NATIONAL REPORT BY JAPAN

JUNE 2020

Enhanced Black Carbon and Methane Emissions Reductions

Arctic Council Framework for Action

National report by Japan

2020

to the Arctic Council Expert Group on Black Carbon and Methane

1 Introduction

In Japan, CH4 emissions in the latest FY2018, 1,197 Gg including LULUCF, decreased by 32.8% since FY1990. The decrease is mainly a result of a 63.1% decrease in emissions from the waste sector, solid waste disposal. The FY2018 emissions consist of agriculture sector (rice cultivation, enteric fermentation etc.,78.2%), followed by waste sector (solid waste disposal etc., 15.5%) and energy sector (fugitive emissions from fuels etc., 5.9%). The main driving factor for the decrease in CH4 emissions from the largest sector (i.e. agriculture) since FY1990 was the decrease in the emissions from enteric fermentation due to the decrease in the number of cattle. The main driving factor for the decrease in CH4 emissions from the second largest sector (i.e. waste) since FY1990 was the decrease in the emissions from solid waste disposal on land as a result of decrease in the amount of disposal of biodegradable waste due to improvement in the volume reduction ratio by intermediate treatment under the Waste Management and Public Cleansing Act (Act No.137, 1970) and the Basic Law for Establishing the Recycling-based Society, and other recycling law (Act No.110, 2000).

The Black carbon (BC) emissions of FY 2015[1] were estimated to be approximately 13.4 Gg, which decreased by 40% over the 5 years since 2010. BC is recognized as one of the air pollutants that have been significantly declining. Anthropogenic BC emissions are mostly derived from combustion, 70% or more of which are emitted from internal combustion engines. BC emissions from those engines are as follows: 5.3 Gg from vehicles; 2.1 Gg from operating machines; 0.4 Gg from aircraft; and 2.4 Gg from ships. Internal combustion engines will be continuously replaced with the ones which meet updated regulations in future years; therefore, we will continue to see a downward trend in BC emissions from internal combustion engines.

2 Black carbon emissions and future projections

2.1 Short summary of main findings on the historical and trends towards the future in emissions at state level. Also a short sectoral level descriptions on the historical and future trends, a paragraph per sector as relevant for each state.

BC emissions are not specifically estimated in Japan. However, the Ministry of the Environment of Japan has been working on building an emission inventory (EI) of air pollutants and the profiles of VOC and particulate matter (PM) since 2013 as part of a comprehensive initiative to deal with the formation of secondary products including $PM_{2.5}$ and photochemical oxidants. Therefore, BC emissions can be calculated by firstly obtaining PM emissions by multiplying the PM emission intensity by the amount of activity, and then multiplying the obtained value (PM emissions) by the ratio of BC to PM.

[1] Japanese fiscal year, from April 2015 to March 2016

The current estimation of BC emissions is based exclusively on anthropogenic sources. The BC emissions of fiscal year 2015[2] were estimated to be approximately 13.4 Gg, which decreased by 40% over the 5 years since 2010. BC is one of the air pollutants that are significantly declining in Japan.

Anthropogenic BC emissions are mostly derived from combustion, 70% or more of which are emitted from internal combustion engines. BC emissions from those engines are as follows: 5.3 Gg from vehicles; 2.1 Gg from operating machines; 0.4 Gg from aircraft; and 2.4 Gg from ships[3]. As for BC emissions from fixed combustion sources, 1.0 Gg of BC emissions are from electric generation and the manufacturing industry, and 1.3 Gg of BC emissions are from open burning of agricultural residues. BC emissions from sources such as waste combustion and heating appliances using kerosene used for residential heating are small in amount. Besides combustion-derived BC, BC emissions in tire wear dust were also estimated, and the amount is little.

Internal combustion engines will be continuously replaced with the ones which meet updated regulations in future years; therefore, we will continue to see a downward trend in BC emissions from internal combustion engines. As for vehicles, tighter regulations on PM emissions are being examined. Regarding large combustion sources such as electric generation and the manufacturing industry, the government is implementing a research as part of measures to deal with $PM_{2.5}$. Programs to reduce $PM_{2.5}$ are also considered effective in reducing BC.

Note that new regulations on fuel oils for ships have been implemented by the IMO in January 2020. Therefore, the decrease in sulfur content in fuel oils is expected to contribute to a reduction in PM emissions.

2.2 Informative graphs showing state emissions – time series graphs from 2013 and estimate for 2025. Having longer time series is also welcome, if the data is available.

Figure 1 illustrates the BC emission estimates of 2010, 2012, 2015, and the BC emission estimates of 2025 based on two types of scenarios.

The BC emissions of 2010 were calculated on the basis of the project[4] which served as the base for $PM_{2.5}$EI, while those of 2012 and 2015 were calculated according to $PM_{2.5}$ emissions in $PM_{2.5}$EI. The BC emissions of 2025 were calculated on the basis of the estimated future emission result set by the Ministry of the Environment for an assessment of the measures to reduce the concentration of photochemical oxidants. Future BC emissions from ships, which reflect the IMO fuel oil regulations, were estimated according to the data[5] from the National Maritime Research Institute. Note that all the BC ratios to $PM_{2.5}$ are set in detail by source category and fuel type on the assumption that those ratios would not change in the future.

[2] Japanese fiscal year, from April 2015 to March 2016
[3] Ships only in major harbors and major lines on the coasts; Fukui Tetsuo, Kokuryo Kazuo, Baba Tsuyoshi, and Kannari Akiyoshi, Updating EAGrid2000-Japan emissions inventory based on the recent emission trends (in Japanese), Journal of Japan Society for Atmospheric Environment/Taiki Kankyo Gakkaishi 49(2), 117-125, 2014
[4] Japan AuTo-Oil Program, 2006-2017, supported by the Ministry of Economy, Trade and Industry
[5] Shirota Hideyuki et al., Preparation of Ship Emission Data on Concentrations of Air Pollutants in the Present Status and Future, the National Maritime Research Institute Report, 13(3), 2013 (in Japanese)

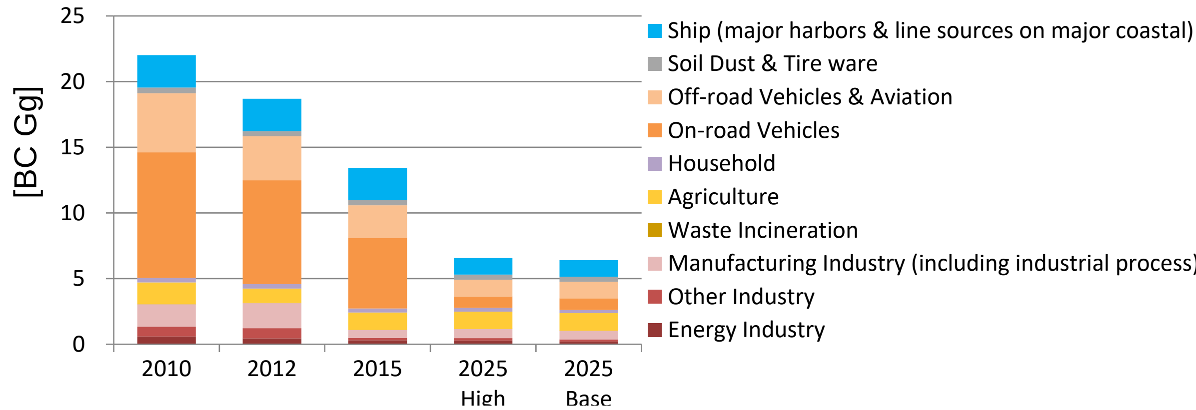

Figure 1 BC Emissions in Japan

Another research conducted in Japan shows the estimated changes in BC emissions since 1950 (Figure 2)[5]. Until the 1960s, the majority of BC emissions resulted from coal combustion. The usage of coal decreased later, and around that time BC emissions from vehicles increased. From the 2000s onward, BC emissions have been falling drastically due to gas emission regulations for vehicles, and such downward trend is expected to continue in the future.

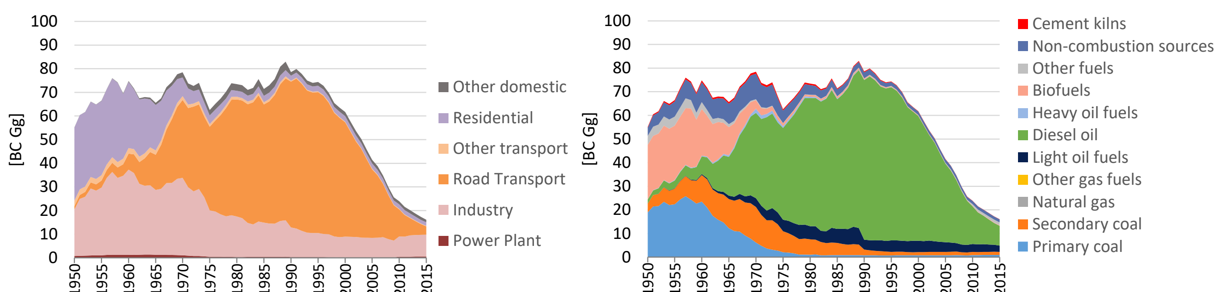

Figure 2 Changes in BC Emissions in Japan According to another Research[6]

3 Methane emissions and future projections

3.1 Short summary of main findings on the historical and trends towards the future in emissions at state level. Also a short sectoral level descriptions on the historical and future trends, a paragraph per sector as relevant for each state.

CH4 emissions in the latest FY2018 were 1,197 Gg (including LULUCF). They decreased by 32.8% since FY1990 and by 1.3% compared to the previous year. Their decrease since FY1990 is mainly a result of a 63.1% decrease in emissions from the waste sector (solid waste disposal).

[6] Kurokawa, J and Ohara, T. "Long-term historical trends in air pollutant emissions in Asia: Regional Emission inventory in ASia (REAS) version 3.1" (2019) https://www.atmos-chem-phys-discuss.net/acp-2019-1122/

The breakdown of the FY2018 emissions showed that the largest source was agriculture sector (rice cultivation, enteric fermentation etc.,78.2%), followed by waste sector (solid waste disposal etc., 15.5%) and energy sector (fugitive emissions from fuels etc., 5.9%).

CH4 emissions from the agriculture sector in FY2018 were 937 Gg. They decreased by 8.0% since FY1990 and by 0.4% compared to the previous year.

The main driving factor for the decrease in CH4 emissions from the agriculture sector since FY1990 was the decrease in the emissions from enteric fermentation due to the decrease in the number of cattle.

CH4 emissions from the waste sector in FY2018 were 186 Gg. They decreased by 63.1% since FY1990 and by 4.0% compared to the previous year.

The main driving factor for the decrease in CH4 emissions from the waste sector since FY1990 was the decrease in the emissions from solid waste disposal on land as a result of decrease in the amount of disposal of biodegradable waste due to improvement in the volume reduction ratio by intermediate treatment under the Waste Management and Public Cleansing Act (Act No.137, 1970) and the Basic Law for Establishing the Recycling-based Society, and other recycling law (Act No.110, 2000).

CH4 emissions from the energy sector in FY2018 were 70 Gg. They decreased by 72.2% since FY1990 and by 4.8% compared to the previous year.

The main driving factor for the decrease in CH4 emissions from the energy sector since FY1990 was the decrease in the emissions from coal mining due to the decrease in coal production, as a result of decrease of operational coal mines.

In the future, Japan aims to reduce the CH4 emissions to 31.6Mt-CO2eq by FY2030, as stated in the Plan for Global Warming Countermeasures.

3.2 Informative graphs showing state emissions – time series graphs from 2010 and estimates for 2020 and 2030. Having longer time series is also welcome, if the data is available.

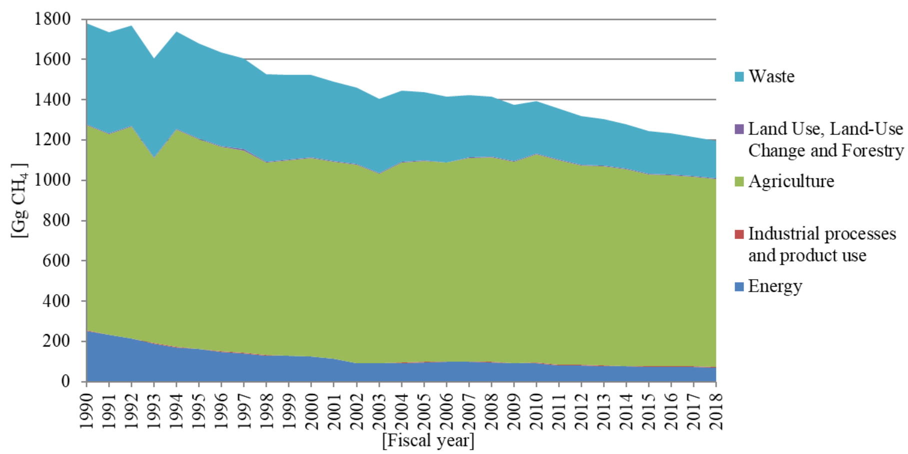

Figure 3. Methane emissions in 1990-2018 in Japan by aggregated sector

4 National strategies and action plans

4.1 Short overview on governance structure regarding BC and methane (What are the responsible ministries, agencies etc. for developing strategies and action plans. I.e. a list or a table naming the responsible bodies with short descriptions on what are the roles and responsibilities. As appropriate per state.)

Methane emissions associated with rice cultivation can be reduced by changing the way organic matter is managed in line with local conditions, including replacing the conventional approach of plowing in rice straw with application of compost. The Government will reduce methane emissions associated with landfilling of waste by promoting the reduction of the amount of directly landfilled wastes such as raw garbage through reviews of disposal methods and thorough waste sorting and collection, and reinforcement of disposal systems by municipal governments. The use of semi-aerobic landfill structure for the installation of final waste disposal sites can reduce biological degradation of organic waste, such as raw garbage, and lower the amount of methane emissions from waste landfills compared to anaerobic landfill structure.

As for BC, NA

4.2 National strategies

NA

4.3 National action plans

In the Plan for Global Warming Countermeasures, Japan aims to reduce the CH4 emissions to 31.6Mt-CO2eq by FY2030.

5 International work

5.1 Highlight the main priorities for international work and major changes since the 2017 national reporting.

NA

5.2 List international work if international work was not reported in the 2017 national report – one paragraph per work area.

NA

6 Sector based plans and projects

Each Arctic State and participating Arctic Council Observer States should provide brief information about key mitigation actions occurring in each sector. For example, highlighting the most current and relevant information on national actions, brief summaries of action plans, or brief descriptions of mitigation strategies can be included.

6.1. Mobile and stationary sources

6.1.1. Specific national strategies

NA

6.1.2. Existing regulatory instruments

NA

6.1.3. Follow up of EGBMC recommendation (1.a-1.e)

NA

6.1.4. Best practices and projects (Toolbox)

1) Gas Emission Regulations for Vehicles

PM emission regulations for diesel vehicles started in 1994, and those regulations have been and continue to be gradually strengthened. In addition, a new approach has been introduced to control PM emissions from not only diesel vehicles but also all the vehicles equipped with gasoline direct injection engines including stoichiometric gasoline direct injection engines (effective in December 2020). The following figures illustrate detailed BC emissions from vehicles and the BC ratios to $PM_{2.5}$. In addition to BC emissions from diesel vehicles, those from gasoline vehicles are notable. We are examining the future introduction of particle number (PN) regulations to solve the problem of measurement accuracy in the current regulations based on the weight of PM.

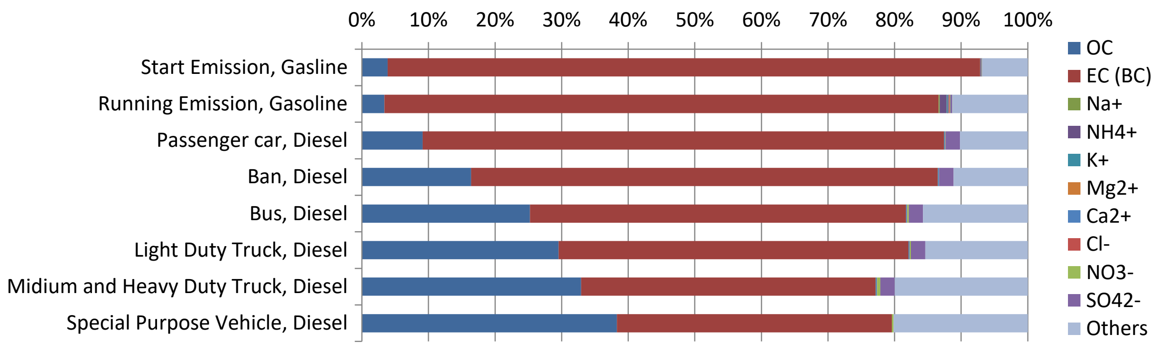

Figure 4. Component analysis of $PM_{2.5}$ emitted from vehicles

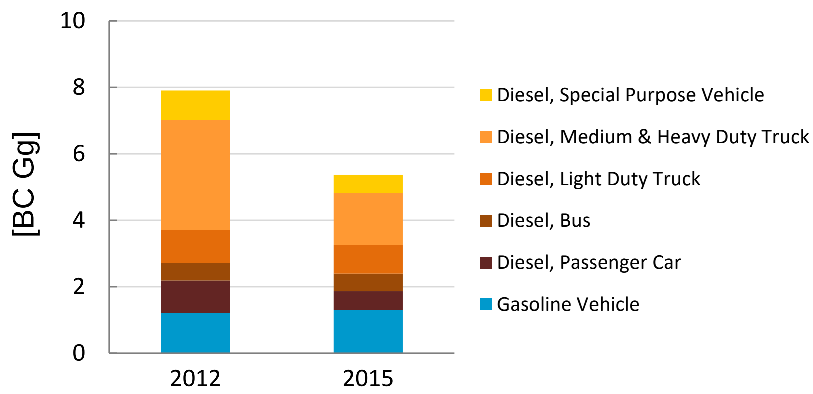

Figure 5. BC emissions by fuel and vehicle type

2) Fuel Quality

The regulations on the sulfur content of diesel fuel for vehicles have been gradually strengthened. The petroleum industry had voluntarily reduced the sulfur content prior to the implementation of the regulations in accordance with the law. The current sulfur content of light oil is 10 ppm or lower (Figure 6).

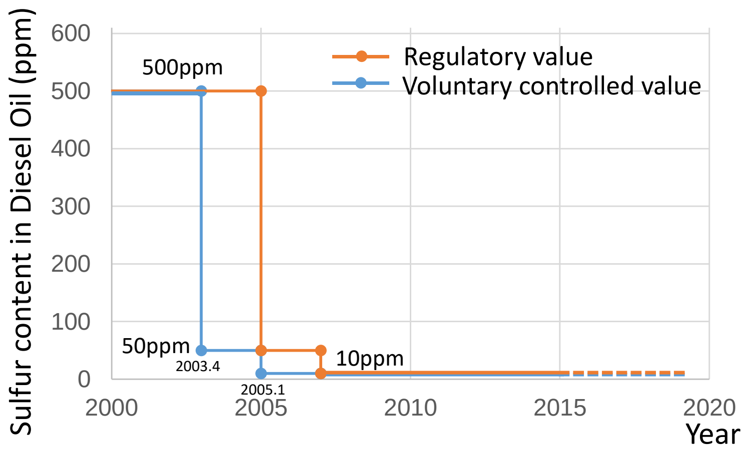

Figure 6. Changes in Sulfur Content of Diesel Fuel

3) Measures in the Metropolitan Areas

In a metropolitan area where roads are congested with vehicles, registration is regulated for vehicles that do not comply with the emission standard prescribed in the area. In addition, when using vehicles in business, a company owning a certain number of specific vehicles must develop a management plan for using vehicles. The designated prefectures formulated the “Total Emission Reduction Plan” and have been implementing policies to reduce NOx and PM emissions from vehicles as previously arranged.

4) Promotion of the Use of Low-Emission Vehicles

Since fiscal year 2002, the government has provided subsidies for introducing next-generation vehicles in order to improve the issues of air pollution and global warming and achieve energy conservation.

6.1.5 Story box

States may wish to share the story of a demonstration, or mitigation projects that address either emissions characterization, emission reduction potential, mitigation implementation feasibility, mitigation costs, and/or environmental, health, and climate effects. Should preferably be put forward as a story, not statements of facts.

NA

6.2 Oil and gas (2.a-2.d)

The same content as under "Mobile and stationary sources", and continue with all sectors.

NA

6.3 Residential combustion (3a -3c)

NA

6.4 Solid waste (4a-4c)

NA

6.5 Agriculture and animal husbandry (5a-5c)

NA

6.6 Management of wildfires (6a-6d)

NA

7 Annexes

Annex 1: Black carbon emission tables

Unit (Gg BC)

	2012	2015	Latest Inventory year	2025 Base Case	2025 High Case
A_PublicPower	0.450	0.307	2015	0.292	0.211
B_Industry	1.907	0.600	2015	0.691	0.660
C_OtherStationaryComb	1.105	0.481	2015	0.468	0.417
D_Fugitive	0.000	0.000	2015	0.000	0.000
E_Solvents	0.000	0.000	2015	0.000	0.000
F_RoadTransport	8.306	5.754	2018	1.252	1.258

G_Shipping	2.466	2.466	2010	1.258	1.258
H_Aviation	0.354	0.367	2015	0.367	0.367
I_Offroad	2.996	2.120	2015	0.905	0.905
J_Waste	0.005	0.000	2015	0.000	0.000
L_AgriOther	1.107	1.332	2015	1.332	1.332
Total	18.695	13.427		6.564	6.409

	2012	**2015**	**Latest inventory year**	**2025 Base Case**	**2025 High Case**
Industry and power generation	3.139	0.948	2015	1.023	0.912
Residential and other small scale stationary combustion	0.327	0.441	2015	0.428	0.377
Fugitive (incl. Flaring)	NA	NA	2015	NA	NA
Road transport	8.306	5.754	2018	1.252	1.258
Shipping and aviation	2.820	2.833	2010/2015	1.625	1.625
Off-road transport	2.996	2.120	2015	0.905	0.905
Field burning and agricultural wastes	1.107	1.332	2015	1.332	1.332
Other	NA	NA		NA	NA
Grand Total	18.695	13.427		6.564	6.409

Annex 2: Methane emission table

Unit: Gg CH_4

	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
Energy	253	233	214	189	171	161	148	140	131	129
Industrial processes and product use	2	2	2	2	2	2	2	2	2	2
Agriculture	1,018	995	1,050	920	1,079	1,041	1,017	1,007	957	968
Land Use, Land-Use Change and Forestry	4	4	4	5	4	4	5	5	4	4
Waste	504	500	499	491	484	473	462	449	434	421
Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total	1,781	1,734	1,768	1,606	1,741	1,681	1,634	1,604	1,528	1,523
Total (without LULUCF)	1,777	1,730	1,765	1,601	1,736	1,677	1,629	1,599	1,524	1,520

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Energy	124	112	91	90	93	96	99	99	96	91
Industrial processes and product use	2	2	2	2	2	2	2	2	2	2
Agriculture	985	977	984	940	993	996	986	1,011	1,017	1,000
Land Use, Land-Use Change and Forestry	4	4	4	3	4	4	3	3	4	4
Waste	408	394	381	367	353	339	324	310	294	278
Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total	1,523	1,489	1,462	1,403	1,445	1,437	1,414	1,425	1,414	1,375
Total (without LULUCF)	1,519	1,485	1,457	1,400	1,441	1,434	1,411	1,422	1,410	1,371

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2020	2030
Energy	93	81	81	77	76	74	74	74	70		
Industrial processes and product use	2	2	2	2	2	2	2	2	2		
Agriculture	1,033	1,017	993	991	977	955	951	940	937		
Land Use, Land-Use Change and Forestry	3	3	3	3	4	3	3	4	3		
Waste	263	252	241	231	221	212	203	194	186		
Other	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Total	1,395	1,354	1,319	1,304	1,279	1,246	1,232	1,213	1,197		
Total (without LULUCF)	1,391	1,351	1,316	1,301	1,275	1,243	1,229	1,209	1,194		

Annex 3: States are invited to annex a table listing all actions in regard to each of the recommendation in the 2019 Summary Report. Please group the actions by sector and each recommendation (please see the example below). Focus on new projects or projects now having effect. Please note that the 2017 and 2015 Summary Reports are publicly available on the Arctic Council Open Access Archive, and you are welcome to refer to those reports.

For reference, please see the Summary Report 2019, appendix 1 on page 56. The idea is that this annex in the national report will feed into a similar annex in the 2021 Summary Report.

Mobile and stationary diesel-powered sources
Table A1: Table A1: Status of recommended actions 2019 related to the reduction of emissions from diesel engines.

Recommendation 1a	In December 2020, new regulations will be implemented to control PM emissions from vehicles and lightweight vehicles equipped with stoichiometric direct injection engines using gasoline or LPG. New regulations were applied to diesel vehicles except heavy duty vehicles in 2018, while new regulation for heavy duty diesel vehicles had already started in 2016.

Recommendation 1b	Promotion of next-generation vehicles and a subsidy system for improving fuel consumption
Recommendation 1c	Implementing the Automobile NOx/PM Law in the metropolitan areas