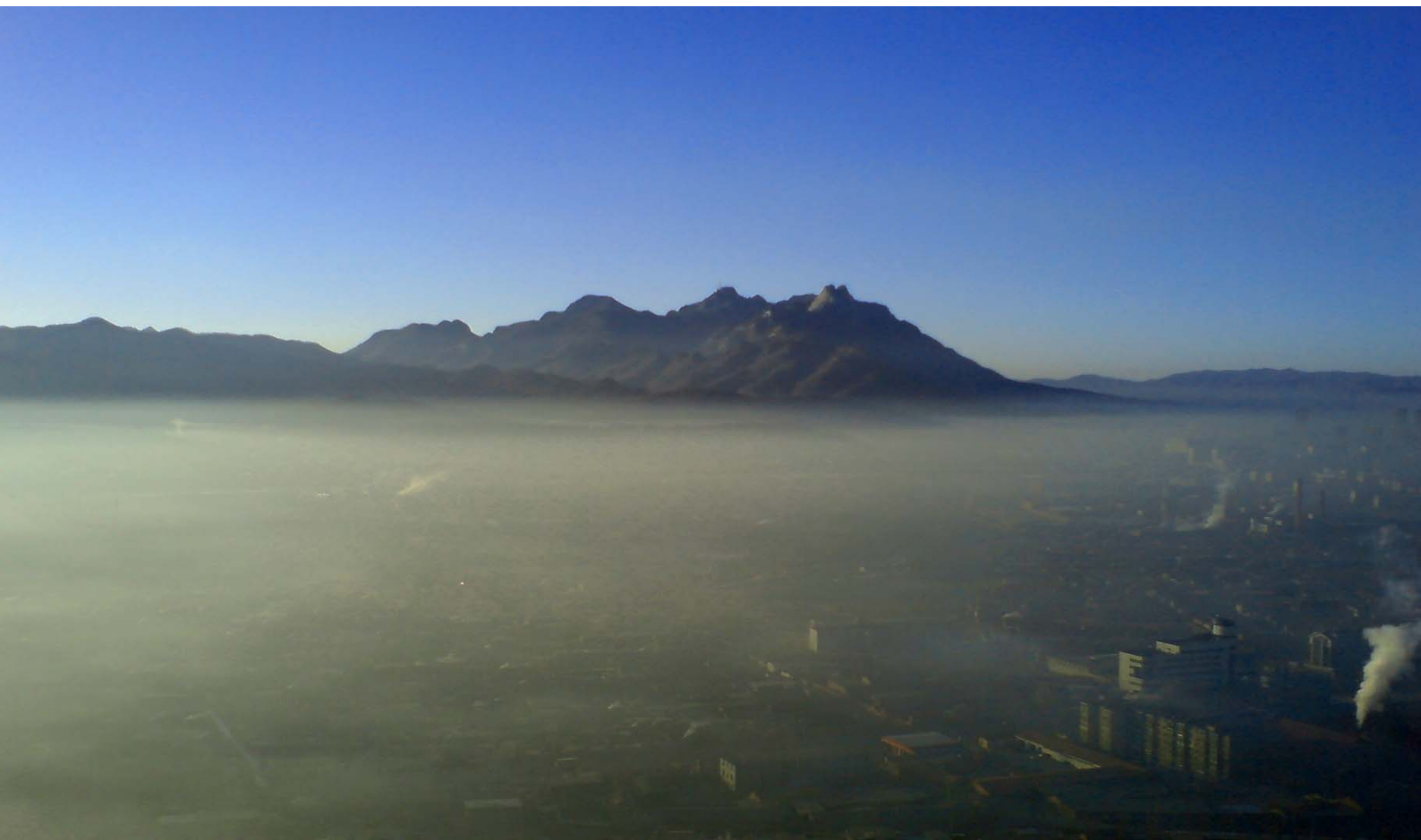


Major Developments in China's National Air Pollution Policies in the Early 12th Five-Year Plan



March 2014

IGES Policy Report: Major Developments in China's National Air Pollution Policies in the Early 12th Five-Year Plan Period

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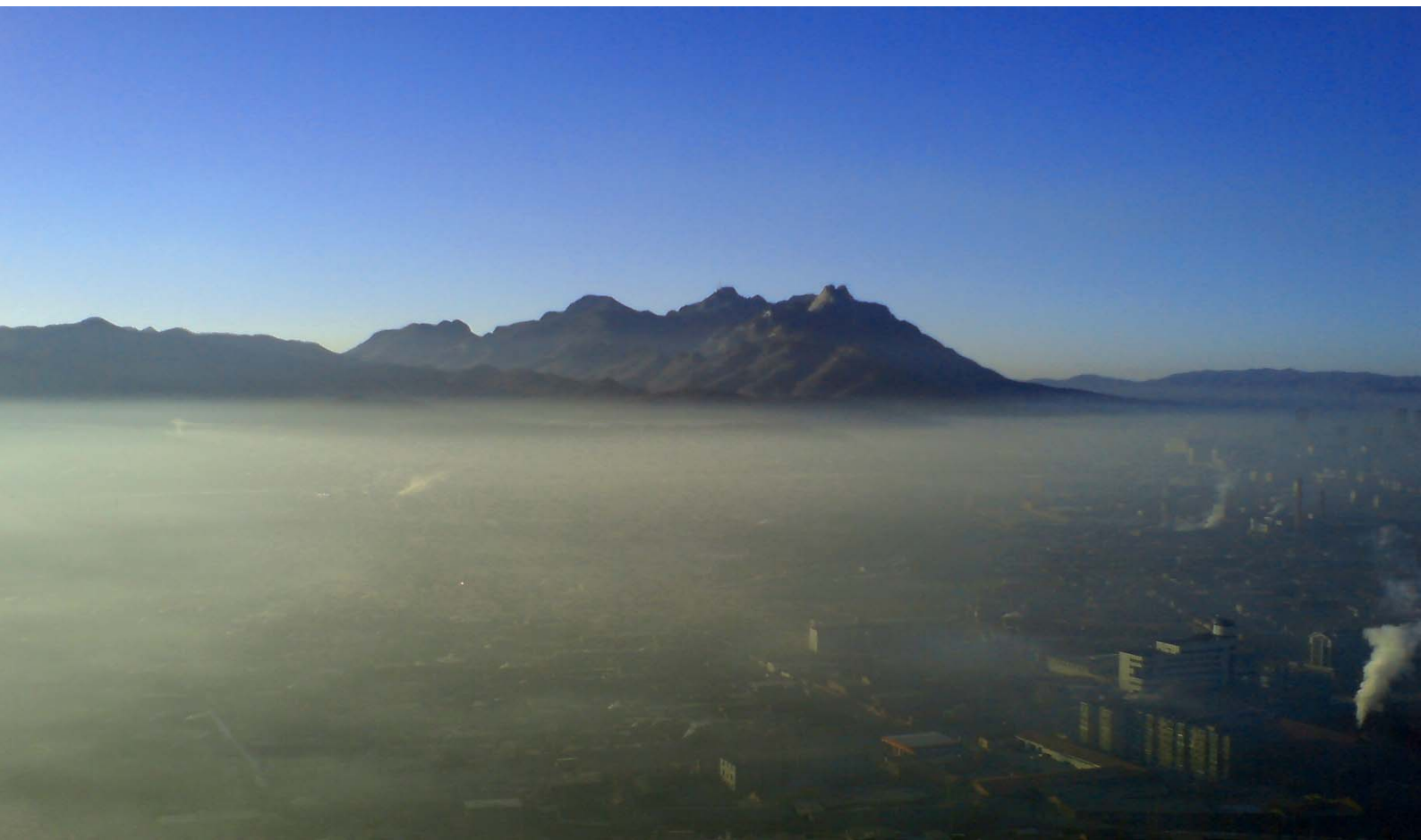
ISBN: 978-4-88788-163-1

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Acknowledgements

The research for this report was supported by the Environment Research and Technology Development Fund (S-7-3) of the Ministry of the Environment, Japan. The authors wish to express sincere thanks for valuable assistance and comments provided by Eric Zusman, Hideaki Koyanagi, and Xin Zhou of IGES, and several experts in China. Any remaining errors and omissions are the responsibility of the authors.

Abstract

This report reviews recent developments in China's formal national air pollution policies from late 2011 to late 2013. It also reviews the related legal framework and administrative structure of implementation of air pollution prevention and control measures in China, to illustrate the context and legal significance of these trends. The complexity of this structure contributes to difficulties in implementation. This report shows that China's air pollution policies are made up of a range of different types of policy measures including laws, standards, regulations, action plans, and others. Moreover, air pollution is addressed in a broad range of policy areas including overall energy policy, energy conservation, industrial policy, and technology promotion. The main finding is that China has steadily strengthened its formal policies relating to air pollution during the first half of the 12th Five-Year Plan period in a variety of ways. Many changes are related the process of developing the Plan and its sub-plans, and follow the Master Plan (the 12th Five-Year Plan for National Economic and Social Development), which introduced binding pollution reduction targets. Important new Five-Year Plans include a regional one with stronger targets for designated regions, some relating to energy conservation, environmental health, law and policy construction, as well as the Blue Sky Science and Technology Project. Many plans designate significant financing for implementation. The Total Emission Control Program and various emissions standards have been strengthened, monitoring capacity has been significantly increased, and much data has been released to the public. Revision of the Air Pollution Prevention and Control Law has been delayed. The most recent important initiative is the Air Pollution Prevention and Control Action Plan issued by the State Council in September 2013. This Action Plan is related to and builds on many earlier measures including the regional management system (Joint Prevention and Control) to address domestic transboundary air pollution. It focuses not only on pollution targets, but also industrial restructuring, industrial location, and technological innovation, as well as stronger governance. The Action Plan will be enforced by linking industrial project approvals to EIA and energy audits, and linkage with senior officials' performance evaluations. This report does not analyze the effectiveness of these policies, but the broad policy overview provided by this report would be a necessary starting point for conducting such an analysis. Overall, China has adopted many broad ranging new policies, but implementation of these policies certainly remains a key challenge.

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Abbreviations

BMEPB	Beijing Municipal Environmental Protection Bureau
CCICED	China Council for International Cooperation on Environment & Development
CPPCC	Chinese People's Political Consultative Conference
CNEMC	China National Environmental Monitoring Center
EIA	Environmental Impact Assessment
EPB	Environmental Protection Bureau
EPL	Environmental Protection Law
FYP	Five-Year Plan
MEP	Ministry of Environmental Protection
MIIT	Ministry of Industry and Information Technology
MOF	Ministry of Finance
MOFCOM	Ministry of Commerce
MOST	Ministry of Science and Technology
MPS	Ministry of Public Security
MRV	Measurement Reporting and Verification
NBS	National Bureau of Statistics
NDRC	National Development and Reform Commission
NH ₃	Ammonia
NO _x	Nitrogen Oxides
NPC	National People's Congress
O ₃	Ozone
PM	Particulate Matter
PM ₁₀	Particulate Matter less than 10µm
PM _{2.5}	Particulate Matter less than 2.5µm
RMB	Chinese Renminbi
SEPA	State Environmental Protection Administration
SO ₂	Sulfur Dioxide
TEC	Total Emission Control
TECP	Total Emission Control Program
USD	US Dollar
VOCs	Volatile Organic Compounds
WHO	World Health Organization

1. Introduction

This report reviews recent developments in the air pollution policies of the People's Republic of China (hereinafter referred to as China) from late 2011 to late 2013. It also provides an overview of the related legal framework and administrative structure of implementation of air pollution prevention and control measures in China, to illustrate the context and legal significance of these trends.

It should be emphasized that this study only focuses on the formal policies, and to some extent on institutional development. It does not focus on the actual status of air pollution in China, the extent of implementation of the policies, or the effectiveness of the policies. A full analysis of policy effectiveness requires two steps: 1) assessing the extent to which the policies were implemented, and 2) the extent to which the implemented policies affected the actual levels of air pollution. Therefore, a clear understanding of the actual contents of China's formal air pollution policies is an essential prerequisite for assessing their implementation and effectiveness. It is hoped that this survey could contribute to future efforts to analyze policy implementation and effectiveness by providing basic information about the actual policy contents.

This report shows that China's air pollution policies and related legal and administrative structure are highly complex, and it is very difficult to construct an overall picture and confirm the precise legal status of each policy. China's air pollution policies are made up of a range of different types of policy measures including laws, standards, regulations, action plans, and others. The Five-Year Plans are particularly important, and a number of them are related to air pollution. Many experts in China generally are knowledgeable only about policies related to their own specialized area, so it is difficult to understand the overall picture even by talking to a range of experts; close examination of official written policy documents is indispensable. In particular, this research showed that China's air pollution policy should be understood to include a wide range of areas, not only regulations and targets directly related to air pollution, but also broader energy, energy conservation, industrial policy, and technology promotion measures and policies.

It should also be noted that this report focuses on national policies and to some extent

national policies relating to provincial and local governments. However, it does not address provincial and local policies directly. In fact, important new air pollution policies are also being adopted and implemented by provinces and local governments such as Beijing and Shanghai, but these are beyond the scope of this survey.

The main finding regarding policy developments is that China has steadily strengthened its formal policies on air pollution prevention and control during the first half of the 12th Five-Year Plan (12th FYP) period in a variety of ways. Many of the changes are directly related to the process of developing the 12th FYP and a variety of its sub-plans, and follow from the Master Plan (the 12th Five-Year Plan for National Economic and Social Development published in March 2011), which introduced binding pollution reduction targets.

The most important element is probably the strengthening of the Total Emission Control Program (总量控制) (TEC), which is a part of the FYP. Energy policies and targets, particularly for energy conservation and efficiency, feature prominently in the 12th FYP and are also very important for controlling air pollution, although this report does not provide a comprehensive survey of China's energy policies. Other important new trends include stronger air quality standards, incorporation of health concerns, increased monitoring and greater public disclosure of monitoring data, and strengthened administration and accountability mechanisms.

The Air Pollution Prevention and Control Action Plan (大气污染防治行动计划), issued by the State Council in September 2013 (2013 Action Plan), is also very important (State Council, 2013). Generally, it is related to and builds on many earlier measures, particularly the FYPs. However, the 2013 Action Plan may be interpreted as the next step in their development and implementation. More importantly, it may signal the leadership's intent to make air pollution a priority and strengthen the implementation of related policies.

The most important new accountability mechanism is the addition of environmental targets to the target responsibility system used to evaluate the performance of government officials. The system was used previously for energy efficiency targets but its application to air pollution is an important step forward. The 2013 Action Plan also calls for approval of new industrial projects to be linked to the results of Environmental Impact Assessments and energy audits.

Two important new air pollution trends are the increasing complexity and regionalization of China's air pollution. Complex secondary pollutants such as PM_{2.5} and O₃, which are formed from primary pollutants and therefore difficult to manage, are rapidly rising in importance. Moreover, air pollution has become a domestic transboundary issue as provinces and cities are unable to manage air pollution on their own, an issue which was highlighted by the necessity of using a regional approach to clean up the air for the Beijing Olympics.

The steady development of a regional air quality management system is another major new policy trend. It brings together a variety of measures to address domestic transboundary pollution between provinces, and PM_{2.5} is a major focus. Overall, the regional management system is key part of the move towards a more integrated approach and development of a more comprehensive and regionally coordinated measures, especially to address secondary pollutants such as PM_{2.5}.

There are several other important trends. Research capacity for air pollution control is being strengthened. Special measures regarding particulate matter (PM) have also been developed. Finally, the Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution is currently under revision. It is expected to be strengthened, but the decision on the final contents of the revisions has been delayed. Nevertheless, continued strengthening of air pollution related policies is expected throughout the 12th Five-Year Plan period.

It is important to note that the FYP did not start out as a complete plan. Rather, it began with a master plan indicating some overall directions, and incorporates many plans and sub-plans for specific areas. Initial plans often indicated overall directions for developing sub-plans. New plans are being developed throughout the FYP period. Moreover, some plans specify directions for developing or amending laws, regulations, and various other policies, and the decision-making processes for adopting them is very complex, so the distinction between FYPs, laws, regulations, and policies can easily become blurred.

The experience of the previous two Five-Year Plans had an important influence on the stronger policies emerging from the 12th FYP, so it may be worthwhile to briefly mention the background of the 11th Five-Year Plan (11th FYP). The 11th FYP incorporated lessons learned from the failure to reach the target of 10 percent reduction of SO₂ emissions during the 10th Five-Year Plan period (2001-2005). Thus, in the 11th FYP period (2006-2010), the

government deployed an expanding and evolving policy toolbox, and it succeeded in reducing total amount of emissions of SO₂ in China by 14 percent.

The 11th FYP's toolbox for air pollution control included a wide variety of policies. Command-and-control policies included emission standards and limits, technology mandates, and mandatory closures of power plants. Market-based incentives and subsidies included pollution levies, lower prices for electricity from less-efficient power plants, higher prices for electricity from power plants with satisfactory FGD (flue gas desulfurization) equipment, tradable generation quotas, and restrictions on access to loans and stock market listings. Administrative measures included negotiated agreements, performance evaluations, and environmental impact assessment approvals (Schreifels, et al., 2012).

However, these measures did not succeed in controlling SO₂ emissions sufficiently to significantly improve the current severe air pollution situation. To achieve the World Health Organization air quality targets, the emissions of NO_x, PM₁₀, and VOCs would need to decrease by 40, 50 and 40 percent respectively, from 2005 levels (Wang & Hao, 2012). Secondary pollutants such as O₃ and PM, resulting from the interaction of massive emissions of primary pollutants such as SO₂, NO_x, VOCs and NH₃, have become another major part of China's severe air pollution problem. Thus, the overall direction is to broadly strengthen a range of policies in the period of the 12th FYP.

Development of the new policies described in this report was underway during the process of developing the 12th Five-Year Plan. However, the development of new policies was probably accelerated by the global media attention that accompanied severe pollution episodes in Beijing during late 2011 and early 2013 and the publicity of monitoring data from the US Embassy in Beijing (U.S Embassy, 2011). Some new policies were developed and implemented in response to these episodes.¹ The episodes continued into early 2014 as did related global media attention.

¹ The Guardian reported on January 22nd 2012, that Beijing released air pollution data after public pressure. Xinhua reported on March 7th 2013, that China seeks for help from international society for air pollution control technologies. Xinhua reported on March 7th 2013 that China starts special stringent pollution emission standards in 6 industries. Xinhua reported on March 12th 2013 that China subsidized more denitrified power plants. CRI online reported on March 13th 2013 that a regional air quality management mechanism in the Jin-jin-ji area is being developed.

This report is based on information collected and analyzed from official documents released by Chinese government agencies, interviews with related experts conducted in Tokyo and Beijing, as well as news sources and secondary literature. This scope of this survey of China's air pollution policies is intended to be as comprehensive as possible at the national level. However, this survey does not include provincial and local government policies, which have also experienced very important new developments. It also does not provide a systematic or detailed examination of energy and energy conservation policies, except when they are specifically included in other air pollution policies, and to emphasize that they should be considered as part of the overall policy framework related to air pollution. Nevertheless, despite the authors' best efforts, there still may be some other remaining aspects of air pollution-related policies that were not included in this report.

This report provides many of the original official Chinese names of many of the policies in order to facilitate a more precise understanding. In addition, translations of some key policies and concepts are contained in the appendix. Many of the policies have similar names and overlapping content which can easily cause confusion and misunderstanding. It is hoped that the bilingual references to the policies may be helpful to researchers in the future.

The Organization of this report is as follows. Section 2 reviews the policy system of air pollution control in China focusing on the existing legal framework and administrative implementation structure. This is intended to help to clarify the context of the recent policy trends. Section 3 surveys the main recent policy trends in detail. The conclusion summarizes the key messages and discusses future challenges.

2. Overview of the Legal Framework and Administrative Implementation Structure of Air Pollution Control

This section reviews China's legal framework and administrative implementation structure, focusing on the Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution (hereinafter referred to as "China's Air Pollution Prevention and Control Law"), the Five-Year Plan decision making system, standards and regulations, policies and instruments. This section clarifies the legal status, significance, and context of the major recent developments in China's air pollution policies.

2.1 Legal Framework

The legal framework has several levels. Laws are decided by the National People's Congress. Other policies at the national level such as regulations and standards, etc., are issued by the State Council and ministries such as the Ministry of Environmental Protection. The last level includes policies and regulations by provincial and local governments. The relationship of the FYP process to the official legal structure is ambiguous. FYPs themselves are not laws, but they provide guidance for government policies and also in some cases direct that new laws or official policies should be developed, or that existing ones should be revised.

Under China's legal system, there are four laws relating to air pollution control: the Environmental Protection Law (环境保护法), the Air Pollution Prevention and Control Law (大气污染防治法), the Environmental Impact Assessment Law (环境影响评价法), and the Law on Promoting Clean Production (清洁生产促进法). This section focus on explaining the Air Pollution Prevention and Control Law, then it discusses the standards, regulations, and policies that are based on this law. The FYP Process is also discussed.

2.1.1 Laws

China's regulations for atmospheric pollution control were first developed in 1979 in the trial version of the Environmental Protection Law (EPL), which established basic principles, regulations, and measures for air pollution prevention and control. This trial version was summarized by Zusman (2007:91) as follows: "Three environmental management system were formulated, collectively labeled the three olds (老三项制度) because they have

remained enduring features of China's regulatory regime since they were codified in the EPL. The first old, the environmental impact assessment – EIA (环境影响评价), required that polluting enterprises receive written approval describing a project's effects on the surrounding environment before being constructed. The second old, the three simultaneities (三同时), required that, after undergoing an environmental impact assessment, pollution abatement installations be designed, built, and put into operation *at the same time* that new, reconstructed, or extended projects discharging pollutants are designed, built, and put into operation. The third old, the pollution levy (排污收费), required that polluting enterprises pay a fee for emission and effluent discharges, the clearest indication that China was willing to adopt innovative market-driven measures at an early stage of development.”

In 1987, China's Air Pollution Prevention and Control Law was promulgated. It establishes general principles, including ones for supervision and management, prevention and control of smoke and dust, waste gas, dust and malodorous gases, as well as legal responsibilities, while the 1987 version of the corresponding regulatory framework was rather vague (Alford & Liebman, 2001).

In 1995, the first revision of China's Air Pollution Prevention and Control Law was made. This revision expanded the geographic control area of atmospheric pollution, defined two control zones (acid rain and SO₂), established rules to eliminate outdated industrial machines causing severe atmospheric pollution, and strengthened supervision and management of emissions discharged by motor vehicles. However, due to the outdated air pollution management methods, ineffective control measures for SO₂, and inadequate supervision and management over vehicle emissions), this revision of the Air Pollution Prevention and Control Law was not able to curb the worsening air pollution (Zhao, 2012).

In 2000, the Air Pollution Prevention and Control Law was amended a second time. This version added a new chapter on prevention and control of pollutants discharged by motor vehicles and vessels; established regulations for pollution discharges, total emission control policies, a system of certificates for emissions discharges; designated key cities for atmospheric prevention and control; and established regulations including penalties for excessive emission discharges (Zhao, 2012).

The Air Pollution Law has not been revised again since 2000. The law was still under the process of revision as of the time of writing of this report, but its finalization has been

delayed.

It is notable that the “first old” – the Environmental Impact Assessment system – has gradually evolved and developed into a legal system, in the form of articles in relevant Laws (e.g., article 11 in the 2000 Air Pollution Prevention and Control Law), as well as a stand-alone piece of legislation (the EIA Law) since 2012 (Zhu and Lam, 2009). EIA may become one of the more effective environmental legal measures as it is strengthened as discussed below. Environmental authorities should be able to control the increase in emissions by using the EIA system. For example, advanced control devices must be installed, in order to obtain EIA approval, as well as the approval from NDRC. EIA is intended to prevent the increase in the total emission and concentrations by reducing traditional emission sources. Advanced EPS for smoke, scrubbers for SO₂ and Selective Catalytic Reduction (SCR) for NO_x should be installed to meet the emission standard. For certain areas, such as two control zones (Acid rain and SO₂ control zones), scrubbers for SO₂ are mandated no matter what emission amount and air quality level.

2.1.2 Five-Year Plans

The Chinese government has developed a Master Plan for Economic and Social Development every five years since the Maoist era. The Master Plan coordinates public policy priorities and lays down the main national development objectives. Composed of 63 chapters and divided into 16 sections, the 12th Five-Year Plan for National Economic and Social Development lays out China's development strategies, clarifies the government's working focus, and provides guidance for the activities of major market actors. It also functions as the basis for economic regulation, market supervision, social management, and public service (State Council, 2011a). In Section 1, Chapter 3, the seven main goals of the plan cover the areas of economic development, industrial structure adjustment, education for technology, natural resource conservation and environmental protection, quality of life, social services, and deepening of reform and opening. According to the Master Plan, the Chinese government should develop various sub-plans for various sectors and different levels of government. With this comprehensive decision making mechanism engaged by all the Chinese government agencies in five-year cycles, FYPs structure the nation's planning system.

In China's FYP decision-making system, some FYPs mandate overall directions for the revision of laws, regulations, standards, and other measures and instruments for air pollution

control. Incorporating air pollution policy into the FYPs is required by the Air Pollution Prevention and Control Law. Article 2 of the Third Revision of the Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution states:

*The State Council and the local people's governments at various levels shall **incorporate the protection of the atmospheric environment into the national economic and social development plans**, make rational plans for the geographical distribution of industry, improve scientific research in the prevention and control of atmospheric pollution and adopt measures to prevent and control atmospheric pollution, in order to protect and improve the atmospheric environment (National People's Congress, 2000).*

Thus, Article 2 of the Law also indicates that geographical factors and technological capacity building should be incorporated in the development of various FYPs relating to air pollution control. Therefore, this survey is not focused simply on the Air Pollution Prevention and Control Law, but it also examines a range of FYPs in various areas that are related to air pollution control policy.

The FYPs can be divided into three administrative tiers and three functional categories. The three administrative tiers include national, provincial, and local (city and county) plans. Functional categories include general, special, and regional plans (WWF, 2009). In practice, however, the number of planning tiers can exceed three. For example, governments of townships, development zones, and sometimes enterprises make their own special or regional plans.

The legal status of FYPs is somewhat complex. They are not mandated by China's constitution, and they do not have the status of law or regulations. The FYPs are enforced through a target responsibility system (目标责任制) established by a State Council Order. According to Article 89, Section 5 (The Local People's Congresses and Local People's Governments at Various Levels) of the Constitution (National People's Congress, 2004), the State Council determines the extent of authority of policy formulation and policy implementation of the Master Plan. Moreover, regarding policy implementation, the Master Plan is considered to be a State Council Order or Decision (国务院令).

Implementation of the State Council's Orders is mandatory for local governments. As stated in Article 55 in the Organic Law of the Local People's Congresses and Local People's Governments of the People's Republic of China (National People's Congress, 2004), the

implementation of the Master Plan is regarded as an obligation of local governments. The local people's governments at various levels throughout the country shall be state administrative organs under the unified leadership of the State Council and shall be subordinate to it. If a local authority fails to implement local emissions reductions, its head may receive a punishment such as a serious warning, admonishment, demotion, or removal from office, although it is not clear whether this has actually ever happened.

A target responsibility system is included in the FYP planning system in order to facilitate the implementation of air pollution policies at local and provincial levels. Originally, the targets focused on economic development, but in recent years, environmental targets – including ones for air pollution reduction – have been added, although local governments may still tend to prioritize economic development. Quantitative indicators under the jurisdiction of various central government entities and approved by the State Council, are employed in the target responsibility system for local governments. In order to fulfill the emission reduction targets, local leaders are required to establish their own plans with suitable measures to contribute to air pollution control in their respective regions (State Council, 2011b). Economic development and air pollution control indicators are both included in the FYP's target responsibility system. Results are used to evaluate the performance of government officials, and may influence promotions. Therefore, this system has the potential to persuade officials to increase the emphasis placed on environmental targets rather than only on economic targets. Still, stricter enforcement of Environmental Impact Assessment, which is required for new economic projects, may have more influence on local officials who are more concerned with economic development than the targeted responsibility system.

There are three additional important points to understand about FYPs. First, they are not one large integrated plan, but rather are composed of a master plan with many sub-plans, and even sub-sub plans (WWF, 2009). Second, while FYPs are not themselves laws or regulations, they sometimes establish a process to create new laws or regulations or revise existing ones, as can be seen in Section 3. Third, therefore, the plans are not developed all at one time to start at the beginning of the period, but rather their development is an ongoing process continuing throughout the plan period, and many are not finalized until the end of the period.

2.1.3 Standards and Regulations

In addition to administrative law, China has a series of regulatory documents related to emissions of specific pollutants. They are promulgated as ambient air quality standards (空气质量标准), specific standards on pollution discharge (行业排放标准) and administrative regulations (规范性文件) (Zhao, 2012).

Ambient air quality standards stipulate the total amount of pollutants in the air, in order to safeguard human health, conditions for normal life, and the ecological environment. The ambient standards set up the basic criteria for the management and evaluation of ambient air quality, related air pollution prevention and control planning, as well as the standards for other emissions. China's first national ambient air quality standard was formulated in 1982. The GB3095-1982 Atmospheric Air Quality Standard stipulated the intensity standards for 6 air pollutants. In 1996, the GB3095-1996 Ambient Air Quality Standard was promulgated. Compare to the 1982 standards, it added concentration standards for four other kinds of air pollutants (Liu J., 2012). The third revision of the ambient air quality standard, GB3095-2012, was made in 2012, and will be enforced in 2016. This standard specifies the classification of functional areas of this standard, the grading criteria, pollutant items, their intensity limits in the average time, monitoring methods, validity of statistics, and implementation and supervision measures.

Emission standards for air pollutants are divided into two categories. One category is for a particular industry or particular type of pollution. The other category is a general standard specified in the Integrated Emission Standard of Air Pollutants, which includes those industries and pollutants not currently covered by any specific emission standard. The former are mainly prescribed for five types of stationary sources: boilers (Emission Standard of Air Pollutants from Coal-burning, Oil-burning and Gas-fired Boilers), thermal power plants, industrial kilns and furnaces, coke ovens, and cement plants; and two types of mobile sources: motor vehicles (e.g. Emission Standards of Air Pollutants from Gasoline Powered Car Under Idle Conditions) and motorcycles; and eight types of facilities that discharge malodorous substances. The number of categories has expanded over time, and new ones are mentioned below in section 3.5.2. All other air polluting emission sources, including factories in general, are subject to emission standards in the Integrated Emission Standard of Air Pollutants. China's Integrated Emission Standard of Air Pollutants was enacted in 1996 and came into

effect in 1997. In these integrated standards, 33 air pollutants are covered, ranging from general pollutants, such as sulfur dioxide and nitrogen oxide, to hazardous heavy metals and organic chemical compounds, and to non-methane hydrocarbons, which produce photochemical oxidants. Pollutant emission levels are regulated according to concentration, emission rate per hour, and monitored fugitive emissions. Emission standards are enforced by the EIA system and the Pollution Levy system introduced in 2.1.1.²

Pollution levies are one of the most important environmental management systems. They were initiated in 1979 with Environmental Protection Law of the People's Republic of China (1979 trial) and were revised several times since then (Zusman, 2007).

The pollution levy system was significantly reformed by the "Management Regulation for Collecting Pollution Charge Fees" (State Council Order No. 369), promulgated by the State Council in January 2003. The reform was made in four major stages. First, the air pollution fees previously only levied for above-standard discharges were converted to levies on the total amount of discharges. Second, the levies were previously applied only to the concentration of the pollutant discharge, while the reform also applied them to the total quantity of pollutant discharge. Third, the number of targeted pollutants that the levies applied to was increased. Fourth, the previous low rate of the levies was increased in order to compensate for the management costs. To implement the strengthened regulations, several corresponding regulations and measures were subsequently issued. The "Standard Management Measures for Collecting Pollution Charge Fees" (Order No. 31) was jointly issued by the former State Planning Commission, MOF, State Environmental Protection Administration (SEPA), and State Economic and Trade Commission. The "Management Measures for Collecting and Using Pollution Charge Fees" (Order No. 17) was jointly promulgated by MOF, the former State Planning Commission, and SEPA. The "Notice Regarding Removal of Reduction of Pollution Discharge Fees" (Cai Zong [2003] No. 38) was jointly issued by MOF and SEPA. An information communication management system for the pollution levy was established at the same time (NDRC, 2007).

The NDRC noted that there have been a number of defects in the implementation of air pollution levy system. First, the low levels of pollution fees levied could not cover the cost of

² Information for this paragraph was compiled from Global Environmental Forum, 2004.

pollution management. Second, enterprises were not motivated to comply with the regulations, since the charges for not meeting the regulations were lower than the investment costs for air pollution control measures. Third, limited monitoring facilities and lax enforcement of the regulations limited the amount of fees that could be collected. Fourth, some local Environmental Protection Bureaus misused the funds collected from the levies. (NDRC, 2007; also see Zusman, 2007).

Various administrative regulations have been issued over time based on prominent air pollution problems. Examples of administrative regulations for special issues such as household coal use, urban air pollution, severe motor vehicle emission include: Tentative Measures for Coal-use in Households (1987), Measures for Urban Smog and Dust Control (1987), Supervision and Management Measures for Motor Vehicle Emissions (1990, amended in 2010) etc. (Zhao, 2012).

2.1.4 Other Policy Measures and Instruments

The air pollution policies stipulated in the Air Pollution Prevention and Control Law include three control policies: “Total Emission Control,” “Key Control Cities,” and “Two Control Zones,” and three sets of measures for priority emission problems, namely 1) burning of coal, 2) motor vehicles and vessels, and 3) waste gas, dust and malodorous gases. This subsection explains the three control policies.

The Total Emission Control (TEC) policy, first introduced in 1988 at the Third National Conference for Environmental Protection, is a total mass emissions control policy at the national, provincial, and municipal/city levels. In TEC policy planning, the central government first lays down the total mass emission target, prepares a national air pollutant emission control plan, and allocates the plan's tasks to local governments. TEC plans are made and implemented at each level, then the central government assesses implementation. After many trials in pilot cities, TEC was first implemented in 1996 in the “Ninth Five-Year Plan for National Economic and Social Development,” replacing the previous policy focusing on the total concentration of emissions. Despite some deficiencies which have emerged in its implementation so far, it is generally agreed that TEC has made a very significant contribution to China's environment and provided a solid policy foundation for many other environmental policy instruments (Ge, Chen, Wang, & Long, 2009). This does not mean that the overall situation of pollution has improved, but rather that the situation would probably be

significantly worse without it. The revision of the Air Pollution Prevention and Control Law in 2000 focused on urgent air pollution control in designated areas, but nation-wide implementation of the TEC policy was not considered feasible due to concerns about the capacity of enterprises to pay the implementation costs. Article 15 of the Air Pollution Prevention and Control Law (2000) stipulates that TEC should be implemented for the acid rain and sulfur dioxide control zones and areas not in compliance with ambient air quality standards. The clause further requires the State Council to draft various administrative decrees to facilitate the implementation of TEC provisions in this law.

The “Key Control Cities” policy was incorporated in the 2000 Revision of Air Pollution Prevention and Control Law. Article 17 stipulated key control cities of air pollution control to be designated by the State Council. These are generally municipalities directly under the Central Government, provincial capitals, open coastal cities, and key tourist cities. Those key cities which fail to meet the ambient air quality standards will be required to adopt more stringent measures to fulfill them within a designated time period. There were 113 cities designated as key control cities in the Atmospheric Pollution Prevention and Control Key Cities Designation Plan (2002) released by the State Council in 2003 (SEPA, 2003a).

The “Two Control Zones” policy was included in the 1995 revision of the Air Pollution Prevention and Control Law. Article 18 stipulates that areas where acid rain has occurred or will probably occur and areas that are seriously polluted by sulfur dioxide should be designated as Acid Rain Control Areas or Sulfur Dioxide Pollution Control Areas, subject to approval of the SEPA (State Environmental Protection Administration, now called MEP). Based on this Article in the law, the Acid Rain and SO₂ Control Designation Program was developed by SEPA and other relevant government departments, and approved by the State Council in 1998. The Program designated 175 provinces, autonomous regions, and municipalities covering a total of 1,090,000 km², occupying 11.4 percent of the nation's land area, and 60 percent of the nation's total mass emission of SO₂ (SEPA, 2003b).

2.2 Institutional Structure

Like many countries, China's formal governmental structure is divided into legislative and administrative branches, and these branches are further divided into national and sub-national

levels.³ The National People's Congress is the highest lawmaking body, and it must approve all revisions to laws such as the Environmental Protection Law and the Air Pollution Prevention and Control Law. The State Council is the highest administrative body, which supervises the national ministries. The State Council decides the contents of the Master Plan, and examines and approves other FYPs and regulations that are to be implemented by multiple ministries, which require the State Council's coordination.

Air pollution issues are mainly under the jurisdiction of two ministries at the national level. One is the National Development and Reform Commission, which is a kind of "super ministry" in charge of overall economic planning as well as energy and climate change. The other is the Ministry of Environmental Protection (MEP), which has jurisdiction over traditional air pollution issues. MEP was upgraded to ministerial status in 2008; formerly it was the State Environmental Protection Administration (SEPA).

These two ministries share responsibility for the management of comprehensive coordination among various government bodies engaged in China's air pollution control at both the national and subnational levels. At the policy design stage, NDRC is in charge of planning prevention strategies for emission sources, while MEP is in charge of planning for pollution control strategies. At the policy implementation stage, NDRC assigns tasks to the relevant government departments. Since numerous departments are engaged in the air pollution prevention and control, a substantial amount of time is required in air pollution policy coordination, which influences the overall efficiency of policy implementation.

The institutional structure of China's environmental control system is based on a so-called "two committees, one bureau" model (See Figure 1). The two committees refer to the Environment and Resource Committee of the "People's Congress" and the Environmental Protection Committee of the government's administration. "One bureau" refers to the local Environmental Protection Bureaus (EPBs) (Chang and Wang, 2010).

³ The Communist Party also plays a key role in China's political system, but its structure is beyond the scope of this report.

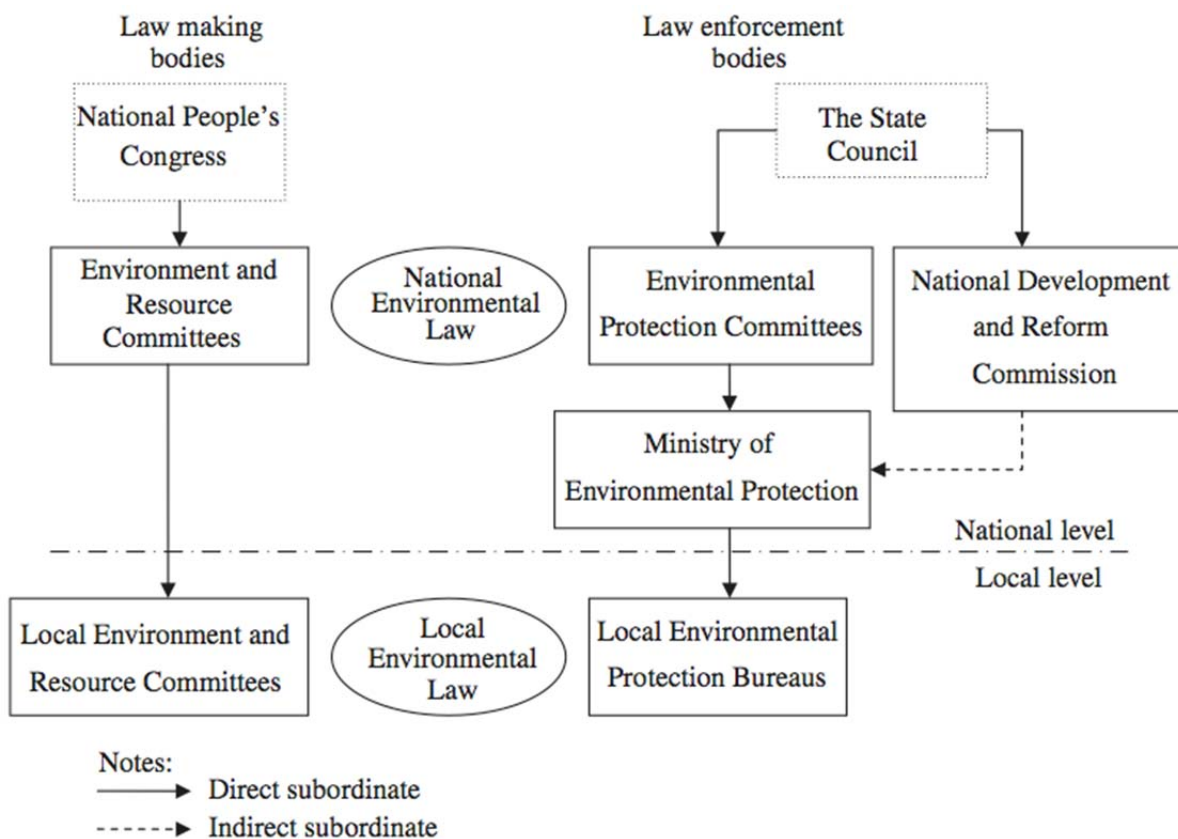


Figure 1: Environmental Governance Structure in China

(Chang and Wang, 2010)

Discussions in the two committees will form the basis for major policy decisions. NDRC (National Development and Reform Commission) and MEP are responsible for coordinating between the “two committees” and “one bureau.” Local EPBs bear the primary responsibility for policy implementation at the provincial and local levels.

2.2.1 Implementation by Provincial and Local Governments

The Environmental Protection Law specifies that implementation is basically carried out by local governments. Under the coordination of various ministries, guidelines (指导意见) on local targets and measures are approved and distributed by the central government to local governments. Based on these instructions, local governments develop local Plans. Competent departments of environmental protection administration of the local people's governments at or above the county level are required to conduct unified supervision and management of the environmental protection work within areas under their jurisdiction (National People's Congress, 1989). The comprehensive system of government duties is reinforced in Article 4

of The Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution which further states:

The administrative departments for environmental protection under the People's Governments at or above the county level shall exercise unified supervision over the prevention and control of atmospheric pollution. The administrative departments for public security, transportation, railways and fishery at various levels shall perform their respective functions in conducting supervision over atmospheric pollution caused by motor vehicles and vessels. The relevant competent departments under the People's Governments at or above the county level shall, with the limits of their respective functions conduct supervision over the prevention and control of atmospheric pollution (National People's Congress, 2000).

Many studies (Jahiel, 1997; Zhang and Jiang, 2002; Lang and Wang, 2003; OECD, 2006; Chang and Wang, 2010; Zusman, 2007) have pointed out that the mode of operation of the EPBs and their relations with local and provincial governments have hindered the implementation of environmental policies. EPBs generally face a tension between the central government's environmental protection policies and the economic interests of local governments, since they are neither institutionally nor financially independent from other parts of local governments, which are often place a higher priority on economic development. Therefore, EPBs may face constraints on their ability to implement environmental policies when there is a conflict between environmental protection and local economic development. In particular, all the operating expenses of EPBs are funded by local sources, according to a general principle stating that local problems should be solved through local funds. This has tended to encourage regulators to focus on generating revenue from selling permits and charging fines rather than reducing or preventing pollution (Chang and Wang, 2010).

The target responsibility system implemented in the recent FYPs has strengthened the compliance of air pollution control in local to some extent. As mentioned above, the target responsibility system sets up the indicators for the evaluation of the performance of local people's governments. An annual examination of the performance on Total Emission Control program is conducted by a group of officers from the MEP, as well as representatives from the Ministry of Supervision and the Ministry of Agriculture. During the 12th FYP period, an interim assessment on the implementation of the Plan will be conducted at the end of 2013, and the final assessment will be conducted at the end of 2015 (State Council, 2011). The assessment results will be reported to the State Council and made public and serve as an

important component for assessing the overall performance of local governments. If a local government fails to meet its environmental protection targets or is responsible for a very serious or large environmental pollution accident, the national environmental protection authority should ask the local government to make a report to the situation, ban the approval of the EIA for any new construction project of the region, and investigate the responsibility of relevant officials.

2.2.2 Implementation by Ministries

In a broader view of air pollution policy, there are many other ministries involved in addition to the Ministry of Environmental Protection. In fact, as discussed elsewhere in this report, there are a number of FYPs related to air pollution control which are related to various different ministries, which are responsible for implementing them. The 12th Five-Year Plan's Environmental Protection Plan elaborated the comprehensive institutional arrangement for environmental protection to implement these comprehensive joint efforts made by relevant departments under the Ministry of Environmental Protection's guidance, coordination, supervision and management. Thirteen ministries/agencies involved in air pollution and their duties (in addition to the Ministry of Environmental Protection) are as follows (State Council, 2011):

- The *Ministry of Finance* (MOF) (1), *Ministry of Commerce* (MOC) (2) and the *National Development and Reform Commission* (NDRC) (3) are responsible for developing finance, taxation, industry, pricing and investment policies conducive to air pollution control.
- *NDRC* is responsible for climate change policy, energy, and overall industrial structure, which are closely related to air pollution.
- The *Ministry of Science and Technology* (MOST) (4) is responsible for supporting research and development relating to air pollution control, and it also develops key technologies for the control of air pollutant discharges and improvement of air quality.
- The *Ministry of Industry and Information Technology* (5) is responsible for making efforts to promote technical improvements of enterprises, imposing standards for new industrial projects and factory construction, improving the mechanisms of phasing out outdated production capacity, and strengthening prevention and control of industrial

pollution.

- The *Ministry of Land and Resources* (6) regulates the development of the land for ecological purposes, and is responsible for strengthening environmental controls and restoration of damages from development activities of mineral resources, and ensuring sufficient land for key projects on environmental protection relating to air pollution control.
- The *Ministry of Housing and Urban-Rural Development* (7) is responsible for strengthening the management of construction and operation of sewage and garbage treatment facilities in urban and rural areas.
- The *Ministry of Transport* (8) and *Ministry of Railways* (9) are responsible for enhancing air pollution prevention and control during the construction of highways, railway, ports and channels as well as the transportation of relevant materials.
- The *Ministry of Commerce* is responsible for controlling air pollution from hotels and restaurants, facilitating green trade and addressing environmental barriers in international trade.
- The *Ministry of Health* (10) is responsible for facilitating activities relevant to environment and health, and making efforts to develop systems for diagnosis and treatment of diseases relevant to heavy metals.
- The *General Administration of Customs* (11) of the People's Republic of China is responsible for strengthening supervision and administration of the import and export of wastes; making efforts to investigate and control conduct threatening environmental safety.
- The *National Energy Administration* (12), which is under the jurisdiction of the NDRC, is responsible for controlling the total consumption of energy, and developing strategies to adjust the energy mix and raise energy efficiency.
- The *China Meteorological Administration* (13) is responsible for strengthening meteorological monitoring and early warning services for prevention and control of atmospheric pollution.

Among these, NDRC is the most important, although it did not directly work on air pollution control with MEP until recent years. Established in 2003, it traces its origins to the former State Planning Commission. NDRC functions as a macroeconomic management and planning agency which studies and formulates policies for economic and social development and guides the overall restructuring of the economic system. In 2003, NDRC gained responsibility for climate change issues, and the National Coordination Committee on Climate Change was located there. In 2008, NDRC also obtained jurisdiction over energy policy (NDRC, 2008).

Since both energy and climate change are closely linked to air pollution issues, it is very important for MEP and NDRC to closely cooperate and coordinate their efforts. It is important to try to achieve synergies while avoiding situations where policies in one area negatively affect other areas. Many synergies are possible between air pollution and energy or climate policies (Zusman, 2008; Bollen et. al. 2009). Some air pollutants have warming effects while others have cooling effects, and some end of pipe air pollution control measures (especially for NO_x and SO₂) lead to increased energy use, so it is important to coordinate air and climate policies. Many measures such as energy efficiency or phasing out outdated industrial machinery can reduce both air pollution and energy consumption. These issues are related to the setting of air pollution and energy intensity goals in the 12th FYP.

3. Major Developments in Air Pollution Policies in China

This section surveys major recent developments in China's air pollution policies. Many are related to the various 12th FYPs, since the FYP planning system plays an overall coordinating role. The section begins with an overview of the 12th Five-Year Plans with a focus on the 21st FYP for Environmental Protection (1). The other major developments are (2) strengthening the Total Emission Control Program, (3) revision of the Air Pollution Prevention and Control Law, (4) enhancing environmental health and supervision, (5) improving air quality standards, (6) progress of the Joint Prevention and Control mechanism (7) the Blue Sky Science & Technology Project, (8) special measures addressing PM, (9) expanding the monitoring network, and (10) the ten air pollution measures and the Air Pollution Prevention and Control Action Plan announced by the State Council in 2013.

3.1 The 12th Five-Year Plans

In recent years, not only has the process of formulating the FYPs been modified, but key elements have also been revised to respond to on-going social and economic changes. Currently China is in the midst of 12th FYP period, and air pollution management is one major environmental issue which has been prioritized in the Master Plan, which has been followed with a series of special environmental plans addressing air pollution control from different approaches and dimensions. Table 1 lists the main 12th FYPs that are relevant to air pollution control in chronological order of their release date.

Table 1: 12th Five-Year Plans Related to Air Pollution

Release Date	Issuing Authority	12 th Five-Year Plan
16/03/2011	CPPCC & NPC	12 th Five-Year Plan for National Economic and Social Development (Master Plan) 国民经济和社会发展第十二个五年规划纲要
09/06/2011	MEP	Science and Technology Development for Environmental Protection 国家环境保护“十二五”科技发展规划
31/08/2011	State Council	Comprehensive Work Plan for Energy Conservation and Emission Reduction “十二五”节能减排综合性工作方案
07/09/2011	MEP	Environmental Health Work of Environmental Protection 国家环境保护“十二五”环境与健康工作规划
01/11/2011	MEP	National Environmental Law & Environmental Economic Policy Construction “十二五”全国环境保护法规和环境经济政策建设规划
15/12/2011	State Council	National Environmental Protection 国家环境保护“十二五”规划
16/06/2012	State Council	Energy Saving & Environmental Protection Industry Development “十二五”节能环保产业发展规划
10/07/2012	MOST, MEP	Blue Sky Science and Technology Project 蓝天科技工程“十二五”专项规划的通知
06/08/2012	State Council	Energy Conservation and Emission Reduction 节能减排“十二五”规划的通知
29/10/2012	MEP, NDRC, MOF	Prevention and Control of Air Pollution in Key Regions 重点区域大气污染防治“十二五”规划
17/02/2013	MEP	Environmental Protection Standards 国家环境保护标准“十二五”发展规划

China's air pollution-related FYPs developed during 12th FYP period cover all administrative levels and a wide range of functional areas. National level target and goal setting is the focus of the National Economic and Social Development Plan (Master Plan) for 2011-2015, which incorporated emission reductions of 8 percent for SO₂, and 10 percent for NO_x into the target responsibility system. It also formulated guidelines for natural resource conservation and environmental protection (State Council, 2011a). More specific measures for achieving the targets are contained in the 12th Five-Year Plan Comprehensive Work Plan for Energy Conservation and Emission Reduction which reduces the emission allowance of SO₂ and NO_x in 31 key provinces, and lays down development directions for energy conservation and emission reduction work (State Council, 2011c). The 12th Five-Year Plan for Environmental Protection provided directions for reaching national goals (State Council, 2011b). Local governments are required to formulate their own Energy Conservation and Emission Reduction Plans, as well as Environmental Protection Plans.

Local governments follow instructions from the central government to develop their own 12th FYPs based on local conditions in order to meet the targets. Therefore different provinces, autonomous regions, and municipalities use different measures for air pollution control. This report will focus only on the ministerial level plans linked to the master plan, which are largely directed by the 12th Five-Year Plan for Environmental Protection.

The 12th Five-Year Plan for Environmental Protection consists of nine chapters. It reviews the current environmental situation; sets up guidelines, basic principles and main objectives; then elaborates specifically on each key task for environmental protection control work. The main points in this plan focusing on air pollution control work are listed and discussed below.

Facilitation of total emission control of major pollutants is a major policy direction in the 12th Five-Year Plan for Environmental Protection. There has been a growing realization of overlap between energy conservation and air pollution control since the 11th FYP period. During the 12th FYP, more energy policies have been synchronized with air pollution policies. The 12th FYP for Environmental Protection calls for more efforts to be made to reduce new increments of pollution discharge. The total amount of energy consumption should be reasonably controlled, and non-fossil fuel energy will be promoted. The Total Emission Control (TEC) Program is the main mechanism for controlling total emissions. The main

strategies of the TEC Program include acceleration of the phasing out of outdated production capacity, the Catalog for Guiding Industrial Structure Adjustment (产业结构调整指导目录), and strict implementation of the Catalog for Guiding Certain Industries to Phase Out Outdated Technologies, Equipment and Products (部分工业行业淘汰落后生产工艺装备和产品指导目录). Desulfurization and denitrification will be strengthened in the electric power industry as well as other key industries including iron & steel, cement, petroleum, petrochemicals and coal chemicals. Control measures for NO_x will be combined with measures to reduce emissions from vehicles and ships. Phasing out of old vehicles, locomotives and ships will be accelerated. Details of this Program will be discussed below in Section 3.2.

Strengthening the legal system. The 12th Five-Year Plan for Environmental Protection calls for a fundamental review to develop amendments of several laws such as the Environmental Protection Law, the Law on Prevention and Control of Atmospheric Pollution, and the Law on Promotion of Clean Production, which are scheduled to be strengthened during the 12th FYP. The review will focus on measures including the control of total discharge of pollutants, management of pollution discharge licenses, prevention and control of vehicle pollution, compensation on pollution damage, etc. Section 3.3 below discusses the situation regarding the process of revision of the Air Pollution Prevention and Control Law.

Also the 12th FYP calls for the development of a special plan for the overall amendment and strengthening of environmental protection standards such as environmental quality and pollutant emission standards. MEP issued several plans based on this guidance, including the 12th Five-Year Plan for National Environmental Law and Environment & Economic Policy Construction, the National 12th Five-Year Plan for the Environmental Health Work of Environmental Protection, and the 12th Five-Year Plan for Environmental Protection Standards. Specific plans to develop amendments to strengthen various laws relating to air pollution control, enhance the foundation of environmental health supervision and management, and improve related standards were also put forward.

Prevention and control of regional air pollution is a priority emphasized in the 12th Five-Year Plan for Prevention and Control of Air Pollution in Key Regions which was co-issued by the Ministry of Environmental Protection, the National Development and Reform Commission, and the Ministry of Finance. It designates major regions for joint prevention

and control of atmospheric pollution such as Beijing-Tianjin-Hebei, Yangtze River Delta and Pearl River Delta. In these designated regions, monitoring systems for regional ambient air quality will be established, special emissions limit for air pollutants at regional level will be implemented, and simultaneous control of several kinds of pollutants will be conducted. The focus is on prevention and control of the pollution from industries such as thermal power, iron & steel, non-ferrous metals, petrochemicals, building materials and chemicals. The regional air pollution issue is mentioned in several 12th FYPs, but this plan is the only one that includes specific measures. Regional air pollution is discussed in more detail below in Section 3.6.

Improving comprehensive control of several kinds of air pollutants is another major focus. Secondary pollutants, which are formed through interactions of primary pollutants, are becoming more serious in China, particularly particulate pollution (PM), which has become an urgent policy priority requiring more comprehensive control. To control particulate pollution, China aims to intensify the control of industrial smoke and dust, and facilitate the upgrading of dust removal equipment of coal-fueled power plants and cement plants.

Volatile organic compounds (VOCs) and toxic waste gases are another set of secondary pollutants being targeted in various 12th FYPs. The control of VOC emissions during production, transport and storage in petrochemical industry is planned to be strengthened. Other measures include strengthened scientific support, further development of related environmental protection industries, and additional related investments. Improving the related capacity in fundamental research and application of environmental science & technology, developing key industrial projects, and gradually increasing the central government's budget for environmental protection are designated as the major focuses of policy development in the 12th Five-Year Plan for Environmental Protection.

Strengthening energy conservation. Corresponding to these guidelines in the 12th Five-Year Plan for Environmental Protection, the State Council issued the 12th Five-Year Plan of Comprehensive Work Program for Energy Conservation and Emission Reduction and the 12th Five-Year Plan for Energy Conservation and Emission Reduction to specify industrial structure adjustment measures for air pollution control as well as energy conservation. These two Plans provide guidance to the Total Emission Control Program.

Improving air pollution technology and promotion of environmental industries. To

strengthen the scientific basis for comprehensive control of several kinds of air pollutants, MEP issued the 12th Five-Year Plan for Science and Technology Development for Environmental Protection, which specified the overall approach of research and development for environmental protection, including technology for regional comprehensive air quality management. In order to further promote the development and adoption of new technologies, environmental industries will also be promoted, supported by the 12th Five-Year Plan for Energy Saving & Environmental Protection Industry Development, issued by the State Council. Another plan issued by the Ministry of Science and Technology and Ministry of Environmental Protection is the Special 12th Five-Year Plan for Blue Sky Science and Technology Project. Measures for developing scientific projects, plans to develop related industries, as well as specific related investment budgets are specified in these Plans.

3.2 Total Emission Control Program

Total Emission Control (TEC) is one of the most important program in prevention and control of air pollution in China since it contains the reduction targets (see Table 3 below in Section 3.2.3.). It is important to note that TEC also includes targets for other areas such as water pollution and energy conservation. During 12th FYP period, TEC added additional types of air pollutants, made the NO_x reduction target legally binding, and expanded the scope of emission control to more industries. The natural resource conservation and environmental protection goal of the Master Plan itself sets a goal to reduce total mass emissions of SO₂ by 8 percent and NO_x by 10 percent during the 12th FYP period. These measures are also linked to the air pollution control policies in the 12th FYP Energy Conservation and Emission Reduction Plan. Other air pollution related FYPs also contain targets which are elaborated in TEC, for example for energy conservation. Although specific measures were specified for major air pollutants of SO₂ and NO_x, a management system specifically targeting PM_{2.5} was not included in the plan.

TEC can be thought of as having three main elements. First, it contains a variety of binding pollution reduction targets, which it allocates to provinces, other local governments, industries, and major enterprises. Second, it contains specific measures, which are mainly engineering or technological, to achieve these targets. The Director of the MEP department in charge of TEC referred to these as four “strategies,” each including a number of “tasks” to be implemented (Liu B., 2012). These strategies and tasks are described below. Third, it

contains a number of measures to support the implementation of the strategies which are essentially institutional and/or economic, also described by Liu and summarized below.

It is important to note that while TEC is very concrete in terms of binding targets as well as some of the strategies, in other areas, especially relating to implementation, it does not indicate specific measures to be taken, but rather indicates an overall direction for relevant ministries and departments to prepare more detailed actions and policies. The Total Emission Control Program is in the jurisdiction of the Department of Total Quantity Control of Pollutant Emission in MEP. The Department's director published a description of the major TEC measures in a paper (Liu B., 2012), which is the basis of most of the summary of that follows below.

3.2.1 Summary of the Main Strategies of the Total Emission Control Program

TEC has four main “strategies:” 1) reducing new increments of pollution discharge, 2) accelerating the phase out of outdated production facilities, 3) promotion of denitrification equipment, and 4) comprehensive measures to control NO_x from motor vehicles (Liu B., 2012). These strategies are divided into “tasks” (措施任务). These are summarized below in Table 2.

Table 2: Main Strategies of the Total Emission Control Program

Strategies	Tasks/Content
1. Reduce new increments of pollution discharge	<ul style="list-style-type: none"> • Control energy consumption • Control coal consumption of priority industries in key regions • Use EIA to regulate new projects in priority industries • Establish TEC indicators for EIA as thresholds for approval of new projects • Fully implement the car labeling system
2. Accelerate phase out of old production facilities	<ul style="list-style-type: none"> • Focus on priority areas like electric power, iron & steel, cement, etc. • Catalog for Guiding Industrial Structure Adjustment • Catalog for Guiding Certain Industries to Phase Out Outdated Technologies
3. Promote installation of denitrification equipment	<ul style="list-style-type: none"> • Prioritize NO_x and SO₂ emissions reductions for electric power, iron & steel, petroleum refining, non-ferrous metal smelting, cement.
4. Control NO _x from motor vehicles	<ul style="list-style-type: none"> • Accelerate nationwide adoption of Phase IV vehicle emission standards • Develop implementation capacity for Phase V vehicle emission standards • Strengthen labeling to phase out “yellow label” cars • Improve gasoline quality and synchronize gasoline and vehicle upgrading

The first strategy, reducing new increments of pollution discharge, is the main one, and it is divided into five “tasks (措施任务).” The first required task is to reasonably control the total quantity of energy consumption, establish the target distribution mechanism of energy consumption, and to put it into practice with a strengthened assessment and supervision system. The second task is to implement total quantity control of coal consumption in the Joint Prevention and Control for Key Regions program (implemented in three regions and ten city groups, as described in section 3.6). In these key regions, air pollutant emissions from electric power, iron & steel, petrochemical and cement industries account for more than 60

percent of industrial air pollutant emissions. The third task is to increase efforts to control the total emissions from these four industries based on environmental impact assessments. Construction of all new industrial projects requires an environmental impact assessment (EIA) to be conducted and approved. MEP will establish a maximum emission limit for certain industrial areas, and new industrial projects will not be approved if the new emissions would exceed that limit. Moreover, modification of existing industrial facilities may be required in areas where the pollution limit has already been surpassed. For the fourth task, MEP will establish total emission control indicators to be included in EIAs; meeting the thresholds of these indicators will become a pre-condition for the approval of EIAs for projects. The fifth task is to fully implement the labeling management system for cars, and to explore other methods of regulating urban motor vehicle ownership.

The second strategy in the TEC program focuses on accelerating the phase out of outdated production facilities, improving a mechanism to respond to the increasing pace of fixed asset investment and the scale of production facilities in of key industries such as thermal power, iron & steel, and cement. Then it puts into effect a Catalog for Guiding Industrial Structure Adjustment and Catalog for Guiding Certain Industries to Phase Out Outdated Technologies, Equipment and Products to accelerate the phase out of outdated manufacturing equipment, especially in the electric power, iron and steel, non-ferrous metals, building materials, coking, and petrochemical industries.

The third strategy is to strengthen industrial emission reductions by promoting the installation of denitrification equipment for flue gas emissions. The first and most important task is assigned to the electric power sector, which is responsible for the most SO₂, and NO_x emissions. During the 12th FYP, desulfurization equipment will be required to be installed in all coal-fired machinery. Installation of low NO_x combustion technology in coal-fired units, and flue gas denitrification equipment will be accelerated. Denitrification equipment will be required for coal-fired electric power plants with capacity of 300,000 kilowatts or more nationwide, and for coal-fired electric power plants with capacity of 200,000 kilowatts or more (except circulating fluidized bed boilers) in Northern China.

The iron & steel industry accounts for the second largest amount of SO₂ and NO_x emissions in China after the electric power industry. During the 12th FYP, the iron & steel industry will be required to fully implement flue gas desulfurization of all in-service sintering machinery.

Flue gas desulfurization with an efficiency of 80 percent or higher will be required for all sintering machinery and pellet production equipment located in urban areas.

The petroleum refining industry is the third key industry for desulfurization and denitrification measures. Catalytic cracking equipment will be required to have flue gas controls. Existing production facilities will be required to introduce advanced sulfur recovery processes to reach a sulfur recovery rate of 99 percent, and 149 sets of existing catalytic cracking equipment will be required to implement desulfurization control of flue gas. Heating furnaces will be required to use clean fuels. Installation of flue gas desulfurization equipment will also be required for the boilers for combusting petroleum coke with high sulfur content.

The non-ferrous metal smelting industry is the fourth key industry. The industry will be required to increase the sulfur recovery rate during production. Flue gas with SO₂ content higher than 3.5 percent will need to be processed with sulfur recovery techniques, while flue gas with a lower SO₂ concentration will be processed with desulfurization.

The cement industry, with high emissions of NO_x (ranking second after the electric power industry), is another key industry for denitrification, which will be enforced through the EIA process. During the 12th FYP, the cement industry is expected to keep growing, and EIA approval will be required for new projects. In order to secure approval of the EIA, new cement projects will be required to be equipped with denitrification equipment with an efficiency of no lower than 60 percent. NSP (New Skill Process) kiln cement production lines will be required to have a denitrification rate of 35 percent or higher.

The fourth strategy focuses on comprehensive measures to control NO_x from motor vehicles. In 2011, the overall quantity of motor vehicle registrations in China was 215 million, and the NO_x emissions from motor vehicles were about 6.4 million tons. In 2011, China's "yellow label vehicles"⁴ (high polluting vehicles that do not meet the Euro I emission standard) accounted for 7.1 percent of all motor vehicles, while emissions from these yellow label vehicles accounted for 57.8 percent of total motor vehicle NO_x emissions. Therefore, controlling yellow label vehicles has become the key task for controlling NO_x during the 12th

⁴ Specifically, vehicles which do not meet any of the following requirements are marked as "yellow label vehicles:" 1) first category light-duty vehicles registered after July 1st, 2000; 2) second category light duty vehicles registered after October 1st, 2001; 3) heavy duty vehicles registered after July 1st, 2003 (MEP,2009b).

FYP. To strengthen control of air pollution from vehicles, MEP will explore methods for regulating the quantity of motor vehicles, accelerating the nationwide adoption of Phase IV vehicle emission standards, developing the capacity to implement Phase V vehicle emission standards in key regions, fully implementing environmental labeling management to phase out yellow label vehicles, fully improving the quality of gasoline, and synchronizing the upgrade of both cars and gasoline.

3.2.2. Measures to Support Implementation of TEC

The following are the measures planned to support the implementation of these strategies. They tend to emphasize institutional and economic measures in a general sense, as opposed to technological measures. This list was compiled by the authors from documents of the relevant FYPs.

Improve the Environmental Protection Law and related regulations. This includes revision of the Atmospheric Pollution Prevention Law itself; acceleration of the development of administrative rules such as measures for pollution discharge licensing and motor vehicle pollution prevention; implementation of the Emission Standards for Atmospheric Pollutants from Thermal Power Plants, Emission Standards for Atmospheric Pollutants from Iron and Steel Sintering Plants, Emission Standards for Atmospheric Pollutants from Cement Plants, as well as Emission Standards for Atmospheric Pollutants from Petroleum Refineries; strengthening of standards for limits of motor vehicle fuel consumption and emission standards for low-speed automobiles; revision and strengthening the Stage V emission standards for light vehicles; and issuance and implementation of Stages IV and V of the national standards for vehicle fuel.

Continue to promote the construction of the “Three Big Systems.” This refers to an online pollutant source monitoring and control system, an environmental information system, and a motor vehicle environmental monitoring and management system. The plan aims to strengthen these systems at national, provincial, municipal, and township levels.

Improve the management support system. This involves several elements, including: strictly implementing the Calculation Rules for Emission Reduction of Major Pollutants in the 12th FYP; specifying the allowable incremental amount for major pollutants; revising the calculation method for amount of emission reduction; and strengthening regulations for on-

site inspections. It also aims to improve the online reporting system for emissions of major pollutants, including quarterly adjustment of the system, as well as publicizing the annual emission information. The regulations on informationization (信息化) of emissions reduction management should be strengthened. Information communication technologies should be fully utilized to promote innovation of Measurement Reporting and Verification (MRV) methods.

Training for MRV of emission reduction. MRV training should be strengthened for key industries such as electric power, iron & steel, and cement, including improved human resource capacity building.

EIA procedures and restrictions will be strictly enforced to strengthen implementation. The State Council has directed that contracts for total emission control of major pollutants targets should be signed with each province, the Xinjiang Production and Construction Corps, and eight major enterprise groups. Every project will have a time limit to implement emission reduction requirements. If the emission reduction objectives are not achieved, MEP will have the authority to reject EIA approval for new projects for these regions and enterprise groups.

Fully implement electricity pricing policy to promote denitrification. According to the experience of the 11th FYP Desulfurization Electricity Price Policy, the electricity pricing mechanism for power plants has a strong effect on emission reduction. Construction of denitrification facilities should be promoted, as well as revision of the electricity pricing policy to promote denitrification.

Intensify the compensated use of emission rights, and pilot emissions trading. Compensated use of emission rights (排污权有偿使用制度), and pilot emissions trading is a major fundamental reform and mechanism innovation in the field of environment in China. Liu (2012) argues that practice has proved that this mechanism is a useful exploration in market-based instruments for emissions reduction. It has had positive effects on air quality improvement, economic structure adjustment, and development pattern transformation.

Increase capital investment, and improve financing measures. These include: strengthening the dominant position of government investment in environmental protection, increasing the share of environmental protection in total investment of additional financial resources from all levels of government, raising special funds for emissions reduction of

pollutants, motivating innovation of environmental financial products, improving market-oriented financing mechanisms, exploring mortgage financing models for sewage disposal rights, developing financing and leasing business for environmental protection equipment and facilities, and encouraging various channels to establish funds for environmental protection industries.

3.2.3 Linkage with Energy Policies

Specific guidelines and distribution of tasks of the TEC program are contained in the Energy Conservation and Emission Reduction Plans. China has had a consistent and integrated policy for energy conservation and air pollution – the Energy Conservation and Emission Reduction Plan – since the 11th FYP (China Energy Label, 2011). Table 3 lists the binding targets for energy and air pollution reductions established by the Master Plans for the 11th FYP and 12th FYP.

Table 3: Binding Targets for 11th FYP & 12th FYP Total Emission Control Program

National Energy Conservation and Emission Reduction Program	11 th FYP (2005-2010)	12 th FYP (2011-2015)
Energy conservation targets	Approx. 20% energy intensity reduction	16% energy intensity reduction
Air pollution reduction targets	-10% SO ₂	-8% SO _x
		-10% NO _x

(State Council, 2011a)

During the 11th FYP period, a binding target of 20 percent reduction in energy intensity (for every 10,000RMB Gross Domestic Product, the consumption of coal should be reduced from 1.22 tons in 2005 to 1 ton by 2010) was set, and the air pollution emission reduction target was a 10 percent reduction in SO₂ (the total emission should be reduced from 25.49 million tons in 2005 to 22.95 million tons by 2010) (State Council, 2007).

The 12th FYP established a binding target of a 16 percent reduction in energy intensity (for every 10,000 RMB Gross Domestic Product, the consumption of coal should be reduced from 1.034 tons in 2010 to 0.869 tons in 2015), an 8 percent reduction in SO₂ (the total emission should be reduced from 20.864 million tons in 2010 to 22.678 million tons by 2015), and a 10 percent reduction in NO_x (the total emission should be reduced from 20.462 million tons in

2010 to 22.736 million tons by 2015) (State Council, 2011c).

The 12th Five-Year Plan Comprehensive Work Plan for Energy Conservation and Emission Reduction includes 12 major areas and 50 policy measures, and it distributes energy conservation and emission reduction measures and targets to 31 provincial level governments. The 12th Five-Year Plan for Energy Conservation and Emission Reduction established 10 national energy conservation and emission reduction key projects which were divided into three categories: energy conservation key projects, emission reduction key projects (including air and water pollution emission reduction projects), and circular economy key projects. The expected investment for these key projects during the 12th FYP period totals 2.366 trillion RMB (State Council, 2012). The energy conservation projects are: Energy-saving Renovation Project, Energy-saving Projects to Directly Benefit the People, Management and Promotional Projects relating to Contracting Energy, and Model Projects of Energy-saving Technology. The specialized project on air pollution emission reduction is the Desulfurization and Denitrification Project. The circular economy projects are the Model Project for Promotion of Circular Economy, and Capacity Building for Energy-saving and Emission Reduction projects.

One major energy saving program during 12th FYP period is the 10,000 Energy Consuming Enterprises Program. During the 11th FYP period, the previous Top 1,000 Energy-Consuming Enterprises Program targeted the largest 1,000 enterprises in China, and successfully achieved and surpassed its energy-saving target of 100 million tons of coal equivalent (Mtce), with a reported savings of just over 150 Mtce. It was decided to expand this program to the Top 10,000 Program under the 12th FYP. The Top 10,000 Program aims to cover two thirds of China's total energy consumption, or 15,000 industrial enterprises that use more than 10,000 tonnes of coal equivalent (tce) per year, and around 160 large transportation enterprises (such as large shipping companies), and public buildings that use more than 5,000 tce per year. The total number of enterprises covered by this program is around 17,000. The energy-saving target of the Top 10,000 Program is 37 percent of the total national energy-saving target (Institute for Industrial Productivity, 2011).

3.2.4 Coordination

To facilitate policy coordination, NDRC has been assigned by the State Council's Leading Group for Energy Conservation and Emission Reduction (国务院节能减排工作领导小组)

to enhance the comprehensive coordination of energy and resource conservation and emission reduction efforts. The Department of Resource Conservation and Environmental Protection (资源节约与环境保护司) within NDRC has primary responsibility for work relating to pollution and emission reduction, while the National Bureau of Statistics is responsible for strengthening energy conservation statistics and monitoring work. Other relevant departments are required to perform their duties in close coordination with each other. The provincial people's governments are responsible for formulating immediate plans for the energy-conservation and emission-reduction work under the 12th FYP within their areas, and further define the responsibilities, division of work, and schedule requirements of their relevant departments (China Energy Label, 2011).

3.2.5 New Directions and Measures in 2013

Several new measures to support the strengthening of 12th FYP TEC program strategies have been implemented in 2013.

Energy conservation and emission reduction policies are being reinforced. In addition to the 12th FYP Comprehensive Work Plan for Energy Conservation and Emission Reduction, the State Council has approved and released the Statistical and Measure Methods for Total Emission Reduction of Major Air Pollutants during the 12th Five-Year Plan (“十二五” 主要污染物总量减排统计, 监测办法). These two documents have together identified work directions, clarified government duties and tasks of China's energy conservation and emission reduction work (MEP, NBS, NDRC, MOS, 2013).

Denitrification has become the focus of emission control in the electric power industry, replacing the previous focus on desulfurization. Denitrification pricing policy in coal-fired power plants has expanded from 14 trial provinces to nationwide. Since January 1st 2013, for coal-fired power plants which have installed denitrification equipment, the electricity pricing is subsidized with allowance of 0.008 RMB/kilowatt (MEP, 2013f). The amount of this subsidy received when selling electricity to State Grid Corporation of China is estimated to cover the coal-fired power plants' expense of installing denitrification equipment.

New economic methods for regulating the control of the total quantity of pollutant emissions have been proposed. NDRC, MOF and MEP have submitted a draft of the Guiding Opinion for Compensation Usage of Emission Rights and Emission Trading in Pilot Cities (排污权有

偿使用和交易试点工作指导意见) to the State Council for approval. This draft would direct the relevant ministries to establish an emissions trading system (SHEC, 2013).

The MEP is also drafting Measures of Total Emission Index for Newly Built Industrial Projects (新建项目总量指标前置管理办法方案) in 2013 (China Environment News, 2013). This program is designed for managing the total mass of pollutant emissions of specific industrial projects in their initial construction stage, to better strengthen industrial adjustment by phasing out high polluting and low efficiency machinery and factories.

3.3 Revising the Air Pollution Prevention and Control Law

The 12th FYP for Environmental Protection states that the existing legal system is insufficient to effectively manage China's air pollution. It observes that since 2000, China's air pollution has undergone a huge change, shifting from typical coal smoke pollution to combined vehicle and coal pollution. The major components of air pollutants are no longer limited to SO₂, NO_x and PM₁₀, but they have expanded to include PM_{2.5}, O₃, and their precursors as air pollution expanded from cities to regions, and mobile and industrial process sources joined coal-fired sources in producing air pollution. Overall, air pollution has become significantly more complex and has expanded to a regional geographic scope due to rapid industrialization, urbanization, and motorization. The Plan concludes that the existing law is not adequate for addressing these new trends (CCICED, 2012).

In the 12th Five-Year Plan for National Environmental Law & Environmental Economic Policy Construction points out several problems with China's existing environmental laws including legislative gaps in certain areas, overlaps in some environmental regulatory regimes, weak penalties for illegal environmental actions, imperfect legal constraints on government behaviour, and incomplete social supervision mechanisms for environmental protection (MEP, 2011a).

Both the Environmental Protection Law of the People's Republic of China, (last amended in 1989), and the Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution currently are in the process of revision. On August 31st 2012, the draft revision of the Environmental Protection Law was released by the National People's Congress, and suggestions were requested to be submitted by September 30th 2012 (National People's Congress, 2012). At the time of writing of this report, the revision process had not

been finalized.

One major proposed change is that the management mechanism of total emission control for key pollutants would be added as a separate article (clause). More important is the proposed establishment of new, strong sanctions against government bodies which fail to meet the ambient quality standards in key regions and rivers, and exceed the total emission allowance. If standards and targets are not met, it is proposed that the environmental protection authorities at various levels (including the State Council, provinces, autonomous regions and municipalities) could refuse to examine or approve the EIA (environmental impact assessment) documents which are required for new construction projects that will add to the emissions of key pollutants (National People's Congress, 2012).

Further deliberations on the revision of the Law during early 2013 discussed topics such as adding secondary pollutants as control targets in Total Emission Control program. Major institutional changes were also proposed such as the possibility of shifting the jurisdiction of the Total Emissions Control Program from the Ministry of Environmental Protection to the National Development and Reform Commission (NDRC) (which MEP has publicly objected to), and the possibility of merging MEP with other ministries such as the State Forest Administration Bureau.⁵ Shifting TEC to NDRC would be a very significant change as it might facilitate the coordination and harmonization of energy efficiency and air pollution targets.

3.4 Enhancing Environmental Health Supervision and Management

Lack of a scientific foundation for environmental health measures is one major reason that the contents of current environmental laws and regulations relating to environment and health remain too general. There is a lack of baseline studies to analyze current worsening air pollution problems which could better inform revisions to the legal framework or emission standards. In general, the management instruments for environment and health are insufficient, and most existing environmental management systems and objectives are not very well connected to health problems.

⁵ Based on interviews with air pollution experts in Beijing, China, in February and March 2013.

To address these problems in China, 12th Five-Year Plan for Environmental Health Work of Environmental Protection (MEP, 2011b) was released. MEP has three main objectives by 2015 under the plan: 1) establish a management team for environmental health work, 2) complete survey on environmental health issues in national key areas, and 3) understand the basic status of the impacts of major environmental problems on human health in key areas. MEP will carry out preliminary measures to establish comprehensive monitoring on environmental health, set up a comprehensive monitoring network of environmental health in key areas, further improve the environmental health standards system and release relevant standards and technical specifications, and establish a database and information system to support the management of environmental health risk and to effectively improve the capacity to assess environmental health risks and emergency response to environmental accidents.

Risk-based management is recognized as the core task relating to China's environmental health policies. Based on studies of the experience of the U.S and Japan, the plan concluded that the best approach for risk management is for environmental agencies to integrate environmental health risk assessment into environmental monitoring, early warning systems, environmental supervision and management, environmental impact assessment, pollution prevention and control, environmental publicity and education (MEP, 2011b). Thus, based on lessons drawn from developed countries, China is making efforts to develop a risk-based management system for air pollution.

3.5 Improving Air Quality Standards

Since 2011, new standards and administrative regulations for ambient air quality, industrial emission, and vehicle emission have been developed gradually. On February 17, 2013, a special 12th Five-Year Plan on National Environmental Protection Standards Development was released by MEP. It provides 211 million RMB to be used in developing the overall environmental protection standards, including especially air quality standards. Of this amount, 142 million RMB is to be used for establishing 450 new standards and implementing 600 projects for environmental protection standards (MEP, 2013c). Overall, more than 300 standards will be released covering ambient air quality standards; industrial emission standards for thermal power, iron and steel, cement, livestock, non-ferrous metals; and vehicle emission standards.

The remainder of this section discusses in more detail ambient air quality standards, industrial

emission standards, and vehicle emission standards. In addition, the 2013 Action Plan generally calls for the establishment or strengthening of emission standards in key industries and for fuel consumption. It makes several references to strengthening various standards including for VOC emissions, low speed trucks, and the development of green building standards. (State Council, 2013)

3.5.1 Ambient Air Quality Standards

On 29 February 2012, the first ambient air quality standard limiting the amount of PM_{2.5} was approved and issued by the State Council. It requires all cities to implement the WHO's recommended interim target-1 standard with an annual mean concentration of 35 ug m⁻³. Compared to the previous revision of the ambient air quality standard, a short-time 8 hour standard for ozone was added, together with the new limit for PM_{2.5}. Limits for PM₁₀ and NO₂ also became more stringent. Grade III, which had more lenient limits for special industrial areas, was merged into Grade II for residential, commercial, normal industrial and rural areas. Analytical methods for measuring each pollutant were also clarified in the new standard. Prior to the release of new ambient air quality standard, management guidelines for technical support were also updated in Measures on Site Supervision and Inspection on Automatic Monitoring Facilities of Pollution Sources Determination of Atmospheric Articles PM₁₀ and PM_{2.5} in Ambient Air by Gravimetric Method (HJ 618-2011), and Technical Guidelines on Environmental Monitoring Quality Management (HJ 630-2011) (MEP, 2013b).

Table 4: Comparison of GB 3095-2012 and WHO Ambient Air Quality Standards

Pollutant	Averaging Time	Unit	GB 3095 - 2012		WHO			
			Grade I	Grade II	IT-1	IT-2	IT-3	AQG
PM ₁₀	Annual	µg/m ³	40	70	70	50	30	20
	24-hrs	µg/m ³	50	150	150	100	75	50
PM _{2.5}	Annual	µg/m ³	15	35	35	25	15	10
	24-hrs	µg/m ³	35	75	75	50	37.5	25
NO ₂	Annual	µg/m ³	40	40	-	-	-	40
	24-hrs	µg/m ³	80	80	-	-	-	-
	1-hr	µg/m ³	200	200	-	-	-	200
SO ₂	Annual	µg/m ³	20	60	-	-	-	-
	24-hrs	µg/m ³	50	150	125	50	-	20
	1-hr	µg/m ³	150	500	-	-	-	-
O ₃	8-hr	µg/m ³	100	160	160	-	-	100
	1-hr	µg/m ³	160	200	-	-	-	-
CO	24-hrs	mg/m ³	4	4	-	-	-	-
	1 hr	mg/m ³	10	10	-	-	-	30

*Grade I is for Natural Protection Area and Other areas which need special protection.

*Grade II is for Residential, Commercial, Industrial and Rural Area

Cited from (MEP, 2012a)

MEP announced that the new ambient air quality standards will be implemented in phases due to differences in air pollution characteristics, financial capacity, and demand for environmental management in different regions. Implementation of the new standards requires various preparation measures such as the installation of new equipment, procedures to manage data quality, and training for operational staff.

By the end of 2012, 74 cities in key regions such as Beijing-Tianjin-Heibei, the Yangtze River Delta, and the Pearl River Delta, as well as various municipalities and provincial capitals, have already started monitoring based on the new GB3096-2012 ambient air quality standard. Real-time levels and air quality indices of pollutants for each monitoring site are released on an hourly basis, together with advice on health and daily life. However, real time monitoring only covers the most recent 6 hours, and historical data are not open to the public. This information can be viewed from MEP official websites, Weibo (Chinese twitter), mobile phone applications, and television weather forecasts (MEP, 2013c). In 2013, the monitoring network and public reporting system will be expanded to 113 key cities. The network will

cover all cities in China in 2015. By January 1, 2016, the nation-wide monitoring network based on the new air quality standards, including the public reporting system, will be completed in both urban and rural areas (MEP, 2012b).

3.5.2 Industrial Emission Standards

Many emission standards for industries have been revised or newly established since 2011. Some of them focus only on air pollution, but some include other types of pollution in addition to air pollution. The new standards are listed in Table 5 below.

Table 5: Emission Standards for Industries Updated in 2011 and 2012

Pollutants/Air Pollutants	Industry	Number
Air pollutants	Flat glass	GB 26453-2011
Pollutants	Rubber products	GB 27632-2011
Air pollutants	Thermal power plants	GB 13223-2011
Pollutants	Coking chemical	GB 16171-2012
Pollutants	Ferroalloy smelting	GB 28666-2012
Air pollutants	Steel rolling	GB 28665-2012
Air pollutants	Steel smelting	GB 28664-2012
Air pollutants	Iron smelting	GB 28663-2012
Air pollutants	Sintering and pelletizing of iron and steel	GB 28662-2012
Pollutants	Mining and mineral processing	GB 28661-2012

(MEP, 2013b)

It is notable that the, e.g. new emission standard for thermal power plants, GB13223-2011 (replacing GB13223-2003), is more stringent than standards in US, Canada, and the EU. Moreover, new emission sources should meet the standard regardless of the environmental impacts.

Major polluting industries will need to gradually comply with the strictest existing international emission limits on airborne pollutants starting March 1, 2013. Designated industries include thermal power, iron and steel, petrochemicals, cement, non-ferrous metals, and chemicals in 47 cities in China's most heavily polluted regions (MEP, 2013d). The major reason to implement special international limits in these six industries is because the annual amount of smoke and dust from these six industries accounts for more than 70 percent of total

emissions. New projects in these cities in the thermal power and iron & steel industries will be required to begin following the special limits on March 1, 2013. Current projects in the thermal power industry will need to follow them from July 1, 2014, and current projects in the iron & steel industry from January 1, 2015.

3.5.3 Vehicle Emission Standards

Vehicle emissions have become a key source of air pollution in China. Many studies have confirmed that air pollution in China's megacities has shifted from being dominated by coal burning to a mix of coal burning and vehicle emissions (Wang & Hao, 2012). China's non-point emission standards system consists of about 25 standards for road vehicles, off-road vehicles, engines, and fuel for new and used vehicles (MEP, 2013a).

China's emission standards for new vehicles and engines are based on the European Union's standards. The latest version of the Catalog of Newly Produced Vehicles and Engines within the National Vehicle Emission Standards, published on February 26, 2013, updates the names and addresses of vehicle manufacturers and changes in vehicle terminology. Several types of cars which were allowed to be produced based on the 3rd and 4th Phase standards have been removed from the new Catalog (MEP, 2013e). Since July 1, 2011, all light-duty gasoline cars, dual-fuel cars, and single fuel cars for retail sale, both domestically produced and imported, must meet the requirement of the 4th Phase Emission Standards (MEP, 2011c). Studies indicate that due to the implementation of Phase 1-4 emission standards since 1995, the fleet-average emission factors of cars decreased annually by 12.5%, 10.0%, 5.8% and 13.0%, respectively (Wu, et al., 2011). Since July 1, 2013, all heavy-duty gasoline cars and their engines which are registered or sold at retail, both domestically produced and imported, must also meet the 4th Phase Emission Standards (MEP, 2012c).

Some cities are encouraged, if feasible, to implement 5th Phase Emission Standards, which are approximately 40 percent stricter. On February 1, 2013, Beijing implemented the 5th Phase Emission Standards. Since then, Beijing has stopped approving applications for permits for cars meeting only the 4th Phase Emission Standards. Beijing has also stopped issuing permits for vehicles meeting the 4th Phase Emission Standard (第四阶段排放标准轻型汽油环保目录) as listed in the Environmental Protection Directory of light-duty gasoline vehicles, and it has stopped sales and registrations for light-duty gasoline cars as well as heavy-duty diesel vehicles for public transportation and cleaning purposes that do not meet

the 5th Phase Emission standards. Cars with “Beijing V” emission standards will be distributed with blue label (BMEPB, 2013).

China also regulates emissions for vehicles in use with a supervision and management system. An annual environmental protection attainment examination system for cars is being implemented in the 113 key cities for air pollution prevention (MEP, 2009a). Cars which fail to meet the attainment standards will be marked with a yellow label as “outdated.” Standards for Mandatory Phase out of Vehicles will be implemented from May 1, 2013 for vehicles in use, which will phase out cars with high emissions. In this administrative regulation, the estimated emission is not measured by the time length of usage, but rather by the distance of usage (MOFCOM, NDRC, MPS, MEP, 2012). To strengthen the management basis and secure technical support for implementing the above introduced standards, Limits and Measurement Methods for Exhaust Emissions from Motorcycles and Mopeds at Dual Idle Speed (GB 14621-2011) and Guideline for Air Quality Assessment of Passenger Cars (GB/T 27630-2011) were issued.

In addition, some megacities in China have implemented controls on the total numbers of vehicles. Beijing and Shanghai use a license auction system. This has significantly contributed to controlling the growth of the number of private cars in the city (Wang & Hao, 2012).

3.6 Joint Prevention and Control of Regional Air Pollution

China's government has recognized that air pollution in China is now a domestic regional transboundary problem, not just a local problem. This is especially a problem for secondary air pollutants, which result from interactions among primary air pollutants emitted from multiple sources, such as ground ozone, photochemical smog, PM_{2.5}, etc. which can travel over long distances. Many provinces and cities, including particularly Beijing, cannot solve air pollution problems solely by their own efforts, so regional coordination is necessary. Regional coordination mechanisms were established to control air pollution for the 2008 Beijing Olympics and the 2010 Shanghai Expo (Zhou and Elder, 2013).

This was followed by the Guideline on Strengthening Joint Prevention and Control of Atmospheric Pollution to Improve Air Quality, which was issued by the General Office of the State Council on May 11, 2010 (State Council, 2010). In the Guideline, “joint planning,”

“joint monitoring,” “joint supervision,” “joint assessment,” and “joint coordination” were proposed for regional air pollution management. Key air pollutants were designated, namely SO₂, NO_x, PM, and VOCs. Major sources of air pollution were listed as the electric power, iron & steel, nonferrous, metals, petrochemicals, cement, and chemical industries. Nine pilot regions for joint prevention and control of atmospheric pollution were designated: Jing-Jin-Ji Region, Central Liaoning Region, Shandong Peninsula, Yangtze River Delta, Western Taiwan Straits Metropolitan Region, Cheng-Yu Metropolitan Region, Pearl River Delta, Wuhan Metropolitan Region, Cheng-Zhu Tan Region (State Council, 2010; Zhou and Elder, 2013).

This Guideline has been further developed in the 12th FYP process and incorporated into the 12th FYP. Based on the Guideline, on October 29, 2012, the 12th Five-Year Plan on the Prevention and Control of Air Pollution in Key Regions (Regional Plan) was released jointly by the Ministry of Environmental Protection, the National Development and Reform Commission, and the Ministry of Finance as China's first special plan on air pollution control in China.⁶ The Plan aims to resolve some prominent issues concerning regional air pollution such as PM_{2.5} and ozone pollution to enhance the improvement of urban air quality. This Regional Plan identifies the overall direction, basic principles, scope of the plan, objectives, indicators, key tasks, major projects and enforcement measures for regional air pollution prevention and control in key regions during the 12th FYP period (MEP, NDRC, MOF, 2012).

In the 12th Five-Year Plan for Prevention and Control of Air Pollution in Key Regions, overall directions for developing the mechanism for “Joint Prevention and Control” are discussed. It states that a mechanism should be developed that unifies coordination, provides supervision, enforces the laws and regulations, provides for consultations regarding environmental impact assessments for national major development projects, and shares environmental information. It should also include early warning mechanisms as needed. To facilitate this management system, the Plan also calls for the improvement of tax incentive policies, development of pricing policies and financial trade policies, strengthening of discharge fee policies for pollutants including secondary pollutants such as VOCs, full

⁶ This section benefited significantly from the English translation of this plan prepared by the Secretariat for Clean Air Alliance of China and supported by the Energy Foundation. Some of the summaries draw on this translation. It can be found at <http://www.epa.gov/ogc/china/air%20pollution.pdf>.

implementation of the discharge permit system, stronger environmental protection verification systems for key industries, development of a franchising system for the construction and operation of pollution control facilities, a stronger environmental information disclosure system, and development of a system of compliance management of urban air quality standards. In addition, a unified network of air quality monitoring should be built. The Plan considers it necessary to strengthen capacity in the areas of monitoring and control of major pollutant sources, vehicle emission controls, and emission inventories and environmental quality management (MEP, NDRC, MOF, 2012).



Figure 2: Key Regions for Joint Prevention and Control for Air Quality Management⁷

The Regional Plan designates three major regions and ten city clusters, and specifies their overall priorities (Regional Plan section 3.1.1.). All of the key regions and city clusters should focus on PM_{2.5} and ozone, and additional priorities such as PM₁₀, acid rain, SO₂, NO₂ and traditional coal pollution are designated for particular regions and clusters. The *three major regions* are Jing-Jin-Ji (Beijing-Tianjin-Hebei Provinces), the Yangtze River Delta and the Pearl River Delta. The *ten city clusters* are central Liaoning Province, Shandong Province, Wuhan region, Changsha-Zhuzhou-Xiangtan, Chengdu-Chongqing, the West Bank of the Taiwan Strait, Gansu and Ningxia, Central and Northern part of Shanxi (山西) Province, Central Shanxi (陕西) Province and Urumqi City Cluster. In total, it covers 107 cities suffering from serious air pollution, accounting for 14 percent of China's land area, 48 percent of its pollution, 71 percent of total economic output and 52 percent of coal consumption (MEP, NDRC, MOF, 2012). Generally, it covers more developed regions in eastern, central and western China, with denser population, and more severe pollution. The Key Regions are illustrated on the map in Figure 3.

⁷ Cited from (Yang, 2012).

3.6.1 Major Policies in the Special Five-Year Plan for Regional Air Quality Management

The Regional Plan contains a large number and wide variety of measures with a fairly comprehensive scope. It expands key control regions, elaborates joint prevention and control mechanisms, and specifies detailed measures for air pollution. In particular, it includes new emission limits, and stricter environmental impact assessment procedures to be applied to new industrial projects. Industrial structure adjustment, which includes measures to phase out outdated and high polluting production facilities, is still the most important approach. Many measures are to be designated for specific industries. Particular emphasis is given to PM_{2.5}, ozone, and VOCs throughout the Plan. The Plan also allocates a large amount of money to implement “key projects.” This section describes the Plan’s major elements.

Controls on new industrial projects and implementation of strengthened EIA. New investment in high polluting industries will be prohibited or highly restricted (including limits on production capacity) in key control areas. These industries include coal-fired power plants, iron and steel, building materials, coking, non-ferrous metals, petrochemicals, and chemicals. Exceptions will be made in cases where electricity cogeneration is used. Different regions and city clusters are directed to prioritize controls on emissions and production capacity of particular industries. EIA approval is to be linked to total emission control. The Regional Plan states that industrial construction projects which fail to receive EIA approval should not receive approvals for construction (or even have their applications reviewed or considered), production licenses, safety production licenses, or emission permits. Also, financial institutions should not provide any form of credit, and public utilities should not supply the project with water or electricity (Regional Plan section 3.2.2.). New projects should have advanced pollution control equipment, which is specified in particular for thermal power plants, iron and steel, and cement industries. In addition controls on VOCs will also be added to the requirements for EIA of new industrial projects (Regional Plan, Section 3.2.4).

Elimination of backward production capacity. Eliminating “obsolete” high polluting production capacity is a major focus of the Regional Plan, and implementation of other existing plans will be accelerated. In cases where implementation is insufficient, then procedures for review and approval of permits may be suspended for new construction in key industries such as thermal power, iron and steel, nonferrous metals, petrochemicals, cement,

chemicals, and others. Emission permits, production licenses, and other licenses may be revoked for enterprises failing to meet deadlines for the elimination of backwards production capacity. Specific equipment to be eliminated is mentioned in the Regional Plan, including thermal power, iron and steel, building materials (including cement), as well as VOCs. (Regional Plan, Section 3.3.1.)

Optimizing industrial location. The Plan calls for reconsideration of the location of industries taking into account environmental carrying capacities, atmospheric patterns, and development priorities, aiming to relocate heavy polluting industries out of environmentally sensitive and urban areas. This includes the concentration of enterprises into industrial parks which may also facilitate energy efficiency, including centralized heating systems. A regulatory system to supervise this industrial relocation should be established. The Plan also states that moving backwards production capacity to economically underdeveloped areas should be prevented. (Regional Plan, Section 3.3.2.)

Promote clean energy and restrict coal consumption. Renewable energy and promotion of natural gas is emphasized in general without much attention to specific measures. It should be noted that energy comes under the jurisdiction of NDRC rather than MEP. Still, more attention is given to the establishment of a cap on coal consumption and other measures to improve coal quality and increase the efficiency of coal usage. Coal consumption cap plans should be developed by designated regions and city clusters. Zones restricting the use of high polluting fuel will be expanded. Small scale coal boilers should be eliminated, and centralized heating should be encouraged. Coal quality should be improved, and use of low quality coal should be prohibited in key control areas. (Regional Plan, Section 4)

Stricter air pollution technology requirements for specific industries. For specific designated pollutants (SO₂, NO_x, industrial dust & smoke, PM, and VOCs), a range of specific technologies to be adopted by specific industries is to be required to varying degrees; in a few cases, pilot projects are to be established. In particular, control measures for VOCs and solvents are specified for the petrochemical, organic chemical, coating process, and printing and packaging industries (Regional Plan, Sections 5.1, 5.2, 5.3)

Policy development for VOCs. A regulation and management system for VOCs is to be developed, starting with an emissions survey and calculation of emission factors and emission inventories in key sectors. VOC emission standards, an index system for evaluating

clean production, and technical specifications should be established as soon as possible. Environmental labeling and product certification standards and other management measures should also be established. Measures to promote oil and gas recovery at gas stations, oil storage tanks and oil tank trucks should be strengthened. (Regional Plan, Section 5.3)

Policy development for toxic wastes. A national priority control list of toxic waste pollutants should be developed, supervision of enterprises emitting toxic wastes should be strengthened including monitoring measures, and clean production should be promoted. Toxic waste will be an important factor in the EIA approval process. Technologies for mercury control should be developed and promoted. Management of ozone-depleting substances should be strengthened. (Regional Plan, Section 5.4)

Strengthen control of mobile source emissions. Development of sustainable transportation systems should be strengthened. Fuel quality standards should be upgraded; in particular, the three priority regions should implement the National V auto-diesel standard by the end of 2014. Implementation of new vehicle emission standards should be accelerated. Vehicle labeling and inspections should be strengthened, and elimination of yellow sticker vehicles should be accelerated. In particular, yellow label vehicles in the three key regions should be nearly eliminated. A management system should be developed for non-road vehicle sources. For machines and ships, the National Phase III non-road vehicle machinery emission standards and National Phase I ship engine emission standards should be implemented by the end of 2013. Construction of Green Ports in Tianjin, Shanghai, Nanjing, Ningbo, Guangzhou, and Qingdao should be accelerated. (Regional Plan, Section 5.5)

Strengthen fugitive dust control and non-point source pollution management. The Plan calls for the establishment of a coordination agency to implement integrated management of urban fugitive dust. Control zones should be established. A target is established to reduce the dust densities in urban areas by more than 15 percent in control areas and 10 percent in general compared with 2010. Environmental supervision and inspection for construction dust should be strengthened. Construction agencies should create detailed fugitive dust control plans, which should be separately submitted to construction as well as environmental authorities before starting. Fugitive dust control should be included in project budgets. Several green construction measures are specified to be promoted. Measures to control road dust should be strengthened, for example, the target ratio of mechanized cleaning on major

urban roads should exceed 70 percent in general and 90 percent in control areas by the end of 2015. Other measures include strengthening of urban forestation, supervision of biomass burning, and supervision of oil smoke from catering services such as outside barbecues. (Regional Plan, Section 5.6)

Special emission limits for air pollutants, in addition to the major air pollutants (SO₂ and NO_x) in the TEC program, are established in this special plan at the regional level. The Regional Plan defines the cooperative control targets of SO₂, NO_x, PM₁₀, PM_{2.5}, and VOC; and strategies for synergistic control of several kinds of air pollutant sources including industrial, area, and mobile sources. Targets for both air quality improvement and emission reduction have been clarified. Mandated binding targets for emission reduction in key regions are 12% for SO₂, 13% for NO_x, and 10% total quantity of PM. Mandated binding targets for air quality improvement in key regions require reductions in concentration of 10% for PM_{2.5}, 10% for SO₂, 7% for NO₂, and 5% PM₁₀ (MEP, NDRC, MOF, 2012). (See Table 6 below.) These targets are planned to be related to EIA, and the approval requirements for new industrial projects in the key regions will be stricter than for those outside the key regions. In the Plan, the emission targets of these air pollutants are distributed among provincial and municipal units as in seen in Table 7 below:

Table 6: National Binding Targets for Air Pollution Control in Key Regions (2011-2015)

Category	Emission Reduction Targets (Reduction in total quantity)			Environmental Quality Targets (Reduction in concentration)			
	SO ₂	NO _x	PM	SO ₂	NO ₂	PM	PM _{2.5}
Total reduction by 2015	12%	13%	10%	10%	7%	5%	10%

Table 7: Provincial & Municipal Indicators of 12 FYP for Air Pollution Control in Key Regions

Category	No.	Target	Beijing	Tianjin	Hebei	Shanghai	Jiangsu	Zhejiang	Pearl River Delta	Central Liaoning	Shandong
Environmental quality indicators	1	SO ₂ annual decline in concentration (%)	10	8	11	11	12	11	12	11	14
	2	NO ₂ annual decline in concentration (%)	7	9	7	9	10	10	9	9	10
	3	PM _{2.5} annual decline in concentration (%)	15	12	12	10	14	10	8	12	14
	4	PM annual decline in concentration (%)	15	6	6	6	7	5	5	6	7
Emission reduction indicators	5	Industrial smoke and dust emission reduction(%)	5	8	15	5	15	15	8	10	15
	6	VOCs emission reduction in existing source (%)	15	18	15	18	18	18	18	15	15

Category	No.	Target	Wuhan region	Changsha-Zhuzhou-Xiangtan	Chongqing	Sichuan	West Bank of Taiwan Strait	Central&Northern Shanxi	Central Shanxi	Gansu	Ningxia	Urumqi
Environmental quality indicators	1	SO ₂ annual decline in concentration (%)	7	9	6	9	6	10	7	14	10	9
	2	NO ₂ annual decline in concentration (%)	4	5	4	5	5	7	5	8	7	9
	3	PM _{2.5} annual decline in concentration (%)	10	10	12	10	8	12	14	14	10	12
	4	PM annual decline in concentration (%)	5	5	6	5	4	4	4	4	5	14
Emission reduction indicators	5	Industrial smoke and dust emission reduction(%)	12	12	10	10	8	10	12	15	10	15
	6	VOCs emission reduction in existing source (%)	10	10	15	10	10	10	10	10	10	10

表3 “十二五”重点区域大气污染防治各省市规划指标

类别	序号	指 标	北京	天津	河北	上海	江苏	浙江	珠三角	辽宁中部	山东	武汉及其周边	长株潭	成渝(重庆)	成渝(四川)	海峡西岸	山西中北部	陕西关中	甘宁(甘肃)	甘宁(宁夏)	新疆乌鲁木齐
环境质量指标	1	二氧化硫年均浓度下降比例(%)	10	8	11	11	12	11	12	11	14	7	9	6	9	6	10	7	14	10	9
	2	二氧化氮年均浓度下降比例(%)	7	9	7	9	10	10	9	9	10	4	5	4	5	5	7	5	8	7	9
	3	可吸入颗粒物年均浓度下降比例(%)	15	12	12	10	14	10	8	12	14	10	10	12	10	8	12	14	14	10	12
	4	细颗粒物年均浓度下降比例(%)	15	6	6	6	7	5	5	6	7	5	5	6	5	4	4	4	4	5	4
排放控制指标	5	工业烟粉尘减排比例(%)	5	8	15	5	15	10	8	10	15	12	12	10	10	8	10	12	15	10	15
	6	重点行业现役源挥发性有机物排放削减比例(%)	15	18	15	18	18	18	18	15	15	10	10	15	10	10	10	10	10	10	10

(MEP, NDRC, MOF, 2012)

Specific “key projects” are a major part of the Regional Plan, which indicates a large amount of funds to be used. The Plan calls for an investment of 350 billion RMB (about 56 billion USD) for a total of 13,369 projects. These funds will be allocated to eight main areas: SO₂ control, NO_x control, industrial PM treatment, industrial VOC treatment, oil-vapor recovery, phase out of vehicles failing to meet the European No.1 standard for exhaust emissions, and comprehensive treatment of dust, and capacity building (MEP, NDRC, MOF, 2012). Capacity building projects include developing capacity for air quality monitoring network building projects, online monitoring of enterprise emissions, vehicle monitoring, and surveys of emissions and environmental quality. An overall summary of the key projects is presented in Table 8. A detailed list of these projects, including responsible units and targets, is attached to the Regional Plan.⁸

⁸ For specific examples in English, see the Appendix in (MEP, NDRC, MOF, 2013).

Table 8: Summary of Key Projects in the Regional Plan

Types of Projects	Number of Projects	Tons/year Increase in Reduction Capacity	Investment (Bil. RMB)
SO ₂	447	2,280,000 (SO ₂)	73.0
NO _x	755	2,430,000 (NO _x)	53.0
Industrial Smoke & Dust	10,073	860,000 (PM)	47.0
VOC in key industries	1,311	605,000 (VOC)	40.0
Oil & Gas recovery	281	405,000 (VOC)	21.5
Yellow Sticker Vehicles	188 (8,066,1000 vehicles)	1,158,000 (NO _x) 213,000 (PM) 515,000 (VOC)	94.0
Fugitive Dust	192	406,000 (PM)	10.0
Capacity Building	122	NA	11.5
TOTAL	13,369	2,280,000 (SO₂) 3,590,000 (NO_x) 1,480,000 (VOC) 1,525,000 (PM)	350.0

(MEP, NDRC, MOF, 2013)

The Regional Plan also estimates the benefits expected from these key projects. The implementation of these key projects for prevention and control of air pollution is expected to enhance capacity to reduce SO₂ by 2.28 million tons per year, 3.59 million tons per year for

NO_x, 1.48 million tons per year for particulate matter, and 1.53 million tons per year for VOCs. Ambient air quality will be improved, and photochemical smog, haze, and acid rain will be reduced. A total social loss of 2000 trillion RMB (320 trillion USD) is expected to be saved.

3.6.2 Capacity and Implementation

The Regional Plan also includes measures to strengthen the management mechanism and capacity of joint prevention and control. The key regions and city clusters should set up joint conferences. For four regions (Beijing-Tianjin-Hebei, Yangtze River Delta, Chengdu-Chongqing, Ganning) joint pollution prevention and control working groups should be established and led by MEP; other regions can decide on their own leadership. Joint enforcement and inspections are envisaged. Provinces should cooperate and coordinate on major air pollution cases, cross-border pollution disputes, and relocation of industrial projects. Environmental impact assessment should consider region wide impacts, and results should be opened to public comment. Regional environmental information sharing mechanisms and air pollution early warning systems should be established. Regional emergency response plans should be developed. (Regional Plan, Section 6.1)

The Regional Plan calls for various fiscal and economic measures. These include improvement of the fiscal subsidies incentive policy for eliminating backwards production capacity, introducing new technology, and eliminating yellow label vehicles. Preferential consumption tax treatment should be given to enterprises whose vehicles meet the next phase fuel standards. In the electricity industry, the policy of differential prices should continue to be used to promote de-sulfurization. Financial institutions should establish stricter standards for loans to high polluting industries which should be enforced by integrating environmental information into a rating system managed by the People's Bank of China. Import-export tax policy should be adjusted to discourage exports of energy intensive and high emission products. A pollution charge policy should be developed and adopted for VOCs. The Pollutant Discharge Permit System should be fully implemented; key enterprises should apply for permits before 2014, and discharges will not be allowed without a permit. The Regional Plan calls for the development of a Key Industry Environmental Protection Inspection System for heavy polluting industries; enterprises which fail inspections may be required to implement correction measures, stop production, or shut down. Inspection results

should be announced to the public, and the plan suggests that the inspections would be linked to an enterprises' ability to obtain credit, production permits, and import/export permission. (Regional Plan, Section 6.2)

Environmental disclosure systems are to be strengthened. Not only cities, but also key enterprises should publicize environmental information. The Plan calls for public input on EIAs. The Plan expects that improved disclosure of environmental information will promote greater civil society participation and encourage social monitoring of enterprises. (Regional Plan, Section 6.2.7)

Supervision of cities/municipalities is to be strengthened. Municipalities which do not meet air quality standards will need to develop time limited plans to do so, and these should be open to the public. Compliance deadlines of municipalities directly under the central government should be approved by the State Council. Compliance deadlines for 113 national Key Environmental Protection Cities should be approved by the respective provincial governments and MEP, and the deadlines of other cities should be approved by their provincial governments and recorded by MEP. Implementation should be monitored by national and provincial environmental protection departments. (Regional Plan, Section 6.2.8)

Strengthened monitoring is also called for by the Regional Plan, although much of the expansion of the monitoring system is addressed by other plans (see Section 3.9 below). The Regional Plan calls for the development of a regional monitoring system, which should be linked together centrally. The regional plan also emphasizes that VOCs and mercury should be included in monitoring and pollution statistics, and stronger capacity to monitor pollution from vehicles. (Regional Plan, Section 6.3)

Initial implementation of regional coordination seems to have been slow. The Regional Plan sets up a framework for discussion among provinces and specifies many areas of expected cooperation as discussed above, but it does not include any specific mechanisms for requiring an agreement or requiring this cooperation.

In particular, it has been difficult to forge a consensus between different provincial governments in the regions designated for Joint Prevention and Control. According to interviews with air pollution experts with knowledge about the discussions in the Jing-Jin-Ji (Beijing, Tianjin, Hebei) region, the negotiations have been difficult and Tianjin and Hebei

have been reluctant to commit to strong reduction measures. In particular, Hebei has been opposed to Beijing's request to reduce coal use, since it is a major center of coal consuming industries, particularly steel, and its level of economic development is comparatively lower than Beijing. Without a stronger governance mechanism, it may be difficult to persuade provinces like Hebei to significantly reduce air pollution emissions voluntarily. Overall, many provinces still prioritize economic growth and focus on industrial development to achieve GDP growth targets. Many people still believe that China still has to continue its progress in industrialization, so many provinces at this stage are not willing to slow down industrialization for the sake of air pollution control.

Nevertheless, it should also be pointed out that the regional plan does not simply rely on cooperation among provinces and municipalities. Many specific targets, policies, and key projects are established to apply to both key regions and enterprises without the need for any voluntary cooperative measures among provinces and municipalities. Moreover, the Plan calls for MEP to supervise the implementation of the time limited plans of local governments which are not meeting the standards. Therefore, it is possible that this Regional Plan in the long run might gradually strengthen the position of MEP in contrast with the provinces and municipalities to strengthen the implementation national policies.

3.7 Blue Sky Science and Technology Project

The Blue Sky Science and Technology Project is a Special Plan issued by MEP and MOST (Ministry of Science and Technology) which aims to develop atmospheric pollution control technologies, commercialize them, and develop them into viable industries. The Special Plan calls for new projects worth 100 billion RMB which would expand size of the environmental protection technology market, and it expects that the new technology should lead to a 10 percent increase in the rate of achievement of air pollution emission reduction targets (MOST, MEP, 2012). This Special Plan identifies the national goals, strategic objectives, and priority areas of technology development.

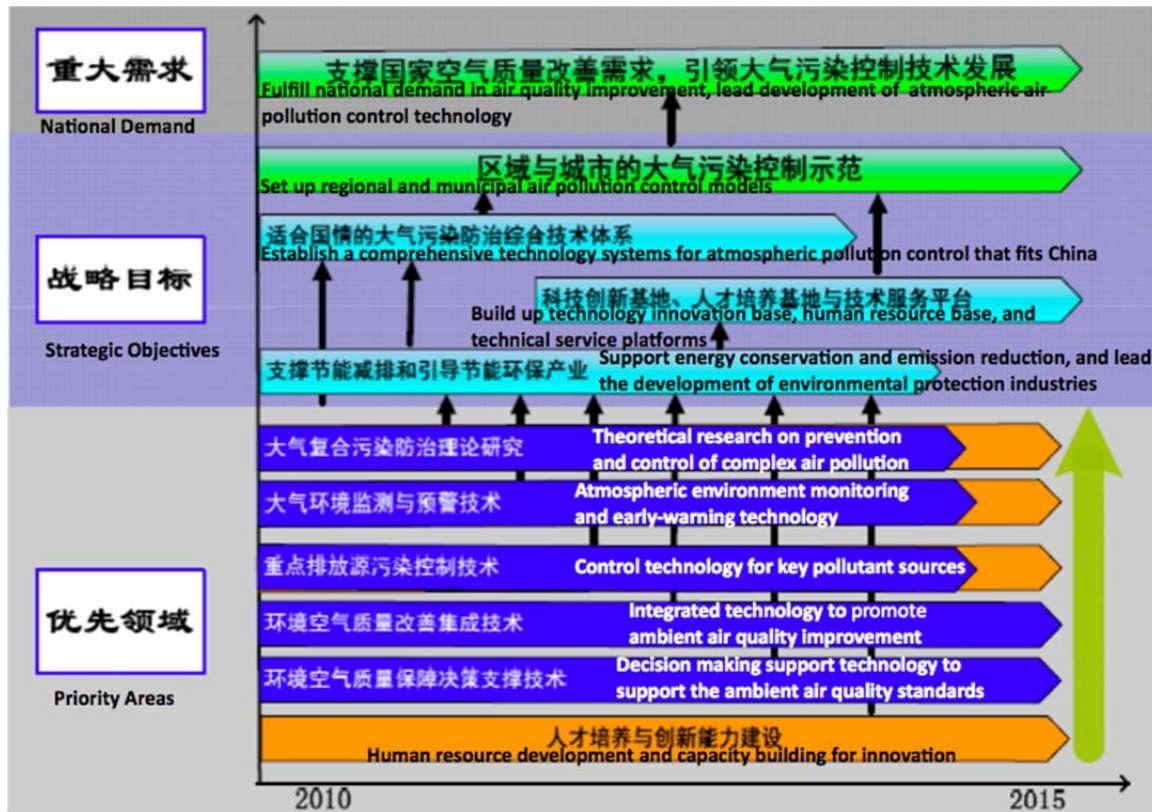


Figure 3: The Blue Sky Science and Technology Development Process

(MOST, MEP, 2012)

Human resource development and capability building for innovation are the highest priority areas. Also emphasized are: decision making support technology to support the ambient air quality standards; integrated technology to promote ambient air quality improvement; control technology for key pollutant sources; and atmospheric environment monitoring and early-warning technology.

Research and development in these technologies and related management concepts is expected to achieve the following three strategic objectives: 1) to support energy conservation and emission reduction, and to lead the development of environmental protection industries; 2) to build up technology innovation base, human resource base, and technical service platforms; and 3) to establish comprehensive technology systems for atmospheric pollution control.

It is expected that the policies related to research and technology promotion will also contribute to the continued development of regional and municipal air pollution control models which are necessary to strengthen the capability to address multiple pollutants

simultaneously, especially secondary pollutants such as PM_{2.5} and ozone. These policies are also expected to facilitate the establishment of modelling capability and systems to strengthen the regional management system (MOST, MEP, 2012).

Research capacity for atmospheric pollution is also being developed by other programs, not just the Special 12th FYP for the Blue Sky Science and Technology Project. There are many competitive research projects funded by different government bodies (MOST, 2013). Projects sponsored by MOST's State Centre for Evaluating Science and Technology Projects (国家科技计划项目申报中心) include the "Special Grand National S&T Project," "973 Plan," "863 Plan," and the "National S&T Supporting Plan." Projects sponsored by MEP include the State Environmental Protection Commonweal Scientific Research Project (国家环境保护公益性行业科研专项项目申报). Air pollution related research projects are also sponsored by some local governments such as Beijing and Shanghai.

3.8 Special Measures for Addressing PM

China's PM pollution became the focus of global media attention in late 2012 and early 2013. According to the World Health Organization (WHO)'s first report on global urban air pollution on September 26, 2011, the average PM₁₀ annual concentration of Chinese cities is 98 µg/m³, 4.9 times the value of the WHO's guideline (WHO, 2011). The annual concentration of PM_{2.5} was not surveyed since monitoring had not been conducted in most cities. The Chinese Academy for Environmental Planning's simulation result of annual average PM_{2.5} concentrations under the 12th Five-Year Plan Total Emission Control Program predicts that the state of heavy PM_{2.5} pollution in China will not change until 2015. A key approach to reduce PM_{2.5} is the simultaneous control of PM, SO₂, NO_x, NH₃ and VOC emissions, as well as incorporating the removal of these pollutants into the 2013 Action Plan (Xue, et al., 2013).

The PM issue has been particularly severe in the area around Beijing, and several new policies were quickly adopted in response, especially by the Beijing Municipal government. These measures included strengthening the monitoring system, publicizing emissions data, setting up early warning systems, and strengthening various local standards and regulations. Table 9 below summarizes the specific measures implemented nationally as well as in Beijing relating to PM_{2.5}.

Table 9: Measures for PM_{2.5} Implemented in 2012 Nationally and in Beijing

Measures for PM_{2.5} Implemented in 2012 Nationally and in Beijing	
January	<ul style="list-style-type: none"> PM_{2.5} real-time monitoring data of Beijing's CGZ station (used for research) was released.
February	<ul style="list-style-type: none"> First revision of the Ambient Air Quality Standard (including PM_{2.5} and O₃). Technical Regulation on Ambient Air Quality Index (on a trial basis) was released. These measures were expected to reduce PM_{2.5} by 15% from 2010 to 2015 in Beijing.
March	<ul style="list-style-type: none"> The central government announced a special fund for major pollutants emission reduction to finance national environmental air monitoring network construction projects including Beijing.
May	<ul style="list-style-type: none"> A detailed 3 step plan for the implementation of the new standard was released. The first stage of the comparison test on PM_{2.5} automatic monitoring instruments was finished
June	<ul style="list-style-type: none"> Standards of Beijing gasoline and diesel were upgraded from the Beijing-IV to Beijing-V, and set particulate matter (PM) emission limits for the first time.
October	<ul style="list-style-type: none"> Beijing publicly reported the PM_{2.5} real-time monitoring data of 35 stations. Beijing issued the Beijing Emergency Response Plan for Heavy Air Pollution (provisional) Public comments were requested for six draft environmental standards including Technical Specifications, Test Procedures for Ambient Air Quality (PM₁₀ and PM_{2.5}), Continuous Monitoring System Technical Requirements and Testing Methods (on trial) etc.
December	<ul style="list-style-type: none"> The first comprehensive air pollution control FYP set a target to reduce the average annual concentration of PM_{2.5} in Beijing-Tianjin-Hebei area by 6% during the 12th FYP. 496 stations in 74 cities across the country reported real-time monitoring data.
	Source: (CAI, 2013)

Several policies and measures discussed elsewhere in this report address the PM_{2.5} issue, including the TEC Program, the regional management system, and expansion of monitoring networks.

PM_{2.5} is also the focus of recent intensive research efforts sponsored by MEP, the Beijing Municipal Government, and others. Particularly, new research in 2013 is being conducted to investigate the recent haze problem in Beijing, for which PM_{2.5} is a major contributor. Emission reduction from vehicles is considered to be a major factor in PM_{2.5} emissions. New policies for primary and secondary pollutants contributing to PM_{2.5} are expected to be prepared based on the results of this research.⁹

3.9 Expanding the Air Pollution Monitoring Network

Expansion of the air quality monitoring network is another recent major policy development. Two major policies it relates to are the ambient air quality standard and the 12th Five-Year Plan on Capacity Building for Environmental Supervision.

The GB 3095-2012 Ambient Air Quality Standard is to be synchronized with expansion of air quality monitoring network in three phases. The implementation of first phase monitoring network of the new ambient air quality standard had been completed by the end of 2012 in the three key regions of air pollution prevention and control, and provincial capitals and municipalities with independent planning status. Real-time reporting of air quality status in these 74 jurisdictions started from January 1, 2013. The implementation of the second phase monitoring network of the new ambient air quality standard is planned to expand to 116 national key cities of environmental protection, and model cities, which is planned to include 449 monitoring locations by the end of October 2013. Another goal in the second phase is to initiate the construction of regional air quality early warning centers in Jing-jin-ji, Yangtze River Delta, and Pearl River Delta regions (MEP, 2013g). The Implementation Plan of Third Phase Monitoring Network of New Ambient Air Quality Standard has yet not been published, but the main goal will be to establish an air quality monitoring network in every city in China by the end of 2015.

⁹ This point was confirmed by interviews with air pollution researchers at air pollution related research institutes in Beijing in February and March 2013.

The implementation of the monitoring networks is mainly organized by provincial (municipal, regional) environmental protection authorities. Their work includes bidding for equipment, procurement, installation, debugging, and information publication. The China National Environmental Monitoring Center (CNEMC) is responsible for formulating the corresponding technical requirements and guidance (MEP, 2012d).

Local governments also have new responsibilities corresponding with the development of the monitoring network. Provincial (municipal, regional) environmental protection authorities and agencies are required to upload monitoring data to CNEMC for real-time reporting of SO₂, NO₂, PM₁₀, PM_{2.5}, O₃ and CO. The data reported should include real-time concentration values, 24-hours average concentration values, daily concentration values, air quality indices, health tips as well as geographical areas covered by the monitoring locations. This data should also be publicized by these environmental protection authorities and agencies through their websites, television, radios, etc. (MEP, 2012c).

The technical requirements of supporting monitoring facilities have become more advanced. In order to facilitate the second phase implementation of GB 3095-2012 Ambient Air Quality Standard, especially to build up capacity for PM_{2.5} monitoring, CNEMC published the Technical Indices and Requirements of PM_{2.5} Automatic Monitoring Devices (PM_{2.5} 自动监测仪器技术指标与要求) on a trial basis on June 5, 2013. This official document includes a variety of monitoring regulations such as: methods of automatic monitoring equipment, range, limit of detection, display resolution, the measurement time and cycle, sampling system, sampling flow, operating environment, the digital output signal, etc. These technical indices of monitoring devices are made based on comparative test result of monitoring PM_{2.5} by automatic and manual methods conducted in main environmental monitoring centers such as in Beijing, Shanghai, Chongqing, Guangdong, Guangzhou, and Jinan during four seasons in 2012. The test also examined monitoring equipment by regression analysis in comparison with the results from main monitoring stations. The PM_{2.5} monitoring equipment which passed the comparative test is listed in Table 10 below.

Table 10: List of Qualified PM_{2.5} Monitoring Equipment in 2013

Maker, Country (Province, City)	Monitor Type
Sailhero, China (Hebei)	XHPM-2000E-type β -ray Monitor 河北先河公司 XHPM-2000E 型 β 射线法监测仪
Tianhong, China (Wuhai)	TH-2000PM-type β -ray Monitor 武汉天虹公司 TH-2000PM 型 β 射线法监测仪
Landun, China (Anhui)	LGH-01E-type β -ray Monitor 安徽蓝盾公司 LGH-01E 型 β 射线法监测仪
Zhone Sheng Tai ke, China (Beijing)	7201 Tyco monitor type β -ray Monitor 北京中晟泰科公司 7201 型 β 射线法监测仪
Thermo Scientific, USA	1405F TEOM Continuous Ambient Air Monitor 美国热电公司 1405F 型振荡天平法监测仪
Focused Photonics, China (Hangzhou)	BPM-200-type β -ray Monitor 杭州聚光公司 BPM-200 型 β 射线法监测仪
Horiba, Japan	APDA-375A β -ray Monitor 日本 HORIBA 公司 APDA-375A 型 β 射线法监测仪
Thermo Scientific, USA	SHARP-5030 β -ray Monitor 美国热电公司 SHARP-5030 型 β 射线法监测仪
ESA, France	MP-101M β -ray Monitor 法国 ESA 公司 MP-101M 型 β 射线法监测仪
METONE, USA	BAM-1020 β -ray Monitor 美国 METONE 公司 BAM-1020 型 β 射线法监测仪

(CNEMC, 2013)

The 12th Five-Year Plan on Capacity Building for Environmental Supervision also has a major focus on monitoring (in addition to other areas). The share of equipment at environmental supervision institutions meeting the standards nationwide should reach 85 percent at the county level, 90 percent at the prefectural level, and 95 percent at the provincial level by 2015. Emergency and early warning monitoring capabilities should be strengthened, and all institutions at the provincial level should be up to the standard. The Plan has more general directions to strengthen areas such as equipment for on-site enforcement, automatic monitoring networks, environmental statistics, satellite remote sensing, nuclear radiation, and

supervising key industries, vehicles, and non-point agricultural sources. Monitoring of newly added pollutants such as VOCs and heavy metals should be improved. (MEP 2013h)

The Plan for capacity building also calls for 40 billion RMB in related investments in infrastructure, “guarantee” (supervision), and human resources. Specific areas include environmental monitoring, supervision, emergency response, environmental information, environmental assessment, publicity and education, development of standards, and supervision of newly added pollutants. (MEP 2013h)

3.10 Ten Air Pollution Measures and Air Pollution Prevention and Control Action Plan Announced by the State Council in 2013

The two most significant policy developments in 2013 were the announcement of ten major air pollution measures by Premier Li Keqiang at a State Council executive meeting on June 14, 2013 (Climate Group, 2013), and its follow up measure, the Air Pollution Prevention and Control Action Plan which was issued by the State Council on Sept. 10, 2013 (State Council, 2013; China Daily, 2013). These developments followed the major air pollution episodes of late 2012 and early 2013 which received widespread global media attention. The ten measures announced in June also received significant global media attention (e.g. Bloomberg.com, 2013; Xinhuanet.com, 2013, Wall Street Journal, 2013).

3.10.1 Ten Measures June 2013

The ten measures announced by Premier Li Keqiang at the State Council in June 2013 are listed as follows (quoted from Climate Group, 2013):

1. **Reduce pollutant emissions** through renovation of key industries. Accelerate the clean transformation of urban dust and fuel quality.
2. **Strictly control high energy consumption** of high-pollution and other key industries' production capacity.
3. **Improve public transport and clean energy production**, reducing atmospheric pollutants emission intensity by 30 percent or more by 2017.
4. **Develop natural gas, coal methane and other clean energy supplies.**
5. **Strengthen energy-saving and environmental indicator constraints** on construction, land, power and water supply.

6. **Implement incentives and constraints on new energy saving mechanisms to increase sewage collection efforts, as well as increase support for air pollution control. Strengthen international cooperation to cultivate environmental protection and new energy industries.**
7. **Enforce laws and standards for industrial restructuring and upgrading. Formulate or revise emission standards for key industries, using the proposed amendments of the Atmospheric Pollution Prevention Act and other laws. Heavy polluting industries and enterprises must disclose environmental information, and urban air quality rankings and penalties for violations will be established.**
8. **Densely populated urban areas around the Bohai Sea, including Beijing, Tianjin, the Yangtze River Delta, Pearl River Delta and other regions, must establish joint prevention and control mechanisms on atmospheric environmental targets and assessment systems.**
9. **Establish local government emergency management in response to heavily polluted weather, and limit emissions from polluting enterprises and vehicles.**
10. **Develop a code of conduct that can be applied to the whole society, with local government taking overall responsibility on local air quality. The main responsibility for the implementation of corporate pollution lies with the State Council's relevant departments who should advocate conservation and green consumption patterns.**

These measures are very wide-ranging and comprehensive, and sound very general as concrete details are not provided. Many appear to repackage or build on previous measures described earlier in this report. The specific legal status of these ten measures was not mentioned in the media reports, and commentators emphasized the importance of implementation. Nevertheless, the fact that they were announced by the Premier with wide media coverage indicated the rapidly rising political priority of the air pollution issue, and possibly increased political commitment to strengthen measures to address it.

3.10.2 Air Pollution Action Plan

The subsequent Action Plan¹⁰ announced in September 2013 is more concrete and based on the June measures. It also builds on other measures, particularly the 12th Five-Year Plan for Joint Prevention and Control, as it applies primarily to the designated priority regions. Like other measures, it is a mixture of general aspirations/ directions, concrete measures, and

¹⁰ An English translation is available from the Clean Air Alliance of China, <http://en.cleanairchina.org/product/6346.html>.

targets. It often is not clear why some measures are classified under one heading instead of another.¹¹

The legal status of the 2013 Action Plan is not the same as a law or regulation, since it was issued by the State Council, and not approved by the National People's Congress or issued by a ministry. However, it may have more chance of being implemented since it will be enforced through the Communist Party's personnel evaluation and promotion system for high level officials.¹² It also contains a number of strengthened governance measures discussed below, such as linkage of environmental impact assessment to the approval of new industrial projects.

The contents of the 2013 Action Plan are organized under ten headings/areas and 35 paragraphs which are outlined as follows:¹³

1. *Increase Effort of Comprehensive Control and Reduce Emission of Multi-Pollutants*
 - 1) *Industrial enterprises*
 - *Enhance comprehensive control (small boilers, district heating, fuel switching; accelerate desulfurization (SO₂), denitrification (NO_x), and dust removal (PM control); retrofit projects in key industries, VOCs control; complete pollution control facilities in coal power plants, boilers & industrial furnaces; and complete comprehensive control of organic waste gas in petrochemical enterprises by the end of 2015 in 3 priority regions.*
 - 2) *Area sources*
 - *Enhance area source pollution control, comprehensive urban dust control, green construction, oil and smoke treatment in catering services industry.*
 - 3) *Mobile sources*
 - *Urban transportation, fuel quality, yellow-label vehicles, environmental management of vehicles, upgrade low-speed vehicles, new energy vehicles.*
2. *Optimize the Industrial Structure, Promote Industrial Restructuring*
 - 4) *Strictly control new capacity in high energy consuming & polluting industries.*
 - 5) *Accelerate elimination of backward productivity.*

¹¹ This may be related to compromises made during the decision making process involving bargaining among a range of stakeholders.

¹² Personal communication with MEP official, Dec. 2013.

¹³ Based on the English translation by Clean Air Alliance of China, available at <http://en.cleanairchina.org/product/6346.html>.

- 6) *Reduce excess capacity.*
- 7) *Firmly stop illegal construction projects in industry with over capacity.*
3. *Accelerate the Technology Transformation, Improve the Innovation Capability*
 - 8) *Strengthen scientific and technological development and promotion.*
 - 9) *Fully practice clean production.*
 - 10) *Vigorously develop circular economy.*
 - 11) *Foster energy saving and environmental protection industries.*
4. *Adjust the Energy Structure and Increase the Clean Energy Supply*
 - 12) *Coal consumption cap*
 - 13) *Clean energy*
 - 14) *Clean coal*
 - 15) *Energy efficiency (also green buildings, heating metering reform)*
5. *Strengthen Environmental Thresholds and Optimize Industrial Layout*
 - 16) *Optimize industrial layout.*
 - 17) *Enhance the use of environmental protection and energy saving indicators.*
 - 18) *Optimize land use*
6. *Better Role of Market Mechanisms and Improve Environmental Economic Policies*
 - 19) *Market mechanism*
 - 20) *Pricing & tax policy*
 - 21) *Investment & financing*
7. *Improve Law & Regulation System. Carry on Supervision & Management Based on Law*
 - 22) *Improve the law, regulation and standard system.*
 - 23) *Improve environmental regulation capacity.*
 - 24) *Strengthen the environmental protection law enforcement.*
 - 25) *Implement environmental information disclosure.*
8. *Establish the Regional Coordination Mechanism & Integrated Regional Environmental Management*
 - 26) *Regional coordination mechanism.*
 - 27) *Allocate goals and tasks.*
 - 28) *Strict accountability.*
9. *Establish Monitoring and Warning System. Cope with Heavy Pollution Weather*
 - 29) *Establish the monitoring and warning system.*
 - 30) *Develop emergency plans.*
 - 31) *Take emergency measures in a timely manner.*
10. *Clarify the Responsibilities of the Government, Enterprise and Society. Mobilize Public to Participate in Environmental Protection*
 - 32) *Clearly define the responsibility of local governments.*
 - 33) *Strengthen the coordination between departments.*

34) *Strengthen enterprises' activities.*

35) *Widely mobilize social participation.*

Several overall observations can be made about the contents and focus:

- Major areas include reduction of coal use, energy efficiency, clean energy, transport, fuel standards, desulfurization, denitrification.
- There is a focus on designated key regions and close linkage with the regional management system (Joint Prevention and Control).
- The focus is not just on pollution targets, but also industrial restructuring, industrial location, technological innovation.
- Stronger governance mechanisms are emphasized. The plan will be enforced by linking industrial project approvals to EIA and energy audits, and linkage with senior officials' performance evaluations.

Major new elements are stronger restrictions on coal consumption, phase out of yellow label vehicles, clean fuel roadmap/timeline, and making PM_{2.5} targets compulsory in 3 key regions, according to Clean Air Asia (CAA).¹⁴

The 2013 Action Plan establishes goals for air quality by 2017 from 2012 levels. For 338 major cities in China, it aims to reduce PM_{2.5} concentration by at least 10 percent. The goal for key air pollution regions is to decrease the concentration of PM by 25 percent in Jing-Jin-Ji, 20 percent in Yangtze River Delta, and 15 percent in Pearl River Delta. For Beijing, the required average annual concentration of PM is 60 micrograms per cubic meter.

Some selected details are described below in the remainder of this section. It is not a comprehensive discussion, but rather is intended to highlight a number of important details. For full details, readers are advised to consult the original document.

Significant attention is directed to reducing coal usage. The Plan calls for comprehensively renovating small coal-fired boilers. Except for necessary reserves, all major cities should eliminate coal-fired boilers with efficiency lower than 10 tons of vapor per hour, and stop

¹⁴ CAA's analysis can be found at <http://cleanairinitiative.org/portal/node/12066>, no date, accessed Jan. 14, 2014.

building coal fired boilers with efficiency lower than 20 tons of vapor per hour. For other regions, in principle coal-fired boilers with efficiency lower than 10 tons of vapor per hour should not be built. Quality of coal should also be increased, for example by increasing coal washing. The import of coal that is high in ash and sulfur will be banned. Replacement of coal-fired boilers, industrial furnaces, and coal-fired power with natural gas in Jing-Jin-Ji, Yangtze River Delta, and Pearl River Delta should be completed. By 2017, the percentage of coal in national energy consumption should be lower than 65 percent.

Promotion of renewable energy is highly encouraged, including hydropower, geothermal, wind, solar, biomass energy, as well as nuclear power. By 2017, the running capacity of installed nuclear power plants should reach 50 million kilowatts, and the consumption of non-fossil energy should increase 13 percent. By 2017, energy consumption per unit of industrial added value should be 20 percent lower than 2012.

Measures to reduce air pollution from vehicles are fairly comprehensive. Overall, green transport policies and public transportation should be promoted. Improvement of gasoline quality is a key priority; by the end of 2017, the national supply of gasoline and diesel should be in line with the National IV Standard for Gasoline and Diesel. The phase out of “yellow label cars” is to be accelerated; by 2017 they should be phased out nationwide. The environmental protection requirements for low-speed vehicles (three wheeled automobiles, low-speed trucks) should be continuously improved; from 2017 new low speed trucks will need to meet the same energy-saving and emission standards as light trucks.

The 2013 Action Plan emphasizes industrial transformation as much as pollution control. Key phrases are “acceleration of the phase out of outdated productivity” and full promotion of “clean production,” the “circular economy,” and “technology transformation.” The Plan calls for accomplishing the 12th FYP task of phasing out outdated production facilities in 21 key industries one year in advance. Specific targets to phase out outdated production capacity by 2015 include 15 million tons for iron-refining, 15 million tons for steel-refining, 100 million tons for cement, and 20 million weight cases for flat glass. In 2016 and 2017, the local governments should formulate new policies to phase out a wider range of additional outdated production facilities. Production phase-outs are to be enforced through strict control of approval of new investments in key industries. By 2017, the pollution intensity of key industries such as iron, cement, chemical, petrochemical and non-ferrous metal smelting

industries should decrease at least 30 percent. Circular economy planning should be implemented at 50 percent of the national industrial parks and 30 percent of the provincial industrial parks, and the recycling rate of major non-ferrous metals and steel should reach at least 40 percent. Last but not least, the Plan emphasizes technological development, innovation, and promotion of environmental protection industries, in line with earlier, similar policies discussed earlier in this report.

Reduction of excess production capacity in high polluting and energy intensive industries is a key element of industrial transformation. Enforcement of environmental, energy consumption, and safety regulations are to be used to accelerate this. The Plan specifically emphasizes that “illegal construction projects” should be “firmly stopped” (paragraph 7).

A vision is articulated to promote “emerging strategic industries” focusing on new energy, energy saving, and environmental protection industries. Industrial policies should be developed to expand the domestic market and promote new business models, and “foster large companies with international competitiveness.” Related foreign investment should also be encouraged. (Paragraph 11)

It is important to note that governance and implementation receive a significant amount of attention in the plan, and can be said to include seven of the ten areas (2, and 5-10). To be sure, these sections mostly contain very general directives, such as to increase penalties for polluters, strengthen environmental protection law enforcement, improve environmental regulation capacity, clarify various priorities and responsibilities, and strengthen monitoring. Nevertheless, other sections of the plan contain more specific enforcement mechanisms such as rejection of permission for new industrial projects or specific direction for local government bodies to set particular standards. The Plan also directs the acceleration of existing efforts to strengthen and revise specific laws and policies such as the Environmental Protection Law and the establishment or revision of various standards such as for emissions and fuel consumption. Monitoring and early warning systems should be established, as well as corresponding emergency response plans for severe pollution episodes. The section on regional management in the 2013 Action Plan is fairly general and focuses on governance issues, although earlier regional frameworks (Joint Prevention and Control, and the Special Five-Year Plan for Regional Air Quality Management) discussed above were much more comprehensive including specific pollution reduction targets, industrial reform measures,

technology promotion, monitoring expansion, etc. Coordination among departments is to be strengthened, and MEP is to strengthen its guidance, coordination, and supervision. Relevant departments are directed to establish policies supporting this Plan and contribute to its implementation. The Plan ends by calling for companies to “conscientiously fulfill their social responsibilities” and to widely mobilize social participation and promote “more civilized, energy efficient, and greener consumption life styles” (paragraphs 34 and 35).

Industrial policy measures are an important governance mechanism, in line with the emphasis on industrial transformation. In particular, production capacity should be reduced in polluting industries with overcapacity. This is to be enforced by rejecting permission for new industrial projects in certain cases. Industrial location policy is also to be used to restrict high polluting industries, enforce pollution controls, and encourage the use of more environmentally friendly technology. Land use planning should be strengthened in order to minimize air pollution impacts. High polluting industrial facilities in central city zones should be relocated and refitted with more advanced environmental technology by 2017. They will be prohibited in ecologically fragile and environmentally sensitive regions.

Perhaps most significant, industrial location policy is to be linked with environmental impact assessments and energy audits (area 5). Industrial projects which do not pass environmental impact assessments and energy audits will be denied various permits and permissions, and the projects will not be allowed to move forward.

It should also be mentioned that the Plan calls for an expansion of scientific research on air pollution, including areas which in the past were considered to be sensitive, such as source analysis and analysis of the relation between air pollution and human health. The Plan specifically mentions the creation of an enterprise technology center, national key laboratory, national engineering laboratory, large-scale atmospheric photochemical simulation lab, and a large aerosol simulation lab (paragraph 8). Development of other specific pollution technologies is also mentioned including desulfurization, denitrification, dust removal, VOC control, diesel emissions, environmental monitoring, new energy vehicles, and smart grid. International technological cooperation should also be strengthened.

Overall, the 2013 Action Plan is very wide ranging and impressive on paper, and it might be expected to make a significant difference to the extent that it is implemented. Still, many or most of these measures are not really new, but are based on or extending directions and

measures developed in various other plans and policies, particularly those related to the FYP process, described earlier in this report. Nevertheless, the fact that the Premier chose to highlight these air pollution measures in a speech with wide media attention, along with the State Council's follow-up with the comprehensive 2013 Action Plan, may be considered to indicate the rising political priority of the air pollution issue, and a stronger motivation to implement concrete countermeasures.

4. Conclusion

4.1 Main Conclusions

This report surveyed the major developments in China's air pollution policies during approximately the first half of the 12th FYP period, and outlined the related legal framework and administrative structure. One key point is that the process of formulating the FYPs is one of the main mechanisms for air pollution policy development. The FYPs provide direction to the process for revising changes in laws, standards, regulations, and other policy measures and instruments for air pollution control. The Action Plan of 2013 has not been directly described as being officially part of the FYP process. However, the contents of the Action Plan are substantially similar to and build upon measures from the FYPs and other policies, so the Action Plan may be interpreted as an important step in furthering their implementation. The Action Plan has also raised the political visibility and priority of air pollution issues, and thus hopefully may strengthen the effectiveness of all of the related policies.

It is interesting that as China has moved away from the planned economy to a market economy, the planning tools and leadership promotion system from the era of the planned economy are being used to help to regulate the environmental externalities of market-led growth. Moreover, promotion of technological innovation and industrial policy to develop environmental industries is also part of the overall strategy.

A key point relating to the administrative structure is that multiple departments in different areas as well as different levels have roles in policy formulation and implementation. Thus, the system of air pollution policymaking and implementation in China is very complex, and this complexity poses a significant challenge to policy coordination (as well as conducting a comprehensive survey of China's air pollution policies).

Major recent trends in China's air pollution control policies can be summarized as follows:

Five-Year Plans. Since the beginning of the 12th FYP period in 2011, many FYPs in a wide variety of areas have been developed relating to air pollution control. In addition to the FYPs focused on air pollution, other FYPs focus on areas such as science and technology promotion and investment, promoting environmental industries, energy policy, and public

health policy. FYPs have directed the strengthening of various aspects of the environmental and Air Pollution Prevention and Control Laws, various environmental and air pollution policies, other related policies, and developing a regional air pollution management framework.

Air Pollution Prevention and Control Law. The Air Pollution Prevention and Control Law is currently in the process of being revised. One major new proposal is to establish stronger sanctions against local and regional governments and enterprises which do not meet their air pollution reduction targets by withholding approval of Environmental Impact Assessments for new investment projects.

Total Emission Control Program. This Program sets binding reduction targets for primary air pollutants for a wide range of pollutants for all levels of governments as well as major industries and companies. These targets have been strengthened since the 11 FYP.

Standards. Air quality standards have become more stringent, including ones for ambient air quality, industrial emissions, and vehicle emissions. In addition, measurement procedures and techniques (especially for monitoring) and public reporting rules have also become stricter.

Regional coordination. Regional air quality management was begun during the 11th FYP and is to be strengthened in the 12 FYP in key regions. The Regional Plan contains a wide variety of targets and other measures. Highlights include the establishment of regional coordination mechanisms, stronger targets, strengthened EIA, increased financial incentives, a large sum of money for a large collection of key projects, calls for greater environmental information disclosure, and a greater emphasis on newer pollutants such as PM_{2.5}, ozone, and VOCs. There is a major focus on directing the implementation of specific technological improvements in specific industries for specific pollutants, as well as phasing out high polluting production equipment and regional EIAs to facilitate the optimum location of polluting industries. Implementation and development of regional coordination aspect appears to be slow in practice, since there is no mechanism to enforce cooperation among relevant provinces, and consensus seems difficult to achieve on a voluntary basis. However, hopefully this will not be an obstacle to most of the specific policies of in the Regional Plan since they mainly do not depend on regional coordination, including the stronger emission targets. It appears that one main difference between TEP and the Regional Plan is that the former applies to the entire country while the latter applies stricter standards and policies to

designated key regions and city clusters.

Technology and environmental industry promotion. The Blue Sky Science & Technology Project, a special FYP co-issued by MEP and MOST, demonstrates China's commitment to strengthen research and development capacity for air pollution control. The project design is also expected to contribute to multi-pollutant control and regional air quality management. In addition, a significant amount of money has been designated to support investment in environmental protection industries, including those related to air pollution.

A comprehensive environmental health management system is currently in the initial stage of development. It aims to integrate environmental health risk assessment into environmental monitoring and early warning systems, environmental supervision and management processes, environmental impact assessments, pollution prevention and control measures, and environmental publicity and education.

Monitoring and supervision, including publication of monitoring data. Air pollution monitoring is being significantly expanded, and more monitoring data is being publicized. Quality of monitoring, including related human resource capacity building, is also planned to be strengthened. The importance of environmental criteria is being strengthened in the performance evaluation of government officials.

Air Pollution Prevention and Control Action Plan (Sept. 2013). This Action Plan, issued by the State Council, is very wide ranging with an emphasis on industrial policy measures and governance/implementation as well as an extensive collection of conventional pollution control measures. It covers much the same ground as the other policies mentioned above, but may be interpreted as the next step in their further development and implementation, as well as an indication of rapidly increasing political priority of air pollution.

Overall, China has a wide range of policies of a broad and comprehensive scope to address air pollution, and these policies are continuously being strengthened. They are very impressive on paper. Implementation, as always, is the key issue. Many new policies also recognize the implementation issue, and various governance measures are included in these policy frameworks. Still, it remains to be seen to what extent these governance measures to improve implementation will themselves be implemented.

4.2 Official Assessment of Policy Effectiveness for 2012

The most notable limitation of this report is that it does not assess the effectiveness of the surveyed air pollution policies. In fact, many of them have been newly implemented, and some of are still at the trial stage in pilot cities, so a systematic, objective assessment would be difficult.

Nevertheless, the Chinese government has made its own assessment of policy effectiveness for 2012. The results were presented in a speech by a MEP official in Tokyo, Japan, in February 2013 (Yan, 2013). The speech addressed the performance of Total Emission Control Program in 2012, and the main contents are summarized here. During the 12th FYP air pollution control policies have been greatly developed in comparison to the changes made in the 11th FYP.

In 2012, total emission reduction of 4.52 percent for SO₂ and 2.77 percent for NO_x was achieved. These reductions in NO_x and SO₂ were explained by a combination of technical and economic factors. One major factor was the overall economic slowdown in 2012. Lower production has directly reduced the emissions of SO₂ and NO_x. In particular, for SO₂ reduction, more widespread installation of desulfurization equipment made an important contribution. Over 90 percent of electric power plants and a large number of steel sintering facilities are now equipped with desulfurization technology, and good progress was made in phasing out obsolete production capacity. A number of small power plants and boilers were closed. Also 2012 was a year with plentiful rainfall which enabled expanded hydroelectric power generation, resulting in reduced reliance on thermal power plants. NO₂ emissions reduction also benefited from new installations of denitrification applied to 60 million kilowatts of electric power generation capacity, so that more than 27 percent of China's thermal power plants have installed denitrification equipment by 2012. Denitrification experiments in pilot factories were conducted in 2012, demonstrating greatly improved efficiency. In the cement industry, denitrification is now applied to 10 percent of production capacity. For motor vehicles, phase out standards for older, higher polluting vehicles were strengthened.

4.3 Future Challenges

The total emission reduction of 4.52 percent for SO₂ and 2.77 percent for NO_x during 2012

illustrates some positive progress in achieving China's 12th FYP objectives (8 percent reduction in SO₂, 10 percent reduction in NO_x). However reaching these objectives has not been enough to solve the worsening air pollution problem, which became particularly severe in early 2013 and again in late 2013, attracting continued global media attention. To be sure, after 2012, policies are on track to be steadily strengthened further, although it is not clear that this will be sufficient.

One of the main challenges is implementation. This is not a new challenge and it has long been recognized as a key issue, but it still continues. One important point is that MEP's influence over governments of provinces, autonomous regions and municipalities is still limited. Enhanced policy coordination with different government departments which rank higher in terms of institutional size and administrative scope (e.g. NDRC, MIIT, MOST, MOF) compared to MEP, may have some potential to strengthen air pollution control policy. Coordination with NDRC is especially important, since NDRC is in charge of both energy and climate policy, which are very closely related to air pollution. Moreover, the regional management system may also be intended to enhance MEP's role in strengthening regional coordination, although as discussed above, progress has been limited. Clearly, under the current structure, the central government cannot effectively manage air pollution on its own, and greater efforts from provincial and local governments based on a bottom-up mechanism are desirable. These points are recognized and addressed by the Action Plan of 2013, but the related text is still fairly general so the extent to which it will be realized remains to be seen.

To be sure, some local governments, in particular Beijing, Shanghai, and Guangzhou, are developing their own air pollution control policies and control measures; these are not reviewed in this report. However, these cities cannot manage the problem by themselves, since a significant part of their air pollution comes from neighbouring provinces, so greater domestic regional cooperation remains necessary.

Hopefully, the governance measures outlined in the 2013 Action Plan can enhance the effectiveness of implementation. Still, the extent to which these governance measures will themselves be implemented remains unclear.

Another challenge is to strengthen the scientific foundation for air pollution control in China. Already certain capability has been developed at the national level and in a few major metropolitan areas, and MEP has recently been increasing its funding for research related to

air pollution. However, more capacity building is necessary, particular in other cities and regions. Also, there are already plans to significantly expand monitoring of various pollutants, but appropriate equipment needs to be installed, and qualified technicians still need to be trained with appropriate methodologies. China's air pollution problems are growing in severity and complexity, and more advanced scientific analysis is necessary in order to improve the efficiency and effectiveness, including cost effectiveness, of the control measures. The 2013 Action Plan directs the strengthening of the scientific foundation for air pollution control in China, so hopefully progress can be made.

Appendix: Selected Translations

Administrative Regulations	规范性文件
Air Pollution Prevention and Control Action Plan	大气污染防治行动计划
Air Pollution Prevention and Control Law	大气污染防治法
Ambient Air Quality Standards	空气质量标准
Catalog for Guiding Certain Industries to Phase Out Outdated Technologies, Equipment and Products	部分工业行业淘汰落后生产工艺装备和产品指导目录
Catalog for Guiding Industrial Structure Adjustment	产业结构调整指导目录
Concentration Control	浓度控制
Department of Resource Conservation and Environmental Protection, NDRC	国家发改委资源节约与环境保护司
Environmental Impact Assessment Law	环境影响评价法
Environmental Protection Directory of Light-Duty Gasoline Vehicles	排放标准轻型汽油环保目录
Environmental Protection Law	环境保护法
Guiding Opinion for Compensation Usage of Emission Rights and Emission Trading in Pilot Cities	排污权有偿使用和交易试点工作指导意见
Informationization	信息化
Law on Promoting Clean Production	清洁生产促进法
Measures of Total Emission Index for Newly Built Industrial Projects	新建项目总量指标前置管理办法方案
Specific Standards on Pollution Discharge	行业污染排放标准
State Council Order or Decision	国务院令
State Council's Leading Group for Energy Conservation and Emission Reduction	国务院节能减排工作领导小组
Statistical and Measurement Methods for Total Emission Reduction of Major Air Pollutants during the 12 th Five-Year Plan	“十二五”主要污染物总量减排统计，监测办法
Target Responsibility System	目标责任制
Total Emission Control Program	总量控制

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