

Korea Environmental Policy Bulletin

Emission Reduction Program for In-Use Diesel Vehicles

CONTENTS

Summary	01.
I. Background of the Special Measure for Metropolitan Air Quality Improvement	02.
1. Air Pollution Status in SMA	
2. Hazards of Particulate Matter	
II. Special Measures for Metropolitan Air Quality Improvement	06.
1. Legislation for the Special Act on Metropolitan Air Quality Improvement and subordinate regulations	
2. Master Plan for Metropolitan Air Quality Management	
III. Outline of Emission Reduction Program for In-Use Diesel Vehicles	09.
1. Installation of Emission Reduction Equipment or Low Emission Engine	
2. Financial Support for Vehicle Owners	
3. Certification System on Equipment and Engine	
4. Ex-post management of Equipment and Engine	
IV. Effectiveness Evaluation and Future Plans	13.
1. Effectiveness Evaluation of Program	
2. Future Plans	

Summary

Air pollution in the Seoul metropolitan area (SMA) is 1.3-1.4 times higher than non-SMA regions in terms of nitrogen dioxide (NO₂) and particulate matter (PM₁₀). Vehicles are responsible for more than 65% of total PM₁₀ emissions that cause adverse impacts on health and amenity. In order to improve the air quality of the SMA and bring it up to the standards of cities in the developed world within 10 years, the Korean government has promoted a "Master Plan for the Metropolitan Air Quality Management" based on the "Special Measures for Metropolitan Air Quality Improvement" and "Special Act on Metropolitan Air Quality Improvement". As a part of the Master Plan, an emission reduction program for in-use diesel vehicles on road through enforcement of stricter emission standards to specific diesel vehicles running in the SMA has been implemented since 2005. Installation of emission reduction equipment such as Diesel Particulate Filters (DPF), and Diesel Oxidation Catalysts (DOC), or retrofit with low emission engines like Liquefied Petroleum Gas (LPG) engines are required as alternative technologies for vehicles which fail to comply with

the new emission standards in the program. In the case of old and superannuated vehicles which can't be modified, the owners of those vehicles are required to scrap their vehicles. The mayors of Seoul and Incheon and the governor of Gyeonggi province have the authority to enforce the measures on specific vehicles classified by dead-weight ton and vehicles' age based on their registration date. The central government and municipalities provide a financial support

to vehicle owners for installing emission reduction equipments or retrofitting low emission engines in their vehicles. For vehicle owners to participate in this program, the central government is conducting benefit measures such as the exemption of environmental improvement charges and periodic vehicle inspection as well. In the near future, this program will be enforced in five metropolitan cities in Korea as well.

I. Background of the Special Measure for Metropolitan Air Quality Improvement

1. Air Pollution Status in SMA

Air pollution in the SMA is more serious than other areas because 47% of the total population and automobiles are concentrated in the SMA which accounts for only 11% of the territory of

the Republic of Korea. In 2003, 57% of national ozone warnings were given in the SMA, and the contamination levels of nitrogen oxide (NO₂) and particulate matter (PM₁₀) in the SMA were 1.3-1.4 times higher than non-SMA regions.

Table 1. Comparison of air pollution in the SMA and non-SMA areas

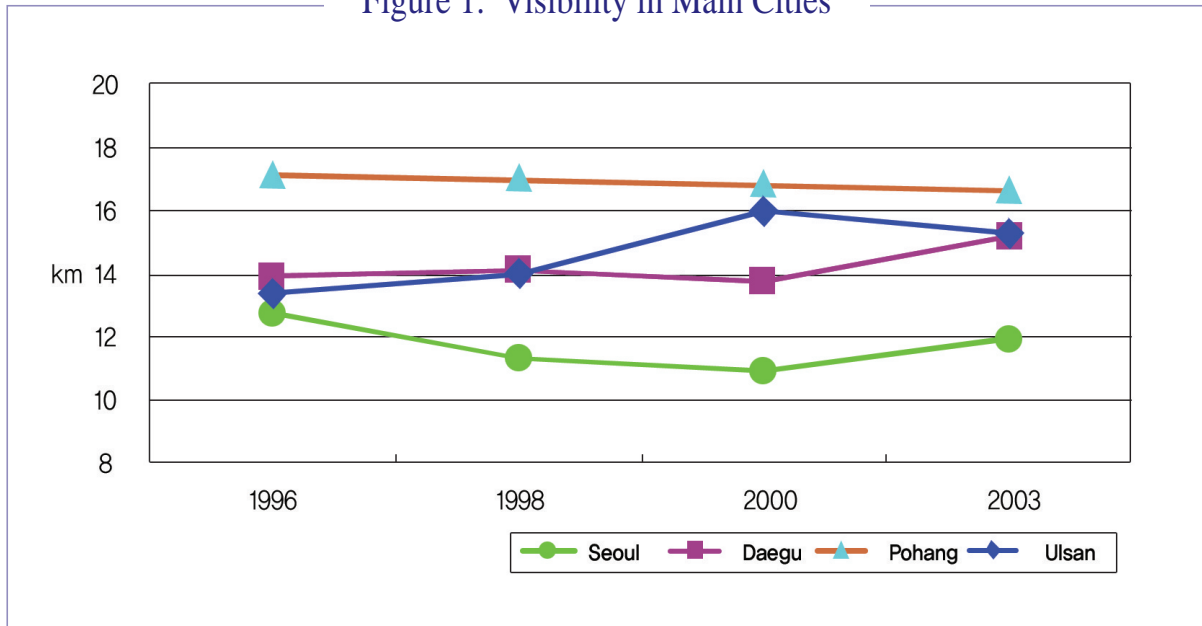
	2003		
	NO ₂ (ppb)	O ₃ warning (time)	PM ₁₀ (μg/m ₃)
SMA	31(38)	27(2)	67(69)
Non-SMA	22	21	53

Unit : 1) annual average concentrations of NO₂ and PM₁₀, 2) times of O₃ warning for whole year, 3) the number in parenthesis indicates the number for Seoul

Source : Ministry of Environment, The master plan for metropolitan air pollution management, November 2005.

In 2003, the visibility of Seoul (11.9 km) was 20-40% worse than those of Ulsan (13.6 km) and Daegu (15.3 km) due to smog.

Figure 1. Visibility in Main Cities



Source : Ministry of Environment, The master plan for metropolitan air pollution management, November 2005.

In 2003, 44.4% of the nationwide CO emissions, 31.9% of NO_x, 14.2% of SO_x, 25.5% of PM₁₀, and 38.9% of VOC were emitted from Seoul metropolitan air control areas. Among

them, Gyeonggi province, ranked first, and Seoul and Incheon ranked second and third respectively.

Table 2. Emissions by pollutant in 2003

Classification		CO	NO _x	SO _x	PM ₁₀	VOC
Nationwide		857,952	1,167,329	499,010	70,120	730,653
SMA	Total	380,582 (44.4%)	372,305 (31.9%)	70,630 (14.2%)	17,868 (25.5%)	283,955(38.9%)
	Seoul	177,984	108,307	7,636	4,708	86,693
	Incheon	48,949	66,352	15,428	3,112	55,262
	Gyeonggi province	153,649	197,645	47,566	10,048	142,000

Unit : ton/year, the number in parenthesis represents the percent of SMA in emissions nationwide

Source : National Institute of Environmental Research, The air pollutants emission in 2003, August 2005.

The emission of SO_x in the SMA is decreasing continuously (an average of 2.1% per year) due to policies to reduce air pollution, including the

use of clean fuel, the supply growth of low sulfur fuel, and the supply of low emission vehicles. However, the emissions of NO_x, VOC, and CO,

which are the main causes of photochemical pollution in urban areas and mostly discharged by motor vehicles, have increased. Compared to the mid-1990s, PM₁₀ from artificial pollutants

decreased, but is increasing recently due to the growing number of diesel vehicles (an average of 0.4% per year).

Table 3. Emission of pollutants in the SMA by year

Year	SO _x	NO _x	PM ₁₀	CO	VOC	TSP
1999	545,729	974,760	69,158	805,666	643,953	-
2000	531,059	1,003,958	67,515	825,193	664,852	89,424
2001	552,173	1,050,997	69,881	837,568	712,230	91,597
2002	501,753	1,106,269	68,890	860,584	723,857	89,019
2003	499,010	1,167,329	70,120	857,952	730,653	90,642

Unit : ton/year

Source : National Institute of Environmental Research, The air pollutants emission (<http://airemiss.nier.go.kr/>, 2008.9.10); National Institute of Environmental Research, The air pollutants emission in 2003, August, 2005.

2. Hazards of Particulate Matter

The socio-economic damages caused by air pollution are so serious that it even impedes national competitiveness. Research results show that the number of premature deaths caused by particulate matter in the SMA is estimated to be more than 10,000 people¹⁾ and that the socio-economic cost projected is approximately 10 trillion Korean won per year²⁾. According to a US Environmental Protection Agency (EPA) report, more people (1.5%) will die of stroke because of an increase of particulate matter. Particulate matter aggravates respiratory diseases such as asthma and hampers lung function. Particulate

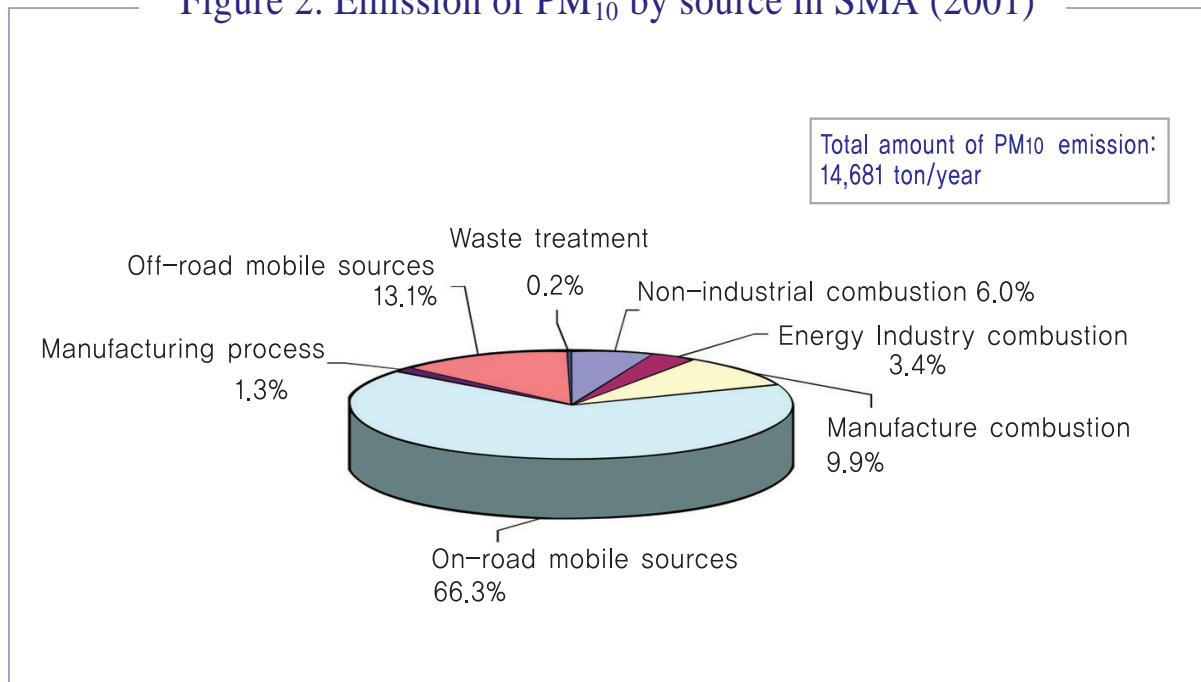
matter also worsens visibility, causes sediment that obstructs the metabolism of plants and is corrosive to cultural relics and statues³⁾.

Particulate matter is a mixture of solid and liquid particles and their diameter is less than 10 micrometers. The shape and size of the matter is very different, since they are emitted from not only natural but also different kinds of point and non-point sources. Particulate matter is emitted directly from the source or is formed secondarily by gas materials such as SO_x and NO_x. Referring to the figure2, approximately 66% of particulate matter is emitted from motor vehicles which are the main part of on-road mobile sources.

¹⁾ Gyeonggi Research Institute (2003), Estimating Social Cost of Air Pollution and Developing Environmental Control Strategies for Gyeonggi province

²⁾ Korea Environment Institute (2003), Cost-Effectiveness on Special Measures for Metropolitan Air Quality Improvement

³⁾ National Institute of Environmental Research (2005), Annual report of atmospheric environment 2004

Figure 2. Emission of PM₁₀ by source in SMA (2001)

Source : Ministry of Environment, The Master Plans for Metropolitan Air Quality Management, November 2005.

Of the total amount of air pollutant emissions, 51% of NO_x and 66% of PM₁₀ are from motor vehicles. Half of registered motor vehicles are in the SMA and the number of registration in the SMA increased 26-fold from 270,000 in 1980 to 6,920,000 in 2004. In 2014, the number of registered motor vehicles is expected to reach about 9,412,000. In 1994, only 1.0% of motor vehicles running on the road were more than 10 years old based on their registration date. In 2002, however, the percentage of old and superannuated vehicles increased to 9.1%, so that the emissions from those vehicles aggravated air pollution in SMA.

At the same time, as diesel recreational vehicles (RVs) increased from 135,000 in 1995

to 929,000 in 2002, PM₁₀ and NO_x emissions from diesel RVs have shown the tendency to increase, too.

In 2001, the total number of motor vehicles in the SMA was 5,780,000, with 62%, 27%, and 11% being gasoline, diesel, and LPG vehicles, respectively. Interestingly, diesel vehicles that account for 27% of the total number of vehicles emit 100% of the particulate matter and 71% of the NO_x. Considering the fact that 75-77% of diesel vehicle pollutants were emitted from old and superannuated vehicles more than five years old, proper emission control measures should be enforced for those in-use diesel vehicles.

II. Special Measures for Metropolitan Air Quality Improvement

1. Legislation for the Special Act on Metropolitan Air Quality Improvement and subordinate regulations

In order to set up a basic strategy to improve the air quality of the SMA, the “Special Measures on Metropolitan Air Quality Improvement” (hereinafter referred to as ‘the special measures’) were devised by the Ministry of Environment in April 2002. The special measures aimed to reform the ex-post control system into a prevention-oriented one and to introduce a wide area management system covering the entire SMA by complementing the dispersed management system operated by each municipality individually. The special measures is to establish an air quality management system with a mid-to long-term plan and goal by 2014. Later, the “Special Act

on Metropolitan Air Quality Improvement” (hereinafter referred to as ‘the special act’) and its subordinate regulations were enacted in December 2003 and December 2004, respectively. The goal of the special act is to develop an institutional framework for the effective implementation of the special measures. The special act includes main policy measures such as the total air pollution load management system for region and industrial sectors, emission trading system, control measures for on road mobile sources, mandatory purchasing of low-emission vehicles, environmentally friendly energy and city management, etc. Some areas in the SMA where air pollution is especially severe or air pollutants emitted have heavy influence on the entire SMA were designated and managed as Metropolitan Air Quality Management District (AQMD).

Figure 3. Map of Metropolitan Air Quality Management District in SMA



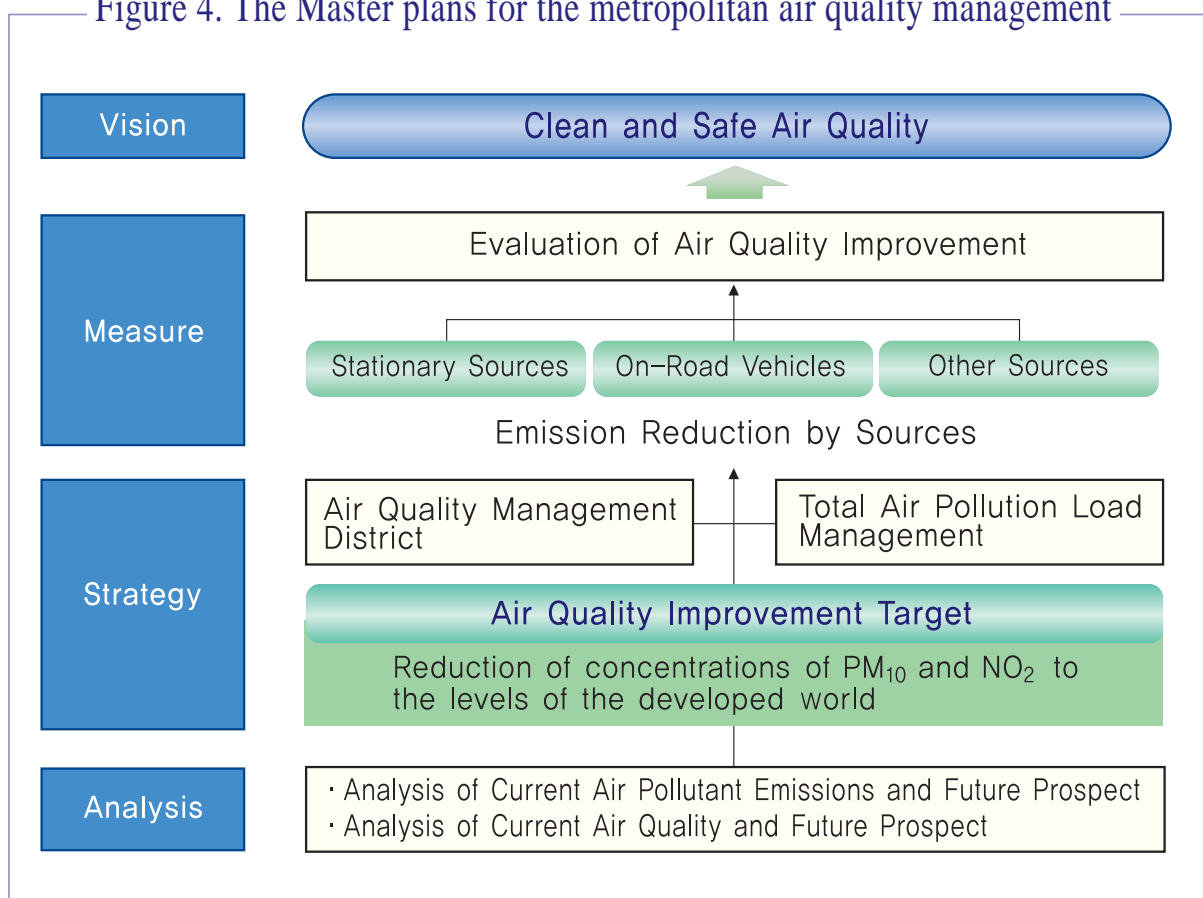
Source : Ministry of Environment, Special Measures on Metropolitan Air Quality Improvement, December, 2004 (http://eng.me.go.kr/docs/cyber/cyber_view.html, 2008.10.5)

2. Master Plan for the Metropolitan Air Quality Management

The special act has been in force since January 2005. According to the special act, the Ministry of Environment established the "Master Plan for the Metropolitan Air Quality Management"

(hereinafter referred to as 'the master plan') as a 10-year framework plan including a 5-year implementation plan in November 2005. In December 2006, the three municipalities, namely Seoul, Incheon and Gyeonggi province, in SMA set their own implementation plans to carry out the master plan.

Figure 4. The Master plans for the metropolitan air quality management

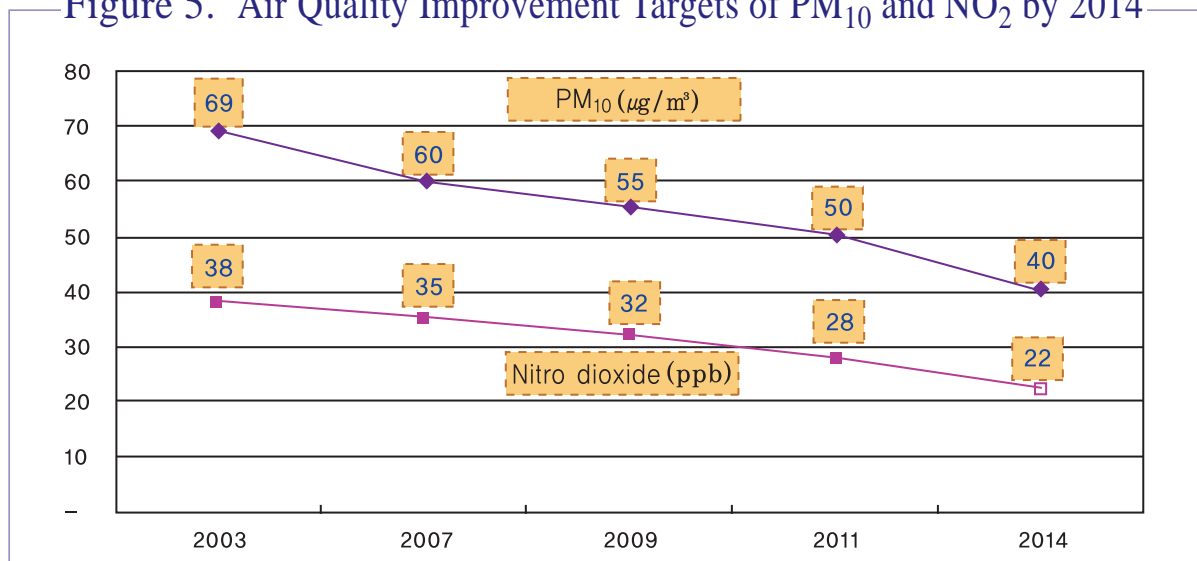


Source : Ministry of Environment, the master plan for the metropolitan air quality management, November, 2005.

The main air quality improvement targets of the master plan are to reduce the concentrations of PM₁₀ and NO₂ to the levels of the developed world by decreasing their emissions in the SMA by half compared to 2001 by 2014. The air

pollutants to be controlled in the master plan are PM₁₀, NO_x, VOCs, SO_x, etc. To meet this emission reduction target, the targets for each year and detailed implementation measures have been set up as follows.

Figure 5. Air Quality Improvement Targets of PM₁₀ and NO₂ by 2014



Source : Ministry of Environment, The Master plan for the metropolitan air quality management, November, 2005

Detailed Implementation Measures of Master Plan

Control Measures for On-Road Mobile Sources

- Newly Manufactured Vehicles
 - Strengthening Emission Standards in accordance with the EU standards, Low Emission Vehicles (LEVs) Supply, Stronger Enforcement of Emission Testing
- In-Use Vehicles
 - Installation of Emission Reduction Equipment, Retrofit with Cleaner Engines, Early Scrapping of Old and Superannuated Vehicles, Replacement of Metropolitan Buses with CNG Buses
 - Promotion of Vehicle Inspection System, Strengthening Education and Management of Auto Repair Shop, Strengthening Standards on Fuel Quality

Control Measures for Stationary Sources

- Large Sized Enterprises
 - Allocation of the Annual Allowable Emission Loads, Strict Control of Emission within Allocated Amount, Establishment of an Emission Trading System
- Small and Medium Sized Enterprises
 - Strengthening Emission Standards in accordance with Developed Countries
 - Strengthening the management of Small Incineration Facilities, VOCs Reduction in Paints, Stringent VOCs Control (STAGE-II)
 - Installation of Low-NO_x Burners, Technology Assistance, Voluntary environmental management, Education & Training

Environmentally Friendly Energy and City Management

- Expansion of Community Energy Supply System, Reinforcement of Energy Demand Management, Expansion of Low-Sulfur and Clean Fuels Supply
- Air Quality Management through Wind Passages, Strengthening of Environmental Impact Assessment

Source : Ministry of Environment, The Master plan for the metropolitan air quality management, November, 2005

III. Outline of Emission Reduction Program for In-Use Diesel Vehicles

As a part of the master plan based on the special act and special measures, the Ministry of Environment has carried out a program to reduce emissions from in-use diesel vehicles running on the road. In accordance with the special act, the Ministry of Environment conducted a pilot project for in-use diesel vehicles owned by public and non-profit organizations from 2004 to 2005. Since 2006, this program has been implemented in the full-fledged manner.

1. Installation of Emission Reduction Equipment or Low Emission Engine

Under the special act, the in-use diesel vehicles⁴⁾ in the SMA are obligated to undergo a stricter and more detailed vehicle inspections under new emission standards. If the vehicle fails to comply with the emission standards, the vehicle owner is required to install reduction equipment such as DPF or DOC, or retrofit the vehicle with low emission engines like LPG engine. If the old and superannuated vehicles can't be modified through these technical alternatives, the vehicle owners are required to

scrap their vehicles early. The mayors of Seoul and Incheon and the governor of Gyeonggi province have enforced these technical alternatives on in-use diesel vehicles which weigh more than 3.5tons and were registered before December 31, 2005 and older than seven years since the registration date .

When the vehicle owners are selecting emission reduction equipments or cleaner engines, the driving conditions such as road condition, emission temperature and the production year of the vehicle should be taken into account to decide whether the certification standards of equipments or engines are fit for their vehicles. After the installation of emission reduction equipment or retrofit of engine, the vehicle should pass a remodeling inspection and emission inspection. Within one month after the inspection, an equipment installation certificate or a cleaner engine certificate should be submitted to a competent municipal authority. During the warranty period, the diesel vehicles with emission reduction equipment or cleaner engines are excused from detailed emission inspection and environment improvement charges that are imposed on specific in-use diesel vehicles.

⁴⁾ The diesel vehicles registered in Seoul city, Incheon city, and 24 cities or guns of Gyeonggi province that have an expired exhaust emission warranty. (Article 24 Clause 1 of special act)

2. Financial Support for Vehicle Owners

The central government and three municipalities have provided financial assistance for those owners to install emission reduction equipments or retrofit with low emission

engines. The mayors of Seoul and Incheon and the governor of Gyeonggi province support the expenses of the installation of equipment or retrofit of engine. The financial support is also available for vehicles that should be scrapped under relevant regulations. (See Table 4)

Table 4. Financial Support for the Equipment Installation/Engine Retrofit and Early Scrapping

Vehicle	Example	Equipment Installation Engine Retrofit	Maximum Financial Support			Maximum Financial support for scrapping
			2008	2009(Prediction)	Maintenance	
RVs	Galoper, Musso, Korando, Carnival, etc.	DOC	69	64	1	100
		Engine Retrofit	370	360	1	
Mini Van	Starex, Grace, Istana, etc.	DOC	69	64	1	100
		Engine Retrofit	370	360	1	100
Mid/small size truck (total weight < 3.5 tons)	Porter, Frontier, Presio, etc. 1 ton capacity	DOC	89	84	1	100
		Engine Retrofit	391	381	1	100
Big size truck/bus (total weight>3.5 tons)	2.5 ton capacity (3000-6000 cc)	Engine Retrofit	401	304	1	300
		2 nd type of PDF	300(296)	228(224)	5(1)	300
	Total weight>3.5 tons	Big size DPF	608(578)	468(438)	44(31)	600
		Mid size DPF	568(538)	437(407)	44(31)	
		Complex DPF (big)	764(734)	586(556)	44(31)	
Complex DPF (medium)	728(698)	559(529)	44(31)			

Unit : 10,000 Korean won

Note : The amount in parenthesis excludes expenses for the installation of TDMS and for the 6-month qualification inspection.

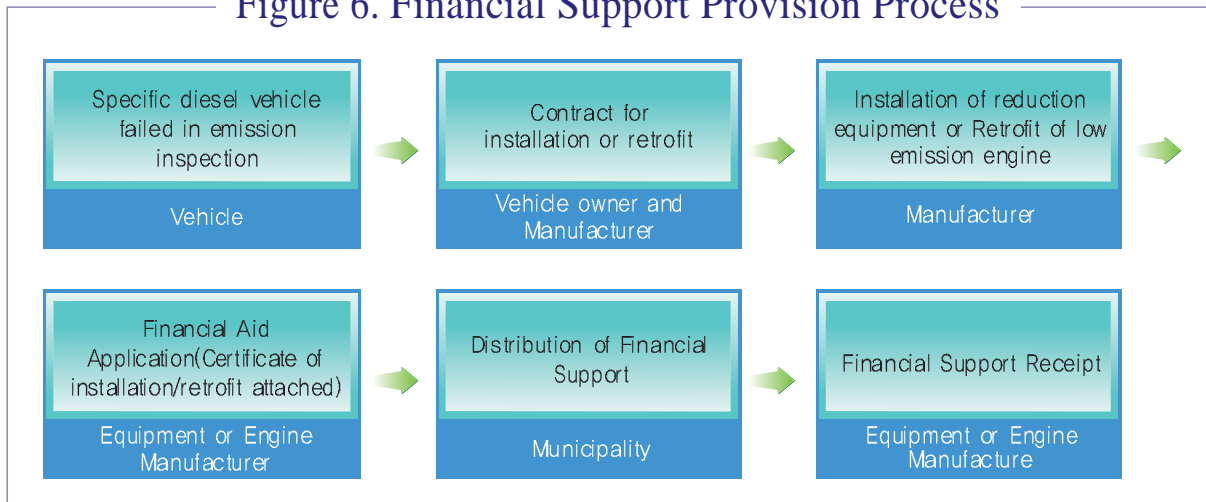
Source : Ministry of Environment, 2008 Financial Support Guidance of Emission Reduction Program for In-Use Diesel Vehicles, February, 2008

The manufacturer who has completed the installation of emission reduction equipment or the retrofit of engine has a right to claim the financial assistance from the three municipalities. Within one

month after the claim, they shall provide the financial support, excluding maintenance fees, directly to the manufacturer who installed the equipment or engine after confirming the following:

- Fact of installation of emission reduction equipment or retrofit of engine
- Eligibility under financial support regulations and certification standards of equipments or engines
- Approval of vehicle remodeling and certificate of inspection
- Issuance of certificate of equipment
- Warranty of ex-post management or agreement on ex-post management between the equipment manufacturer and the related association

Figure 6. Financial Support Provision Process



Source : Ministry of Environment, Regulations on the ex-post management and financial support for emission reduction program for specific in-use diesel vehicles, December, 2007

3. Certification System on Equipment and Engine

Manufacturers should acquire a certificate issued by the Ministry of Environment. The certificate shows that the equipment and engine meet the regulations on emission reduction efficiency imposed by the Ministry of

Environment during the warranty period. The detailed certificate regulations on emission reduction efficiency have been enforcing as follows. The output of power and fuel efficiency of the vehicle, however, should not be reduced by more than 5% after installation of the emission reduction equipment.

Table 5. Certificate Regulations on Emission Reduction Efficiency of Equipment or Engine

	Reduction efficiency (%)	Warranty period	Measuring method
Emission Reduction Equipment			
Type I, emission reduction equipment	Particulate matter or NOx > 80%	3 years or 160,000 Km	CVS-75 mode or ND-13 mode
Type II, emission reduction equipment	Particulate matter or NOx > 50%	3 years or 80,000 Km	
Type III, emission reduction equipment	Particulate matter or NOx > 25%	3 years or 80,000 Km	
Low Emission Engine			
Gas engine	Emissions from low emission engine should be under the limits certified according to the Clean Air Conservation Act: Article 3	3 years or 160,000 Km	CVS-75 mode or ND-13 mode
Diesel engine	Emissions from low emission engine should be under the limits for diesel vehicles manufactured during the period of retrofit	3 years or 80,000 Km	

Gaseous pollutants (carbon monoxide, hydrocarbon or nitrogen oxides) from the vehicle also should not be increased by more than 5% after the installation of the emission reduction equipment.

To receive the certificate, the reduction efficiency test, environment assessment test (applies only to fuel on catalyst type active regeneration DPF), characterization test, and road test should be applied to type I and II emission reduction equipments, and the characterization test and road test should be applied to type III emission reduction equipment and low emission engines. If the manufacturer wants to change the content of the certificate, for example, equipment name, type, spec, condition, etc., the manufacturer should apply to the Minister of Environment for the change.

4. Ex-post Management of Equipment and Engine

The manufacturer is responsible for the submission of quarterly reports regarding installation status of equipments and engines to the head of the municipalities and the head of the Metropolitan Air Quality Management Office under the Ministry of Environment. The report should include exhaust gas temperature diagrams of vehicle, vehicle models, investigations of emission reduction efficiency, information of vehicle owners, etc.

If the owner wants to scrap or export the vehicle with the equipment or engine during the warranty period, the owner has to return equipment or engine to the municipalities or the manufacturer. In the case of removing reduction equipment or changing the low emission engine back into a diesel engine without adequate

reason during the warranty period, the provision process of financial support for manufacturer can be restricted or the paid money can be withdrawn from the manufacturer. However, these regulations of ex-post management are not applied to cases that have apparent reasons recognized by the municipality, such as installation condition change due to changes in route traveled by vehicle, use of similar fuel, accident, robbery, vehicle trouble which is not related to equipment and engine, or natural disaster etc.

The ex-post management authorities, namely the three municipalities of the SMA and the Metropolitan Air Quality Management, are responsible for monitoring the reduction equipment installation and engine retrofit and their efficiency. If problems are detected with regard to reduction efficiency, the manufacturer should submit a "plan for correction" to the authorities and repair or replace the equipment and engine accordingly. Then, the authorities should confirm whether the correction was made in the proper way.

The above-mentioned ex-post management authorities are responsible for inspecting the efficiency of installed emission reduction equipments or low emission engines certified by the Ministry of Environment within the warranty period. In the case of defective equipment, the manufacturer should investigate the reduction equipment or low emission engine thoroughly and report their findings of defect and correction plan to the Ministry of Environment. According to a review of the correction plan and its performance result, the Ministry of Environment may revoke certificates of concerned equipment and engine if defects are not fixed.

IV. Effectiveness Evaluation and Future Plans

1. Effectiveness Evaluation of Program

The program to reduce emissions from diesel vehicles is being implemented as part of a

master plan to improve air quality in the SMA. The program began as a pilot project in 2004 and has since contributed to the installation of 83,735 DPFs, 133,335 DOCs, and the retrofit of 72,956 LPG engines by the end of 2007.

Table 6. Emission Reduction Equipment Installation and Engine Retrofit (2004~2007)

	DPF	DOC	LPG	Total
2004	479	1,022	1,233	4,738
2005	18,054	16,573	6,557	43,189
2006	25,684	62,234	28,769	118,693
2007	39,518	53,506	36,397	131,428
Total	83,735	133,335	72,956	298,048

The effectiveness of the emission reduction program for in-use diesel vehicles firstly can be evaluated by estimating the emission reduction amount from the reduction equipments installed and low emission engines retrofitted. The results show that this program is the most effective for PM₁₀ reduction. The amount of PM₁₀ reduced by

the program is estimated at 424 tons in 2006 since the beginning of the pilot project in 2004 and the DPF (or DOC) installation and LPG engine retrofit in 2005. This would be equivalent to 3.8% of total emissions from total on-road mobile sources running in the entire SMA.

Table 7. Effectiveness of Emission Reduction Program for in-use Diesel Vehicles

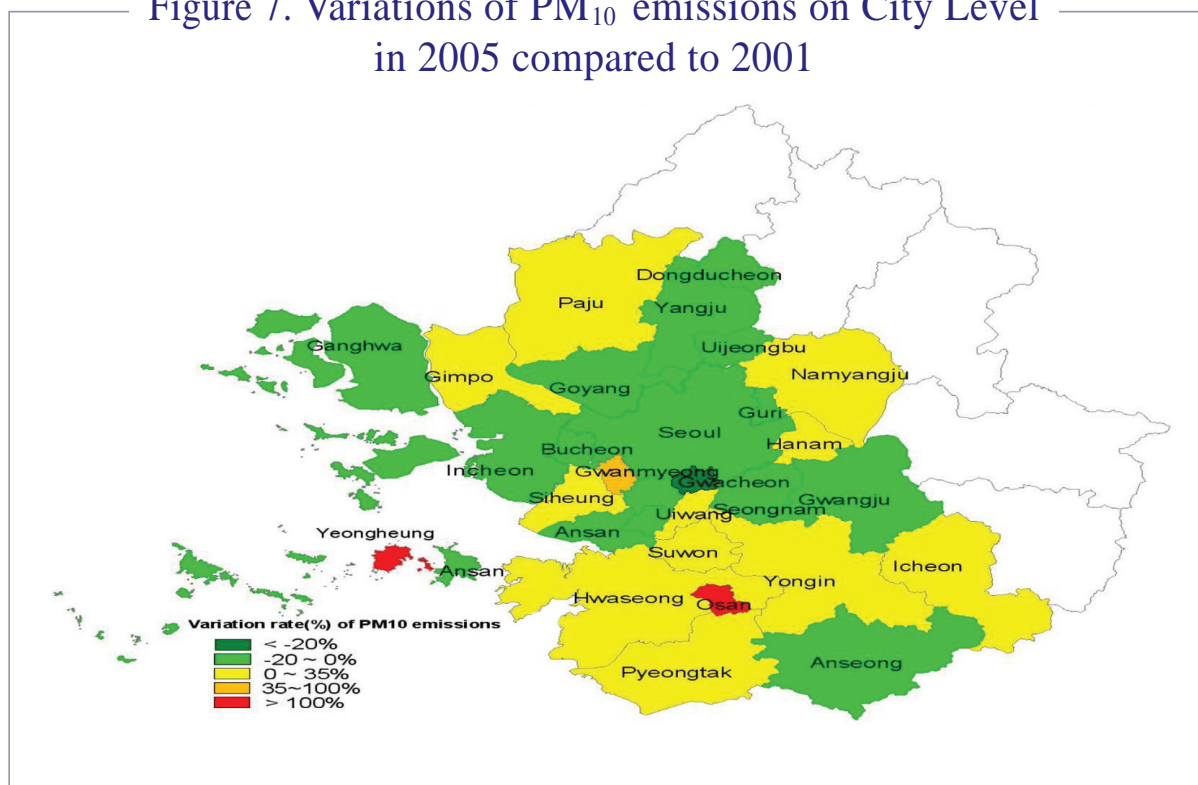
Exhaust	Year		Seoul	Incheon	Gyeonggi	SMA
PM ₁₀	2006	Total vehicle emission (ton)	3,449	1,694	5,915	11,058
		Emission reduction (ton)	191	48	185	424
		Reduction ratio (%)	5.5%	2.8%	3.1%	3.8%
NOx	2006	Total vehicle emission (ton)	60,970	25,919	86,505	173,394
		Emission reduction (ton)	77	15	37	130
		Reduction ratio (%)	0.13%	0.06%	0.04%	0.07%
HC	2006	Total vehicle emission (ton)	20,345	6,673	18,878	45,897
		Emission reduction (ton)	440	98	443	981
		Reduction ratio (%)	2.3%	1.5%	2.4%	2.2%
CO	2006	Total vehicle emission (ton)	131,734	39,387	118,979	290,100
		Emission reduction (ton)	1,733	388	1,926	4,047
		Reduction ratio (%)	1.3%	1.0%	1.6%	1.4%

Source : Ministry of Environment, The evaluation of the 2005 emission reduction program for in-use diesel vehicles in the SMA and the ex-post management strategy, December, 2006.

Figure 7 shows the geographical distribution on variations of PM₁₀ emissions in cities through the GIS mapping method. PM₁₀ emissions went

down a bit in a number of cities under AQMD in 2005 compared with 2001.

Figure 7. Variations of PM₁₀ emissions on City Level in 2005 compared to 2001



Source: National Institute of Environmental Research, Emission Trend Analysis of air pollutants in SMA (2001-2005), April, 2008

The annual average concentration of PM₁₀ has also decreased steadily in Seoul since 2004. This trend infers that there is a certain relationship

between the concentration decrease and emission reduction of PM₁₀ through this program for in-use diesel vehicles

Table 8. The variation trend of PM₁₀ concentration in Seoul

	'00	'01	'02	'03	'04	'05	'06	'07 ²⁾
PM ₁₀ (μg/m ³) ¹⁾	65	66	65	69	59	56	55	57

Source : 1) The days when Dust and Sandstorms occurred were excluded.

2) Because of El Nino, the number of days with high concentrations (>100 μg/m³) increased from 23 in 2006 to 40 in 2007. As a result, the annual average concentration of PM₁₀ value was higher by 4 μg/m³. So the actual concentration of PM₁₀ in 2007 can be estimated to be 53 μg/m³.

According to an evaluation by the Ministry of Planning and Budget in 2007, in addition with the evaluation on reduction of the amount and concentration of pollutants, the program was estimated to have higher economic value than

the National Assembly predicted in 2005. Thus the emission reduction program for in-use diesel vehicles was considered to be of great economic value.

Table 9. Evaluation Result of the Economic Value of Program

	DPF installation	LPG engine retrofit	DOC installation	Early vehicle scrap
2005	12.4	9.0	8.0	4.6
2006	18.4	10.3	9.1	5.3

Source : Korea Development Institute (KDI), In-depth evaluation of the emission reduction program on in-use diesel vehicles, December, 2007

2. Future Plans

This emission reduction program for in-use diesel vehicles running in the SMA will continue targeting 1,100,000 diesel vehicles by investing 3.8 trillion Korean won until 2014, and will be expanded to five metropolitan cities in non-SMA. Since 2006, the Ministry of Environment has been implementing a pilot project in non-SMA. Emission reduction equipments or low emission engines have been installed or retrofitted in 3,350 in-use diesel vehicles from 2006 to 2007 in those metropolitan cities in non-SMA. The central government and 5 non-SMA

municipalities will start the program from 2009.

The government will also assist promoting the development of high efficiency emission reduction equipments and low emission engines in order to expand the scope of the program.

Through this program, Korean technologies for manufacturing emission reduction equipments and low emission engines have improved to the standards of developed countries. And Korean manufacturers of those equipments and engines have various plans to promote international cooperation with overseas partners in order to disseminate their technologies, products and experiences in future.

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