

Korea: a second clean air plan after successful first 2004-14

(Last 10 years(2004~2014) 1st and current 2nd phase air quality management program of Metropolitan Area)

March 14, 2019

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KAEA(Korea Automobile Environmental Association)

10th VERT Forum, Empa Zurich Swiss



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KAEA (Korea Automobile Environmental Association)

www.aea.or.kr

Purpose of Establishment

The purpose of this program is to contribute to the health and environmental preservation of the people by reducing the risks to human health and the environment caused by automobile exhaust gas and to promote mutual interest among KAEA members.

A legal basis : Article NO. 78, 80 of the “Clean Air Conservation Act”

History

- 2007.11. Held the inaugural assembly of the Korea Automobile Environmental Association
Obtained permission of incorporation (Ministry of Environment NO.321)
Corporate registration (Seoul Central District Court)
- 2007.12. Performed a follow-up management service for a reduction program
- 2009.01. Performed a device return management service on commission
- 2010.03. Performed the service to determine cars subjected to accelerated retirement
- 2011.02. Performed a follow-up management service for Idle stop and go system
- 2011.03. Implemented a Korean style auto-oil program
- 2012.07. Propagated an Eco-drive Campaign on commission
- 2015.03 EV public quick charging infrastructure operation management consignment work

Main business

- 1. Diesel vehicle emission reduction program**
 - Diesel Particulate Filter(DPF)
 - PM-NOx reduction device(SCR)
 - Low-emission engine remodeling/replacement
 - Emission reduction program call center
 - Selection and confirmation testing of early scrapped subject
- 2. Eco driving culture spread program**
 - Eco driving nationwide campaign (eco-drive.or.kr)
 - Eco driving contest
- 3. EV charging infrastructure management**
 - Public quick charging infrastructure management
 - Slow charger installation service
- 4. Research for Environmental transportation field**
 - Support Vehicles Emission In-use Compliance Test (Recall, NIER)
 - Support Heavy-duty Vehicles Real Driving Emission Test(PEMS, NIER)
 - Auto-Oil program(MOE)
 - LEZ(Low Emission Zone) Research & Consultation
 - Pilot Project : New reduction device supply
 - Select a target vehicle for In-use Compliance Test
 - Other environmental transportation field research business

Members of KAEA

Diesel Particulate Filter(9)



econix
에코닉스



eracomb
Ceramic Honeycomb



CMC 씨엠씨(주)



MNS HK
HYUNDAI-GA Venture Network



ILJIN



CleanEarth
Clean Technology CleanEarth



Metal Fiber Technology
FiberTech



Eco & Dream



후지노테크(주)
Fuchino Tech. Co., Ltd.

LPG Modification(6)



EXCION



(주)이알인터내셔널



KNMT
Korea Engine Emission Technology



ENGINE TECH
KORZA CO., LTD.



GSC
The Solution for Ecology Future



(주)블루플래닛
<http://www.blueplanet.co.kr>

I . Background of Air Quality

Management Program

1-1

1st phase(2004–2014) Program for Metropolitan Air Quality Management

1-2

1st phase Retrofit Quantity of Diesel Vehicles

1-3

Results and Limits of 1st phase Program

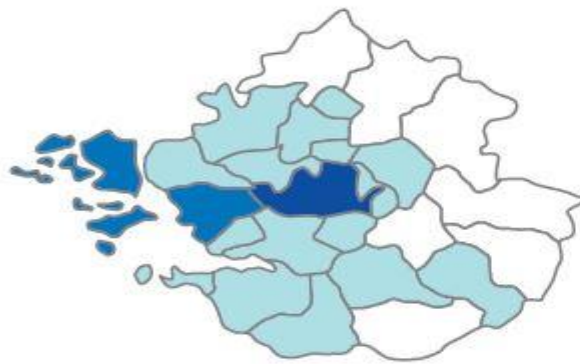
1-1. 1st phase Special Measures on Metropolitan Air Quality Improvement

Improvement Plan and Target Area

Target

Significant Reduction of PM and NO₂

2014 Goal PM 40 μ g/m³, NO₂ 22ppb (since 2005)



- Seoul (Entire Area)
- Incheon (excluding Ongjin-gun, including Yeongheung-myeon)
- Gyeonggi-do (Gwangju, Anseong, Yeosu, and Pocheon will be included, Gapyeong, Yangpyeong, and Yeoncheon are excluded)

(December, 2014)

Visibility distance from Nam Mountain to the coast of Incheon on a clear day



1-1. 1st phase Special Measures on Metropolitan Air Quality Improvement

Old Diesel Vehicles Retrofit Program

Implementation of emission reduction program since 2005 by installation of after-treatment devices, LPG conversion, and early scrapping by government subsidy.



Aftertreatment Devices

- Type: DPF, p-DPF, DOC
- Reduction: PM10(80%, DPF)
- Vehicles older than 5 years



LPG Conversion

- Diesel Engine → LPG Engine
- Reduction: PM(99%), CO, HC(30%), NOx(70%)
- Convert piston, injector, fuel pump, LPG tank etc.



Early Scrapping

- Very old diesel vehicles
- Reduction: All air pollutants 100%
- Vehicles older than 7 years



1-2. 1st phase Retrofit Quantity of Diesel Vehicles

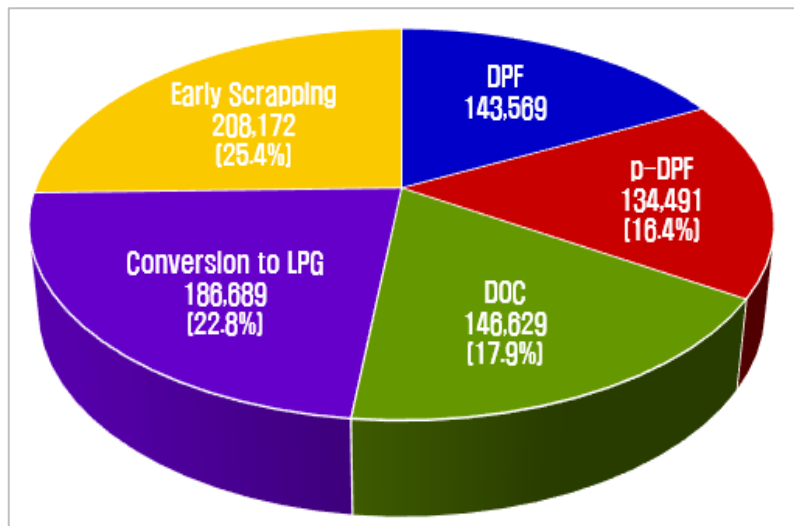
Achievements

Total 820,000 vehicles Retrofitted with an Investment of 2.2b USD Government Subsidy

- ❖ (DPF) 143,569, (p-DPF) 134,491, (DOC) 146,629
(LPG Modification) 86,689, (Early Scrapping) 208,172

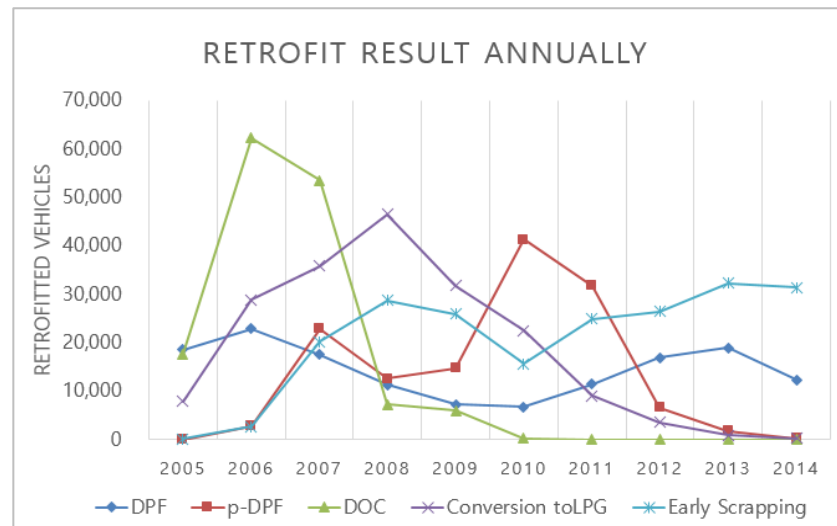
Retrofit Type Ratio

('05~'14)



Retrofit result Trend

(unit : ea)



1-3. Results and Limits of 1st phase Program

PM₁₀

Seoul

60 $\mu\text{g}/\text{m}^3$ (2006) \rightarrow 46 $\mu\text{g}/\text{m}^3$ (2014)

NO₂

Seoul

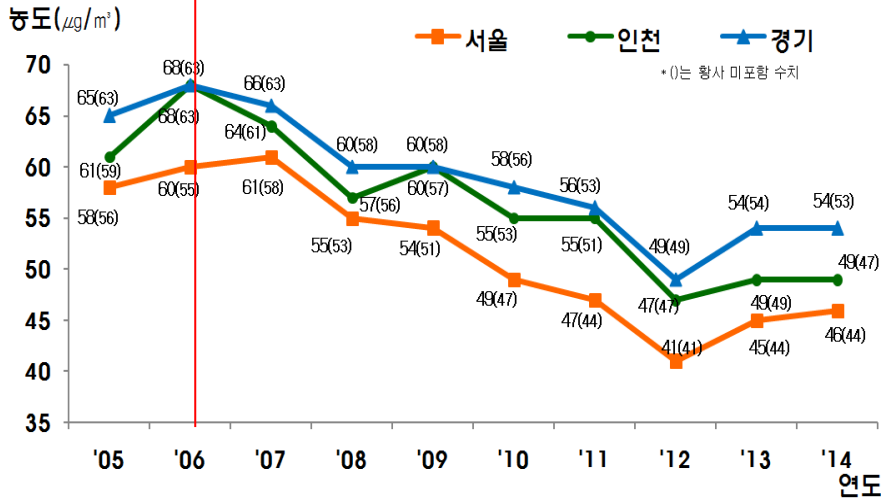
36 ppb (2006) \rightarrow 33 ppb (2014)

Insufficiency

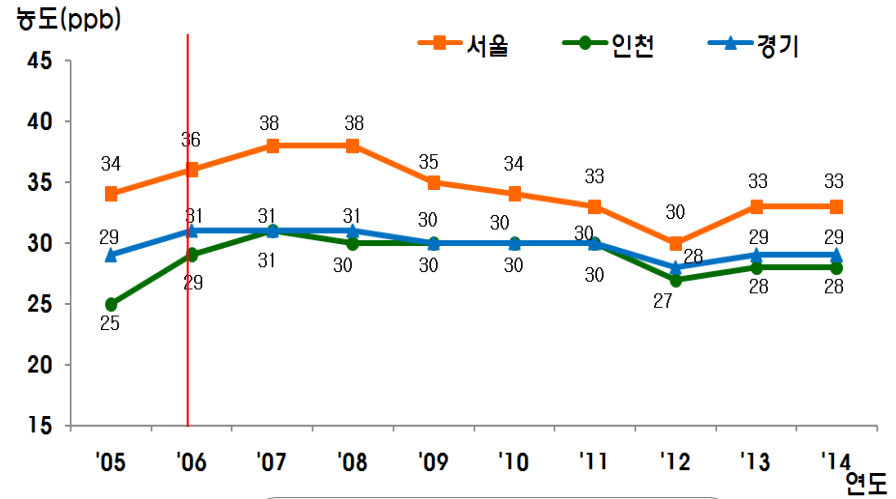
Air Quality has improved, but not reached 2014 final goal.

☞ (Goal of 2014 Air Quality) PM₁₀ : 40 $\mu\text{g}/\text{m}^3$, NO₂ : 22ppb

Air Quality in Metropolitan Area



PM₁₀



NO₂

1-3. Results and Limits of 1st phase Program

Results & Limits

- (1) On-road air pollutants reduced, while off-road pollutants increased
 (2) PM_{2.5}, O₃ are not managed, so insufficient for human risk management.

PM₁₀ Exhaust Quantity

(Unit : Ton)

Year	On-road	Off-road
2004(A)	8,904	2,855
2013(B)	3,538	3,386
2014 Target	5,964	1,175
(B-A)	△5,366	531

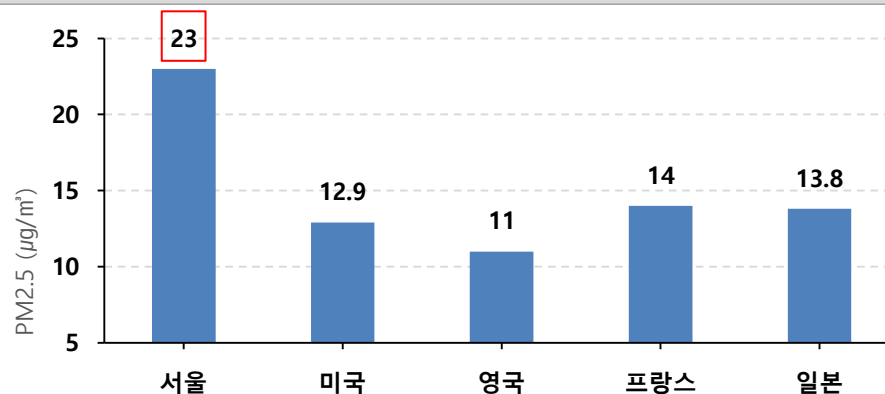
NO_x Exhaust Quantity

(Unit : Ton)

Year	On-road	Off-road
2004(A)	167,964	51,566
2013(B)	113,805	64,064
2014 Target	73,736	23,159
(B-A)	△54,159	12,508

Needs Arise to Strengthen the management of off-road vehicle by using engine replacement and retrofit with DPF and PMNO_x system.

Status of PM_{2.5} of Seoul compared with major global cities



II. 2nd phase(2015~2024) Air Quality Management Program

2-1

2nd phase Special Program on
Metropolitan Air Quality Management

2-2

Achievements during 2015-2018

2-1. 2nd phase Special Measures on Metropolitan Air Quality Management

Strengthening the improvement Target
and extending the Air Quality Management Area

Realize Healthy 100 Years age by clean air

Outline

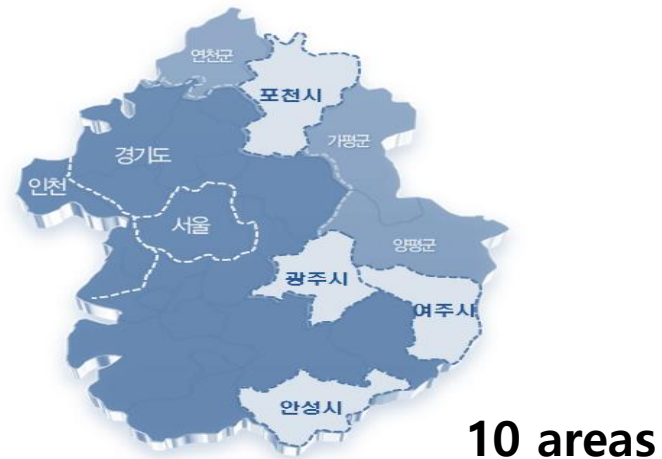
- Target : PM_{10} $30\mu g/m^3$, $PM_{2.5}$ $20\mu g/m^3$, NO_2 21ppb, O_3 21ppb
- Period : 2015~2024
- Areas : Including 7 areas excluded during 1st Program

〈 Extention of Air Quality Management Area 〉

1st Plan('05-'14)

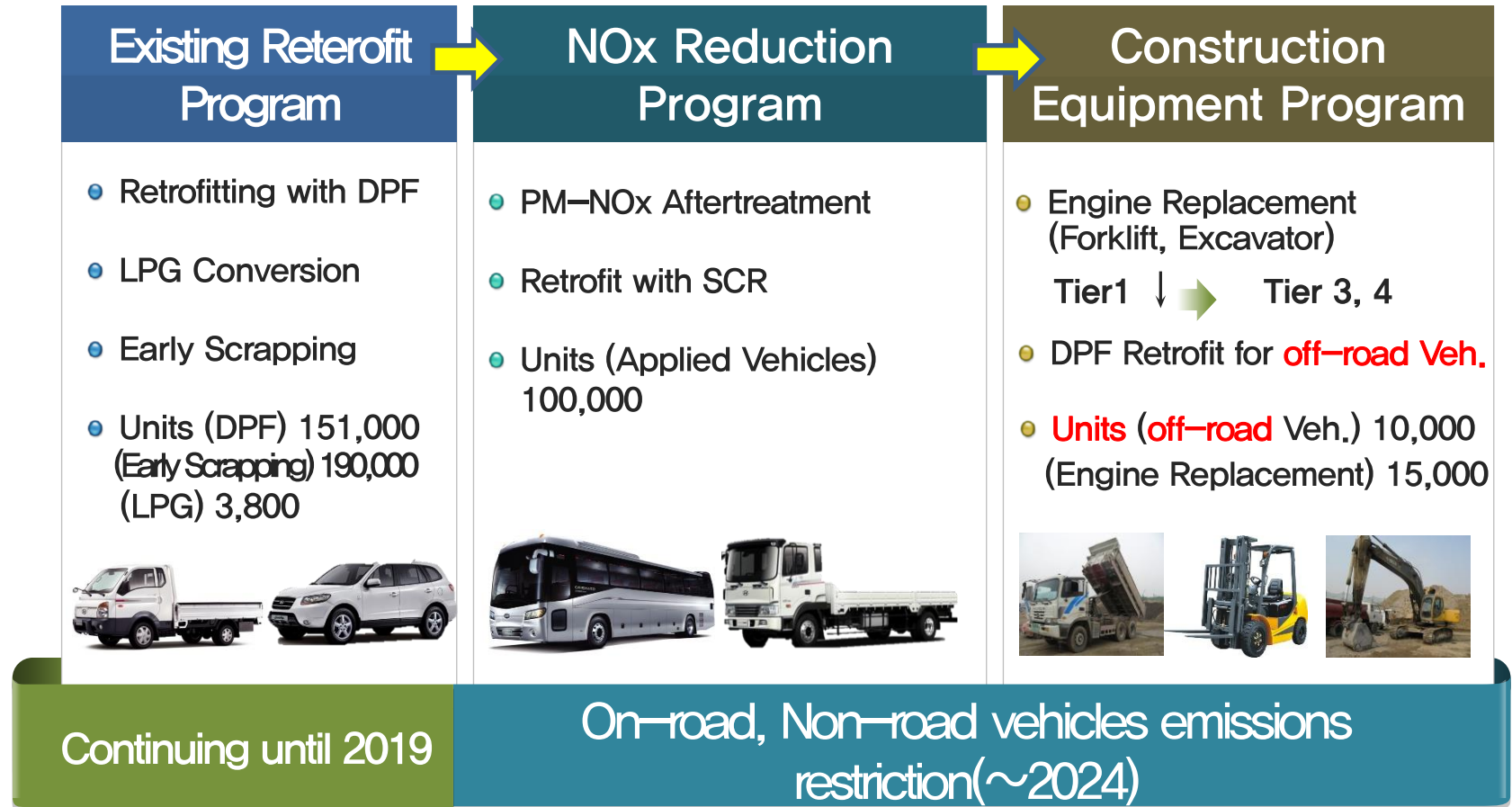


2nd Plan('15-'24)



2-1. 2nd phase Special Measures on Metropolitan Air Quality Management

Technology Upgrade and Coverage Expansion of Retrofit Tech. ('15~'24)



2-1. 2nd phase Special Measures on Metropolitan Air Quality Management

LEZ Implementation targeting Old Diesel Vehicles

(Application Target) Vehicles registered in metropolitan area and **comprehensive inspection failed vehicle or non-compliant vehicles against the order of low pollution measures.**

(Phase 1) 2017 Seoul **(Phase 2)** 2018 Seoul, Incheon, 17 Gyeonggi cities

(Phase 3) 2020 All Air Quality Management Area (Seoul, Incheon & 28 Gyeonggi cities)



2-1. 2nd phase Special Measures on Metropolitan Air Quality Management

Strengthen management of Off-road vehicle and NOx emission

PM-NOx Emission Reduction

- Target vehicle: HD Bus & Truck
- Reduction Efficiency: PM(80%)
NOx(80%)
- Units ('18~'24) : 3,000 units a year



Off-road vehicle Retrofit

- (DPF Retrofit) Dump truck, Concrete Mixer truck, Pump truck
- (Engine Replacement) Forklift, Excavator
- Units (DPF) 32,000 units
(Engine Replacement) 95,000 units



2-2. Achievements during 2015~2018

Achievements

**Total 350,000 vehicle Retrofit
with 320b USD Investment**

- ❖ 2nd phase Air Quality Management program is focusing on the retrofit with PM-NOx system and low-pollution measures for In-use Off-road equipment.
- ('15-'18): DPF 63,235, LPG conversion 1,706, engine replacement of Off-road equipment 3,681, early-scrapping 281,840

(Unit : ea)

Yeay/Category		'15	'16	'17	'18
Total		46,701	58,499	102,525	142,737
Early Scrapping		29,365	43,410	90,155	118,910
DPF(include p-DPF) Retrofit		16,251	13,176	10,132	20,338
LPG conversion		799	637	56	214
PM-NOx System Retrofit		60	185	249	517
Off-road Equipment	DPF Retrofit	-	159	1,106	1,062
	Engine Replacement	226	932	827	1,696

☞ With investment by 2.5b USD, total 1,206,788 in-use vehicles units were retrofitted during 2005~2018(DPF 514,582, LPG 197,788, Off-road equipment 3,827, early scrapping 490,074)

III. DPF Certification and Managements of Korea

3-1

Certification Process by NIER of MOE
Korea

3-2

Retrofit Technologies

3-3

Follow-up Management and Supports

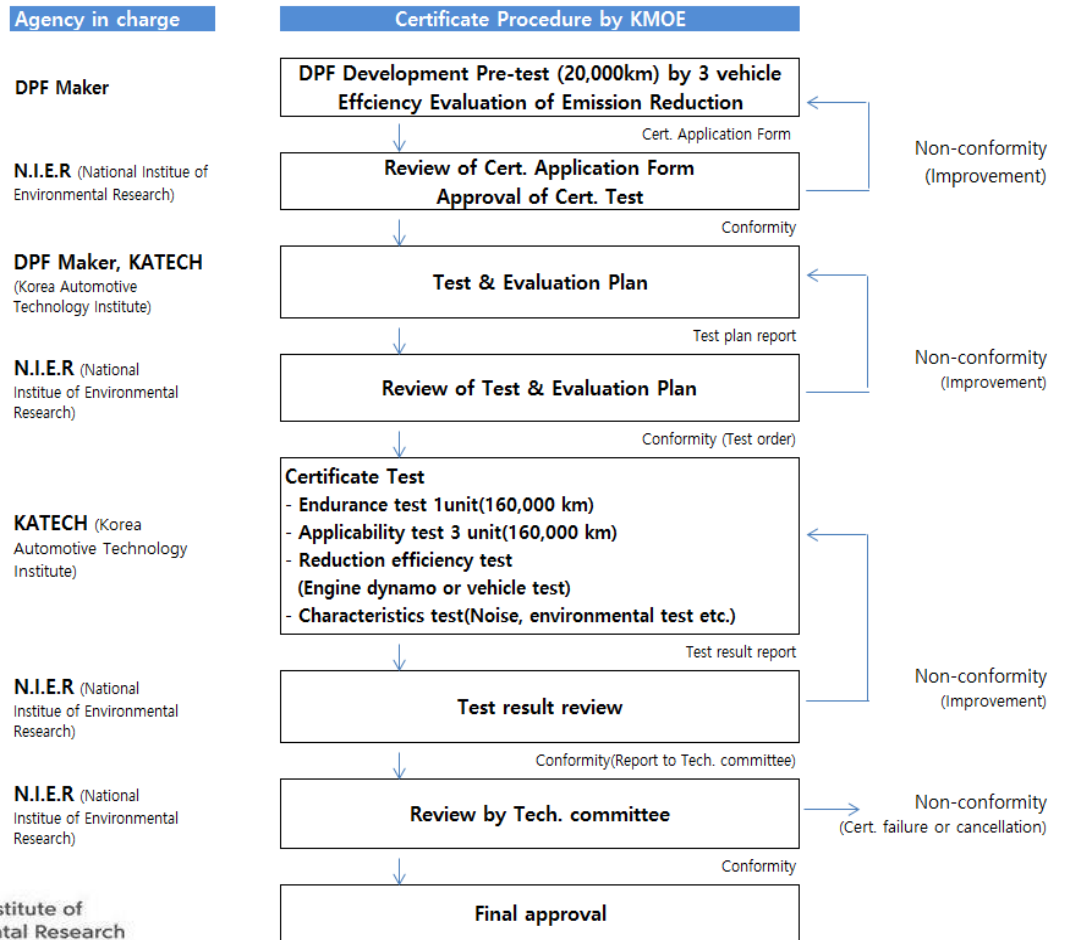
3-1. Certification Process by NIER of MOE

Status of DPF Certification of NIER

Total 70 DPF (including p-DPF) Certified ('18.12.31)

Certificate Procedure

- The NIER(National Institute of Environmental Research) , Affiliated organization of MOE, manages certification and KATECH(Korea Automotive Technology Institute) conducts the certification test
- Tests are composed with durability test, applicability test, reduction efficiency test, and characteristics test

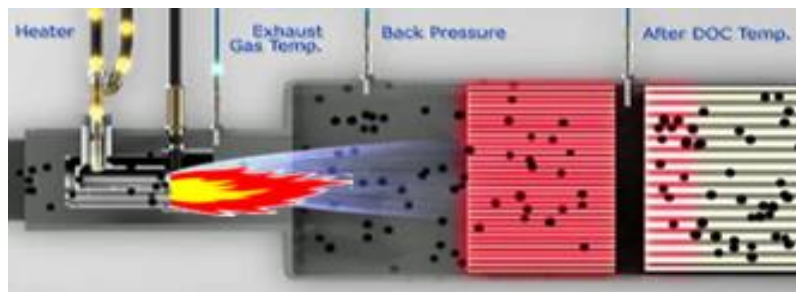


3-2. Retrofit Technologies

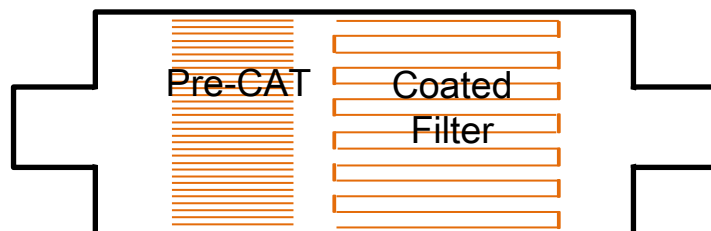
Active and Passive DPF System(Diesel Particulate Filter)

Fuel Burner

Active

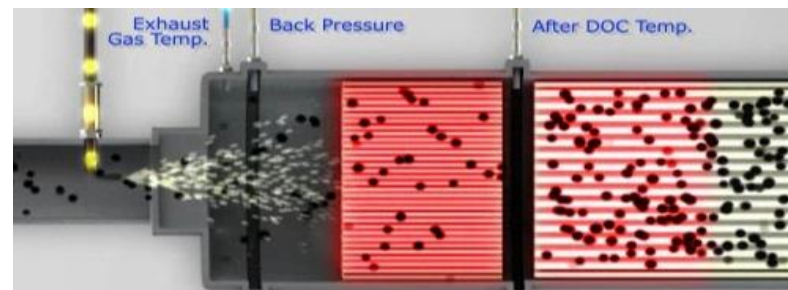


Passive(CCRT)

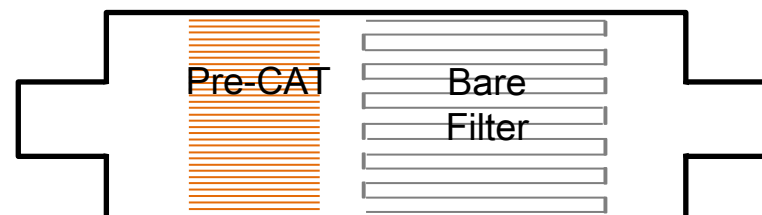


Catalytic combustion with Fuel injection

Active



Passive(FBC+CRT)

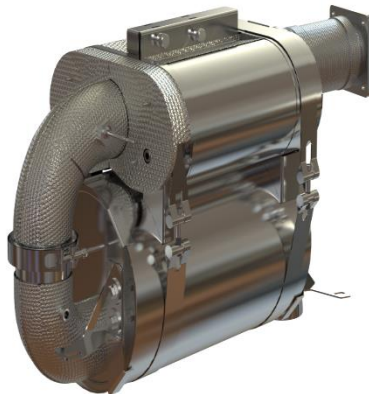
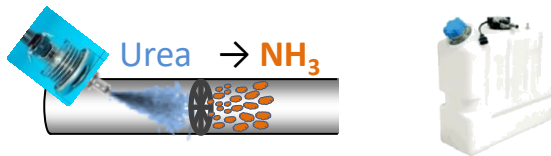


3-2. Retrofit Technologies

SCR (Selective Catalyst Reduction)

Liquid Injection

- Injector & Nozzle + Urea tank



Gaseous Injection

- Gas Tube + Storage cartridge



3-2. Retrofit Technologies

LPG Conversion



- Various parts : piston, ECU, fuel tank etc. for LPG

Substrates



- Locally production of Ceramic honeycomb, Metal fiber substrate for DPF/SCR
- Catalyst Coating technology

3-3. Follow-up Managements and Supports

Follow-up Managements

1. Nonscheduled Field Monitoring and Check by NIER of MOE
2. Call Monitoring by KAEA
3. Defect Checking Inspection : Selection 5 units under warranty and filtration efficiency test, more than 3 units should show above 80% efficiency. by KAEA
4. Performance Check : Performance check after 2months of installation by KOTSA
5. Reuse and Recycle of returned units from the scrapped vehicles and warranty period elapsed units by KAEA

Supports

1. Cleaning Support : 3-times during warranty period(3 years) and since then 1-times a year (130 USD support per a cleaning)
 - Management by 36 Cleaning Center nationwide
2. UREA Cost Support : 1500L during warranty period(3 years)(1,600 USD)

Thanks for your Attention !

