“Reducing Ultrafine particles by 20%”

Source-wise action plan to Clean up the air of Seoul

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Introduction

About Seoul

- Population: 10,464 thousand
- No. of Cars: 2,954 thousand
- Subway: 315.4km (9 lines)
- National Rail: 75.1km
- No. of Buses: 8,012 (408 routes)
- No. of Taxies: 72,365
- No. of Trips: 31.0 millions/day
- Modal Share
  - Bus 27.8%, Subway 35.2%, Taxi 6.2%,
  - Autos 25.9%, Bicycle and others 4.9%
Urbanization and Economic Growth in Seoul

Population:
- (1960) 240
- (1980) 836
- (1990) 1,062
- (2010) 1,057
(Unit: 10K)

Housing:
- (1960) 46
- (1980) 98
- (2000) 192
- (2010) 360
(Unit: 10K)

Vehicles:
- (1960) 1.1
- (1980) 20.6
- (1990) 119
- (2010) 298
(Unit: 10K)

Area Expansion:
- 1957
- 1972
- 1985
- 1997

Rapid urbanization & economic growth resulted in environmental problems – air & water pollution, waste, etc.
Current Status

Seoul is located in a basin surrounded by high mountains, thus difficult to diffuse air. Various factors affecting air pollution (e.g. increasing number of cars, yellow dust, etc.) exist. Pollution has been improving thanks to use of clean fuels and pollutant-lowering of diesel fuelled cars.
Seoul, 2016
Seoul 1977

SOx - Industrial area 0.063ppm
- Commercial area 0.058ppm
- Residential area 0.049ppm

- Legislated anti-pollution law in 1963
- Due to economic development focused policies, the law had no power until late 1970s
- Establishment of Environmental Office in 1980 promoted law enforcement
HOW, did Seoul become a city with clean air?
First,

Converting household fuels
In 1979, Seoul divided the city into 5 areas, built 5 city gas companies, and began to supply city gas.
Effects of converting fuels

City Gas Supply and SO2 Concentration Levels

Anthracite consumption in private sector (1,000 ton/year)
Collective Energy Supply
Collective energy supply areas in Seoul
Second,
Regulating commercial fuel
Regulating sulfur levels in diesel (ppm)

Prohibiting lead in transportation fuel (1993)

Concentration of lead in air:

250ng/m³ (1992) to 36ng/m³ (2014)
Mandatory use of clean fuel in Buildings

Mandatory use of LNG: Boilers for business use

2,000 low NOx burners provided to small and medium sized businesses
Third, Measures on Vehicles
Rapid increase in number of vehicles

Without appropriate measures, Could become a disaster

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</tr>
</thead>
<tbody>
<tr>
<td>Korea</td>
<td>201</td>
<td>528</td>
<td>1,113</td>
<td>3,395</td>
<td>8,469</td>
<td>12,060</td>
<td>14,587</td>
<td>15,895</td>
<td>17,325</td>
<td>17,648</td>
<td>18,437</td>
<td>18,871</td>
<td>19,400</td>
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<tr>
<td>Seoul</td>
<td>85</td>
<td>207</td>
<td>446</td>
<td>1,194</td>
<td>2,043</td>
<td>2,441</td>
<td>2,777</td>
<td>2,857</td>
<td>2,955</td>
<td>2,961</td>
<td>2,978</td>
<td>2,696</td>
<td>2,974</td>
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Stronger new vehicle emissions standard

<table>
<thead>
<tr>
<th>Standard</th>
<th>Euro 1</th>
<th>Euro 2</th>
<th>Euro 3</th>
<th>Euro 4</th>
<th>Euro 5</th>
<th>Euro 6</th>
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Legislated Enforcement Decree of the Environment Conservation Act in 1978:

Established new vehicle emissions standards for the first time
City Bus 100% Replace
Replace public buses and cleaning cars with CNG vehicles

- 7,896 artery buses (100%) among 7,522 (as of Aug '12)
- 965 short-haul shuttles (87.7%) among 1,091
- 501 cleaning cars (98.2%) among 510

Delay in building CNG charging stations due to concerns around safety,
Built the station at city hall as an example
Pollutant reduction for diesel-fuelled cars

- Installation of Diesel Particulate Filter (DPF)
- Conversion into low-polluting LPG engine conversion
- Early scrapping of cars
### Performance of emissions reductions project

<table>
<thead>
<tr>
<th>Type</th>
<th>Performance of In-Use Diesel Vehicle</th>
<th>Emissions Reduction Project (Unit: No. of cars)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Total</td>
<td>'03 ~ '04</td>
</tr>
<tr>
<td>Total</td>
<td>265,591</td>
<td>1,015</td>
</tr>
<tr>
<td>LPG Retrofit</td>
<td>68,111</td>
<td>585</td>
</tr>
<tr>
<td>Emissions Control Device</td>
<td>142,907</td>
<td>430</td>
</tr>
<tr>
<td>Early Scrapping of Car</td>
<td>54,573</td>
<td>-</td>
</tr>
</tbody>
</table>
Fourth,
Traffic Demand Management
Expanded dedicated median bus lanes

In 1999, 1 lane, 4.5km, In 2012, 13 lanes, 122.1km
Expansion of subway

- In 1974, constructed subway line No. 1, from Seoul station to Cheongnyangni (7.8km)

- In 2016, 9 subway lines with 311 stations
  Total length: 331.9km

- Including metropolitan Incheon and Gyeonggi area:
  27 subway lines with 631 stations
  Total length: 1,007.3km
Air quality improvement
Trends in Air Pollution, 1980-2012

Significantly improved PM10 and sulfur dioxide

But due to transportation and heating, have limits in reducing nitrogen oxide
Challenges and problems
Introduction of eco-friendly cars

**EV supply**
- Total 1,209 EVs
- 57 rapid electric car charging station
Electric bus

Introduction of green electric buses

Complete removal of noise and exhaust gas

- Namsan shuttle bus from Dec. 2010 (9 units)
- Seoul Grand Park shuttle bus from Dec 2012 (5 units)

Electric taxi

- Pilot electric taxi (60 units from Jan. ’16)
Measures to reduce nitrogen dioxide

- Eco Friendly Home Boilers
- Zero Energy Building Design
- Replacing Three way Catalytic Converters
Cooperation to improve air quality
## Air Quality Improvement Targets

<table>
<thead>
<tr>
<th>Air Quality Improvement Index</th>
<th>2013</th>
<th>2016</th>
<th>2018</th>
</tr>
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<tbody>
<tr>
<td>Ultrafine Particles (PM-2.5, $\mu g/m^3$)</td>
<td>25</td>
<td>23</td>
<td>20</td>
</tr>
<tr>
<td>Fine Particles (PM-10, $\mu g/m^3$)</td>
<td>45</td>
<td>42</td>
<td>39</td>
</tr>
<tr>
<td>Nitrogen Dioxide (NO$_2$, ppm)</td>
<td>0.033</td>
<td>0.030</td>
<td>0.028</td>
</tr>
<tr>
<td>NO$_x$ emissions (1,000 ton) *Emissions outlook 70,000 ton</td>
<td>-</td>
<td>55(21% ↓)</td>
<td>35(50% ↓)</td>
</tr>
</tbody>
</table>
Not easy to meet ultrafine particles reduction target

- Working together with experts, civic groups, academia, and businesses

Aim to reach 20μg/m³ by 2018
Thank You

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