An Introduction to Beijing Air pollution Control

Beijing Municipal Environmental Protection Bureau
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Main Content

一 Basic Information

二 Air Pollution Control and Prevention Progress

三 Causes and Challenges

四 2013-2017 Clean Air Action Plan

五 Emergency Response Action for Heavy Pollution Days
I. Basic Informations

- **Landform**: Mountains around
- **Area**: 16,000 km²
- **Climate**: Temperate continental monsoon
- **Annual precipitation**: 448 mm
- **Population**: > 20 million
- **Vehicles**: > 5.6 million
- **Annual construction sites**: 200 million m²
GDP: 0.24 trillion RMB in 1998
2.13 trillion RMB in 2014
Increased by 7.98 times

Permanent Population: 12.45 million in 1998
21.516 million in 2014
Increased by 73%

Vehicle Fleet: 1.35 million in 1998
5.6 million in 2014
Increased by 3.12 times

Energy Consumption: 38.08 million tons of standard coal in 1998
74.54 million tons of standard coal in 2014
Increased by 95.7%
Compared with the year of 1998, the annual average of SO$_2$, NO$_2$, PM$_{10}$ have respectively decreased by 81.8%, 23.4% and 38.4% in the year of 2014. And the concentration of PM$_{2.5}$ in 2014 is 85.9 $\mu$g/m$^3$. The air quality has been continually improved with the rapid development of economy and society.
Beijing is better than most of northern cities which have to supply winter heating.

The concentration of SO$_2$ in Northern cities of China
Concentration of PM10 NO₂ PM2.5 exceed the standard

<table>
<thead>
<tr>
<th>Pollutants</th>
<th>Concentration (2015)(μg/m³)</th>
<th>National Standard (μg/m³)</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>SO₂</td>
<td>13.5</td>
<td>60</td>
<td>Meet standard</td>
</tr>
<tr>
<td>NO₂</td>
<td>50</td>
<td>40</td>
<td>Exceed by 25%</td>
</tr>
<tr>
<td>PM10</td>
<td>101.5</td>
<td>70</td>
<td>Exceed by 45%</td>
</tr>
<tr>
<td>PM2.5</td>
<td>80.6</td>
<td>35</td>
<td>Exceed by 130%</td>
</tr>
</tbody>
</table>
Air Pollution Control and Prevention Progress

In 1998-2012, Beijing has intensively implemented the air pollution control measures in 16 phases and 3 annual clean air action plans successively, which have effectively controlled air pollution and improved air quality.

- **Restructure the Industry.** More than 400 seriously polluting plants, such as Shougang Group, coking plant, etc. have been closed or relocated from Beijing. Output of tertiary industry took over 76.3% in the total GDP

- **Optimize energy structure.** In central urban area, more than 300,000 bungalow houses converted their coal heating stoves to electro-heating utilities. More than 17,000 coal-burning boilers had been replaced by natural gas boilers.
Accelerate Vehicle Pollution Control. Vehicle emission standards (Form National I to National V) were implemented in advance of the nation. The economic incentives measures were adopted to eliminate the outmoded heavy-polluting vehicles, and 156,000 yellow label cars and 601,000 outmoded vehicles were eliminated. Before Beijing Olympic Games in 2008, 52 oil depots, 1,462 gas stations and 1,387 oil tankers all over the city was implemented with oil vapor recovery system.

Improve the Eco-construction. The first green belt has been basically completed. The urban green coverage rate has increased from 35.6% in 1998 to 46.2% in 2012

The air quality in Olympic Games period was successfully guaranteed, and the mechanism for regional joint control and prevention of air quality was explored.
Compared with the year of 2005, the energy consumption for per ten thousand GDP has decreased from 0.79 ton of standard coal to 0.392 ton of standard coal, decline by 50.4%.
Beijing Air Quality Release

- Air quality weekly report from March, 1998
- Air quality daily report from March, 1999
- Air quality forecast from May, 2001
- Air quality real-time report from Jan. 2013
Local emission remains at high level

- Vehicles fleet 5.7 million (by 2015)
- Coal consumption 12 million Ton per year (by 2015)
- Industrial structure needs further adjustment, a considerable number of small chemical, building material factories existed
- The area of annual construction sites over 200 million m²
Ⅲ  Causes and Challenges

Regional pollution transportation

PM2.5 Jan-jun 2013
PM2.5 Jan-jun 2014
PM2.5 Jan-jun 2015

Power
Cement
Iron & steel
In summer and autumn, the straw-burning pollution cross the region impact air quality obviously in short period
Unfavorable natural geographic and meteorological conditions

- U-type landscape, three sides are surrounded by mountains, the atmosphere diffusion conditions are unfavorable
- Shortage of rains, annual rain precipitation is less than 450mm in the last 10 years, unfavorable sedimentation of pollutants
- Generally, the unfavorable climate conditions days reached about 20% per year
Fast urbanization, fragile eco-condition
In typical conditions, regional pollution transport constitutes 28-36% of PM$_{2.5}$ pollution in the city, and the local pollution emission constitutes 64-72%.

In local emissions, automobile exhaust constitutes 31.1%, coal combustion emission constitutes 22.4%, industrial pollution emission constitutes 18.1%, fugitive dust emission constitutes 14.3% and other pollution, such as catering oil fume, constitutes 14.1%.
PM$_{2.5}$ not only comes from the primary pollutant emissions, but also from the secondary transformation of gaseous pollutants.
## 2013-2017 Clean Air Action Plan

### The core contents are
- Coal reduction
- Vehicle fleet control and fuel reduction
- Pollution control and emission reduction
- Dust reduction

### Eight major projects of pollution control and emission reduction projects

- **Increment control**
  - Source control
    - Energy structure adjustment
    - Vehicle structure adjustment
    - Industrial structure optimization
    - Post-treatment of pollutant
    - Urban refined management
    - Serious air pollution response

- **Storage reduction**
  - Eco-environment construction

### Six major supporting measures
- Laws and regulations perfection
- Economic leading
- Science and technology support
- Organization safeguards
- Responsibility fulfillment
- Supervision and examination

### Three major public participation projects
- Pollution treatment by enterprises’ self-discipline
- Pollution reduction by public’s consciousness
- Pollution precaution by social supervision
Adhere to the clean energy strategy, and vigorously develop electricity and natural gas, optimize the energy structure.

Reduce coal use. The total coal consumption in 2012 was 23 million ton, by 2017 it should be 10 million ton, decline by 56%.

Develop the green energy, such as geothermal energy, solar energy, wind power, etc.

Gas-fired boiler

Utilization of solar energy in rural areas

Guanting Wind Power Plant

Coal Reduction

Coal Reduction

2012年
2300万吨

• 电厂煤改气，削减925万吨
• 采暖锅炉煤改气，压煤100万吨
• 工业减煤200万吨
• 农村减煤100万吨

2017年
1000万吨
Beijing's coal consumption in 2012

Boiler distribution:
- Power plant: 920 boilers, 40%
- Industry: 400 boilers, 17%
- Household: 430 boilers, 19%
- Boilers for winter heating: 550 boilers, 24%

Energy structure in 2012:
- Coal: 25.40%
- Diesel and gasoline: 31.10%
- Natural gas: 16.70%
- Electricity: 25.70%
- Others: 1.10%

Coal consumption in Beijing:
- 2005: 3069
- 2006: 3056
- 2007: 2985
- 2008: 2748
- 2009: 2665
- 2010: 2635
- 2011: 2366
- 2012: 2270
- 2013: 2107
- 2014: 1736
- 2015: 1200
- 2017: 1000

Year
Reduce power plant coal use
Reduce coal-fired boilers
Beijing’s High Pollution Fuel Prohibited Areas
It is difficult to reduce coal use in suburban and countryside area.

“five measures”

1. Urbanization
2. Pull down illegal buildings
3. LPG for cooking
4. Clean energy for winter heating
5. Replace poor-quality coal by good-quality coal

Examples of these measures in practice.
(II) Vehicle emission control and fuel reduction

- Develop public transportation. The proportion of public transportation trips in the downtown has reached to 48%.
- Control vehicle fleet size (within 6 millions)
- Implement the fifth stage of vehicle emission standard
- Eliminate 1 millions outmoded vehicles
- Strictly regulate in use vehicles

Updated buses

Subsidy apply window for replacing outmoded vehicles
Develop high-tech industry and modern service industry, and the proportion of tertiary industry has reached 77.9%

Adjust and relocate 1,200 high-pollution enterprises

Implement one hundred environmental protection and technical renovation projects

Carry out cleaner production auditing

(III) Pollution control and emission reduction

- Primary industry, 0.7%
- Secondary industry, 21.4%
- Tertiary industry, 77.9%

Shougang Group off production

VOCs treatment
(IV) Fugitive dust reduction

- Formulate and implement construction site **environmental protection standards** and carry out fugitive dust **special fund** management experiment, strengthen supervision
- Increase mechanical cleaning and washing areas on road and make experiment of washing with recycled water
- Implement **closure slag trucks renovation**, and more than 8,000 slag trucks came into use
- Carry out city afforestation, and rectify **bare lands**
- Protective cultivation
(V) Enhance ecological protection and construction

- 20 natural reserves were built up all over the city
- 3 green-shelter belts have been basically established
- The urban green coverage rate in 2014 reached to 58.4%
(VI) Strengthen policy and regulation

- Established and implemented *Beijing Air Pollution Control Regulation*

- Issue economic *policies*, such as increase pollution charges, promoting electric vehicles, etc.

- Release and implement 33 most stringent environmental protection *standards* in the country

*Regulation*

A total of eight chapters and 130 terms

- On-road and off-road vehicle emission control
- General provisions
- Total emission control for key pollutants
- Joint control and prevention
- Supplementary provisions
- Legal responsibilities
- Stationary sources pollution control
- Raise dust pollution control
(VII) Promote joint air pollution control and prevention

- According to requirement of the central authorities, seven provinces and municipalities, including Beijing, Hebei Province, Tianjin, Shanxi Province, Inner Mongolia, Shandong Province and Henan Province, and eight departments of the central government, including Ministry of Environmental Protection, National Development and Reform Commission, Ministry of Finance, Ministry of Industry and Information Technology, Ministry of Housing and Urban-Rural Development, Ministry of Transportation, National Weather Bureau as well as National Energy Bureau, have jointly established the Jing-Jin-Ji (Beijing-Tianjin-Hebei) and Surrounding Areas Air Pollution Control Coordination Group.

- Since the Coordination Group has been established, with the principle of “fully consider the regional differences, gradually improve the top-level design, jointly solve the common key problems and uniformly strengthen the regional joint action”, the members in the group have together promoted regional joint control and prevention of air pollution based on the respective implementation of clean air action plans in each municipality/province.

- Set up regional air pollution control expert committee, build the information sharing platform of joint air pollution control and prevention, strengthen regional joint law enforcement

- Compile *Beijing-Tianjin-Hebei Overall Idea Framework for Collaborative Development Planning and Planning for Coordinated Development of Eco-environmental Protection in Beijing-Tianjin-Hebei*
(VIII) Improve environmental awareness of the public

- Pursue life styles and consumption patterns which are beneficial to resource-saving and environmental protection

- Advocate green travel and implement the measure of no driving once a week

- Continually strengthen the consciousness of the whole society to protect the environment and cope with climate change
V Heavy Pollution Days Emergency Response Action

- Heavy Pollution Days Emergency Response Action
  Published in 2013  Revised in 2015

- In 2014, there were 47 heavy pollution days, 18 alerts were issued, the forecast accuracy reached 70%

- In 2015, there were 38 heavy pollution days, 15 alerts (including 2 red alert) were issued, the forecast accuracy reached 97%

- Blue Alert
  11 Times
  5 Times

- Yellow Alert
  5 Times
  6 Times

- Orange Alert
  2 Times
  2 times

- Red Alert
  2 Times
The First Red Alert was issued on December 7th, 2015. Orange alert was issued 31 hours before heavy pollution happened, red alert was issued 13 hours before it happened, the heavy pollution actually lasted 81 hours.
There are 4 response levels.

<table>
<thead>
<tr>
<th>Response Level 4 (Blue Alert)</th>
<th>When forecast shows heavy pollution* will last 1 day (24 hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response Level 3 (Yellow Alert)</td>
<td>When forecast shows heavy pollution will last 2 days (48 hours)</td>
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<tr>
<td>Response Level 2 (Orange Alert)</td>
<td>When forecast shows heavy pollution will last 3 days (72 hours)</td>
</tr>
<tr>
<td>Response Level 1 (Red Alert)</td>
<td>When forecast shows heavy pollution will last more than 3 days (more than 72 hours)</td>
</tr>
</tbody>
</table>

*Heavy pollution—AQI > 200
The measures are divided into 3 categories

- Health Protection Measures
- Optional Emission Control Measures
- Mandatory Emission Control Measures
<table>
<thead>
<tr>
<th>Category</th>
<th>Main Measures</th>
<th>Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health Protection measures</td>
<td>Remind sensitive people to consider reduce outdoor exertion</td>
<td>Level 4</td>
</tr>
<tr>
<td></td>
<td>Remind sensitive people to stay indoor and avoid outdoor exertion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Remind people to reduce outdoor exertion</td>
<td></td>
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<tr>
<td></td>
<td>Remind people to avoid outdoor exertion or wear mask</td>
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<tr>
<td></td>
<td>Related public agencies enhance communications with public about heavy pollution and health protection</td>
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<tr>
<td></td>
<td>Hospitals should be ready for respiratory emergency treatment</td>
<td></td>
</tr>
<tr>
<td>Category</td>
<td>Main Measures</td>
<td>Levels</td>
</tr>
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<tr>
<td>Optional Emission Control Measures</td>
<td>Take public transportation for commute, Reduce idling time</td>
<td><img src="image" alt="Level 4" /> <img src="image" alt="Level 3" /> <img src="image" alt="Level 2" /> <img src="image" alt="Level 1" /></td>
</tr>
<tr>
<td></td>
<td>Enhance dust control on construction sites, Clean road surface to reduce fugitive dust</td>
<td><img src="image" alt="Level 4" /> <img src="image" alt="Level 3" /></td>
</tr>
<tr>
<td></td>
<td>Sources take measures to reduce emission</td>
<td><img src="image" alt="Level 4" /> <img src="image" alt="Level 3" /></td>
</tr>
<tr>
<td></td>
<td>Control coating, painting, solvent use to reduce VOCs emission</td>
<td><img src="image" alt="Level 4" /> <img src="image" alt="Level 1" /></td>
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<tr>
<td></td>
<td>Kindergarten, primary school, middle school stop outdoor exercise class</td>
<td><img src="image" alt="Level 3" /> <img src="image" alt="Level 2" /> <img src="image" alt="Level 1" /></td>
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<tr>
<td></td>
<td>Kindergarten, primary school, middle school stop all the class</td>
<td><img src="image" alt="Level 1" /></td>
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</table>

Note: The symbols ![Level 4](image), ![Level 3](image), ![Level 2](image), ![Level 1](image) represent the level of implementation for each measure.
<table>
<thead>
<tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Level 4</td>
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<tr>
<td>Mandatory Emission Control Measures</td>
<td>Stop construction activities such as groundworks, demolition works</td>
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In a certain period of future, high speed economic growth in Beijing will sustain, the scale of city construction, vehicle fleet, and population will continue to increase. The conflicts among population, natural resources, and environment continue to be dominant.

The improvement of environment, Better air quality, promotion of urban sustainable development, adopting measures to combat climate change and building a resource-saving and environment-friendly society shall be considered as a whole.
Thank you!

谢谢！