Clean air of Korea without concerns about fine dust Comprehensive Plan for Fine Dust Management

October 2017







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I. Promotion Background

Promotion background



II. Status and Condition of Korea

1. Fine dust pollution level





2. High concentration production $(PM_{2.5})$

Seasonal characteristics

 \odot The average $\text{PM}_{2.5}$ concentration increases and the number of watch issuance increases in spring and winter.

% Average PM, concentration(Jan → May) : 28 in 2015 → 29 in 2016 → 30µg/m³ in 2017

※ Number of watch & warning issuance(Jan → May) : 72 in 2015 → 66 in 2016 → 92 times in 2017

• The number of bad days ($PM_{2.5}$) in Jeonbuk, Gyeongbuk, Chungnam and Chungbuk is 2~3 times higher than the average number in the whole country.



Fine dust concentration of cities and provinces in 2016

3. Domestic emission and foreign influence

(Metropolitan area) Diesel car(23%) > Construction machine & ships(16%) > workplace(14%)
 (Whole country) <u>Workplace(38%)</u> > Construction machine & ships(16%) > Power plant(15%)



• The portion of foreign influence is different according to season and weather condition.

- Year average of 30-50% including China and North Korea in normal times and 60-80% under high concentration are estimated.

% As the result of joint research with NASA, it is analyzed that foreign influence including China occupies 48%, and domestic emission occupies 52% (measurement period : May → Jun in 2016)

Domestic emission

Foreign influence

4. Characteristics of fine dust emission

• (General) Fine dust emission is divided into direct emission and indirect emission (secondary production)*

* Sulfur oxides(SOx), nitrogen oxides(NOx), volatile organic compound(VOCs), and the like are converted into fine dust

• (Portion) About 72% of total emission is emitted indirectly (whole country)

- As the result of fine dust component analysis (PM₁, aerial observation) in the joint research with NASA, the secondarily produced component is 75% of total emission (July, 2017)

- The production caused by SOx and NOx is highest among cause substances of secondary production, and NOx and VOCs should be managed as ozone (O₃) producing substances.

Classification	Total	Direct emission	Indirect emission (secondary emission)				
Classification		(primary emission)	Subtotal	NOx	SOx	VOCs	
Metropolitan area	53,634 ton	14,427 ton	39,207 ton	21,348 ton	10,857 ton	7,002 ton	
	(100%)	(27%)	(73%)	(40%)	(20%)	(13%)	
Whole country	324,109 ton	91,460 ton	262,649 ton	90,416 ton	118,418 ton	23,817 ton	
,	(100%)	(28%)	(72%)	(28%)	(37%)	(7%)	

A plan for domestic reduction is needed as well as reduction of foreign influence.

The comprehensive management of air pollutants (NOx, SOx,etc.) considering fine dust is needed.

II. Direction and Promotion System of Comprehensive Plan

1. Conversion of fine dust management paradigm





3. Main promotion subject

Field		Main promotion subject
Reduction o f domestic e mission	1. Development sector	 Reducing portion of coal power generation such as shutting tow aged coal fired power plant Reviewing change of power energy tax rate system Establishing eco-friendly 8th power supply plan Expanding renewable energy distribution
	2. Industrial sector	5. Expanding total emission management area and enforcing total dust emission regulation 6. Creating nitrogen oxide emission charge
	3. Transportation sector	 Reducing pollution of aged diesel car and expanding restriction on driving aged diesel car Expanding distribution of eco-friendly car such as LPG car and electric car Enforcing eco-friendly car cooperation charge system Strengthening fine dust management of ships & construction machine
	4. Life sector	 Management focused on blind spot of management such as construction site and illegal i ncineration Distribution of road cleaning vehicle and expending urban forest
International cooperation	5. Cooperation of Korea-China and East Asia on fine dust	13. Promoting presentation of joint statement through Korea-China summit 14. Reviewing agreement of East Asia fine dust reduction
Protection o f sensitive cl ass	6. Sensitive class protection inf ra and service	 Preparing indoor standards for children Installing fine dust measurement network around daycare centers and schools first Expanding indoor sports facility of school Care visiting service for sensitive class
Base of plan	7. Scientific management base	19. Measurement using environmental satellite, etc. and enhancement of forecast & warning system 20. Promoting national strategy project (R&D) for fine dust

4. Comparison of past 6/3 plan and current comprehensive plan

Classification		Past 6/3 plan	Current comprehensive plan
Reduction	n goal	Domestic emission in 2021 14% \downarrow	Domestic emission in 2022 30 %↓
Power generat ion	Coal powe r generatio n	 Fundamentally prohibiting installation of new coal power plant Strengthening new coal power gener ation emission standard 	 Reviewing coal power plant (No. 9) with low rate of process and changing it into LNG No. 4 (reinforcement) Stopping operation of aged power s tations in spring season (Mar~Jun) a nd early shutting down (new)
	Renewable energy	- Expanding to 11% in 2025	- Expanding to 20% in 2030 (reinforce ment)
Industr y	Dust mana gement	-	- Enforcing total dust load regulation (new)
	Emission c harge	- Reviewing creation of NOx emission cha rge	- Creation of NOx emission charge (rei nforcement)
	total emiss ion manag ement	- Metropolitan area total emission manag ement	- Expanding total emission managemen t area beyond metropolitan area (Chun gcheong, southeast, Kwangyang Bay ar ea) (reinforcement)

4. Comparison of past 6/3 plan and current comprehensive plan

Classificatio	on	Past 6/3 plan	Current comprehensive plan
Transporta tion	Eco-friendly ve hicle	- Distributing electric vehicles	 Expanding distribution of eco-friendly vehicles (reinf orcement) Eco-friendly vehicle cooperation charge (new)
	Ship, constructi on machine	- Reducing construction machine emission	 Strengthening ship and port management (new) Expanding reduction of construction machine pollut ion (reinforcement) Strengthening two wheel vehicle management and distributing electric two wheel vehicle (new)
	Aged diesel car	- Restricting driving in metropolitan area	- Expanding driving restriction area (Chungcheong, sou theast, and Kwangyang Bay area) (reinforcement)
Sensitive c lass	Environmental standard	-	 Advancing environmental standard of fine dust (ne w) Creating standard of sensitive class and indoor fine dust (new)
	Infra expansion	- Expanding fine dust measurement network	 Expanding measurement network near education fa cility (new) Installing indoor sports facility (new)
	Education & e nvironment ser vice	- Preparing manual and performing education & promoti on	 Changing school bus for children into electric vehicl es (new) Care visiting service for sensitive class (new) Introducing fine dust clean management area desig nation system (new)
Internation al coopera	Item for agend a	- Korea-China-Japan ministers of environment	- Korea-China summit (reinforcement)
tion	Agreement	-	- Actively reviewing signing international agreement on fine dust reduction

IV. 30% Reduction of Domestic Emission

1. Reduction goal and plan

Reducing 30% of domestic fine dust emission by 2022

Plan

Goal

Intensive reduction of 4 major sources (power generation, industry, transportation and life)

Reduction rate of sectors and main plan (based on reduction of 31.9%)

							Reduction rate		
Sector	Emission i (ton, referer		Emission i (ton, △1		Emission i (ton, △3		Reduction (ton)	Reduction rate of sectors	Portion of reduction based on 31.9%
Total	324,109	(100%)	283,400	(100%)	220,836	(100%)	∆103,273	31.	9%
Power generation	49,350	(15%)	42,973	(15%)	36,839	(17%)	△12,511	25%	3.9%
Industry	123,284	(38%)	104,652	(37%)	70,493	(32%)	△52,791	43%	16.3%
Transportation	90,361	(28%)	79,982	(28%)	61,377	(28%)	△28,984	32%	9.0%
Life	61,114	(19%)	55,793	(20%)	52,127	(23%)	∆8,987	15%	2.8%

1–1. Power generation sector

😑 (Emission status) 15% of total national emission (49,350 ton), coal power plant focused on Chungnam area (30 plants/total 61 plants) * The portion of coal power generation is 39% which is higher than average of OECD (30% in 2015)

(Goal) Reducing 5% of emission from power generation sector by 2022(\triangle 12,511 ton, total \triangle 3.9%)

(Main plan) Reducing portion of coal power generation such as reviewing coal power plant with low rate of process, and extending eco-friendly energy source such as increasing renewable energy

> Reviewing construction of coal power plant (no. 9) with low rate of process from the beginning (considering emission, progress, location, etc.)

- Including fundamental prohibition of new coal power plant in the 8th electric power supply plan (2017)
- Temporally shutting down aged coal power plants in spring(Mar June) (shutting down in Jun 2017)
- Strengthening allowable emission standard of coal power plant no.39 by two times higher considering possibility of prevention facility improvement, optimal prevention technology level, etc. (first half year of 2018)
- Improving overall performance of coal power plant during operation and replacing overall environmental facility (spending 7.2 trillion by 2022)

> Performing real-time analysis monitoring, periodical precision checkup (once a year) and review of approval (every 5 years) for emission concentration, operation condition, and the like of SAF cogeneration power plant

SRF using facility

Renewable

energy

Coal power

generation

▶ In order to respond to weather change and expansion of renewable energy, promoting next commercialization technology, and supporting climate industry model + from seeking demand to proof (2017 -) * Urban photovoltaic generation,

development of next fuel cell for building power IT, etc.)

Short term plan (~first half of 2018)

	Coal power generation	 Advancing closing schedule of coal power plant (No. 7*) aged 30 years or more to close it in the term * (Jul 2017) Already closing No. 3, (Jan 2019) No. 1, (Dec 2019) No. 2, (Jan 2021) No. 2, (May 2022) No. 2
Mid and long term plan (the second half of 2018~2022)	Changing energy paradigm	 (As-is) considering power generation cost first ⇒ (To-be) integrally considering environment and safety Establishing the 8th basic power supply plan (2017) and the 3rd basic energy plan (2018) for changing into clean and safe future energy Reduction of coal power portion, increase of renewable energy portion* and the like are included as the main contents in order to achieve eco-friendly to dispersed energy mix * Renewable energy portion: 6.44% in 2015 → 20% in 2030
	SRF using facility	 Strengthening emission standard of liquid fuel (B-C oil) using power plant and adding power plants in island areas (58 plants) to emission facility, and performing management and inspection (second half of 2018) Limiting by including solid fuel products in solid fuel use restriction range, and strengthening emission standard of using facilities near residential area (2018) Reviewing plan for expansion of solid fuel use restriction area
	Eco-friendly tax rate system	 Organizing joint TF with relevant department for reflecting social cost such as fine dust for each power generation fuel (bituminous coal, LNG, etc.) (2017), and deriving adjustment plan through joint research in 2018 ※ Special consumption tax(current): coal (bituminous coal) 30 won/kg, LNG 60 won/kg

1-2. Industry sector

※ The number of workplaces in the country (total 57,500, in Dec 2016): 5,496 of type 1 ~ 3, 52,004 of type 4

- \bigcirc *(Goal) reducing 43% of emission from industry sector by 2022 (\triangle 52,791 ton, total \triangle 16.3%)
 - (Main plan) intensive reduction and seeking substantiality of management by expending total emission regulation and reinforcing monitoring
 - * 33% of smokestacks of mid and large-size workplaces (type 1 ~ 3) has smoke stack tele-monitoring system (TMS) attached

r—tem plan irst half of 2018)	Workplace manageme nt	 Step-by-step expansion of total dust emission regulation (testing in 2017, and applying to metropolitan area common combustion facilities first in 2018) Mandating attachment of TMS of total emission regulation applying workplaces (types 1 - 3) (the first half of 2018) Applying and re-permitting optimal environmental management process, after reviewing environmental management status of industrial emission facilities (1,300 businesses in 19 classifications in 2017 - 2022) Strengthening allowable emission standard of large-emission workplace (iron & steel manufacture, oil refining, cement, etc.) considering optimal prevention technology level (the first half of 2018)
	Strict monitoring of illegal act	 Intensively inspecting large emission work place in high-concentration producing seasons (spring and winter) Strengthening monitoring skill such as expanding environmental inspector and introducing portable clampdown equipment (the second half of 2017) Inspection & implementation of VOCs emission source such as petroleum chemical industries and pain manufacturers (every May ~ July) Inspecting compliance with facility management standard of fugitive emission and standard of VOCs contained in paint. etc. Real-time monitoring and preparing management plan for workplace of which TMS attachment is not mandatory using IoT, drone, etc. (the second half of 2017)

Shor

Short—term plan (~first half of 2018) Supporting mid and small-size workplace Implementing technical support for type 4 & 5 small-size workplaces through "environmental consulting*"

* Experts in the relevant field explain prevention facility operation tips and relevant laws.

Mid and long-term plan (second half of 2018~2022) Workplace managemen t Designating fine dust emission concentrated area excluding metropolitan area as "atmosphere management areas" (Chungcheong, Southeast, and Kwangyang Bay area in the first half of 2019), and introducing total emission regulation for workplace

Charging atmospheric emission charge on nitrogen oxides (currently, 9 types including dust and SOX) which cause production of fine dust & ozone (revising ^rClean Air Conservation Act Enforcement Decree & Enforcement Aegulation in the second half of 2018)

Introducing VOCs leakage checking regulation with respect to storage facility of petroleum products, etc. and strengthening leakage concentration standard of fugitive leakage facilities

% (Current) 2,000ppm \rightarrow (enforcement in 2018 ~ 2019) 1,000ppm \rightarrow preparing next step-by-step strengthening plan

1-3. Road transport sector

😌 (Emission status) 12% of total national emission (39,005 ton), No.1 reason for fine dust in large city is diesel car

- % (Case of LA) diesel car occupies about 15% of PM25 concentration in atmosphere, but occupies about 84% of calcinogenic risk.
- * Portion of emission of diesel cars in metropolitan area : 23/(Ist), portion of cargo truck emission: 60% of vehicle sector (registration rate is 15%)

\bigcirc (Goal) Aeducing 43% of road transport sector emission by 2022 (\triangle 16,624 ton, total \triangle 5.1%)

(Main plan) Expanding reduction of pollution caused by aged diesel cars (completing reduction of pollution of 2.22 million cars by 2022) with activating eco-friendly vehicles such as electric vehicle & hybrid vehicle

		Significantly increasing supplies for early car scrapping support (80 thousand cars in 2017 → year average 160 thousand cars from 2018)
Short—term plan	Strengtheni ng diesel	 * Promoting incentive system such as reviewing target of subsidy in order to activate early scrapping of aged cargo trucks Intensively promoting reduction of pollution from aged cargo trucks Issuing pollution reduction order for aged large-size diesel car (15 ton or more) frequently entering port & airport first (limiting driving in case of failure to comply), and supporting costs (cooperation with local government)
(~first half of 2018)	car	 * Emīssīon of aged vehīcles whīch are 31½ (2.86 mīllīon cars) of total dīesel car (9.27 mīllīon cars) is 57½ of total diesel car emīssion > Strengthening allowable exhaust standard of driving diesel cars (in 2018, precision test 15%→8%, regular test 20%→10%)
	manageme	Creating NOx emission standard [•] under the condition driving on the road beyond indoor certification test of new diesel car (less than 3.5 ton) (September 2017)
	nt	 * The certification standard of large-size diesel car (3.5 ton or more) on real road is in force since January 2016 * [Checking satisfaction of standards using portable emissions measurement system (PEMS*) before selling new car * PEMS : measuring exhaust production of various driving condition (rapid acceleration, slope
		drīvīng, aīr condītīoner operatīon, etc.) and determīnīng fītness

Short—term plan

(~first half of 2018)

Activating

ecofriendly vehicle distribution

Strengtheni

ng traffic

Aelieving limitation to use of LPG vehicles

- (Current) car (small-type, seven-seat or more), van and cargo truck → (improvement) step-by-step expansion to AV vehicle, etc. (ongoing revision of LPG Act)

- Improving eco-friendliness of public transport due to expansion of CNG bus
- Changing large city route bus into CNG bus*(continued), expanding electric bus(2018 \sim)
- * About 60% of total buses (44,784 buses) are CNG buses (in the end of 2016)
- Allowing creating new route of CNG buses (including electric and hydrogen-powered vehicles) and increasing CNG buses for intra-city (red) & town bus entering Seoul
- ▶ Supporting activation of eco-friendly vehicle distribution such as expanding mandatory purchase, etc.
- Increasing mandatory eco-friendly vehicle purchase ratio of public institution (in 2017, current 50→70%)

* Reviewing plans for improving effectiveness such as imposing fine for organizations violating mandatory purchase rate

In order to improve portable charger using condition in apartment houses, simplifying installation of existing electronic vehicle identification tag of houses* and mandating installation of socket on new houses**

* Enabling vehicle identification device attaching process around existing socket to be allowed only by agreement of management body for using mobile charger (enforcement on Jan 2017, ^[]Decree on the Management of Apartment Houses,)

** Revising "Regulations on Standards, etc. of Housing Construction, for houses of 500 or more households (Feb 2017)

- Activating designating congested area as "special green traffic measure area"
- Seeking a plan for activating designation of special green traffic measure area such as financial support, requirement relaxation, etc. after closely reviewing promotion status of Seoul (2018)

※ Establīshīng & enforcīng comprehensīve plan such as actīvatīng mass transportatīon such as BRT and tram when desīgnatīng area

- Биралding "restricted mass transportation district" for limiting car driving
- Analyzing and promoting effect in Jungang-ro in Daegu and Yeonse-ro in Seoul currently in place

X Daegu Jungang-ro (3 billion won of government expense in 2008~2009), Seoul Yeonse-ro (1.35 billion won of government expense in 2012-2014)

- Local government presentation, local government presentation, and promoting project expansion connecting to budget influence (Suwon Aju-ro and original downtown in 2018)

demand managemen t desīg • Ekp 2012-2 - Local downto Popularizin g ecofriendly vehicle **Expanding** aged diesel car **limited area** (metropolitan area in 2017 \rightarrow Chungcheong, southeast, and Kwangyang Bay area in 2020)

> Distributing 2 million eco-friendly vehicles such as electric & hybrid vehicle by 2022

Expanding & reorganizing "low-carbon vehicle cooperation charge system" for greenhouse gas (delaying enforcement until 2020) to "eco-friendly cooperation charge system" including air pollutant

	Clas	sification	Current	2020 (6/3 plan)	2022 (comprehensive plan)
Mid and long-term plan (second half of		Total	Total 0.25 million	Total 1.5 million	Total 2 million
2018~2022)	Eco-friendly vehicle (accumulated)	Electric vehicle	12 thousand	250 thousand	350 thousand
		Hydrogen-powered vehicle	0.1 thousand	10 thousand	15 thousand
		Hybrid vehicle	238 thousand	1.24 million	1.635 million
		Total	Total 764	Total 3,100	Total 10,310
	Charging infra (accumulated)	Electric (high speed)	750	3,000	10,000
		Hydrogen	14	100	310
	× comorning 1	'inancial (subsidy s u	ipport), non-financia	d means (eco-frīend	У

vehicle cooperation charge system, etc.)

Expanding installation of electric & hydrogen-powered vehicle

- Installing 10 thousand high-speed charging stations in large markets (500 markets) and gas stations (12,000 stations) by 2022 (including private stations)

- Building 160 complex rest and charging stations (complex electric, hydrogen power, and CNG charging stations) by 2022 (cooperating with Ministry of Land, Infrastructure and Transport and Ministry of Environment, 2018 –)

※ Promoting package private sector investment project integrating rest area and charging station on expressway, national highway, city road, etc.

Distributing 50 thousand electric two wheel vehicle by 2022

- Concluding MOU with post offices, local government offices having regular driving route first and reviewing introduction of "Mandatory electric two wheel vehicle purchase"

* Preparing mandatory purchase regulation through revision of 'Eco-friendly vehicle Act, and 'Act on Seoul Metropolitan Air Quality,

- **Supporting** customized **electric two wheel vehicle technology development** in which public organizations and franchise business participate together, and promoting **demonstration project**

Combining with construction of charging infra using existing electric vehicle charger*

* Installing additional sockets for 220V charge on electric vehicle charger, using RFID tag. etc.

- ▶ Integrating exhaust gas testing organization and eradicating manipulation (2018~)
- Integrating testing organization gradually for large buses in order to prevent manipulation 🕆 illegal test (Korea Transportation Safety Authority)

- Preparing ground for punishment for random setting of exhaust gas related part or damage of reduction device (2018, revision of "Clean Air Conservation Act,")

Mid and long-term plan (second half of 2018~2022) Expending electric & hydrogenpowered vehicle charge

station

1-4. Off road transport sector

(Emission status) 16% of total national emission (51,355 ton), poor management of high emission

* Detail portion of off road transport sector (PM25 in 2014): Ship (62%) > construction machine (29%) > agricultural machine, etc. (9%)

 $_{\odot}$ (Goal) Reducing 24% of off road transport emission by 2022(\triangle 12,360 ton, nationally \triangle 3.8%)

(Main plan) strengthening blind spot management through reduction of ship emission and expansion of reduction pollution of construction machine*

* The supplies for reducing pollution from construction machine in 2016 is about 0.6% of aged construction machine

▶ Establishing fine dust comprehensive plan for ships and ports around major harbor city[•] (second half of 2017), and implementing research of port fine dust status (2017 -)

* Portion of ship emission in harbor city (PM_{2.5}, in 2014) : 28% in Busan, 21% in Jeonnam, 13% in Ulsan, 9% in Gyeonggi

- Converting fuel of mobile loading equipment (total 581 yard tractors) into eco-friendly fuel (diesel -+ LNG) (-+ 2022)
- Developing and commercializing fine dust reduction device for ships*(2017 ~), and developing charging infra (bunkering) technology of LNG ships**(2018 ~)

* Promoting demonstration by 2019, and then commercializing trial installation

** Responding to ship exhaust gas regulation (IMO), national trend of introducing LNG-powered ship operation infra

Ship registration and management status >

(Ship emission) occupying 49% (NOx), 98% (SOx) of off-road transport pollutant (in 2014)

 (Allowable emīssīon standard) applying NOx emīssīon standard (diesel engine over 130kW) and fuel sulfur content standard (35%) according to MARPOL of IMO, Marine Environment Management Act, and Clean Air Conservation Act,

Short-term plan

(~first half of 2018)

Ship & port plan Reducing pollution from constructio n machine diesel railway

Mid and long-term plan

(second half of 2018~2022)

Ship and port managemen t Implementing reduction of pollution such as replacing engine of 31 thousand aged construction machine* (20% of total aged machines), attaching diesel particulate filter (DPF), etc. by 2022

* 157 thousand cars of forklīfts, excavator, three type cars for road (dump, concrete mīxer and concrete pump), etc.

Improving system for construction site needing fugitive dust report (1,000m² or more) to use only new construction machine or low pollution construction machine (~ 2018, revising ^rClean Air Conservation Act Enforcement Aegulations,)

* Taking action for reducing pollution of aged construction machine (three types for road) (combining with budget support), restricting use in case of failure of compliance

Establishing new allowable emission standard for diesel railway vehicle* which is fine dust blind spot (preparing a ground article of "Clean Air Conservation Act, in 2017, and then establishing new allowable emission standard in 2018)

* Currently operating total 380 diesel engine vehicle and power vehicle (including war readiness necessary holding amount)

- - Building LNG ship* charging infra(total three places: Tongyeong, Busan, and Ulsan) (2019 🖬 2025, private investment)
- * Effect of reducing 90% or more of fine dust& sulfur oxides compared to normal ship
- Building and operating land power supply facility (AMP*) for educing fine dust emission of ships on the berth (targeting newly built wharf)

* Supplying land power instead of existing bunker oil generator to remove air pollutant emission on the berth

1–5. Life sector

(Emission status) 19% of total national emission (61,114 ton), urgent management of fugitive dust 🕆 life VOCs

* Portion of life sector: road re-fugitive dust(39%) > agricultural remainder incineration (16%) > construction site(7%)

(Goal) reducing 15% of life sector emission by 2022(\triangle 8,987 ton, nationally \triangle 2.8%)

(Main plan) Strengthening management of **pollutant around living environment** such as expanding **road cleaning car** distribution and strengthening **paint VOCs** content standard

Preventing re-fugitive dust production by changing road design standard*(2017, "Construction Technology Management Act Article 34 Reducing (standards for design and execution)) * Installing concave flower bed for preventing soil injection from flower bed, etc. fugitive dust Aeducing fugitive dust from construction site of road and - Expanding subject to report fugitive dust (arranging agricultural site, etc.) and introducing quantitative standard (dustproof net construction opening rate, etc.) for increasing fugitive dust reduction effect (2018) Short-term plan site - Implementing intensive inspection of large area construction site such as apartment in high concentration fine dust season (proper installation & operation of dustproof membrane, sprinkling facility, etc.) (~ first half of Forming "urban forest" initially dispersing & reducing fine dust by connecting city-suburb (Korea 2018) Forming Forest Service, 2 billion won in 2017) urban Promoting "increasing I pyeong of green area (100 places)" in the city (Gwangju) forest Metropolitan City, 2017 - 2018)

	Road re-	Reducing road re-fugitive dust source by preparing low-abrasion tire standard* (2022)
	fugitive	* Developing low-abrasion tire through R&D (I st step completed, currently in 2 nd step Aug 2016 ~ April 2021)
	dust	Distributing \mathcal{T} expanding double current road dust cleaning cars (1,008 cars in 2016 \rightarrow 2,100 cars in 2022)
	VOCs	Strengthening VOCs content standard of construction and industrial paint
	managemen	* Now promoting relevant research service and forum (Dec 2016 ~ Sep 2017)
	t	Adding paint for wood to paint containing restricted VOCs (currently 4 types for construction and industry, etc.)
Mid and long—term plan		
(second half of 2018~2022)		Strengthening emission standard of liquid fuel (B-C oil) using power generation facility, and reviewing addition & management of island area power plant (58 places) to emission facilities (second half of 2018)
	Gas station	Gradually expanding installation of gas station oil mist collecting facility according to yearly gasoline sales** in 10 cities* over 500 thousand population (Daejun, Ulsan, etc.)
	oil mist	* Installation of gas station oil mist collecting equipment is already mandated in 24 cities such as Seoul and Incheon including existing special measure area and air environment regulation area (1998 ~)
		** (Jan 2019) sales 2,000 m ³ or more \rightarrow (Feb 2019) 1,000 m ³ or more \rightarrow (Dec 20120) 300 m ³ or more
	Blocking illegal	Expanding installation of "recycle village yard" for waste separation & storage (447 in 2017→1,080 places in 2021) and expanding common collection place of loads (1,000 ea every year by 2021)
	incineration	▶ Promoting crushing & spraying support project for proper treatment of agricultural remainders which are mostly illegally incinerated (Ministry of Agriculture, Food and Aural Affairs, Jan riansignarrow Feb, Oct riansignarrow Nov)

V. Strengthening International Cooperation

- Goal) Establishing cooperation channel and research cooperation ⇒ changing to substantial reduction
- (Main plan) Strengthening international cooperation for fine dust based on joint research and technical support

Strengthening Korea-China cooperation and joint confrontation

- Discussing fine dust issue as agenda of Korea-China summit (agenda of minister conference before)
 - Promoting joint declaration of Korea-China fine dust cooperation (2018 2019)
- Strengthening joint research on Chinese area and technology transfer cooperation project
 - Promoting joint research & study on air quality of Chinese area having high influence on Korea (North China & Shandong, etc.) 「Clean sky(晴天) project」 (May 2017 - 2020)
 - * Arranged by Korea-China air quality joint research group (organized in Beijing in June 2015)
 - Expanding demonstration project of Korea-China joint fine dust reduction environmental technology (prevention facility) for reducing qualitative pollution reduction*(2021)
 - * (Target area) Shandong, Hebeī, Shanxī, Shaanxī, Līaonīng, Inner Mongolīa → addīng Jīangsu, Henan, Jīlīn, Heīlongjīang

(Target technology) desulfurīzatīon, denītrīfīcatīon, and dust collectīon of īronworks, coal power, īncīneratīon power plant, etc.

- Strengthening information sharing through expansion of Korea-China air quality measurement data sharing (2018)
- * (Current) three cītīes īn Korea and 35 cītīes īn Chīna \rightarrow (īmprovement) 17 cītīes īn Korea and 74 cītīes īn Chīna
- Improving unity and continuity through strengthening of Korea-China cooperation project base
 - Establishing "Korea-China environmental cooperation plan, (2018) and installing "Korea-China environmental cooperation center, (Beijing)

Strengthening international effort in dimension of East Asia

Activating Korea-China-Japan channel, East Asia multilateral channel, etc.

2

- Preparing ground for Northeast Asia fine dust agreement by launching NEACAP(Northeast Asia clean air partnership)
- Promoting installation of international joint research organization responding to air pollution from Northeast Asia long distance transport (2021)
- §Combining with activating air quality plan sharing channel between Northeast local government and building country-local government platform
- ※ (Cooperation case) Beijing-Seoul-Tokyo cooperation (1995 ~ 1999), cooperation project between cities in China-Japan (2013 ~)
- Actively reviewing Korea-China-Japan fine dust cooperation contract based on Europe (CLATAP), US-Canada air quality cooperation model in long term (2021)
- * Based on Korea-China-Japan cooperation, but other Southeast countries such as Mongol and North Korea can participate in.

<Air quality-related foreign cooperation model >

- ♦ Convention on Long-range Transboundary Air Pollution (CLRTAP, passed in 1979)
- o (Overview) international cooperation such as information sharing & joint study for reducing influence of long range movement in Europe
- o (Implication) step-by-step approach from technical cooperation in 1972 to singing cooperation in 1979
- \diamond U.S.-Canada Air Quality Agreement, passed in 1991
- o (Overview) preparing joint response plan for solving air pollution issues in both countries
- o (Implication) regulating detail obligation such as ① environmental influence evaluation,
- 2 notification in advance, 3 reduction agreement & information sharing related to activities causing severe air pollution of partner country

VI. Fine dust-sensitive class-centered protection

(Goal) implementing passive and posterior response ⇒ active and proactive notification & protection measures * Breathing quantity per 1kg of body weight of children is three times that of adults (200L of adult and 100L of children less then 1 year old)

* IARC : classifying fine dust as carcinogen group I developing cancer of human (Oct 2013,)

(Main plan) special management of activity space such as strengthening sensitive class protection ground and indoor sports facility installation by strengthening standard and expanding measurement network

Strengthening sensitive class-centered protection ground

Strengthening environmental standard and sensitive class protection standard

 Strengthening fine dust environmental standard to developed country level, and gradually strengthening warning criterion

- Establishing new indoor fine dust (PM_{2.5}) maintenance standard of sensitive class using facility*
- Daycare center PM_{2.5} standard 3
- 2018 (recommended standard) → 2020년(maintenance standard)/ School PM25 standard : adapting maintenance standard from Mar 2018
- Expanding air quality measurement around daycare center, school, etc.
- Extensively expanding urban air measurement network* around school, and expanding fine dust measurement station around power station (currently 35 places → 70 places in 2019)
- * 264 places īn 2016 ightarrow 505 places īn 2022 (needīng cooperatīon of local government)

 Building precise daily school notification system by additionally arranging measurement equipment such as simple gauge* and movement measurement vehicle, etc. around schools (using data synchronizing system)

* Preparing optimal installation plan through demonstration project, and contributing to increase in accuracy of daily school notification system

Classīfīcatīon	current (20 16)	Strengthening plan (2018)
PM _{2.5} envīronmental standard (24 hours)	50	35 (US and Japan level)
PM _{2.5} watch crīterīon	90	70 ~ 80 (provisional)

Special management of sensitive class use & activity space

Managing air quality of sensitive class using facility when high concentration fine dust is produced

 Supporting installation of indoor sport facility of elementary, middle and high schools (8.4%, 979schools/11,700schools) without gym (- 2019, local education finance grant)

- Supporting installation of air purification facility in school, daycare center, elderly care facilities, etc.
- Designating sensitive class using facility concentrated area among fine dust severe area as fine dust cleaning management area ("fine dust free zone")(2019)
 Taking action of restricting entering aged diesel car and diesel car for school busses, entering eco-friendly vehicle first, and reducing fine dust producing work for the same area
 - * Adapting ground for designation to 'Special Act on the Reduction and Management of Fine Dust,
- Introducing sensitive class activity space (daycare center, etc.) safety certificate system (demonstration project in 2018 → implementing certification in 2019)
- 🗢 Changing school buses of children (diesel car) into eco-friendly vehicles (LPG · CNG vehicle, etc.) (🗝 2022)

2

10% (2,600 cars) of supporting trial change of aged small diesel car before 2009 into LPG vehicles, and inducing gradual change of diesel cars after 2010
 52 thousand small vehicles (15 seat or less) and 26 thousand aged small vehicles before 2009 among school buses (78 thousand diesel cars)

Strengthening fine dust responding skill of sensitive class

- Strengthening protective service for sensitive class in case of high concentration
 - Implementing "visiting care service" for sensitive class such as the elderly living alone
 - Establishing fine dust causing disease monitoring and notifying service system (demonstration in 2018)
 - Developing treatment & care guideline for medical team (facility worker) and teachers and **developing** prevention guide and special articles* (demonstration project in 2019)
 - * Guideline of caution & prevention of each disease, and prevention article for each underlying disease, etc.
 - Supporting mask to sensitive class such as babies and children (local government such as Seoul, Daegu, and Gyeongbuk, 2017)
 - Operating "customized environmental education program" for babies, elementary, middle school students

Classīfīcatī on	Maīn promotīon detaīls
Babīes	Operating baby environmental education center (three places in 2 areas, yearly 20 thousand) connected to Nuri curriculum
Elementary and mīddle school	 Operating Purmi transport environment class⁽(8 classes in 7 areas, yearly 80 thousand students), environment experience program (yearly 50 thousand student) connected to free semester system * Reforming large truck and bus, and containing educational material

- Manufacturing & distributing practice manual for vulnerability (2018) and improving field trip skill (inspecting relevant institutions application status (twice a year) and itinerant education of person in charge (once a year))
- Implementing proactive promotion & education to people

3

- Intensive promotion such as fine dust risk, response tip in case of high concentration, and reduction practice (mass transportation, etc.) before heating season (Oct)
- Performing citizen participating event * with citizen & environment agency
- * Operating "fine dust education visiting class" (all-year), and operating "fine dust experience & hall (tentative)" (Nov 2017)

Strengthening emergency fine dust reduction measures in case of high concentration

- Enforcing three type (all metropolitan areas, metropolitan public sector, and Seoul area) emergency reduction measures (no-driving system and workplace operation control) in metropolitan area in case of high concentration
 - Expanding private participation by strengthening economic group participating campaign and civil group cooperation

4

Classīfīcatīon	Total īssuance of metropolītan area	īssuance of metropolītan publīc sector	Issuance in Seoul area
Implementation area	Metropolītan area (excludīng three dīstrīcts īn Gyeonggī)		In Seoul City
Issuance crīterīon	 <u>Warning (2hours of 90μg/m')</u> Today 50μg/m' <u>Tomorrow 100μg/m'(3 hours)</u> 	{None> ① Today 50μg/m³ ② Tomorrow 50μg/m³	
Measure contents	 △ Alternatīve-day-no-drīvīng system of publīc organīzatīons (voluntary prīvate partīcīpatīon), and closīng publīc parkīng lots īn Seoul △ Measures for reducīng workplace & constructīon sīte operated by publīc organīzatīon △ Free mass transportatīon when enforcīng measures (partīcīpatīon of Seoul Cīty īs determīned, and Gyeonggī & Incheon īs not determīned yet) △ Immedīately īssuīng when meetīng īssuance crīterīon (skīppīng meetīng of emergency reductīon commīttee) 		

※ Not enforcing alternative-day-no-driving system on holiday (weekend & public holiday)

- Expanding and enforcing current metropolitan public sector to private sector and areas excluding metropolitan area (2019, promoting establishment & revision of laws)
- \bigcirc Strengthening measures such as expanding operation of road water cleaning car (one \rightarrow two times a day) and intensive crackdown of illegal incineration
 - * Adjusting current alternative-day-no-driving system and workplace & construction site operation reduction

VII. Strengthening plan base

 \bigcirc (Goal) changing individual and fragmentary approach \Rightarrow systemic and comprehensive study

(Main plan) strengthening fine dust response base through enforcement of special act beyond improving scientific technology-based responding skill such as national R&D and satellite observation

Strengthening science-based fine dust responding skill

Strengthening scientific study such as fine dust production mechanism study

- Promoting national A[®]tD for strengthening fine dust responding skill (2017 2023)
- Promoting A&D* in four major field such as production & introduction, measurement & forecast, dust collection & reduction and protection & response

* (Ist step, 2017 ~ 2019) īssue response \rightarrow (2nd step, 2020 ~ 2021) sīte applīcatīon and demonstratīon \rightarrow (3rd step, 2022 ~ 2023) īndustrīalīzatīon

- einforcing scientific analysis using environmental satellite, etc.
 - Implementing fine dust three-dimensional measurement using environmental satellite (launching in 2020) (2021)
 - Regular joint observation of domestic air quality with NASA (1st in May 2016 and 2nd in 2021)
 - Developing "Korea Monitoring-Emission Model System (K-MEMS) * for analyzing reason of fine dust production (2017 2022)

* K-MEMS(Korea Monitoring-Emission Model System): tool for predicting influence on air quality according to chemical reaction, movement, and diffusion of pollutant emitted in air

Strengthening science-based fine dust responding skill

😑 Building Al-based air quality forecast 🟵 warning system

- Building AI * prediction system applying big data, result of numerical forecast, and machine learning
 - * Decision making by itself through computer inference algorithm by learning AI & past data
- Developing short-term (2 day) predication system, and building mid-term (about seven days) prediction system by 2021 through trial forecast (investing 7.95 billion won)
- 🗢 Systemic production �tmanagement of fine dust national emission information
 - finding leakage emission source (biological combustion, etc.) for compensating current emission research (CAPSS) system, and expanding emission coefficient* development suitable for domestic condition
 - Reinforcing emission coefficient proving system by constructing **'tr operating research consultative group**
 - * The emīssīon coefficient developed in Korea is currently 24% of total 20,000 emission coefficients.
 - Establishing "fine dust comprehensive information center" in mid and long term (2019) and systemically producing and managing national emission information
 - * Adapting ground for establishment to 'Special Actor on reduction and management of fine dust,

Promoting enforcement of special acts (2 acts) for strengthening fine dust management

2

• Promoting legislation of **"Special Act on the Aeduction and Management of Fine Dust**, (tentative name) for implementing comprehensive fine dust measures and protecting & supporting the vulnerability (the second half of 2017 - 2018)

_ Designating fine dust clean management area (restricting aged diesel car driving and reducing field work, etc.) and taking emergency action in case of high concentration

Aesearching health damage caused by fine dust and protecting sensitive class (activity space safety certification system, etc.)
 Promoting legislation of ^rSpecial Act on Improvement of Air Quality in Metropolitan Area, etc., (tentative name) for nationally expanding total emission management centered on metropolitan area (the second half of 2017 ~ 2018)

* ①Chungcheong region such as Dangjin, Taean, etc. ② Southeast area such as Ulsan, Changwon, etc. ③Kwangyang Bay area such as Yeosu, Kwangyang, etc.

VIII. Necessary budget and implementation inspection

Necessary budget

Investing total 7.2 trillion won to reduce fine dust and protect sensitive class by 2022

■ Spending 2.2 trillion won in 2017~2018 and 5.0 trillion won in 2019~2022

Implementation inspection & evaluation

- Aole of organizations
 - (Evaluation organization) inspection & evaluation is managed by the Office for Government Policy Coordination (assistant administrator : Ministry of Environment)
 - (Relevant department & organization) establishing implementation plan, self-evaluation, result feedback, implementation plan improvement, etc.
- Evaluation and feedback
 - (Concept) establishing implementation plan of each relevant department \Rightarrow evaluation \Rightarrow feedback
 - (Evaluation result feedback) correcting & compensating comprehensive plan based on inspection & evaluation result
 - Strengthening & compensating subject lack of effectiveness such as reduction effect, and seeking & adding new subject when necessary

Private and public joint governance establishment

- (Role) organizing "private Upublic fine dust countermeasure committee (tentative name)", and playing the role as social committee for solving fine dust issues
 - Publicizing plan implementation status, proposing new subject, seeking and implementing citizen practice program
 Promoting continuous compensation & development of fine dust plan through committee
- (Constitution) total 20 people of experts and civic activists in the major field such as power generation, vehicle, industry, etc. (including elected chairman and six female members)
 - Adding relevant experts when necessary or performing presentation of external specialist
- Operation) presenting & debating in regular meeting in which entire committee members participate by setting subject every quarter (once a quarter)

* Working level, assistant minister and chief level of relevant department such as the Ministry of Trade, Industry and Energy, Ministry of Land, Infrastructure and Transport, Ministry of Education, etc. also participate.

Thank you

Clean air of Korea without concern about fine dust! We will make the environment of Korea.

