Air Pollution Control in China: Progress and Perspectives

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Tsinghua University
Nov. 16, 2013
Air Pollution Control in China: Historical Progress
Phase 1: 1970～1990

- **Main source**: Point sources (industry)
- **Major pollutants**: TSP
- **Scale of air pollution**: Local
- **Air quality management**: Emission concentration, smoke and dust control, point sources, local management
- **Milestones**:
  - 1973, 1st national comprehensive emission standard — The three wastes emission standard of industry
  - 1987, Air Pollution law, targeting industry and coal-burning pollution
Main source: Coal burning, industry

Major pollutants: SO$_2$, TSP

Air pollution problems: Smoke, acid rain

Scale of air pollution: local + regional

Air quality management: Emission concentration, coal burning control, point sources, local management

Milestones:

- 1998, SO$_2$ and acid rain control zone; 2000, total emission amount control of SO$_2$ in the SO$_2$ and acid rain control zone
Phase 3: 2000～2010

- **Main source:** Coal burning, industry, dust, vehicles
- **Major pollutants:** SO$_2$, TSP, NO$_x$, PM$_{10}$
- **Air pollution problems:** Smoke (coal burning), acid rain, haze/PM2.5, photochemical pollution, regional complex air pollution
- **Scale of air pollution:** Regional + global
- **Air quality management:** Single pollutant total amount control, coal burning emission control, point sources, local management with start of multi-pollutants management, trial of regional control in some key regions.
- **Milestones:**
  - 2000, amendment of air pollution law: total amount control in SO$_2$ and acid rain control zone, vehicle emission control, dust control
  - Total emission amount control of SO$_2$ was expanded to whole country
  - Regional corporation for Beijing Olympics, Guangzhou Asian Games and Shanghai Expo
Emission Standards—Stationary Sources

Upgrade of Emission Standard-PM

1996
National
200mg/m³

2002
Beijing
50mg/m³

2003
National
50mg/m³

2007
Beijing
10mg/m³

2007
Beijing
50mg/m³

Emission Standard of Air Pollutants for Thermal Power Plants
Dust emission limit of newly built, expanded and transformed boilers in China

Upgrade of Emission Standard-SO2

1996
National
200mg/m³

2002
Beijing
100~150mg/m³

2003
National
400~1200mg/m³

2007
Beijing
50mg/m³

Emission Standard of Air Pollutants for Coal-Burning Oil-Burning Gas-Fired Boilers
Dust emission limit of newly built, expanded and transformed boilers in Beijing
### Emission standards for gasoline vehicles

<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
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<th>91</th>
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### Emission standards for diesel vehicles

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<td>CHINA</td>
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<td>2000</td>
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</tbody>
</table>

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**Emission Standards—Vehicle Sources**

- **US**
  - Tier0
  - Tier1
  - Tier2
- **EU**
  - EURO1
  - EURO2
  - EURO3
  - EURO4
  - EURO5
- **CHINA**
  - CHN1
  - CHN2
  - CHN3
  - CHN4
- **BEIJING**
  - CHN1
  - CHN2
  - CHN3
  - CHN4
  - CHN5
Air Quality Trends: 2000-2005

Special column 1  Changes in Major Air Pollutants Concentration During the 10th FYP Period

![Graph showing changes in air pollutants concentration from 2000 to 2005.](image)
With the efforts of air pollution treatment in past years, concentrations of main pollutants are declining:

- SO₂: ↓77%
- NO₂: ↓26%
- PM₁₀: ↓39%
- CO: ↓58%

However, there is still a gap between air quality and public expectation.
The percentage change of \( \text{SO}_2 \) emission (provinces) and \( \text{SO}_2 \) concentrations (cities) in China.

Lu et al., ACP, 2010
Rapid Industrialization in China

Energy Consumption

Vehicle Population

Steel Production

Cement Production

During the 10th Five-year Plan period (2000-2005), coal consumption increased by 953 million tons, with an annual average increased amount of 190 million tons. During the 11th Five-year Plan period between (2006-2010), coal consumption increased by 1.13 billion tons, with an annual average increased amount of 220 million tons. Coal consumption increased by 320 million tons in 2011.
Rapid Urbanization in China

<table>
<thead>
<tr>
<th>Name of city group</th>
<th>City group GDP</th>
<th>Hub city GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Large city group</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beijing-Tianjin-Hebei (37)</td>
<td>10.8%</td>
<td>7.9%</td>
</tr>
<tr>
<td>Shanghai (19)</td>
<td>10.8%</td>
<td>6.2%</td>
</tr>
<tr>
<td>Shandong Peninsula (67)</td>
<td>9.0%</td>
<td>2.1%</td>
</tr>
<tr>
<td>Hangzhou (38)</td>
<td>6.7%</td>
<td>1.6%</td>
</tr>
<tr>
<td>Guangzhou (24)</td>
<td>6.6%</td>
<td>2.6%</td>
</tr>
<tr>
<td>Nanjing (27)</td>
<td>4.8%</td>
<td>1.8%</td>
</tr>
<tr>
<td>Nanjing (27)</td>
<td>4.3%</td>
<td>2.9%</td>
</tr>
<tr>
<td><strong>Medium city group</strong></td>
<td></td>
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</tr>
<tr>
<td>South-central Liaoning (30)</td>
<td>4.3%</td>
<td>2.4%</td>
</tr>
<tr>
<td>Xiamen-Fuzhou (42)</td>
<td>4.2%</td>
<td>1.4%</td>
</tr>
<tr>
<td>Middle and lower Yangtze River (42)</td>
<td>4.0%</td>
<td>1.8%</td>
</tr>
<tr>
<td>Central China (40)</td>
<td>3.8%</td>
<td>0.7%</td>
</tr>
<tr>
<td>Changchun-Harbin (36)</td>
<td>3.6%</td>
<td>1.6%</td>
</tr>
<tr>
<td>Chengdu (29)</td>
<td>3.2%</td>
<td>1.6%</td>
</tr>
<tr>
<td>Hefei (29)</td>
<td>2.8%</td>
<td>0.8%</td>
</tr>
<tr>
<td>Changsha-Zhuzhu-Xiangtan (28)</td>
<td>2.2%</td>
<td>0.8%</td>
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<tr>
<td>Central Shaanxi (15)</td>
<td>1.9%</td>
<td>1.2%</td>
</tr>
<tr>
<td>Chongqing (6)</td>
<td>1.8%</td>
<td>1.5%</td>
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<tr>
<td><strong>Small city group</strong></td>
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<tr>
<td>Nanning (28)</td>
<td>1.8%</td>
<td>0.3%</td>
</tr>
<tr>
<td>Nanchang (22)</td>
<td>1.7%</td>
<td>0.6%</td>
</tr>
<tr>
<td>Taiyuan (19)</td>
<td>1.4%</td>
<td>0.5%</td>
</tr>
<tr>
<td>Hohhot (10)</td>
<td>1.3%</td>
<td>0.4%</td>
</tr>
<tr>
<td>Kunming (16)</td>
<td>1.1%</td>
<td>0.5%</td>
</tr>
</tbody>
</table>
PM$_{2.5}$: 2001-2006

van Donkelaar et al., *Environmental Health Perspectives* 2010
http://www.nasa.gov/topics/earth/features/health-sapping.html
Regional average population-weighted PM$_{2.5}$ concentration in 2005

- Estimate global PM$_{2.5}$ concentration as per the scale of 10km x 10km
- Estimate based on satellite (AOD), atmospheric transmission model and surface observation
- South/east Asia is the region with the world’s highest PM$_{2.5}$ concentration
- 89% of world’s population live in areas with PM$_{2.5}$ concentration higher than the WHO’s AQG (average annual 10 µg/m$^3$)
### Smog in Many Cities

<table>
<thead>
<tr>
<th>City</th>
<th>Days</th>
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<tbody>
<tr>
<td>Xi’an</td>
<td>103</td>
</tr>
<tr>
<td>Taiyuan</td>
<td>225</td>
</tr>
<tr>
<td>Shijiazhuang</td>
<td>184d</td>
</tr>
<tr>
<td>Beijing</td>
<td>100d</td>
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<tr>
<td>Tianjin</td>
<td>207d</td>
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<tr>
<td>Chengdu</td>
<td>239d</td>
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<tr>
<td>Qingdao</td>
<td>88d</td>
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<tr>
<td>Chongqing</td>
<td>133d</td>
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<tr>
<td>Nanjing</td>
<td>211d</td>
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<tr>
<td>Shenzhen</td>
<td>164d</td>
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<tr>
<td>Guangzhou</td>
<td>131d</td>
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<tr>
<td>Shanghai</td>
<td>140d</td>
</tr>
<tr>
<td>Nanchang</td>
<td>152d</td>
</tr>
<tr>
<td>Wenzhou</td>
<td>108d</td>
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<tr>
<td>Fuzhou</td>
<td>120d</td>
</tr>
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</table>
According to the report released by the World Bank in 2012, the health losses of diseases and pre-mature death of the public triggered by PM$_{10}$ pollution in 2009 accounted for 2.8% of GDP.

In 2011, the WHO released the air quality report of world cities with PM$_{10}$ as the major factor which showed that Beijing ranked 1,035$^{th}$ among 1,082 cities and Haikou, a city with sound air quality in China, ranked behind the 800$^{th}$ position.
China’s Strategic Targets

The Ministry of Environment Protection of China and the Chinese Academy of Engineering jointly completed the Studies on China’s Macro Environment Strategy from 2007 to 2009, a critical project that summarizes the past, guides the present work, and plans the future.

Overall atmospheric environment protection target by 2050:

Through comprehensive air pollution control, China works to greatly reduce the concentration of various pollutants in the air, significantly improve air quality in cities and major regions, fully reach national air quality standards, basically realizes the concentration standard for ambient air quality of the World Health Organization (WHO), and meet the requirement for public health and ecological safety. (China hopes to integrate with the standard system of the WHO.)
Air Pollution Control in China:
Efforts since 2010
Phase 4: 2010

Emission of multi pollutants

Regional complex air pollution

- High concentration of PM$_{2.5}$
- High PM$_{2.5}$/PM$_{10}$
- High SOA in PM$_{2.5}$
- Low visibility

- High O$_3$
- High atmosphere oxidability
- City centered regional pollution

He Kebin, Zhang Qiang etc.

van Donkelaar et al., *Environmental Health Perspectives* 2010

van Donkelaar et al., 2010
Integrate $\text{SO}_2$ and $\text{NO}_x$ Emission into the Obligatory Targets in the 12th FYP

<table>
<thead>
<tr>
<th></th>
<th>SO2 (million tons)</th>
<th>NOx (million tons)</th>
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<tbody>
<tr>
<td><strong>Emission in 2010</strong></td>
<td>22.08</td>
<td>21.57</td>
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<tr>
<td><strong>Projected increment emission (2010-2015)</strong></td>
<td>4.17</td>
<td>5.34</td>
</tr>
<tr>
<td><strong>Increased emission reduction capacity (2010-2015)</strong></td>
<td>5.97</td>
<td>7.6</td>
</tr>
<tr>
<td><strong>Proportion of emission reduction (2010-2015)</strong></td>
<td>8%</td>
<td>10%</td>
</tr>
</tbody>
</table>
Environment Standards Optimized, Industries Upgraded and Emission Limits

Evolution of emission standards of China’s coal-fired power plants

1996
China
SO2: 1200-2100 mg/m³
NOx: 650-1000 mg/m³
PM: 200 mg/m³

2003
China
SO2: 400-1200 mg/m³
NOx: 450-1000 mg/m³
PM: 50 mg/m³

2011
China
SO2: 200 mg/m³
NOx: 100-200 mg/m³
PM: 30 mg/m³
# Ambient Air Quality Standards (GB3095-2012)

## Attachment

ICS 13.040.20
Z 50

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**National Standard of the People's Republic of China**

**GB 3095—2012**

Replace GB 3095—1996 GB 8177—88

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**Ambient air quality standards**

This electronic edition is a release version. Please subject to the formal standard text published by China Environmental Science Press.

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**GB**

Released on Feb. 29, 2012
Effective as of Jan. 1, 2016

Ministry of Environment Protection
The State Administration of Quality Supervision, Inspection and Quarantine

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### Table 1  Concentration Limits of Basic Ambient Air Pollutants

<table>
<thead>
<tr>
<th>SN</th>
<th>Pollutants</th>
<th>Average time</th>
<th>Concentration Limit Level 1</th>
<th>Concentration Limit Level 2</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sulfur dioxide ((\text{SO}_2))</td>
<td>Yearly average</td>
<td>20</td>
<td>60</td>
<td>(\mu)g/m³</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Daily average</td>
<td>50</td>
<td>150</td>
<td>(\mu)g/m³</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hourly average</td>
<td>150</td>
<td>500</td>
<td>(\mu)g/m³</td>
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<tr>
<td>2</td>
<td>Nitrogen dioxide ((\text{NO}_2))</td>
<td>Yearly average</td>
<td>40</td>
<td>40</td>
<td>(\mu)g/m³</td>
</tr>
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<td></td>
<td></td>
<td>Daily average</td>
<td>80</td>
<td>80</td>
<td>(\mu)g/m³</td>
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<tr>
<td></td>
<td></td>
<td>Hourly average</td>
<td>200</td>
<td>200</td>
<td>(\mu)g/m³</td>
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<tr>
<td>3</td>
<td>Carbon monoxide ((\text{CO}))</td>
<td>Daily average</td>
<td>4</td>
<td>4</td>
<td>(\mu)g/m³</td>
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<tr>
<td></td>
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<td>Hourly average</td>
<td>10</td>
<td>10</td>
<td>(\mu)g/m³</td>
</tr>
<tr>
<td>4</td>
<td>Ozone ((\text{O}_3))</td>
<td>Average maximum in 8 hrs per day</td>
<td>100</td>
<td>160</td>
<td>(\mu)g/m³</td>
</tr>
<tr>
<td></td>
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<td>Hourly average</td>
<td>160</td>
<td>200</td>
<td>(\mu)g/m³</td>
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<tr>
<td>5</td>
<td>Particulate matter (grain size less than or equal to 10 (\mu)m)</td>
<td>Yearly average</td>
<td>40</td>
<td>70</td>
<td>(\mu)g/m³</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Daily average</td>
<td>0</td>
<td>150</td>
<td>(\mu)g/m³</td>
</tr>
<tr>
<td>6</td>
<td>Particulate matter (grain size less than or equal to 2.5 (\mu)m)</td>
<td>Yearly average</td>
<td>15</td>
<td>35</td>
<td>(\mu)g/m³</td>
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<td>Daily average</td>
<td>35</td>
<td>75</td>
<td>(\mu)g/m³</td>
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### Table 2  Concentration Limits of Other Ambient Air Pollutants

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<th>SN</th>
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<th>Average time</th>
<th>Concentration Limit Level 1</th>
<th>Concentration Limit Level 2</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Total suspended particulates ((\text{TSP}))</td>
<td>Yearly average</td>
<td>80</td>
<td>200</td>
<td>(\mu)g/m³</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Daily average</td>
<td>120</td>
<td>300</td>
<td>(\mu)g/m³</td>
</tr>
<tr>
<td>2</td>
<td>Nitrogen oxide ((\text{NO}_x))</td>
<td>Yearly average</td>
<td>50</td>
<td>50</td>
<td>(\mu)g/m³</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Daily average</td>
<td>100</td>
<td>100</td>
<td>(\mu)g/m³</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hourly average</td>
<td>250</td>
<td>250</td>
<td>(\mu)g/m³</td>
</tr>
<tr>
<td>3</td>
<td>Lead ((\text{Pb}))</td>
<td>Yearly Average</td>
<td>0.5</td>
<td>0.5</td>
<td>(\mu)g/m³</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Quarterly average</td>
<td>1</td>
<td>1</td>
<td>(\mu)g/m³</td>
</tr>
<tr>
<td>4</td>
<td>Benzo-a-pyrene ((\text{BaP}))</td>
<td>Yearly Average</td>
<td>0.001</td>
<td>0.001</td>
<td>(\mu)g/m³</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Daily average</td>
<td>0.0025</td>
<td>0.0025</td>
<td>(\mu)g/m³</td>
</tr>
</tbody>
</table>
Four strategic Turning Points

Objective
emissions
Air quality

Pollutants
Coal fired
Multi-pollutants

Focus
industry
Multi-sources

Scale
local
regional

Milestones:
two critical documents issued by State Council
 ✓ 2012, the 12th FYP on air pollution control for key regions heralds the four turning points for the first time.
 ✓ 2013, the action plan of air pollution control indicates a new air quality management after the four turning points.
3 regions and 10 city clusters

1. Beijing-Tianjin-Hebei
2. Yangzi river delta
3. Pearl river delta
4. Middle Liaoning
5. Shandong
6. Wuhan region
7. Changsha-Zhuzhou-Xiangtan
8. Chengdu-Chongqing
9. The west coast of the Taiwan Straits
10. North Shanxi
11. South Shaanxi
12. Gansu-ningxia
13. Urumuqi

- Totally 13 regions, including 19 provinces, 117 cities, 1.3256 km²
- Emission intensity is 2.9-3.6 times higher than national average
- 82% cities are non-attainment, according to the new air quality standard
- Complex air pollution, including PM$_{2.5}$, O$_3$
# Planning Targets of Key Regions

## Focus on both emission reduction and air quality

<table>
<thead>
<tr>
<th>Category</th>
<th>Index</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Air quality</strong></td>
<td>1 Annual SO$_2$ reduction</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td>2 Annual NO$_2$ reduction</td>
<td>8%</td>
</tr>
<tr>
<td></td>
<td>3 Annual PM$_{10}$ reduction</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td>4 Annual PM$_{2.5}$ reduction</td>
<td>5%</td>
</tr>
<tr>
<td></td>
<td>5 O3 non-attainment days reduction</td>
<td>5%</td>
</tr>
<tr>
<td><strong>Emission control</strong></td>
<td>6 SO$_2$ emission reduction</td>
<td>12%</td>
</tr>
<tr>
<td></td>
<td>7 NO$_x$ emission reduction</td>
<td>13%</td>
</tr>
<tr>
<td></td>
<td>8 Dust emission reduction</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td>9 VOCs emission reduction (key sectors)</td>
<td>14%</td>
</tr>
</tbody>
</table>
### Jan. 2013: features

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1300 thousands km²</td>
<td></td>
</tr>
<tr>
<td>In some region, it lasts 3 weeks</td>
<td></td>
</tr>
<tr>
<td>PM2.5 concentration is higher than the instrument max</td>
<td></td>
</tr>
<tr>
<td>850 million people exposed</td>
<td></td>
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</tbody>
</table>

**Graphs:**

- **Left graph:**
  - Title: Shijiazhuang, Baoding, Tianjin
  - X-axis: Dates from 2013/1/10 to 2013/1/17
  - Y-axis: Concentration (ug/m³)
  - Colors: Red, Green, Blue

- **Right graph:**
  - Title: Beijing, Tianjin, Baoding, Shijiazhuang
  - X-axis: Dates from 2013/1/10 to 2013/1/25
  - Y-axis: Concentration (ug/m³)
  - Colors: Blue, Red, Green, Purple
Action Plan on Prevention and Control of Air Pollution
or 10 measures from the State Council:
Breakthrough in AQ management
Objectives and principals

1. Accelerate AQ improvement: An enhanced plan based on current 12th FYP to make greater change

2. Highlight the key regions: Higher target for key regions (Beijing-Tianjin-Hebei, YRD, PRD)

3. Differentiate the priorities: $\text{PM}_{2.5}$ for the key regions, and $\text{PM}_{10}$ for the other
Objectives:
After 5 years of commitment, the number of days under heavy pollution would be significantly reduced, nationwide air quality would be improved, air quality in Beijing-Tianjin-Hebei, YRD, PRD and other regions would be evidently improved.
Heavy pollution weather would be basically eliminated and nationwide air quality evidently improved in another 5 years.

Indicators:
by 2017, PM$_{10}$ concentration in prefecture cities and above across the country would be down by more than 10% based on the 2012 level and the number of fine days would be increased year by year.

Concentration of PM in Beijing-Tianjin-Hebei, YRD, PRD and other regions would decrease by more than 25%, 20%, and 15% respectively based on the 2012 level, and average annual concentration of PM would be controlled at about 60µg/m$^3$ in Beijing.
Beijing-Tianjin-Hebei: PM2.5 concentration declines by 25%
YRD: PM2.5 concentration declines by 20%
PRD: PM2.5 concentration declines by 15%
Other: $PM_{10}$ concentration down by 10%
Shanxi, Inner Mongolia and Shandong: support Beijing-Tianjin-Hebei in realizing targets
Important Factors of Air Pollution: 1. Accelerate industrial restructuring

Compliance of \( \text{SO}_2, \text{NO}_x, \) smoke and dust, VOCs emission with requirements becomes the precondition for approving environmental assessment.

Strengthen the standards for environmental protection, energy consumption and quality, and facilitate the exit of overcapacity of high energy consumption and pollution industries.

Fulfill the task of eliminating backward capacity of 21 key industries during the 12\(^{th}\) FYP period one year ahead of schedule.
### Important Factors of Air Pollution: 2. Speed up clean energy utilization

<table>
<thead>
<tr>
<th><strong>Optimize energy structure</strong></th>
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<tbody>
<tr>
<td>• By 2017, the proportion of coal nationwide should be declined to <strong>less than 65%</strong>; coal consumption in Beijing-Tianjin-Hebei, YRD and PRD would witness <strong>negative growth</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Promote clean coal utilization</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• By 2017, the selection rate of raw coal would reach <strong>more than 70%</strong>; scattered raw coal combustion would be reduced</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Increase clean energy supply</strong></th>
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<tbody>
<tr>
<td>• More than <strong>150 billion m³</strong> of natural gas pipeline transportation capacity would be newly added</td>
</tr>
</tbody>
</table>
If newly-added 150 billion m³ natural gas supply would be used to replace some coal consumption of coal-burning industrial boilers, it’s expected to reduce emission of 3.59-5.79 million tons of \( \text{SO}_2 \), 0.6 to 1.6 million tons of \( \text{NO}_x \), 1.34-2.72 million tons of smoke.

<table>
<thead>
<tr>
<th>Emission factors</th>
<th>( \text{SO}_2 )</th>
<th>( \text{NO}_x )</th>
<th>PM</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal-burning industrial boiler (kg/t)</td>
<td>10-16</td>
<td>3-5.7</td>
<td>3.8-7.5</td>
<td></td>
</tr>
<tr>
<td>Gas-fired industrial boiler (kg/10k·m³)</td>
<td>5.53</td>
<td>33.15</td>
<td>2.21</td>
<td>New standard for gas-fired industrial boiler</td>
</tr>
</tbody>
</table>
Replacing coal-burning industrial boiler with CHP shows evident emission reduction.

According to equivalent replacement principle, if CHP boiler replaces some small industrial boiler (according to measurement, coal consumption of coal-burning industrial boiler below 20t/h is 266 million tons)

*When CHP boiler reaches new emission standard (GB 13223-2011), emission of 2.48-4.08 million tons of SO₂, 0.62 to 1.34 million tons of NOx, 0.95 to 1.94 million tons of dust would be reduced;*

*When CHP boiler reaches special emission limit value (GB 13223-2011), emission of 2.57-4.16 million tons of SO₂, 0.62 to 1.34 million tons of NOx, 0.97 to 1.95 million tons of dust would be reduced.*
Important Factors of Air Pollution: 3. Tighten vehicle emission control

**Control vehicle population in metropolises**

Beijing, Shanghai, Guangzhou and other megacities strictly limit vehicle population

**Improve fuel oil quality**

By the end of 2015, major cities in Beijing-Tianjin-Hebei, YRD, PRD and other regions would supply vehicle-use gasoline and diesel oil with the sulphur content no more than 10ppm; by the end of 2017, vehicle-use gasoline and diesel oil with the sulphur content no more than 10ppm would be supplied across the country.

**Rapidly eliminate yellow label cars**

By 2015, 5 million yellow label cars in Beijing-Tianjin-Hebei, YRD, PRD and other regions would be basically eliminated. By 2017, yellow label cars across the country would be basically eliminated.
Enhance management of vehicle environment protection

Tighten annual inspection of in-use vehicles, Non-compliance vehicles on the environmental protection qualification label are not allowed to drive on roads.

Accelerate the upgrading and replacement of low speed vehicles

From 2017, new low-speed trucks shall meet the same energy saving and emission standard as light trucks.

Vigorously promote new energy vehicles

Bus, sanitation, and other industrial and governmental departments shall take the lead in using new energy vehicles. Personal purchase shall be encouraged. Beijing and other cities would increase or replace more than 60% of new energy and clean fuel buses in total buses.
Co-control of Multi-pollutants

Stationary Sources

Mobile Sources

Area Sources

PM
SO₂
NH₃
NOₓ
VOC

PM₂.₅
O₃
Acid rain

Public health
Visibility
Climate
Eco-system
Regional Coordination Mechanism in Beijing-Tianjin-Hebei and YRD

Address evident regional environmental issues in a coordinated manner

Organize environmental assessment conference, joint law enforcement by environmental and other departments, information sharing, early warning and emergency treatment, among other works

Report on work progress

Clearly define periodical work requirements, priorities and major tasks.
Special Requirements for Beijing-Tianjin-Hebei

- Beijing-Tianjin-Hebei + Shanxi-Inner Mongolia-Shandong
- Pollution control requirements higher than national average
- Tightened elimination of backward productivity of iron & steel, cement and other industries
- Reduction in coal consumption by **83 million tons**
- Strengthen joint control and supervision and evaluation mechanism
Air pollution control in China: Perspectives
Emission Reduction of Multiple Pollutants

Emission intensity per unit GDP (100 million)

Total emission amounts

SO₂, NOₓ, PM₂.₅, VOC emission intensity (100 million yuan GDP, 1990 price)

Year

SO₂, NOₓ, PM₂.₅, VOC emission amount (1 m t)

Year
Requiring Great Efforts to Achieve Goals

- In order to achieve targets, the degree of emission reduction of multiple pollutants is much larger than ever.

Comparison of percentage of pollutants emission reduction targets

<table>
<thead>
<tr>
<th></th>
<th>SO$_2$</th>
<th>NO$_x$</th>
<th>PM</th>
<th>VOCs</th>
</tr>
</thead>
<tbody>
<tr>
<td>(To guarantee) action plan</td>
<td>&gt;15%</td>
<td>&gt;20%</td>
<td>&gt;20%</td>
<td>&gt;7%</td>
</tr>
<tr>
<td>12$^{th}$ FYP</td>
<td>&gt;8%</td>
<td>&gt;10%</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>11$^{th}$ FYP</td>
<td>&gt;10%</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

- The proportion of emission reduction is higher for three major regions.
Co-benefit of Energy Saving to Air Pollution Control

Gap between energy consumption of China’s industrial products and international advanced level

<table>
<thead>
<tr>
<th>Unit energy consumption (kgce/t)</th>
<th>China</th>
<th>International advanced level</th>
<th>Gap (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron &amp; steel</td>
<td>625</td>
<td>550</td>
<td>13.6</td>
</tr>
<tr>
<td>Cement</td>
<td>151</td>
<td>118</td>
<td>28.0</td>
</tr>
<tr>
<td>Ethylene</td>
<td>1003</td>
<td>629</td>
<td>59.5</td>
</tr>
</tbody>
</table>

- Improve energy efficiency in industrial production
- Enhance materials R&D and management, and reinforce energy efficiency in building sector
- Decrease oil consumption in transportation
Integrate industrial and energy adjustment requirements into urbanization: Tighten industrial threshold, control expansion of backward productivity; reinforce infrastructure construction, ensure clean energy supply.

Make scientific urban planning: Reasonably plan the size of cities, remain prudent in developing cities with 10 million population; control urban coal consumption to reduce coal burning pollution.

Urban space design: Optimize transportation system to reduce vehicle pollution.

O₃ pollution: Improve O₃ control in key regions along with in-depth PM pollution control.
Mobile Source Pollution Control

- Properly deal with pressure of vehicle population and frequent vehicle utilization
- Actively promote off-road mobile source pollution control

Rapid vehicle increase largely offsets the emission reduction outcome

Traffic demand will greatly increase
Long-term, Constant and Prudent Progressive Commitment

Scientific Research

Environment Quality Target

Emission Reduction Target

Track and Evaluation

Control Measures

Project Implementation

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Conclusion: A Long-term Task for Air Control

1. Air pollution is local, regional and global;

2. Improving ambient air quality calls for focusing on primary pollutants and secondary pollutants formed in the air environment;

3. Total emission reduction is more important than concentration control by standards for air pollution control. The emission reduction by 30-50% could help evident air quality improvement;

4. Air quality management needs long-term efforts on sustainable development and improvement. It requires regional coordination and cooperation among governments, enterprises and the public. To get real blue skies, resolve and patience are needed.
Thank You!