



**CCICED Special Policy Study Executive Report**

**Environmental Strategy and Measure for Transformation of  
Development Mode in Eastern China**

**CCICED Annual General Meeting 2012**

**December 12-14, 2012**

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## **GLOSSARY**

EIA	Environmental Impact Assessment
FYP	Five-Year Plan
GDP	Gross Domestic Product
GIOV	Gross Industrial Output Value
MEP	Ministry of Environmental Protection
OECD	Organisation for Economic Co-operation and Development
PRD	Pearl River Delta
RSP	Respiratory Suspended Particulate
SAR	Special Administrative Region
SERC	State Electricity Regulatory Commission
SEZ	Special Economic Zone
SOE	State Owned Enterprise
SPV	Solar Photovoltaic
TVE	Township and Village Enterprise
UNEP	United Nations Environment Programme

## ABSTRACT

This study has three main objectives: first, to develop a conceptual framework identifying key elements of green development. Second, to review economic development in the three focus areas of Eastern China, i.e. Beijing, Shanghai and the Pearl River Delta (PRD), and the environmental challenges it has given rise to. Third, to analyze the qualitative and quantitative data and formulate policy recommendations to facilitate economic restructuring and green development in Eastern China.

Analysis and findings show that all three focus areas have experienced rapid development of the tertiary sector after 2000. Another important observation is the decoupling trend between Gross Domestic Product (GDP) growth and pollution emissions (i.e. the economy grew faster than the rate of emissions). Findings from the PRD also indicate the diffusion trend of environmental pollution, possibly due to the relocation of industries to inland prefectures to benefit from lower land and labour costs. Data also show a strong cross correlation between environmental parameters at the regional level (e.g. Hong Kong and Guangdong). The pattern of energy use and pollutant emissions in these areas show a marked shift from industrial to domestic demand and is anticipated to be the future trend along with lifestyle change.

Mega events in the three focus areas (i.e. Beijing Olympics, Shanghai Expo and Guangzhou Asian Games) have seen expedited investment in clean infrastructure (e.g. rail), wastewater treatment plants, solid waste treatment, changing the fuel structure to increase use of natural gas, commercialization of green technologies and products, and most importantly, providing the impetus for the public to take ownership in the “green” life-style movement, and effectively forging regional co-operation.

Proceeding from four basic propositions concerning pathways for green development in China, the study highlights both successes and shortcomings in existing policy approaches to balancing economic development and environmental quality based on qualitative and quantitative analysis. The report suggests it is essential that policy mechanisms and institutional strengthening are reinforced at all levels to ensure that the pursuit of green development is confirmed as a core and continuing task of government.

Building on nine guiding principles to facilitate green development in China, this report sets out six general recommendations applicable to the whole country and additional six intended to further strengthen green development in the developed part of Eastern China specifically.

The former include greater emphasis on policy integration and coordination among sectors, strengthening monitoring capacity and measures and developing the potential for regionally-based policy initiatives, more effective and stringent control on development impacts, strict implementation of accountability of job performance in relation to green development at local government level, fostering public awareness building and environmental education at all levels, and accelerating green development process by means of demonstration projects.

Recommendations for Eastern China include the adoption of more stringent environmental standards and targets, disclosing information more widely to facilitate

public monitoring, promoting green consumption through targeted taxation measures, providing funding for local environmental protection and pollution prevention projects, establishing a regional financial transfer payment mechanism to promote environmental protection in less developed areas to encourage co-development initiatives between neighbouring regions, and promoting corporate environmental governance.

**Keywords:** *Eastern China, green development, structural economic change, regional co-operation, policy recommendations*

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# 1 INTRODUCTION

## 1.1 Background

Since the beginning of the Open Door Policy in 1978, China has begun to develop rapidly and became one of the world's fastest growing economies. In 2010, China overtook Japan to become the world's second-largest economy. The introduction of the Open Door Policy also triggered enormous changes in the country's economy, society and environment on a scale and at a speed that has not been witnessed in any other country.

From 1978 to 2010 per capita GDP of China increased 79-fold from 381 yuan to 29,992 yuan while over the same period exports grew 129-fold. Other economic indicators show similar dramatic changes. Economic growth has however come at a considerable environmental cost although there are now some indications that the rate and scale of environmental degradation may be slackening off as economic development becomes de-linked from damage to the environment. For example, between 1995 - 2010, SO<sub>2</sub> emissions increased by 15.5% and wastewater discharges increased by 65% but per capita GDP increased almost six-fold over the same period. Nonetheless, the Chinese environment remains under acute stress due to continuing high rates of economic growth and urban development, and associated environmental pollution, and habitat and biodiversity loss.

In recent years, the Chinese government has progressively addressed these concerns by pursuing a more appropriate balance between economic development and its environmental consequences. This has been achieved through the explicit and consistent statement of environmental objectives and targets in the 11<sup>th</sup> and 12<sup>th</sup> Five Year Plans (FYPs). In particular, the 11<sup>th</sup> FYP has laid down stringent targets on energy saving and emissions reductions, e.g. to reduce the energy intensity per unit of GDP by 20% and reduce the emission of major pollutants by 10% etc. Traditional sources of environmental pollution, including SO<sub>2</sub>, NO<sub>x</sub> and COD are to be significantly reduced during the period of the 12<sup>th</sup> FYP. Forest cover is also set to be protected and increased during the period of the current Plan.

This study was premised on some important observations: the more proactive and preventive approach attached by the Chinese government in tackling unacceptable levels of environmental damage and wasteful resource use (in particular water resources) resulting from thirty years of rapid economic growth, especially in the most developed, eastern coastal provinces and regions; the growing concern that removing these problems from one part of the country (e.g. Eastern China) might result in the geographical displacement of the same problems to other regions or localities (e.g. Central and Western China) unless more effective environmental and resource use safeguards are put in place; and the recognition of the need for cost-effective policies, regulations and other administrative measures to speed up and intensify the implementation of green development in Eastern China as well as in the rest of China.

## 1.2 Study Objectives

The goal of the study is to identify critical elements of green development for Eastern China. Expected outputs include sets of operational principles and guidelines for the promotion of green transformation, and effective modes and instruments of environmental governance, policy and regulation.

Three key objectives and research issues are identified:

### ***(1) Development of a conceptual framework that identifies the crucial factors associated with green development***

The processes of industrialization and urbanization are commonly seen to be in conflict with ecological well-being. Environmental pollution and degradation are often regarded as the price that a province has to pay for economic development and the urban transition. Most forms of urbanization begin with rapid industrialization involving intensive resource inputs (i.e. water and minerals) and substantial environmental impacts (i.e. air and water pollution, solid waste, impact on biodiversity) at the downstream end of the production cycle.

However, some scholars and policy-makers have argued that environmental degradation does not necessarily have to go hand-in-hand with economic development. Concepts such as sustainable development, ecological modernization, green growth and green economy suggest that, subject to a range of factors and conditions, economy and ecology can be effectively integrated in a way that preserves the environment while maintaining economic growth. Building on the assumption that more effective management of resource use and pollution control can be balanced with economic development, these concepts promote economic efficiency and technological innovation within a framework of sound environmental governance.

### ***(2) Review of the economic development trajectory in Eastern China (Beijing, Shanghai and the Pearl River Delta) and associated environmental challenges***

The coastal cities in the Eastern China have experienced over three decades of rapid economic development based upon industrialization. In the last decade, some of these cities have undergone the economic restructuring process, which has led to permanent shut down of some polluting industries, reductions in industrial production, upgrading of industries to comply with stricter environmental standards or relocation of industries to the less developed Central and Western China. While the socio-economic contexts and detailed characteristics of the urbanization process differ from one city to another, in-depth study into the development trajectory of these coastal provinces can provide important insights into the pull and push factors that facilitate a greener economic restructuring process. Three study areas are identified for in-depth review



and analysis: Beijing, Shanghai and the PRD (including Hong Kong Special Administrative Region (SAR)).

The review of the three areas examines five aspects of data and information, and statistical analysis is conducted to explore possible relationships between these aspects: (i) the key features of economic development and/or restructuring; (ii) application and effectiveness of environmental regulations and policies; (iii) other factors associated with the economic restructuring process (i.e. the role of the market, public awareness, etc.); (iv) natural resources, energy production and consumption, and energy use efficiency; and (v) changing environmental conditions.

### ***(3) Identifying lessons learned from the qualitative and quantitative analysis, and setting out policy recommendations for green development in China***

Based on the above objectives, the study provides a detailed assessment of whether the current economic restructuring in Eastern China provides a positive context for environmental improvement. The extent to which environmental policies and regulations, natural resource constraints, public awareness, market forces, etc., serve as barriers and/or catalysts for the green development process is highlighted. Proceeding from four basic propositions concerning pathways for green development in China, the study highlights the successes and shortcomings in existing policy approaches to facilitating both economic development and environmental quality based on qualitative and quantitative analysis. The study sets out six general recommendations applicable to the whole country and an additional six intended to further strengthen green development in the developed part of Eastern China.

## **1.3 Methodology**

*(1) Desktop research:* the study builds upon existing CCICED initiatives such as the recently completed reports on "Development Mechanism and Policy Innovation of China Green Economy" and "Green Transformation of China Economic Development Mode" and various other initiatives focusing on energy, environment and sustainable cities. Literature reviews have been carried out on recent reports on green development and green growth published by OECD and UNEP, and others.

*(2) Quantitative data analysis:* in order to provide an evidence-based investigation, quantitative data for Beijing, Shanghai and PRD (including the Hong Kong SAR) on economic structure and transformation parameters (GDP, Industrial Output Value, energy production and consumption etc.) and environmental conditions (emission inventories, wastewater discharge, water quality, biodiversity etc.) over recent years have been collected from relevant government published sources. We note, however, that analysis is constrained by incoherent data sets (different time span, measurement units, etc.)

(3) *Qualitative and Case study analysis*: qualitative analysis of three mega events (the Beijing Olympics, Shanghai World Expo and Guangzhou Asian Games) has been carried out to understand their impacts in terms of providing a stimulus for short to long term environmental improvement. Local case studies are also used to illustrate the effects of economic transformation on environmental conditions. These include a review of the Suzhou Creek Revitalization in Shanghai and the introduction of Ultra Low Sulphur Diesel fuel in Hong Kong. The two international case examples studying the de-industrialization process of Malmo in Sweden and the role and functions of air pollution control policies and regulations in Los Angeles also provide insights to help analyze the situation in Eastern China.

(4) *Brainstorming sessions*: based on the statistical analysis and case study observations, intensive discussion sessions have been conducted to formulate the study recommendations. The study team has drawn upon the views and feedback from academics and senior government officials from the three study areas, CCICED's chief advisors, and higher-level policy makers to help finalize the analysis and recommendations.

## **2 EASTERN CHINA: DEVELOPMENT TRAJECTORY AND CHANGES IN ENVIRONMENTAL QUALITY**

### **2.1 Economic Change, Restructuring and Environmental Quality in Eastern China**

Different parts of Eastern China had different development patterns and trajectories as each area has its unique features such as historical context and strategic function. In order to complete the perspective of Eastern China, this study considers three focus areas that demonstrate more advanced development, i.e. Beijing, Shanghai and the PRD, so as to illustrate the relationships between economic performance and environmental quality.

Serving as the country's bridgehead, Eastern China was the first region to initiate the modernization process. The most rapid growth can be observed in the past three decades when industrialization and urbanization took place. GDP increased both sharply and continuously. There was a population influx from rural to urban areas over the past three decades. Relocation activities also occurred as production plants moved away from core city areas to peripheral areas or suburbs owing to various factors like saturation in traditional industrial markets, spiraling production costs and planning policies. The industrial structure also entered a transformation phase in which areas with a comparatively advanced economy saw secondary industry overtaken by the higher value-added industry / tertiary industry. The contribution from tertiary industry then incrementally grew to over 50% of GDP, resulting in the establishment of a "3-2-1" economic structure. For example, in Beijing and Shanghai

the tertiary sector has accounted for over 50% of GDP since 1994 and 1999 respectively. The tertiary sector has become serviced-based and the major economic driver, and signifies the post-industrial characteristics of the more developed cities in Eastern China.

While Eastern China has undergone industrial relocation and restructuring, these activities have resulted in different levels of adverse impact on the environment. However, the study indicates that the industrial restructuring shows some success in localized environmental improvements in terms of reduction in the rate of environmental deterioration. For instance, manufacturing plants that use diesel-powered generators have been closed and cleaner power plants (for electricity generation) have been progressively introduced into the market; the development of centralized heating systems for urban households and encouraging urban residents to use more natural gas instead of coal, etc., have reduced pollution emissions.

These development trends are not extraordinary and have been observed in western countries as they have industrialized and urbanized. However, the development in China is at an astonishing speed and on such a huge scale that both positive and negative impacts have emerged very rapidly. It is therefore essential to establish the major characteristics of the economic transformation in Eastern China to prevent the recurrence of problems there in the near future, as well as to assist the formulation of development policy in less developed areas such as Central and Western China. As business-as-usual is no longer a viable option, pursuing the transition to a greener development path is deemed an appropriate response for the purpose of creating a low-carbon, resource-efficient and environmental-friendly society – a sustainable growth paradigm that should also be advocated in Central and Western China regions, so as to avoid repeating the mistake of “polluting first and cleaning up later”.

## **2.2 Beijing**

Being the national capital, Beijing has multiple roles. It serves as the country’s political, cultural, education and international exchange centre. It is also the national economic and financial policy-making and management centre. Over the years, Beijing has actively initiated development of urban infrastructure and this can be divided into four phases. The first phase occurred (between 1949 and 1980s) and focused on the development of a heavy industry-led economy. During the second phase (1980s – mid-1990s) its role as an economic centre weakened gradually and the economy shifted from industry- to the service-sector. During the third phase (mid-1990s – early 2000s), Beijing enhanced its functions through globalization and the advocacy of a “capital economy” development strategy. In the fourth phase (since the early 2000s), the 10<sup>th</sup> FYP defined the four aspects of capital economies, namely technology-based economy; service-based economy; culture-based economy; and open economy. At present, the “capital economy” development concept continues to

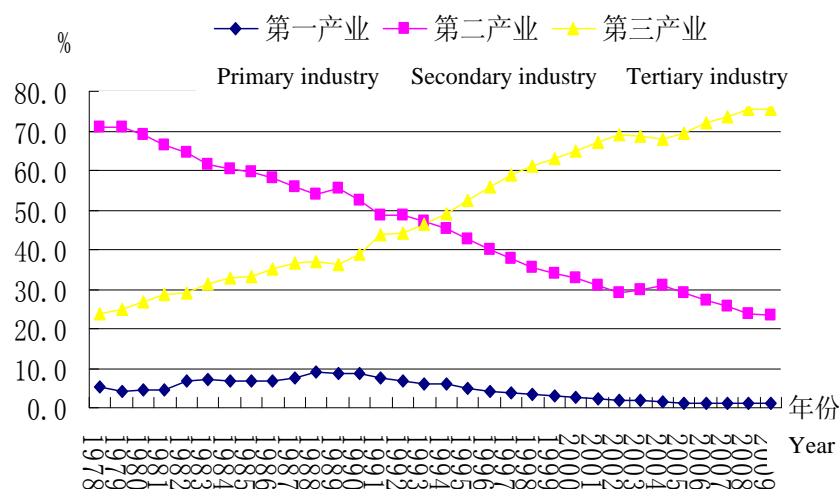
develop and intensify, and this is driving the city towards a knowledge-, headquarter- and green-based economy.

The population of Beijing has grown dramatically over the past 35 years. The reform and opening up policy resulted in a large population influx and an over-flow of the registered and floating populations in the urban area. The rapidly expanding population exceeded the city's carrying capacity, causing impacts on natural resources and ecosystems that triggered off a chain of social, economic and ecological problems. In 2011, the city recorded a total population of 20.186 million (including both registered and floating residents). Compared with 1978, the registered population and floating population have increased by 2.2 times and 32 times respectively.

Regarding the economic performance, Beijing experienced a rapid growth in GDP starting in the 1990s. The annual economic growth rate reached double digits after the application to host the Beijing Olympics was submitted in 2001. By 2011, Beijing's GDP exceeded 1,600 billion yuan. The GDP was 4.5 times the 2000 level and the GDP per capita was over 80,000 yuan.

As highlighted in the previous paragraph, the opening up policy and official recognition of "capital economy" in 1998 has encouraged the growth of tertiary industry in Beijing. At the same time, it has gradually encouraged Beijing to transform from a key industrial base to a tertiary-based service economy. The city's industrial structure first shifted from "2-3-1" to "3-2-1" in 1994. Divergent development between secondary and tertiary industries are noted thereafter. The ratio of primary, secondary and tertiary industry changed from 5.9 : 45.2 : 48.9 in 1994 to 0.9 : 24.0 : 75.1 in 2010. This implies that the transformation from manufacturing-based to service-based has been completed, and the city has entered the post-industrialization era.

**Figure 1. Changes in composition of primary, secondary and tertiary sectors in Beijing (1978-2009)**

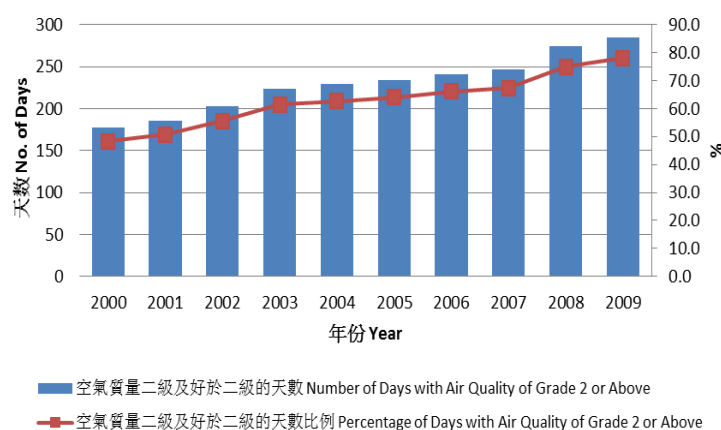


Source: Beijing Statistical Yearbook (1979-2010), Beijing Municipal Bureau of Statistics

Notwithstanding this transformation, the industrial sector in Beijing also experienced modernization. Within the primary industry, the operation changed from the traditional planting and breeding industries to modern urban agriculture, such as seed agriculture and agri-tourism. For secondary industry, hi-tech industries were the driver with automobiles, electronics and construction materials as pillars, and machinery, iron and steel and chemicals providing the base. In the tertiary sector, there was steady growth in the traditional service industries such as transportation and logistics, wholesale and retailing, while modern service industries such as financial, information, and technology services also developed rapidly. The pattern of urban construction evolved from single-centre to multi-cores. The industrial pattern has become more rational with the formation of industrial development zones, hi-tech zones, cultural zones, and special-characteristic zones. However, observations over the past decades suggest that Beijing has only a limited influence on the economic development in its surrounding areas. Economic and industrial synergy between Beijing city and the nearby provinces has been limited.

The environmental management of Beijing is mainly the responsibility of the Office of Treatment of Three Wastes, which was set up in 1972 with the objective of reducing emissions of soot and dust, controlling pollution by phenols, cyanogens, mercury, chromium and arsenic, and also to promote work of environmental protection. Since the Open Door Policy, the rate of environmental treatment has not been keeping up with the speed of development, and could only contain increases in pollution; and so the quality of the city's environment continued to degrade. In the 1990s, coal consumption reached almost 30 million tons causing serious pollution. Ownership of vehicles has risen rapidly and along with it vehicular emissions. However, from 2000 to 2009, days with air quality of Grade 2 or above has increased, indicating various environmental control and industrial restructuring policies have taken effect. This index, however, accounts for only some pollutants, leading to on-going public concern.

**Figure 2. Statistics on Air Quality Index of Grade 2 of above in Beijing (2000-2009)**



Source: Beijing Statistical Yearbook (2001-2010), Beijing Municipal Bureau of Statistics

### 2.3 Shanghai

Shanghai has a long history of development. Being China's largest trade port and industrial base, the city is now serving as a key economic, technology, industrial, financial, trade, exhibition and shipping centre. Since the economic reforms, Shanghai has undergone tremendous changes in its city positioning and development strategy, evolving from an industrial base to a multi-functional city. Its development path can be divided into three phases. The first phase occurred between 1978 and early 1990s. Under the influence of the reform and opening up policy, Shanghai repositioned itself from its sole economic function as an industrial production base to become one of the main economic, technology and cultural hubs in China and as an important international port city. The second phase took place during the 1990s. At that time, the government officially affirmed the development strategy that Pudong was being identified as the "leading head" in order to further open up coastal cities along the Yangtze River, turning Shanghai into one of the international economic, finance and trading centres to drive the economy of the neighboring Yangtze River region. The third phase commenced in the late 1990s. The "Master Plan of Shanghai (1999-2020)" was published and explicitly positioned Shanghai as a modern international city and one of the international economic, financial, trading and shipping hubs (i.e. "one dragon head and four centres").

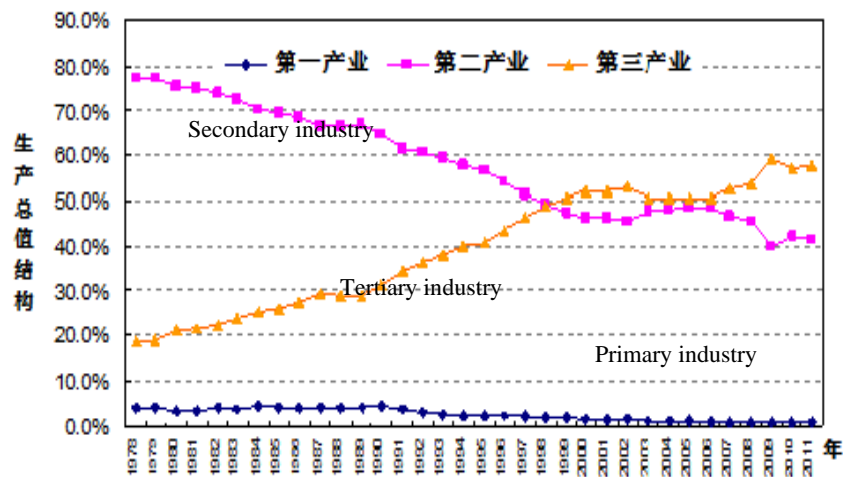
The population of Shanghai has sharply risen over the past three decades particularly due to the influx of a floating population. During the 1990s, Shanghai spearheaded the economic development of China with the development of Pudong. This attracted an influx of external labour to Shanghai seeking job opportunities, causing a rapid increase in the migrant population. By 2010, the resident population of Shanghai reached 23 million, with an increase of 108.6% since 1978 (annual increase of 2.3%). The registered population in 2010 was 14.05 million, with an increase of 27.9% compared to 1978 (annual increase of 0.8%). The floating population recorded in 2010 was 8.98 million.

The GDP of Shanghai has grown rapidly over the last three decades. In 2011, Shanghai's GDP was 1,900 billion yuan. During the drive to develop Pudong in the late 1990s, the economy of Shanghai grew very rapidly with its GDP recording double-digit increases for 16 consecutive years (1992-2007). Since 2008, economic growth has slowed down (growth rate of 9.7% and 8.2% in 2008 and 2009 respectively) due to the international financial crisis and domestic economic downturn. The World Expo in 2010 drove economic growth back to 10.3% temporarily but it dropped to 8.2% in 2011.

Shanghai has served as an "industrial base" for a long period of time even before the Reform and Open Door Policy. Entering the 1990s, greater efforts were made to develop the tertiary sector. By 1999, the tertiary sector overtook secondary industry for the first time. At the end of 1998, in the view of international and domestic

development trends, the Shanghai government decided to build hi-tech industrial zones by boosting industrial investment. Starting from the 11<sup>th</sup> FYP, the industrial structure of Shanghai underwent further adjustment guided by an energy-saving and carbon reduction strategy. The tertiary sector rapidly expanded while secondary industry started to slow down and became less important. The ratio of industrial structure was 57.3%, 42.1% and 0.7% for tertiary, secondary and primary industry respectively, implying the gradual formation of a well-developed “3-2-1” industrial structure.

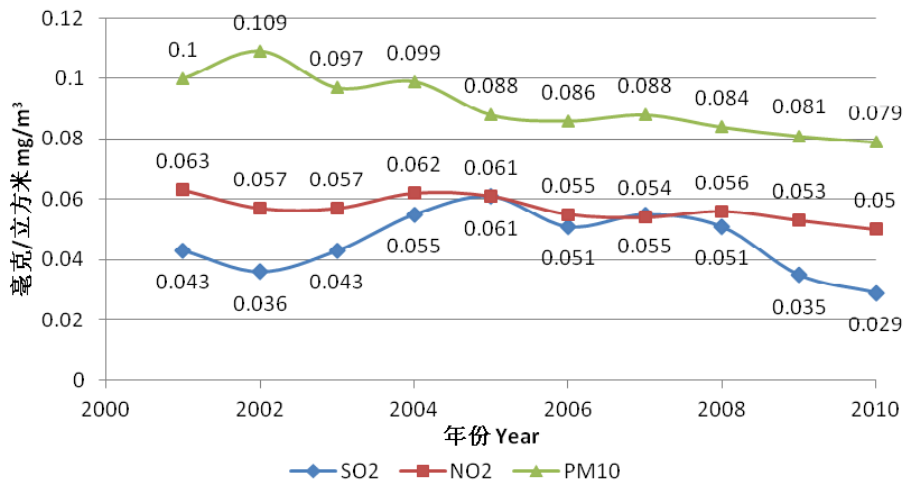
**Figure 3. Changes in composition of primary, secondary and tertiary sectors in Shanghai (1978-2010)**



Source: Shanghai Statistical Yearbook (1979-2011), Shanghai Municipal Statistics Bureau

Regarding environmental quality, the total waste gas emission of Shanghai city has been rising every year. The total waste gas emissions reached 1366.7 billion cu. m in 2010 which is three times the 1991 level. This increase is mainly due to the growth in industrial activities. Total emissions of SO<sub>2</sub> have fluctuated over the past 20 years. However, a significant drop in industrial emissions of SO<sub>2</sub> has been recorded recently. Dust emissions dropped rapidly between the 1990s and the early 2000s, and have remained steady since then. Concentrations of SO<sub>2</sub>, NO<sub>2</sub> and PM<sub>10</sub> in Shanghai have been decreasing over the past decade. All three pollutant concentrations reached Grade II of the National Ambient Air Quality Standards. The rate of “good” ambient air quality in Shanghai reached 92.1% in 2010, in which Air Quality of Grade 1 also reached 139 days.

**Figure 4. Changes in pollutant concentration level in Shanghai (2001-2010)**



Source: Shanghai Statistical Yearbook (2001-2011), Shanghai Municipal Statistics Bureau

Wastewater pollution has continued to increase as a result of rapid industrialization, urbanization and increase of population. Over the past 30 years, wastewater discharges in Shanghai have increased every year. The volume was 1.835 billion tons in 1981 and 2.483 billion tons in 2010. While the industrial wastewater discharges have dropped, domestic discharges exceeded the amount of industrial wastewater discharged in 1996 for the first time. During the same period of time, COD of both industrial wastewater and domestic wastewater have decreased.

## 2.4 The Pearl River Delta Region<sup>1</sup>

The PRD region has a different development pattern from Beijing and Shanghai. Located within Guangdong province, the emergence of the PRD Region has a close relationship to the development of Guangdong Province, which can be classified into the following stages: These include Pre-reform era (1950s to 1980) when few financial resources were invested in industry. During the Staged Reform (1980 to early 1990s), three major sets of reforms were proposed: major shifts in the structure of agricultural production; pricing reforms; and opening up of contacts and investment to the outside world. Guangdong's PRD led-boom peaked between the early 1990s and 2000 when the low land costs, tax breaks, and low-cost, surplus labour of the Special Economic Zones (SEZs) attracted the relocation of industrial firms from Hong Kong. The rapid economic growth in Guangdong also attracted an inflow of unskilled or semi-skilled workers from outside Guangdong. Producers of intermediate inputs were subsequently attracted to these "specialized towns", forming the Township and Village Enterprises (TVEs). Owing to uncontrolled and sprawling growth of urban areas and industry, the province has faced serious environmental challenges. Restructuring commenced after 2000 in which two major trends in the

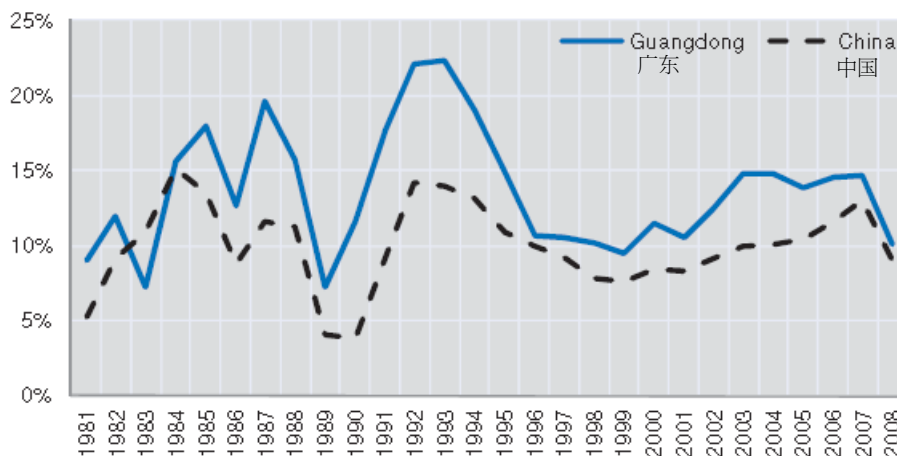
<sup>1</sup> The Pearl River Delta region includes Guangdong Province and Hong Kong and Macao regions. The analysis of this study mainly focused on Guangdong Province.



development strategy were defined. These are (1) increased share of higher value activity in information and communications technology, and (2) an important shift from labour-intensive to high value-added industry.

In 2010, the province had a total population of 104.3 million and the highest urbanization level of all Chinese provinces, excluding provincial-level municipalities like Shanghai, Beijing and Tianjin. Guangdong Province is the largest economy in China and has been a principal driver of the national economy over the last 30 years. In 2011, the province had a GDP of 5,300 billion yuan, making it the largest economy in China, representing 12% of the country’s GDP. Since the inception of the “reform and opening-up” policy in 1978, Guangdong has transformed itself from a backward agricultural economy to an industrial-based economy. The provincial economy is characterized by a larger percentage of industrial sector and lower percentage of primary sector than the national average. In 2009, Guangdong’s GDP was based on the following structural composition: 50.1% from the secondary sector, 47.4% from the tertiary sector and 2.5% from the primary sector.

**Figure 5. Annual GDP growth rate of Guangdong and China (1981-2008)**



Source: Extracted from OECD (2010), OECD Territorial Reviews: Guangdong, China

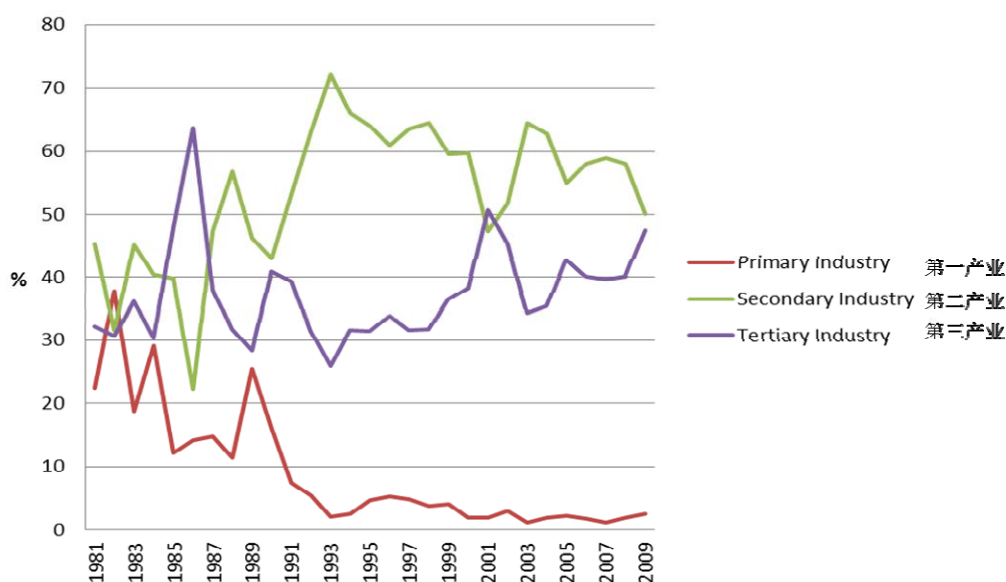
Note: The data are calculated at comparable prices.

Guangdong’s model of economic development differs greatly from those found in industrialized countries. Over the last 20 years of industrialization, Guangdong’s manufacturing contributed to growth in total value added from industry. Guangdong’s economic growth has been characterized by a high trade to GDP ratio. A key development feature of this model has been “processing trade”, which allows companies to benefit from importing, assembling, and exporting via Hong Kong. This has allowed Guangdong to become the largest exporting province in China, accounting for 28.7% of China’s total exports in 2010.

Regarding industrial restructuring, the shift in GDP composition was from primary industry to secondary and tertiary industries. Cities in the PRD demonstrate two extremes – de-industrialization and accelerated industrialization. Guangzhou is a

typical example of de-industrialization. Shenzhen has also started the process while other cities are still in the process of industrialization. In recent years, heavy industry (e.g. car manufacturing) has shown signs of returning to Guangdong. This accounted for the fluctuating composition of secondary and tertiary industry specifically over the past 20 years.

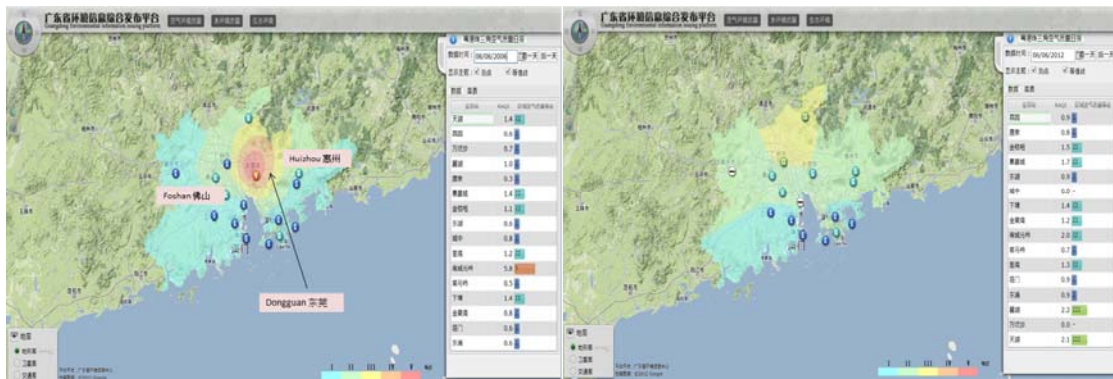
**Figure 6. Share of the Contributions of the Three Strata of Industry (%) in Guangdong (1981-2009)**



Source: Guangdong Statistical Yearbook (1982-2010), Statistics Bureau of Guangdong Province

Environmental data for the PRD region shows that emissions of industrial dust and SO<sub>2</sub> decreased gradually from peak levels in 1996 and 2005 respectively, while the total volume of industrial waste gas emissions has continued to rise within the same period (1996 – 2010). Similar trends are also found from the data released by the PRD Regional Air Quality Monitoring Network, which came into operation in 2005. The annual average concentrations of NO<sub>2</sub>, SO<sub>2</sub> and Respiratory Suspended Particulates (RSP) between 2006 and 2011 reveal that the air pollution problem over the PRD region is gradually improving. This view is confirmed by comparing the PRD Regional Air Quality Index maps between June 2006 and June 2012, which show the most polluted area, Dongguan, already has improved. However, the air quality grading in neighboring areas (e.g. the north of Guangzhou city and Zhaoqing city) is decreasing. The situation may actually be worse since secondary contaminants such as PM<sub>2.5</sub> and ground level ozone are not fully covered in these measures.

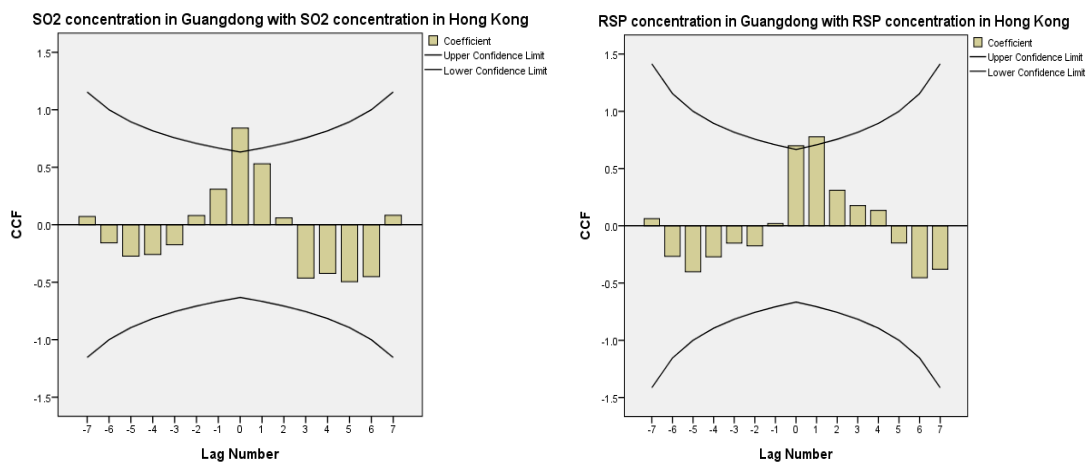
**Figure 7. Air quality grading in PRD region on June 2006 (Left) and June 2012 (Right)**



Source: Guangdong Environmental Information Issuing Platform, Guangdong Environmental Protection Bureau

To further investigate air quality from a regional approach, cross correlation was used to examine the relationship between air quality in Hong Kong and Guangdong using time series analysis. Significant relationships in the time series were found in concentrations of  $\text{SO}_2$  and RSP in Guangdong and Hong Kong. Initial results showed that “RSP in Hong Kong” follows “RSP in Guangdong”. RSP in Guangdong is a leading and/or current indicator predicting RSP in HK currently (lag=0) and one year later (lag=1). “ $\text{SO}_2$  in Guangdong” also serves as an indicator predicting “ $\text{SO}_2$  in HK” currently (lag=0).

**Figure 8. Cross-correlations of  $\text{SO}_2$  concentrations in Guangdong and Hong Kong (Left) and Figure 9. Cross-correlations of RSP concentrations in Guangdong and Hong Kong (Right)**



Source: Data are drawn from the PRD Regional Air Quality Monitoring Network

## **2.5 Mega-events and their Impacts**

In reviewing the economic and environmental conditions of Eastern China from a macro perspective, it is clear that mega events have played a special role in accelerating the development trajectory (economic growth, social development, infrastructure construction etc.) and enhancing environmental conditions through a leapfrogging process. These mega-events are generally characterized by a long period of preparatory work ranging from 6-10 years. The events also have resulted in increase of GDP and reduction of energy intensity. This study covers three mega events, the Beijing Olympics in 2008, the 2010 World Expo, and the 2010 Asian Games.

### **2.5.1 Beijing Olympics**

The Beijing Olympics is considered as the first mega-event introduced into China bringing significant changes in economic development and environmental management in Beijing. The earliest preparatory work dates back to 1999. Various measures were carried out based on the requirements of the “Green Olympics” laid down by International Olympics Committee. These measures follow the principle of sustainable development regarding the protection of the environment, resources and eco-balance. A key focus was on air pollution. Some key measures involved modification of the energy structure by using more natural gas and clean energy, expansion of rail and public transport, leap-frogging to more stringent vehicular emission standards (from Euro I to Euro III), relocation of heavily polluting industries, (e.g. Capital Steel Works), effective regional cooperation in pollution control, and adoption of a scientific approach in specific source identification through the use of a regional air model.

Another insight from the Beijing Olympics is the commencement of promotion and education. This is supported by a series of projects like “Green community”, “Green school” and “Green Commuting” as well as the development of ecological districts, leisure rural towns, and ecological culture, etc. These projects occupy an important niche to enhance environmental awareness and responsibilities among the community through public participation. They also induced behavioural changes in consumption, greener and safer production, and a sustainable living environment. While some policy measures were transient, many have remained in place. The Beijing Green Olympics set a model for “Green Development” leaving a legacy not only in Beijing but also in the rest of China.

### **2.5.2 World Expo**

The World Expo served as another showcase for green development. In the lead-up to the Expo, Shanghai implemented various policies and measures that laid out in a Three-Year Environmental Action Plan in order to enhance the environment: strengthening of the integrated environmental management system; joint unit

pollution prevention and control over the Changjiang Delta; improvement of environmental risk prevention and emergency response system; initiation of all-directional environmental monitoring and inspection work; and the promotion of “Green Expo” and “Low Carbon Expo” concepts. The evaluation concludes that Shanghai has achieved considerable improvement in environmental quality in the past decade, with the rate of “good” ambient air quality reaching 98.4% during the event period and air pollutants such as SO<sub>2</sub>, NO<sub>x</sub> and PM<sub>10</sub> reduced to the minimum in the last decade. The event also facilitated the socio-development of cities, and provided a platform to facilitate the exchange of environmental protection work and ideas at both the domestic and international levels.

### **2.5.3 Asian Games**

The Guangdong government followed a similar approach to that adopted in the previous two mega-events and implemented various measures during the pre-games and games periods. Some key measures included joint unit air quality monitoring work; desulphurisation and emission reduction in industrial plants; promotional use of National III vehicle fuel; and the green commuting campaign to encourage use of public transport and control private vehicle use. The data demonstrates that the emissions of CO, HC, NO<sub>x</sub> and PM<sub>10</sub> were reduced by 42%, 46%, 26% and 30% respectively during the games period. Together with the infrastructure development for road and rail transport, the Games also provided a boost to tourism and other forms of economic development.

Mega events embracing a green theme indeed have served as an excellent catalyst for green development. They attracted enormous additionality of financial investments for the improvement of environmental conditions. Many such green measures are permanent, providing long-term benefits. Obvious examples are the expanded mass transit railway systems, and the leap-frogged vehicle emission standards. However, there are those measures that could only be temporary, such as the scaling down of production volume to reduce energy consumption and associated air pollution. The most important yet less tangible aspect of green development is the greater public awareness and people’s empathy for a better environment.

**Table 1. Key temporary and long-term measures implemented during the three mega-events**

<b>Temporary</b>	<b>Long-term</b>
Reduction in industrial production	Infrastructure – railway construction
Closure of polluting industries during the event period	Industrial relocation
Drastic traffic control	Wastewater treatment
Intensive regional cooperation	Solid waste treatment
International tendering	Fuel ratio adjustment
	Traffic management and vehicle ownership policy

### **3 THE GREEN DEVELOPMENT EXPERIENCE IN EASTERN CHINA: PROGRESS AND LESSONS**

#### **3.1 Four Propositions**

Based on the literature and the statistics and case studies of the Eastern China reviewed, we identify four propositions to illustrate the elements influencing the progress of green development in the region in the recent decades. The four propositions relate to government policies and regulations, natural resources and public awareness, market forces and regional cooperation as the pull and/or push factors as well as major sources of opportunities and challenges for green development in Eastern China:

*Proposition 1: Government policies and regulations facilitate green development – Eastern China’s experience suggests that industrial restructuring and the transition in economic growth patterns were largely initiated by government through overarching policies, regulations and administrative measures. It should be noted, however, that there is considerable room for improvement in policy implementation and institutional arrangements.*

*Proposition 2: Natural resource constraints and increased public awareness give impetus to green development – limitations in the provision of natural resources and greater public awareness of the impact of environmental degradation may serve as two important push factors for green development. Natural resource endowments available to an economy or an area is a factor that influences the growth of certain industries, and the growing public awareness drives the government to achieve higher environmental standards and continuous improvement in environmental performance. It is also noteworthy that the rise of living standards and consumerism have posed considerable challenges to future work for environmental protection.*

*Proposition 3: Market forces as a factor influencing green development – the market is a basic mechanism for effective resource allocation, while the progress towards*

green development depends on the degree of market efficiency. The transition towards market-based economy started in the Eastern China region and such an ideology has contributed to various aspects of green development. These aspects include internationalization of production process and standards and the change in the economies of scale. However, also noteworthy is the fact that market forces can also lead to surplus production and increases in production cost and employment issues.

*Proposition 4: Regional economic and environmental cooperation is a key enabling condition for achieving green development* – in view of the regional differences in resource endowments, development status, industrial structure and human capital as well as the cost of pollution control, regional cooperation through co-development initiatives will ensure more efficient and cost-effective use of resources. However, the need for regionally-based initiatives addresses the challenges derived from the competing and reciprocal relationships among provincial and local units in contributing together to green development in China.

## **3.2 Decoupling Economic Development and Environmental Stress**

### **3.2.1 The decoupling trend**

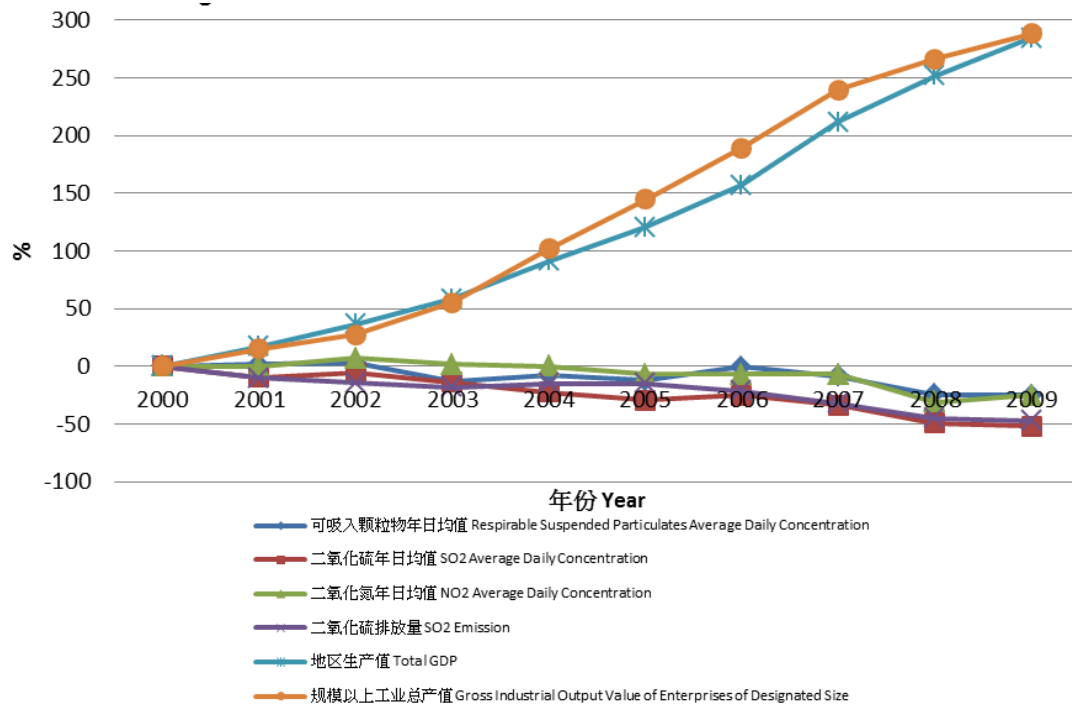
To identify and evaluate the elements that influence green development under rapid economic development, it is important to investigate the interaction between economic growth and environmental quality. Statistics were collected on Gross Industrial Output Value (GIOV) and GDP to reflect economic development. Emissions data and pollutant concentration data also were collected for portrayal of environmental condition.

Correlation analysis is used to test if there is relationship between economic development and environmental quality in the three focus areas of Eastern China. Significant relationships (either positive or negative) were found in almost all cases indicating the two have been inter-related. For example, the results concerning Beijing reveal that the selected environmental variables (e.g. emission concentration) negatively correlate with economic variables, suggesting that the environmental pressure in Beijing has decoupled from economic growth.

Simply reviewing the results of a correlation test might not show the decoupling of economic growth and environmental quality as the relationship is absolute, but through observation of trends, we could observe the relative decoupling of the two. Analyzing the statistical trends is helpful to examine the pattern of relationships between economic growth and environmental conditions over the past decade and even for the projection of future trends. The three figures below present the situation in Beijing, Shanghai and Guangdong. Trends of economic and environmental variables of all three areas demonstrate the relative decoupling of economic growth

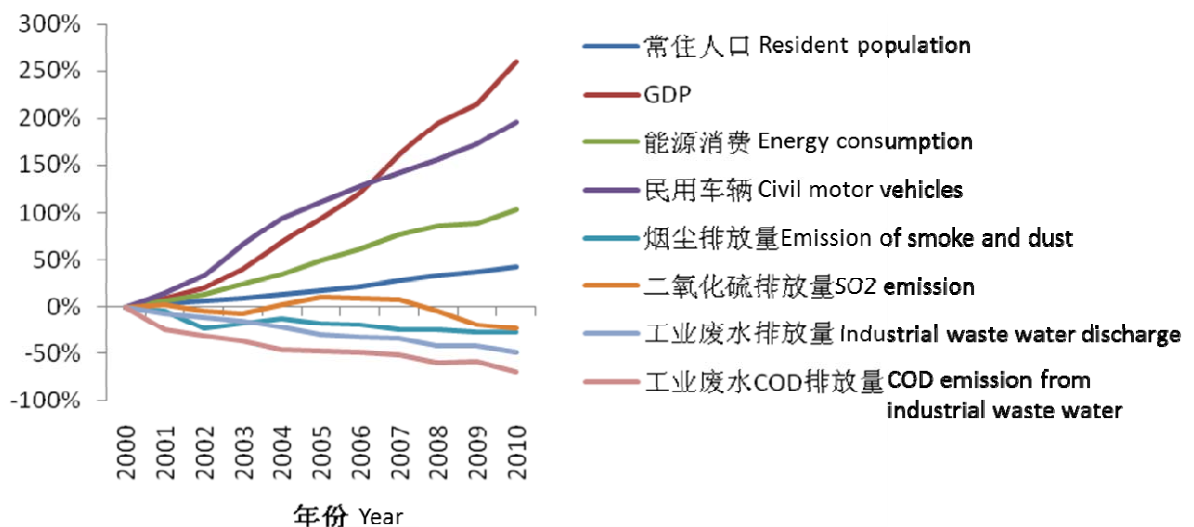
and environmental quality, where the rate of economic growth is much higher than the rate of environment degradation.

**Figure 10. Changes in economic development and pollutant emissions and concentration in Beijing (2000-2009)**



Source: Beijing Statistical Yearbook (2001-2010), Beijing Municipal Bureau of Statistics

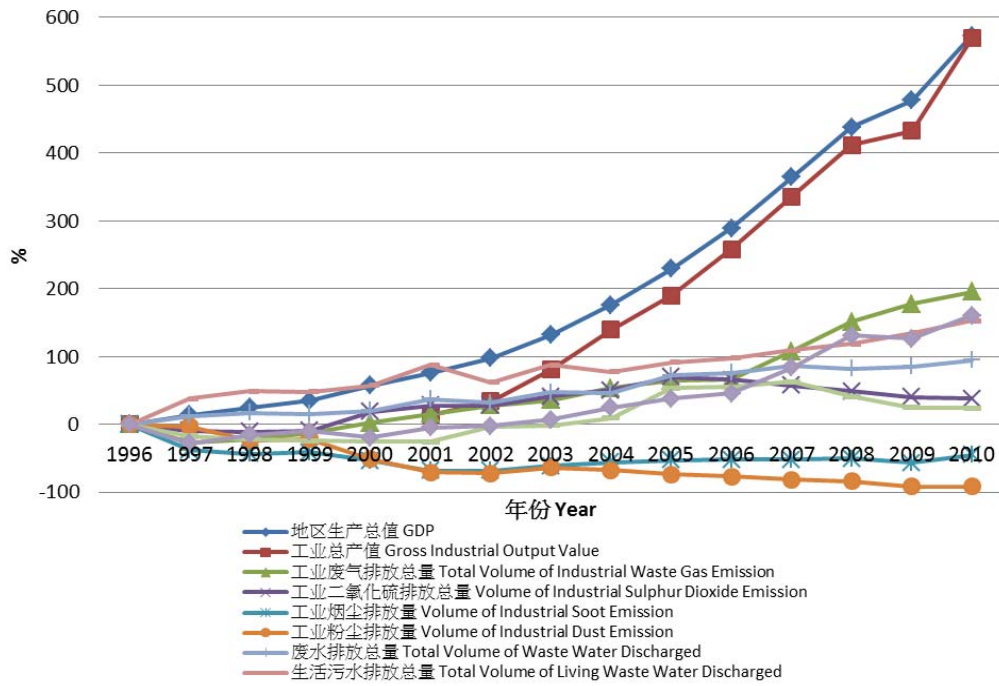
**Figure 11. Changes in economic development and pollutant emissions in Shanghai (2000-2010)**



Source: Shanghai Statistical Yearbook (2001-2011), Shanghai Municipal Statistics Bureau



**Figure 12. Changes in pollutant emissions and economic development in Guangdong (1996-2010)**

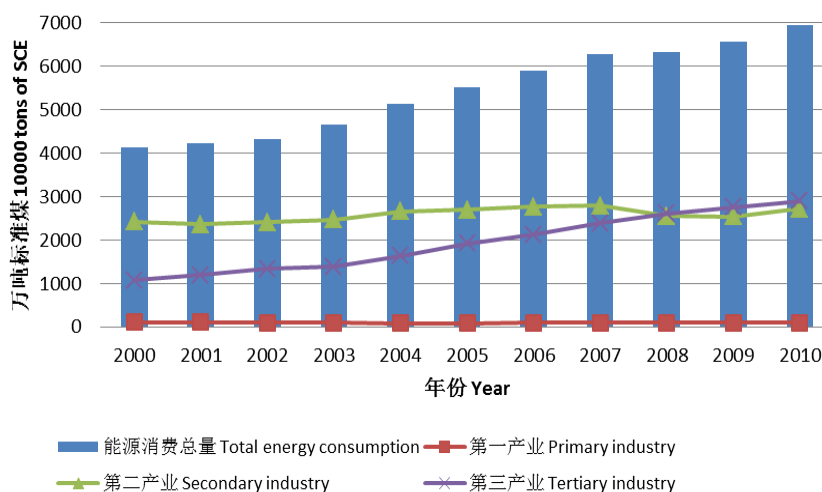


Source: Guangdong Statistical Yearbook (1997-2011), Statistics Bureau of Guangdong Province

### 3.2.2 Changes in energy consumption

Energy consumption also captures the dynamics between economic growth and environmental quality. In particular, energy consumption data by sector can, to some extent, reflect the possible effects resulting from economic restructuring and changes in energy structure. The data suggest that the tertiary sector has become increasingly important and is now the most important energy consuming sector in some areas. Data on energy production and consumption by energy source show the society is moving towards green development when the contribution from greener fuels is increasing. Data also show that usage of clean energy remains low while total energy consumption is rising rapidly every year.

Figure 13. Energy consumption by sector in Beijing (2000-2010)



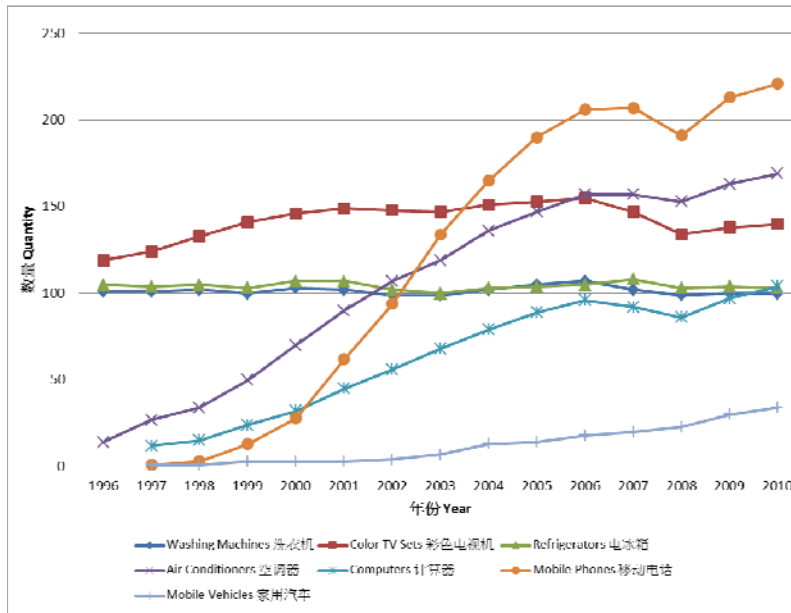
Source: Beijing Statistical Yearbook (2001-2011), Beijing Municipal Bureau of Statistics

### 3.2.3 Domestic consumption and emission

Industrial enterprises have been the significant contributor to pollution emissions. With rising living standards and emerging consumerism, the domestic sector becomes an increasingly important source of pollution. Figure 14 and 15 show the trends of increased possession of durable consumer goods, such as air conditioners, computers, mobile phones and motor vehicles in Beijing's and Shanghai's urban households.

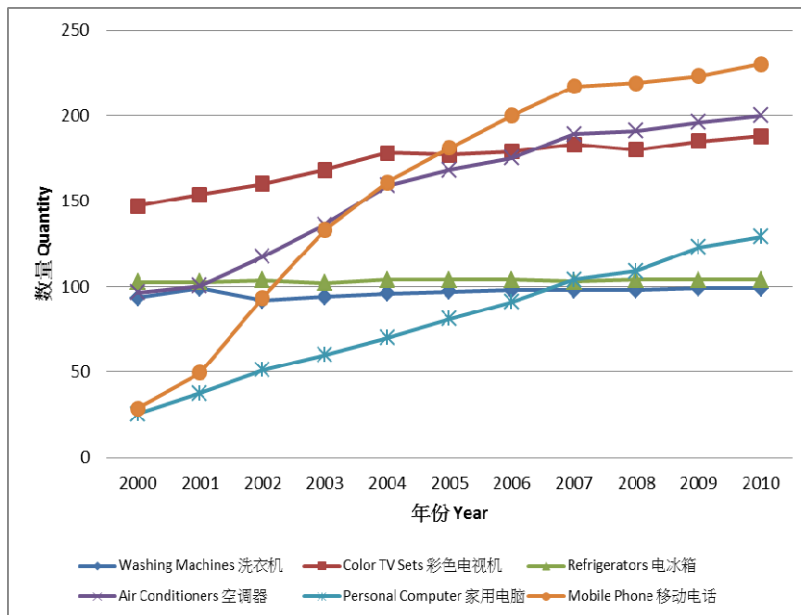
Increasing consumption inevitably leads to increasing pollution. Data suggested that the domestic sector contributed more than half of the NO<sub>2</sub> emission in Beijing from 2006-2008 (Figure 16). It shows that possible over-consumption is leading to greater stress on the environment, and that consumption behavior is becoming more significant in affecting the progress of green development.

**Figure 14. Per 100 Urban Households Annual Possession of Durable Consumer Goods in Beijing (1996-2010)**



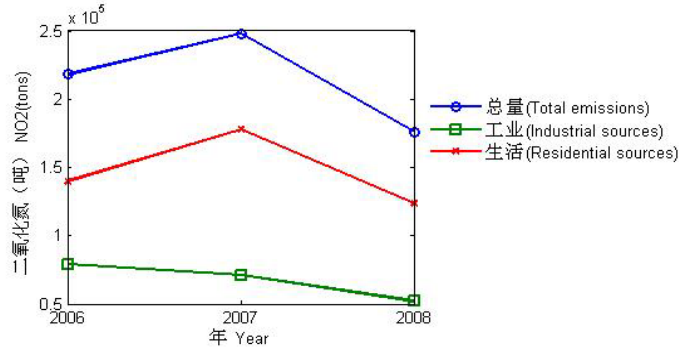
Source: Beijing Statistical Yearbook (1997-2011), Beijing Municipal Bureau of Statistics

**Figure 15. Per 100 Urban Households Annual Possession of Durable Consumer Goods in Shanghai (2000-2010)**

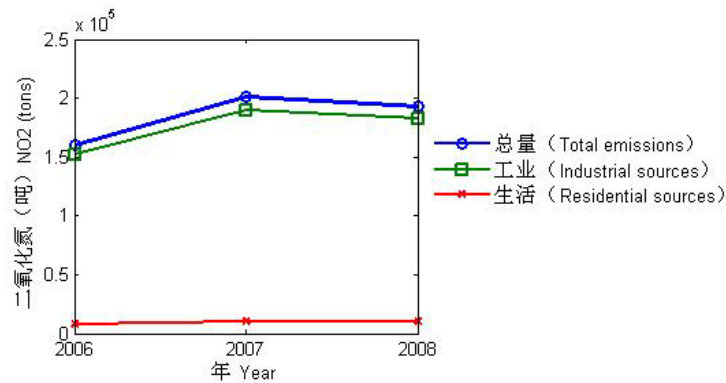


Source: Shanghai Statistical Yearbook (2001-2011), Shanghai Municipal Statistics Bureau

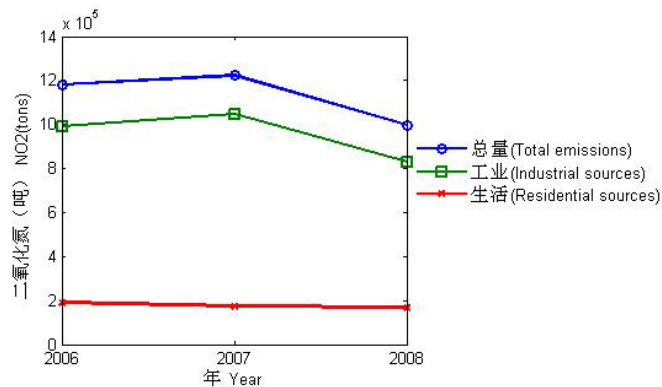
**Figure 16. NO<sub>2</sub> Emission (2006-2008)**



Beijing



Tianjin



Hebei

Source: China Statistical Yearbook on Environment (1999-2009), National Bureau of Statistics and Department of Environmental Protection

### 3.3 Conclusions

Successful decoupling of economic growth and environmental quality may suggest that measures and policies for pollution reduction have been effective, which indicates that policies and regulations can serve as a pull factor towards green development. The rapid growth of economy is also worth noting as it would put pressure on the environment, while the influence of domestic and international markets would also affect progress towards green development. Energy is a major factor in environmental

protection especially when consumption is continuously increasing and clean energy accounts for only a low proportion of total consumption. The adjustment of energy structure and raising energy efficiency are the key challenges ahead. The growing significance of the domestic sector in contributing to emissions raises concerns about the role of the general public in green development. Domestic consumption should become key focus in future environmental and social development policies. Emission data within the same airshed as well as the experience of mega-events indicate the importance of regional cooperation and co-development arrangements for more effective resource allocation and for reducing negative impacts on green development at the regional level.

### ***3.3.1 To promote green economic restructuring and green development through effective policy implementation and institutional arrangements***

China considers green development as an inevitable strategic choice that fits the context of the fundamental realities of a huge population, unbalanced development, shrinking natural resources and a fragile ecological environment. The Chinese government has been intentionally determining the pathway of its environmental policies. From the 1970s and 1980s, China defined environmental protection as a basic state policy, with its emphasis on industrial pollution control and prevention (especially end-of-pipe pollution control). In 1994, the Chinese government approved and issued China's Agenda 21, and developed a more comprehensive strategy, countermeasures and action plans for sustainable development. The notion that economic development should be based on the "circular economy" was officially confirmed, along with the establishment of "scientific outlook on development" and the promotion of an environmental-friendly and resource-efficient society. These efforts have yielded considerable results, which have effectively curbed some environmental deterioration and resource depletion, although major existing problems and some new ones continue to limit success.

Thus there is still considerable room and much need to improve. (1) *Increasing government efficiency and responsiveness.* It has been generally accepted that government bodies (at the provincial and local levels) responsible for the implementation of environmental laws and regulations are hindered by their weak institutional capacities. More importantly, a clear line dividing the functions of the government and enterprises is often missing under the largely state-owned economy where the roles of the government authority and private enterprise are unclear. Thus, local authorities typically give priority to economic growth and investments over the stringent enforcement of environmental regulations and standards, which makes regulatory enforcement at the local level inefficient and sometimes virtually non-existent. (2) *A critical disconnect still remains between central government planners who lay down the broad policy directions and the local governments that are responsible for formulating plans and implementing the FYPs.* Critics also argue that some government departments have not developed enough awareness of green

development, and without in-depth thought on what social, economic and environmental policies adjustments are needed in order to achieve green economic transformation. (3) *From an environmental governance perspective, the interactions between the government, enterprises and the public in the integrated decision making process for economic and environmental planning are very limited.* It is suggested that stakeholders' participation and information dissemination are particularly important, and the government should provide incentives to actively encourage industries and enterprises to become more self-regulatory and adopt international best practices. (4) *It is also widely acknowledged that China is moving away from a rigid, command-and-control system to a decentralized and more flexible environmental policy-making and implementation system.* However, more efforts should be made to achieve policy integration and strengthen institutional arrangements for fostering green development. These include more effective monitoring and implementation mechanisms, fostering use of market-based instruments, providing more opportunities for public participation, as well as increasing government transparency and accountability.

The recent proposal by the Ministry of Environmental Protection (MEP) to promote large scale environmental projects involves the construction of model sustainable cities with strategic planning covering all aspects of development including spatial design, industrialization and urbanization, innovative technology support, etc. This may provide a platform for focused efforts on institutional and policy innovation for the advancement of the environmental decision-making mechanism in China.

### ***3.3.2 To achieve economic development goals with minimum natural resources depletion and environmental quality degradation while simultaneously increasing public awareness can give an impetus to green development***

Natural resource endowments available to an economy or an area determine the development of certain industries, and the growing public awareness drives the government to achieve higher environmental standards and continuous improvement in environmental performance. It is also noteworthy that the rises of living standards and higher levels of consumerism have posed considerable challenges to future work for environmental protection.

The heavy reliance on fossil fuels energy has limited the progress of green development in Eastern China. Rapid economic development since the Open Door Policy has relied on manufacturing industries that also turned out to be the major sources of pollution. Manufacturing has always been the leading sector in energy consumption, accounting for over half of the overall energy consumption in some areas. In Guangdong, final energy consumption has been rising steadily each year with 30-40% of the fuel mix comprised of polluting coal and oil. Electricity accounts for over 40-50% throughout the past decades but according to data from the China Electricity Council, electricity generated by renewable energy contributes to less than

20% of the total production. The use of natural gas and other clean energy sources for electricity production remained relatively insignificant.

Indeed, our analysis in the three focus areas of this study shows that domestic and other consumption of energy have been rising, and so too has their contribution to pollutant emissions. It is foreseeable that even though Eastern China is moving more towards the development of the tertiary sector. With rising living standards, the domestic sector would bring about more pollution than ever. Yet, public awareness of the impact of materialism on environmental quality remains limited.

But things are beginning to change. The promotion of green development has always been initiated by the government in a top-down manner but civic society is now gaining momentum in this area. Limited by regulations and with little resources and mobilizing ability, green groups have often encountered difficulties in assessing and monitoring environmental quality. But more green groups are becoming increasingly influential as some are now capable of monitoring the environmental impacts associated with business practices.

The advancement of society has created factors that can both slow down and speed up the progress of green development. Rapid industrial development led to a heavy reliance on non-renewable energy which continues to create pressure on the environment. Yet, with the increasing development of renewable energy and accelerating concerns about environmental quality and the growing influence of green groups and civic society, it is possible that the effects of these constraining forces could be minimized.

### ***3.3.3 Harnessing market forces to accelerate progress on green development***

Market forces could serve as both a pull and push factor for green development in Eastern China. The influence of market forces would be internal or external. They help to drive the development of sustainable urbanization and to facilitate the development of knowledge- and innovative- based economies which are key contributors to green development.

Since the Open Door Policy, China has been experiencing a transition towards a market-based economy. China has moved from the planned economy, where economic activities were largely controlled by the state, towards the development of special economic zones, the development of private owned business and the introduction of foreign direct investment. The opening-up of markets has not only facilitated the growth of tertiary industries, but also improved living standards in the Eastern region.

The transition to a market-based economy has also made China more vulnerable to the influence of the global economy. While the macro-economic environment has been experiencing a downturn and slow recovery, China has to expand her domestic

demand in order to maintain the continuous growth in GDP. Economic restructuring, the development of tertiary industry, urbanization, regional cooperation for development and increased individual consumer demand are sources of growth in domestic demand. While the government has played an important role in stimulating the domestic market and facilitating urbanization, it has also contributed to economic restructuring through various measures including setting up industrial parks. The private sector also has played a part in restructuring by relocation and upgrading of manufacturing factories. The trend of economic restructuring has also been reinforced by the development of tertiary industries. The growth of the tertiary sector has been identified in different regions. The proportions of tertiary industries in Beijing and Shanghai have already exceeded traditional secondary industries and have become the sector that generated the highest proportion of GDP. All these have contributed to the steady growth of domestic demand, which has facilitated economic restructuring and the development of tertiary industries and eventually has helped promote green development in China.

The experience of mega events demonstrates the role of the market in facilitating good practices in green development via economy of scales and international tendering. The huge market created by mega events created economy of scale for both the domestic and international market. These helped lower the price of costly technology that facilitated the adoption of green innovation.

The market-based economy also facilitated green development through more stringent environmental standards on export products. International markets are concerned about environmental and safety standards of products and production process. More countries have been imposing stricter standards for raw materials, domestic and imported goods and product life-cycles, and promoting environmental labelling. The pressure to conform to international environmental standards and to satisfy the requirements of customers around the world has encouraged China to move towards a more environmentally sensitive manufacturing process.

The influence of the international market also has encouraged China to place greater emphasis on research and development. The amount spent on R&D by enterprises has increased each year. Enterprises also spend huge amounts on applications for patents. All of these influences derived from an R&D emphasis are paving the way towards a knowledge- and innovation-based economy.

The transition towards market liberalization has, however, created other problems such as surplus production and possible destructive competition. State Owned Enterprises (SOE) have been privileged in capital and resources allocation, and have been protected by the state from competition. They tend to continue with product manufacturing even when the market cannot absorb surplus production. These supply-demand unbalances have occurred in various sub-sectors, for example, solar photovoltaic (SPV) production.



With increasing privatization, competition has become more intense with more regions of China, especially the inland regions, having opened up their markets. Regional governments strive for local GDP growth but at the cost of environmental quality. The private sector faces growing pressure in its operation. Production costs including land, material and labor cost have risen tremendously throughout the past decade. With increased competition and increased costs, some businesses were forced to close down or relocate inland without upgrading production facilities that slowed down the progress of green development.

On the whole, in view of the important role of the market forces on the economic restructuring process, it is essential for the government to strengthen the institutional arrangements and harness the market forces for more efficient environmental management and to encourage green economic restructuring.

#### ***3.3.4 To incentivize and advocate regional co-operation for achieving green development***

With the experience of economic liberalization over the past 30 years, regional co-operation has now been intensified and more widely adopted in China. In the Pan-PRD Region, the “Administrative Measures for the Resolution of Conflicts on Trans-boundary Pollution in Pan-PRD Region” prompted the environmental protection agencies to establish regional joint commission for the handling of trans-boundary pollution disputes. Participating provinces are also required to introduce an information exchange platform, pollution enforcement inspectors and a border water quality monitoring system. In the Yangtze River Delta Region, various regional co-operation programmes are set out with a focus on remediation for water pollution and emissions of SO<sub>2</sub>. Examples include the establishment of joint cities water pollution remediation system and water resources information dissemination system.

Regional co-operation mechanisms were also introduced through mega-events, including the Beijing Olympics, the Shanghai Expo and the Guangzhou Asian Games. Three major observations may be made.

First, these regional co-operation programs adopt a holistic approach, which comprises targets, action plans, implementation measures, monitoring systems and even contingency plans in some cases, to cover a wide range of areas such as environment, economy, transportation and urban planning. One of the examples of large-scale regional co-operation is the air quality assurance and monitoring work during the Beijing Olympics. It has developed computerized airshed modeling that takes into account the air pollution trends and meteorological factors over a wide region covering Beijing, Tianjin, Inner Mongolia, Shanxi, Hebei, Baoding and other peripheral areas. Apart from setting out various pre-games remediation and temporary control measures, the airshed modeling was effective in identifying the contingency

measures needed when air quality deviated from the pre-determined level just before the opening ceremony.

Secondly, the focus of regional co-operation has shifted from purely economic in the past to both economic and environmental at present. Since China's Agenda 21, the aim of launching regional co-operation is no longer only to achieve high productivity levels, but also to safeguard the environment.

Thirdly, regional co-operation serves as a possible way to solve the trans-boundary pollution problems. The trend analysis and cross correlation test that were conducted between Hong Kong and Guangdong on selected air pollutants demonstrates the air quality of each place is affected by the other. The dispersion of air pollutants due to cross-border human and natural (e.g. wind) activities cannot be solely tackled by mitigation measures within their own administrative boundaries.

While regional co-operation facilitates sustainable development in China, there also exist difficulties and challenges. Economically, enterprises tend to opt for provinces where lower environmental transaction costs exist. Cooperation becomes difficult when provinces compete with each other in attracting enterprises to boost provincial GDP. Low or even no compliance with institutional arrangements from the participating provinces is resulted. There also exist challenges under the current political arrangements where different jurisdictions have made regional collaboration on air and water management between Hong Kong SAR and other cities in the PRD region difficult.

#### **4 FROM POLITICAL CONSENSUS TO INSTITUTIONAL AND POLICY DEVELOPMENT: PRINCIPLES AND RECOMMENDATIONS FOR GREEN DEVELOPMENT IN CHINA**

Green development now forms part of a global policy agenda that has emerged in response to the imperatives of environmental degradation, biodiversity loss, climate change and global economic slowdown. For China, green development represents a strategic option that is consistent with the key challenges confronting the country, including huge population size, unbalanced development, declining natural resource base and environmental quality, and fragile ecological systems.

The Chinese Government has been attaching great importance to the promotion of green and sustainable development since the 1990s. In 1995, the 9<sup>th</sup> FYP initiated the concept that the economic growth model in China must be transformed from an "extensive" to an "intensive" growth. In 2005, the 11<sup>th</sup> FYP expanded the idea and proposed to bring into being a pattern of economic development with "low input, low consumption, less emission and high efficiency". It also laid down some concrete targets such as reducing energy consumption per unit of GDP, as well as the long-term goals of promoting the capability of independent innovation, vigorously developing the circular economy, and accelerating the construction of resource-saving

and environment-friendly society. In 2007, the 17th National Congress of the Communist Party of China put forward acceleration of transforming the mode of economic growth and optimizing and upgrading the industrial structure. The way of promoting economic growth was shifted from mainly relying on investment and export to relying on the coordination of domestic consumption, investment and export; from mainly relying on the secondary industry to relying on the coordination of the primary industry, the secondary industry, and the tertiary industry; from mainly relying on increased consumption of material resources to relying on technological development, improvement of labor quality and management innovation. From 2010 onwards, China continued to emphasize accelerating the transformation of its mode of economic development, in order to cope with the effects of the international financial crisis; adapt to the changes in the global demand structure; rationalize the distribution of national income; promote social harmony and stability; construct a moderately prosperous society, and meet the new expectations of the people for a better life. More recently the recommendations of the CPC Central Committee for Formulating the 12<sup>th</sup> FYP for National Economic and Social Development also highlighted that to accelerate the transformation of the economic development mode in China will constitute a profound reform in the economic and social fields, and each field will need a comprehensive, systematic and strategic transformation, including the reform of the development concept, transformation of the development mode and innovation within the development path.

#### **4.1 Guiding Principles and Prerequisites**

As mentioned earlier, a clear political commitment and policy direction is the most important prerequisite for green transformation in China. This study suggests it is essential that policy mechanisms and institutional adjustments are introduced and reinforced at all levels of government to ensure that the pursuit of green development is confirmed as a core and continuing task of government for all of China.

This study also proposes the following nine guiding principles to facilitate green development in China.

- 1) This is a long-term transition process that in China's case will need to be continued in subsequent FYPs and major national strategies, and which will extend over many decades;
- 2) Green development is not just about economic growth but also about promoting social progress; green development is a process and not a single end-state;
- 3) Policy continuity is essential at both the central and local government levels;
- 4) An integrative, holistic view of the development process is adopted, one that extends across all policy domains;
- 5) The potential as well as the limits of both technology and market dynamics are recognized;
- 6) Sensitivity to the social dimension of the development process and its goals and objectives is required;

- 7) Both the positive and negative impacts of development are managed in a balanced way;
- 8) The importance of stewardship and the need for responsible management of natural systems and national heritage resources are recognized; and
- 9) The enhanced commitment to adhere to international conventions on sustainable and green development.

Progress towards green development will be influenced by the extent to which these principles can be articulated and made operational through policy systems and their supporting mechanisms. Policy makers are encouraged to recognize the importance of these principles and they should be refined and reaffirmed periodically to reduce the likelihood of “policy drift”.

## **4.2 General Recommendations for Facilitating Green Development in China**

The pursuit of a green development strategy in Eastern China and elsewhere in the country will require systemic changes at both the macro (strategic or state level) and the local and implementation levels. On the basis of our study we put forward six general recommendations that are applicable to the whole country.

### ***4.2.1 Recommendation 1: Improve policy integration and coordination***

To integrate and coordinate different policy sectors, especially energy, transport and infrastructure, education and economic development, under the framework for green development in China:

- 1) Future FYPs should explicitly and consistently indicate in their objectives and quantitative indicators that environmental quality must not be traded off for economic advancement; and
- 2) The FYPs should be subject to an improved auditing, reporting and disclosure process that highlights potential problem areas and which alerts provincial and local decision makers to potential conflicts between key policy objectives (e.g. economic prosperity, environmental quality, biodiversity, heritage and so forth).

### ***4.2.2 Recommendation 2: Strengthen regional monitoring capacity and measures***

- 1) Enhance the supervisory and regulatory role of the Regional Environmental Protection Inspection Centre:
  - The Centre should be equipped with appropriate and additional manpower and resources, including state-of-the-art equipment (hardware) and database management (software) for performing its expanded duties;
  - The Centre should be endowed with specific regulatory powers to facilitate inspection and enforcement in an effective and efficient manner, e.g. to audit the emission inventory of industrial operations, including thermal power generation, and setting up a database with annual updates of the results; and

- The Centre should become the overarching authority to oversee environmental monitoring on operations where an Environmental Impact Assessment (EIA) has stated the expected environmental quality outcome through the implementation of mitigation measures.
- 2) Establish a coordinating body under the State Council (proposed name, Green Development Commission or Environment and Green Development Commission):
- The main tasks of this coordinating body are to provide a platform for discussion of policies relating to energy, industry, transport, infrastructure, economy, agriculture, environmental protection and nature conservation; and to recommend the considered policies to the State Council for implementation by the relevant Bureau(x) in a coordinated and timely manner; and
  - All relevant Ministry heads should be core members of the Commission and should be obligated to meet on a regular basis to discuss policy priorities, review implementation strategies and formulate future plans; this co-operation should go beyond the individual project level.

#### **4.2.3 Recommendation 3: Strengthen policy implementation**

To enforce more effective and stringent controls on minimizing the impact of development on the environment:

- 1) Strictly implement the Environmental Admittance System (e.g. more stringent emission standards and requirements of pollution abatement technologies) in order to prevent new sources of environmental pollution and displacement of polluting industries emerging in less developed regions;
- 2) Strengthen the EIA system and increase the rigour of its implementation to match international best practice:
  - Soil and groundwater pollution of industrial brownfield sites have become a barrier in the process of land redevelopment. However, the effective regulatory and institutional framework for brownfield management has yet to be established. There should be more comprehensive regulations and laws on brownfield site planning and more specific requirements for land decontamination / remediation under the EIA system;
  - Environmental performance committed to in the EIA reports should be strictly monitored. Enterprises and local government departments that fail to comply with the regulatory requirements of the EIA should be disclosed and reported on a regular basis; and
  - A corporate environmental profiles database should be established to facilitate the development of a corporate environmental performance and behavior assessment system. The environmental performance of enterprises should be assessed by the government on a regular basis, with the results made available for public inspection.

#### ***4.2.4 Recommendation 4: Develop a performance-based accountability system on green development at local government level***

- 1) The performance of local officials should be closely monitored and based on consistent assessment and reporting criteria. Green development targets, specific indicators and incentives should be developed to motivate local officials to take proper account of their economic, environmental and social performance (index of economic growth, social progress, people's livelihood, protection of the ecological environment, etc.).

#### ***4.2.5 Recommendation 5: Increase public awareness on environmental protection, green development, and promote public participation***

- 1) Greater transparency in environmental management and information disclosure, e.g. pollution emissions (amount and sources), pollution status and trends and details such as the nature, duration and location of pollution incidents;
- 2) More openness of the public feedback system for receiving comments and interacting with the community;
- 3) Public awareness building and education programmes at all levels and more effective use of media channels; and
- 4) Widespread promotional campaigns of low carbon lifestyle, energy-efficient behavior, and green development decisions at community level and in households.

#### ***4.2.6 Recommendation 6: Accelerate the green development process by means of pilot and demonstration projects***

- 1) Set up pilot green development zones as demonstration areas for modern service sectors, hi-tech industries, sustainable energy and transportation systems, etc.;
- 2) Stimulate integrated economic, industrial and environmental policies and measures through the construction of industrial parks for achieving centralized emission control; and
- 3) The State Electricity Regulatory Commission (SERC) should initiate the installation of a "Smart Grid" in selected urban centres as pilot projects so that the efficiency of renewable energy could be explored and the benefits of demand-side-management (DSM) maximized.

### **4.3 Recommendations for Green Development in Eastern China**

This study also sets out six specific recommendations to strengthen green development in the more developed part of Eastern China. They involve: the adoption of more stringent standards and targets; increased information disclosure; promotion of green consumption; provision of regional funds for pollution prevention and protection; establishment of a regional financial transfer payment mechanism; and promotion of corporate environmental governance.

The recommendations are based on the following rationales:

First, in view of the increasingly open market environment, Eastern China needs to adopt higher environmental and safety standards in the production life-cycle, with more innovative technologies or management techniques in order to enhance global trade competitiveness and respond to the growing public environmental awareness.

Second, it is the duty of the government to provide maximum information to the public, both in response to requests and by regularly publishing key information. With more information and data made available to the public, the cost of governance may be reduced and the interaction and communication between government and citizens enhanced.

Third, as there is an increasing impact of consumer behavior on the environment, with over-consumption being a major cause of waste and pollution, greater effort should be made to encourage more sustainable forms of consumption in the context of societal efforts to reduce emissions. As Eastern China gets richer, sustainable consumption should be given a high priority since consumers will be financially capable of paying more for environmental-friendly products and their behaviour will have a direct impact on the production patterns.

Fourth, the past 30 years of rapid development in Eastern China have created a massive amount of environmental risk to air, water, and to biodiversity. Citizens are exposed to these risks while it is often difficult to find the 'polluter' that caused or exacerbated the pollution. Therefore, regional funds should be set up to facilitate an integrated approach to environmental prevention and protection.

Fifth, the call for a holistic approach in regional co-operation hinges upon environmental protection efforts in less-developed areas. The provision of financial incentives would create a positive stimulus to more effective regional co-operation in environmental protection, ecological conservation, prevention of pollution transfers, and encourage co-development of areas at different levels of development.

Sixth, corporate enterprises have an increasingly important role to play in the society. They need to meet various environmental regulatory obligations laid down by the government and heightened expectations from the public with regard to their environmental performance. The promotion of corporate environmental governance should be given a higher priority in advancing green development.

Details of the recommendations are as follows:

#### ***4.3.1 Recommendation 1: Implement more stringent standards and targets***

Adopt more stringent environmental standards and targets in Eastern China than national standards, e.g. impose more rigorous emission standards for key pollutants in industries that are energy-intensive and highly polluting.

Implement a performance management system at the local government level for evaluating achievements in carbon emission reduction and energy-saving.

#### ***4.3.2 Recommendation 2: Establish greater information transparency***

Disclose information more widely and regularly to facilitate public monitoring, in particular:

- information that concerns most citizens, e.g. data on particulate matter emissions (PM<sub>2.5</sub> etc.), ground-level ozone, and heavy metal emissions that would have a marked effect on human health; greater transparency in environmental management and information disclosure, including the amount and sources of pollution emissions, pollution data and trends and details such as the nature, duration and location of pollution incidents; and
- information and data that are fundamental for research and development and policy-making.

#### ***4.3.3 Recommendation 3: Promote green consumption***

Advocate “green consumption” concepts and behavior by means of:

- voluntary actions through raising environmental awareness and information sharing to instigate behavioural change; and
- the introduction of taxation measures (e.g. environmental taxes and resource taxes) to promote positive changes in corporate and consumer behavior, and enhance the market competitiveness of environmentally friendly service and products.

#### ***4.3.4 Recommendation 4: Set up a regional fund for environmental protection and pollution control projects***

Set up a pilot “Regional Fund for Environmental Pollution Prevention and Protection”, that can facilitate:

- the assessment of environmental health risks (e.g. hazardous chemicals left behind by former industrial plants which have led to soil and groundwater contamination);
- industrial brownfield site decontamination / detoxification / remediation;
- compensation to and resettlement of affected persons; and
- the provision of funding for local environmental protection and pollution prevention projects.



#### **4.3.5 Recommendation 5: Establish a regional financial transfer payment mechanism**

Establish a regional financial transfer payment mechanism, in order to:

- promote environmental protection in less developed areas; and
- encourage co-development initiatives between neighbouring regions.

#### **4.3.6 Recommendation 6: Promote corporate environmental governance**

Promote corporate social responsibility and green corporate governance through the establishment of green business coalitions and development of green supply chain management strategies.

## **5 FUTURE RESEARCH AGENDA**

Several areas related to this study have been identified for future research work:

- An in-depth study focusing on the institutional barriers to policy integration for environmental protection and green economic development, including how the current system operates and where the blockages are;
- A correlation study between environmental quality and health impacts and related policy implications (e.g. land-use planning, urban design, public health policy etc);
- Case studies for assessing the relationship between air / water pollution and the loss of biodiversity at the local and regional levels (with case studies);
- A feasibility study of using shale gas as an interim replacement for coal, focusing on gas exploration, storage, transportation and consumer usage. The medium-term energy policy should be formulated in the light of shale gas availability nationally and globally;
- Detailed studies of business decisions regarding location and investment in the course of economic restructuring / green transformation in China. Data should be collected on what actually makes companies in different sectors, and of different types, sizes and cost structures, locate in different regions and move around, i.e. the influence of different factors, (e.g. environmental costs, land and labour costs, and external economic environment etc.). It is also important to know more about the investment incentives offered by localities (e.g., provinces, cities, counties) to attract industry and how consistent these are and how they relate to national priorities and guidelines; and
- The CCICED as a high-level advisory body to the Chinese government should consider setting up a Special Task Force to bring together experts from industry, government and academia to carry out integrated studies on climate change and energy policies targeting both local and regional development contexts. The studies should be regularly reviewed and updated for designing long-term sustainable energy and industrial development strategies and action plans.

## **ACKNOWLEDGMENTS**

The study team of the Special Policy Study on Environmental Strategy and Measure for Transformation of Development Mode in Eastern China is grateful to receive financial support from the China Council for International Cooperation on Environment and Development (CCICED) and the University of Hong Kong (HKU).

The study team is also grateful to have valuable comments and suggestions from experts and government officials: Mr. Zhao Hualin, Director-General, Department of Pollution Prevention and Control of MEP, Professor Zhang Qingjie, Director, Research Institute of Spatial Planning and Regional Economy of National Development and Reform Commission, Professor Zhang Haibin, School of International Studies of Peking University, Mr. Liu Zhongpu and Mr. Lu Xuyang, Director and Consultant, Habitation and Environment Commission of Shenzhen Municipal People's Government, Dr. Xiao Rongbo, Director, Guangdong Provincial Academy of Environmental Science (Low Carbon & Ecological Research Center), and Professor Xiang Yunrong and Professor Zhong Liuju, Vice Directors of Guangdong Environmental Monitoring Center.

Special thanks also go to Hong Kong Bird Watching Society for providing bird survey data.

**This report is submitted by the Special Policy Study Team**