Air Quality Improvement and Science & Technology Development in China during the Last Decade

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Contents

Air quality management policies

1. Choosing a green and low-carbon development path

- **Ecological civilization**
- **The *Beautiful China* initiative**
- **Air pollution control is essential for advancing ecological civilization and building the Beautiful China**

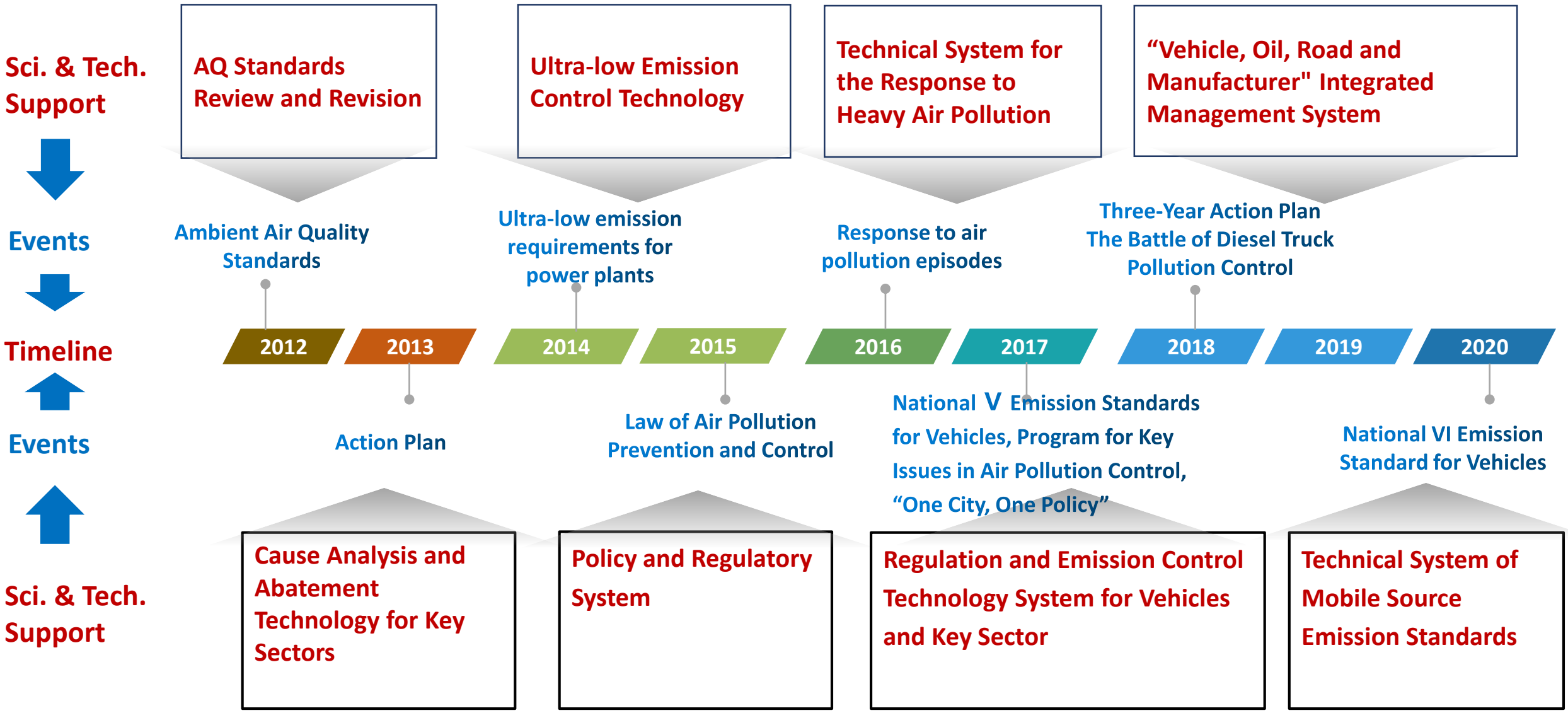
Since 2013, the Chinese government has declared war against air pollution and implemented stringent policies

- **Air Pollution Prevention and Control Action Plan (2013-2017);**
- **The Three-Year Action Plan for "Blue Sky" Defense (2018-2020)**
- **Guiding Opinions on Deepening the Nationwide Battle to Prevent and Control Pollution.**

Explored and established a multi-stakeholder model to improve the air quality through "Government-led, departmental cooperation, enterprise-wide devotion, public participation"

Air quality management policies

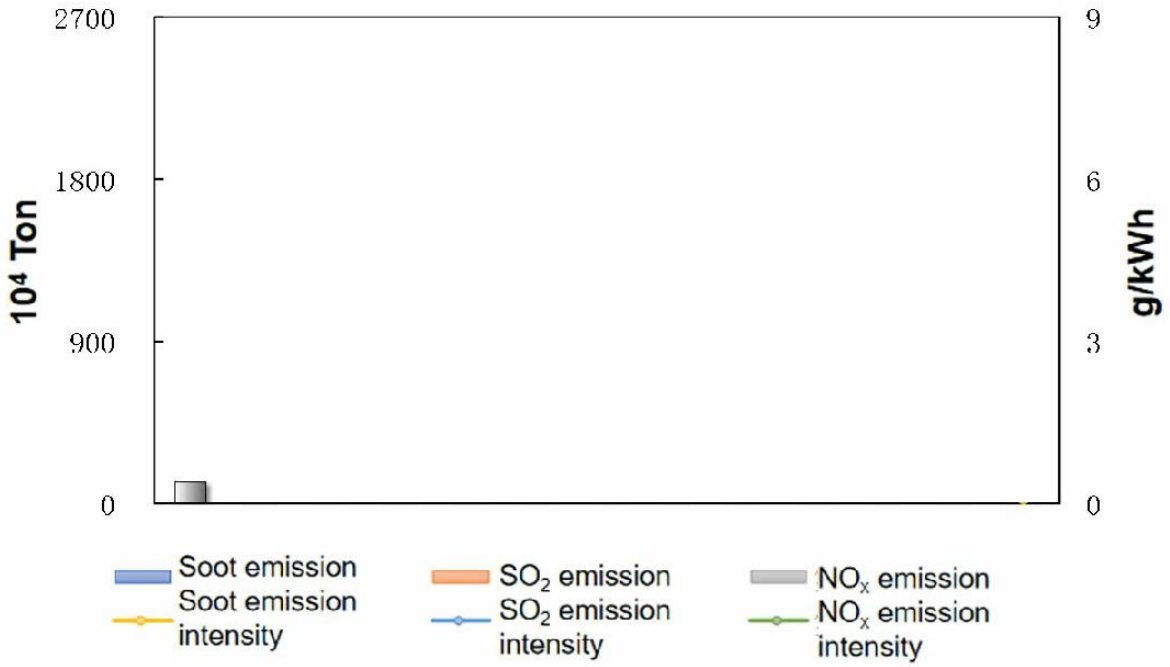
2. Milestones of air pollution control in China since 2013



Air quality management policies

3. Optimization of industrial, energy and transportation structures

- **Elimination of outdated and excessive production capacity:** 300 million tons (MT) of iron and steel, 400 MT of cement, 150 million weight boxes of flat glass; the world's most extensive clean coal power supply system was built, and 1.03 billion KW of coal power and 630 MT of crude steel production capacity completed ultra-low emission retrofit;
- National coal-fired boilers and furnaces reduced by 400,000 units; rural residents completed the renovation of more than 27 million households for clean heating in winter, reducing the burning of raw coal by more than 60 MT in total; 2/3 of the newly increased energy consumption became clean energy.



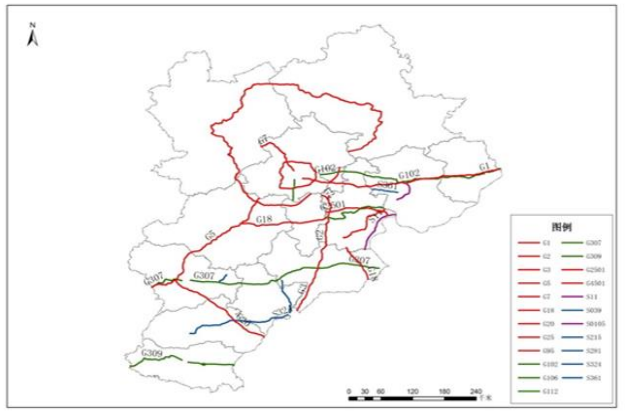
Emissions from coal power plants (2005-2017)

Coal consumption and SO_2 annual concentration trend in Beijing from 2012-2017

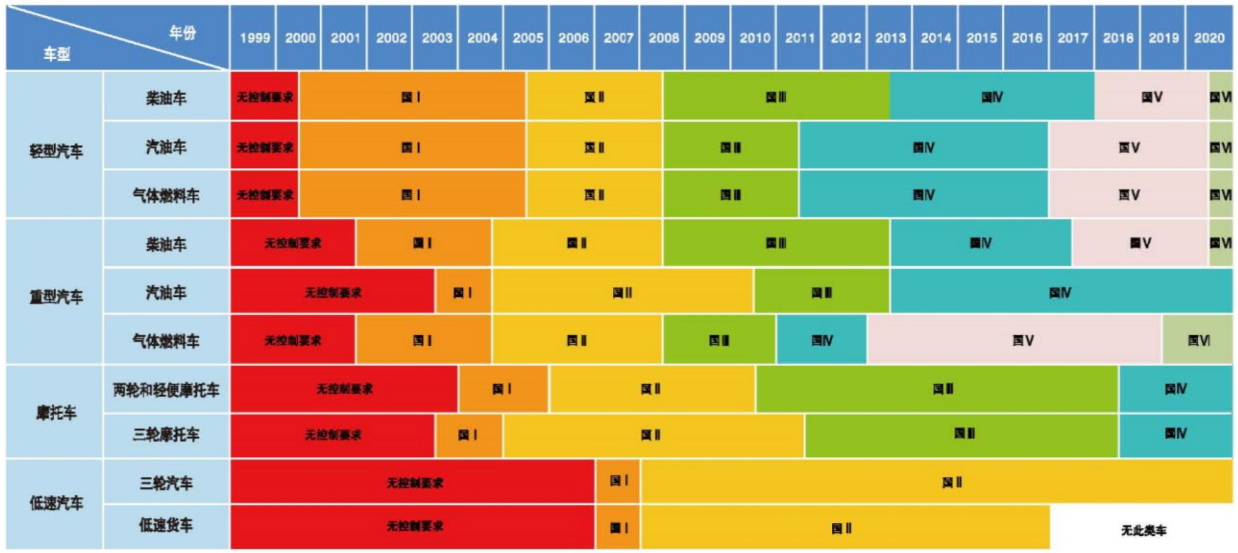
Air quality management policies

3. Optimization of industrial, energy and transportation structures

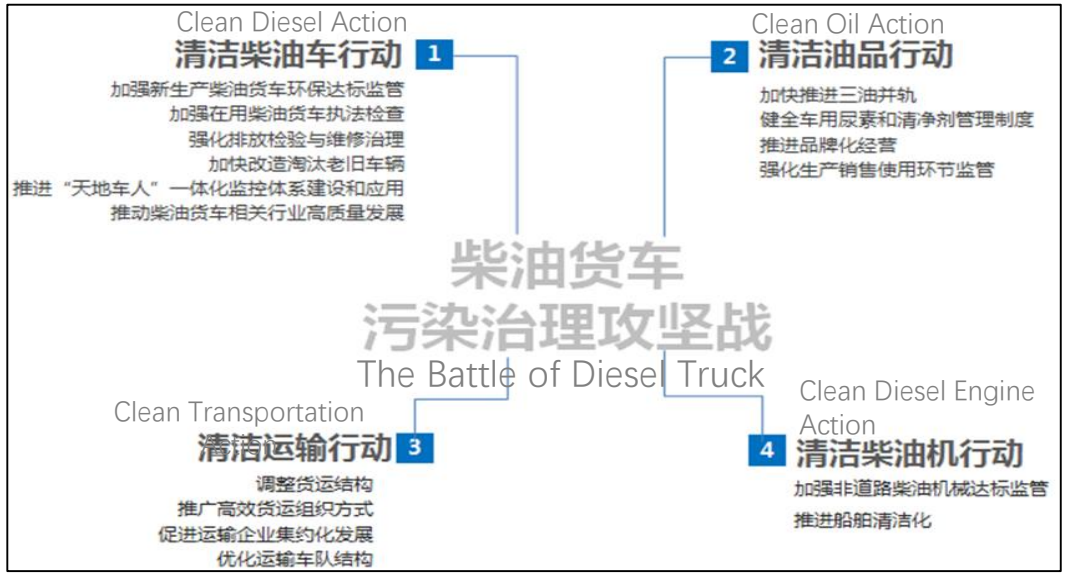
- The **world's most stringent control policies for diesel cars** have been adopted, and over **30 million** outdated and high-emission vehicles have been eliminated in the past decade
- Vehicle emission standards and oil quality standards have made the **frog-leaping from National III to National VI** and have reached the global advanced level
- **The new-energy-vehicle population has steadily ranked first in the world.**



Road-to-Rail



Tightening emission standards for new vehicles

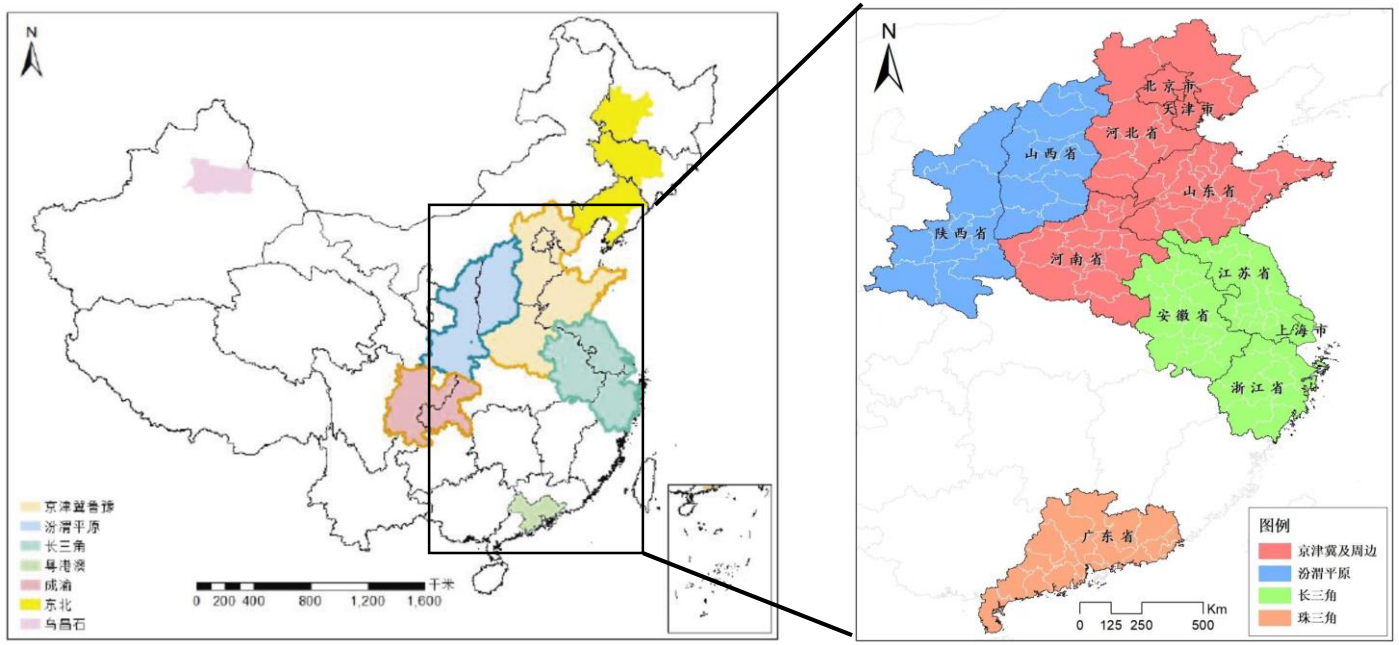


The Battle of Diesel Truck Pollution Control

Air quality management policies

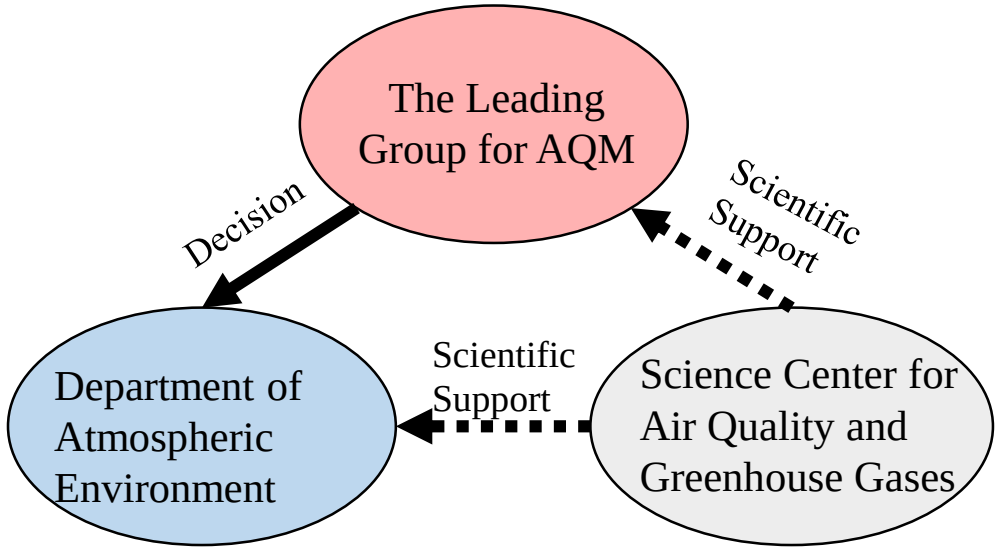
4. Establishment of joint prevention and control mechanism in key regions

- In 2013, regional air pollution control coordination mechanisms were established in **BTH and surrounding areas, the Yangtze River Delta and the Pearl River Delta** to implement joint prevention and control through unified planning, standards, monitoring and prevention and control measures in the regions.
- In 2018, the leadership for regional AQM in the BTH and surrounding areas was established, set up and led by the Department of Atmospheric Environment of the Ministry of Ecology and Environment.



Key regions of air pollution prevention and control in China

Regional Air Pollution Joint Prevention and Control Policy Making



Exercising the Executive Function for Reducing Pollution and Carbon

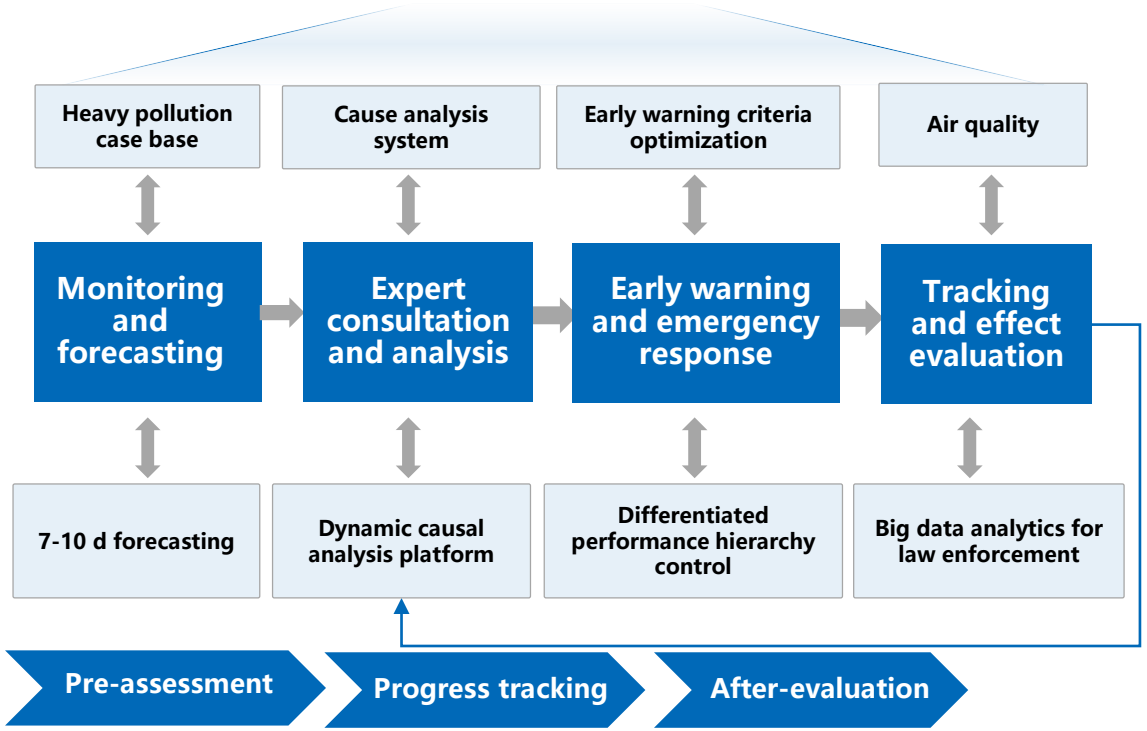
Provide the Synergetic Scientific Support

Air quality management policies

5. Heavy air pollution emergency response technical system

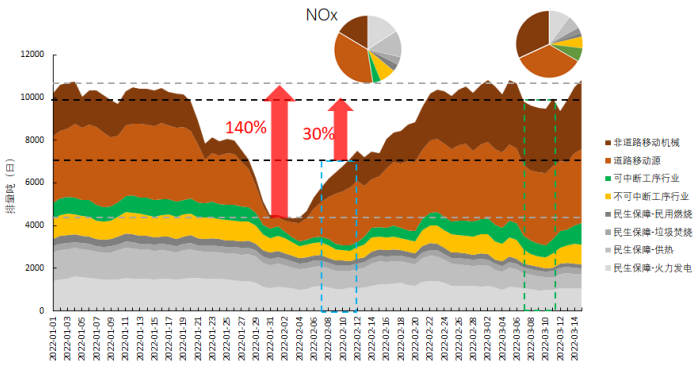
Establish and upgrade the regional heavy pollution response technology system to enhance dynamic and refined management

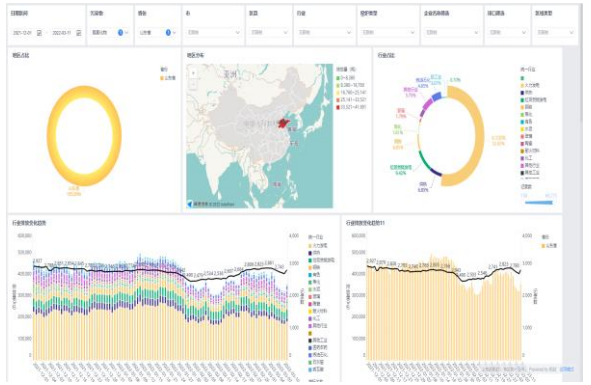
Technical system for joint emergency response to heavy air pollution



Build a technical support platform to enhance the air quality management for Beijing 2022 Winter Olympics and other mega-events

Ensure the air quality of all the competition area and venues can meet the AQ standards



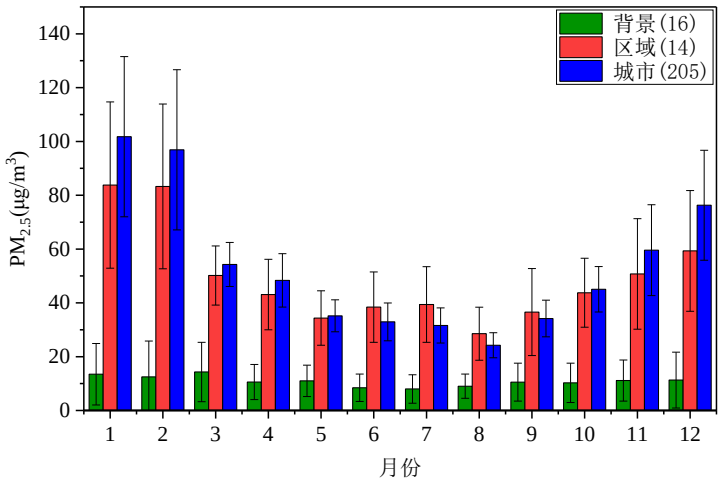


Air quality management policies

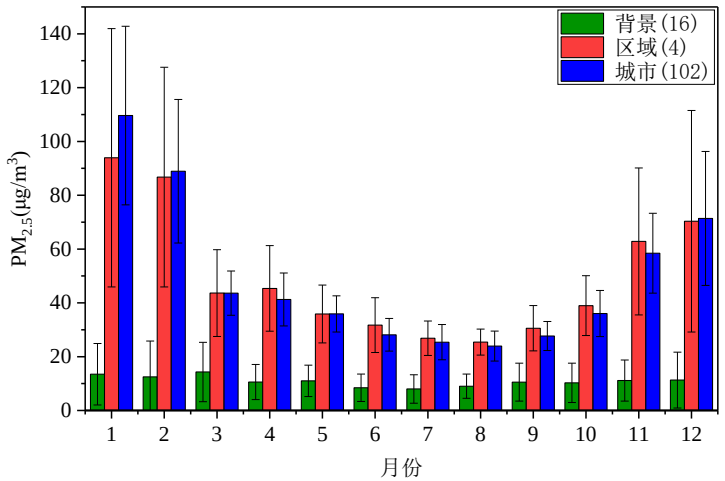
6. Recent actions for better air quality by 2025

Battle to Eliminate Heavy Air Pollution

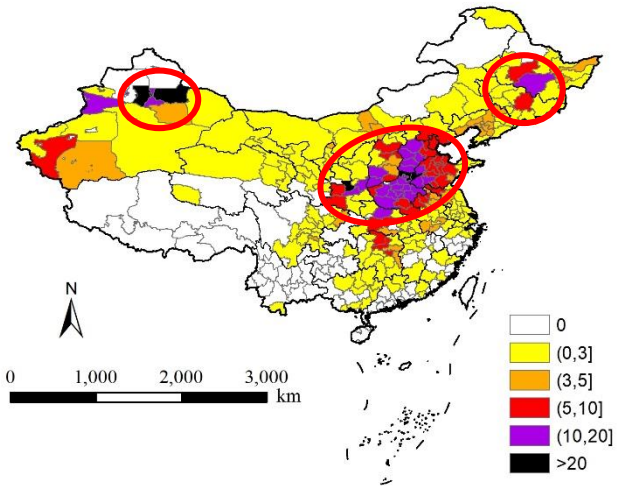
- Objective: basically eliminate heavy air pollution, and control the ratio of days with heavy or above pollution to less than 1% nationwide by 2025
- Focus on $PM_{2.5}$ pollution, within fall and winter seasons (October-next March) as the key time period.
- **BTH and surrounding area, Fen-Wei Plain, Northeast China, and the urban agglomeration on the north slope of Tianshan Mountain** as the key regions.



$PM_{2.5}$ monthly pattern in BTH and surrounding area



$PM_{2.5}$ monthly pattern in Fen-Wei plain



$PM_{2.5}$ grade 5+ days in the past six autumn-winter seasons

Data source: MEE, CNEMC

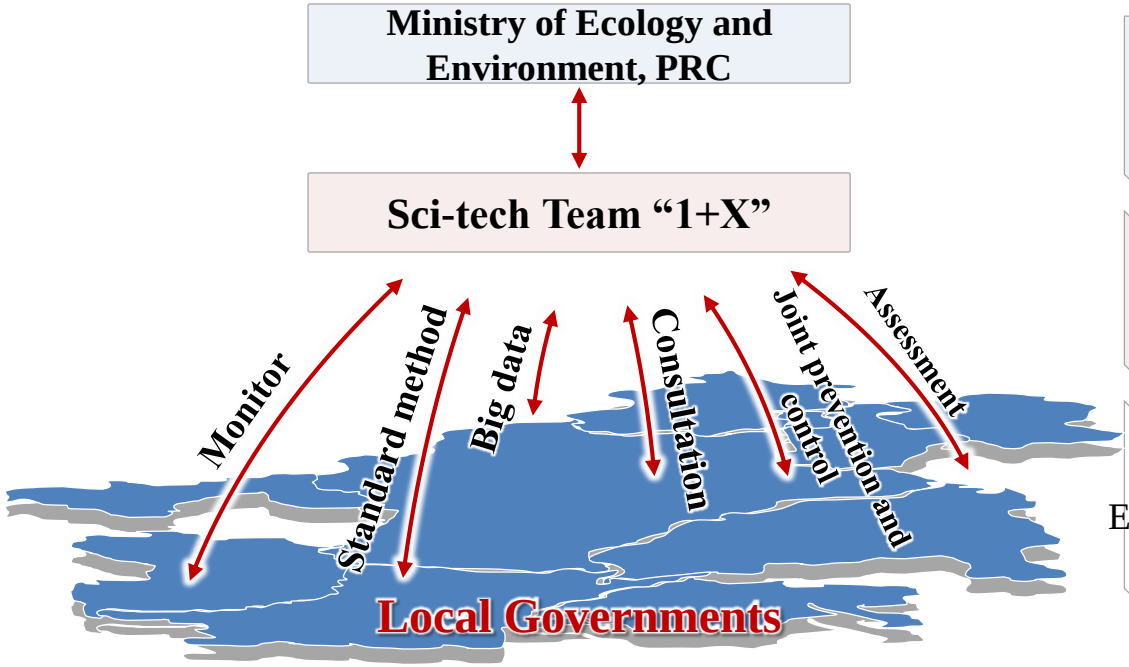
Contents

Scientific and technical support

1. Innovation in national-level research project organization

The Ministry of Ecology and Environment (MEE), together with other related ministries and scientific research institutes, with CRAES as the main supporting institute, established the National Joint Research Center for Tackling Key Problems in Air Pollution Control (NAPC), including 295 institutes and more than 2,900 scientific researchers.

Joint Efforts of Research Community

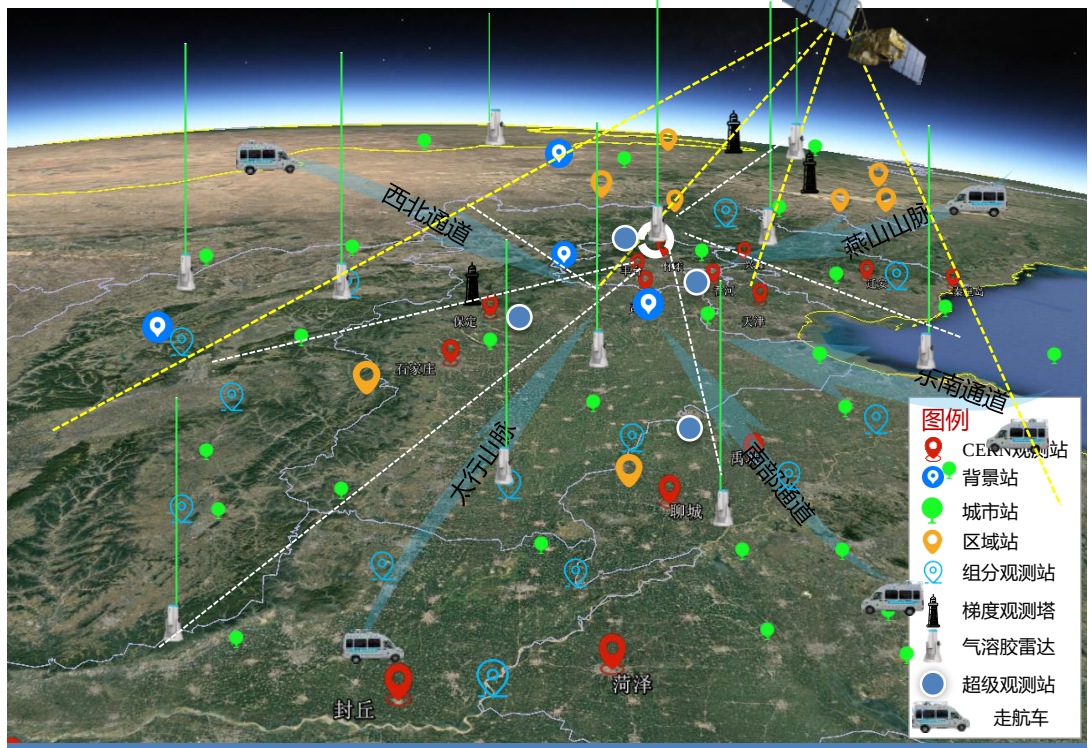


"1+X" Organizational Mechanism and Governance Structure

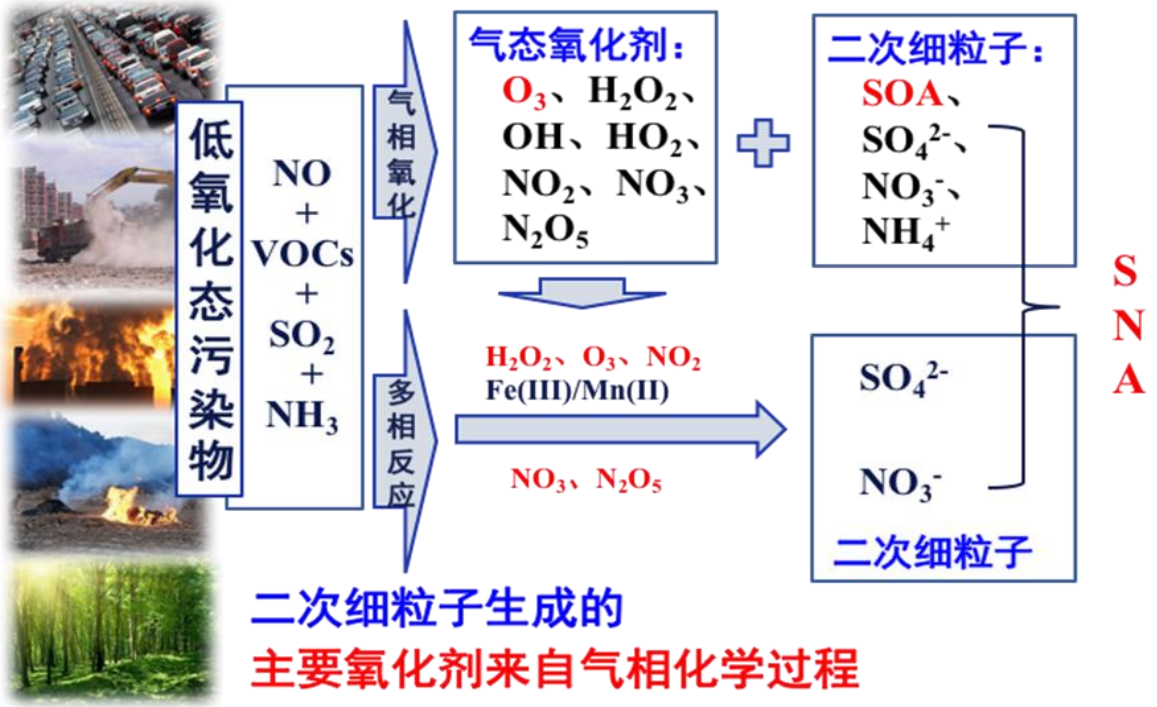
Scientific and technical support

2. Established an Integrated Ground-air-space Monitoring and Observation Network

- **Established the largest comprehensive 3-D monitoring and observation network for the BTH and surrounding areas in China,** including 22 regional sites, 2 background sites, 38 automatic sites for components analysis, 6 supersites, 15 eco-system research sites, 4 sets of aerial observation equipment, 3 gradient observation sites, etc.
- The reason of heavy air pollution in autumn-winter seasons in the region was systematically elucidated.



Integrated ground-air-space stereo observation network

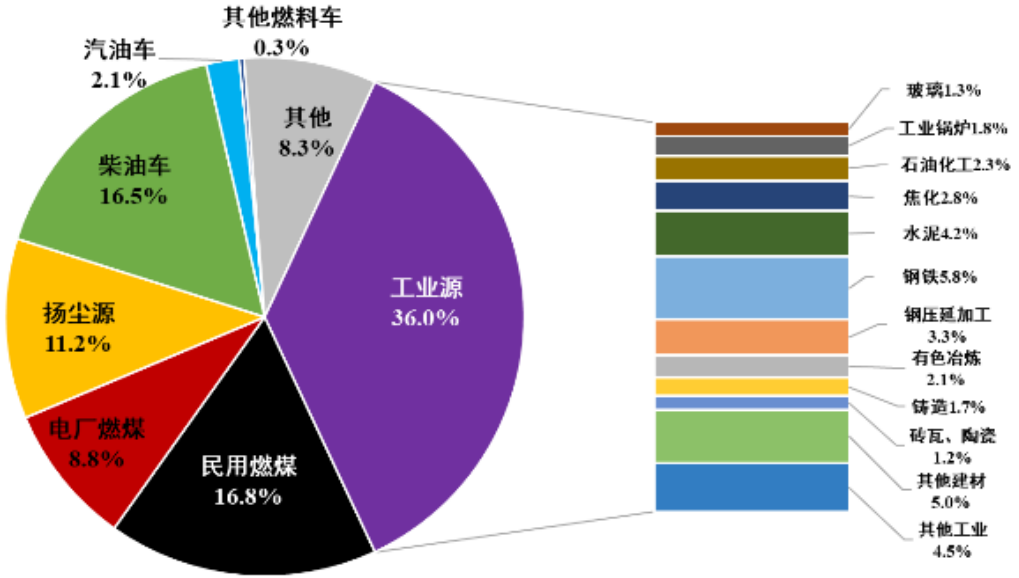


Causes of pollution: emissions, meteorology, chemistry, transportation

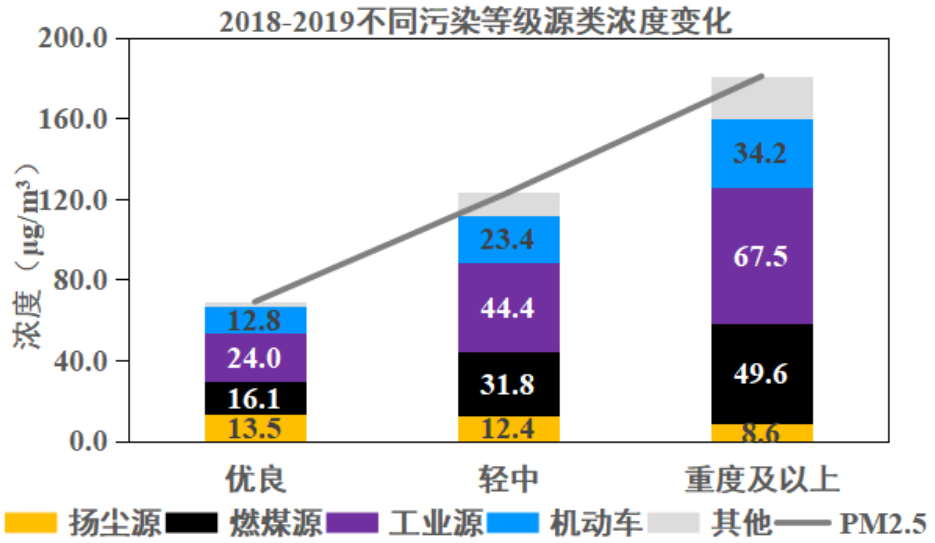
Scientific and technical support

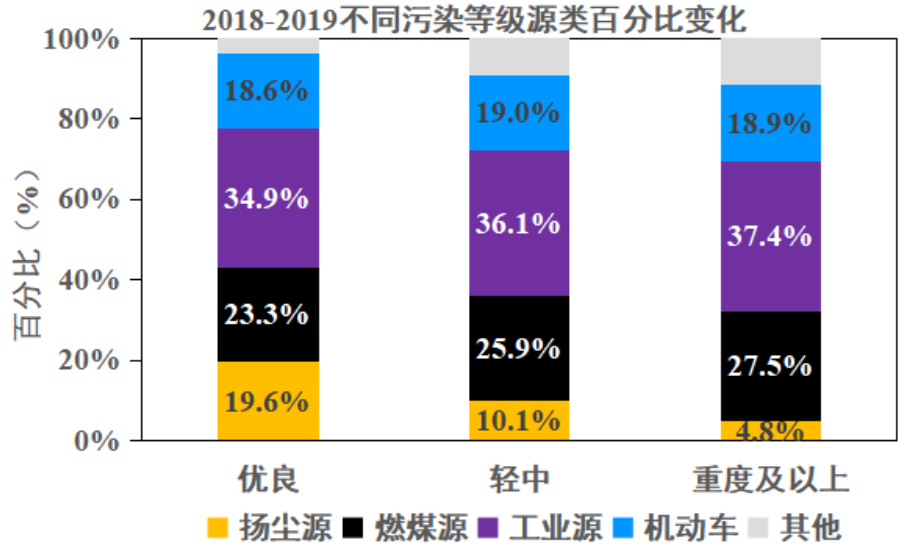
3. Recognition of main $PM_{2.5}$ sources in the BTH region during fall and winter

- In the fall and winter of 2018-2019, on heavy pollution days, the contributing concentrations of industry, coal combustion, and motor vehicles were 1.8 times, 2.1 times, and 1.7 times higher, respectively, compared with the good-fair days
- **Heavy pollution is mainly affected by industry, bulk coal and diesel vehicles, which should be the focus of emission reduction control, especially for eliminating heavy pollution**



$PM_{2.5}$ sources in 2018–2019 autumn-winter seasons

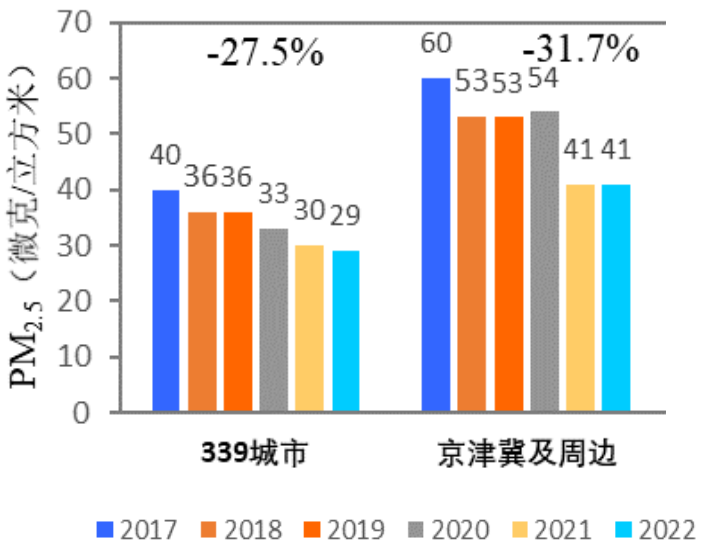


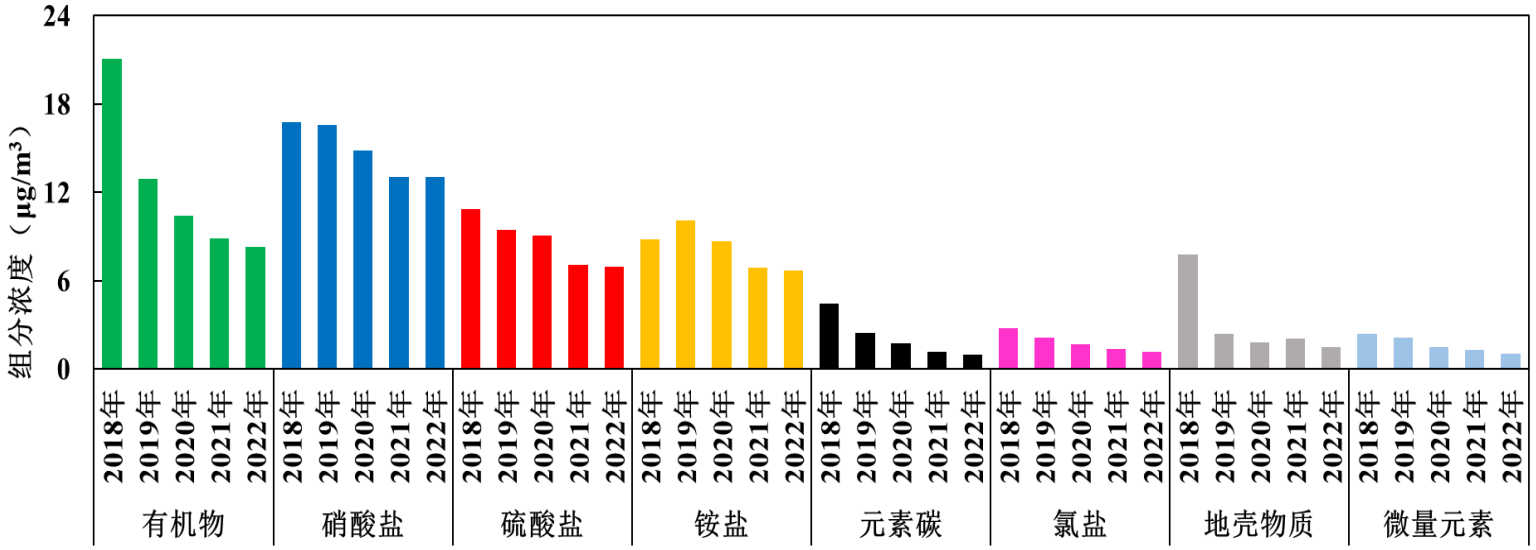


Scientific and technical support

4. Tracking region- and city-level $PM_{2.5}$ characteristics changes over time

- Between 2016 and 2020, Beijing witnessed a 48% decline in $PM_{2.5}$ concentration (from 73μg/m^3 to 38μg/m^3) and a 71% reduction in the number of heavy pollution days (from 34 to 10).
- The "2+26" cities achieved a reduction of the $PM_{2.5}$ concentrations by 30% and the number of heavy pollution days by 60%, while cutting the carbon emissions by 200 million tons.
- **In 2020 in BTH and surrounding area, the dream of clean air for blue skies of 200 million people were becoming reality.**

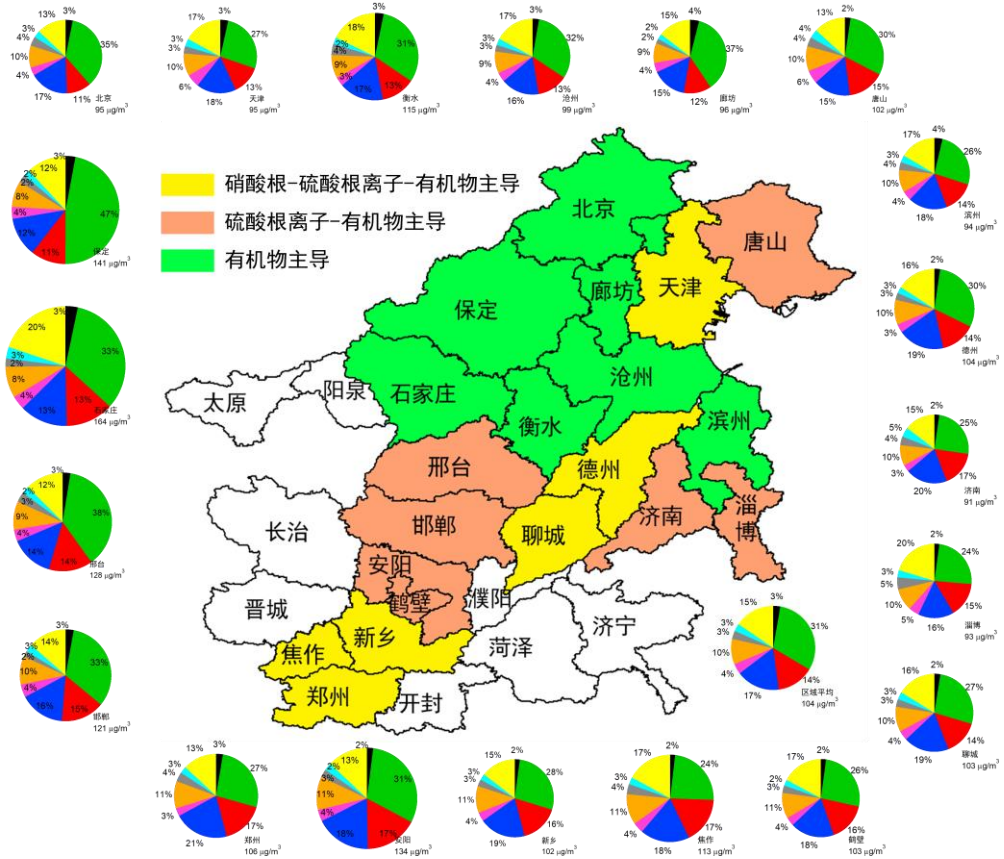




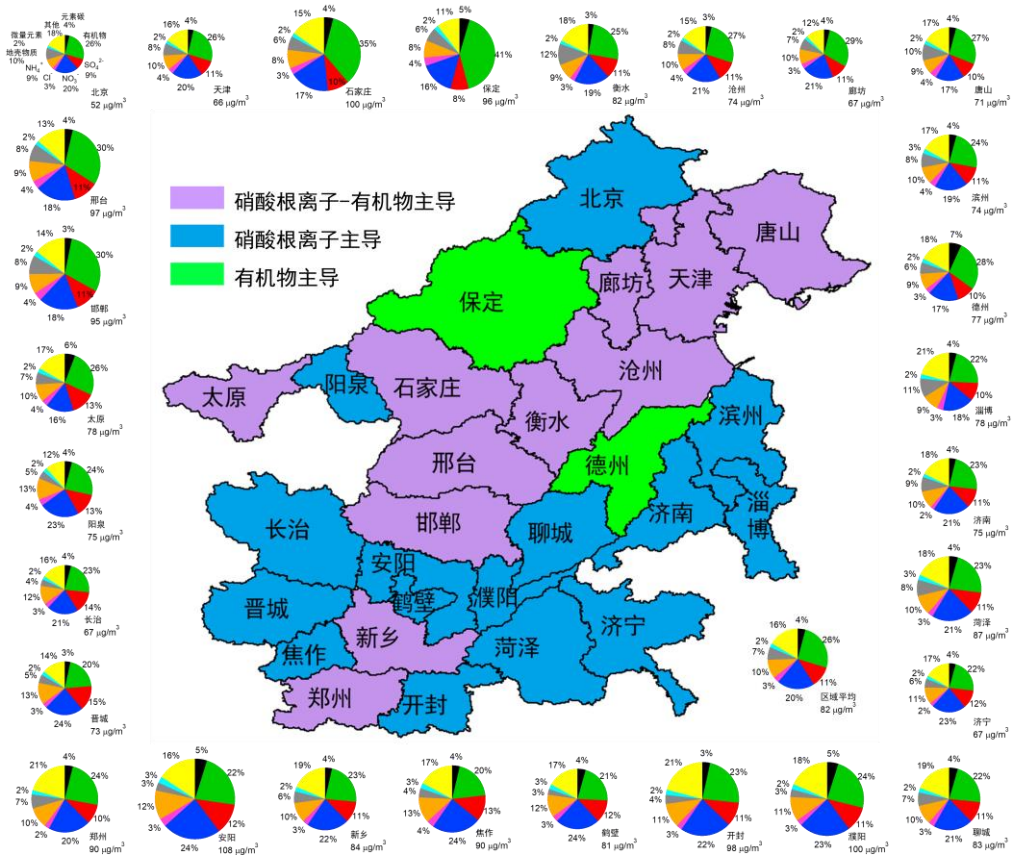
Scientific and technical support

4. Tracking region- and city-level $PM_{2.5}$ characteristics changes over time

- In the fall and winter of 2018-2019, the contributing concentration of coal-fired sources to $PM_{2.5}$ decreased by 33% compared with the fall and winter of 2016-2017, and there were significantly fewer cities where the increase in $PM_{2.5}$ concentrations was driven by organic matter and sulfate



$PM_{2.5}$ composition in the 2016-2017 autumn-winter seasons

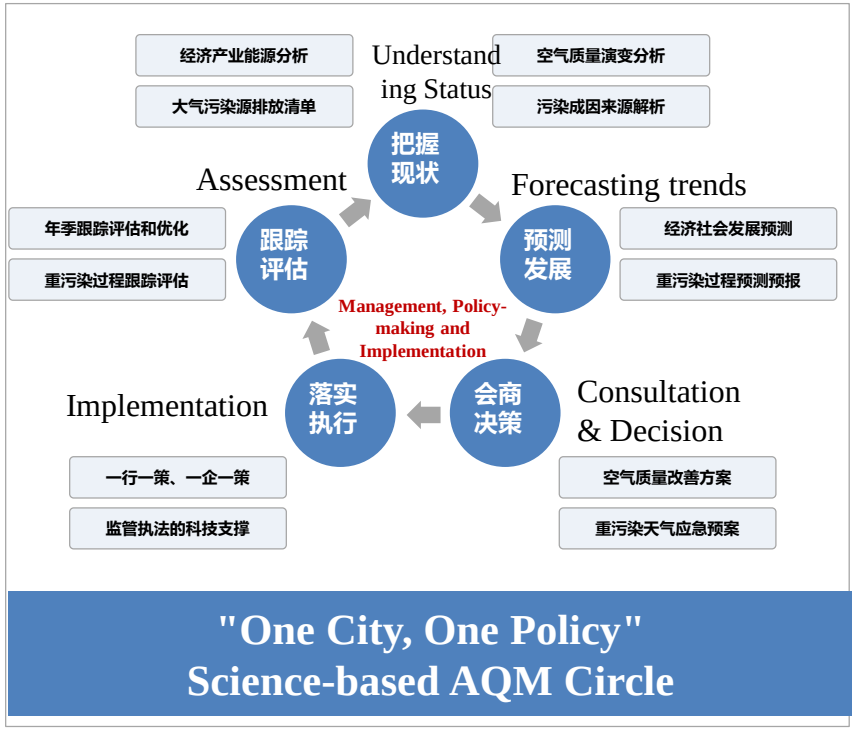


$PM_{2.5}$ composition in the 2018-2019 autumn-winter seasons

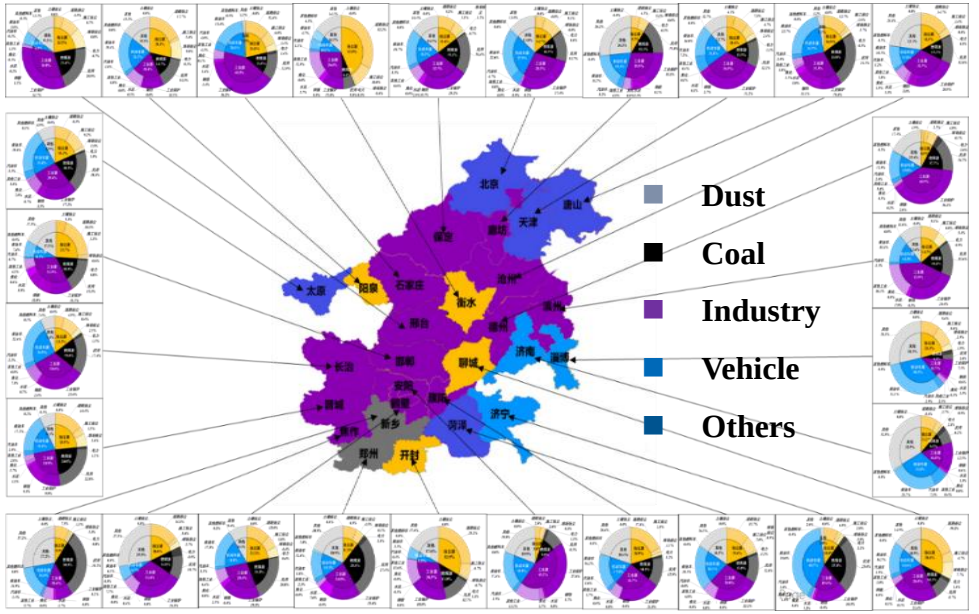
Scientific and technical support

5. Implementing the “One City, One Policy” program for science-based AQM

Carried out “One City, One Policy" tailored research programs for cities of BTH and surrounding areas and completed the "last mile" of scientific and technological applications to the ground.



"One City, One Policy" Science-based AQM Circle



Source Appointment Results for “2+26”cities

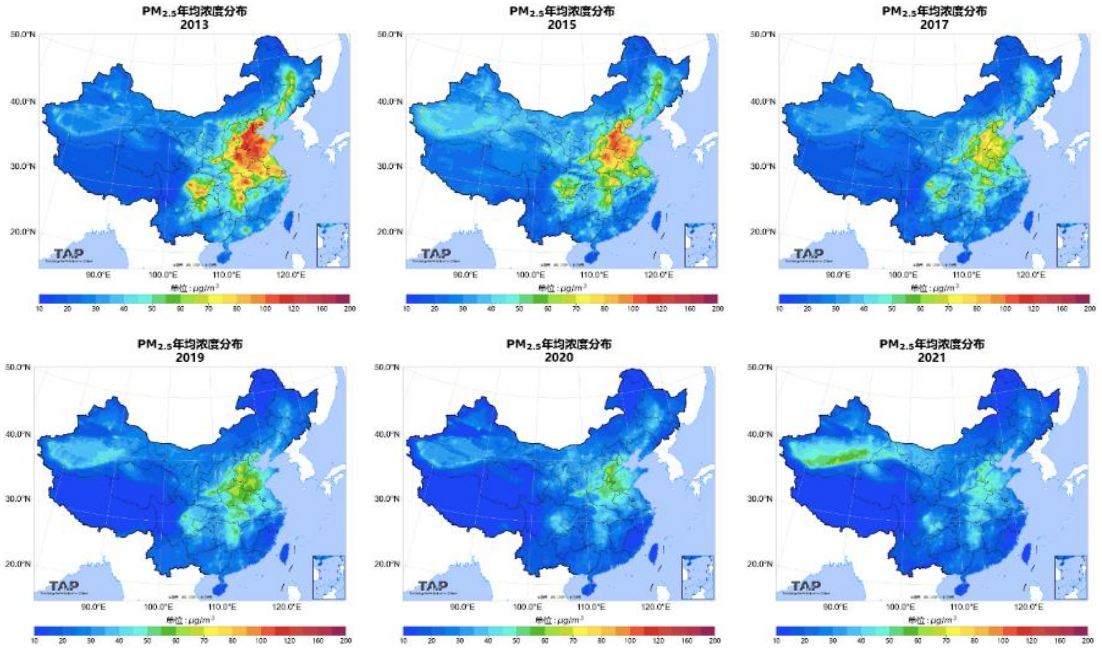
Research workbook

Contents

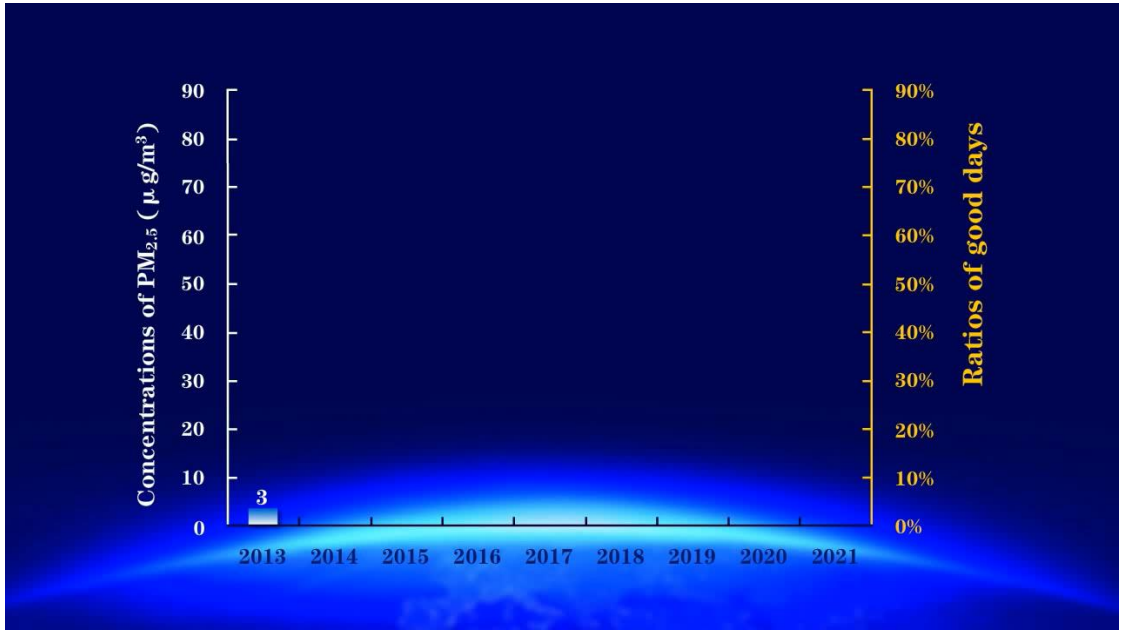
Air quality improvement

1. Significant Improvement of Air Quality in China since 2013

- **Action Plans have been implemented successively since 2013, making China the 1st developing country to control $PM_{2.5}$ pollution effectively.**
- **From 2013 to 2022, the $PM_{2.5}$ concentration in China decreased by 57%, and by 66% in Beijing. The $PM_{2.5}$ concentration in Beijing have been continuously reaching the national secondary standard since 2021.**
- **In less than 10 years, China has accomplished the achievement made by US in nearly 30 years, which has become a highlight of China's ecological civilization construction.**



Annual average concentration of $PM_{2.5}$ in China

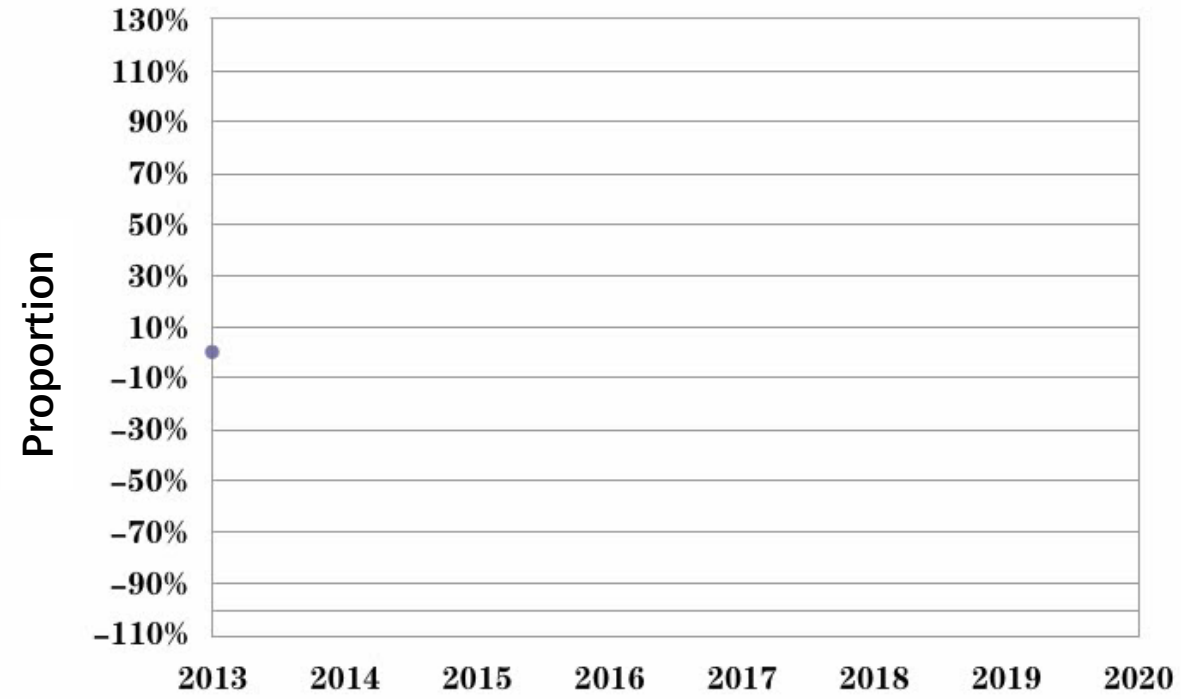


Improvement of Air Quality in Beijing

Air quality improvement

2. Reaching a “Win-win” situation between economic development and AQ improvement

- **China achieved significant improvement of air quality since 2013 with a rapid GDP growth, reaching a "win-win" situation of economic and social development and ecological and environmental protection.**
- **The innovation of AQM and science-technology support promote continuous improvement of air quality in China, which can provide experience and reference for air pollution control in other countries and regions in Asia.**



Trends in air quality and major economic indicators in China

Thank you for your attention!