

BREAKTHROUGHS

CHINA'S PATH TO CLEAN AIR 2013-2017

CHINA AIR: AIR POLLUTION PREVENTION
AND CONTROL PROGRESS IN CHINESE CITIES

**SPECIAL
REPORT**

ABOUT CLEAN AIR ASIA

Clean Air Asia (CAA) is an international non-governmental organization that leads the regional mission for better air quality and healthier, more livable cities in Asia. Established in 2001 as the premier air quality network for Asia, Clean Air Asia has been an UN-recognized partnership.

Our headquarter is located in Manila, the Philippines, and we have offices in Beijing, China and New Delhi, India. Our network is comprised of 261 organizations around the world, including six Country Networks – Indonesia, Malaysia, Nepal, the Philippines, Sri Lanka and Vietnam.

Since 2002, Clean Air Asia has been working in China to improve air quality management and promote green transport. Clean Air Asia China Office is officially registered as a foreign NGO in China on March 12th, 2018, under the supervision of the Ministry of Ecology and Environment and the Beijing Municipal Bureau of Public Security. We will continue our work to improve air quality through capacity building, policy research and public campaigns across the country.

ABOUT THE REPORT

The “China Air – Air Pollution Prevention and Control Progress in Chinese Cities” report series are produced by CAA to objectively monitor the development and implementation of national, regional and municipal policies that are enacted since the release of China’s Action Plan for Air Pollution Prevention and Control in 2013. The annual reports also track ambient air quality status in over 300 Chinese cities and analyze city best practices. The reports facilitate civil society to support and supervise policy implementation and promote cross learning among cities. Additionally, the English version help other countries better understand China’s pathways towards clean air.

As special report of the series, this report is an attempt, from the standpoint of a third-party, to summarize and analyze major air pollution prevention and control measures and methods undertaken by China between 2013 and 2017. We hope that it can help environmental administrators of other countries and regions learn how China has accomplished so much in achieving cleaner air and provide reference for them to develop clean air action plans.

AUTHORS

CHENG Huihui
(Senior Environmental Researcher, CAA China Office)

ZHANG Weihao
(Senior Environmental Researcher, CAA China Office)

WANG Qiuxia
(Communications and Campaigns Manager, CAA China Office)

WAN Wei (Senior Technical Consultant, CAA China Office)

DU Xuan (Technical Consultant, CAA China Office)

REVIEWER

Dr. FU Lu
(China Director, CAA China Office)

SUPPORTING STAFF

GAO Yanqiu (Finance and Administration Officer, CAA China Office)

REPORT DESIGNER

LIN Qinyun / Hoover H00 (MANLYNTECH)

ACKNOWLEDGEMENT

CAA would like to express sincere gratitude to Professor HE Kebin from Tsinghua University and Mr. DING Yan from Vehicle Emission Control Center of Ministry of Ecology and Environment for their kind advice on the structure of the report and their review of the content.

We are grateful to the Rockefeller Brothers Fund and the Bloomberg Philanthropies for their financial support to the report.

PREFACE

While still maintaining economic growth over the past five years, China was able to achieve a significant improvement in air quality. In 2017, the average concentrations of PM_{10} in 338 prefecture level and above cities dropped 22.7% from 2013 levels. The average concentrations of $PM_{2.5}$ in the most air-polluted Beijing-Tianjin-Hebei region also fell 39.6% from 2013 levels. Beijing saw its annual average $PM_{2.5}$ concentrations decline from $89.5 \mu\text{g}/\text{m}^3$ in 2013 to $58 \mu\text{g}/\text{m}^3$ in 2017. Internationally, very few countries and cities that made efforts in combating heavy air pollution have achieved such significant air quality improvements in just five years.

It is worth drawing lessons from China's successes in these five years of extraordinary efforts. Summarizing and analyzing China's experiences is important, not only as a reference so China can continue improving its air quality in the next stage, but also as key lessons for other developing countries similarly plagued by air pollution problems. To this end, I am happy to see that Clean Air Asia completed this report, *Breakthroughs: China's Path To Clean Air (2013 - 2017)*.

Clean Air Asia, as a non-profit environmental protection organization, has been tracking the implementation of the Action Plan for Air Pollution Prevention and Control in China for the past five years, releasing a series of report, *China Air*, on China's progress annually. This year, Clean Air Asia wrote a special report in its *China Air* series. This report, based on a third-party standpoint, analyzes what the organization deems to be the effective and useful measures implemented by China between 2013 and 2017.

This report describes nine major measures in four categories, including science-based capacity building, key pollution source control, supporting measures, and inter-departmental cooperation mechanisms. It provides further analysis on every measure, including information on its background, major implementation practices, and key lessons from the experience.

After the State Council issued the Three-year Action Plan to Win the Blue Skies Battle (2018-2020) this June, China has entered another crucial stage in its air quality improvement efforts. This plan prioritizes addressing pollution at the source and great efforts have been made to adjust and optimize the underlying structures of industry, energy, transport, and land use. The three-year action plan requires that, by 2020, days attaining air quality standards in China's prefecture level and above cities should reach 80% of a year.

China's efforts have been focused on protecting public health, and I believe China will continue its efforts to improve air quality and attain its "blue skies" goal. In this process, I think that this report will be helpful by providing independent analysis and summarizing China's relevant experiences. With this information, I hope all stakeholders involved can continue to reflect on how China succeeded and what are the underlying causes behind the success.

For other developing countries around the world that are suffering from heavy air pollution, I hope this report can help them create and implement policies, laws, and measures that are tailored to their conditions. This way, more people can breathe clean air – there is no time to waste.

HE Kebin

Academician of Chinese Academy of Engineering
Dean of Environment School, Tsinghua University

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PREFACE

ABBREVIATIONS

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Introduction:

For 1.3 Billion Chinese to Breathe Cleaner Air

In 2013, the Chinese people suffered heavy air pollution episodes that an entire generation of people will never forget.

The same year, as this generation will also forever remember, China launched an unprecedented “battle for blue skies”.

China began its air pollution prevention and control work as early as the 1970s. At that time, the Chinese government already began stressing that its old “treatment after pollution” strategy was out of date and released China’s first enterprise emission standards. Nonetheless, meeting basic food and clothing needs of the population that accounted for one fifth of global population, was still the top priority for China, a developing country, at that time.

It was not until the air pollution episodes that appeared in 2013 that every Chinese became cognizant that the simple act of breathing could be risky. Since then, environmental issues have gained national attention and achieved an important consensus. It was obvious that, for public health, China must improve its air quality as quickly and as early as possible.

After the public outcry, the Chinese government reacted with a timely and powerful response. China began the unprecedented “battle for blue skies,” which began with the release of the Action Plan for Air Pollution Prevention and Control (the Action Plan) that was issued in 2013. If we compare China’s air pollution prevention and control to a nonstop train, we can say that, China has been, starting from 2013, moving forward at high-speed and achieving continuous breakthroughs.

From 2013 to 2017, while maintaining its economic growth, China witnessed a substantial decline in emissions of various air pollutants, such as $PM_{2.5}$. In that process, the public has benefited from the

growing number of blue sky days. Despite the fact that the air quality in many Chinese cities still failed to meet the standard set by the World Health Organization (WHO), China has created an innovative path with its continued efforts and actions. China's practices offer important lessons that can help other developing countries and cities that are similarly plagued with heavy air pollution.

This report is an attempt, from the standpoint of a third-party, to summarize and analyze major air pollution prevention and control measures and methods undertaken by China between 2013 and 2017. We hope that it can help environmental administrators of other countries and regions learn how China has accomplished so much in achieving cleaner air and provide reference for them to develop clean air action plans.

History of Air Pollution Prevention and Control in China

In 1972, China attended the first United Nations Conference on the Human Environment. This marked an important starting point in China's environmental protection efforts. Since then, China has gone through several critical stages in dealing with air pollution. The fourth stage, starting in 2010, saw the implementation of the most intensive and strictest measures in China's history of air pollution prevention and control.

• Stage I (1970-1990)

In this first stage, SO₂, CO, NO_x, and dust were the biggest contributors to air pollution in China. In response, China released its first environmental protection standard in 1973, the Tentative Standard for Discharging Three Industrial Wastes (GBJ4-73). The document contained uniform rules for waste water, gas, and residues discharged by the industrial sectors. Afterwards, China's first Ambient Air Quality Standards (GB 3095-1982) and first Air Pollution Prevention and Control Law (1987) were enacted. With these regulations in place, China had established the initial air pollution prevention and control system.

• Stage II (1990-2000)

During this stage, China's main air pollution problem was acid rain. Acid rain, which came from large amounts of coal burning and inadequate treatment, was severely harmful to forests and crops. In 1998, China created the State Environmental Protection Administration and more emphasis was put on environmental protection. That same year, China designated acid rain control zones and SO₂ pollution control zones ("Two Control Zones") and also implemented a number of measures focusing on SO₂ emissions control.

• Stage III (2000-2010)

In the third stage, China's rapid industrialization and urbanization made its pollution problems increasingly worse. Its pollution problems no longer just resulted from coal combustion, and became complex pollution from a variety of sources. In this time, China's focus on air pollution problems expanded from acid rain and SO₂ to include these other pollution sources.

In terms of policy, China started an air pollution prevention and control initiative through the Five-year Plan. During the "10th Five-year Plan" (2001-2005), the Chinese government initiated the Tenth Five-year Plan for Acid Rain and SO₂ Pollution Prevention and Control in the "Two Control Zones." With this new plan, SO₂ pollution control strategy was newly focused on controlling total emissions rather than emission concentrations.

The policy proved effective in limiting the growth of pollutant emissions. During the "11th Five-year Plan" (2006-2010), China's GDP and coal consumption continued to rise, but SO₂ emissions were reduced by 15.6%. At this time, the problem of NO_x pollution also started to get attention, so China included measures to control NO_x as part of its total emission reduction scheme during the period of the "12th Five-year Plan".

Figure 1

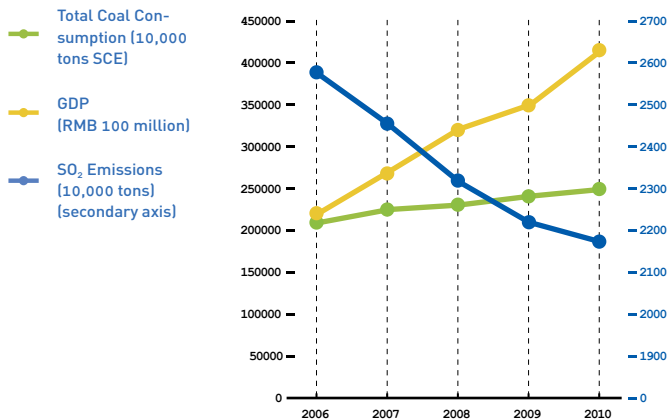
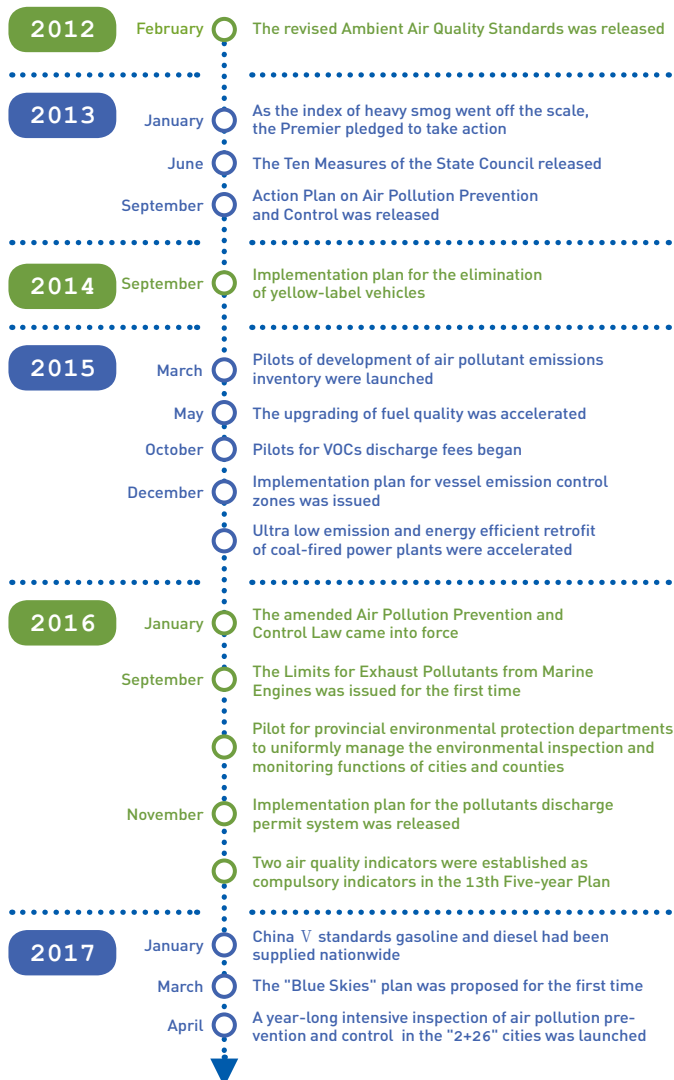
SO₂ Emissions Control During the “11th Five-Year Plan” Period

Figure 2

Air Pollution Prevention and Control Milestones since 2010



In this stage, Beijing and Shanghai took the lead in strengthening air quality management during major events like the 2008 Beijing Olympics Games and the 2010 Shanghai World Expo. The experiences from the two cities offered key lessons for later efforts, such as China’s science-based pollution control measures and regional collaboration.

• Stage IV (2010-today)

China is currently in its fourth stage for air quality management. The unprecedented smog outbreak and the release of the Action Plan were the key landmarks of this stage. Starting in 2011, China suffered from many days of heavy air pollution and the public was gravely concerned. The pollution episodes arose from a change in China’s primary air pollutants, in addition to the earlier SO₂, NO_x, and dust emissions, there appeared an even smaller particle -- PM_{2.5}.

In response to PM_{2.5}, the government was quick to incorporate PM_{2.5} into China’s ambient air quality standards in early 2012. The following year, PM_{2.5} pollution control became such an urgent issue that it became a priority for the central government. Afterwards, in June 2013, a simplified version of the Action Plan, the “Ten Measures,” which had 10 key measures for air pollution control was publicized. China had officially begun its war against air pollution.

A few months later, in September 2013, China released the Action Plan, which laid out air quality improvement targets and measures to be implemented from 2013-2017. For implementation, China’s central and local governments rolled out a range of policies, standards and measures. Step by step, China created an air pollution prevention and control system. This system’s ultimate goal is to improve overall air quality by reducing multiple pollutants’ emissions and controlling all key pollution sources. Over the past five years, China has achieved significant improvements in air quality, which has created a foundation for attaining air quality targets in the long-term.

By 2017, China’s efforts had paid off, but there is still more work to do. In 2018, China issued a new three-year plan, the Three-year Action Plan to Win the Blue Skies Battle. China’s journey to restore blue skies is not over.

Five Years of Breakthroughs

China’s policy framework for air pollution prevention and control is composed of the Action

Figure 3

Primary Air Pollutant Emissions in China

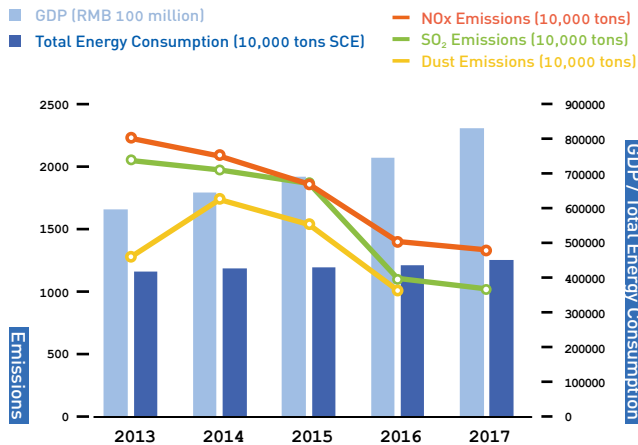


Figure 4

Annual Average Concentrations of Six Primary Pollutants in 74 Chinese Cities (2013-2017)

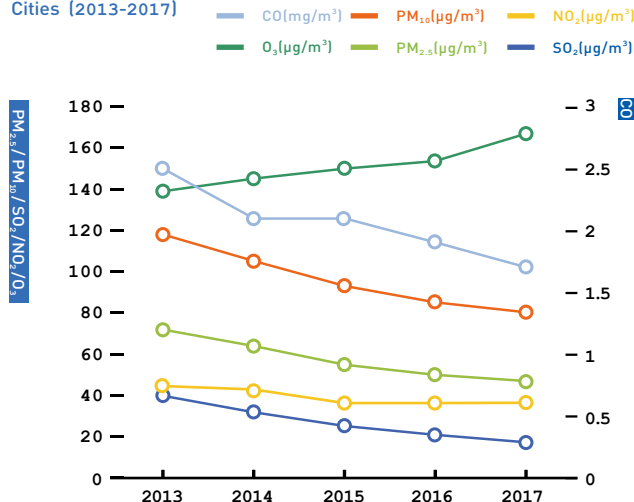
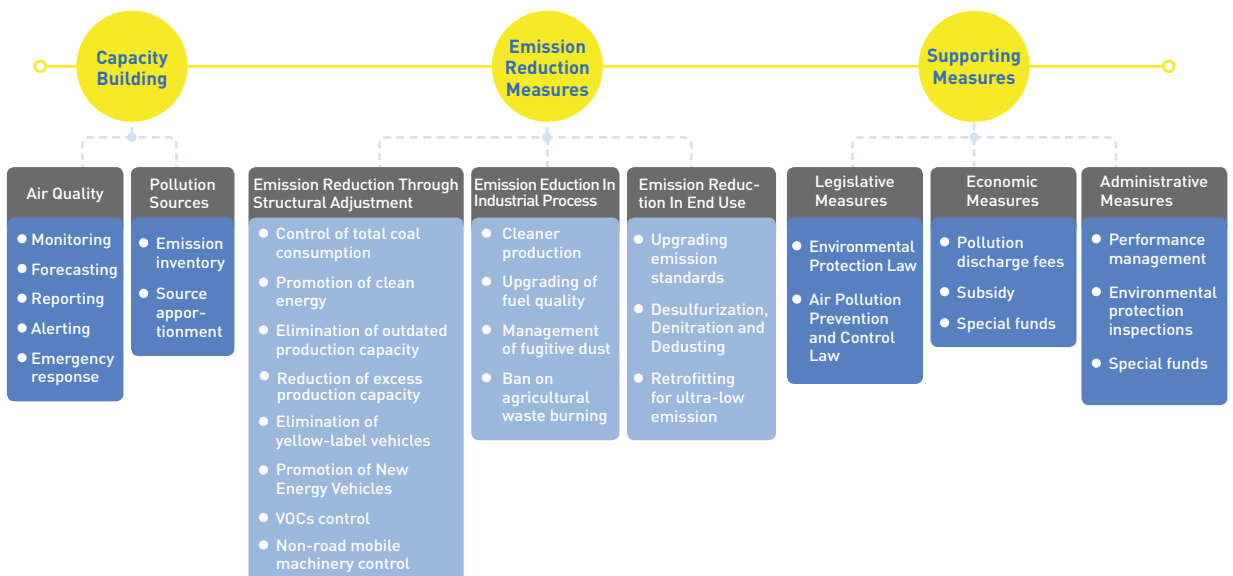


Figure 5

China's Policy Framework for Air Pollution Prevention and Control



Plan and other supporting measures. The framework has three categories of measures: basic capacity building, emission reduction measures, and supporting measures. PM_{2.5} comes from a variety of sources, including stationary sources, mobile sources, and area sources. Thus, the framework has unique measures for controlling each of these complex pollution sources. From 2013 to 2017, China prioritized emission reduction efforts for the coal, motor vehicle, and industrial sectors.

During the five-years of Action Plan implementation, China was able to maintain rapid economic growth. Most importantly, China saw an annual drop in emissions from almost all criteria air pollutants and overall air quality in Chinese cities significantly improved. Air quality data of 74 key cities in 2017 showed that the percentage of air quality attainment days increased 20.2% from 2013 levels. Among the six criteria pollutants, the concentration of SO₂ saw the biggest decline of 57.5%, followed by 34.7%, 32.2%, 32.0% and 9.1% for that of PM_{2.5}, PM₁₀, CO and NO₂, respectively. However, O₃ pollution worsened during the period, and in 2017, its average concentration of 74 cities even rose 20.1% from 2013 levels, which exceeded national standards for the first time.

In the three key regions, namely Beijing-Tianjin-Hebei (BTH) region, Yangtze River Delta (YRD) region, and Pearl River Delta (PRD) region, the percentage of air quality attainment days increased 49.3%, 16.5% and 10.7%, respectively. For the BTH region, the annual average PM_{2.5} concentrations in 2017 fell 39.6% from 2013 levels and the days of heavy pollution decreased from 75 days in 2013 to 28 days in 2017.

Over the past five years, in terms of air quality improvement, China saw significant breakthroughs. China has substantially reduced pollutant concentrations through a top-down air pollution prevention and control system. The key to China's progress lies in its efforts and innovations in the following four categories covering nine measures in total:

(1) Science-based Capacity Building

- Ambient Air Quality Standards and Monitoring
- Emissions Inventory and Source Apportionment

(2) Key Pollution Sources Control

- Coal Pollution: Total Consumption Control and Clean Use of Coal
- Industrial Air Pollution Prevention and Control
- Advancing Motor Vehicle Emission Management System

(3) Supporting Measures

- Performance Management:
Accountability Mechanisms for Local Governments
- Information Disclosure and Public Participation

(4) Inter-departmental Coordination and Cooperation

- Regional Air Pollution Prevention and Control Cooperation
- Mechanisms for Inter-departmental Coordination

This report offers a comprehensive introduction to these nine measures. It explains why each measure was put in place, introduces how each measure was designed and implemented, and summarizes the key lessons of its success. We hope that this report will provide practical information for other policymakers and practitioners working in air quality management and help readers learn how China has come so far in air pollution prevention and control.

1



SCIENCE-BASED CAPACITY BUILDING



1.1

AMBIENT AIR QUALITY STANDARDS AND MONITORING

BACKGROUND

Ambient air quality standards, which are key to public health, can determine the direction a country or region will take to improve air quality. At the beginning of the 21st century, based on the latest research on air pollution's health effects, a host of countries and regions revised their air quality standards concerning pollutants like PM, and O₃. China was primarily confronted with air pollution from coal burning before 2000. To solve the problem, the Ambient Air Quality Standards (GB 3095-1996) that were in effect at the time ("the old Standards") mostly placed concentration limits on total suspended particles (TSP), PM₁₀, SO₂, NO_x, and other pollutants.

Rapid socio-economic development has made China's air pollution feature regional transportation and multiple pollutants. Economically-developed regions saw increasingly severe PM and ozone pollution. Many places in China started to see long-lasting haze that covered a wide area in 2012 where PM_{2.5} was the primary pollutant. Pollution had aroused broad critical attention from the public. As a result, the government sped up the revision and upgrading of the ambient air quality standards.

China released new Ambient Air Quality Standards (GB 3095-2012) ("the new Standards") in 2012. The implementation of the new Standards added pollutants for monitoring, expanded the number of monitoring cities, and increased the frequency that air quality information would be publicly released. All these measures raised requirements for China's ambient air quality monitoring network. The upgrade of the ambient air quality standards and monitoring network meant the public had access to timely air quality information to make better decisions for their health protection. Eventually, it also acted as a foundation of data for other work such as municipal performance management and source apportionment in the implementation of the Action Plan.

(II). Revising Ambient Air Quality Standards

1. Creating standards that are based on the latest scientific research and aligned with international standards

Since 2000, countries and regions like the United States, the Europe Union, Japan, Britain, Canada, India, and Thailand have revised their ambient air quality standards based on the latest scientific research. Their revisions prioritized higher requirements for protecting human health and the natural environment. The revised standards in these countries increased the PM_{2.5} and 8-hour O₃ concentrations limits¹. The World Health Organization (WHO) updated the guidelines in 2005 with amendments of four typical pollutants including PM_{2.5} and O₃.

China began revision of ambient air quality standards in 2008. A key step in the revision process was to compare Chinese standards with other countries' standards. The team behind China's standards revision selected over 10 countries that updated their national standards after 2000, including the US, Canada, Australia and Japan to draw on their experiences. These standards were analyzed and compared to guide the team how to better revise Chinese standards based on China's national conditions. The new Standards include the following major changes to the pollutants that are monitored compared with the old Standards:

- Added PM_{2.5} concentration limits and 8-hour average ozone concentration limits
- Adjusted concentration limits on pollutants such as PM₁₀ and NO₂

2. Classifying monitored pollutants

The new Standards require monitoring of 15 pollutants and these pollutants are divided into three categories: six basic pollutants (PM_{2.5}, PM₁₀, SO₂, NO₂, CO and O₃), four "other" pollutants (TSP, NO_x, Pb and BaP), and five reference items (Cd, Hg, As, Cr (VI) and F). Basic pollutants are monitored in all cities across the country; "other" pollutants are pollutants that cause pollution in specific regions and should be monitored in these regions. The new Standards also added reference pollutants of heavy metal and fluoride in the appendix, which can serve as a reference for the regions that are affected by these pollutants.

The "other" pollutants and the reference pollutants do not affect all the regions in China, so they are not monitored by the national monitoring network. The information on these pollutants act as reference points for regions and cities when they develop their local standards.

3. Setting standards based on environmental function zones

The old Standards divided the function zones into three categories that corresponded to three levels of standards. This meant that the populations that lived in different function zones breathed air of different grades. This was unfair to the populations of people that lived in areas with lower standards and was also not helpful to effective implementation of the standards.

The new Standards changed previous three levels of ambient air quality function zones into two by incorporating Class III (industrial areas) in the old Standards into Class II. After revision, Class I areas include nature reserves, scenic spots, and other areas in need of special protection; Class II areas include residential areas, mixed areas (business, transport, residential), cultural areas, industrial areas, and rural areas.

Accordingly, pollutant standard limits are changed to two levels. Level I standards applies to Class I areas to protect the natural ecological environment and social material wealth; Level II standards applies to Class II areas to protect public health. Most importantly, equal treatment is given to all areas where people live, showing that public health is the key purpose of ambient air quality standards formulation.

¹ Ambient Air Quality Standards compilation group, (2011), Ambient Air Quality Standards (the second exposure draft) compilation notes.

For toxic and harmful pollutants, like Pb and BaP, the new Standards adopt unified concentrations limits rather than having different levels of standards.

4. Collecting a wide range of opinions

The new Standards were revised through three rounds of collecting opinions and over ten revision seminar discussions. The team for the standards revision collected opinions and suggestions from various stakeholders. Experts in air pollution prevention and control from a number of scientific research institutions contributed many helpful and effective revision suggestions.

To deal with the problems in the old Standards, the team for the standards revision sent letters to over 190 related departments and institutions to solicit opinions and collected opinions from the public through the website of the former MEP. According to feedback from all parties and through rounds of seminar discussions, the team finished the first draft of the new Standards.

Afterwards, the team collected opinions in two rounds again through sending letters to over 200 related departments and institutions, seeking the public feedback from the public through the former MEP website and having seminar discussions. Based on all the combined feedback, the team created the second draft of the standards and afterwards completed the final version.

(II). Monitoring

1. Building a national monitoring network

1.1 Layout of monitoring sites

The Ambient Air Quality Monitoring Norm (for Trial Implementation) ("the Norm") issued by the former MEP requires each city, based on its own conditions, determine and report the number and location of monitoring sites to the former MEP. After reviewing, the former MEP published the Plan for National Ambient Air Monitoring Network Establishment in 2012, and made public the number and specific locations of the state-controlled monitoring sites in 338 cities.

In 2013, the former MEP optimized and upgraded the Norm to be mandatory environmental protection standard. The standard is designed to guide local governments at each level to set up and manage local monitoring sites at the level of province, city, district, county and town. The standard specifies details such as the principles, requirements, number, and management processes related to the ambient air

Figure 6

Categorization and Purpose of Ambient Air Quality Monitoring Sites

Category	Scope	Purpose
City Air Quality Assessment Sites	Areas with a radius of 500m to 4km	To monitor the overall status and changes in trends of air quality in built-up urban areas
Regional Air Quality Assessment Sites	Areas with a radius of dozens of kilometers	To monitor region-wide air quality and regional pollutant transmission and the area of influence
Air Quality Background Sites	Areas with a radius of over 100km	To monitor the background levels of ambient air quality within the scope of the country or large areas
Pollution Monitoring Sites	Areas with a radius of 100m to 500m	To monitor the impact of pollution-concentrated areas (such as key stationary sources and industrial parks) on local ambient air quality
Roadside Traffic Sites	Roadsides and nearby areas that are influenced by pollution emissions from road traffic	To monitor the impact of road traffic pollutant emissions on ambient air quality

quality monitoring site layouts. The monitoring sites fall into five categories: city assessment sites, regional assessment sites, background sites, pollution monitoring sites, and roadside traffic sites (shown in the table below). In line with the standard, local governments upgraded and built over 3,000 local monitoring sites to manage local air quality.

1.2 Selection of monitoring devices

China National Environmental Monitoring Center (CNEMC) began suitability tests of automatic continuous monitoring systems starting in January 2012. The first batch of tests targeted 30 devices of 10 types of PM_{2.5} continuous monitoring systems from 10 device manufacturers. After completing these tests, the CNEMC announced the list of qualified devices. Later, the CNEMC published a list of qualified devices that passed suitability tests for automatic continuous monitoring systems for PM₁₀, SO₂, NO₂, O₃, and CO. This way, local governments have a reference when purchasing devices. The testing is completed annually and the list of qualified devices is also updated annually based on the test results and all unqualified devices are prohibited from being used for air quality monitoring.

Based on the suitability tests of the automatic continuous monitoring systems, the former MEP successively issued a series of technical specifications in 2013 to establish a technical system that is tailored for automatic continuous monitoring systems under the new Standards. These specifications include: technical requirements and testing methods for six criteria pollutants, technical specifications for installation and acceptance of the continuous monitoring systems for six criteria pollutants, as well as technical requirements and test methods for PM sampling. These standards are released and implemented to specify technical indicators and requirements of monitoring devices suitable for China, and provide technical support for Chinese cities to increase the monitoring capacity.

1.3 Building a monitoring network

The ambient air quality monitoring network was built in three stages. Cities completed the construction of state-controlled monitoring sites according to the schedule laid out by the central government. More information about the phased implementation process is listed in Figure 7.

Figure 7

Phased Construction
Process of National
Ambient Air Quality

Stage	Year	Number of Cities	City Scope	Number of Sites
Stage I	2012	74	Cities, direct-administered municipalities, provincial capitals, and cities under separate central planning in the BTH, YRD and PRD regions	496
Stage II	2013	161	74 cities in Stage I + 50 key cities under national environmental policy + 37 cities starting construction in 2012	884
Stage III	2014	338	161 cities in Stage I and II + the remaining 177 cities	1436

Prior to 2012, China's national ambient air quality monitoring network covered only 113 key cities. The 661 state-controlled sites monitored just three criteria pollutants, PM₁₀, SO₂ and NO₂. By the end of 2015, China had built 1,436 state-controlled monitoring sites in 338 cities at the prefecture level and above. These sites are required to monitor all the six criteria pollutants in the new Standards, including PM_{2.5}, PM₁₀, SO₂, NO₂, CO and O₃.

Furthermore, as the national ambient air quality monitoring network grew, the scale of local monitoring networks also continued to expand. Apart from the 1,436 state-controlled monitoring sites, local air quality monitoring sites at the levels of province, city, district, county and town were also built across the country. Within five years, the total number of built and upgraded local monitoring sites exceeded 3,000. All the sites monitor the six criteria pollutants.

The government had completed the ambient air quality monitoring network at both the national and local level. This network helps the government have an accurate understanding of China's air quality and assess local progress in air pollution prevention and control.

2. Improving quality control/quality assurance system

2.1 A shift in monitoring authority from local government to central government

The former MEP took back their authority to operate the 1,436 state-controlled monitoring sites across China in 2015. In the past, the operation of the state-controlled monitoring sites was performed by the local governments, while the air quality evaluation was done by the central government. As a result, due to pressure from being evaluated, local governments in some cities interfered with and fabricated the monitoring data. To resolve this problem, the former MEP took back their operation authority of all state-controlled monitoring sites in 2015. The shift in authority from 'Party being evaluated operates' to 'Party conducting evaluation operates' has improved the accuracy of air quality data.

As the authority over monitoring sites' operation shifted from local environmental monitoring departments to the central government, all state-controlled monitoring sites are directly managed by the CNEMC. The CNEMC is responsible for the transmission and review of state-controlled monitoring data. Local cities support their operation and maintenance, but no longer manage the data production and review. State-controlled site operation and maintenance is entrusted to third-party monitoring institutions selected through open bidding by the former MEP, without any interference from local governments.

2.2 Remote control system to increase monitoring quality

After taking back the monitoring authority, the CNEMC created a remote control system to manage state-controlled sites. The system has functions like the ability to record and detect abnormal changes in data and an alarm for abnormal functioning to increase monitoring quality. Monitoring data is produced at each state-controlled site and delivered to the city and provincial monitoring stations, and then the CNEMC, without any delay or transfer. All sites adopt unified data algorithms to ensure that the collected data is comparable, which helps to avoid errors in the data caused by different calculation methods or manual revision.

2.3 Comparing manual PM monitoring data with automatic PM monitoring data from state-controlled monitoring sites

To assess the accuracy and precision of the automatic monitoring data of state-controlled sites, cities have created a unified manual comparison system for particulate matter. Cities use a classic manual monitoring method. Manual monitoring results are compared with results from automatic monitoring and then the relative difference is calculated to assess the quality of automatic monitoring data of state-controlled sites. If the relative difference is too high and fails to reach the data quality standards, the automatic monitoring data is considered to be substandard and relevant personnel will resolve the problem in a timely manner. The data is re-examined after correction measures are put into place to ensure data quality.

2.4 Stronger supervision, stricter punishments

The central government continues to strengthen supervision over all aspects of automatic air quality monitoring and has begun imposing stricter punishments on violators to ensure objective and accurate monitoring data.

The CNEMC set up a routine mechanism to strengthen supervision over local governments. In addition, every year, the CNEMC organized experts to conduct on-site checks at state-controlled monitoring sites in 20% of cities at the prefecture level and above and the supervisors report any problems found in the checks to each province before actions for rectification are ordered. In 2016, monitoring personnel of Xi'an Municipal EPB were discovered to put cotton in the air samplers to interfere with monitoring data. In this case, seven defendants were sentenced from one year and three months to one year and ten

months in prison under the crime of breaking the government's computer information systems. These severe punishments were powerful in deterring local governments from illegally interfering with monitoring data.

For the third-party companies that work on operation and maintenance of monitoring sites, the former MEP launched a program to create a credit system for the companies. It introduced a blacklist and a market exit mechanism for violators. It also provided critical feedback to these companies and held any company fabricating data legally accountable. In 2017, the Linfen state-controlled monitoring site was interfered with repeatedly, but the third-party operation and maintenance company failed to perform its due responsibilities. They concealed the interference and fabricated data. In the end, the employees involved in the case were sentenced to eight months or six months in prison and the CNEMC terminated the service agreement with the company.

3. Establishing a system for real-time air quality information disclosure

In conjunction with building the monitoring network, within three years, China made rapid progress in upgrading and expanding real-time air quality information disclosure system. In the past, Chinese cities released the daily air pollution index (API) and monitoring results for the criteria pollutants, PM₁₀, SO₂ and NO₂. Now, these cities are able to release real-time average concentrations of all six criteria pollutants (PM_{2.5}, PM₁₀, SO₂, NO₂, O₃ and CO) hourly and the corresponding air quality index (AQI).

Furthermore, the Chinese government diversified its means of disclosure so that the public could know the information to manage their day to day lives and travel schedules. Local governments utilized EPB's official website and other means like television, Weibo and mobile applications to disclose information so that the public has timely and convenient access to air quality data.

In terms of publicizing air quality information, Beijing and Shanghai are good examples. Beijing releases real-time pollutant concentrations, AQI, and forecast and alert information from the 35 automatic monitoring sites across the city through EPB's official website. It also releases real-time information about the primary pollutant concentrations and air quality forecasts in each district through a Sina Weibo account called "Beijing Environment Monitoring." It has also developed a mobile application and official WeChat account called "Beijing Air Quality" to enable citizens to get air quality data, forecast and alert information on their phones.

Shanghai designed a cartoon depiction of "Air Baby" to show air quality data through different facial expressions and colors of the air baby image. These innovative practices have been widely praised by the public.



The new Standards have been smoothly implemented across China. Through five-years of construction, China now has the largest ambient air quality monitoring network among developing countries. This nationwide network of monitoring sites sets a leading example globally. Support from governments at all levels and all sectors of society greatly contributed to the revision and implementation of the new Standards as well as rapid development of the ambient air quality monitoring network. China's key experience are composed of the following six points:

1. Learning from international experience

When revising its ambient air quality standards, China fully learned the standards of some developed countries and WHO guidelines as well as their experiences of standards revision. By doing so, China aimed to catch up to the standards of developed countries and protect the environment and human health. The main revisions include: 1) Adding PM_{2.5} concentration limits and 8-hour average ozone concentration limits; 2) Adjusting concentration limits on pollutants such as PM₁₀ and NO₂.

2. Collecting a wide range of opinions

The new Standards revision went through three rounds of collecting opinions, respectively focusing on the problems in the old Standards, 1st draft and 2nd draft for the new Standards. During this period, the former MEP held over 10 standards revision seminars to comprehensively collect opinions and suggestions from stakeholders. Additionally, teams of experts from a number of scientific research institutions in the air pollution prevention and control field suggested a lot of helpful, feasible, and effective revisions.

3. Publishing construction plans in stages to facilitate the expansion and upgrading of the national monitoring network

Given the large number of Chinese cities and their different levels of economic development, air quality management capacity, synchronous construction of the monitoring network was not an appropriate option. For this reason, the former MEP released three-step implementation plans, i.e., 338 cities completed monitoring sites construction and implemented the new Standards in stages on an annual basis.

The implementation plan for each stage outlined the city scope, schedule, and the responsibilities of governments at each level. Specifically, EPD of each province and autonomous region, EPB of each direct-administered municipality were in charge of the overall organization and implementation work of monitoring site construction in cities under their jurisdiction, including information disclosure and the bidding, procurement, installation, and commissioning of devices.

The CNEMC formulated relevant technical requirements and provided technical guidance. During the second stage of implementation in 2013, the former MEP issued documents to urge cities to complete relevant work within the required time due to the very imbalanced construction progress among different cities.

4. Releasing technical guidelines that cover the entire construction process

Some cities that built the air quality monitoring sites for the first time lack relevant experience. Therefore, the central government had to publish technical guidelines for each component of the construction process and offer on-site technical guidance. The technical guidelines involve all aspects in the entire process of construction, including the number and location of monitoring sites, monitoring device selection, installation and operation, manual monitoring comparison, and air quality assessment. These guidelines help local governments effectively supervise the construction process.

5. Central government providing financial and capacity-building support

The 1,436 state-controlled monitoring sites across all 338 cities at the prefecture level and above were tremendously costly. The capital needed for construction was provided by both the central and local governments, with the central government bearing a larger proportion of the cost and local government offering supporting funds. Each city may apply for special funds dedicated to monitoring sites construction from the central government. For any remaining capital needs for the network's construction, local governments were required to solve the problem independently.

In total, the central and local governments invested RMB 1.82 billion (RMB 1.13 billion from the central government and RMB 690 million from local governments) on the national ambient air quality monitoring network construction for 338 cities at the prefecture level and above.

During the process of monitoring network development, the CNEMC organized and initiated specialized training courses on monitoring technology, technical operations and networking technology in relation to the new Standards. All cities dispatched technicians working on monitoring to take the courses. Within three years, the CNEMC organized over 10 sessions of training with over 1,000 participants.

Each province, autonomous region, and direct-administered municipality also organized technical training to make sure operation personnel had the adequate technical capacity to operate monitoring devices.

6. Severe punishments for violations

After the monitoring network construction was completed, a supervision mechanism was established to ensure local governments and third-party companies provide objective and authentic monitoring data.

For local governments, the CNEMC set up a routine supervision mechanism. Every year, the CNEMC organized experts to conduct on-site checks on state-controlled monitoring sites in 20% of cities at the prefecture-level and above. The experts would report problems found during the checks to each province so that actions for rectification could be enforced. Violations are punished by law.

For third-party companies, the former MEP launched a program to create a credit system. It introduced a blacklist and an exit mechanism to exclude violators from the market so that misbehaviors could be criticized and companies that fabricated data could be held legally accountable.

1.2

EMISSIONS INVENTORY AND SOURCE APPORTIONMENT

BACKGROUND

Before deciding on which air pollution prevention and control measures to use, regulators must first identify the effectiveness of different pollution control measures for different pollution sources. Emissions inventory and source apportionment are science-based tools that can be helpful in this identification process. Emissions inventory can help to identify key polluters, understand the specific status and location of the pollution, provide necessary information to evaluate potential impacts on air quality and health, and estimate the cost-effectiveness of control measures. Source apportionment is useful to understand different sources' contribution to air pollutant concentrations.

Most Chinese cities, with the exception of the mega-cities like Beijing and Shanghai, have prioritized controlling high-pollution industries for a long time. These cities first set total emissions control targets for primary pollutants and created corresponding emission reduction strategies. These practices have stunted the growth of sulfur dioxide (SO₂) and nitrogen oxide (NO_x) emissions, two pollutants with total emissions control targets.

Around 2011, PM_{2.5} pollution became a pressing problem, with more complex formation mechanism than ever before. This new and more complex situation made it impossible to control pollution with the same old strategy of focusing only on the polluting industries. Thus, in the face of these complex pollution sources, Chinese cities faced the difficult challenge of understanding their contribution to air pollution and implementing necessary targeting measures to alleviate it.

Under this backdrop, emissions inventory and source apportionment gradually gained prominence in China. Some cities and regions have already applied emissions inventory and source apportionment to developing science-based strategies for air pollution control. In addition, central and local governments are pushing forward targeted management, and promoting emissions inventory and source apportionment as a key component to air quality management.

(II) Localized Strategies in Leading Cities

Beijing and Shanghai, as economic powerhouse cities, were the first to create a science-based policy-making system for air quality management. As early as 2000, Beijing and Shanghai began to explore emissions inventory development and source apportionment. Both cities used these systems to manage air quality during major events, including the 2008 Beijing Olympics Games and the 2010 Shanghai World Expo. This allowed them to greatly improve their abilities to scientifically manage air quality.

After nearly a decade of efforts, Beijing officially launched emissions inventory work in 2011. Beijing created a work plan for emissions inventory, incorporating the development of emissions inventory into the routine duties of the Municipal Environmental Protection Bureau and its affiliated scientific research institutions and gradually formulating a series of technical specifications. In 2012, Beijing initially released the emissions inventory, which kept being updated in the following years and included more scattered and small-scale pollution sources.

For PM source apportionment, Beijing began in 2004 with single-method source apportionment targeted at coarse particles, and eventually created a complete technical source apportionment system that integrated sample collection, analysis, and modelling. In 2012, when the public was hotly debating what was “the main culprit for China’s haze”, Beijing was China’s first city to release PM_{2.5} source apportionment results. This allowed the public to understand the complexities of haze formation mechanism and acted as a scientific reference for decision-makers to enact alleviating measures.

Given the dynamic nature of the pollution sources in any region, Beijing released updated source apportionment results in 2014 as requested by the former MEP. The updated research was highly praised by leading experts for its effective locating of monitoring stations, standardized data collection, accurate analysis, scientific method, and reliable results.

Shanghai has a similar story in terms of emissions inventory and source apportionment development. In 2003, Shanghai compiled its air pollutant emissions inventory and then updated it a number of times. The inventory was made to be operational and precise and eventually covered a diverse number of emission factors and sources.

Shanghai began PM_{2.5} source apportionment in 2009 and source apportionment gradually became part of the routine work for the Shanghai Environmental Monitoring Center. Backed by an excellent foundation of data and professional teams, Shanghai eventually made groundbreaking progress in real-time dynamic source apportionment of PM_{2.5} and VOCs, outperforming other cities in China, even becoming an international leader.

Through a dedicated long-term effort, Beijing and Shanghai developed their own localized methods for source apportionment, providing valuable lessons for other Chinese cities. The key to using source apportionment to support science-based policy-making is two-fold: 1) Select methods suitable for local conditions; 2) Make local source spectrum.

These two requirements are without doubt very difficult for some cities to reach. There is a huge demand for time and resources. As other Chinese cities might be lacking scientific research capacity and capital, the lessons from Beijing and Shanghai become even more valuable. Beijing and Shanghai chose several localized methods after testing a variety of methods, and comparing advantages of different methods through years of experimentation. The way that they selected source apportionment methods and set up local source spectrum system offers important lessons to other cities.

(III) Developing Technical Guidelines for Cities

Before 2013, the majority of provinces and cities in China, except the leading cities, had failed to establish their own emissions inventory, nor conduct source apportionment. The reasons for this included insufficient technical capacity, inadequate talent and capital resources, and poor data availability. To help

cities overcome these difficulties and promote science-based policy-making, the former MEP and scientific research institutions compiled and issued technical guidelines and launched pilot programs to assist more cities with emissions inventory and source apportionment work.

In early 2013, the former MEP required environmental monitoring departments in China to conduct source apportionment and issued the Technical Guidelines for Air PM Source Apportionment (for Trial Implementation). These guidelines outlined the technical methods, result assessment and application, technical procedures, etc. for source apportionment work. These guidelines provided uniform technical methods for China's cities and important technical support for future air quality management and regional collaboration. .

In 2013, shortly after the Action Plan was published, then MEP vice-minister Zhai Qing publicly emphasized that environmental departments at each governmental level were required to set up emissions inventory by 2014. The former MEP released the following four technical guidelines for emissions inventory development in 2014:

- ❶ Technical Guidelines for PM_{2.5} Primary Source Emissions Inventory (for Trial Implementation)
- ❷ Technical Guidelines for Air VOCs Source Emissions Inventory (for Trial Implementation)
- ❸ Technical Guidelines for Air NH₃ Source Emissions Inventory (for Trial Implementation)
- ❹ Technical Guidelines for Prioritized Classification of Air Pollution Sources (for Trial Implementation)

Compared with the earlier Technical Guidelines for Air PM Source Apportionment (for Trial Implementation), the four guidelines listed above provided more detailed guidance on emissions inventory. For instance, the Technical Guidelines for PM_{2.5} Primary Source Emissions Inventory (for Trial Implementation) provides reference values for the PM_{2.5} generation coefficient of different processing techniques of stationary coal combustion sources. Furthermore, these guidelines also highlight principles for emissions inventory development, such as prioritizing local data, adjusting to local conditions, dynamic updates, and accumulating data.

(III) Initiating Pilot Programs of Emissions Inventory and Source Apportionment in more Cities

While a few cities such as Beijing, Shanghai, and Guangzhou completed source apportionment early, other Chinese cities are also beginning to catch up. The State Council required the former MEP, the Chinese Academy of Sciences, and the Chinese Academy of Engineering to create a collaboration mechanism to conduct the first phase of PM source apportionment. They released the source apportionment results for nine cities in 2014. By the end of 2017, during the five years of Action Plan, over 100 cities have engaged in source apportionment research.

In 2014, the former MEP selected pilot cities to put emissions inventory into practice, step by step, at the city level. The 14 pilot cities in the first batch included not only large cities like Beijing, Shanghai and Guangzhou, but also more representative cities in the northern, central and western regions.

After the first batch completed the pilot program, the former MEP hosted a meeting to share and summarize the experiences from the pilots. The attendees discussed the working form, experiences, and existing problems. Experts were also invited to provide suggestions for each city. This batch of pilot experiences also served as a reference for the later batches of pilot cities.

On the foundation of the pilot projects, to raise the air quality management capacity of the most polluted region, namely BTH region and surrounding areas, the former MEP further intensified source apportionment and emissions inventory efforts in the region. In 2017, the former MEP issued two plans and made clear that the 28 key cities in the region are required to adopt uniform technical methods and processes to set up urban air pollution emission inventories, including more refined inventories at the district and county level. Technical and professional support from experts was also available to each city. These

efforts played a significant role in improving the air quality of these cities during autumn and winter. As the cities' management and technical personnel obtained many learning opportunities, local technical talent was also able to greatly improve.

Results of source apportionment for cities like Beijing, Shanghai and Guangzhou revealed that in these megacities, motor vehicle pollution, regional transmission, and coal burning are the main air pollution issues. In light of this conclusion, the municipal governments of these cities clarified key measures to implement the Action Plan. These key measures include yellow-label and outdated vehicle elimination, updating standards of vehicle emission and fuel quality, total coal consumption control, setting high-polluting fuel burning ban zones, and regional collaboration on air pollution prevention and control.

Most importantly, as motor vehicles are the biggest contributors to local pollution in these cities, motor vehicle control was regarded as the top priority. For example, the emissions inventory released by Beijing in 2014 indicated that motor vehicle emissions were responsible for 31.1% of local PM_{2.5} pollution, ranking the first among all pollution sources. Hence, the city put driving restrictions for motor vehicles as a key measure in the emergency response plan for heavy air pollution days. Based on Shanghai's 2014 source apportionment, eliminating yellow-label vehicles would significantly reduce black carbon and NO_x concentrations.

A number of cities in northern China differ from Shanghai and Beijing, where coal emissions are the biggest pollution source of local air pollution, especially in the cold regions that have a long heating season, such as Heilongjiang Province. According to the results of the PM₁₀ and PM_{2.5} source apportionment in 13 cities of the province, in 2016, their biggest emitter of PM₁₀ and PM_{2.5} was coal combustion from stationary sources, accounting for 30% of the total emissions. Coal burning contributed to 36.0% of the PM_{2.5} emissions in Harbin, and its contribution to pollution emissions during the heating season was notably higher than the non-heating season. Therefore, northern provinces and cities have prioritized special measures for the heating season and consider coal-fired boiler elimination and clean coal utilization as key measures for local air pollution prevention and control.

(IV) Building Professional Teams and Inter-departmental Cooperation Mechanisms

Pollution source apportionment in Beijing, Shanghai and other large cities is usually conducted by local scientific research institutions, such as local research academy of environmental sciences and environmental monitoring centers. However, second and third-tier cities at the early stages with no technical capability tend to partner with experts from institutions and universities and then gradually cultivate their own talent. More and more cities have set up a stable core team and standardized their operational procedures. This way, they can consistently increase the efficiency of emissions inventory development and operate continuously.

These teams often have core technical experts who understand the demands of pollution management while also having expertise in air pollution. The teams also usually include professionals from various fields, including sample collection and analysis, quantitative modelling, and quality control. Yet, the core teams sometimes still need to cooperate with external labs and scientific research institutions for additional help and analysis.

Developing emissions inventory requires mass amounts of information and data, often from a wide assortment of departments. Hence, it is necessary to create a mechanism for inter-department cooperation. In Chinese cities, environment management departments usually provide information of Environmental Impact Assessment, pollution discharge permit, and total emission data. In contrast, commissions, offices and bureaus for transport, housing and rural-urban development management, and agriculture manage basic polluter information and provide data on motor vehicles, vessels, construction sites, livestock and poultry breeding, etc. Moreover, all kinds of industry associations have data on pollution sources such as construction machinery and coatings. Finally, data on special pollution sources like biogenetic emissions is mainly collected by scientific research institutes.

Chinese cities created technical expert teams to ensure high-quality data for emissions inventory. The expert teams manage the entire process from data collection and calculations to result output and verification and ensure the results are accurate and reflect real situation.

SUMMARY OF EXPERIENCE

1. Formulating National -level Technical Guidelines

Air pollutant emissions inventory and source apportionment are technical tasks that require long-term, complex, and systems-based work, making it necessary to have clear technical requirements and scientific rules. Hence, corresponding technical specifications at the national level are extremely important. The series of guidelines that the central government issued offer cities quick access to basic knowledge and information in developing emissions inventory and conducting source apportionment. The guidelines also provide uniformity to ensure that results from different cities and regions are comparable and able to be cross-referenced.

2. Fostering Close Cooperation with Scientific Research Institutions

Strengthening technical exchanges and cooperation between city air quality management departments and scientific research institutes is important. Universities and scientific research institutes can help with improving and innovating on modelling methods, while environment protection departments possess solid technical capacity in the monitoring of atmospheric environment and pollution sources. Through closer technical cooperation, these two types of institutions are able to draw on each other's strengths and constantly integrate new technologies into the technical system of science-based policy-making.

3. Establishing Long-term and Stable Inter-departmental Cooperation Mechanism

Multiple departments from different sectors need to provide data and information to develop emissions inventory and conduct source apportionment. Only when environmental and non-environmental departments establish a long-term mechanism for cooperation can there be proper data acquisition and regular data updating.

For Beijing and Shanghai, the inter-departmental cooperation mechanisms for emissions inventory and source apportionment have become mature. Under these mechanisms, transport, agricultural, and other departments provide environmental protection departments with regular information and data of pollution sources. This information and data is updated with a fixed format for convenient import and use in the emissions inventory by the environmental protection departments. To make cooperation mechanism properly function, staff from non-environmental departments should be trained to put more emphasis on data and information acquisition and sharing.

Finally, because emissions inventory relies on data aggregation from a large number of sources, maintaining data quality is absolutely vital. Quality control, data verification and data review must be properly done within each department related to development of emissions inventory and source apportionment.

2



KEY POLLUTION SOURCES CONTROL



2.1

COAL POLLUTION: TOTAL CONSUMPTION CONTROL AND CLEAN USE OF COAL

BACKGROUND

Coal can drive economic development, but also results in air pollution. Coal combustion produces air pollutants such as PM, SO₂, NO_x, and greenhouse gases such as CO₂; these pollutants threaten urban environment and human health. In the 1980s, China suffered from acid rain resulting from coal combustion, but later brought it under control through limiting SO₂ emissions.

In recent years, industrialization and urbanization have made coal, motor vehicles, and industries major sources of PM pollution in China. PM source apportionment results show that coal combustion contributes to 20% to 50% of local air pollution in Chinese cities. Particularly during the heating period in winter, northern cities in China get more pollution from coal combustion. During the winter in Beijing, typically a time of heavy pollution, coal consumption is responsible for as much as 60% of the air pollution.²

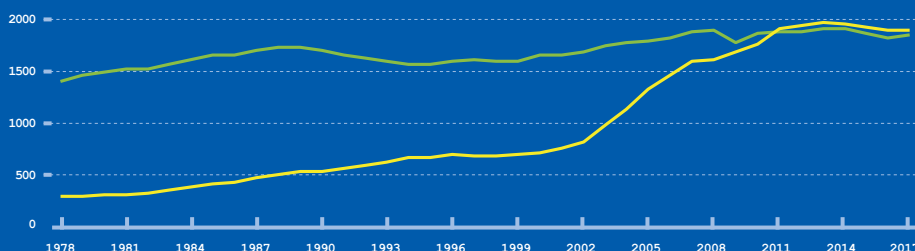
The sub-optimal structuring of energy consumption and the industries is the fundamental reason why coal contributes to such a disproportionate amount of pollution in China. Coal accounts for over two thirds of total energy consumed. Moreover, the industrial sector is dominated by heavy industry and this further worsens the pollution from coal, especially in the BTH region where PM_{2.5} pollution is the most severe. Additionally, the use of coal is not clean, which also makes emissions worse.

Within the ten major initiatives of the Action Plan, one is targeted at coal pollution. This initiative aims to reduce the emissions from coal combustion through industrial structural adjustments, end-of-pipeline (EOP) treatment, clean energy promotion, and other measures. During the five-year implementation of the Action Plan, these measures have been implemented effectively, especially the measures that concern total coal consumption control and clean use of coal. All of this has contributed to achieving the goals of the Action Plan.

Figure 8

Total Coal Consumption of China Compared to the World (1 million tons of oil equivalent; 1 ton oil equivalent=1.5 tons of hard coal)³

■ China
■ Other countries



² Portal website of the central government, January 11, 2016, http://www.gov.cn/xinwen/2016-01/11/content_5032147.htm.

³ BP Statistics Review of World Energy 2018, British Petroleum, <https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy/coal/coal-consumption.html>.

(II) Total Coal Consumption Control

In order to reduce coal pollution from the source, China must control total coal consumption. The Action Plan requires the structure of energy consumption and industry to be optimized simultaneously to reduce coal consumption. The concrete measures include shutting down outdated coal-fired boilers, cutting production capacity in energy-intensive and high-polluting industries, and replacing coal with clean energy. The Action Plan aims to reduce the share of coal consumption in the energy structure to below 65%, increase the proportion of non-fossil fuel energy consumption to over 13%, and achieve negative growth of coal consumption in the BTH, YRD and PRD regions by 2017.

Due to the efforts of the past five years, China has effectively controlled total coal consumption. Since 2014, for three years consecutively, China has seen a drop in total coal consumption, although there was a slight rise in 2017. The proportion of coal consumption in energy structure in China decreased from 68.4% in 2012 to 60.4% in 2017. The proportion of non-fossil fuel energy rose from 9.4% to 13.8% during the same period. Therefore, China has exceeded the targets of the Action Plan.

Figure 9 (left)

The Process of Optimization for the Structure of Energy Consumption in China

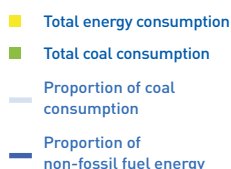
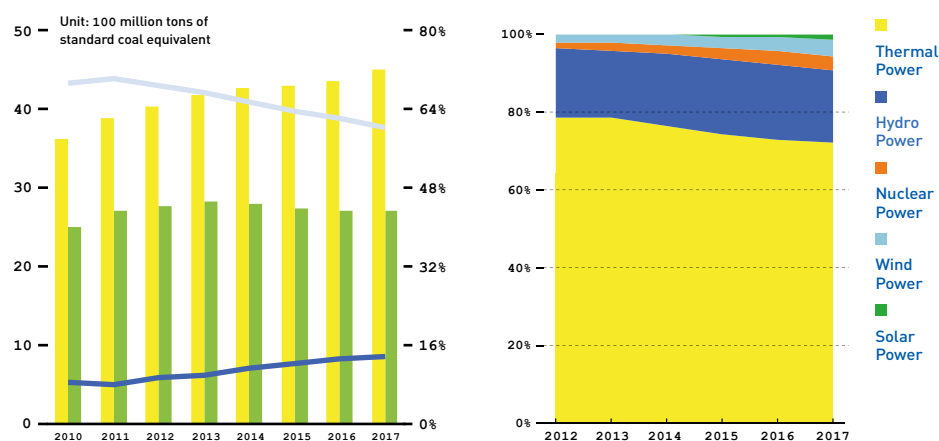


Figure 10 (right)

The Process of Optimization for the Power Sector Structure in China



Note: The total coal consumption data for 2017 is an estimate by CAA.

The achievements outlined above are due to the following measures:

1. Reducing Production Capacity of Energy-intensive and High-polluting Industries

During the implementation of the Action Plan, China optimized its industrial structure by reducing production capacity in energy-intensive and high-polluting industries (the "Two High Industries") to limit coal consumption. There are two ways to reduce production capacity – one is to reduce outdated and excess capacity, and the other is to limit new capacity.

In terms of reducing existing industrial capacity, China has accelerated the elimination of outdated capacity in iron and steel smelting, cement, plate glass, and other major industries⁴. China has also required that elimination tasks scheduled for completion in 2015 to be accomplished one year before originally planned. Since 2016, China has prioritized the iron, steel, and coal-fired power industries in terms of reducing excess production capacity.

To control the growth of new capacity, China has required that new projects, expansions, and renovations must offset the equivalent or more of the outdated or excess capacity. This means that, before any company can have new projects being built, an equal or higher amount of outdated and excess capacity must be eliminated.

⁴ Iron and steel smelting, coke, calcium carbide, ferroalloy, electrolytic aluminum, copper, lead and zinc smelting, cement, plate glass, papermaking, alcohol, monosodium glutamate, citric acid, tanning, printing and dyeing, chemical fiber and lead storage battery, etc. The standards for elimination are based on the Catalogue for Guiding Industrial Restructuring (Version 2011) [Amendment] issued by the NDRC.

For iron and steel, cement, plate glass, and electrolytic aluminum industries that are plagued with over-capacity, the MIIT has put forward calculation methods to guide cities in eliminating outdated or excess capacity. Furthermore, the MIIT has set tighter regulations for the BTH, YRD and PRD regions, requiring that new projects in the three key regions must offset higher amount of existing production capacity than production capacity newly added.

Policies directly forcing enterprises to dismantle workshops and facilities has caused some suspicions of whether or not those policies are legal. Given this, China has improved the standards for energy consumption, emission, and technology in relevant industries to accelerate the transformation of the “Two High Industries”.

For example, in terms of emission standards, China respectively raised the emission standards from 2011 to 2013 in plate glass, steelmaking, ironmaking, and other industries.

China also set the special limitation for air pollutants for these industries located in key regions. Meanwhile, in terms of steel, cement, and other sectors that are exceeding industrial standards for energy and electricity, the government has increased their pollution discharge fees and prices for electricity and water.

Figure 11

Examples of Outdated and Excess Capacity Elimination in Energy-Intensive Industries

	2012-2015	2016-2017
Steelmaking (10,000 Tons)	6640	12000
Ironmaking (10,000 Tons)	5897	No data
Cement (10,000 Tons)	50000	
Plate glass (10,000-Ton Standard Weight Box)	14000	

For the enterprises with capacity elimination, the government has created special incentive and compensation funds to support these enterprises in staff resettlement and industrial transformation.

During the implementation of the Action Plan, the capacity of the “Two High Industries” was significantly and effectively reduced to reduce coal consumption. From 2012 to 2016, six energy-intensive industries eliminated the use of 590 million tons of standard coal equivalent and energy consumption per unit of industrial-added value reduced by 22.2 percent.⁵

2. Eliminating Outdated Coal-Fired Boilers

In China, around 70% of coal use is for power generating boilers and industrial boilers. Some coal-fired boilers have small capacity, high coal consumption, low combustion efficiency, and pollutant emission levels that fail to comply with emission standards. Enterprises with these boilers are better off replacing them with central heating system, which is also better for lowering emission levels. Therefore, eliminating this class of boilers has been a preferred measure in China.

At the very beginning, the government was able to set up clear criteria for elimination. For example, the NDRC set an elimination criterion for coal-fired generating units in 2016, concentrating on such factors as energy-savings, environmentally-friendly renovations, net coal consumption rate in power supply, and whether or not the units comply with emission standards (as shown in Figure 12). For industrial coal-fired boilers, criteria for eliminating existing boilers in different regions varied.

Figure 12

Elimination Criteria of Coal-fired Generating Units

Elimination Criteria	Requirements for Capacity of the Units to be Eliminated
Pure condensing coal-fired generating units without feasibility for heating system retrofitting	Units with unit capacity of less than 50,000 KW, units covered by bulk power system with less than 100,000 KW or units that are expiring with less than 200,000 KW
Retrofitted generating units that do not meet the net coal consumption rate requirements in power supply	Retrofitted generating units fail to meet the net coal consumption rate specified by the Norm of Energy Consumption per Unit Product of General Coal-Fired Power Set (GB21258-2013), except ultra-supercritical units
Generating units that fail to comply with emission standards and do not meet the retrofitting qualifications.	A focus on pure condensing generating units that have been in operation for 20 years with unit capacity of less than 300,000 KW and extraction condensing turbines that have been in operation for 25 years.

⁵ National Bureau of Statistics, July 2017, <http://dangjian.people.com.cn/n1/2017/0711/c412885-29397064.html>.

To help the enterprises that had to eliminate boilers meet their energy needs, the government has recommended that they either use electricity from large power plants or install clean-energy boilers. In this process, local governments also provided various levels of compensation funds to encourage the elimination of outdated coal-fired boilers.

Eliminating coal-fired boilers has seen smooth progress. Based on conservative estimates, from 2011 to 2017, China was able to eliminate energy-intensive and high-polluting thermal power generating units that totaled at least 40 million KW of capacity. Since 2017, built-up areas in 338 prefecture-level and above cities eliminated over 200,000 small industrial coal-fired boilers with a capacity of 10 t/h or less to achieve the targets of the Action Plan.

Elimination of coal-fired boilers has made a significant impact on reducing coal consumption and emissions. For instance, from 2013 to 2017, Beijing eliminated and retrofitted coal-fired boilers that had a total capacity of 39,000 t/h, reducing coal use by nearly 9 million tons. This in turn reduced about 6,600 tons of SO₂ and 5,500 tons of soot emissions annually.⁶

3. Adopting Clean Energy

In the long term, adopting clean energy is necessary to optimize China's energy consumption structure. In implementing the Action Plan, China focused on the pollution control of scattered coal used by industrial boilers and households. One solution is to replace scattered coal with clean energy.

Transforming to clean energy is one of the alternatives for industrial coal-fired boilers for which elimination is not suitable. For example, coal-fired boilers can be transformed into gas-fired ones. At the central level, the government recommended using gas-fired boilers as an alternative for coal-fired ones. At the city level, the local governments implemented substitutions for scattered coal that were tailored to local considerations (such as local energy demand and supply needs).

For example, when advancing the clean energy transformation of industrial coal-fired boilers, the Shanghai city government encouraged the enterprises to replace coal with one or several kinds of clean energy, including natural gas, electricity, central heating, heat pumps, and solar power. In terms of technical problems during the retrofitting process, the Shanghai government took the lead in hosting conferences for multiple stakeholders to offer comprehensive one-stop solutions for the enterprises. To further encourage the enterprises, Shanghai also optimized the mechanism for subsidies: the earlier an enterprise completes a clean energy transformation, the higher the subsidy it can get. In 2015, Shanghai reduced 2.85 million tons of coal consumption in total, a key success in its quest to substitute clean energy for coal-fired boilers and industrial kilns.⁷

Household use of scattered coal is a challenge in controlling air pollution during the autumn and winter in northern China. In this regard, in addition to pushing the replacement of inferior coal with high-quality bulk coal and promoting clean cook stoves, the government focused on advancing the shift from "scattered household coal to electricity" and "scattered household coal to gas". For households that use traditional coal-fired heating, the government recommended technologies of electric heaters and natural gas, and provided funding subsidies to purchase equipment, electricity bills, and natural gas bills, to compensate for the additional cost of using electricity or gas to encourage households to transform.

In the BTH region alone, about 4.74 million households completed the "shift from coal to electricity" and the "shift from coal to gas" in 2016 and 2017, replacing a total of 12 million tons of scattered coal, which accounted for nearly 30 percent of the region's scattered coal consumption. Scattered coal control decreased the average PM_{2.5} concentration by 21% in the region, and this was up to a decrease of 30% in Hebei in the region.⁸

(II) Clean Coal Use

Despite the continued rise in the use of clean energy in China, coal will still remain China's major energy source for a period of time. Therefore, in order to improve air quality, it is imperative to improve the efficiency and clean use of coal. China is undertaking two main strategies to increase "clean coal use": one

⁶ Beijing Municipal Environmental Protection Bureau, November 20, 2017, <http://www.bjepb.gov.cn/bjhrb/index/tpxw/824606/index.html>.

⁷ Shanghai Economic and Informatization Commission, January 14, 2016, <http://www.sheitc.gov.cn/gdyt/669009.htm>.

⁸ Feng Xiangzhao, June 20, 2018, http://www.sohu.com/a/236798140_760848.

is to increase the proportion of “thermal coal” and the other is to reduce emissions from coal-fired boilers.

“Thermal coal” is coal that is used for power generation. Only about half of China’s coal is used for power generation, much lower than the average of 80% in developed countries. With a higher level of combustion efficiency and lower pollutant emissions, thermal coal is relatively more efficient and cleaner than scattered coal used in industrial boilers and households. China has set a goal to increase the proportion of thermal coal in coal consumption to more than 60% by 2020 to make coal use cleaner and more efficient.

On this basis, reducing emissions continuously from power generating boilers and industrial boilers, has become a major strategy for China. Especially for thermal coal, China is now a world leader in reducing the emissions level of coal-fired power plants. In addition, China has also strengthened coal quality management and information disclosure on emissions from coal combustion enterprises. The information disclosure strategy will be described in detail in the section of the report entitled “Information Disclosure and Public Participation”.

1. Achieving Ultra-low Emissions in Coal-fired Power Plants

Due to its large coal consumption, the power industry became the focus of China’s EOP treatment. In 2012, the industry consumed nearly 50% of the coal in the country, and its emissions of pollutants such as soot, SO₂, and NO_x accounted for 12.2%, 41.7% and 40.6 % of the country’s total, respectively. During the implementation of the Action Plan, China tightened the emission standards for coal-fired power plants and required the plants to also apply desulfurization, denitration, and dedusting technologies as well as to achieve ultra-low emissions, all to significantly reduce the emissions levels of coal-fired power plants.

In 2011, after tightening emission standards five times, China already led the world in terms of emission standards⁹ for coal-fired power plants. The new emission standards not only tightened the emission limits of soot, SO₂, and NO_x, but also imposed special limitation for air pollutants in key regions, which are stricter than the current emission standards in Europe and America (Appendix I).

Figure 13
Emission Limits
of Coal-fired
Generating Units
(unit: mg/m³)

	Targeted Units	Soot	SO ₂	NO _x
Air pollutant emission standards in coal-fired power plants	Existing coal-fired generating units	30	200	100
	New coal-fired generating units	30	100	100
	Coal-fired generating units in key regions	20	50	100
	Natural gas-fired generating units	5	35	50
Ultra-low emission limits		10	35	50

In order to meet the increasingly strict emission standards, EOP treatment facilities in China have been widely promoted and used in power plants. As early as 2011, the installation rate of dedusting facilities for coal-fired generating units in China reached nearly 100%.¹⁰ During the implementation phase of the Action Plan, the installation rate of desulfurization and denitration facilities for coal-fired generating units also increased significantly. From 2010 to 2017, the proportion of generating units installed with flue gas denitration (DeNox) facilities in China increased from 12% to 98.4%, and the proportion of units installed with flue-gas desulfurization (FGD) facilities rose from 83% to 95.8%. The remaining 4.2% of coal-fired generating units also removed sulfur compounds during combustion.

⁹ Applicable to coal-fired power boilers with a single unit capacity of more than 65t/h.

¹⁰ The State Council, China’s Energy Policy 2012 [White Paper], http://www.gov.cn/jrzq/2012-10/24/content_2250377.htm.

Figure 14

Installation Rate of
EOP Treatment
Facilities for
Coal-fired Generating
Units in China

	Desulfurization		Denitration	
	Capacity of units (one hundred million of KW)	Proportion in China's coal-fired generating units	Capacity of units (one hundred million of KW)	Proportion in China's coal-fired generating units
2010	5.3	83%	0.8	12%
2013	7.15	91%	4.3	55%
2017	9.4	95.8%	9.6	98.3%

In 2014, China required new and existing¹¹ coal-fired generating units to achieve ultra-low emissions. Hence, China's coal-fired power plants entered the era of "ultra-low emissions". Ultra-low emission is making "burning coal as clean as burning gas." This means that the concentration of soot, SO₂, and NO_x discharged by coal-fired generating units (under the condition that the oxygen content is less than 6%) is lower than 10 mg/m³, 35 mg/m³, and 50 mg/m³, respectively, which is the emission level of gas-fired generating units.

On a regional basis, the government required existing coal-fired generating units to retrofit to ultra-low emissions in phases. The government also required utilities in different regions to complete the retrofit of 580 million kilowatts nationwide by 2020. Under the pressure to control air pollution, some provinces and cities have incorporated ultra-low emission limits into their revised emission standards for local coal-fired power plants.

The government has also introduced multiple incentive policies to promote ultra-low emissions of power plants. These incentives include support for electricity purchase prices, electricity generation volumes, differentiated pollution discharge fees, and other government funding incentives and subsidies. Details on the specific policies can be found in Figure 15.

Figure 15

Government Incentive
Policies for Ultra-low
Emission Conversion

Policy	Details
Increasing electricity purchase prices	The government increases purchase prices for collectively-purchased grid power. For existing generating units built before January 1, 2016, one cent was additionally incentivized per kWh. For newly-built generating units after that, 0.5 cents was additionally incentivized per kWh.
Enabling higher electricity generation volumes	The government enables power plants with ultra-low emissions to generate more power through power generation dispatching.
Differentiated pollution discharge fees	When a power plant's pollutant emission concentrations are below 50% of the emission limits mandated by the country or province, pollution discharge fees are halved.
Awards and subsidies	The government provides subsidies or awards to encourage utility companies to achieve ultra-low emissions. For instance, Shaanxi province offered a subsidy of RMB 100,000/10,000 kWh to generating units in the Guanzhong Area. Gaomi, Shandong province, granted an award as high as RMB 300,000/10,000 kWh to coal-fired generating units achieving ultra-low emissions before the end of October 2016.

Coal-fired power plants smoothly progressed in ultra-low emission conversions and had notable emission reduction results. By the end of 2017, a total installed capacity of 700 million kilowatts have been retrofitted to achieve ultra-low emissions, which accounted for over 70% of the total capacity of China's coal-fired power generating units. This means that China achieved the target of "retrofitting coal-fired power plants with a capacity of 580 million kilowatts by 2020" two years ahead of schedule.¹²

¹¹ Existing coal-fired generating units refer to public coal-fired generating units with a capacity of 300,000KW or more and self-provided ones with a capacity of 100,000 KW or more.

¹² China Electricity Council, 2017 Overview on China's Electric Power Development, <http://www.ccoalnews.com/201806/15/c78653.html>, China Power 2017.

Emission intensities of power plants have been significantly reduced. From 2012 to 2017, soot, SO₂ and NOx emission intensities of thermal power plants saw a sharp decrease, from 0.39g/kWh, 2.26g/kWh and 2.4g/kWh in 2012 to 0.06 g/kWh, 0.26 g/kWh and 0.25 g/kWh, respectively, in 2017.¹³ In 2017, China's soot, SO₂ and NOx emissions from power generation declined to 0.26 million, 1.2 million and 1.14 million tons, respectively.¹⁴

2. Increasing Emission Standards for Industrial Coal-fired Boilers

Industrial boilers¹⁵ are the second-largest coal consumer and air pollution emitter after coal-fired power plants. Over 80% of China's existing industrial boilers are coal-fired. In 2012, there were 467,000 existing coal-fired industrial boilers in China. These boilers consumed around 700 million tons of raw coal each year, accounting for more than 18% of total coal consumption in China. Moreover, their soot, SO₂ and NOx emissions made up 33%, 27% and 9%, respectively, of total emissions in China.¹⁶

To regulate industrial coal-fired boilers, China has undertaken EOP treatment in addition to eliminating small boilers and substituting clean energy for coal-fired boilers. Newly-built and installed coal-fired boilers with a capacity of 20t/h and above must install high-efficiency desulfurization and dedusting technologies, and in-use coal-fired boilers with a capacity of 10t/h and above must have desulfurization, dedusting, and low-nitrogen combustion technology.

In 2014, China released its strictest-ever air pollutant emission standards for boilers¹⁷. The new standards tightened the soot and SO₂ emission limits on new coal-fired boilers by 75% and 67% to 30mg/m³ and 200mg/m³, respectively. Moreover, the new standards set NOx emission limits on coal-fired boilers (at 300mg/m³) for the first time and they also set special limitation on boilers in key regions, as shown in Figure 16:

Figure 16
Coal-fired Industrial
Boiler Emission Limits
(Unit: mg/m³)

	Soot	SO ₂	NOx
Existing coal-fired boilers	80	400	400
New coal-fired boilers	50	300	300
Boilers in key regions	30	200	200

Improving coal quality is an important measure for clean utilization of coal since inferior coal causes more pollutant emissions. Coal selection can help reduce sulfur and ash content in coal and improve the coal utilization efficiency. This means that improving coal quality in the production and processing phases is an important tactic. Between 2013 and 2017, China's coal selection rate rose from 57.1% to 70.2%, achieving its set target of "a 70% coal selection rate by 2017."

China also improved the quality control for coal being sold and used. In January 2015, China conducted whole-process quality control for commercial coal, including the phases of production, processing, transport, sales, import, and use. The government also banned brown coal that had over 30% ash content and over 1.5% sulfur content.

Governments also implemented stricter measures in the BTH, YRD and PRD regions, where the sale and use of scattered coal with over 16% ash content and over 1% sulfur content was prohibited.

These management rules were the first mandatory coal quality requirements set by the Chinese government. These rules held enterprises responsible for coal quality, and also provided a basis for supervision by government departments.

Moreover, China created forbidden zones for highly polluting fuels that banned the use of coal with levels of sulfur and ash content that were too high. In 2017, the former MEP released a high-pollution fuel

¹³ China Electricity Council, 2017 Overview on China's Electric Power Development, <http://www.ccoalnews.com/201806/15/c78653.html>, China Power 2017.

¹⁴ Ibid.

¹⁵ Applicable to coal-fired boilers with a single unit capacity of 65t/h or less.

¹⁶ The NDRC, October 29, 2014, http://www.ndrc.gov.cn/zcfb/zcfbtz/201411/t20141118_648367.html.

¹⁷ Applicable to coal-fired boilers with a single unit capacity of 65t/h or less.

directory. According to the new Air Pollution Prevention and Control Law, city governments can designate forbidden zones for highly polluting fuels in their cities. For instance, in some cities located in the middle and western China, local governments banned a number of boilers from using coal with over 10% ash content and over 0.5% sulfur content to decrease coal pollution.

Figure 17

Partial Coal Quality Control Requirements in China

Coal Types and Coal Products	Sulfur Content	Ash Content
Commercial coal (brown coal)	≤1.5%	≤30%
Brown coal with a transport distance exceeding 600km inside China	≤1%	≤20%
Scattered coal in the BTH, region and surrounding areas, YRD and PRD	≤1%	≤16%
Coal and coal products in some forbidden zones for highly polluting fuels	≤0.5%	≤10%

SUMMARY OF EXPERIENCE

China was able to achieve effective coal pollution control after the implementation of the Action Plan. The key experience is summarized as follows:

1. Controlling total coal consumption using “top-level design”

Decreasing total coal consumption is a necessary measure to control coal pollution. China, however, faces huge challenges in reducing coal consumption. A major reason is that coal consumption control not only requires strong political determination, but also faces resistance from industries, enterprises, and local governments, especially given that China’s economic development has long been dependent on coal. In the face of this reality, China started using top-level design to employ administrative orders in a top-down manner to advance total coal consumption control efforts nationwide.

At the central level, the Chinese government set total coal consumption control targets, specified major reduction measures, and ordered relevant commissions and ministries to formulate detailed supporting rules. These targets and tasks are assigned to local governments and enterprises from all industries through a multi-tiered mechanism. During the five years of implementing the Action Plan, China saw negative growth in coal consumption, with total coal use reduced by 90,213,500 tons by Beijing, Tianjin, Hebei province and Shandong province alone. Top-level design is the core driving force behind these huge reductions.

2. Raising emission standards and propelling enterprises to technology upgrade

Clean coal utilization is crucial to decrease coal pollution in a short period of time. China raised air pollutant emission standards targeted at coal-fired power generating units and other coal-fired boilers. These standards include special limitations on air pollutants in heavy-pollution regions and ultra-low emission limits for large generating units. Using these tightened emission standards, the government required power plants and boiler-using enterprises to install and upgrade EOP treatment facilities.

By 2017, all of China’s coal-fired power generating units installed dedusting facilities and removed sulfur compounds either during or after the combustion (FGD). Moreover, the installation rate for flue gas denitration facilities increased to 98.4% and 70% of coal-fired power generating units achieved ultra-low emissions. All these measures helped to significantly reduce emissions from coal.

3. Ensuring implementation of coal control measures with economic incentives

There are additional costs for enterprises that implement measures for coal control. In order to effectively put these measures into effect, China used economic stimulus policies as an aid to encourage enterprises to take more initiatives regarding coal pollution control.

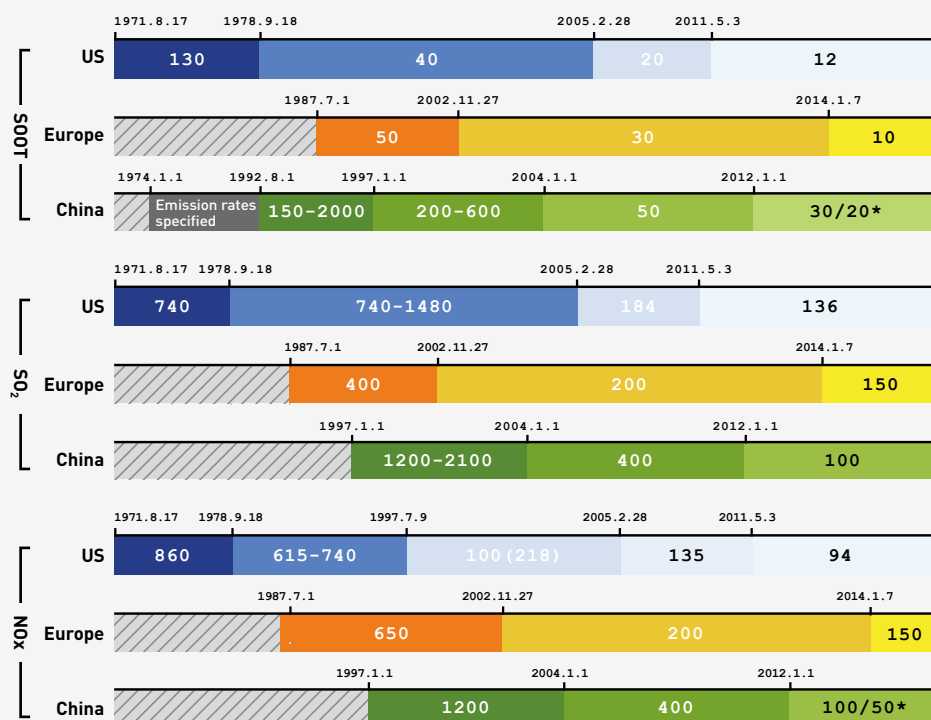
During the implementation of the Action Plan, the Chinese government provided capital support to help eliminate and retrofit small coal-fired boilers, eliminate outdated capacity, control household scattered coal consumption, and achieve ultra-low emissions in coal-fired power plants. For instance, as part of the effort to encourage residents to use electricity or gas for cooking and heating, the governments granted subsidies on device purchase fees, electric bills, and gas bills. These subsidies serve to encourage the families to switch from traditional coal by offsetting the additional costs from using electricity and gas instead of coal.

In terms of measures and subsidies for coal-fired power plants and enterprises that are proactively engaged in coal pollution control, the government also increased power generation quotas, supported higher purchase prices, and lowered pollution discharge fees. Because of these policies, realization of ultra-low emissions of nationwide coal-fired power plants could be advanced smoothly.

APPENDIX

Appendix I

Upgrading Process of Emission Standards of Air Pollutants for Coal-fired Power Plants in the US, the EU and China



- Notes:**
1. The date in the figure indicates when the corresponding emission limits were implemented for newly built coal-fired power plants. The US emission standards were targeted at coal-fired power generating units with thermal power exceeding 73MW; the European emission standards were targeted at coal-fired power generating units with thermal power exceeding 50MW, with the above showing the emission limits on coal-fired power generating units with a thermal power of 500MW; China's emission standards were targeted at coal-fired power generating units with a capacity above 65t/h.
 2. * indicates special limitations that were applied in key regions.

2.2

INDUSTRIAL AIR POLLUTION PREVENTION AND CONTROL

BACKGROUND

In the forty years since reform and opening-up, China has achieved sustained, fast-paced economic growth and development that gave rise to all kinds of industrial enterprises in cities across the country. These enterprises generated unprecedented wealth, but their extensive, unconstrained development also brought about unprecedented air pollution. In 2012, value added from industry accounted for 38.5% of China's GDP, but industrial emissions of SO₂ and NO_x made up 90.3% and 70.9% of national total emissions.

The air pollution episodes around the end of 2012 revealed this problem. BTH region and surrounding areas, where PM_{2.5} pollution was the most severe, were also concentrated areas of China's primary heavy-pollution industrial enterprises, such as steel and cement enterprises. Afterward, PM_{2.5} source apportionment in many cities testified to the huge impact of industries on PM_{2.5} levels. Generally, industrial emissions contribute 10%-30% to PM_{2.5} pollution in Chinese cities. Industry is one of the true major culprits of smog.

In the Action Plan, industry, coal and motor vehicles are listed as the three major pollution sources to be controlled. Based on the characteristics of air pollution in China, the Action Plan confirms that a major task at the current stage is to control industrial exhaust gas by adjusting industrial structures and treating exhaust and prioritizing these efforts on industries like coal power generation, and steel and cement production. These measures and tasks, together with China's environmental regulatory system, formed the powerful industrial pollution management system. In the last year of implementation for the Action Plan, China's total emissions of SO₂ and NO_x dropped by 52.1% and 43.2% respectively from 2012 levels.

The chapter "Coal Pollution: Total Consumption Control and Clean Use of Coal" of this report introduces the control measures used in the coal power industry in detail. This chapter will focus on China's measures and experiences with regards to air pollution control in industries outside of power generation.

(I) Adjusting Industrial Structure to Reduce Emissions from the Source

As part of the Action Plan, industrial structure adjustment focused on industries with high energy consumption and high emissions, or the “Two High Industries” for short, which included steel, cement, electrolytic aluminum, plate glass, coking, non-ferrous metals, calcium carbide and ferroalloy industries. In the past, due to irrational planning and distribution of industry, an excessively large number of plants in these industries were built and put into operation, resulting in high proportion of heavy industry in Chinese industry development and substantial excess production capacity from the “Two High Industries.” Consequently, pollutants discharged by these industries surpassed the environmental carrying capacity. In order to reduce pollutant emissions from the source, the Action Plan put forward the strategy of “adjusting and improving industrial structure, and advancing the transformation and upgrade of industry.”

Eliminating outdated production capacity is one of the indispensable steps in adjusting the industrial structure. Outdated production capacity is generally produced by energy-intensive enterprises with low production capacity and outdated technologies that fail to both meet environmental standards and install end-of-pipe (EOP) facilities. Given the various characteristics of different industries, the specific criteria for outdated production capacity differ.

Local governments investigated the status of outdated production capacity for all local industrial enterprises, followed by releasing specific elimination plans. The enterprises on the elimination list needed to dismantle or seal up the production line equipment cited on the list. If the enterprises on the list could not dismantle or seal up production line equipment temporarily, the government instead levied higher electricity, water and pollution discharge fees.

From 2013 to 2015, China totally eliminated over 1 million tons of electrolytic aluminum, 230 million tons of cement, and over 76 million weight cases of plate glass. During the five years of the Action Plan’s implementation, China eliminated over 170 million tons of steel capacity.

For those industries whose total capacity surpasses market demand, the Action Plan demands that any newly-added capacity within these industries be limited. Since 2013, all cities have stopped approving projects in the “Two High Industries”. If cities still needed to build, renovate or expand projects in these industries, they must remove equal or more production capacity.

Apart from directly regulating capacity, China also forced high-polluting enterprises to move from heavily polluted areas by tightening environmental protection standards. In 2013, 47 cities at the prefecture-level and above within 19 provinces (including autonomous regions, direct-administered municipalities) belonging to the three key regions (BTH, YRD and PRD) and ten city clusters” started to impose special emissions limits on air pollutants from the five industries of steel, petrochemicals, cement, non-ferrous metals, and chemicals, as well as coal-fired boiler projects. Among over 40 emission standards for air pollutants from stationary sources in China, more than 20 have set such special emission limits. Industries failing to comply needed to update facilities to meet the standards within a set time limit. Those unable to do so within the required timeline can be ordered to restrict output or halt production, face fines, or even be forced to shut down.

Credit and loan for “Two High Industries ” has been strictly controlled. China also took financial measures to push forward industrial structure adjustment. In 2014, the China Banking Regulatory Commission (CBRC) issued Green Credit and Loan Guidelines, requiring financial institutions to strictly control loans provided to enterprises of the aforementioned industries. Many banks followed the Guidelines and cut loans to these industries. In 2015, loans provided to enterprises of these industries across country decreased by RMB 480 billion compared with 2014.

In addition, China also optimized the previously irrational distribution of industries. Three methods were adopted for dealing with heavy-polluting enterprises in major urban areas: plant renovation, relocation, and closure. Some enterprises were moved to industrial parks so that environmental and other depart-

ments could carry out centralized management by adopting unified pollution control measures. And these enterprises were required to vigorously advance cleaner production to reduce pollutant emissions in the production cycle.

(III) Upgrading EOP Measures

Apart from controlling high-polluting industries at the source through industrial structure adjustment, China has also made great efforts to control exhaust gas emissions from industrial enterprises since the Action Plan was implemented. The main measures adopted include stricter emission standards and upgrading EOP technologies.

In China, the MEE is responsible for formulating national emissions standards for different industries. Industries without national industrial emissions standards are in effect subject to limits set by the Integrated Emission Standard of Air Pollutants (GB 16297-1996) or local industrial standards. The latter is formulated by the local government itself provided that it is stricter than the national standard.

At present, China has made industrial emission standards for dozens of industries. During the five years of the Action Plan implementation, China revised the emission standards for different industries, including tightening emission limits, adding special emission limits and unifying requirements on new and old pollution sources. Furthermore, China also issued emissions standards on high-polluting industries such as batteries, petrochemicals and synthetic resins, etc. In terms of local emissions standards, Beijing, Chongqing, and Guangdong province (to name a few) all revised or introduced new local emission standards.

Figure 18

Comparison of Different Versions of Air Pollutant Emission Standards for Steel Industry (Using emission limits on SO₂ discharged by sintering machines as an example)

	Emission limits on newly-built enterprises (unit: mg/m ³)	Special emission limits (unit: mg/m ³)
National standard (newly issued in 2012) Emission Standard of Air Pollutants for Sintering and Pelletizing of Iron and Steel Industry (GB 28662-2012)	200	180
Local standard of Hebei province (revised in 2015) Emission Standard of Air Pollutants for Iron and Steel Industry (DB 13 2169 — 2015)	180	160
Local standard of Hebei province (revised in 2018) Ultralow Emission Standard of Air Pollutants for Iron and Steel Industry (DB 13 2169-2018)	35	

Facing stricter emission standards, industries also needed to upgrade their EOP technologies. Just as with the coal power industry, China also demanded that steel and cement industries add desulfurization, denitrification and dedusting equipment. At the end of 2015, the area of sintering machines that installed desulfurization equipment accounted for 88% of total area of sintering machines in the steel industry, and the cement clinker capacity from the new dry process cement production line equipped with denitrification equipment accounted for 92% of total capacity.

The above measures effectively restrained the emissions from major heavy-pollution enterprises. In 2015, the amount of SO₂ discharged by steel enterprises across the country declined by 24.3% from a year earlier and that of NO_x discharged by cement industries fell by 11.0%. Between 2013 and 2017, stricter emission standards and the transformation of industries contributed to a respective 12% and 13% decrease in the total SO₂ and NO_x emissions throughout the country.

(III) Fully Controlling VOCs Pollution

Volatile organic compounds (VOCs), which are key precursors of PM_{2.5} and O₃, are also mentioned in the industrial pollution control measures of the Action Plan. Since 2013, in contrast to the continued decline in the concentration of other five criteria pollutants, the ozone pollution in Chinese cities has worsened, albeit slowly. China addressed this issue by paying greater attention to VOCs pollution control during the implementation of the Action Plan. In 2016, China essentially established a VOCs control policy framework, which included controls on total VOCs emissions, control plans for key industries, and a VOCs discharge fee system.

2016 was also the year that China first included VOCs into its total emissions control system, and clearly stated that it would implement controls on total VOC emissions in key regions and industries during the period of the 13th Five-Year Plan (2016-2020). By 2020, the goal is to reduce national total VOC emissions by over 10% compared with 2015.

For VOCs control in key industries, China has formed a thorough prevention and control strategy for the entire industrial process, "focusing primarily on reduction at the source and process control, and secondarily on EOP control". Reduction at the source means that raw materials containing VOCs should meet the VOCs content quality standards. Process control means strictly controlling against the leakage of VOCs in the production process. For example, a production process that uses raw materials containing VOCs requires a sealed environment, and the enterprises need to create a ledger for the strict control of VOCs. EOP control includes material recovery equipment, and VOC collection and treatment measures.

China has required that VOC emissions in the industrial sectors should be reduced by more than 3.3 million tons in 2018 compared with 2015, and announced specific measures for 11 key industries in which VOCs emissions account for more than 80% of total industrial VOCs emissions (these industries include petroleum refining and petrochemicals, coatings, inks, adhesives, pesticides, automobiles, package printing, rubber products, synthetic leather, furniture, and shoes manufacturing).

Economic leverage has also played an innovative role in VOCs control. Before 2018, some cities adopted the differentiated principle of "higher charges for high emissions and lower charges for low emissions" to impose VOC discharge fees on enterprises. Since January 1, 2018, China abandoned VOC discharge fees in accordance with the Environmental Protection Tax Law, and began to levy environmental taxes on VOCs which covered around 20 different kinds of VOC pollutants.

So far, VOCs control has been successively implemented in various cities across the country. In 2017 alone, Beijing, Jiangsu and Zhejiang reduced VOCs emissions by 4,408, 95,000 and 50,000 tons, respectively.

(IV) Strengthening Supervision to Promote Emission Compliance

For a long time, the failure to ensure that enterprises meet emission standards was a lingering problem for both environmental protection departments and the general public. This problem was partially due to the lack of effective technologies to retain evidence of enterprises' excess emissions, and partially due to lax laws and regulations that allowed some enterprises to act in disregard of the law.

In order to redress these shortcomings, China established an online monitoring system to keep an eye on key pollution sources. Beginning January 1, 2014, the government required all enterprises under national key monitoring network start carrying out environmental monitoring and publish their exhaust emission data in real time on websites of local environmental protection departments. In order to ensure the accuracy of the data, local environmental protection departments also conducted comparative testing on monitoring systems from time to time. With these data, the general public and environmental protection NGOs can assist the government in monitoring corporation's pollution discharge.

During the implementation of the Action Plan, local environmental protection departments also introduced other new technologies to monitor emissions from enterprises. For example, the use of drones for pollution inspections has become a common regulatory method, which has helped departments conduct aerial and long-distance monitoring on enterprises and identify which enterprises emit pollution in secret. Moreover, the drones also enabled departments to obtain evidence effectively, without the trouble of playing "hide and seek" with law-violating enterprises.

Since earlier punishments were not severe enough to intimidate polluters, China systematically renewed the regulations for environmental violations, allowing for more ways to punish such violations. China drew a clearer line between liabilities requiring civil compensation and criminal penalty, and began handing out more severe punishments accordingly. The new Environmental Protection Law, revised in 2015, raised the cost of fines for polluters, and a daily penalty system made enterprises bear significantly higher costs if they didn't rectify after being informed.

Since then, many local EPBs have put the "daily penalty system" into practice. For instance, Shaanxi Coal and Chemical Energy Co., Ltd. was fined RMB 15.8 million for air pollution in 2015, the largest among Chinese enterprises that year. Beginning in January of 2015, Xianyang Municipal EPB handed out an administrative penalty of RMB 200,000 to Shaanxi Coal and Chemical Energy Co., Ltd. for emitting exhaust without a pollutant discharge permit, and required the company to rectify within 30 days. However, upon the bureau's later inspection, the company was still illegally discharging the pollutant without any rectification, and thus a daily fine was imposed, totaling RMB 7.4 million. By the end of March, the fine had ballooned to RMB 15.8 million for violating the law over 79 consecutive days.

In a bid to strengthen supervision, China started implementing innovative environmental law enforcement mechanisms, with the most representative "environmental police." The "environmental police," as the name suggests, describes a new form of cooperation between departments of environmental protection and public security.

The environmental protection departments provided clues of pollution cases for the environmental police, who can then collect evidence and conduct investigation over illegal behavior. The power of criminal law enforcement that the public security department brings, together with the environmental protection departments' administrative law enforcement, allowed for illegally polluting enterprises and individuals to be held accountable for their actions.

Unlike in the past, when environmental protection departments could only enforce administrative law, the additional criminal law enforcement power granted to the environmental police meant that any manufactures considering illegally discharging pollutants were much more likely to be deterred from doing so, as the costs for violating the law were now so much higher.

In the course of the Action Plan's implementation, the government attached greater importance to public participation in supervising enterprises. In addition to previous whistleblowing hotlines, environmental protection departments added new kinds of channels for whistleblowing, such as via letter, phone, Weibo, WeChat, and websites. Many provinces and cities also raised the rewards for environmental pollution whistleblowing in order to encourage more residents to join in on environmental supervision and offer environmental protection departments more valuable clues. Hebei Province, for example, increased its highest reward from RMB 3,000 to RMB 50,000.

SUMMARY OF EXPERIENCE

1. Improving the Air Pollutant Emission Standards System

The exhaust treatment is the key component in industrial air pollution prevention and control. China improved its air pollutant emission standards for industrial sectors and established a system of integrated national and local standards, thereby remarkably reducing industrial exhaust emissions. From 2013 to 2017, China released new standards, revised old ones, and proposed special emission limits, among other measures. Under these strict new standards, China established a rigorous system that places the "chimneys" of industrial enterprises under tight control, and "shuts out" those enterprises that fail to meet environmental standards. All these measures have worked to effectively reduce emissions in the industrial sector.

2. Monitoring Pollution Sources with New Technologies

China's supervisory officials used to conduct on-site inspections that would require a multitude of human resources and take up considerable time. The intermittent nature of the inspections also gave dishonest enterprises the opportunity to discharge pollutants on the sly. However, after successfully adopting new technologies, China can now control the polluting actions of enterprises more easily.

As all key polluters have been installed with online monitoring systems connected to the environmental protection departments' monitoring network, they are required to release real-time data on pollution discharge to society and accept public supervision.

Furthermore, through the application of telemetry technology, supervisors can uncover some previously well-disguised enterprises stealthily emitting pollutants, thereby completing inspections that go beyond the ability of regular manpower. Compared with the past, when monitoring had to rely on humans alone, new technologies can do more with less.

3. Increasing Enterprises' Environmental Violation Costs via Legislation

Owing to the light punishments that violators of environmental regulations faced, enterprises which lacked a strong awareness for environmental protection were able to frequently and illegally discharge pollutants. During the implementation of the Action Plan, China successively revised Environmental Protection Law and the Air Pollution Prevention and Control Law. It systematically updated its punishments for environmental violations. To be specific, China created more ways to penalize environmental violations, drew a clearer line between liabilities requiring civil compensation and criminal penalty, and handed out more severe punishments overall in accordance with the law.

A good case in point is the "daily penalty system," in which, starting from the day after the issuance of a rectification order, any law-violating enterprise(s) that have not taken action to rectify illegal emissions will be fined on a daily basis, without a cap on the fines, until the issue is resolved. Additionally, in accordance with the revised environmental laws, the person(s)-in-charge of an enterprise shall be held accountable for any corresponding administrative and criminal violations committed by the enterprise.

These advances in legislation helped to greatly increase the costs faced by enterprises that violate environmental regulations, which has given way to higher rates of compliance with emission standards.

2.3

ADVANCING MOTOR VEHICLE EMISSION MANAGEMENT SYSTEM

BACKGROUND

Since China's reform and opening-up, there has been a substantial rise in the number of motor vehicles. Between 1980 and 2017, China's total motor vehicle population increased by 83-fold, and the number of automobiles increased by 116-fold¹⁸. Unfortunately, this rise is coupled with increasingly severe urban air pollution and poses a daunting challenge to urban air quality. Motor vehicles are heavy emitters of CO, HC, NOx, and PM.

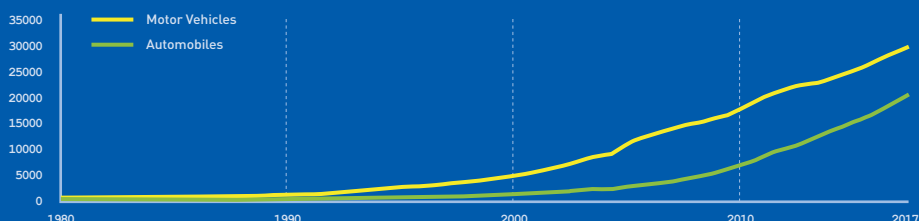
Prior to 2000, China had few measures to prevent and control motor vehicle pollution. From 1980 to 2000, exhaust emissions rose annually, showing linear growth coupled with the rising motor vehicle population. In these two decades, the aggregate level of emissions from the major four pollutants (CO, HC, NOx, PM) increased 11-fold along with a 14-fold increase in the motor vehicle population¹⁹.

To combat heavy air pollution, China put motor vehicle pollution control on the agenda in 2000 and there have been improvements. Since then, the Chinese government has gradually adopted stricter motor vehicle fuel and emission standards, and initiated policies to phase out yellow-label vehicles. Major cities like Beijing, Shanghai and Guangzhou implemented measures such as driving restrictions based on license plate numbers, license-plate lottery systems, and subsidies for retrofitting in-use vehicles. Through these efforts, motor vehicle exhaust emissions began to increase at a lower rate. Between 2000-2012, even though the motor vehicle population rose by 316%, emissions of the four pollutants increased by only 43%²⁰.

China was under the international spotlight in 2013 due to its heavy smog. This put additional pressure on China to control motor vehicle pollution since exhaust emissions are one of the chief contributors to urban air pollution. In 2014, nine major Chinese cities²¹ released source apportionment results of PM. These results revealed that motor vehicles are the primary contributors to local air pollution in Beijing, Hangzhou, Guangzhou, and Shenzhen, with the proportions ranging from 21.7% to 41%²². Another study showed that motor vehicles were responsible for over 50% during the heavy air pollution days²³.

Figure 19

Changes in China's
Motor Vehicle and
Automobile Popu-
lation between 1980-
2017 (10,000 Units)



¹⁸ According to data provided by the Vehicle Emission Control Center (VECC) of the MEE. ¹⁹ *ibid.* ²⁰ *ibid.*

²¹ Beijing, Tianjin, Shijiazhuang, Shanghai, Nanjing, Hangzhou, Ningbo, Guangzhou and Shenzhen were the nine cities that completed the source apportionment results in this first stage.

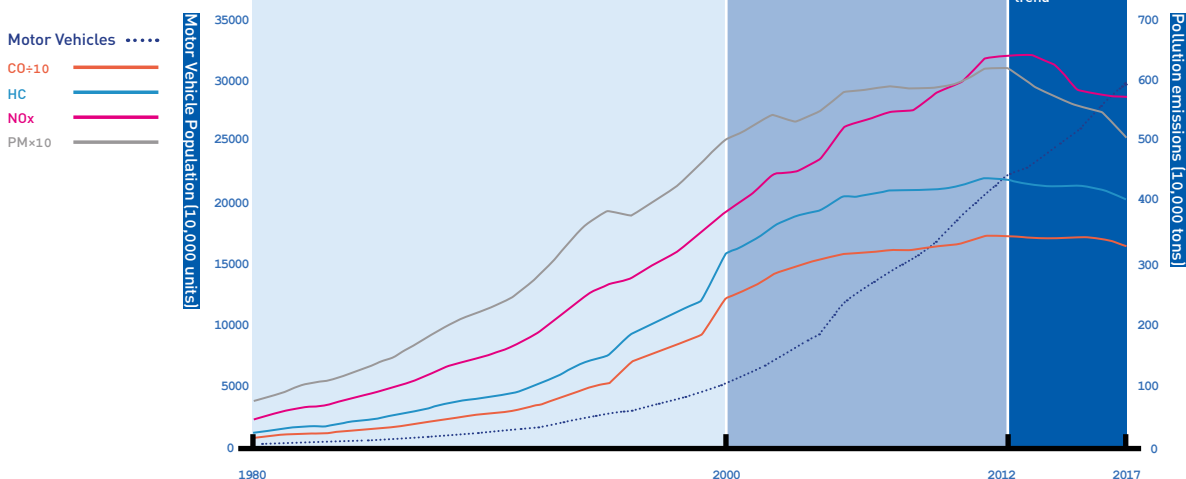
²² MEE, 2017 Annual Report on China Motor Vehicle Environmental Management.

²³ MEE, 2016 Annual Report on China Motor Vehicle Environmental Management.

In the past five years, through the Action Plan, China has effectively curbed motor vehicle pollution by improving prevention and control systems. In 2013, China's motor vehicle exhaust emissions were in decline for the first time, and change in emissions were decoupled from the change in the motor vehicle population. From 2013 to 2017, although China's motor vehicle population grew by 33%, total pollutant emissions fell about 5%. NO_x and PM emissions fell by 10% and 14%, respectively, the largest decrease among the pollutants²⁴.

Figure 20

Changes in China's Motor Vehicle Population and Exhaust Emissions



Note: 1) Among the four pollutants emitted by motor vehicle exhaust, CO accounts for the highest proportion while PM accounts for the lowest proportion; 2) CO data is divided by 10 and PM data is multiplied by 10 in this figure in order to better display the changing relationship between exhaust emissions and the motor vehicle population.

The achievements shown in the figure above can be attributed to the following measures:

(I) Stricter Management of New Vehicles

1. Upgrading Emission Standards

Tightening emission standards on new vehicles has been an important strategy for China to mitigate single vehicle emissions. Upgrading of new vehicle emission standards has been accelerated since the Action Plan was implemented. Since January 2017, China 5 emission standard is now applied to light-duty gasoline vehicles (LDGV). Moreover, heavy-duty diesel vehicles (HDDV) have been required to comply with China V emission standard since July 2017, only two years after China IV emission standard were implemented across China (in January 2015).

China released the China 6/VI emission standards for LDGVs and HDDVs in December 2016 and June 2018, respectively. The new LDGV and HDDV standards are scheduled to be fully implemented by July 2020 and July 2021, respectively.

²⁴ MEE, Annual Report on China Motor Vehicle Environmental Management (2014-2018).

Figure 21 shows a comparison of China and the EU in milestones for upgrading to new vehicle emission standards. Figure 22 exhibits the NOx emission limits under the China 3/III, 4/IV and 5/V standards.

Figure 21

Comparison of New Vehicle Emissions Standards: China and the EU

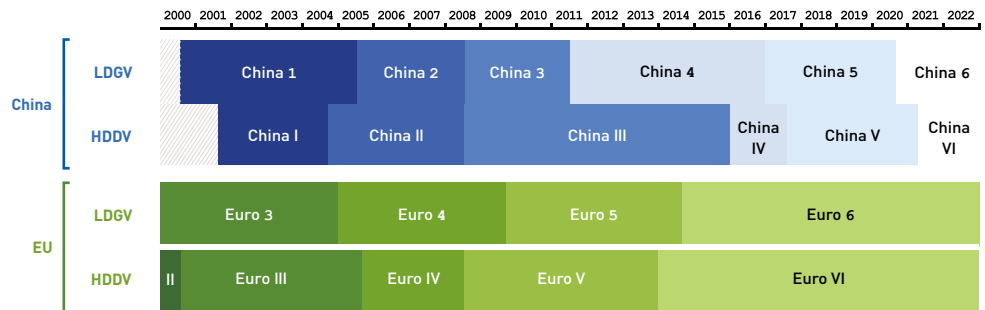
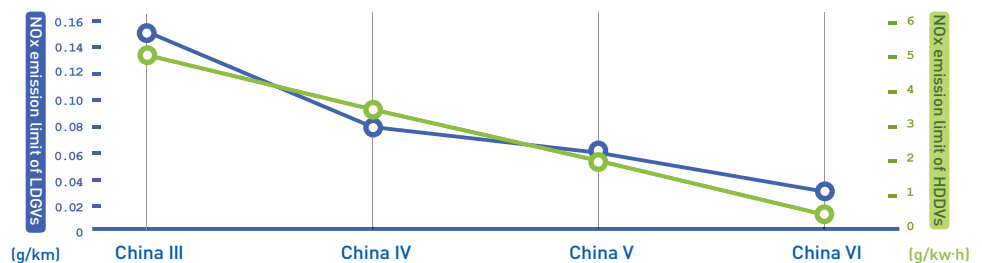


Figure 22

NOx Emission Limits under Different Stages of Implementation

LDGVs (g/km)
HDDVs (g/kw·h)



2. Revamping Regulatory Strategies

Since new vehicle emission standards were put into place in 2000, the Chinese government was responsible for ensuring that newly-manufactured motor vehicles met standards. The government supervised new vehicles mainly through new model type approval and inspecting for vehicle production conformity. However, there was a loophole in the inspection process for the phase of mass production that some motor vehicle manufacturers took advantage of. This led to the appearance of substandard vehicles on the market.

To address this issue, the government canceled the type approval system. In its place, the government established an environmental protection information disclosure system for new vehicles. The revised Air Pollution Prevention and Control Law requires vehicle manufacturers to have all their vehicles inspected and manufacturers can only sell vehicles that pass the inspection. Manufacturers are also required to make public all inspection information.

In 2016, the former MEP established an environmental protection information disclosure platform for motor vehicles, through which enterprises manufacturing and importing motor vehicles disclose their emission control technologies and emission test information, including: 1) vehicle type test information; 2) inspection information showing production conformity; 3) inspection information of in-use compliance; 4) pre-delivery inspection. MEP's Vehicle Emission Control Center (VECC)'s website hosts the platform.²⁵

To encourage public supervision, any department, enterprise, or citizen can obtain environmental protection information about new vehicles. During the fourth quarter of 2016 when the information disclosure platform for motor vehicles was under trial operation, 405 enterprises across China disclosed information on 10,702 newly-manufactured motor vehicle types. In 2017, 76% of motor vehicle manufacturers in China, or 1,031 enterprises, disclosed information on 52,952 vehicle types.²⁶

²⁵ The website of Vehicle Environmental Protection Information Disclosure Platform is <http://219.141.229.209/ve/index>.

²⁶ MEE, 2018 Annual Report on China Motor Vehicle Environmental Management.

The environmental protection information disclosure system for new vehicles emphasized the obligation of manufacturers to ensure new vehicles comply with standards. The system also conducts random inspections to punish enterprises under violation, with the goal of deterring enterprises from violating standards. In December 2017, VECC performed a check on manufacturers for production conformity. Shandong Kama Automobile Manufacturing Co., Ltd. and Shandong Tangjun Ouling Automobile Manufacturing Co., Ltd. were fined a total of RMB 38.77 million because they produced trucks failing the emission test and exhibited fraudulent conduct in installing pollution control devices. This was the first time that the MEE punished motor vehicle enterprises.²⁷ This conveyed a critical message: in ensuring that motor vehicles comply with standards, the most crucial stakeholders are the manufacturers and they have an absolute obligation to abide by standards.

(III) Increasing Adoption of New Energy Vehicles

Promoting new energy vehicles (NEV) has also become an important measure to prevent and control motor vehicle pollution. Clean energy increasingly occupies a larger proportion of China's power sector and the government has also been encouraging the use of ultra-low-emission coal-fired power plants, NEVs generate less pollution than traditional internal combustion engine vehicles (ICEVs).

As early as 2001, China began NEV research and development. Since 2009, cities including Beijing, Shanghai, and Chongqing have initiated pilot projects to encourage the public service sector to use more NEV's. Yet, the early-stage NEV industry failed to develop at scale.

After the launch of the Action Plan, China took an unprecedented step in promoting NEVs and boasted the largest market share in the global NEV sector. In 2013, the Chinese government, under increasing pressure to curb air pollution, became more determined to promote the use of NEVs. China's NEV sales grew significantly from 2014 to 2015, seeing a dramatic annual growth of 324% and 343%, respectively²⁸.

Since 2015, China has been the world's largest seller of NEV's for three straight years. In 2017, China boasted 777,000 units of NEV sales²⁹, 43 times higher than the previous five years.

Adoption of NEV's in public services like public transport, environmental sanitation, taxi, and logistics has been substantial. In 2017, new and clean energy buses accounted for over 65% of the total buses in Beijing and the proportion of new and clean energy buses exceeded 75% in Shandong province. Shenzhen not only electrified all its buses, but also ranked first in the world in total number of NEV taxis and logistics vehicles.

On one hand, China's rapid development of NEVs is largely due to preferential fiscal and tax policies. Starting in 2013, a host of

fiscal and tax policies have been introduced to support NEV's. Consumers buying NEVs can obtain fiscal subsidies from both the central and local government. NEVs are also exempt from taxes required for ICEVs, such as the purchase tax (10% of automobile sales price) and vehicle and vessel taxes.³⁰

On the other hand, restrictions on the purchase and use of ICEVs in certain cities have also affected consumers. In addition to restrictions on ICEVs purchase and use, local governments in Beijing, Tianjin,

Figure 23

NEV Sales in China and Other Countries from 2013 to 2017



²⁷ MEE, 2018 Annual Report on China Motor Vehicle Environmental Management.

²⁸ According to data released by China Association of Automobile Manufacturers (CAAM).

²⁹ Ibid.

³⁰ Vehicle and vessel tax, targeted at vehicles and vessels, is levied annually on the owner or manager of vehicles and vessels. For example, the owner of a passenger car with a 1.6L emission needs to pay RMB 360 every year as vehicle and vessel tax.

Shanghai, Hangzhou, Guangzhou, Shenzhen and other large cities plagued by motor vehicle pollution have guaranteed that newly purchased NEV's will be granted a license plate, whereas ICEVs still faced restrictions. All these policies led to a huge stimulus of NEV sales.

Figure 24

Preferential Fiscal and Tax Policies for Single New Energy Vehicle between 2013 and 2018

	2013	2014	2015	2016	2017	2018
Central Subsidy (RMB 10,000)	6.0	5.7	5.4	5.5	4.4	4.4
Local Subsidy	Most cities (like Beijing and Tianjin) offered the same level of subsidies as the central government				Local fiscal subsidies did not exceed 50% of the central government's subsidies for a single vehicle.	
Exemption from purchase tax		New energy vehicles shall be exempt from purchase taxes starting on September 1, 2014.				
Exemption from vehicle and vessel tax		From May 7, 2015, all-electric commercial vehicles, plug-in hybrid electric vehicles (PHEVs) and fuel cell commercial vehicles are exempt from vehicle and vessel taxes. Vehicle and vessel taxes shall not be levied on all-electric and fuel cell passenger vehicles.				

(III) In-use Motor Vehicle Emission Reductions

1. Eliminating High-emission Vehicles

An important measure in reducing in-use vehicle emissions is better management of high-emission vehicles. Yellow-label³¹ and outdated³² vehicles are considered high-emission vehicles due to their long periods of use, poor pollution control, and lack of stability in their emissions. In 2012, yellow-label vehicles across China totaled 14.51 million, accounting for 13.4% of the total. However, the yellow-label vehicles were responsible for over half of the vehicle emissions in China, contributing to 52.5%, 56.8%, 58.2% and 81.9% of the CO, HC, NOx and PM emissions, respectively.³³ Hence, the Action Plan prioritized elimination of yellow-label and outdated vehicles and implemented a phased plan to decommission all yellow-label vehicles by the end of 2017.

The MEE assigned specific elimination tasks to provinces and cities. Cities encouraged elimination of yellow-label and outdated vehicles ahead of schedule through financial compensation and restricted driving zones. The city of Nanjing in Jiangsu province, for example, imposed driving zone restrictions on yellow-label vehicles starting in 2010. In 2016, the restricted zones for yellow-label vehicles were expanded from semi-urban areas to administrative regions throughout the city, and the daytime (from 7:00 a.m. to 10:00 p.m.) restriction was expanded to a 24-hour driving restriction. Nanjing also offered yellow-label vehicle owners a subsidy ranging from RMB 1,500 to RMB 10,000 depending on the vehicle type and service life. They were also offered a price reduction ranging from RMB 1,000 to RMB 100,000 to buy a new vehicle.³⁴

From 2014 to 2017, China phased out a total of 20,642,000 yellow-label and outdated vehicles, including 11,547,000 yellow-label vehicles. By the end of 2017, China had 1,947,000 yellow-label vehicles, 0.9% of its total vehicle population, reduced from 10.7% in 2013.³⁵

Eliminating yellow-label and outdated vehicles helped to further reduce urban air pollutant emissions. In Beijing, from 2013 to 2015, 1,222,000 yellow-label vehicles were eliminated, reducing 71% and 16% of urban NOx and primary PM_{2.5} emissions, respectively.³⁶

2. Supervising In-use Vehicle Emission Compliance

With the implementation of the Action Plan, China created a supervision system that consisted of "regular inspections" and "random inspections" to ensure in-use motor vehicles comply with standards. The gov-

³¹ Yellow-label vehicles refer to gasoline vehicles below the China I emission standard and diesel vehicles below the China III emission standard.

³² Outdated vehicles are those that fall below the China IV emission standard.

³³ MEE, 2012 Annual Report on China Motor Vehicle Environmental Management.

³⁴ Clean Air Asia, China Air 2017: Air Pollution Prevention and Control Progress in Chinese Cities.

³⁵ MEE, Annual Report on China Motor Vehicle Environmental Management (2012 and 2014).

³⁶ People's Daily Online, "Chinese Academy of Engineering 2016 Report on Mid-term Evaluation of the Action Plan", July 6th, 2016.

ernment also strengthened supervision of vehicle emission inspection agencies.

Performing regular inspections on motor vehicle exhaust emission levels and exhaust aftertreatment systems is a vital step to sustainably manage in-use vehicles. In 2012, only 51.3% of China's in-use vehicles were regularly inspected and many inspection agencies suffered from improper management. The Action Plan implementation caused a sharp rise in inspection rates, reaching 88.8% in 2017³⁷.

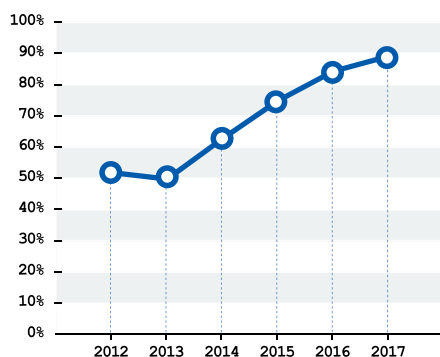
As a way to resolve improper management, the MEE built a national motor vehicle emissions monitoring platform, where regular inspection data of motor vehicles are integrated at the municipal, provincial, and central level. The platform makes it convenient and efficient for environmental protection departments to manage and supervise agencies responsible for regular motor vehicle inspection. The platform provides real-time inspection video retrieval and access to information such as in-use vehicle emission inspection data. The platform helps China move toward a comprehensive information-based management system for motor vehicles. By 2017, the platform has covered 89.2% of China's motor vehicle inspection agencies.³⁸

While regular environmental protection inspection rates for motor vehicles is steadily rising, environmental protection departments, with the help of innovative enforcement mechanisms, have also set up systems to perform random inspections. The revised Air Pollution Prevention and Control Law stipulates that environmental protection departments may conduct random inspections in centralized parking and maintenance locations (i.e. perform random on-site inspection). They can also perform roadside inspections using technologies like remote sensing that does not affect traffic.

Figure 25

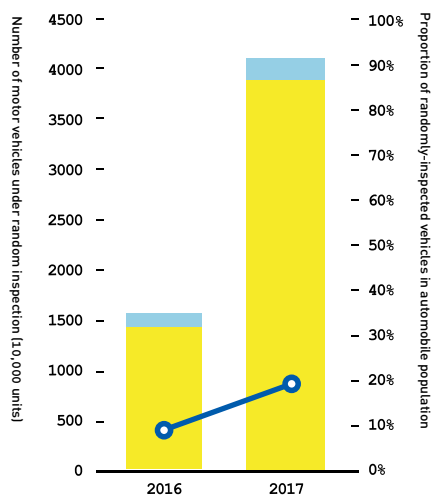
Changes in Environmental Protection Supervision of In-Use Motor Vehicles

Regular environmental protection inspection rates of in-use motor vehicles



Random environmental protection inspection of in-use motor vehicles

■ Road Inspection (Including random on-site inspection)
 ■ Remote Sensing Monitoring
 ● Proportion



In 2016, local environmental departments, with support from their traffic management counterparts, completed random environmental protection inspections on 15,553,000 in-use vehicles, or 8.4% of the automobile population, and this rose to 18.9% the following year.³⁹ By the end of 2017, of the 38.82 million vehicles monitored by 260 remote sensing devices installed nationwide, 4.5% did not comply with emission standards. Roadside inspections (including random on-site inspections) found that 7.1% of the 208,700 vehicles failed to comply with emission standards.⁴⁰

Having environmental protection departments collect data, and traffic management departments impose punishments significantly resolved difficulties in punishing motor vehicles that exceed emission limits. In the past, environmental protection departments lacked authority to punish vehicles and local traffic management departments found it hard to impose punishments due to lack of relevant punishment code in the vehicle violation penalty system. On May 1, 2017, this changed when the Traffic Management Bureau of the Ministry of Public Security added a national uniform penalty code (6063) that implemented the law enforcement principle of "environmental protection departments collect the data, traffic management departments impose the punishment."

³⁷ MEE, 2017 Annual Report on China Motor Vehicle Environmental Management.

³⁸ MEE, 2017 Annual Report on China Motor Vehicle Environmental Management.

³⁹ *ibid.* ⁴⁰ *ibid.*

Under this new model, the traffic management department can halt an on-road motor vehicle and then the environmental protection department can test whether the motor vehicle complies with the exhaust emissions standard. In cases of violation, the vehicle owner will be punished by the traffic management department. This new model achieved more effective supervision of vehicles that exceed emission limits.

Moreover, regional law enforcement cooperation improved the supervision of non-local vehicle emissions. Every day, on average, 100,000 transit vehicles and Beijing-bound diesel vehicles passed through Beijing⁴¹. To better supervise non-local vehicles, Beijing established the BTH joint law enforcement model.

Under this model, four joint law enforcement and inspection sites were set up (i.e. wholesale markets, logistics areas, and Beijing-bound checkpoints). Law enforcement personnel from the three regions examined Beijing-bound vehicles, immediately punished vehicles that exceeded emission limits, and handed over vehicles in violation to the relevant local government department. In 2017, manual inspections found that 16% of inspected 3,010 HDDVs exceeded emissions limits at Beijing-bound checkpoints.⁴²

(IV) Accelerating Fuel Quality Upgrade

Upgrading fuel quality is another important component to help vehicles comply with the emission standards. Prior to the implementation of the Action Plan, China often adopted vehicle fuel standards after the corresponding vehicle emission standard. For example, the China 4 emission standard for LDGVs came into force as from July 2011, but the corresponding China 4 gasoline standard did not come into effect until two years later.

Problems caused by a delay in issuing fuel standards for diesel vehicles were even more serious. The China IV emission standard was planned to apply to HDDVs in 2010, but was delayed twice. This is because the corresponding China IV diesel standard failed to be released on time due to a lack of the required fuel supply for as long as five years.

The Air Pollution Prevention and Control Law ended the time lag for implementing fuel standards. The new law stipulates fuel standards must comply with air pollutant control requirements and motor vehicle emission standards and that the fuel and emission standards must be implemented at the same time. Furthermore, to avoid the problem of insufficient fuel supplies, the new law also requires petroleum refining and manufacturing enterprises to produce fuels that comply with the fuel standards. The onset of the China IV emission standard marked a new period where cleaner vehicle fuels are supplied earlier than, or, at the same time as the implementation of the corresponding emission standards.

China upgraded the vehicle fuel standards twice during the implementation of the Action Plan. China began supplying vehicle gasoline and diesel with 50ppm sulfur content (China IV standard) in January 2014 and January 2015, respectively. In January 2017, China reduced the sulfur content of vehicle gasoline and diesel to 10ppm (China V standard) by 93% and 97%, respectively, from that of the China III standard.

Figure 26

Process of Synchronizing Upgrades of Vehicle Fuel and Emission Standards (Using HDDV as an Example)

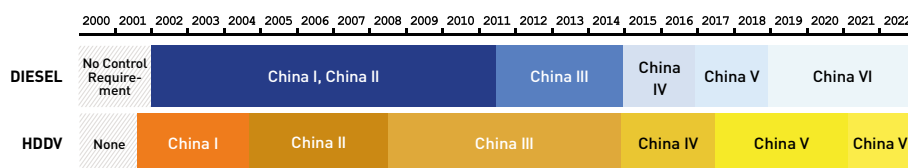
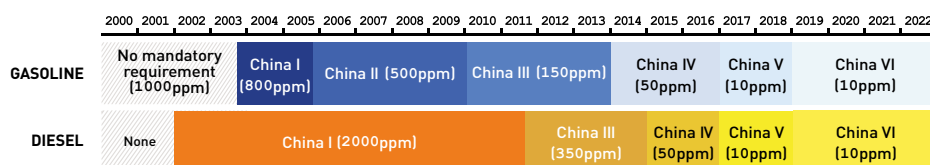


Figure 27

Fuel Upgrading Process of Vehicle Gasoline and Diesel



⁴¹ China Environment News, "Heavy Duty Diesel Vehicles Emit Huge Amount of Pollutants", January 26th, 2016, http://news.cenews.com.cn/html/2016-01/26/content_39355.htm.

⁴² Beijing EPB, "Supervision of HDDVs became the Focus of Management of Mobile Sources", February 1st, 2018, <http://www.bjepb.gov.cn/bjhrb/xxgk/jgzn/jgsz/jjgjszjz/xcyj/xwfb/828994/index.html>.

(V) Special Action on Diesel Vehicle Pollution Control

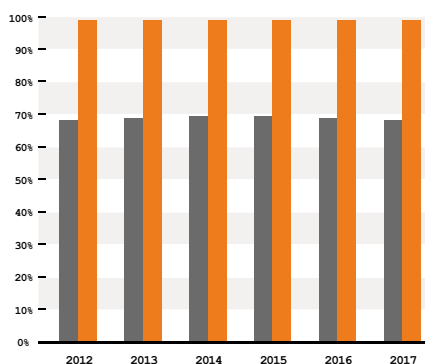
China did not require additional diesel vehicle pollution control policies when beginning to implement the Action Plan. Afterwards, through upgraded emission standards, higher fuel quality, and elimination of yellow-label and outdated vehicles, NO_x and PM emissions from diesel vehicles have been in decline since 2013, decreasing 2.6% and 3.7% annually between 2013 and 2017⁴³.

However, the proportion of total emissions from diesel vehicles was still very high. NO_x and PM emissions from diesel vehicles accounted for nearly 70% and 99% of total automobile emissions, respectively, during 2013–2017.⁴⁴ Provinces and cities that were heavily impacted by diesel vehicle exhaust or that suffered the most from air quality problems took the lead in implementing stricter diesel vehicle pollution control measures. These measures include designating restricted driving zones, retrofitting in-use diesel vehicles, and reducing the rely on diesel vehicles in the transportation structure.

Figure 28

Proportion of NO_x and PM Emissions from Diesel Vehicles in China's Total Automobile Emissions

■ NO_x
■ PM



In 2017, Beijing, Tianjin, Shenzhen and Shanghai introduced policies that required exhaust purification devices to be installed in diesel trucks. Beijing, Tianjin, Hebei province, and Shandong province adopted stringent all-day traffic restriction measures to forbid high-emission diesel vehicles from driving within urban areas. The combination of remote sensing and joint law enforcement has successfully imposed stricter supervision of high-emission diesel vehicles on the road.

Moreover, the disproportionate number of diesel vehicles in the transportation structure is a key reason for heavy diesel vehicle pollution. Road freight in China use diesel trucks and road transport has contributed to over 70% of freight transport starting in the 1980s, reaching 76.8% in 2017⁴⁵. Therefore, adjusting the transportation structure which heavily rely on road freight has become a priority and the Beijing-Tianjin-Hebei region initiated a pilot project.

Starting in May 2017, the Tianjin port, the Weifang and Yantai ports in Shandong province, and the Tangshan port in Hebei province around the Bohai Sea have banned diesel trucks from transporting coal in its port, as part of the shift from road-to-railway coal transportation. The onset of the “road-to-railway” policy has yielded some early results in optimizing the transportation structure. In 2017, the ports around the Bohai Sea witnessed a 19% increase over 2016 in coal transported by rail; this accounted for 25% of the total increase in China’s railway freight volume in 2017⁴⁶. From October 2017, the daily average of coal-loaded vehicles passing through the municipal boundaries of Beijing dropped between 3,000 to 4,000 units, or about 50%.⁴⁷

The Three-Year Action Plan to Win the Battle for Blue Skies (Three-Year Action Plan) made “winning the battle against diesel truck pollution” one of the key tasks to complete from 2018 to 2020. China plans to tackle diesel vehicle pollution with a three-tiered approach – through better management of vehicles, fuels, and roads. The goal is to have diesel vehicles (engines) comply with emission standards through optimizing freight transportation structure, creating a stringent diesel vehicle environmental monitoring system, and guaranteeing quality diesel fuel and urea.

SUMMARY OF EXPERIENCE

The Action Plan helped to improve China’s motor vehicle environmental management system. China’s key experience can be summarized in three aspects:

⁴³ MEE, Annual Report on China Motor Vehicle Environmental Management (2013–2017). ⁴⁴ *ibid.*

⁴⁵ MEE, 2018 Annual Report on China Motor Vehicle Environmental Management.

⁴⁶ *ibid.* ⁴⁷ *ibid.*

1. Resolving long-standing issues through legal accountability

The Action Plan was an opportunity for China to revise the Air Pollution Prevention and Control Law. The revised law specifies the responsibilities of stakeholders (including enterprises) and the supervision role of the government. It called for greater efforts to tackle three long-standing and fundamental problems: 1) Failure of newly-manufactured vehicles to comply with emission standards; 2) Delayed availability of fuel supply; 3) Improper management within in-use vehicle inspection agencies.

Before the Action Plan was implemented, there were frequent reports of “fake China III” and “fake China IV”. To address the problem of newly-manufactured vehicles not complying with emission standards, the new law stresses the manufacturer’s obligation to disclose environmental protection information to the public. Moreover, the government can require manufacturers to recall motor vehicles.

The revised law imposes two new requirements to resolve the problem of delayed fuel supply that led to lags in upgrading emission standards. One is to implement new fuel standards in synchronization with new motor vehicle emission standards. The other is that oil refining enterprises are liable for “producing fuel that complies with the fuel standards.” These requirements guarantee the sufficient supply of quality fuel in time.

In terms of in-use vehicle inspection agencies not conforming to regulations and inspection fraud, the revised law requires motor vehicle emission inspection agencies and persons-in-charge to be directly responsible for the authenticity and accuracy of inspected data. This ends the relationship based on entrustment between the government and motor vehicle environmental protection inspection agencies. To prevent fraud, the revised law requires the government to build a motor vehicle emissions monitoring platform to manage, inspect and supervise motor vehicle inspection agencies.

2. Innovating supervision pattern and means with more capital support

The motor vehicle population in China was 310 million in 2017. Limited number of personnel made it difficult to supervise the large number of in-use vehicles. With the Action Plan implementation, the government created new information systems and adopted new technologies to strengthen management and supervision of vehicle emissions.

To alleviate some of the difficulties of in-use vehicle supervision, the MEE created a national motor vehicle emissions monitoring platform that is connected to the motor vehicle inspection agencies nationwide. With this platform, the government can obtain annual in-use vehicle inspection data to identify vehicles that exceed standards. Moreover, the government has invested significant capital to install remote sensing devices capable of all-day monitoring to screen for high-emission vehicles.

Previously, detecting and punishing in-use vehicles that exceeded emission standards was difficult as environmental protection departments did not have jurisdiction to halt vehicles on the road. To address this issue, environmental protection departments and traffic management departments have collaborated to create a new law enforcement model that allows traffic management departments to punish vehicle owners based on data and evidence collected by the environmental protection departments.

3. Adjusting transportation structure to reduce pollution at its source

China’s continued pace of economic development and accelerated rate of urbanization have led to an increase in motor vehicles and higher demand for freight transport. Hence, for the past five years, China has been proactive in reducing motor vehicle pollution at its source. China adopted new energy vehicles, especially electric passenger vehicles and electric vehicles in the field of public services involving buses, taxis, and mail trucks. To make this happen, the government offered preferential fiscal and tax policies to subsidize new energy vehicle purchases and imposed restrictions on the purchase and use of ICEVs.

In terms of high-emission diesel vehicles, China has learned its lesson from Europe and the United States and is working to optimize its freight transportation structure. In 2017, due to strict regulations and supervision from the government, the Beijing-Tianjin-Hebei region started a pilot project for carrying freight by rail instead of with diesel trucks. To further reduce emissions from the freight industry, with the new Three-Year Action Plan (2018-2020), China has planned for a significant increase in the share of railway freight transport, which is scheduled to grow 30% from 2017 to 2020.

3



SUPPORTING MEASURES



3.1

PERFORMANCE MANAGEMENT: ACCOUNTABILITY MECHANISMS FOR LOCAL GOVERNMENTS

BACKGROUND

To ensure that local governments are able to achieve their goals for cleaner air, China's central government has signed responsibility contracts that specify responsibilities for each level of implementation at local level with local governments. In 2014, the State Council released the Measures for Evaluating the Implementation of the Air Pollution Prevention and Control Action Plan (for Trial Implementation) ("Evaluation Measures") to create a performance management system for air pollution prevention and control targets. Afterwards, the central government established an environmental inspection system that operates at both central and local levels. The central governments also implemented stricter air pollution inspections for the BTH region and surrounding areas to encourage local governments to fulfill their assigned responsibilities.

Performance management and environmental inspection systems are partly shifting responsibilities that were formerly under the jurisprudence of environmental protection departments to local governments. To implement the Action Plan, governments at all levels are responsible for air pollution prevention and control tasks. These new systems are effective in making sure local governments implement emission reduction measures and meet air quality targets set in the Action Plan.

In 2018, the MEE, NDRC and other departments conducted an end-of-term evaluation of the Action Plan in 31 provinces (autonomous regions and direct-administered municipalities). The evaluation concluded that all 45 key tasks in the Action Plan were accomplished according to schedule and all air quality improvement targets were met.

The Action Plan issued in 2013 proposed a system for accountability and evaluation to better achieve air pollution prevention and control targets. The proposed system has three components: division of tasks and targets, means of evaluation, and accountability mechanisms. From this, the central government gradually completed detailed implementation plans and to create a complete performance management system for air pollution prevention and control targets.

Of the three components, accountability mechanisms are the most important and the most difficult. China has adopted a multi-tiered accountability system, under which various levels of government can be held legally accountable for shirking responsibilities. This can be completed through interviews, legal investigations and other forms of punishments. The environmental inspection system implemented in 2015 linked the assessment, appointment, and dismissal of government officials with their performance of carrying out air quality improvement tasks. The new inspection system also placed an importance on public opinion. These changes have put immense pressure on local governments.

(II) Multi-tiered Targets and Task Assignments

The Action Plan creates two categories of cities and has distinct air quality improvement targets for each category. The first category includes cities from key regions including the BTH, YRD and PRD. The second category includes other cities at the prefecture level or above. The Action Plan assessed concentration changes by 2017 in $PM_{2.5}$ for the first category and in PM_{10} for the second category. The Evaluation Measures issued in 2014 created more specific targets for each city (Figure 29).

Central and local governments signed the Air Pollution Prevention Responsibility Contract which allocated key tasks and measures. When the Action Plan was released, the former MEP signed a Responsibility Contract with provincial (autonomous regions and direct-administered municipalities) governments to allocate specific air quality improvement targets and tasks for each province. Based on the Action Plan and targets set at the national level, local governments created annual work plans and assigned detailed tasks for implementation.

Based on the central government's requirements to achieve air quality targets, local governments also allocated measures and responsibilities to cities, districts, and counties within their jurisdiction during the implementation process of the Action Plan. Governments of cities, districts and counties must also sign responsibility contracts with their local government. With these contracts, China created a multi-tiered model for performance management that has unique division of responsibilities and evaluation mechanisms for each level of government.

Figure 29

Local Government Evaluation Targets

Regions that use the annual average decrease in $PM_{2.5}$ concentrations as the evaluation target

BTH Region and Surrounding Areas

Beijing Municipality, Tianjin Municipality, Hebei Province, Shanxi Province, the Inner Mongolia Autonomous Region and Shandong Province

PRD Region

Guangzhou, Shenzhen, Zhuhai, Foshan, Jiangmen, Zhaoqing, Huizhou, Dongguan and Zhongshan in Guangdong Province

YRD Region

Shanghai Municipality, Jiangsu Province and Zhejiang Province

Chongqing Municipality

Regions that use the annual average decrease in PM_{10} concentrations as the evaluation target

Other Regions



(III) Specific Evaluation Mechanisms

The Action Plan innovated on evaluation mechanisms. First, it created evaluation targets that made local governments ultimately responsible for ensuring key tasks were implemented. Second, it created a two-level evaluation index composed of targets based on: 1) Air quality improvements; 2) Completion of key tasks related to air pollution prevention and control.

1. Evaluation Targets

Effective in 2000, the Air Pollution Prevention and Control Law states, "Local governments at each level shall be responsible for the air quality within their own administrative region." However, local governments did not take on these responsibilities until the implementation of the Action Plan in 2013. Revised in 2015, the Air Pollution Prevention and Control Law clarified these evaluation procedures. The central government evaluates the performance of the provincial government, while the provincial government evaluates the local governments that are under its jurisdiction.

Results from the evaluations are not only made public, but also serve as an important basis for assessment, appointment, and dismissal of government leaders, as well as the leaders of environmental protection and other relevant departments. Assigning accountability at the level of individual government officials is a source of pressure and motivation for local governments.

2. Evaluation Indexes

The Evaluation Measures requires an annual and end-of-term evaluation of local governments' implementation progress of the tasks laid out in the Action Plan. Progress on air quality targets and key tasks from the Action Plan form the two major indexes for evaluation. Evaluation indexes also vary based on the city and evaluation period. For areas with heavy air pollution like the BTH region and surrounding areas (Beijing, Tianjin, Hebei, Shanxi, Inner Mongolia, Liaoning and Shandong), and YRD and PRD regions, both sets of indexes are considered in the annual evaluation. For the end-of-term evaluation that includes all of the cities, improvements on air quality targets are the only criteria for success or failure (Figure 30).

Progress on air quality improvement targets is one index and evaluated with a hundred-point grading system (Figure 31). The same grading system is used for the evaluation of progress in key tasks, which includes 10 indexes that are divided into 29 sub-indexes (Figure 32). Scoring criteria are designed differently for some of the sub-indexes based on the pollution situation in the corresponding cities. On the whole, the evaluation index prioritizes the performance of local governments in managing key pollution sources in coal, industrial sectors, and motor vehicles. The maximum score for coal, industrial sectors, and motor vehicles is set at 20, 15, and 18 points, respectively.

Figure 30

Annual and End-Term Evaluation Indexes for Different Cities

Region	Annual Evaluation Index	End-of-term Evaluation Index
BTH region and surrounding areas, YRD and PRD regions	✓ Progress in air quality improvement targets ✓ Progress on targets for key tasks	✓ Progress on air quality improvement targets
Other regions	✓ Progress on air quality improvement targets	✓ Progress on air quality improvement targets

Figure 31

Evaluation Indexes of Improvements on Air Quality Targets

Total Score	Index Name	Index Score
100	Annual average decrease in PM _{2.5} or PM ₁₀ concentrations (%)	100

Figure 32 Evaluation Indexes of Completion Progress in Key Air Pollution Prevention and Control Tasks

Total Score	No.	Index Name	Index Score	Sub-Index Name	Sub-Index Score
100	1	Industrial Structure Adjustment And Optimization	12	Management of new capacity for industries with overcapacity	2
				Unfinished illegal project clean-up for industries with overcapacity	2
				Elimination of outdated capacity	6
				Relocation of heavy-pollution enterprises	2
	2	Cleaner Production	6	Clean production audit and technological transformation for key industries	6
	3	Coal Management And Fuel Supply	10	Aggregate coal consumption control	0{6} ¹ {8} ²
				Coal washing and processing	4{0} ^{1, 2}
				Raw coal control	0{2} ¹
				China IV and V fuel supply	6{2} ^{1, 2}
	4	Pollution Control For Small Coal-Fired Boiler	10	Small coal-fired boiler elimination	8
				New coal-fired boiler access	2
	5	Industrial Air Pollution Control	15	Industrial smoke and dust control	8
				Industrial VOCs control	7
	6	Pollution Control For Urban Fugitive Dust	8	Dust pollution control for construction sites	4
				Road dust pollution control	4
	7	Motor Vehicle Pollution Prevention And Control	12	Yellow-label vehicle elimination	7
				Management of motor vehicles meeting targets	2{1} ^{1, 2}
				New energy vehicle promotion	0{1} ^{1, 2}
				Capacity building of motor vehicle emission monitoring	1
				Urban pedestrian and biking infrastructure	2
	8	Building Energy Saving And Heat Supply Metering	5	New building energy saving	5{2} ³
				Heat supply metering	0{3} ³
	9	Capital Investment In Air Pollution Prevention And Control	6	Investments of air pollution prevention and control from all levels of local governments, public stakeholders, and enterprises	6
	10	Atmospheric Environment Management	16	Development of annual action plan	2
				Account management	1
				System building for heavy pollution monitoring, alerting and emergency response	5
				Quality management for atmospheric environment monitoring	3
				Straw burning ban	1
				Environmental information disclosure	4

Notes:

1. If the number "1" is located in the upper right corner outside the brackets in the column of "Sub-index score", the figure in the brackets is the scoring standard set for Beijing municipality, Tianjin municipality and Hebei province.
2. If the number "2" is located in the upper right corner outside the brackets in the column of "Sub-index score", the figure in the brackets is the scoring standard set for Shandong province, Shanghai municipality, Jiangsu province, Zhejiang province and Guangdong province.
3. If the number "3" is located in the upper right corner outside the brackets in the column of "Sub-index score", the figure in the brackets represents the scoring standard set for regions with heating in Northern China. These regions include Beijing municipality, Tianjin municipality, provinces of Hebei, Shanxi, Liaoning, Jilin, Heilongjiang, Shandong, Henan, Shaanxi, Gansu, Qinghai, the Inner Mongolia Autonomous Region, the Ningxia Hui Autonomous Region, and Xinjiang Uyghur Autonomous Region.

(III) Strengthened Supervision and Inspection System

An accountability mechanism is essential for the target-based evaluation mechanism described above to operate effectively. The Action Plan provides the following accountability mechanisms:

- Interviews: Higher-level environmental protection departments (with organizational departments⁴⁸, inspection authorities and other relevant authorities) will conduct interviews with underperforming lower-level departments and relevant officials and suggest measures for improvement. This is an example of a "management system with Chinese characteristics."
- Legal accountability: For those who fail to effectively manage heavy pollution, interfere with and/or fabricate monitoring data, or do not complete annual target tasks, the inspection authority will hold the responsible government departments and persons-in-charge legally accountable.
- EIA approval suspension: Cities that fail to pass the evaluation will be temporarily excluded from getting EIA approval for new construction projects that might cause heavy pollution.
- Honorary title cancellation: Cities that fail to pass the evaluation will be stripped of the honorary environmental protection title granted by the central government.
- Financial support reduction: Cities that fail to pass the evaluation will face a reduction in financial support from the central government.

Moreover, cities that pass the evaluation with excellent results will be rewarded with stronger financial support from the central government.

Based on the measures described above, starting in 2016, China has created an environmental inspection system and strengthened efforts to find loopholes in executing the Action Plan and impose harsher punishments for violations. China has set up a two-tiered environmental inspection system that involves the central and provincial governments. This is an improvement from the old system in which higher-level governments merely getting oral or written briefings from lower-level governments on environmental protection issues. Through environmental inspection, the inspection team organized by the higher-level government directly examines, for the regions under the jurisdiction of the local government, all relevant environmental tasks, including actions related to local air, water and waste disposal. If the team discovers problems, they will require the relevant departments to complete actions for rectification. This system has greatly reduced the ability of lower-level governments to omit or conceal information.

On average, the process for each inspection takes a month. During the inspection, inspection teams set up hotline and post office boxes in the supervised regions to monitor tip-offs of environmental violations from the public. Before and after the inspection, inspection teams will convene meetings for motivation

Figure 33

Four Batches of
Central Environmental
Inspections



⁴⁸ Integrated functional departments set up inside the Chinese governments to handle personnel matters and Party building work.

and feedback. Once they receive inspection results, regions must create a rectification plan and report any progress within the time allotted and this information must be made public.

From 2016 to 2017, the environmental inspections led by the former MEP covered 31 provinces in China, monitored 135,000 tip-offs from the public and held over 17,000 people accountable. As the central inspection system improved, provincial governments also initiated provincial-level environmental inspections.

Since its inception, the most rigorous inspection has been carried out in regions suffering from the most serious pollution – the “2+26” cities in BTH region and surrounding areas. Starting in April 2017 and lasting one year, this inspection is aimed at helping the region achieve targets from the Action Plan. For this inspection process, the former MEP appointed 5,600 environmental law enforcement officials around the country to help the inspection teams.

By the end of February 2018, the inspection teams had inspected 210,000 enterprises, found 36,000 air-quality related environmental problems, supervised and managed 20,000 outstanding cases, and increased the number of enterprises in the heavy pollution emergency response plan to more than 50,000 from over 9,000. This rigorous inspection has helped the BTH region and surrounding areas achieve the relevant targets from the Action Plan.

SUMMARY OF EXPERIENCE

The Action Plan strengthened the central government’s efforts to achieve air quality targets and pushed forward local governments to complete concrete actions toward fulfilling their air pollution prevention and control tasks. The following four points summarize the core lessons of this experience:

1. The key to performance management is to emphasize priorities and implement differentiated policies that consider the unique conditions of each region or area.

The key to effective performance management of air pollution prevention and control targets is to help local governments identify priorities and implement differentiated policies based on the unique situation of the area or region.

The Action Plan stresses differentiated targets and tasks for each region. Regions often have unique and distinct pollution characteristics. The three key regions, BTH, YRD and PRD, have suffered from compound air pollution and need to focus on controlling PM_{2.5}. Other regions should focus on controlling PM₁₀, the major pollutant in those regions. This categorization of regions was also applied to the air quality improvement evaluation targets.

In terms of key tasks, the BTH region and surrounding areas that were the most polluted were required to implement more rigorous measures to achieve higher emission reduction targets. The central government has not only conducted central-level environmental inspections across the country, but also completed stricter inspections in certain period for the most heavily polluted areas – the BTH region and surrounding areas, which effectively solved the pollution problems caused by small, scattered, unregulated and high pollution manufactures in the areas.

2. Quantitative mechanisms for evaluation and accountability must be at the core of assigning responsibility.

The Evaluation Measures used a quantitative index system to evaluate the progress in completing air pollution prevention and control tasks. A weighted score allowed the government to put emphasis on cracking down on the most polluted sources.

Moreover, the quantitative accountability mechanism used in the stricter inspections linked tasks related to air pollution prevention and control with key responsibilities of the municipal and county governments.

The accountability mechanism connects the number of issues with the level of government officials to hold accountable. For example, if there are five issues found in a county government, the deputy county mayor will be held accountable. If there are 10 issues, the county mayor will be held accountable. If two counties (districts) are found to be problematic in a municipal government, the deputy municipal mayor will be held accountable. If there are three counties (districts) with problems, the mayor will be held accountable. Additionally, the central government ranks the local governments according to their completion of air quality improvement targets. Local governments ranked in the bottom three will be investigated and prefecture-level city officials will be held accountable.

3. A multi-tiered inspection system is vital to ensure that local governments perform their responsibilities.

After the central government assigns different tasks to each level of government, the multi-tiered inspection system is vital to ensure their implementation. The central government inspects the provincial government which then inspects the municipal government. Mobilizing and utilizing resources in this top-down manner allows the higher-level governments to better facilitate environmental supervision and management. Through inspecting both polluting enterprises and local governments in this multi-tiered way, significant achievements were made in a short period of time.

4. Public participation is a necessary supplement to governmental supervision.

For environmental inspection, public participation can effectively supplement governmental supervision. Residents provide a wealth of information and clues for environmental inspections. Environmental inspection requires local governments to create a platform at city (prefecture) level for whistleblowers, set up reliable phone lines, mailboxes, and websites for environmental inspection whistleblowing, and ensure proper attention is given to collect, handle and reply to the public's reports and tip-offs. During the central government's first three batches of environmental inspections in Hebei, the pilot province, the inspection team received over 90,000 tip-offs that helped to efficiently identify the team's blind spots.

3.2

INFORMATION DISCLOSURE AND PUBLIC PARTICIPATION

BACKGROUND

Air quality policies are aimed at protecting public health, and public cooperation and participation is needed to implement air quality improvement policies. That is to say, information disclosure and public participation are necessary for effective air pollution prevention and control.

Before 2012, the public's understanding of air quality was limited to the basic ratings from weather forecasts. After the heavy pollution crises in China around 2012, the public had increased demand for more detailed air quality information. With the release of the Ambient Air Quality Standards (GB 3095-2012) and the Action Plan, China's environmental information disclosure work related to air pollution has improved dramatically. Not only is the information disclosed more diverse, the information is also disclosed through multimedia channels.

Improvements in information disclosure have helped the public to better understand air quality conditions and take precautions for their personal health against air pollution. The improvements have also provided a foundation for public participation in air pollution control and supervision. During the implementation of the Action Plan, environmental protection departments also improved the public's avenues to participate in air pollution control by enabling the public to actively report air pollution violations and supervise local governments' implementation progress of the Action Plan.

MEASURES

(II) Air Quality Information Disclosure

1. Air quality broadcasting

In 2012, the new Ambient Air Quality Standards included PM_{2.5} in its scope for monitoring and disclosure. All Chinese cities gradually upgraded their air quality monitoring networks according to the requirements of the former MEP and disclosed air quality information to the public through daily reports and real-time reports (i.e. hourly broadcasting).

To standardize ambient air quality broadcasting across every city, the former MEP created and issued the AQI Technical Regulations (Trial) (HJ633-2012), which required certain computational methods for AQI, and had specifications on required content and frequency of daily and real-time air quality reports. The document also offered suggestions to protect public health from air pollution impacts that were grouped by different AQI levels.

Based on the above regulations, real-time reports and daily reports must include information such as the concentrations of six pollutants (PM_{2.5}, PM₁₀, SO₂, NO₂, CO, and O₃), AQI, primary pollutants, and the air quality level. In the past, a city only publicized one data point concerning air quality, but now, the public can get the real-time data of each monitoring site, which means that the public can learn about local air quality changes so that they can deal with air pollution in a timely and accurate manner.

Starting on January 1, 2015, the public can obtain the air quality data of 1,436 state-controlled monitoring sites in 338 cities nationwide. At the same time, the CNEMC and some provinces and cities also publicly released air quality data from non-state-controlled monitoring sites.

In addition to having real-time data on air quality, China has also developed an air quality forecast system⁴⁹. Since January 1, 2016, China have provided the public with air quality forecasts of 24 hours, 48 hours and 72 hours, further helping the public to take precautions for health.

Figure 34

Contents of Released Air Quality Monitoring Information

Type	Period	Pollutant Indexes
Real-time air quality reports	1 hour	Nine indexes, including 1-hour average of PM _{2.5} , PM ₁₀ , SO ₂ , NO ₂ , O ₃ , and CO, 8-hour moving average of O ₃ , 24-hour moving average of PM ₁₀ and PM _{2.5}
Daily air quality reports	24 hours	Seven indexes, including 24-hour average of PM _{2.5} , PM ₁₀ , SO ₂ , NO ₂ , and CO, daily maximum 1-hour average and 8-hour moving average of O ₃

Figure 35

Air Quality Forecast Contents

Scope	Coverage Area	Forecast Time
National air quality forecasts	Nationwide	Air quality for the next three days
Air quality forecasts in key regions	BTH, YRD, PRD, and northeast, southwest and northwest China	The BTH region can forecast the air quality for ten days; the YRD region and the PRD region can forecast five days; northeast, southwest and northwest China can forecast three days.
Provincial air quality forecasts	Covering each province, autonomous region and direct-administered municipality	Most provinces can forecast three days
City-wide air quality forecasts	A total of 46 cities, covering all provincial capitals and 5 cities under separate state planning (Shenzhen of Guangdong, Xiamen of Fujian, Ningbo of Zhejiang, Qingdao of Shandong, Dalian of Liaoning) and all prefecture-level cities in Hebei Province	Air quality and AQI range can be forecasted for the next 24 hours, 48 hours or 72 hours

⁴⁹ Air quality forecast information release system website: <http://106.37.208.228:8082/>.

With the popularity of the Internet and diversity of media channels, China has improved the ways that air quality information is publicized. Environmental protection departments have set up special webpages to publish air quality information. The Chinese government also published air quality information through various mediums such as TV, radio, Weibo (China's equivalent Facebook and Twitter), and mobile applications to offer the public more convenient access to such information.

The Chinese government has attached great importance to disclosing air quality information in an interesting and intelligible manner, rather than in the traditional way that other information is released. For example, according to national regulations, different air quality levels need to be represented by different colors. A deeper color should mean comparatively worse air quality, which serves as a warning to the public. Local environmental protection departments such as Shanghai and Shaanxi Province are using a cartoon image of "Air Baby" to improve public understanding. The cartoon characters depict changes in air quality through expressions and colors, which has gained praise from the public.

Another great example of public information disclosure is the "Air Quality Information Release" mobile app rolled out by the CNEMC. The application can be used on different mobile systems, providing the real-time air quality data in 338 cities (current AQI and level, primary pollutant, concentrations of six pollutants, and health advice). It shows the location of all state-controlled and some non-state-controlled monitoring sites. By using it, the user can learn the air quality trends of cities, compare and analyze historical air quality data of various cities, and see the monthly air quality ranking of 338 cities. The user can also obtain air quality forecasts for cities for the next three days. The information is also shown in a very readable way, through tables, line charts, bar charts, maps, etc.

Figure 36

Screenshots of CNEMC "Air Quality Information Release" APP Functions



• Real-time air quality and forecast

• Information from state-controlled and non-state-controlled monitoring sites

• Previous air quality changes displayed in a calendar form

• City air quality ranking

• City air quality comparisons

The government's release of the ambient air quality information spurred innovative information broadcasting methods in the society. Since 2013, in addition to the air quality mobile apps developed by the government, some enterprises and civil organizations have also released apps with similar functions, such as Air Matters, Blue Map, Moji Weather, and Air Guard. These apps launched by non-government organizations (NGOs) collect information from government platforms and vary the way that data is presented to meet the needs of different groups of people.

2. Heavy Air Pollution Alerts

When heavy air pollution with an AQI above 200 occurs, the air quality level reaches class 5 "heavy air pollution" or class 6 "severe air pollution," and it is severely harmful to public health. As a result, the Chinese government set up a heavy air pollution alert system to notify the public of upcoming heavy air

pollution. The government also created a heavy pollution emergency response plan that required relevant industries and individuals to work together to alleviate heavy air pollution.

The heavy pollution emergency response plan released by the local government requires the municipal government to give the public an alert at least one day in advance when the environmental protection department predicts heavy air pollution. The announcement must include the alert level, the areas that the heavy pollution will affect, predictions on the duration of the heavy pollution, health protection measures, emergency emission reduction measures, etc. When the air quality improves, the government releases another announcement to end the alert and the emergency emission reduction measures.

Figure 37

Unified Heavy Pollution Grading Standards for “2+ 26” Cities⁵⁰ in The BTH Region

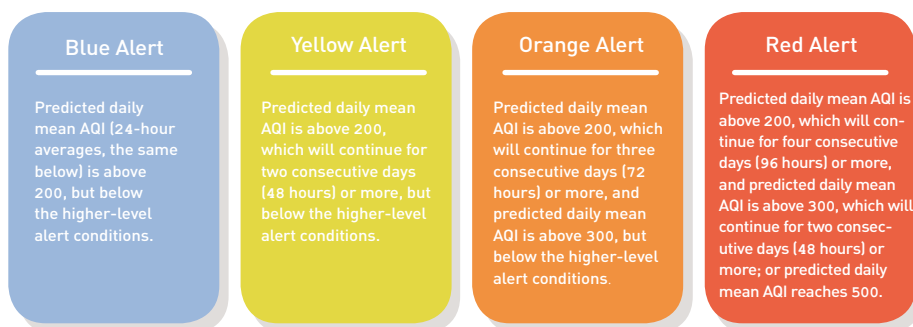


Figure 38

Sample Content of Air Pollution Alert: Beijing's First Heavy Pollution Red Alert in 2016

Heavy Pollution Alert Level	Red alert
Area Affected by Heavy Pollution	Southern part of Beijing is hit by heavy pollution, and the urban area and northern part also is seeing a gradual rise of pollutant concentrations.
Duration	From 8.00 p.m. on December 16 to 12.00 p.m. on December 21
Health Protection Measures	Enterprises and public institutions may, based on the severity of air pollution, adopt flexible working schedules, such as commuting during non-rush hours, taking days off, and telecommuting. Middle and primary schools and kindergartens should adopt flexible teaching schedules, such as cancelling classes or other protection measures.
Emergency Emission Reduction Measures	Light-duty gasoline vehicles that meet China I and China II emission standards are prohibited from being on the roads. Vehicles that meet China III emission standards and above can be used based on odd- and even-numbered license plates. Construction operations that use dirt or rocks is suspended. Production activities of relevant industrial enterprises are halted and restricted.
Meteorological Conditions	From December 16 to 21, the weather in the Northern China tend to be stable, without favorable pollution diffusion conditions.

As heavy air pollution is a severe and urgent matter, the government needs to inform as much of the public as possible of the heavy air pollution alerts. Beyond air quality broadcasting, during the period with heavy air pollution, the government also shared heavy air pollution information on the TV and radio. Through the Internet, more alerts were posted on government websites and popup messages were released through social media and news applications. Information about heavy air pollution was displayed on the electronic screens on the expressways, in community areas, and on the subways and buses. In addition, the government also sent tips to residents through phone messages.

These efforts not only reminded the public to protect their health, but also enabled the public to cooperate with the government to implement emissions reduction measures, such as restricted use of vehicles and increased use of public transportation.

⁵⁰ Referring to air pollution transmission channel cities of the Beijing-Tianjin-Hebei region.

To enable the public to know how heavy air pollution forms and evolves, the government increased communications with the public on heavy air pollution days through live news, reporter interviews, and news conferences. For example, during the period of heavy pollution red alert in late 2015, the Tianjin environmental protection bureau invited many experts from the municipal traffic management bureau, science and technology commission, environmental protection bureau, and meteorological bureau to participate in a 30-minute special interview program to explain to the general public the causes of heavy pollution. At the same time, the government also released a heavy pollution alert to over 90% of the general public through phone messages, TV, and Weibo posts.

(II) Air Polluter Information Disclosure

During the implementation of the Action Plan, another important information disclosure breakthrough was that China urged thousands of enterprises to release real-time emission information.

From January 1, 2014, the key state-monitored enterprises⁵¹ (referred to as state-controlled polluters) were required to conduct their own environmental monitoring and release the monitoring results to the public, including:

- Basic enterprise information: Name, organization code, legal person, contact information, major products, scale, etc.;
- Monitoring information: Monitoring sites and time;
- Pollutant discharge information: Types and concentrations of pollutants, discharge ways and diffusion direction, excess emissions, and any implemented emission standards;
- Information on the construction and operation of pollution prevention and control facilities;
- Information on environmental administrative licenses;
- Information on emergency response plans, etc.

The former MEP released a list of state-controlled polluters and this list put over 3,000 enterprises under key monitoring. These enterprises were responsible for 65% of total industrial emissions of SO₂ and NO_x. According to the national level regulations, a number of provinces and cities confirmed the major pollutant-emitting enterprises at the provincial and municipal level and required them to publish the relevant information.

Enterprises under the national, provincial or municipal monitoring plans were required to release their emission information on government-established information disclosure websites. This way, the public can obtain information on their real-time emissions on these websites. These websites have become an important tool for the public and environmental protection institutions to supervise enterprises to ensure they are in compliance with emission standards.

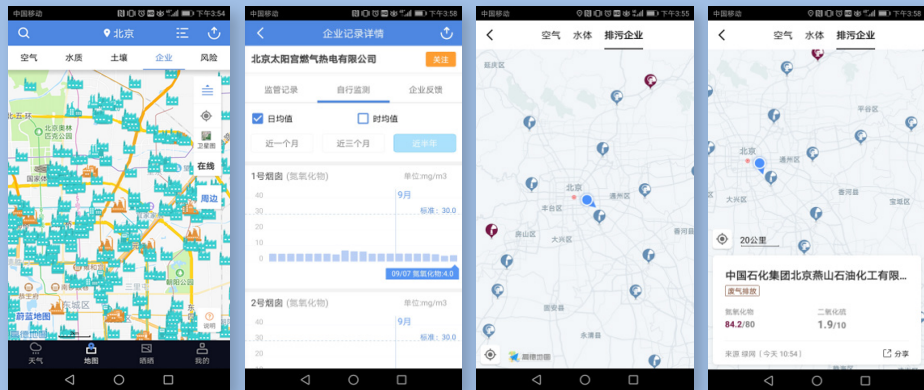
Some non-government organizations and enterprises have integrated the monitoring and emission information of polluters. They use this information to develop mobile applications to engage public to help with finding violators. These applications can then play multiple roles by improving public involvement, supervising enterprise emissions, and assisting in government inspection. For example, Shanghai Qingyue Environmental Protection Center (Shanghai Qingyue) developed the "Dangerous Map", the Institute of Public and Environmental Affairs (IPE) launched the "Blue Map," the Alibaba Foundation, Amap and the Center for Environmental Education and Communications of the MEP (CEEC) jointly developed the Amap Environmental Map, etc.

Using this data, Shanghai Qingyue cooperated with other NGOs to release a monthly list of state-controlled polluters with excess emissions in many provinces. For enterprises that are ranked to be the top ten worst polluters, the NGOs announced their names and then informed the local environmental protec-

⁵¹ From November 25, 2017, key polluting enterprises have been managed by category. Particularly, the list of key enterprises that emit air pollutants includes: [1] Companies discharging one kind or several kinds of exhaust with emissions exceeding the prescribed emission limits; [2] Medium-sized and large companies of the key industries that are under supervision and have actual pollution emissions, including thermal power plants, cement manufacturing, steelmaking, and coal chemical industry; [3] enterprises issued with pollutant discharge permits; and others.

Figure 39

Polluter Information Search via APPs



• Blue Map -- Distribution Map of Polluting Enterprises

• Blue Map -- Enterprise Emission Information

• Amap Environmental Map -- Distribution Map of Polluting Enterprises

• Amap Environmental Map -- Enterprise Emission Information

Figure 40

Polluter Information Search Website Established by Governments



Environmental Information Disclosure Platform of Enterprises and Public Institutions (using Shanghai as an example)

神华国华（北京）燃气热电有限公司

生产经营范围地址：北京市顺义区金港乡马各庄村北京热电中心内 行业类别：火力发电 所在区域：北京市-顺义区-杨镇 发证机关：顺义区环境保护局

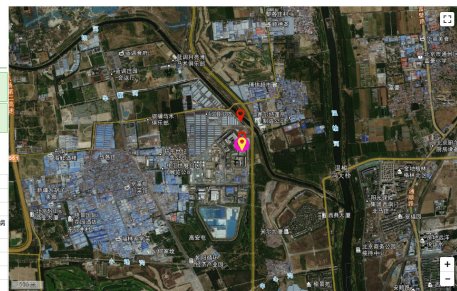
排污许可证编号



许可证编号	业务类型	版本	发证日期	有效期至
9111000556040272N001P	申请	1	2017-06-13	2017-06-12至2020-06-11
9111000556040272N001P	变更	2	2017-06-13	2017-06-12至2020-06-11

大气污染物排放信息	水污染物排放信息	自行监测要求
执行（守法）报告要求	信息公开要求	环境管理台账记录要求
其他许可内容		

主要污染物种类：	废气、废水
大气主要污染物种类：	氮氧化物、二氧化硫、颗粒物、挥发性有机物
大气污染物排放标准：	有组织废气：《火电厂大气污染物排放标准》（GB 13223-2011）；无组织废气：《大气污染物综合排放标准》（GB 16295-1996）
废水主要污染物种类：	pH值、氨氮、化学需氧量、总磷、总氮、五日生化需氧量、石油类、溶解性固体
废水污染物排放标准：	《污水综合排放标准》（GB 8961-1996）
废水污染物排放去向：	污水处理站
排污许可执行标准：	《火电厂大气污染物排放标准》（GB 13223-2011）



执行报告	报告类型	报告周期	执行报告
事项	2017年度环境报告		执行报告名称

National Pollutant Discharge Permit Management Platform (using a power company in Beijing as an example)

tion departments to push them to rectify their issues. The IPE also annually ranks major cities by their level of information disclosure to encourage local environmental protection departments to improve the disclosure of polluter and supervision information.

By the end of 2016, in addition to real-time emission information, China started to issue pollutant discharge permits for stationary pollution sources. As a result, permit information has become an important part of polluter information disclosure. The former MEP required that information, including the application forms from pollutant discharging enterprises, pollutant discharge permits issued, and permit management information, be made public. In particular, the permit information includes the polluter's basic information, emissions permit, the production phases that discharge pollutants, and pollution prevention and control facilities. Currently, over 20,000 enterprises from 15 industries⁵² have obtained the permits. The public can search their environmental protection information through the National Pollutant Discharge Permit Management Information Platform⁵³.

(III) Public Participation

An increasingly improved environmental information disclosure system offered basic information to the public for further participation in air pollution prevention and control. The environmental protection departments optimized public whistleblowing channels for environmental violations. Besides, environmental public interest litigation (EPIL) became an important way for NGOs to help control air pollution.

Due to deep public concerns over air pollution and the public education through opinion leaders, the 12369 environmental protection whistleblowing platform became famous after the release of the Action Plan. Nonetheless, before 2012, the platform was plagued by several problems such as insufficient city coverage, having a single whistleblowing channel, and slow acceptance and feedback. In a move to improve the public participate in the implementation of the Action Plan, the government began to offer more convenient whistleblowing channels, including the environmental protection whistleblowing hotline "12369", the 12369 Internet whistleblowing platform⁵⁴, the 12369 environmental protection whistleblowing WeChat official account, a Weibo official account owned by environmental protection authorities, and the ability to contact mayors on government portal websites. In light of the central government regulations, the whistleblowers can receive feedback within 60 days after the tip-off has been accepted.

To increase the public's enthusiasm for participating in environmental management, most cities have implemented measures that reward whistleblowers reporting environmental violations. For instance, whistleblowers might get monetary rewards if the environmental violations reported are found to be true after being investigated. If the illegal practice is so serious that the company reported is subject to investigation and penalized, the environmental protection department will reward whistleblowers accordingly in proportion to the amount of the penalty imposed. In Shanghai, whistleblowers reporting major environmental violations could receive a monetary reward as high as RMB 50,000.

Convenient ways for whistleblowing and appropriate financial incentives have helped to raise Chinese people's enthusiasm for participating in environmental protection. In 2017, 0.62 million public environmental whistleblowing cases were accepted across the country. Among them, 0.49 million were from phone calls and Internet platforms, amounting to ten times as many as in 2013; and 0.13 million were from WeChat platforms.⁵⁵ Air pollution cases accounted for a large proportion of all environmental violations reported by the public. The figure was up to 77% in 2013 and fell to 56.7%, though still very high, in 2017.

The central government also paid significant attention to public participation in its environmental inspection work. The central inspection teams publicized its timetables on the internet before arriving at different provinces (autonomous regions and direct-administered municipalities) and publicized the office's phone number and created a post office box specially prepared for accepting information from whistleblowers. Phone lines were set up to receive calls for 12 hours every day from 8.00 a.m. to 8.00 p.m. In 2016 and 2017, the central environmental inspection teams completed the inspection of all 31 provinces (autonomous regions and direct-administered municipalities) in China in four batches. Of all the 104,000

⁵² The 15 industries include thermal power, steel, non-ferrous metal smelting, coking, petroleum refining, chemical, bulk drug, farm chemical, nitrogen fertilizer, papermaking, textile printing and dyeing, leather manufacturing, electroplate, plate glass and non-staple agricultural food processing.

⁵³ The website of National Pollutant Discharge Permit Management Platform: <http://permit.mep.gov.cn/permitExt/outside/default.jsp>.

⁵⁴ 12369 Internet whistleblowing platform website: <http://1.202.247.200/netreport/netreport/index/>.

⁵⁵ MEE, June 13, 2018, http://www.mee.gov.cn/gkml/sthjbgw/stbgh/201806/t20180620_443480.htm.

cases reported from the public through letters and visits, 41% were concerned with air pollution.⁵⁶

In addition to participating in the central environmental inspection through whistleblowing, the public has also been motivated by some local governments who worked with the public and NGOs to analyze corrective measures and offer their opinions on how to rectify pollution issues. These local governments also invited the public and NGO's for polluter investigations and on-site inspections.

Environmental NGOs can also participate in air quality management through EPIL. The revised Environmental Protection Law broadened channels for social organizations to participate in environmental protection management by defining who is qualified to file an EPIL. In 2015, the first year when the revision came into effect, social organizations initiated 37 cases that were all accepted by courts.⁵⁷ On March 19, 2015, the All-China Environment Federation filed an EPIL to Dezhou Intermediate People's Court in Shandong province against a glass and glass deep-processing products manufacturer that had discharged excess pollutants. The case was the first of its kind in China.

From then to July 2016, 16 enterprises across China, including enterprises manufacturing and selling motor vehicles and petrochemical enterprises, were brought to court because of air pollution. In this way, EPIL has gradually become an important way for the public to safeguard the public interest concerning air quality.

SUMMARY OF EXPERIENCE

1. Supporting information disclosure and public participation through legislation

Information disclosure and public participation is an essential component of air pollution control. In the past few years, a series of laws and regulations have driven China to optimize its environmental information disclosure and public participation mechanisms. In the past five years, China introduced five laws and regulations⁵⁸ related to environmental information disclosure. Moreover, the revised laws such as the Environmental Protection Law and Air Pollution Prevention and Control Law further detailed the required information, methods, and potential penalties related to information disclosure and public participation.

These law-based requirements made the responsibility and duties of interested parties of air pollution prevention and control clear. More specifically, air quality information is published by the government, while enterprises are obligated to disclose enterprise environmental information with supervision from the government. The public's right to obtain environmental information and participate in air pollution control have also been protected by relevant laws.

2. Using the public's expressed needs to continuously improve environmental information disclosure

The purpose of air pollution control is to safeguard public health. Therefore, public needs should be taken into consideration in air quality information disclosure. Information closely related with public health such as real-time air quality, air quality forecasts and alerts, and polluter information are all important parts of information disclosure.

Information disclosure and public participation mechanisms should incorporate public feedback and be regularly updated. The heavy pollution alert mechanisms in some Chinese cities were revised many times. Each round of revision was completed with full consideration of public opinions on the conditions that initiated alerts and emergency response measures.

In terms of environmental whistleblowing, the public reported that sometimes they could not describe problems clearly through the hotline. Thus, in 2015, the former MEP set up a platform on WeChat as a new channel for whistleblowers. The whistleblowers could then submit polluter pictures and locations, which greatly increased the efficiency of addressing whistleblowing cases.

⁵⁶ Former MEP, December 28, 2017, <http://www.scio.gov.cn/xwfbh/gbwxfbh/xwfbh/hjbhb/Document/1614684/1614684.htm>.

⁵⁷ Chinanews.com, October, 30, 2016, <http://www.hn.chinanews.com/news/shsh/2016/1030/287686.html>.

⁵⁸ Including Measures for the Disclosure of Environmental Information by Enterprises and Public Institutions, Measures for the Administration of Key Pollutant Discharging Enterprise List, Notice of the Ministry of Environmental Protection on Issuing the Measures for the Self-Monitoring and Information Disclosure by the Enterprises subject to Intensive Monitoring and Control of the State, Measures for Public Participation in Environmental Protection, and Measures for Public Participation in Environmental Impact Assessment.

4

**INTER-DEPARTMENTAL
COORDINATION
AND COOPERATION**

4.1

REGIONAL AIR POLLUTION PREVENTION AND CONTROL COOPERATION

BACKGROUND

Regional economic development and expansion of city clusters have become two major ways that China's economy is growing. As regional industrialization and urbanization rapidly increase, air pollutant emissions have increased significantly. The high density of cities has made diluting and diffusing pollutants even more difficult. Regional air pollution has become even more severe due to the transmission of air pollutants among neighboring cities.

Air quality monitoring data and research on heavy pollution have clearly defined the regional characteristics of air pollution in Chinese cities. For example, in January 2013, when China experienced its worst smog ever, heavy pollution affected nine provinces (direct-administered municipalities) in central and eastern China, and the area affected by the smog totaled 1.43 million square kilometers. Official PM_{2.5} source apportionment results released by Beijing and Shanghai also indicated that region-wide pollution transmission contributed to 20% to 40% of local pollution⁵⁹.

Control of regional air pollution requires joint efforts from cities in the region. As early as the "12th Five-year Plan" period (2011-2015), the Chinese government proposed a joint air pollution prevention and control mechanism that was targeted at "three key regions and ten city clusters." The mechanism aimed to address regional air pollution through regional planning, joint policy formulation, and implementation by city clusters, including the BTH, YRD and PRD regions. Unfortunately, no tangible progress was made on the mechanism between 2011 and 2015, except in the PRD, where cooperation was easier since all the cities were under the jurisdiction of the same administrative province. Before the Action Plan was initiated, China's joint air pollution prevention and control work was limited to air quality management for major events, such as the 2008 Beijing Olympics and 2010 Shanghai Expo.

China did not see further progress on joint air pollution prevention and control until the implementation of the Action Plan. The BTH region and surrounding areas, as well as the YRD region, made breakthroughs in regional cooperation, especially the BTH, which garnered significant achievements. China's other city clusters, also plagued by regional air pollution, have gradually realized the importance of joint prevention and control, and have begun to create similar regional cooperation mechanisms in the past two years.

⁵⁹ Beijing Municipal Environmental Protection Bureau (2014). Official Report on Beijing PM_{2.5} Source Analysis. <http://www.bjepb.gov.cn/bjepb/323474/331443/331937/333896/396191/index.html>.

(II) Regional Cooperation Plan

The Action Plan stipulates that “Regional cooperation mechanisms should be established to further joint air pollution prevention and control efforts.” The key to putting this measure into practice lies in creating detailed implementation rules for each region.

The BTH region, spanning Beijing, Tianjin and Hebei Province, has the worst air pollution in China. In the past, heavy industry, a major contributor of pollution, accounted for a large share of the industrial structure in the region. To combat local pollution, Beijing shifted its highly-polluting enterprises to Hebei, a nearby province. However, as regional air pollution worsened, this was no longer effective. This made joint prevention and control an urgent matter.

The central government has long emphasized air pollution prevention and control in the region due to Beijing’s special political position. Due to pressure from the central government, the Detailed Implementation Rules for Implementing the Air Pollution Prevention and Control Action Plan in Beijing-Tianjin-Hebei Region and Surrounding Areas was released just one week after the Action Plan. The detailed rules applied to six provinces (direct-administered municipalities) in the BTH region and surrounding areas. They not only specified tasks for each province (municipality) in controlling polluters in sectors such as coal, industry, and motor vehicles. More importantly, they laid out the specifics of joint prevention and control work, including the creation of a regional emergency response mechanism for heavy-pollution, joint law enforcement, and information sharing. This document was the first major step forward for China’s joint air pollution prevention and control.

In the face of poor air pollution control during autumn and winter, the BTH region, with pressure from the central government, initiated the 2017-2018 Integrated Autumn and Winter Air Pollution Prevention and Control Work Plan for Beijing-Tianjin-Hebei Region and Surrounding Areas. In comparison to the previously mentioned detailed regional implementation rules, the autumn and winter action plan prioritized regional cooperation, and outlined future efforts toward “mapping the route to improving regional air quality”, “establishing regional air quality management agencies”, and other relevant tasks.

Figure 41

Map of Three Key Regions

- BTH
- YRD
- PRD



The YRD region, also called the “Jiangsu-Zhejiang-Shanghai” region, includes Shanghai and the provinces of Jiangsu and Zhejiang. The region is one of the places in China with the fastest pace of industrialization and urbanization, and also one of the three key regions identified by the government for air pollution prevention and control. Different from the BTH region, the region created its implementation rules based on the consensus among its local governments. At the 13th Mayors Joint Conference held by the Yangtze River Delta Urban Economic Coordination Committee in April 2013, the region was the first to publish an environmental manifesto. They wanted to eschew local protectionism, set up a regional environmental protection cooperation mechanism, and jointly build a regional environmental protection system.

After the Action Plan was released, air pollution prevention and control cooperation mechanism in this region was officially formed in 2014. Anhui, a nearby province, was added to the mechanism since Anhui is within the same air basin with Shanghai and the provinces of Jiangsu and Zhejiang. At the central government level, the mechanism was supported by eight commissions and ministries and obtained approval from the State Council.

Later, in January 2014, the mechanism released the Detailed Implementation Rules for Implementing the Air Pollution Prevention and Control Action Plan in Yangtze River Delta Region. These rules outlined six major measures for the region. These measures include controlling total coal consumption, strengthening industrial structure adjustment, preventing and controlling motor vehicle and vessel emissions, and better coordination of emissions reduction work.

(II) Regional Cooperation Mechanism

Besides the previously mentioned implementation plan, a regional cooperation mechanism is also crucial for joint prevention and control work. When implementing the Action Plan, the BTH region and surrounding areas developed a robust regional cooperation mechanism through a step-by-step process of trial and error. The cooperation mechanism involves seven work tasks. A coordination task force was specially formed to complete these tasks.

1. Major tasks of the Cooperation Mechanism

For the joint prevention and control cooperation mechanism of the BTH region and surrounding areas, seven major tasks were placed under the principle of “shared responsibility, information sharing, coordinated consultations, and joint prevention and control”:

- **Regular meetings:** The cooperation mechanism ensures that there is a biannual meeting for the cooperation team. The meeting is to enact key tasks and coordinate efforts to tackle key problems. Central government’s leaders also attended the meeting to aid in the organization and coordination work.
- **Regional policy measures:** One major task under the mechanism is to formulate regional policy measures and standards targeted at the region’s pollution characteristics, which are more stringent than the standards at the national level. Regional measures and standards have been determined for the coal, motor vehicles, and industrial sectors. Of these standards, the most representative is the VOCs Content Limit Standards for Architectural Coatings and Adhesives, the first regional standard jointly issued by Beijing, Tianjin, and Hebei.
- **Information exchange and sharing mechanisms:** The task force for the cooperation mechanism regularly issues a brief report on policies, measures, and experiences of local governments. Using China’s existing air quality monitoring and information network, the BTH region and surrounding areas also gradually set up special information platforms for monitoring regional air quality, supervising polluters, etc. Seven provinces (autonomous regions and direct-administered municipalities) in this region completed real-time sharing of key information such as air quality and emissions of key polluters.
- **Regional pollution alerting and emergency response:** To help the region cope with heavy pollution days, the cooperation mechanism involves the creation of a regional air quality monitoring, forecast-

ing and alerting center to motivate and guide each province (autonomous region and municipality) on improving their heavy pollution emergency response plans. This planning also ensures that when heavy pollution days appear at a regional scope, provinces and municipalities within the region can take emergency measures in a synchronized fashion.

In December 2016, there were a number of days with heavy air pollution across a large geographical area. In response to this, 60 cities in the BTH region and surrounding areas launched a unified alerting and emergency response plan, effectively reducing pollution and cooperating at a regional level for emergency response for the first time.

- EIA (Environmental Impact Assessment) consultation mechanism: Under the cooperation mechanism, EIA for planning is conducted and EIA consultation is done on key projects in the region.

- Joint law enforcement and special cooperation mechanism: Another component of the cooperation mechanism is connected with joint environmental investigations and law enforcement within the region. Some severe air pollution sources in the region, like heavy-duty diesel vehicles, “scattered, unregulated and high-pollution” enterprises, and straw burning are subject to a “special investigation.”

Joint law enforcement and special investigations help to overcome difficulties facing cross-administrative region law enforcement. For instance, when it comes to monitoring motor vehicle pollution, joint law enforcement entails environmental protection, transport and public security departments of different cities sharing environmental violation information about vehicles. This way, local law enforcement officers can investigate and potentially impose punishments on illegal and non-local vehicles.

- Regional air pollution prevention and control expert committee: The cooperation mechanism is also supported by a 30-member regional air pollution prevention and control expert committee. These experts specialize in sources and reactions of air pollution, remote sensing and atmospheric monitoring, pollution prevention and control technology, energy and environmental economics, etc. The expert committee is primarily responsible for work in regional air pollution prevention and control such as analyzing issues, assisting with planning, and recommending useful technologies.

In addition to these seven tasks, the cooperation mechanism also supports other forms of cooperation among cities in the region. Starting in 2015, for example, six cities in the region collectively formed two teams to combat air pollution. Beijing and Tianjin partnered with two cities in Hebei to offer capital, technology, and other forms of support for air pollution prevention and control. Beijing spent RMB 600 million between 2016 and 2017 to assist Baoding and Langfang to eliminate small coal-fired boilers and manage large coal-fired ones. In 2016, Tianjin provided Cangzhou and Tangshan with RMB 400 million in the form of capital and technical support to mitigate local air pollution.

2. Regional Cooperation Task Force

In October 2013, one month after the release of the Detailed Implementation Rules for Implementing the Air Pollution Prevention and Control Action Plan in Beijing-Tianjin-Hebei Region and Surrounding Areas, the region formed a supporting task force. The task force includes provincial governments in the BTH region and surrounding areas and eight commissions and ministries under the State Council, consisting of the former MEP, the NDRC, the MIIT, the MOF, the MOHURD, the MOT, the China Meteorological Administration (CMA), and the NEA.

In terms of institutional administration, the task force’s office is led by the Vice-Minister of the former MEP and the deputy mayor of Beijing. Moreover, the Beijing Municipal EPB specifically set up a coordination office for integrated air pollution prevention and control, which involves the day to day and coordination work of the task force.

In 2018, the task force, after operating for five years, was “upgraded” to be a “leading group” led by Vice-Premier of the State Council. This change means that the joint air pollution prevention and control work in the BTH region and surrounding areas will now have more authority and influence.

1. Top-down regional cooperation mechanism

Regional cooperation is of vital importance to air pollution prevention and control, but it can be difficult if it is only composed of voluntary and spontaneous efforts from local governments. Local governments vary in how they prioritize public affairs, as regions have differing levels of capacity for air quality management and different levels of economic development. Hence, a mechanism that is top-down is very important.

For example, the joint air pollution prevention and control cooperation mechanism effective in the BTH region and surrounding areas has the participation of China's top leader (Vice-Minister). Eight commissions and ministries also act as major driving forces for implementation. Therefore, for the regional cooperation mechanism to be effective, it is important to enlist the support of higher-level governments as a supplement to joint prevention and control at the local government level.

2. Law-based regional cooperation mechanism

An important lesson from China's experience is to provide a legal basis for regional cooperation. The Air Pollution Prevention and Control Law, revised in 2015, contains a special section about "joint air pollution prevention and control in key regions." The section specifies the responsibilities of central and local governments for joint air pollution prevention and control in these key regions. With this basis, the regional cooperation mechanism has legal support for sharing regional information, unifying law enforcement, and unifying regional environmental protection standards.

3. More financial support for backward provinces and cities

Top-down mechanisms can often be lacking in momentum, as regional air pollution prevention and control involves a number of independent administrative divisions. Therefore, providing capital support for backward cities in a region can motivate them to cooperate regionally and alleviate their pressure of having sufficient finances to implement control measures.

The central government has large amounts of special funds to provide financial support for key regions to implement the Action Plan. When the funds are being allocated within a region, provinces and cities that have more tasks to implement are given priority. Priority can also be given to the economically backward cities in the region. Another model emphasizes that capital should flow from more economically developed cities to less developed ones, which can make cooperation easier. A case in point is when Beijing and Tianjin each provided support to two smaller cities in Hebei province.

4.2

MECHANISMS FOR INTER-DEPARTMENTAL COORDINATION

BACKGROUND

For better air quality management, it is not enough to rely solely on environmental protection departments. The control of pollution sources such as coal burning, motor vehicles, and industry has ties with government departments other than the environmental protection departments. For example, coal consumption planning in China also falls under the jurisdiction of the National Development and Reform Commission (NDRC) and the National Energy Administration (NEA). The environmental management of motor vehicles also involves the Ministry of Transportation (MOT), the Ministry of Industry and Information Technology (MIIT), and other government departments. Moreover, as a national policy issued by the State Council, the Action Plan is difficult to be implemented solely through the willpower of the central government. There must be an effective top-down coordination mechanism for government departments that are at the same level and at different levels to work together.

Before the Action Plan was issued, Chinese regulations that aimed to coordinate interdepartmental air quality management work were crude. There were pollution control measures that failed at execution because they only affected environmental policies.

Since 2013, the government has created and continued to improve on a mechanism that equally emphasizes both horizontal and vertical interdepartmental coordination. In this report, the chapter entitled "Performance Management: Accountability Mechanisms for Local Governments" describes the multi-tiered performance management system that the Chinese government adopted to encourage vertical coordination of government departments at different levels through evaluation and accountability mechanisms. This chapter will focus on China's practices, experience and innovations in horizontal coordination among its various government departments that operate at the same level.

(I) Dividing Targets, Tasks, and Responsibilities Horizontally

It is important to first comprehend the working relationship among governments at different levels to understand the government's interdepartmental coordination for China's air quality management system. Within the Chinese government, the departments at the local level are led by local governments, and their upper-level departmental superiors only provide guidance on development and operations. For example, for the environmental protection system, the municipal Environmental Protection Bureau (EPB) is led by the municipal government, the provincial Environmental Protection Department (EPD) guides the municipal EPB in development and operations, and the MEE supervises the provincial EPD.

When implementing the Action Plan, national ministries and commissions are focused on compiling planning documents, policies, standards, and norms related to air pollution prevention and control as well as supervising the local governments.

At provincial level, in terms of horizontal coordination, provincial government departments need to cooperate with the provincial government on planning work, such as detailed implementation processes for the Action Plan. For vertical coordination, provincial government departments need to convey the relevant policies of the national ministries and commissions to lower-level government departments.

Finally, municipal government and its departments play the important role to making sure every measure is fully implemented.⁶⁰

A starting point for optimal interdepartmental coordination is clearly dividing responsibilities. In general, all levels of the Chinese government departments divide responsibilities by breaking down measures in the Action Plan into sub-measures and then specifying the leading department and the cooperating department for each sub-measure.

The leading department is responsible for leading the implementation of particular measures, and its responsibilities include conducting multi-departmental conferences, communicating with relevant departments, and reporting progress to the municipal government. The cooperating department must complete relevant tasks assigned to it by the leading department.

The division of responsibilities among national ministries and commissions is determined by the State Council. Shortly after the release of the Action Plan, in December 2013, the State Council issued the Scheme for Division of Responsibilities among Major Departments in the Air Pollution Prevention and Control Action Plan, which described the division of responsibilities and process of coordination among the national ministries and commissions. For example, the measure on coal pollution control was broken down into 13 sub-measures, each with the leading department and the cooperating departments clearly defined. As shown in Figure 42, the NEA took the lead in implementing eight measures, and the NDRC, and other government departments, including the former MEP, the MIIT, the Ministry of Housing and Urban-Rural Development (MOHURD) all have their own unique roles and functions.

The division of responsibilities among provincial government departments is determined by the provincial governments. After the State Council published the Action Plan in 2013, each provincial government also gradually provided Detailed Rules for the Implementation of the Air Pollution Prevention and Control Action Plan from 2013 to 2017. In addition, provincial government departments need to make sure that all municipal government departments and other relevant departments obtain the national policy documents.

The division of responsibilities among municipal government departments is structured so that tasks are specifically assigned to both leading departments and cooperating departments. Municipal task assignments involve detailed scopes of work, deadlines, among other aspects, and is generally more specific than that of the national- and provincial-level departments. Cooperating departments are also sometimes referred to as "co-organizing departments."

⁶⁰ To help the reader better understand, we provide a basic introduction to the functions and working relationships of the Chinese government at all levels, but the functions and working relationships of specific government departments at all levels can be more complicated. Please refer to the websites of specific government departments when necessary.

Figure 42 Division of Coal Consumption Reduction Responsibilities among Government Departments

No.	Major Tasks	Leading Department	Cooperating Department
1	We must advance the construction of centralized heating, "coal-to-gas," and "coal-to-electricity" projects more quickly. In areas without access to heating and gas transmission networks, electricity, new energy, and clean coal should be used. Efficient, energy-saving and environmentally friendly furnaces should also be adopted widely. In areas with chemical, papermaking, printing and dyeing, tanning, and pharmacy sectors, dispersed coal-burning furnaces should be phased out through the provision of centralized heating and combined heat and power (CHP).	MIIT, MOHURD, former MEP, NEA	NDRC
			General Administration of Quality Supervision, Inspection and Quarantine (AQSIQ)
			Ministry of Finance (MOF)
2	We must accelerate the desulfurization of coal-fired power plants, steel/iron enterprises, petroleum refining enterprises, nonferrous metal smelting enterprises, and coal-fired boilers. We must also accelerate the denitration of coal-fired generator sets (with the exception of circulating fluidized bed boilers) and new-type dry process cement kilns and upgrade dedusting facilities for coal-fired boilers and industrial kilns.	Former MEP	MIIT
			NDRC
			NEA
3	We must complete the comprehensive renovation of volatile organic compounds in petrochemical, organic chemical, coating, and package printing industries. We must technically upgrade the LDAR technology in the petrochemical sector.	Former MEP	MIIT
4	We must set medium and long-term targets for total national coal consumption and carry out performance management for target completion.	NDRC	NEA
			former MEP
5	Besides for CHP, we must prohibit new coal-fired power generation projects in BTH, YRD and PRD regions.	NEA	NDRC
			former MEP
6	We must expand the supply of natural gas, synthetic natural gas (SNG) and coalbed methane (CBM), and optimize the use of natural gas. New natural gas projects should be prioritized to be used for people's daily energy needs or to replace coal.	NEA	NDRC
			MOHURD
7	We must encourage the development of natural gas-fired distributed energy and other energy efficient projects and restrict the use of natural gas in chemical industry projects. We must develop natural gas peaking power plants in a structured way, and in principle, new natural gas power generation projects should not be built.	NEA	NDRC
			MOHURD
			former MEP
8	We must create SNG development plans and accelerate the industrialization of SNG on a large scale with the premise of meeting strict environmental standards and protecting water resource supplies.	NEA	NDRC
			MOHURD
			MEE
9	We must develop hydropower in a structured way and in the same way develop and utilize geothermal, wind, solar, and biomass energy. We must develop nuclear power safely and efficiently.	NEA	NDRC
			MIIT
			former MEP
			former Ministry of Land and Resources (MLR)
10	We must promote the proportion of coal washing and processing, build coal preparation plants to accompany newly-built coal mines and move forward with upgrading existing coal mines.	NEA	NDRC
11	We must prohibit the import of inferior coal with high ash and sulfur content and set up better coal quality management. We must restrict the import of high-sulfur petroleum coke.	NEA	NDRC
			former MEP
			Ministry of Commerce (MOF)
			General Administration of Customs (GAC)
12	We must enlarge the forbidden zones for highly polluting fuels in cities.	MEE	MOHURD
13	We must phase in the replacement of coal with natural gas and electricity through policy-based compensation and by implementing peak-valley prices, seasonal prices, tiered prices and peak-shaving prices for electricity use. We must encourage rural areas in northern China to build clean coal distribution centers and expand the use of clean coal and briquette coal.	NEA	NDRC
			MOHURD
			former MEP

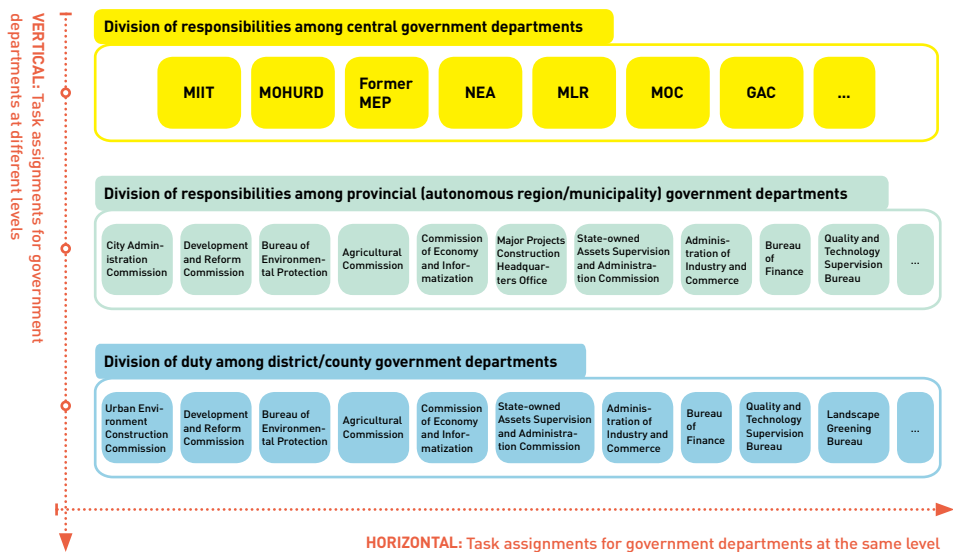
Figure 43

Key Tasks Assigned for 2017 Measures in the Beijing 2013-2017 Clean Air Action Plan (Partial)

No.	Key Tasks	2017 Measures	Deadline	Leading Official	Leading Department	Principal Units	Co-organizing Units
II. Coal reduction tasks					Measure Category		
6	Realizing mostly-coal-free industrial enterprises Sub-Measure	Achieving mostly coal-free industrial enterprises (except those using raw coal) through means such as industrial structural adjustment and transformation of coal-powered facilities toward clean energy. Industrial enterprises failing to finish coal-to-clean energy tasks will be required to suspend coal-powered facility operations starting from Aug. 1. Specific Tasks Under The Sub-Measure	By late July	Sui Zhen-jiang	Municipal Commission of Economy and Informatization	Related district governments, Municipal gas company, Beijing Electric Power Corporation	Municipal Environmental Protection Bureau, Municipal State-owned Assets Supervision and Administration Commission, Municipal City Administration Commission

Figure 44

Horizontal and Vertical Assignments of Tasks to Achieve Air Pollution Prevention and Control Targets



Some cities even designate principal units and officials in charge. Principal units are the governmental departments that must implement specific measures, and officials in charge must be responsible in ensuring the implementation.

These detailed measures and checklists of responsibilities are usually available in the clean air plans released annually by cities. Figure 43 gives an example of how responsibilities are divided among the Beijing municipal government departments.

(III) Accountability at the Individual-level

The Chinese governance system has made it clear that municipal governments actually have more decision-making power within their area of jurisdiction in air quality management than the provincial-level EPD or the MEE. Hence, effective interdepartmental coordination in the municipal government is the most critical. Full accountability can only be achieved when departmental accountability is traced down

to individual-level accountability. Individual-level accountability mechanisms must be in place at the municipal level and at the lower district and county levels.

The coal consumption reduction work in Beijing is a good example of this. For the local Clean Air Action Plan, the Beijing municipal government created a checklist of the key tasks and released internal government documents to divide the responsibilities into six sub-measures and four key tasks. The government specified a deadline, leading department, leading official, principal units, and co-organizing units.

For the sub-measure to “achieve mostly coal-free industrial enterprises,” the deputy mayor of Beijing was designated to be the government official leading the implementation process. If the sub-measure fails to be completed, the higher-level department will investigate the deputy mayor’s work. If there are serious problems, his future appointments and opportunities for promotion will also be impacted.

(III) Innovations to Interdepartmental Cooperation: Environmental Police

To better implement the Action Plan, China created new modes of interdepartmental cooperation. The most representative one is that of the “environmental police”. “Environmental police” represents a new form of cooperation between environmental protection and public security departments. Environmental protection departments provide information on pollution violations for the environmental police. The police then collect evidence and investigate the violations. Through the combined law enforcement powers from the criminal aspects from the environmental police and the administrative aspects from the environmental protection departments, enterprises and individuals that violate laws can be held legally accountable.

In the past, environmental protection departments often faced challenges enforcing the law because they only had administrative powers. For instance, enterprises might prevent environmental protection officers from entering their factory for on-site evidence collection of pollution discharge. Administrative environmental punishments were limited to warnings, fines, orders of rectifications, etc., which are not as effective in deterring pollution violations as criminal punishments.

Starting in 2013, provinces and cities like Hebei, Henan, and Beijing have tackled some of these challenges by integrating “environmental police” within their public security departments. The environmental police inside the public security system have access to their abundant resources for evidence collection and other relevant expertise. Additionally, as the environmental police are granted criminal law enforcement powers to forcibly detain assets and impose criminal detention on violators, factories that illegally pollute are more likely to be deterred due to the higher costs of violation.

Hebei created China’s first provincial environmental police team. Hebei Provincial Public Security Bureau’s Environment Security Guards were officially inaugurated on September 18, 2013. Ever since its inception, Hebei’s environmental police specially launched an annual “pollution crackdown” program that targets environmental crimes. In particular, punishments were inflicted on enterprises that illegally damaged the air quality.

Hebei’s environmental police partnered with Hebei Provincial Environmental Protection Bureau, Provincial People’s Procuratorate and Provincial Higher People’s Court to complete 2017’s “pollution crackdown” program. Through the program, Hebei’s environmental police solved 528 environmental crime cases and arrested 1,132 suspects. Provincial People’s Procuratorate handled 479 cases that it transferred for examination and prosecution with 852 suspects; Hebei’s provincial court system dealt with 143 environmental pollution crimes and sentenced 276 criminals. Hebei provincial environmental protection departments imposed administrative punishments on 2,064 enterprises suspected of pollution, of which 1,480 were ordered to take actions toward rectification and 25 were given a time limit for rectification under public supervision. The government departments also exposed 47 cases through the media. The penalties imposed totaled over RMB 84 million. Therefore, Hebei’s case shows that the environmental police can achieve tangible results in limiting pollution violations.

The Action Plan has helped government departments at the same level work together to improve air quality. The core experience can be summarized in two lessons:

1. Specifying tasks and detailing responsibilities

Even though each government department outlines its obligations for environmental protection in departmental provisions, departments shirking responsibility to protect their own interests is not uncommon for air pollution prevention and control work. Over the past five years, experience has shown that the best way to hold relevant departments responsible is to: 1) Create a detailed task list based on specific air pollution prevention and control responsibilities; 2) Specify the leading officials, deadlines, leading departments, principal units, and co-organizing units; 3) Adopt individual-level accountability mechanisms; 4) Link official's performance in air pollution prevention and control work with their evaluations, particularly for promotions, appointments, and dismissals.

2. Innovating on law enforcement cooperation mechanisms to combat environmental violations

The newly revised Environmental Protection Law states that environmental protection departments can close down and detain polluting enterprises or order them to limit production. The environmental protection departments can also provide information on violations to public security departments to hold the polluting enterprises criminally liable for violations. However, in terms of execution, environmental departments still face difficulties in collecting legal evidence, and even more difficulty in enforcing the law. The creation of the "environmental police" helps the environmental protection and public security departments to work collectively to manage pollution violation cases and use both administrative and judicial means to uphold environmental laws.

