the importance to formulate a basic and comprehensive energy law system to cope with these challenges and issues. The Energy Law are drafting by an inter-ministerial team which will formulate the compressive and long term energy policy. The amendment of "Energy Conservation Law" and "Program on Energy Saving Technology Policies in China" are also ongoing at the central level.

In central level, the core department also uses the plans, notices and enforcement regulations as a policy instrument to set the national goals related to energy development. In year 2005, NDRC launched the China Medium and Long-term Energy Conservation Plan (CMLECP) [7] which covers two phases: 2005-2010 and 2010-2020. In this plan, the detailed energy conservation targets were set up. In the CMLECP, ten key project were put forward including coal-fired boiler renovation, regional cogeneration, waste heat and pressure utilization, petroleum conservation and substitution, motor system energy conservation, energy system optimization, building energy conservation, green lighting, energy conservation in governmental agencies and creation of energy conservation monitoring and technical service systems. The target of these ten key projects is to achieve 240 million tce saving. In the first half year of 2006, the NDRC arranged 540 million RMB from the national debt to support 98 energy saving projects. It is estimated that 7.2 million tce saving can be achieved from the implementation of these energy saving projects thus around 20 million tons of CO_2 reduction.

In March 2006, NDRC and four other governmental agencies jointly issued the Notice on strengthening resource conservation in governmental agencies. According to this notice, a target of 20% reduction of energy consumption was adopted. In April 2006, the NDRC also launched the Top-1000 Enterprise Energy Conservation Action Plan. In this action plan, 1008 enterprises have been identified and asked to improve the energy efficiency to achieve a 100 million tce saving by 2010.

A year ago, in March 2005, NDRC and General Administrative of Quality Supervision, Inspection and Quarantine announced a joint Energy Efficiency Labeling Management Directive. According to this Directive, energy efficiency labels will be provided to qualified products to help the users to identify the energy efficiency grades of these products. The labeling system has been used for household refrigerators and air conditioners (see Figure 2).

[Figure 2 here]

In these laws and regulations, the central government uses pricing, taxation and financial support to prompt the development of renewable energy and improvement of energy efficiency. The Renewable Energy Law confirms the government's support of the pricing of renewable energy. And the "Tentative management measures for price and sharing of expenses for electricity generation from renewable energy" provides a concrete guidance to the pricing of renewable generation: the price of wind generation is basically based on a bidding procedure while the price of biomass generation is set as the average feed-in tariff plus a 25 cents subsides per kWh. Regarding taxation, the government provides tax reduction to the projects covered by the Guidance Catalog for the Development of Renewable Energy. For example, the Value Added Tax (VAT) is 3% for artificial gas project and 6% for hydropower, while the current general VAT is 17%. The central government also provides fund, interest subsidies or treasure loans to renewable projects covered by the Guidance Catalog for the Development of Renewable Energy.

3 Institution and responsibility between central and local government

Institutional arrangement at national and local level

The government of China has a five-tier hierarchical structure with central government in Beijing at the top. The four tiers of local government include provincial-level government, prefecture-level government, county-level government and township-level government. At national level, the NDRC and State Environment Protection Agency (SEPA) are the two of key ministries which are responsible for energy conservation, energy project planning, environment protection and climate change. The environment and energy conservation policies can also be categorized into three levels: laws and general guidance, development and action plans, and practical or managerial guidelines. Generally speaking, the first level is set by central government, the second level is also decided by central government but delegated to sub-national government, while the third level is always set by local government.

At the national level, China also has established the inner-ministerial National Climate Change Policy Coordinating Committee in 1990, making it responsible for policies and measures to address climate change. However, there is no clear division of activities with lower level organizations. Some provinces have adopted the climate

change actions and some provinces have not. The local EPA and DRC are key department to implement national energy, environment and forthcoming climate policy at local level. They are under the leadership of both the local government and the same department in the higher level government (e.g SEPA and NDRC). But the local government determines the hiring and firing of the departmental employees.

Corresponding to the government structure, the fiscal system of China also has five levels. The central government has a direct relation with provincial governments while the provincial governments determine their relations with sub-provincial governments. The central government also determines the assignment of expenditure responsibilities between national government and sub-national government. Environmental protection and its budget is a purely local responsibility which is assigned further to prefecture, county and township government.

The environment responsibility arrangement between central government and local government in China is the institutional basis for decomposing a national energy reduction target and pollutants total amount target into local level.

Target plan and its decomposition to local level

To ensure the goals of 11th Five Year Plan, the State Council issued a circular in August 2006. In the circular, a 20% reduction in energy intensity, 10% reduction in major pollutants and other six targets are regarded as obligatory targets which have legal effects and must be achieved. NDRC and SEPA are appointed as the department in charge of the reduction target of energy intensity and major pollutants at national level. These two targets are also translated into targets for provincial level. According to the circular of State Council, the NDRC submitted a reduction target plan to State Council. In this target plan, the provincial targets are set according to provincial target in their own 11th five year plans and national balance, and range from 30% reduction for Jilin province and 12% reduction for Tibet. In September 2006, the State Council approved the NDRC's reduction target plan for energy intensity and asked the provincial government to further allocate targets to city and county level, as well as to the industry sectors and major enterprises. In the mean time, a communiqué system will also be established to publish the provincial energy intensity and major pollutants data every half year. In August 2006, the SEPA, National Bureau of Statistics of China (NBSC), NDRC and Office of National Energy Leading Group (ONELG) published the communiqué of energy intensity and major pollutants in the first half of 2006. Although the energy intensity and pollutant total amount are set as obligatory targets by the central government, the first half year energy intensity communiqué shows a 0.8% increase of energy intensity over the last year which makes the 4% reduction target of year 2006 more difficult to achieve. One reason for the 0.8% increase lies in the fact that some project with high energy intensity planned in 10th five year are just put into operation in 2006 and it takes time to switch the industrial structure and reverse the trend. It is also worth mentioning that the current system of local government organization and finance in China are not always conductive to the achievement of such a target.

Local fiscal system in China and implementation of central policies at local level

According to the assignment of responsibilities between the central and local government, local capital construction and environment protection belongs to local responsibilities which are funded by local finance. The fiscal system in China is characterized by tax sharing scheme (TSS) between central and local government. Taxes are divided into central government taxes, local government taxes and taxes shared between the central and local government. The revenue of local government mainly comes from tax assigned to local government and other extra-budgetary revenues. Shared taxes are one of the major revenue for local government which mainly include domestic value added tax (VAT, 75% for central government and 25% for local government) and income tax (60% for central government and 40% for local government) [10]. The central government also returns part of its tax revenue to local government then an intergovernmental fiscal transfer. The income tax is a major source of local revenue which gives an improper incentive for local government to protect the local industry even inconsistent with the national policy.

The TSS also provides strong incentives for local government to focus more on local development and GDP. The new investment enables local governments to enlarge their tax bases and improves the performance evaluation of local officials which is a major consideration for promotion. This makes the local government pursue local development regardless of environmental damage and energy efficiency target because the evaluation system consists 17 items with only one for environment and none for energy efficiency.

A new evaluation system is being developed in three provinces to give more weight to environmental concerns and to relate them to the performance of local officials. The State Council also asked the Ministry of Personnel to include the energy intensity reduction and target for pollutants into the performance evaluation system for local officials. The new performance evaluation system will be expected to provide sufficient incentives for local governments to follow the policies of central government.

Barriers and obstacles at local level

The central government has been reforming the performance evaluation system and “Green GDP” is also used by the Chinese leadership to take into account the environmental damage of development. Local governments are changing their behavior because environmental issues are becoming increasingly political issues especially in coastal region of China. At local level, the finance disparities between west and east make the reduction target more difficult for local government in the west region since the energy intensity reduction and environment protection target also means a heavy investment in the renovation of existing facilities and new investment in energy sectors. For local government, there are still barriers to overcome.

Lack of an independent budget for energy saving, environment protection and

adaptation at local level: To finance the activities of energy saving, environment protection and adaptation in a stable manner, a separate account and budget for such activity is necessary to make it a transparent and long run effort by the local government.

Lack of an intergovernmental transfer aiming at improving the energy efficiency and environmental standard in the western region: Compared with eastern China, western China has limited local revenue and capacity to play a leading role in making investment. A special intergovernmental transfer aiming at energy efficiency and environment quality improvement is crucial for local government of western China to collect enough fiscal input.

Lack of financing mechanism to support SMEs to improve their energy and environmental performance: Almost half of the emission and pollutions came from Small and Medium Enterprises (SMEs) who has very limited ability to access financial resource. The government should play an active role in SMEs energy efficiency and environment protection financing.

4 Case study 1: Beijing

Beijing is the capital of China with more than 15 million inhabitants. Beijing is one of the relative developed provinces in China with GDP of 772 billion RMB in 2005 or more than 6000$ per capita [11]. The local revenue of Beijing government in 2005 is 111.7 billion RMB. Air quality is the major challenge for Beijing municipal government which should meet the World Health Organization (WHO) standard before 2008 according to the bidding commitment for the Olympics. Dust pollution and vehicle emissions are still key pollutants need to be controlled.

Green Olympic action plan and the 11th five years plan of Beijing

In year 2002, Beijing released the first Olympic Action Plan: Sub-plan for environmental protection. The main guidance of Sub-plan on Energy Development and Energy Mix Readjustment (Sub-plan on EDEMR) [12] includes readjustment of the primary energy structure in “a cost-effective manner in the fuel switch from coal-dominance to more shares of clean energy”, restructure the industrial and product structure to reduce the growth rate of energy consumption and improve the energy efficiency by promoting the application of new and quality technologies. The primary objective of energy mix readjustment is to decrease the share of coal and coke in the energy mix. In line with the Sub-plan on EDEMR, the 11^{th} five year plan of Beijing Municipal also set local goals and policies for energy switch and conservation. The 11^{th} five year plan of Beijing Municipal consists six sub plans related to energy: Sub-plan for Energy Development and Conservation, Sub-plan for Electricity Development, Sub-plan for Heating, Sub-plan for Construction, Sub-plan for Transportation and Sub-plan for Circular Economy. The concrete goals for energy development and energy saving has been raised in different sub-plans. For example, in the Sub-plan for Electricity Development, it is planned to increase the share of

renewable capacity to around 6% in total capacity [13]. To achieve this objective, Beijing will invest about 13 billion RMB into renewable energy. The building sector and transportation sector will be the key to meet the Olympic commitment while concrete goals and policies have been included in the corresponding sub-plans. The local policies on improving energy efficiency and emission standard will be discussed in the following paragraphs.

Local policies on energy efficiency and pollutant control

The Beijing government will adopt a series of policies and programs to improve energy efficiency and reduce energy intensity in all sectors. These policies and programs include local regulation and financial subsidies.

Regulations and guidelines:

Building Sector: The energy consumption in building sector has accounted for 28% of the total energy consumption in Beijing [14]. From 2005-2010, 175 million m^2 low energy building has been built while about 40% of them were designed to meet a 30% energy savings target compared with no energy efficient measures and other 60% were designed based on a 50% energy saving target. The Beijing municipal government also adopts a more strict energy efficiency design standard than the national one. According to the 11^{th} five year plan on building energy conservation, the target of 65% energy savings will be met by new public buildings in 2010.

Transportation Sector: As a leading city to control vehicle emission in China, Beijing is the first city which adopt Euro IV standard 1 January 2007 while Euro I, II and III standard were already adopted in 1999, 2003 and 2005. The local government also launched an environment labeling system for vehicles which will be labeled by stars according to their emission standard. The environment label of vehicles will determine the permitted region for driving. To control vehicle emissions, a tight fuel quality standard (National Standard III) also has been implemented from year 2005.

Financial subsidies:

Green Lighting Project: From the year 2004 to the year 2007, the Beijing government launched a green lighting project to prompt energy saving lamps. The government provided 30% subsidies for the consumers who purchased energy saving lamps. During these three years, 20 million RMB are paid to the consumer and 1.8 million lamps are installed in public toilet, schools and metro stations. It is estimated that the Green Lighting Project saves 39 GWh per year which means around 40,000 tons CO_2 reduction annually.

Subsidies for heating system: The coal-fired heating system is a major pollution source in Beijing during cold season. Since 1998, the Beijing government has invested heavily to renovate about 10,000 coal-fired boilers with boilers using gas or electricity. During the 11^{th} five years, the last 2800 coal-fired boilers will also be renovated. The Beijing government also encourages the usage of heat pump and clean energy (e.g natural gas) in buildings as heating or cooling facilities by providing

subsidies. The subsidies to heat pump project will be 35 RMB/m^2 for water source heat pump and 50 RMB/m^2 for ground source heat pump.

Subsides for public transportation: During the 10^{th} five year plan period, the Beijing municipal government has provided subside to the public transportation sector to promote Compact Natural Gas (CNG) buses, the building of CNG fueling stations and retrofitting of buses and taxis. There are around 3000 CNG buses in Beijing's public transportation system which makes Beijing the city with the most CNG buses in the world.

Brief Conclusion

Climate change is not a priority area in local development, energy and environment plan of Beijing city. The main environment challenge of Beijing is to improve its air quality and environmental quality to achieve the environmental commitments made in its bidding report for the Olympic Games 2008. At the local level, Beijing city has no clear climate change policy, and mitigation action has been integrated into these local plans although it is not stated explicitly. The Olympic games are an important external incentive for Beijing to improve its air and environmental quality. As the dominant share of coal in its energy mix, fuel switching and energy efficiency improvement will be crucial to achieve the goal of air environmental quality improvement then GHGs will also be reduced as a consequence of these activities. Local regulation or guidelines and financial subsidies are the major policies and measures adopted by the Beijing municipal government to improve energy efficiency and environment quality. The relatively high local revenue of Beijing makes it possible to invest heavily into renewable energy and provide subsidies to public transportation.

In August 2006, Beijing Statistics Bureau published the first communiqué of energy and water consumption in first half of year 2006, the energy intensity is 0.8 tce/10^4 RMB, 7% lower than that of year 2005 [15].

5 Case study 2: Guangdong Province

In the first national communiqué on provincial energy intensity, Guangdong province has the lowest energy intensity in China: 0.69 tce per 10^4 RMB of GDP and only 66% of the national average. At the per capita level, Guangdong's reserve of conventional energy is only 1/20th of the nation and 90% energy needs to be imported form other provinces or abroad. Due to the lack of energy resources, the energy price in Guangdong is higher than in most of other provinces in China. For example, the retail electricity price of Guangdong is about 0.65 RMB/kWh, the highest in China and 30% higher than the national average. The low energy reserve and high energy price make Guangdong search for an innovative way to energy saving.

11^{th} five year plan of Guangdong Province

In the 1990s, Guangdong's industrial blueprint was directed towards lower energy consuming industries and high-tech industries. Since the start of the reform process

and opening-up of China, Guangdong's growth in its service industries has outstripped that of manufactory industry. In the 11th five year plan, the Guangdong government aims to increase the share of high-tech industries in the GDP from 9% in 2005 to 18% in 2010. The energy intensity will be reduced by 13% compared with the level of 2005, lower than the national target. The Guangdong government plans to optimize the industry layout, focusing on "high value and low energy consumption" industries like automobiles, electronic appliance, information technology and medicine. Together with the Closer Economic Partnership Arrangement (CEPA) and concept of "Pan Pearl Delta Cooperation", the Guangdong government aims to be center of the service industry along with Hong-Kong government.

LNG project in Guangdong Province

As one of the richest regions in China (GDP per capita are more than 3000$ in 2006), Guangdong suffered from air pollution caused by coal-fired plant and is planning to diversify its generation capacity at an affordable cost. From 1993, Guangdong province had undertaken preliminary research on Liquefied Natural Gas (LNG) market. In 1998, the Guangdong provincial government submitted a project proposal about Guangdong LNG terminals and transmission systems together with China National Offshore Oil Corporation (CNOOC). At end of 1998, the central government approved the pilot LNG project in Guangdong but asked the Guangdong province to reorganize the project proposal to include not only LNG terminal and transmission project, but also gas utilization projects. Five LNG power plants and four city gas projects are grouped together to meet the requirement of central government. The NDRC approved the LNG power plants project with the requirement that they must compete with other conventional coal fired power plant in Southern China grid. The higher generation cost of LNG plant (30% higher coal-fired plant even 10% higher than nuclear plant) make them difficult to compete with other power plants in competitive market. Compared with conventional coal-fired power plant, the four LNG plants in Guangdong can achieve about 5 million tons of CO_2 reduction per year. These plants are also seeking finance from CDM, but it is still not clear how many CERs can be claimed by these projects.

Local policies

Regulations and guidelines [16]: The Guangdong government has passed "The Regulation on Energy Saving in Guangdong Province" in 2003 and is amending the Regulation to include energy standard for high energy consuming industries such as iron & steel, chemical and paper industry. The energy consumption standard will be compulsory. Guangdong also will adopt the Euro III emission standard for vehicles in July 2007.

Financial subsidies: Although Guangdong government is one of the richest provinces in China, it looks like the Guangdong government relies on macro-control policies and market-based mechanism than financial subsidies. The provincial government is planning to provide subside for energy conservation project to achieve the assigned energy intensity target while the scale of such financial subsides is still not clear. At

city level, some cities have planned to provide subsidies to energy conservation activities. For example, the Shenzhen government provides subsides of 8 million RMB to qualified energy conservation project to pay interest. The Zhuhai city is also planning to provide 6.8 million RMB to energy conservation project as subsides.

SO_2 emission trading: Cross border pollution is a major concern of Hong-Kong and Guangdong government. In April 2002, the Guangdong government and Hong-Kong government signed an agreement to reduce sulfur dioxide emissions by 40%, nitrogen oxide by 20% and Respirable Suspended Particulates (RSPs) by 55% by 2010. To achieve this target cost-effectively, these two government plan to design a market-based mechanism, a trading system. In 2006, the implementation plan of "emission trading pilot programme on coal-fired power plants of pearl river delta" has been prepared. The trading system will be in place by 2010. The trading system between Guangdong and Hong-Kong can not only achieve the reduction target of sulfur dioxide but also achieve a co-benefit of GHGs reductions.

Brief conclusion

As a province with less energy resource, the higher energy prices became the best incentives to restructure industry and improve energy efficiency in Guangdong. Like Beijing, Guangdong is also facing environmental pressure and air quality problems. But the Guangdong government relies more on macro-control policies and market based mechanism to adjust the energy structure, industry layout and reduce pollutants. Although those means cannot lead to a sharp improvement of energy efficiency and environment quality, it can provide a long-term solution for the local government.

6 Case Study 3: Shanghai

Shanghai is the biggest city in China and it is also one of the richest cities. In 2005, GDP in Shanghai reached 915.418 billion yuan RMB while the total energy consumption was about 80.69 million tce with a growth rate of 8% annually since the year 2000 [17]. Like Guangdong province, there is almost no primary resource in Shanghai and the pressure for environment is increasing. To satisfy energy demand and reduce pollutant emissions is a challenging task for Shanghai government while keeping its fast economic development. In the year 2005, the Energy intensity in Shanghai was 0.88 tce/10^4 yuan, about 16.5% lower than that of 2000 [18].

Local policies

Regulations and guidelines:

Shanghai has published a series of regulations and guidelines to prompt energy conservation. For example, Shanghai government has issued the energy conservation measurement in building sector. Shanghai is also the first city in china to publish the distributed heating system engineering technology standards. Shanghai government also implement measures to make the public aware of the problems of energy efficiency and energy conservation.

Shanghai government asks that every department takes the lead in saving energy and sets a good example for the whole society in energy conservation. Energy saving technologies and energy management activities have been taken in government offices to reduce the energy consumption of electricity and oil. In governmental offices, green lighting facilities and natural lighting design have been adopted.

26°C action: In Shanghai, the air-conditioners are required to be set at a temperature not lower than 26°C in summer and not higher than 20°C in winter. The aim of 26°C action is not only to save electricity in peak time but also to keep the local citizens aware of energy conservation and create a good atmosphere of energy conservation through joint efforts of the whole society.

Energy Conservation Supervision Center [19]

Authorized by the local government, Shanghai Energy Conservation Supervision Center (SECSC) is the first non-profit energy conservation administrative organization in China. It is affiliated to Shanghai Economic Commission.

SECSC takes an active part in the dissemination of energy conservation information, good case studies, technological consultation and energy conservation popularization and training, etc. It has been given the title of the advanced unit of energy conservation in Shanghai and in China.

Financial subsidies:

Green electricity [20]

The Shanghai Green Electricity Scheme offers electricity consumers in Shanghai the opportunity to “green” their electricity consumption by buying some amount of green electricity for which a premium needs to be paid. The scheme was developed with the support of the Municipal Government, the electric power company and consumers. Through the green electricity project, Shanghai citizens can directly contribute to improve the environment in Shanghai and to build a sustainable future for their children. This project is part of a series of measures to which the city committed during when applying for the World Exposition.

The Municipal Government guarantees that the additional payment for Green Electricity will be used to develop additional renewable electricity generating capacity in the Shanghai Municipality such as wind farms. Participants will be awarded a certificate of participation as a proof of participation and to show that they care about the environment in Shanghai.

To maintain trust in the scheme, a transparent mechanism has been developed to verify and certify that all green electricity sold has actually been produced. This will be done by an independent supervising body who will audit the green electricity accounts and publish the audit results. The Shanghai Energy Conservation Supervision Center holds the information about purchase and sale of Green Electricity and submits relevant reports to the Shanghai Economic Commission.

Brief conclusion

The total energy consumption and total electricity demand of Shanghai city increase respectively about 5% - 7% every year. But the coal still plays an important role in the energy mix of Shanghai, accounting for 52.82% in 2005. To improve the energy efficiency in Shanghai, the Shanghai government not only adopted macro-control policies to address energy issues but also promote energy conservation idea from public awareness. The Shanghai experience shows that it is important to keep the local residence aware of the problem of energy conservation and environment pressures. The public awareness makes it possible to meet the energy and environment challenge through the joint effort of the whole society.

7 Analysis & Conclusion

The Chinese government is developing an overarching energy strategy to address the country's current energy shortage and environmental degradation issues. To cope with these challenges, the Chinese government has set an ambitious target to achieve a deep reduction target for energy intensity and major pollutants. Although climate change is not a priority at national and local level, there are opportunities to achieve GHGs reductions through integrating the emission reduction into energy and environment target.

The central and local governments in China have their own different responsibilities in policy making, fiscal right and fiscal expenditure. In China, the role of central government is to set national target, laws and general guidelines. The existing fiscal system and performance evaluation system is adequate for promoting the development of the local economy but is unfavorable for supporting the choice of a sustainable development path. The central government has been reforming the performance evaluation system to change the behavior of local government.

The Beijing case shows the investment and fiscal input are crucial for improving energy efficiency and air quality through supplying public services. Such measures need huge amount of financial subsidies and are unaffordable for most of the province in the western region. To help the western province achieve their target, a special fiscal transfer from central government to local government may be important. A special account at local budget is also necessary to make the fiscal transfer a stable and long-term financing solution.

The Guangdong case shows the energy price itself may be the best incentive to improve energy efficiency. There are only five provinces with an electricity retail price higher than 0.5 RMB/kWh in 2005: Guangdong, Hainan, Shanghai, Jiangsu and Zhejiang. There five provinces are also the five most efficient province in energy intensity (except Beijing). The pricing of energy resource is the responsibility of central government in China. The central government should adjust the pricing mechanism of energy as soon as possible to include the environment cost of energy into account and make it a signal to reflect the supply and demand. A tax reduction

scheme for energy conservation project or products is also an policy option for central government to set an incentive based policy at national level.

Shanghai case shows that the government is not the only stakeholder to energy and environment issues. The public awareness and the efforts of the whole society is extremely important to achieve the target of energy saving and pollutant control. In local level, the local government is only not the policymaker of local regulations and guidelines but also a messenger to keep the local citizens aware of the challenge of energy and environmental problems.

Finally, macro-control policies at national level should be strengthened to induce the national industry layout. Coordination by central government is also needed to avoid the transfer of high energy consumption industry between provinces.

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Tables and Figures

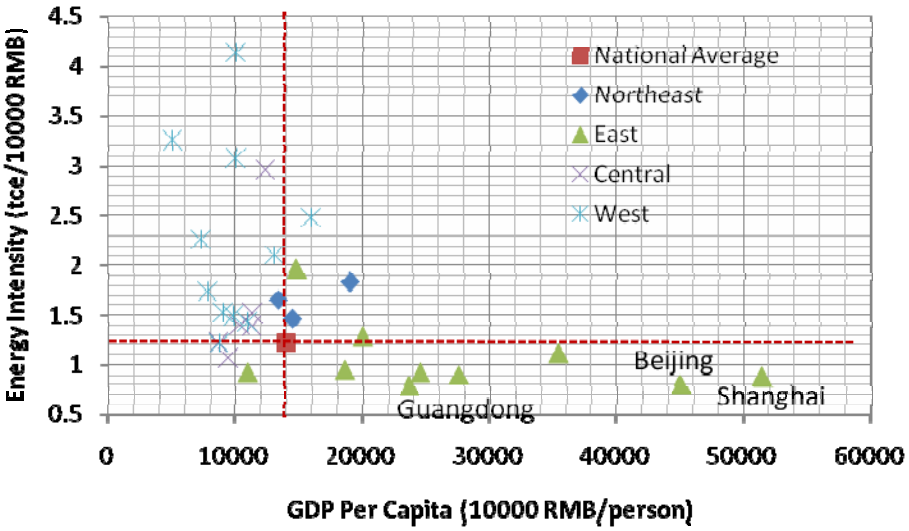

Figure 1 Energy Intensity of different province in China

Source: National Bureau of Statistics and various Provincial Bureau of Statistics.

Figure 2 China Energy Label

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