

“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 Taxis : 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

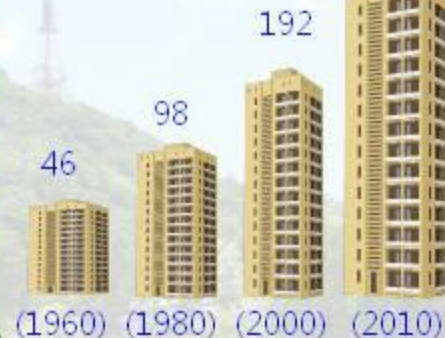
Population

(Unit : 10K)



Housing

(Unit : 10K)



Vehicles

(Unit : 10K)



Area Expansion

1957



1972



1985



1997



Rapid urbanization & economic growth

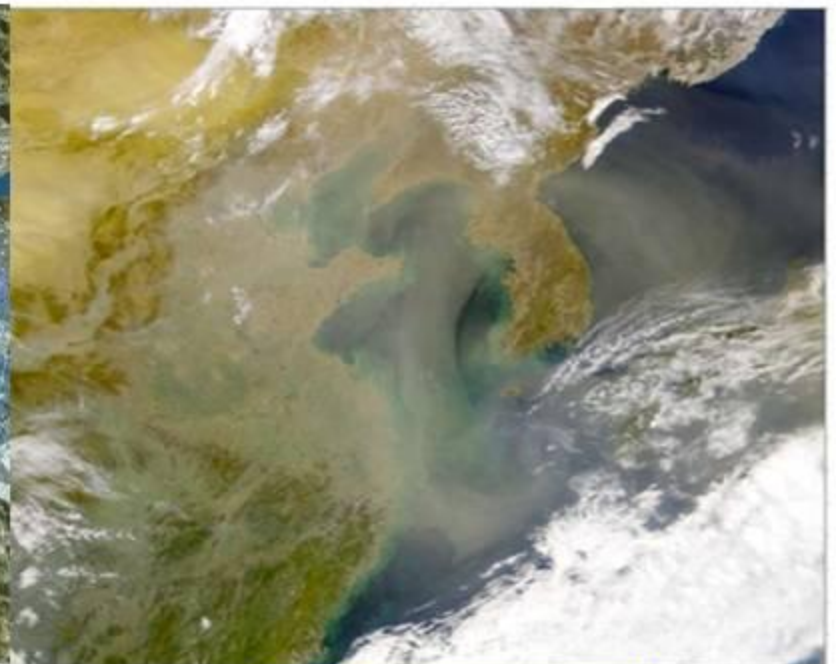
➡ Resulted in environmental problems – air & water pollution, waste, etc

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, surrounded by mountains



Yellow Dust



Seoul, 2016

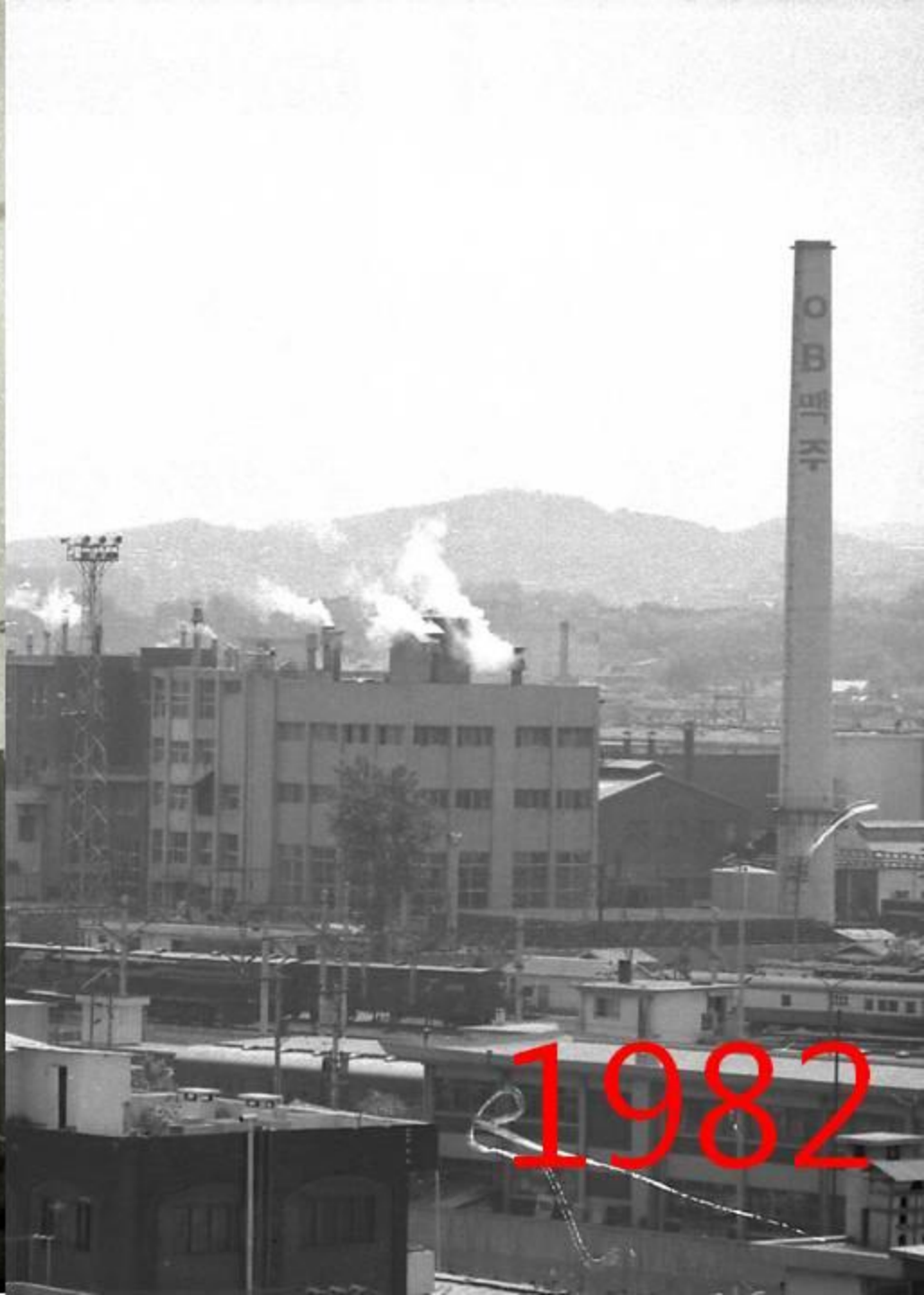


Seoul, 2016

BACK
TO **FUTURE**
THE



Seoul,
1976



1982



Seoul, 1962

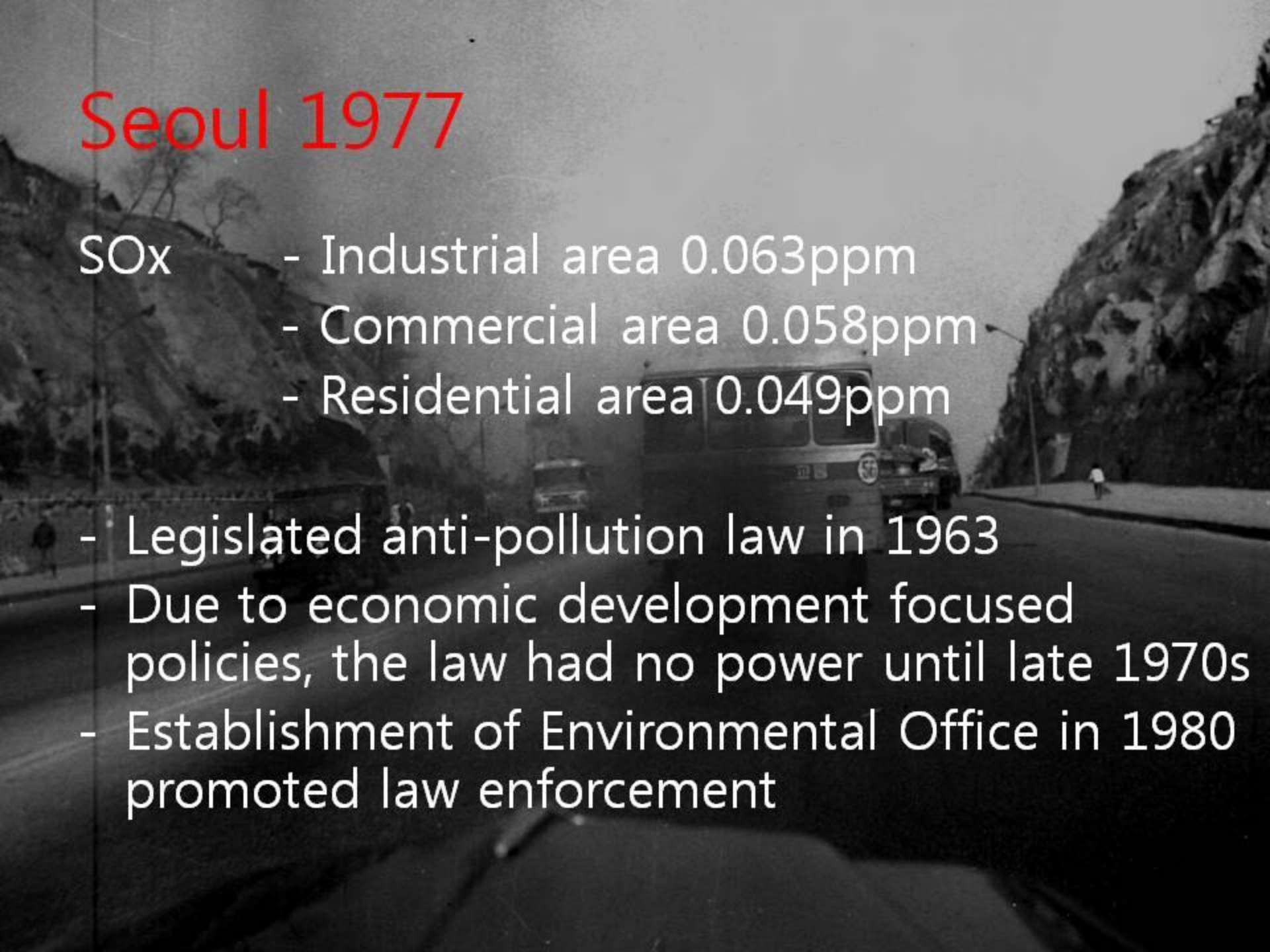


Seoul, 1966



Seoul, 1970

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

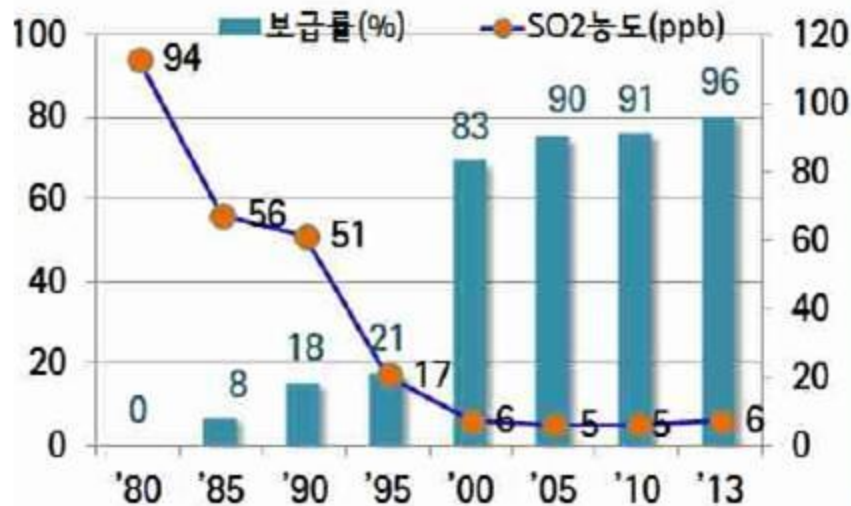
Household heating fuel Converting into City Gas



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

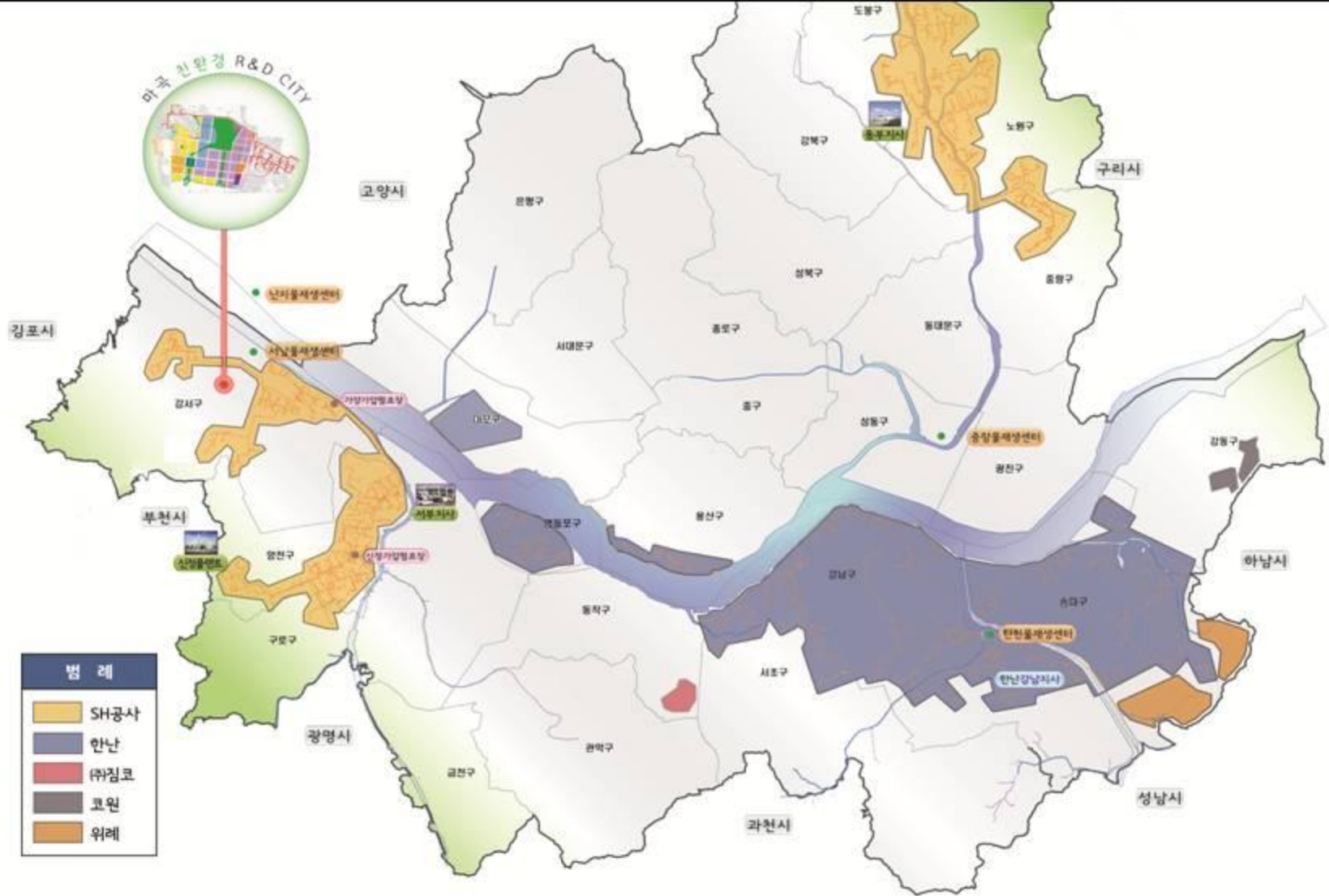


Anthracite consumption in private sector (1,000 ton/ year)

Collective Energy Supply



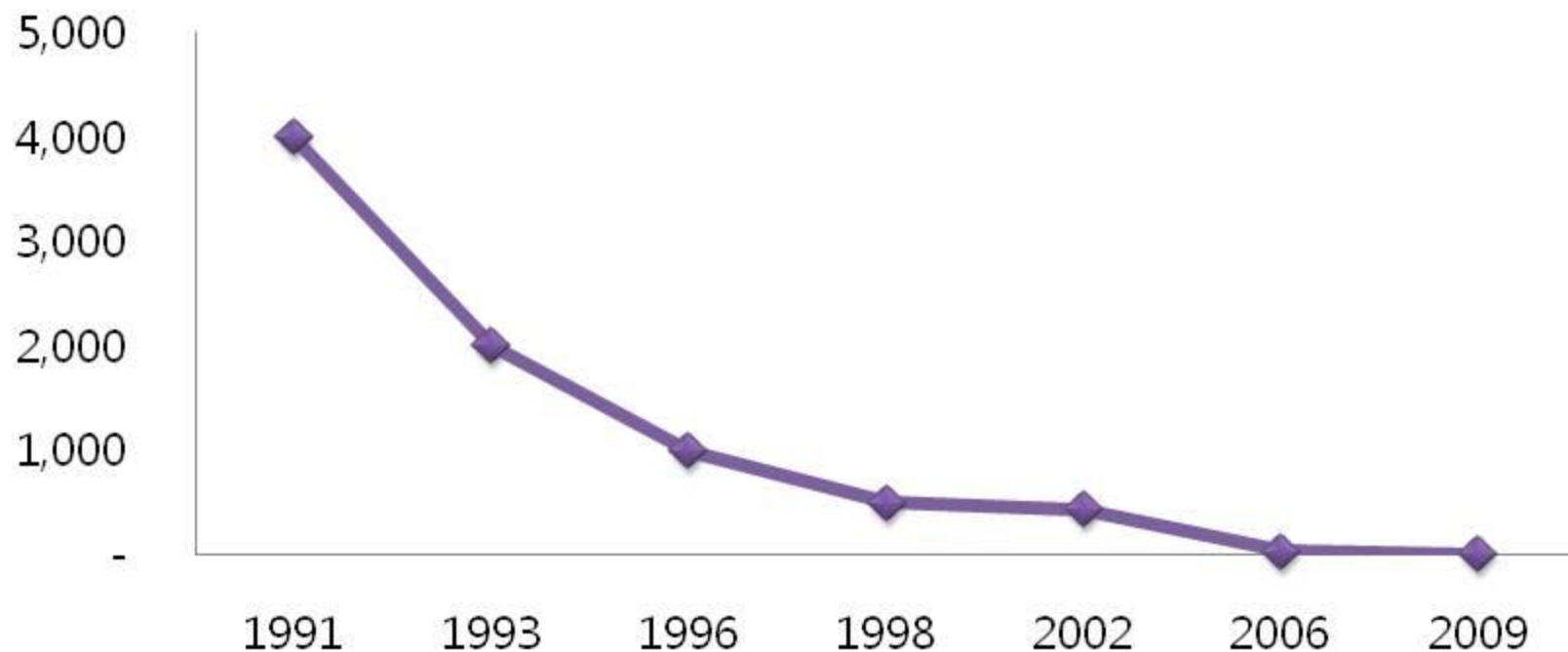
Collective energy supply areas in Seoul



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 **36**ng/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

Number of vehicles in Seoul and Korea (Unit: 1,000 cars)

Type	Year	1975	1980	1985	1990	1995	2000	2003	2006	2009	2010	2011	2012	2013
Korea		201	528	1,113	3,395	8,469	12,060	14,587	15,895	17,325	17,648	18,437	18,871	19,400
Seoul		85	207	446	1,194	2,043	2,441	2,777	2,857	2,955	2,981	2,978	2,696	2,974

Stronger new vehicle emissions standard

Standard	Euro 1	Euro 2	Euro 3	Euro 4	Euro 5	Euro 6
Europe	1992	1996	2000	2005	2008	2013
Korea	'98~2000	2001	2005	2008	2011	2014

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



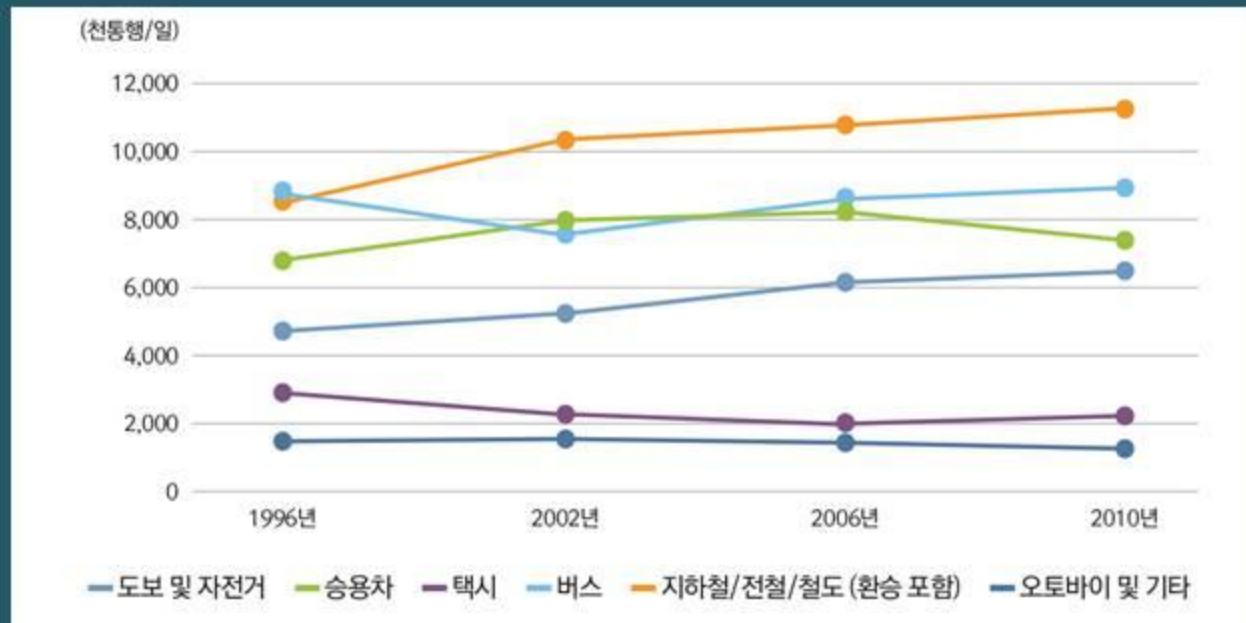
- Early scrapping of cars



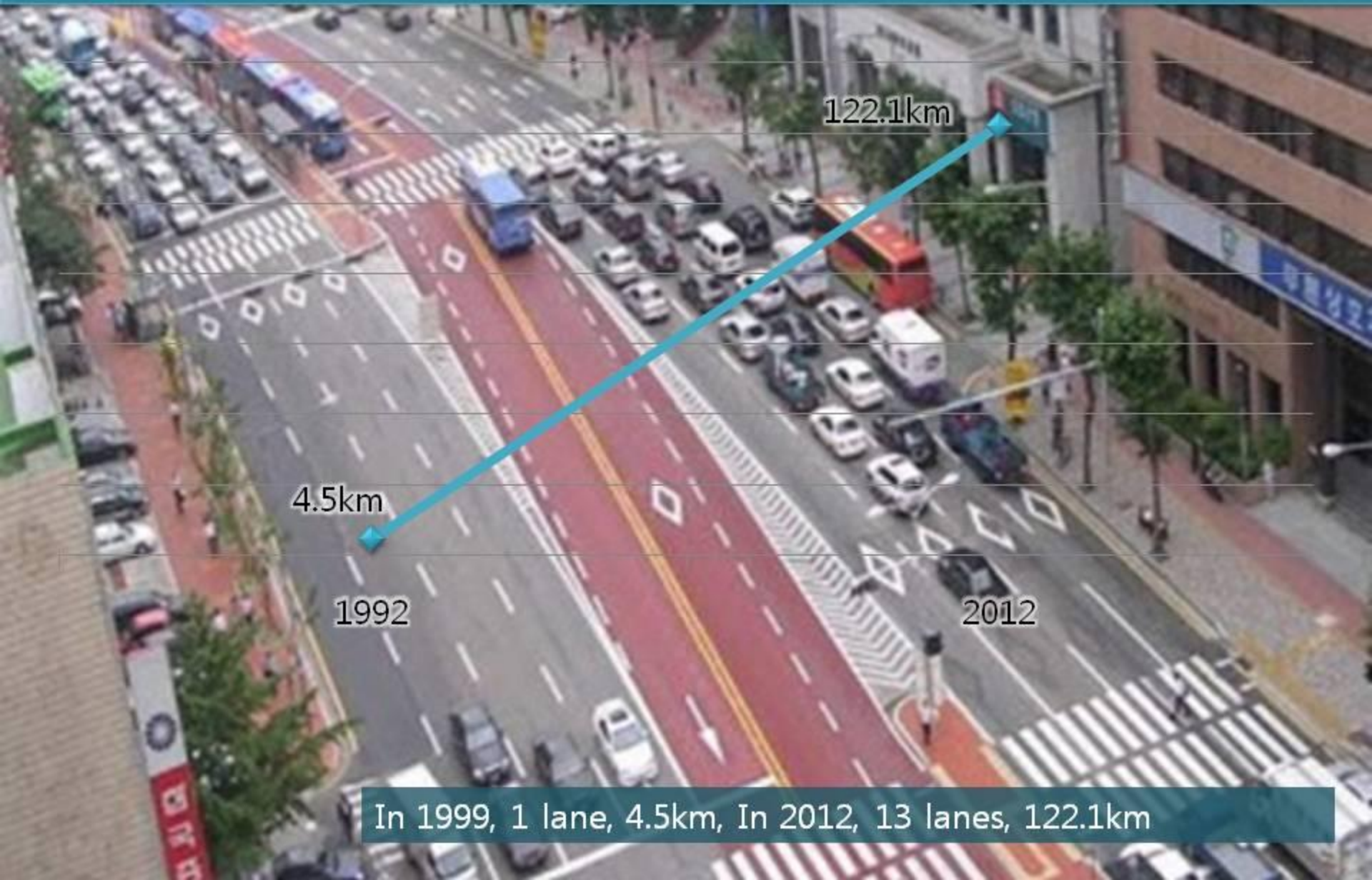
Performance of emissions reductions project

Type	Performance of In-Use Diesel Vehicle Emissions Reduction Project (Unit:: No. of cars)										
	Total	'03 ~ '04	'05	'06	'07	'08	'09	'10	'11	'12	'13
Total	265,591	1,015	12,130	39,038	54,291	36,099	34,866	30,825	24,114	16,401	16,812
LPG Retrofit	68,111	585	2,814	8,714	14,285	16,452	14,027	7,922	2,074	961	277
Emissions Control Device	142,907	430	9,279	29,715	34,201	9,796	11,709	17,461	14,961	7,617	7,738
Early Scrapping of Car	54,573	-	37	609	5,805	9,851	9,130	5,442	7,079	7,823	8,797

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

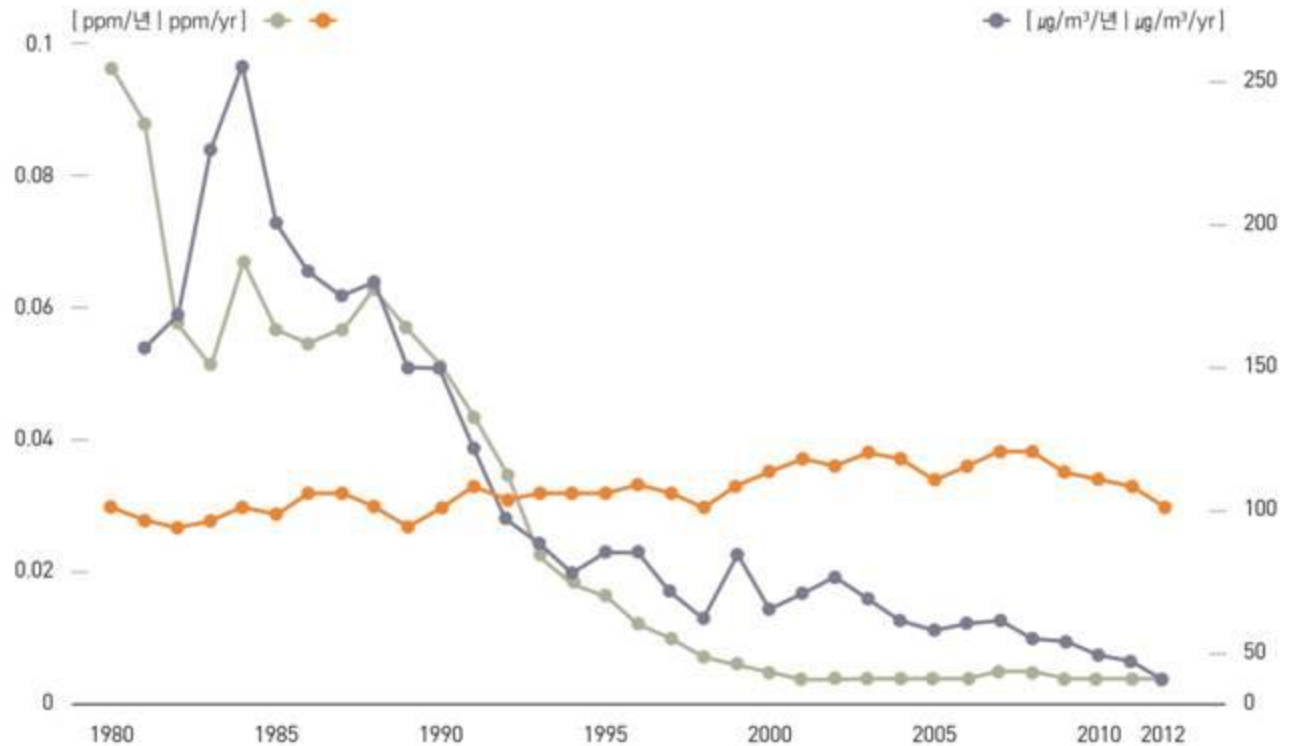
Air quality improvement

Trends in Air Pollution, 1980-2012

그래프 10-2. 대기오염 1980-2012

Graph 10-2. Trends in Air Pollution, 1980-2012

- 아황산가스(SO_2) Sulfur Dioxide
- 아산화질소(NO_2) Nitrogen Dioxide
- 미세먼지(PM_{10}) Microdust



Significantly improved PM_{10} and sulfur dioxide

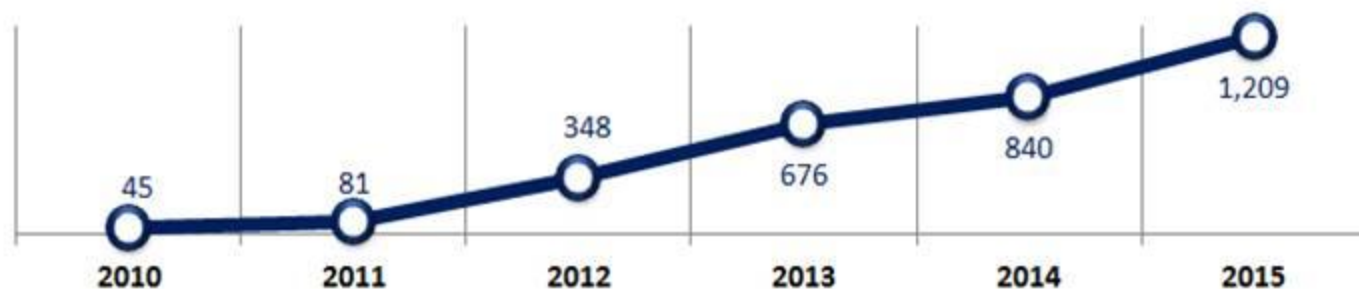
But due to transportation and heating, have limits in reducing nitrogen oxide

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

- 
- A photograph of the Seoul Energy Dream Center, a modern building with a large glass facade and a white, angular roof. The building is set against a clear blue sky. In the foreground, there is a green lawn and a paved area with a motorcycle parked on it. The building's name is written in Korean and English on its facade.
- ▶ Eco Friendly Home Boilers
 - ▶ Zero Energy Building Design
 - ▶ Replacing Three way Catalytic Converters

Seoul Energy Dream Center

Cooperation to improve air quality



2014
Northeast Asia Forum on Air Quality Improvement

Air Quality Improvement Targets

Air Quality Improvement Index	2013	2016	2018
Ultrafine Particles (PM-2.5, $\mu\text{g}/\text{m}^3$)	25	23	20
Fine Particles (PM-10, $\mu\text{g}/\text{m}^3$)	45	42	39
Nitrogen Dioxide (NO ₂ , ppm)	0.033	0.030	0.028
NO _x emissions (1,000 ton) *Emissions outlook 70,000 ton	-	55(21% ↓)	35(50% ↓)

Not easy to meet ultrafine particles reduction target

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

Aim to reach $20\mu\text{g}/\text{m}^3$ by 2018





Thank You

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