Japan's Third Biennial Report under the United Nations Framework Convention on Climate Change

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The Government of Japan

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Introduction

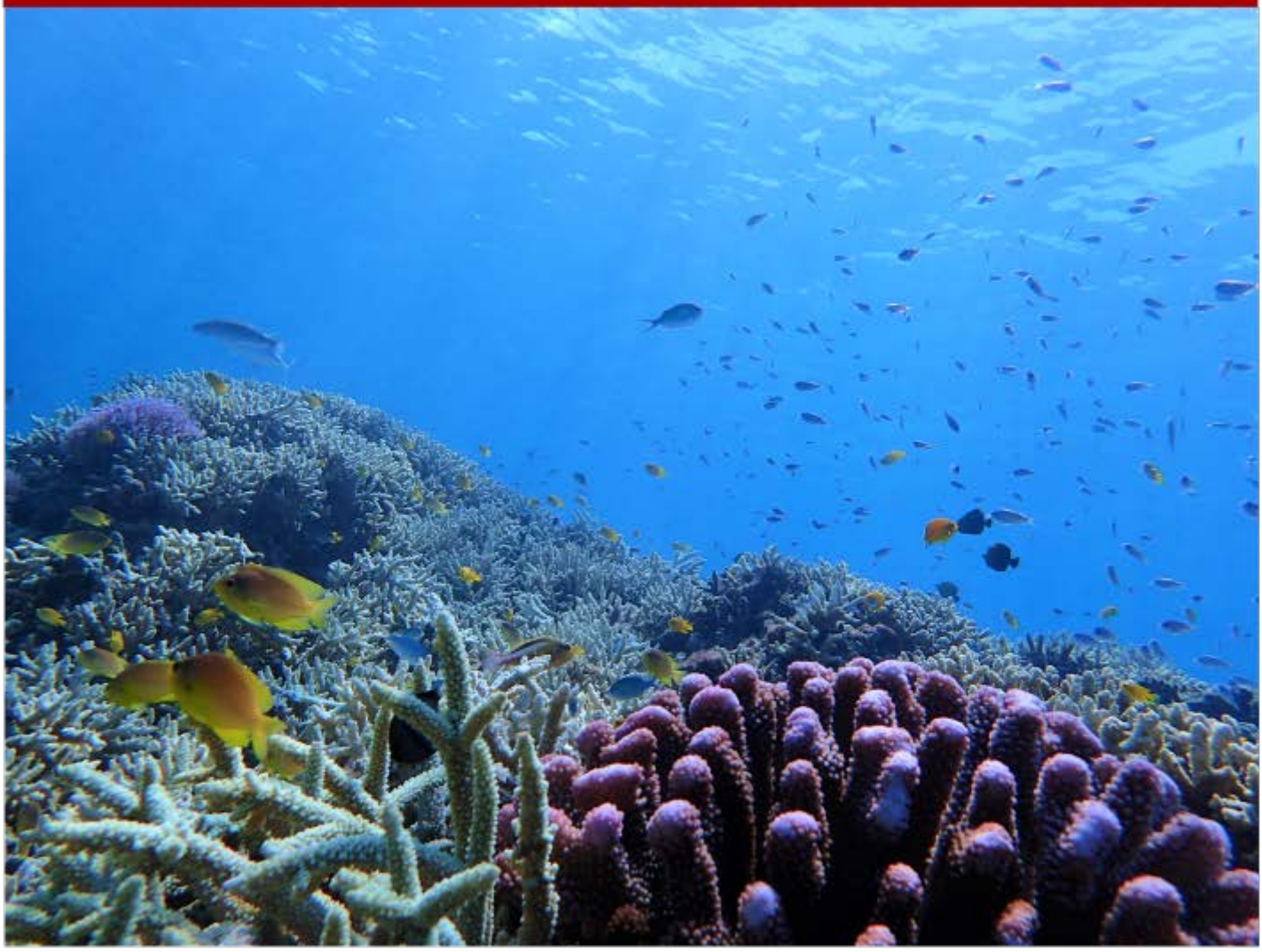
Prior to the United Nations Framework Convention on Climate Change (UNFCCC) adopted in 1992, Japan formulated “Action Program to Arrest Global Warming” in 1990 and has been taking measures to address climate change issues. Subsequently, the Kyoto Protocol was adopted at the third session of the Conference of the Parties (COP3) in 1997, and Japan established “Global Warming Prevention Headquarters” at the Cabinet, and comprehensive and systematic measures have been taken under “Act on Promoting Global Warming Countermeasures” and “Kyoto Protocol Target Achievement Plan”. As a result of the implementation of those measures, greenhouse gas (GHG) emission reduction target in the first commitment period of the Kyoto Protocol was achieved. Even after the first commitment period of the Kyoto Protocol, GHG emission reduction target for FY (Fiscal Year) 2020 based on the Cancun Agreement adopted at the COP16 was announced at the COP19. In addition, Japan prepared the Intended Nationally Determined Contribution (INDC) stipulated in the COP19 Decision, and Japan has decided on the "Japan’s INDC" including the mid-term targets for FY2030 and submitted it to the UNFCCC secretariat. At the 32nd Global Warming Prevention Headquarters held on December 22 2015, “the Action Policy for Global Warming Countermeasures based on the Paris Agreement” was adopted and Japan decided to make steady efforts to achieve the emission reduction target for FY2030 and commit to a long-term and strategic contribution to the reduction of global emissions taking into account that the Paris Agreement set out the 2 degrees goal as a common global goal and aims to achieve a balance between anthropogenic GHG emissions by sources and removals by sinks in the second half of this century. Furthermore, Japan formulated “Plan for Global Warming Countermeasure” based on “Act on Promoting Global Warming Countermeasures”, “Government Action Plans” in line with the plan and has been taking the initiative and strengthening the public campaign. In light of this trend, Japan ratified the Paris Agreement in November 2016 and is implementing further measures to combat global warming.

The COP16 decided that developed country Parties should submit Biennial Reports (BR) including information on progress on emission reduction achieved and mitigation actions to achieve their quantified economy-wide emission reduction targets, projection of GHG emissions and removals and the provision of financial, technological and capacity building support (Decision 1/CP.16). The COP17 decided that developed country Parties shall submit the first Biennial Report (BR1) by January 1 2014 and their subsequent BRs every two years. And it also adopted “UNFCCC biennial reporting guidelines for developed country Parties” (Decision 2/CP.17, Annex I) that stipulates the reporting matters to be reported in the BRs. At the COP18 and COP21, "Common Tabular Format (CTF)" which developed country Parties shall use to report information required in the BR was adopted (Decision 19/CP.18, Annex and 9/CP.21, Annex). In accordance with the provisions above, Japan hereby submits its third Biennial Report (BR3).

The structure of this report is consistent with the reporting elements specified in the BR reporting guidelines. Chapter 1 ”Information on Greenhouse Gas Emissions and Trends” provides information on greenhouse gas emissions and trends between FY1990 and FY2015, consistent with Japan’s National Greenhouse Gas Inventory that Japan submits annually to the UNFCCC in accordance with Article 4 and 12 of the UNFCCC and Decision 2/CMP.8. Chapter 2 “Quantified Economy-Wide Emission Reduction Target” reports Japan's greenhouse gas emission reduction targets for FY2020. Chapter 3 “Progress in Achievement of Quantified Economy-Wide Emission Reduction Targets and Relevant Information” presents information on the progress made toward achieving the GHG emission reduction targets and mitigation actions for achieving the targets. Chapter 4 “Projections” presents projections of Japan's GHG emissions and removals in FY2020 and FY2030. Chapter 5 “Financial, Technological and Capacity-building Support” reports information on the financial, technological and capacity-building support to developing countries provided by Japan in order to support climate change measures in developing countries.

Chapter 1

Information on Greenhouse Gas Emissions and Trends



1.1 Description of GHG Emissions and Removals

1.1.1 Overview of Greenhouse Gas Inventory

1.1.1.1 Background Information on Japan's Greenhouse Gas Inventory

Japan reported the greenhouse gas (GHG) inventories, which contain the information on emissions and removals of GHGs, including indirect GHGs and SOx in Japan for FY1990 to FY2015[1], on the basis of Articles 4 and 12 of the United Nations Framework Convention on Climate Change (UNFCCC) and Decision 2/CMP.8.

Estimation methodologies of GHG inventories are required to be in line with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (2006 IPCC Guidelines) which was made by the Intergovernmental Panel on Climate Change (IPCC), and Japan's estimation methodologies are basically in line with these guidelines. In order to enhance transparency, consistency, comparability, completeness and accuracy of inventory, Japan also applies the 2013 Supplement to the 2006 IPCC Guidelines: Wetlands (Wetlands Guidelines) and the 2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol (KP Supplement (2013)).

Japan's national inventory is reported in accordance with the UNFCCC Reporting Guidelines on Annual Inventories (Decision 24/CP.19, hereinafter referred to as the UNFCCC Inventory Reporting Guidelines) decided by the Conference of the Parties.

1.1.1.2 Brief General Description of Methodologies

The methodology used in the estimation of GHG emissions or removals is basically in accordance with the 2006 IPCC Guidelines. The country-specific methodologies are also used for some source/sink categories in order to more accurately reflect the actual emission status in Japan.

Results of the actual measurements or estimates based on research conducted in Japan are used to determine the emissions factors (country-specific emissions factors). The default values given in the 2006 IPCC Guidelines are used for estimation of emissions, which are assumed to be quite low (e.g., "1.B.2.a.ii fugitive emissions from fuel (oil and natural gas" (CO_2 and CH_4))) etc.

1.1.1.3 Sectors

Japan's national GHG inventory is composed of 7 gases: CO_2; CH_4; N_2O; HFCs; PFCs; SF_6; and NF_3 and of 5 sectors: Energy; Industrial Processes and Product Use (IPPU); Agriculture; Land Use, Land-Use Change and Forestry (LULUCF); and Waste.

(1) Energy

Emissions from the energy sector consist of two main categories: fuel combustion and fugitive emissions from fuels. Fuel combustion includes emissions released into the atmosphere when fossil fuels (e.g., coal, oil products, and natural gas) are combusted. Fugitive emissions are intentional or unintentional releases of gases from fossil fuels by anthropogenic activities.

In Japan, fossil fuels are used to produce energy for a wide variety of purposes (e.g., production, transportation, and consumption of energy products) and CO_2 (Carbon Dioxide), CH_4 (Methane), N_2O (Nitrous Oxide), NOx (Nitrogen Oxide), CO (Carbon Monoxide), and NMVOC (Non-Methane Volatile Organic Compounds) are emitted in the process.

(2) Industrial Processes and Product Use (IPPU)

The Industrial Processes and Product Use (IPPU) sector deals with GHG emissions resulting from chemical and physical

[1] "FY" (fiscal year), from April of the reporting year through March of the next year, is used because CO_2 is the primary GHGs emissions and estimated on a fiscal year basis. "CY" stands for "calendar year".

transformations in industrial processes. Specially, CO_2, CH_4 and N_2O emissions from mineral products (e.g., cement production), the chemical industry (e.g., ammonia production), metal production (e.g., iron and steel production), non-energy products from fuels and solvent use and HFCs, PFCs, SF_6 and NF_3 emissions at the stage of production, use and discharge are estimated. It also deals with N_2O emissions resulting from the use of anesthetics (e.g., laughing gas) and NMVOC emission from solvent production and uses such as paint, metal cleansing, and dry cleaning are estimated.

(3) Agriculture

The agriculture sector deals with GHG emissions resulting from agricultural activities. In particular, CH_4 as the result of enteric fermentation, CH_4 and N_2O generated in the treatment of manure excreted by cattle etc., CH_4 emitted from paddy fields cultivated for rice production, N_2O emitted from agricultural soil, and CH_4 and N_2O from field burning of agricultural waste, CO_2 from application of limestone and urea to soil etc., are estimated.

(4) Land Use, Land-Use Change and Forestry (LULUCF)

The land use, land-use change, and forestry (LULUCF) sector deals with greenhouse gas (GHG) emissions and removals resulting from land use such as forestry activities and land-use change. Japan classifies its national land into six categories—forest land, cropland, grassland, wetlands, settlements, and other land—and subdivides each of them into two subcategories by distinguishing them on the basis of whether or not land conversion has been occurred, in accordance with the 2006 IPCC Guidelines; a default value of 20 years was used when distinguishing the land conversion. GHG emissions and removals in this sector consist of carbon stock changes in five carbon pools (aboveground biomass, belowground biomass, dead wood, litter, and soil), carbon stock changes in harvested wood products (HWP) in forest land, direct N_2O emissions from N fertilization in forest land, CH_4 and N_2O emissions from drainage of organic soils, N_2O emissions from nitrogen mineralization resulting from change of land use or management of mineral soils, indirect N_2O emissions from managed soils, and non-CO_2 emissions from biomass burning.

(5) Waste

In the waste sector, GHG emissions from treatment and disposal of waste are estimated for solid waste disposal, biological treatment of solid waste, incineration and open burning of waste, wastewater treatment and discharge, and other[2] in accordance with treatment processes. "Waste" to be covered in this sector is the waste as defined in the 2006 IPCC Guidelines. Waste sector estimates GHG emissions from not only incineration and disposal of municipal and industrial waste, which are defined by the "Waste Disposal and Public Cleansing Law", but also energy or material use of recycled materials.

1.1.2 Trends in GHG Emissions and Removals

Total GHG emissions in FY2015[3] (excluding LULUCF[4] , including indirect CO_2[5], definition omitted below) were 1,325

[2] Data for some emission source categories in the waste sector are complemented by estimation, when statistical data or related data are not available. The methodologies for this estimation are not described in this chapter. For details, refer to the *Report of the Waste Panel on Greenhouse Gas Emission Estimate (2006)* and the website of the Ministry of the Environment, *Review of Greenhouse Gases Emissions Estimation Methods*

(http://www.env.go.jp/earth/ondanka/santeiho/kento/index.html).

[3] The sum of CO_2, CH_4, N_2O, HFCs, PFCs, SF_6, and NF_3 emissions converted to CO_2 equivalents multiplied by their respective global warming potential (GWP). The GWP is a coefficient by means of which greenhouse gas effects of a given gas are made relative to those of an equivalent amount of CO_2. The coefficients are subjected to the *Fourth Assessment Report* (2007) issued by the IPCC.

[4] Abbreviation of “Land Use, Land-Use Change and Forestry”

million tonnes (in CO_2 eq.). They increased by 4.0% compared to the emissions in FY1990, decreased by 5.3% compared to FY 2005 and decreased by 2.9% compared to the previous year.

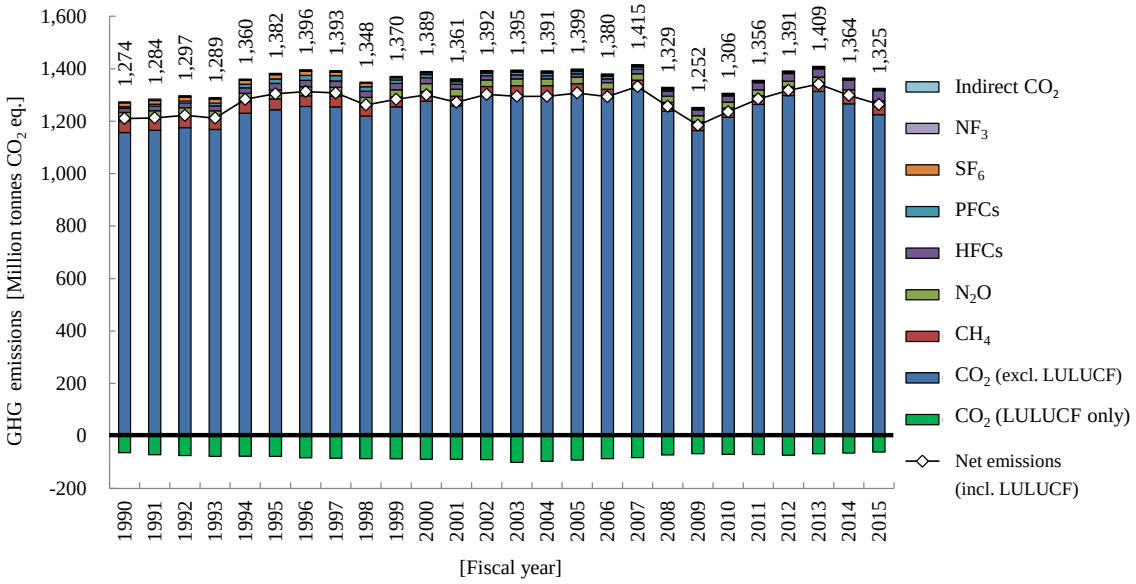


Figure 1-1 Trends in GHG emissions and removals in Japan

CO_2 emissions in FY2015 were 1,225 million tonnes (excluding LULUCF, excluding indirect CO_2, definition omitted below), accounting for 92.5% of total GHG emissions. They increased by 5.9% since FY1990, decreased by 6.3% compared to FY2005 and decreased by 3.3% compared to the previous year. CO_2 removals[6] in FY2015 were 61.2 million tonnes, which were equivalent to 4.6% of total GHG emissions. They decreased by 4.0% since FY1990, by 33.4% compared to FY2005 and by 6.4% compared to the previous year. CH_4 emissions in FY2015 (excluding LULUCF) were 31.3 million tonnes (in CO_2 eq.), accounting for 2.4% of total GHG emissions. They decreased by 29.2% since FY1990, by 11.3% compared to FY2005 and by 2.4% compared to the previous year. N_2O in FY2015 (excluding LULUCF) were 20.8 million tonnes (in CO_2 eq.), accounting for 1.6% of total GHG emissions. They decreased by 33.9% since FY1990, by 16.1% compared to FY2005 and by 0.6% compared to the previous year. HFCs emissions in CY2015 were 39.2 million tonnes (in CO_2 eq.), accounting for 3.0% of total GHG emissions. They increased by 146.1% since CY1990, by 206.7% compared to CY2005 and by 9.6% compared to the previous year. PFCs emissions in CY2015 were 3.3 million tonnes (in CO_2 eq.), accounting for 0.2% of total GHG emissions. They decreased by 49.4% since CY1990, by 61.6% compared to CY2005 and by 1.6% compared to the previous year. SF_6 emissions in CY2015 were 2.1 million tonnes (in CO_2 eq.), accounting for 0.2% of total GHG emissions. They decreased by 83.5% since CY1990, decreased by 58.0% compared to CY2005 and increased by 2.7% compared to the previous year. -NF_3 emissions in CY2015 were 0.6 million tonnes (in CO_2 eq.), accounting for 0.04% of total GHG emissions. They increased 1,651.1% since CY1990, decreased by 61.2% compared to CY2005 and decreased by 49.1% compared to the previous year. Indirect CO_2 emissions in FY2015 were 2.1 million tonnes (in CO_2 eq.), accounting for 0.2% of total GHG emissions. They decreased by 59.4% since FY1990, decreased by 30.5% compared to FY2005 and increased by 1.9% compared to the previous year.

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[5] Carbon monoxide (CO), methane (CH_4) and non-methane volatile organic compounds (NMVOC) are oxidized in the atmosphere in the long term and converted to CO_2. Indirect CO_2 means value in CO_2 equivalent of these emissions. However, emissions of derived from combustion origin and biomass origin of CO, CH_4 and NMVOC are excluded to avoid double counting and/or by concept of carbon neutral.

[6] Since the inventory to be submitted under the UNFCCC reports all GHG emissions and removals from the LULUCF sector, these values do not correspond to emissions and removals under the Kyoto Protocol.

Table 1-1 Trends in GHG emissions and removals in Japan

[Million tonnes CO_2 eq.]	GWP	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
CO_2 (excl. LULUCF) *1	1	1,157.2	1,165.6	1,175.8	1,168.9	1,230.2	1,243.8	1,256.7	1,254.6	1,219.6	1,254.6
CO_2 (incl. LULUCF) *1	1	1,093.4	1,093.9	1,100.9	1,091.1	1,153.2	1,165.8	1,173.5	1,169.5	1,133.1	1,167.6
CO_2 (LULUCF only)	1	-63.7	-71.7	-74.8	-77.8	-77.0	-78.0	-83.2	-85.1	-86.5	-87.0
CH_4 (excl. LULUCF)	25	44.2	43.0	43.8	39.7	43.1	41.6	40.4	39.7	37.8	37.7
CH_4 (incl. LULUCF)	25	44.3	43.1	43.9	39.8	43.2	41.7	40.5	39.8	37.9	37.8
N_2O (excl. LULUCF)	298	31.5	31.2	31.4	31.3	32.6	32.9	34.0	34.8	33.2	27.0
N_2O (incl. LULUCF)	298	31.7	31.4	31.6	31.5	32.8	33.1	34.2	35.0	33.4	27.2
HFCs	HFC-134a: 1,430 etc.	15.9	17.3	17.8	18.1	21.1	25.2	24.6	24.4	23.7	24.4
PFCs	PFC-14: 7,390 etc.	6.5	7.5	7.6	10.9	13.4	17.6	18.3	20.0	16.6	13.1
SF_6	22,800	12.9	14.2	15.6	15.7	15.0	16.4	17.0	14.5	13.2	9.2
NF_3	17,200	0.03	0.03	0.03	0.04	0.1	0.2	0.2	0.2	0.2	0.3
Indirect CO_2	1	5.3	5.1	4.9	4.6	4.6	4.5	4.5	4.4	4.0	4.0
Gross Total (excluding LULUCF, excluding indirect CO_2)		1,268.3	1,278.9	1,292.0	1,284.7	1,355.5	1,377.8	1,391.2	1,388.1	1,344.3	1,366.3
Net Total (including LULUCF, excluding indirect CO_2)		1,204.8	1,207.5	1,217.4	1,207.1	1,278.8	1,300.0	1,308.2	1,303.3	1,258.1	1,279.5
Gross Total (excluding LULUCF, including indirect CO_2)		1,273.6	1,284.0	1,296.9	1,289.3	1,360.1	1,382.3	1,395.7	1,392.5	1,348.4	1,370.3
Net Total (including LULUCF, including indirect CO_2)		1,210.1	1,212.6	1,222.3	1,211.8	1,283.4	1,304.5	1,312.7	1,307.7	1,262.2	1,283.5

[Million tonnes CO_2 eq.]	GWP	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
CO_2 (excl. LULUCF) *1	1	1,275.8	1,259.0	1,296.1	1,301.1	1,300.2	1,307.7	1,287.1	1,321.7	1,237.3	1,164.7
CO_2 (incl. LULUCF) *1	1	1,186.7	1,169.9	1,205.6	1,200.8	1,203.2	1,215.9	1,200.8	1,238.8	1,164.9	1,096.5
CO_2 (LULUCF only)	1	-89.1	-89.1	-90.5	-100.3	-96.9	-91.8	-86.3	-82.9	-72.4	-68.2
CH_4 (excl. LULUCF)	25	37.7	36.6	35.9	34.5	35.5	35.3	34.8	35.0	34.7	33.8
CH_4 (incl. LULUCF)	25	37.7	36.7	36.0	34.5	35.6	35.3	34.8	35.1	34.8	33.9
N_2O (excl. LULUCF)	298	29.6	26.0	25.4	25.2	25.2	24.8	24.8	24.2	23.3	22.7
N_2O (incl. LULUCF)	298	29.8	26.2	25.6	25.4	25.4	25.0	25.0	24.4	23.4	22.9
HFCs	HFC-134a: 1,430 etc.	22.9	19.5	16.2	16.2	12.4	12.8	14.6	16.7	19.3	20.9
PFCs	PFC-14: 7,390 etc.	11.9	9.9	9.2	8.9	9.2	8.6	9.0	7.9	5.7	4.0
SF_6	22,800	7.0	6.1	5.7	5.4	5.3	5.1	5.2	4.7	4.2	2.4
NF_3	17,200	0.3	0.3	0.4	0.4	0.5	1.5	1.4	1.6	1.5	1.4
Indirect CO_2	1	4.1	3.6	3.4	3.3	3.2	3.1	3.0	2.9	2.6	2.4
Gross Total (excluding LULUCF, excluding indirect CO_2)		1,385.0	1,357.3	1,389.0	1,391.7	1,388.3	1,395.7	1,376.9	1,411.9	1,326.0	1,250.0
Net Total (including LULUCF, excluding indirect CO_2)		1,296.2	1,268.5	1,298.8	1,291.6	1,291.6	1,304.2	1,290.8	1,329.1	1,253.9	1,182.0
Gross Total (excluding LULUCF, including indirect CO_2)		1,389.1	1,360.9	1,392.4	1,395.0	1,391.5	1,398.8	1,379.9	1,414.8	1,328.6	1,252.4
Net Total (including LULUCF, including indirect CO_2)		1,300.3	1,272.1	1,302.2	1,294.9	1,294.8	1,307.3	1,293.9	1,332.0	1,256.5	1,184.4

[Million tonnes CO_2 eq.]	GWP	2010	2011	2012	2013	2014	2015	Changes in emissions/removals (2015)	
								1990	Previous year
CO_2 (excl. LULUCF) *1	1	1,215.0	1,263.8	1,298.2	1,313.7	1,266.6	1,225.2	5.9%	-3.3%
CO_2 (incl. LULUCF) *1	1	1,144.7	1,192.9	1,224.5	1,246.0	1,201.2	1,164.1	6.5%	-3.1%
CO_2 (LULUCF only)	1	-70.3	-71.0	-73.7	-67.7	-65.4	-61.2	-4.0%	-6.4%
CH_4 (excl. LULUCF)	25	34.9	33.8	33.0	32.7	32.1	31.3	-29.2%	-2.4%
CH_4 (incl. LULUCF)	25	34.9	33.9	33.0	32.7	32.1	31.4	-29.2%	-2.5%
N_2O (excl. LULUCF)	298	22.3	21.8	21.4	21.4	20.9	20.8	-33.9%	-0.6%
N_2O (incl. LULUCF)	298	22.5	22.0	21.5	21.6	21.1	21.0	-33.8%	-0.5%
HFCs	HFC-134a: 1,430 etc.	23.3	26.1	29.3	32.1	35.8	39.2	146.1%	9.6%
PFCs	PFC-14: 7,390 etc.	4.2	3.8	3.4	3.3	3.4	3.3	-49.4%	-1.6%
SF_6	22,800	2.4	2.2	2.2	2.1	2.1	2.1	-83.5%	2.7%
NF_3	17,200	1.5	1.8	1.5	1.6	1.1	0.6	1651.1%	-49.1%
Indirect CO_2	1	2.3	2.3	2.2	2.2	2.1	2.1	-59.4%	1.9%
Gross Total (excluding LULUCF, excluding indirect CO_2)		1,303.7	1,353.3	1,389.0	1,406.9	1,361.9	1,322.6	4.3%	-2.9%
Net Total (including LULUCF, excluding indirect CO_2)		1,233.6	1,282.6	1,315.6	1,339.4	1,296.8	1,261.6	4.7%	-2.7%
Gross Total (excluding LULUCF, including indirect CO_2)		1,306.0	1,355.6	1,391.2	1,409.0	1,364.0	1,324.7	4.0%	-2.9%
Net Total (including LULUCF, including indirect CO_2)		1,236.0	1,284.8	1,317.8	1,341.6	1,298.9	1,263.8	4.4%	-2.7%

*1 Excluding indirect CO_2

*2 LULUCF: Land Use, Land-Use Change and Forestry

1.1.3 Trends in GHG Emissions and Removals by Gas

1.1.3.1 CO_2

(1) Trends in CO_2 Emissions

CO_2 emissions in FY2015 were 1,225 million tonnes, accounting for 92.5% of total GHG emissions. They increased by 5.9% since FY1990, decreased by 6.3% compared to FY2005 and decreased by 3.3% compared to the previous year.

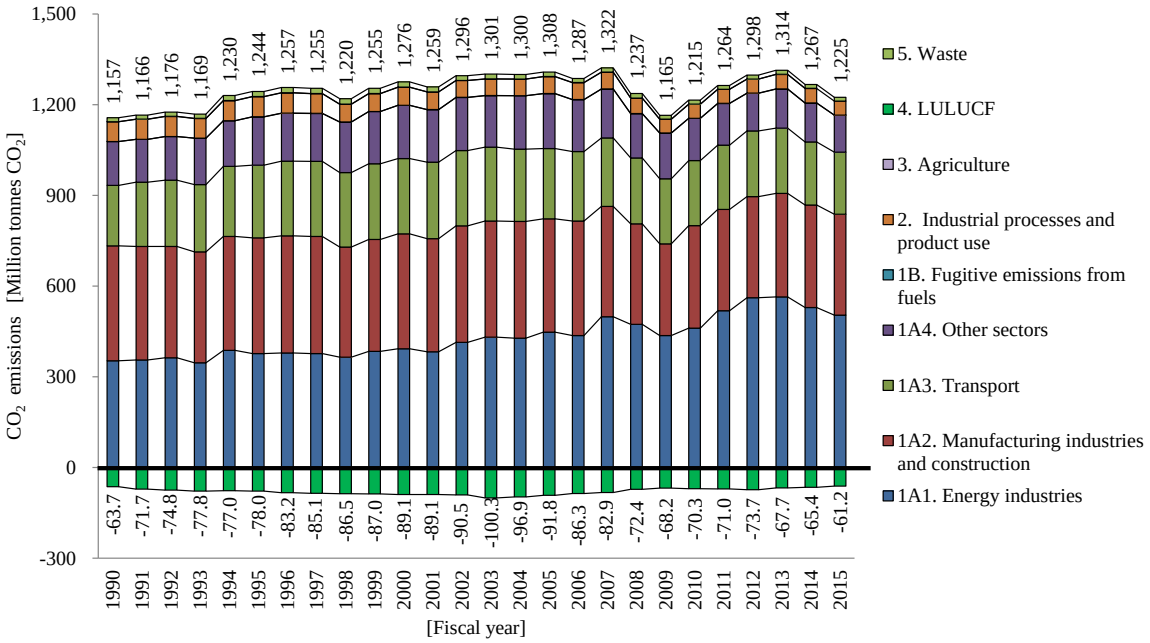


Figure 1-2 Trends in CO_2 emissions

The breakdown of CO_2 emissions in FY2015 shows that fuel combustion accounts for 95.1%, and is followed by industrial processes and product use (3.8%) and waste sectors (1.0%). As for the breakdown of CO_2 emissions within the fuel combustion category, energy industries account for 41.1% and is followed by manufacturing industries and construction at 27.3%, transport at 16.7%, and other sectors[7] at 10.0%. The main driving factor for the decrease in CO_2 emissions compared to the previous year is the CO_2 emissions from electricity power generation in the energy industries sector.

By looking at the changes in emissions by sector, emissions from fuel combustion in the energy industries increased by 42.9% since FY1990, increased by 12.5% compared to FY2005 and decreased by 4.7% compared to the previous year. The main driving factor for the increase compared to the emissions in FY1990 is the increased solid fuel consumption for electricity power generation. Emissions from manufacturing industries and construction decreased by 12.2% since FY1990, by 10.9% compared to FY2005 and by 1.5% compared to the previous year. Emissions from transport increased by 2.4% compared to FY1990, decreased by 11.9% compared to FY2005 and decreased by 1.7% compared to the previous year. The main driving factor for the increase compared to the emissions in FY1990 is the increase in emissions from passenger vehicles, compensating for the decrease in emissions from freight transportation. Emissions from other sectors decreased by 15.7% since FY1990, by 32.5% compared to FY2005 and by 5.0% compared to the previous year.

CO_2 removals in FY2015 were 61.2 million tonnes, which were equivalent to 4.6% of total GHG emissions. They decreased by 4.0% since FY1990, by 33.4% compared to FY2005 and by 6.4% compared to the previous year.

[7] It covers emissions from commercial/institutional, residential and agriculture/forestry/fishing.

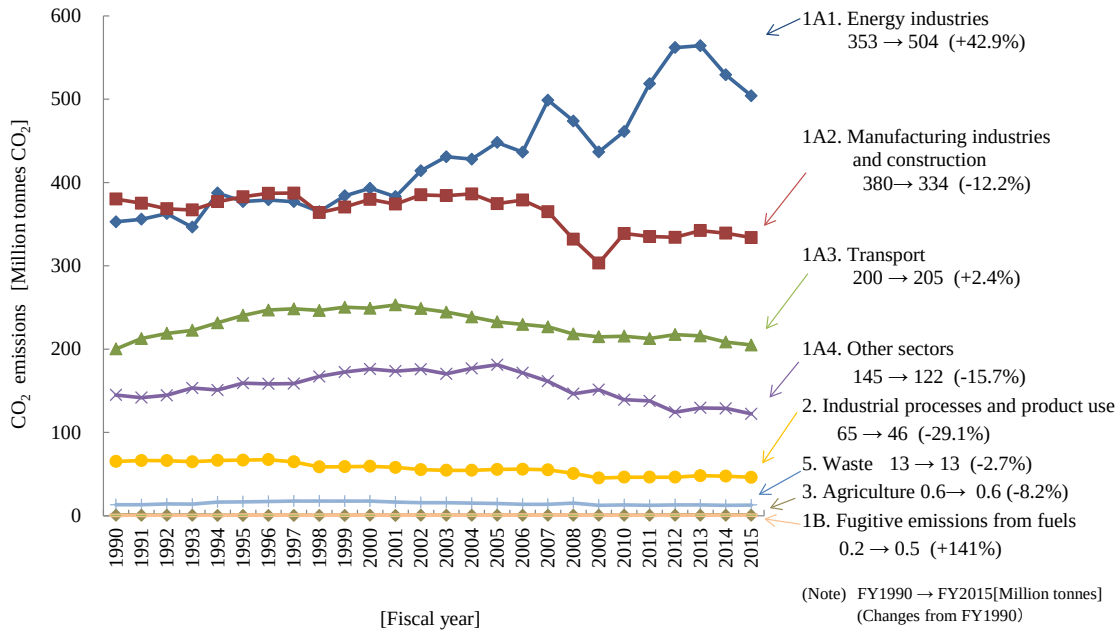


Figure 1-3 Trends in CO_2 emissions by sector/subsector

(Figures in brackets indicate relative increase or decrease to the FY1990 values)

Table 1-2 Trends in CO_2 emissions and removals in each sector

[Thousand tonnes CO_2]

Category	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1A. Fuel combustion	1,078,111	1,159,485	1,197,823	1,236,530	1,216,506	1,251,853	1,170,228	1,106,006	1,154,746	1,204,229	1,237,814	1,251,717	1,205,606	1,165,286
1A1. Energy industries	352,783	377,029	393,060	447,939	436,480	498,751	473,839	436,771	461,182	518,617	561,892	564,207	529,229	504,113
Public electricity and heat production	300,173	318,716	334,091	382,776	374,109	428,020	399,444	360,397	383,264	444,491	490,981	495,626	468,199	443,897
Petroleum refining	37,150	41,766	47,377	50,884	49,775	48,426	46,987	47,307	49,627	46,429	45,144	47,454	41,798	42,123
Manufacture of solid fuels and other energy industries	15,460	16,546	11,592	14,279	12,596	22,305	27,409	29,067	28,290	27,698	25,767	21,128	19,232	18,093
1A2. Manufacturing industries and construction	380,140	382,895	379,700	374,649	378,848	364,920	331,854	303,284	338,812	335,113	334,158	342,281	339,109	333,942
Iron and steel	167,331	155,182	163,244	172,177	179,462	173,629	148,781	139,438	159,485	153,689	159,085	164,755	165,326	160,299
Non-ferrous metals	8,409	7,080	5,536	5,389	5,640	5,536	4,942	4,389	3,073	3,177	3,159	3,398	3,463	3,143
Chemicals	63,684	73,044	65,825	59,926	59,299	58,858	54,003	55,790	55,741	54,606	52,244	57,063	52,627	52,100
Pulp, paper and print	28,247	33,041	32,272	30,010	29,233	28,117	25,707	23,538	24,011	25,056	23,261	25,027	24,871	25,304
Food processing, beverages and tobacco	17,039	19,828	23,810	25,905	24,862	23,003	23,887	17,666	24,818	24,494	23,298	17,813	17,836	18,204
Non-metallic minerals	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
Other	95,430	94,720	89,013	81,242	80,352	75,777	74,534	62,463	71,685	74,091	73,112	74,225	74,987	74,892
1A3. Transport	200,215	240,453	249,014	232,727	229,663	226,722	218,193	214,764	215,467	212,651	217,436	215,803	208,505	204,952
Domestic aviation	7,162	10,278	10,677	10,799	11,178	10,876	10,277	9,781	9,193	9,001	9,524	10,149	10,173	9,899
Road transportation	178,442	214,684	222,613	208,267	205,124	203,061	196,002	193,931	194,956	192,661	196,765	194,172	186,929	183,785
Railways	935	822	711	647	623	594	604	590	574	555	554	540	524	524
Domestic navigation	13,675	14,669	15,012	13,014	12,739	12,191	11,310	10,462	10,745	10,434	10,594	10,942	10,879	10,743
1A4. Other sectors	144,973	159,108	176,049	181,216	171,515	161,459	146,342	151,187	139,285	137,847	124,327	129,425	128,762	122,279
Commercial/institutional	80,186	86,868	102,040	109,061	103,365	94,445	83,597	89,123	73,851	74,603	61,620	69,342	70,845	66,719
Residential	58,366	68,310	71,037	69,614	65,479	64,553	60,897	59,611	62,883	60,670	60,039	57,660	55,501	53,201
Agriculture/forestry/fishing	6,421	3,931	2,972	2,540	2,671	2,461	1,847	2,453	2,551	2,574	2,669	2,423	2,416	2,359
1A5. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1B. Fugitive emissions from fuels	192	521	512	508	553	616	565	501	475	477	490	438	449	462
1C. CO_2 transport and storage	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
2. Industrial processes and product use	65,126	66,774	59,357	55,644	55,893	55,093	50,793	45,235	46,316	46,227	46,288	48,034	47,434	46,156
3. Agriculture	609	359	443	411	383	500	440	390	403	415	520	578	559	559
4. LULUCF	-63,737	-78,050	-89,065	-91,794	-86,321	-82,946	-72,357	-68,168	-70,321	-70,965	-73,655	-67,703	-65,361	-61,169
5. Waste	13,127	16,709	17,642	14,601	13,763	13,652	15,264	12,554	13,071	12,468	13,045	12,919	12,553	12,776
Total (including LULUCF)	1,093,427	1,165,799	1,186,712	1,215,899	1,200,778	1,238,767	1,164,934	1,096,517	1,144,690	1,192,851	1,224,503	1,245,983	1,201,240	1,164,070
Total (excluding LULUCF)	1,157,165	1,243,849	1,275,777	1,307,693	1,287,099	1,321,713	1,237,291	1,164,685	1,215,011	1,263,816	1,298,158	1,313,686	1,266,601	1,225,239

*1 Excluding indirect CO_2

*2 LULUCF: Land Use, Land-Use Change and Forestry

(2) CO_2 Emissions Per Capita, CO_2 Emissions Per Unit of GDP

CO_2 emissions per capita in FY2015 were 9.64 tonnes. They increased by 3.0% since FY1990 and decreased by 3.2% compared to the previous year.

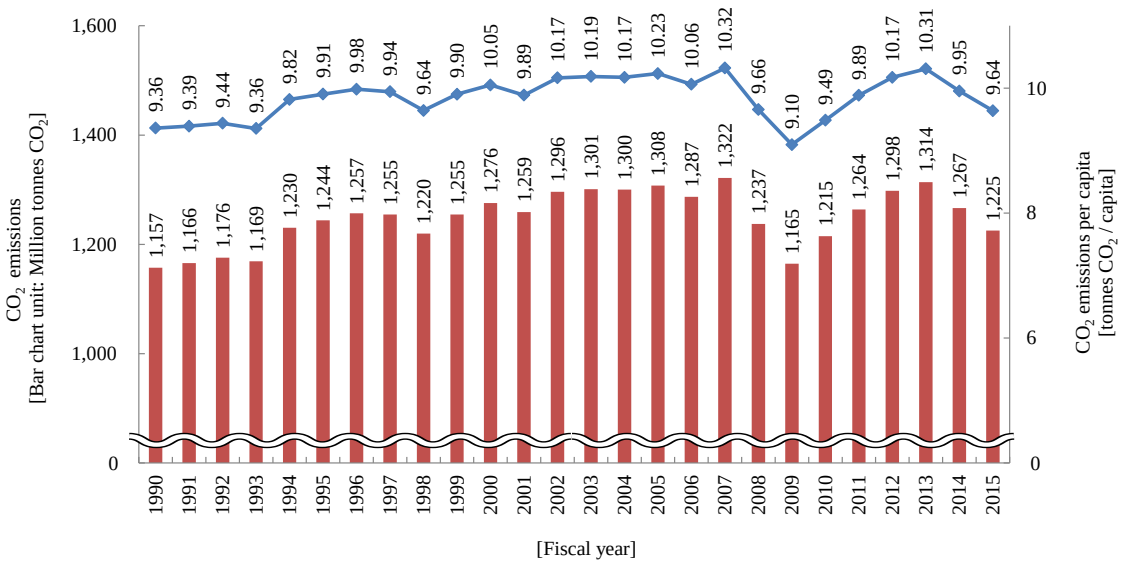


Figure 1-4 Trends in total CO_2 emissions and CO_2 emissions per capita

Source of population data: Ministry of Internal Affairs and Communications, Statistics Bureau, Population Census and Annual Report of Population Estimates

CO_2 emissions per unit of GDP (million yen) in FY2015 were 2.31 tonnes. They decreased by 14.0% since FY1990 and by 4.1% compared to the previous year.

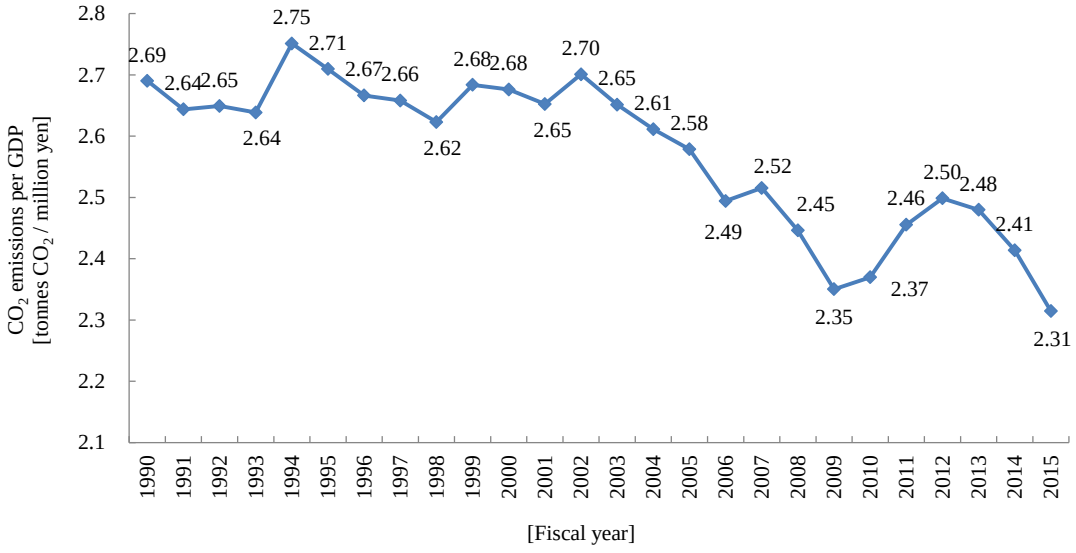


Figure 1-5 Trend in CO_2 emissions per unit of GDP

Source of GDP data: Cabinet Office, Government of Japan, Annual Report on National Accounts

1.1.3.2 CH_4

CH_4 emissions in FY2015 were 31.4 million tonnes (in CO_2 eq., including LULUCF), accounting for 2.4% of total GHG emissions. They decreased by 29.2% since FY1990, by 11.3% compared to FY2005 and by 2.5% compared to the previous year. Their decrease since FY1990 is mainly a result of a 58.3% decrease in emissions from the waste sector (solid waste disposal).

Breakdown of the FY2015 emissions shows that the largest source is rice cultivation accounting for 44%. It is followed

by enteric fermentation (23%) and solid waste disposal (10%).

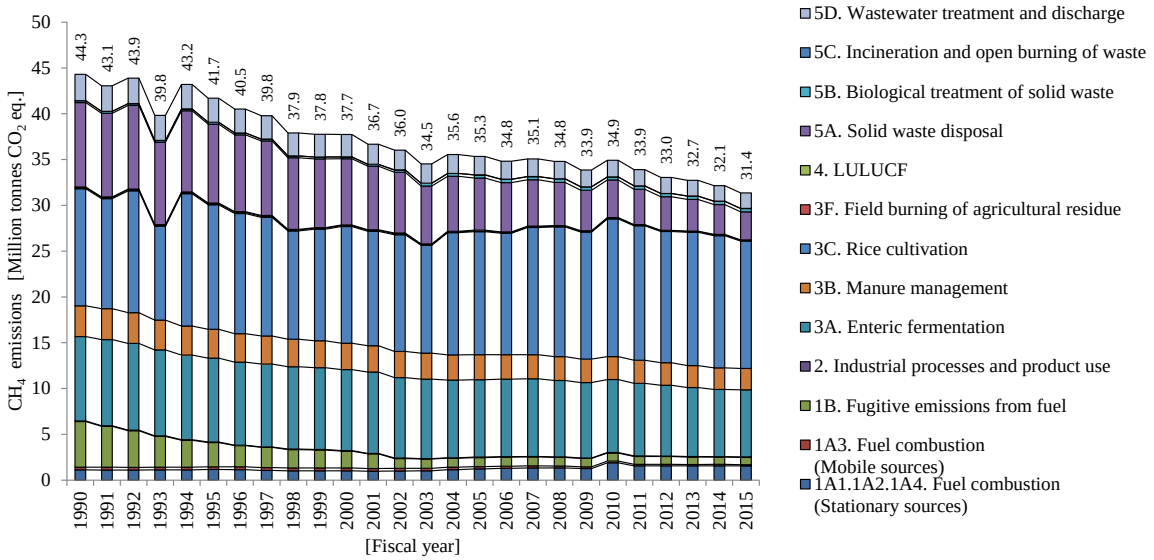


Figure 1-6 Trends in CH_4 emissions

Table 1-3 Trends in CH_4 emissions

[Thousand tonnes CO_2 eq.]

Category	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1A. Fuel combustion	1,419	1,460	1,336	1,480	1,524	1,557	1,534	1,451	2,071	1,720	1,729	1,707	1,713	1,691
1A1. Energy industries	431	403	256	221	218	275	316	313	348	370	397	324	306	286
1A2. Manufacturing industries and construction	441	437	427	522	569	576	551	546	600	480	495	510	540	539
1A3. Transport	291	309	312	248	233	219	200	187	178	170	164	156	148	143
1A4. Other sectors	255	311	342	489	505	487	467	405	944	700	672	717	719	723
1B. Fugitive emissions from fuels	4,973	2,647	1,836	976	982	975	947	916	885	867	851	816	806	788
1B1. Solid fuels	4,760	2,394	1,563	655	644	609	590	577	564	552	545	533	538	521
1B2. Oil and natural gas and other emissions	213	253	273	322	339	366	357	339	321	315	305	283	268	268
2. Industrial processes and product use	61	58	54	54	55	51	50	51	54	54	46	46	43	48
3. Agriculture	25,479	26,017	24,563	24,704	24,486	25,080	25,184	24,742	25,591	25,192	24,593	24,564	24,198	23,648
3A. Enteric fermentation	9,228	9,156	8,839	8,441	8,461	8,476	8,353	8,240	7,966	7,928	7,736	7,528	7,343	7,335
3B. Manure management	3,353	3,146	2,879	2,733	2,676	2,634	2,596	2,564	2,511	2,512	2,461	2,399	2,348	2,335
3C. Rice cultivation	12,771	13,605	12,749	13,445	13,266	13,890	14,157	13,863	15,041	14,680	14,325	14,565	14,437	13,908
3F. Field burning of agricultural residue	127	111	96	86	83	81	78	76	74	73	71	72	70	70
4. LULUCF	73	70	67	67	59	58	81	65	60	61	56	58	76	59
5. Waste	12,291	11,455	9,877	8,065	7,715	7,350	7,006	6,641	6,254	6,007	5,763	5,541	5,308	5,120
5A. Solid waste disposal	9,221	8,619	7,236	5,703	5,383	5,080	4,717	4,413	4,107	3,861	3,655	3,459	3,252	3,063
5B. Biological treatment of solid waste	195	191	194	340	350	337	380	377	329	362	359	356	355	356
5C. Incineration and open burning of waste	16	18	16	17	16	14	14	12	12	11	12	12	11	11
5D. Wastewater treatment and discharge	2,860	2,628	2,432	2,006	1,967	1,919	1,895	1,839	1,806	1,772	1,738	1,714	1,690	1,690
Total (including LULUCF)	44,296	41,708	37,733	35,346	34,821	35,072	34,800	33,868	34,915	33,901	33,038	32,733	32,145	31,354
Total (excluding LULUCF)	44,223	41,638	37,666	35,279	34,762	35,013	34,719	33,802	34,855	33,840	32,982	32,675	32,068	31,295

* LULUCF: Land Use, Land-Use Change and Forestry

1.1.3.3 N_2O

N_2O emissions in FY2015 were 21.0 million tonnes (in CO_2 eq., including LULUCF), accounting for 1.6% of total GHG emissions. They decreased by 33.8% since FY1990, by 16.1% compared to FY2005 and by 0.5% compared to the previous year. Their decrease since FY1990 is mainly a result of a 83.7% decrease in emissions from industrial processes and product use (e.g. adipic acid production in the chemical industry). There is a sharp decline in emissions from the industrial processes and product use from FY1998 to 1999, as N_2O abatement equipment came on stream in the adipic acid production plant in March 1999. However, the N_2O emissions increased in FY2000 because of a decrease in the removal efficiency due to the failure of the machine; the emissions decreased again in FY2001 with the resumption of normal operation.

Breakdown of the FY2015 emissions shows that the largest source is agricultural soils accounting for 26%. It is followed by fuel combustion (stationary sources) (22%) and manure management (19%).

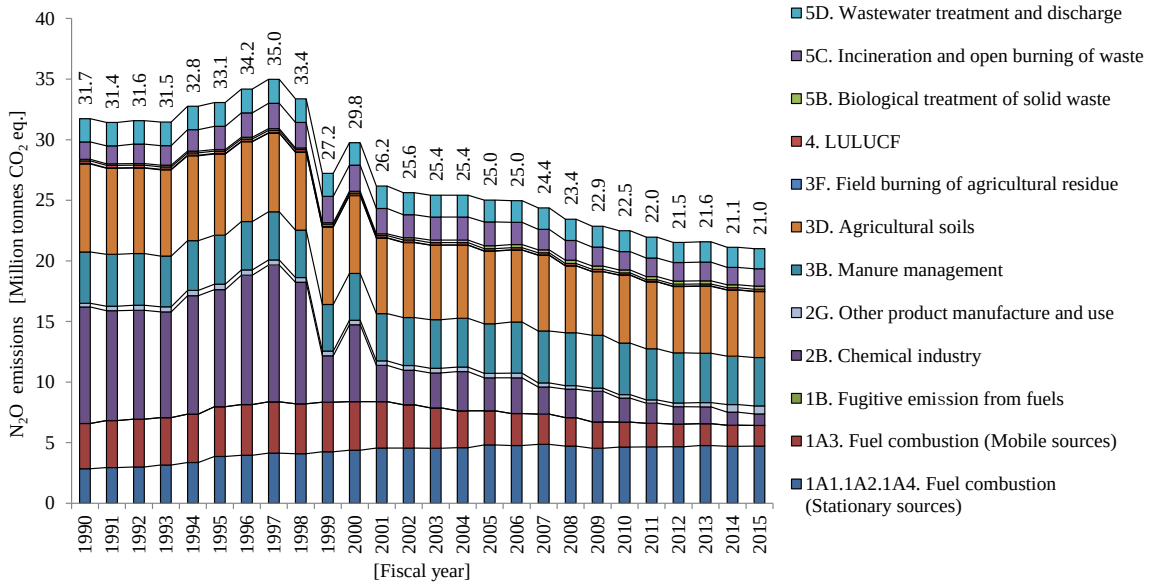


Figure 1-7 Trends in N_2O emissions

Table 1-4 Trends in N_2O emissions

[Thousand tonnes CO_2 eq.]

Category	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1A. Fuel combustion	6,580	7,962	8,375	7,622	7,401	7,358	7,059	6,714	6,685	6,599	6,536	6,561	6,431	6,421
1A1. Energy industries	1,197	1,737	2,056	2,442	2,425	2,489	2,442	2,356	2,374	2,559	2,574	2,620	2,554	2,565
1A2. Manufacturing industries and construction	1,394	1,816	1,991	2,009	1,997	2,042	1,967	1,851	1,875	1,815	1,837	1,873	1,865	1,884
1A3. Transport	3,739	4,104	3,997	2,817	2,637	2,499	2,348	2,186	2,051	1,948	1,871	1,801	1,743	1,716
1A4. Other sectors	249	304	331	354	343	328	302	321	386	277	254	267	269	256
1B. Fugitive emissions from fuels	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2. Industrial processes and product use	9,911	10,114	6,720	3,093	3,339	2,564	2,647	2,777	2,270	1,931	1,737	1,748	1,704	1,612
2B. Chemical industry	9,620	9,665	6,348	2,726	2,944	2,228	2,350	2,518	1,995	1,661	1,429	1,389	1,078	944
2G. Other product manufacture and use	291	449	371	368	395	336	297	259	275	270	308	359	627	668
3. Agriculture	11,548	10,782	10,318	10,113	10,172	10,569	9,902	9,636	9,892	9,754	9,639	9,621	9,475	9,460
3B. Manure management	4,249	4,038	3,867	4,093	4,206	4,282	4,358	4,369	4,264	4,215	4,130	4,062	4,001	3,985
3D. Agricultural soils	7,259	6,710	6,421	5,993	5,941	6,261	5,520	5,243	5,605	5,517	5,487	5,537	5,453	5,454
3F. Field burning of agricultural residue	39	34	30	26	26	25	24	23	23	22	22	22	22	22
4. LULUCF	209	200	189	180	177	175	174	171	169	169	167	168	171	170
5. Waste	3,479	4,003	4,149	4,001	3,884	3,700	3,655	3,562	3,471	3,502	3,439	3,471	3,335	3,337
5B. Biological treatment of solid waste	139	137	139	243	250	241	271	269	236	259	257	254	254	254
5C. Incineration and open burning of waste	1,435	1,905	2,155	1,963	1,843	1,694	1,629	1,571	1,517	1,524	1,528	1,542	1,433	1,434
5D. Wastewater treatment and discharge	1,905	1,961	1,855	1,795	1,791	1,765	1,754	1,722	1,719	1,718	1,654	1,675	1,648	1,648
Total (including LULUCF)	31,727	33,061	29,751	25,009	24,973	24,366	23,438	22,861	22,488	21,955	21,518	21,568	21,116	21,000
Total (excluding LULUCF)	31,518	32,861	29,561	24,829	24,796	24,191	23,264	22,690	22,318	21,786	21,351	21,400	20,945	20,830

* LULUCF: Land Use, Land-Use Change and Forestry

1.1.3.4 HFCs

HFCs emissions in CY2015[8] were 39.2 million tonnes (in CO_2 eq.), accounting for 3.0% of total GHG emissions. They increased by 146.1% since CY1990, by 206.7% compared to CY2005 and by 9.6% compared to the previous year. Their increase since CY1990 is mainly a result of an increase in emissions from refrigeration and air conditioning (+35.8 million tonnes CO_2 eq.) due to the substituting HCFC (an ozone-depleting substance), despite a decrease in emissions of HFC-23 -15.9 million tonnes CO_2 eq. produced as a by-product of HCFC-22 production due to regulation under the Act on the Protection of the Ozone Layer through the Control of Specified Substances and Other Measures (Act No. 53 of May 20, 1988).

Breakdown of the CY2015 emissions shows that the largest source is refrigerants of refrigeration and air conditioning equipment accounting for 91%. It is followed by foam blowing agents (6%).

[8] Emissions of HFCs, PFCs, SF_6, and NF_3 are estimated on a calendar year (CY) basis.

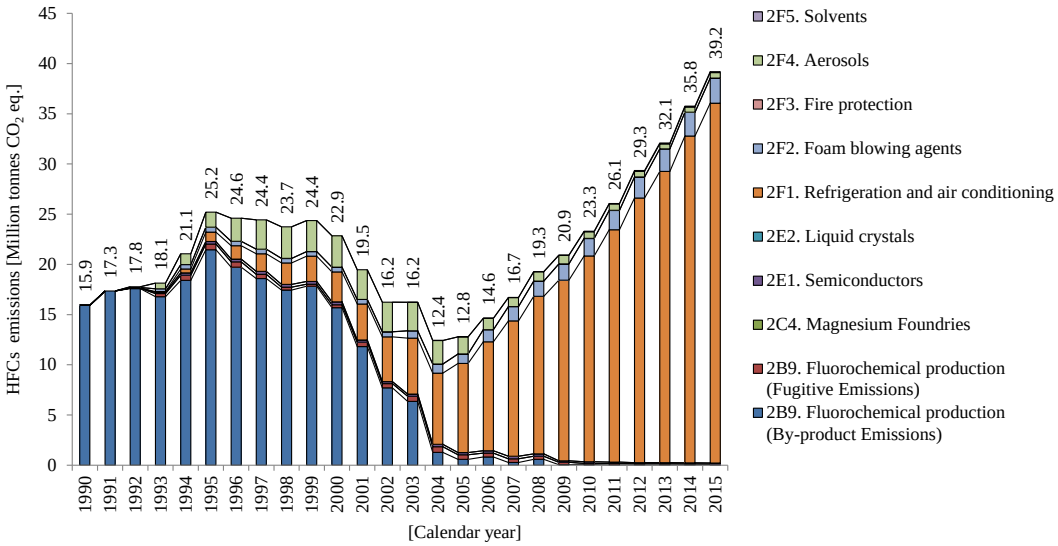


Figure 1-8 Trends in HFCs emissions

Table 1-5 Trends in HFCs emissions

[Thousand tonnes CO_2 eq.]

Category	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
2B9. Fluorochemical production	15,930	22,019	15,984	1,035	1,198	632	900	284	181	168	138	147	124	113
By-product Emissions	15,929	21,460	15,688	586	831	275	593	50	53	16	18	16	24	30
Fugitive Emissions	2	559	296	449	367	357	306	234	128	151	120	131	101	83
2C4. Magnesium production	NO	NO	NO	NO	NO	NO	NO	NO	NO	1	1	1	1	1
2E. Electronics industry	1	271	285	227	246	266	237	152	168	145	124	112	115	115
2E1. Semiconductors	1	271	283	224	243	263	234	150	165	142	122	109	113	113
2E2. Liquid crystals	0.001	0.3	2	3	3	3	3	2	3	3	2	2	2	2
2F. Product uses as substitutes for ODS	1	2,923	6,583	11,519	13,184	15,809	18,148	20,501	22,956	25,757	29,085	31,834	35,525	38,974
2F1. Refrigeration and air conditioning	NO	925	2,977	8,876	10,854	13,468	15,686	17,998	20,483	23,140	26,354	29,008	32,536	35,833
2F2. Foam blowing agents	1	497	484	937	1,194	1,429	1,510	1,608	1,749	1,923	2,081	2,229	2,373	2,484
2F3. Fire protection	NO	NO	5	7	7	8	8	8	8	8	9	9	9	9
2F4. Aerosols	NO	1,502	3,117	1,695	1,123	895	931	845	666	634	561	489	503	540
2F5. Solvents	NO	NO	NO	4	5	10	14	42	50	52	81	99	104	108
Total	15,932	25,213	22,852	12,782	14,627	16,707	19,285	20,937	23,305	26,071	29,349	32,095	35,766	39,203

1.1.3.5 PFCs

PFCs emissions in CY2015 were 3.3 million tonnes (in CO_2 eq.), accounting for 0.2% of total GHG emissions. They decreased by 49.4% since CY1990, by 61.6% compared to CY2005 and by 1.6% compared to the previous year. Their decrease since CY1990 is mainly a result of a decrease in emissions from the solvents (-66.7%).

Breakdown of the CY2015 emissions shows that the largest source is semiconductor manufacture accounting for 48%. It is followed by solvents such as those for washing metals (46%) and fugitive emissions from fluorochemical production (PFCs) (3%).

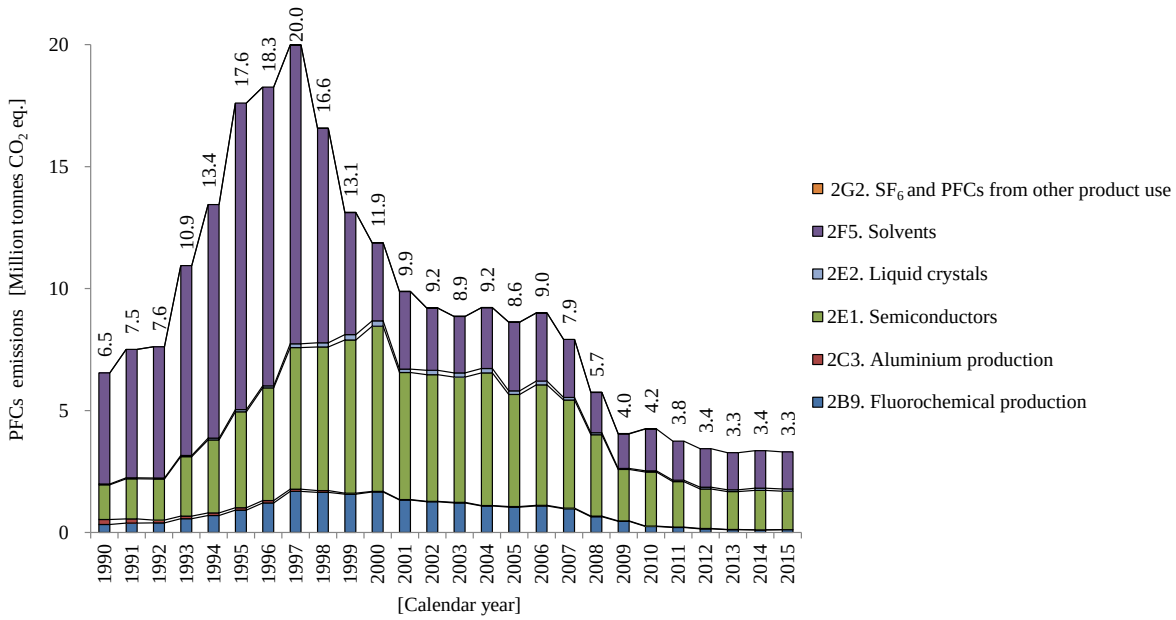


Figure 1-9 Trends in PFCs emissions

Table 1-6 Trends in PFCs emissions

[Thousand tonnes CO_2 eq.]

Category	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
2B9. Fluorochemical production	331	914	1,661	1,041	1,091	977	649	459	248	206	148	111	107	115
2C3. Aluminium production	204	104	26	22	22	22	22	16	15	15	13	10	2	0
2E. Electronics industry	1,455	4,020	6,986	4,746	5,092	4,540	3,422	2,148	2,261	1,922	1,692	1,631	1,707	1,669
2E1. Semiconductors	1,423	3,933	6,771	4,594	4,935	4,433	3,339	2,109	2,214	1,863	1,624	1,556	1,617	1,582
2E2. Liquid crystals	31	87	214	152	158	107	83	39	46	59	68	76	90	86
2F5. Solvents	4,550	12,572	3,200	2,815	2,793	2,377	1,648	1,420	1,721	1,605	1,583	1,518	1,537	1,517
2G2. SF_6 and PFCs from other product use	NO	NO	NO	0.3	0.6	1.4	2	3	4	6	NO	10	9	8
Total	6,539	17,610	11,873	8,623	8,999	7,917	5,743	4,047	4,250	3,755	3,436	3,280	3,361	3,308

1.1.3.6 SF_6

SF_6 emissions in CY2015 were 2.1 million tonnes (in CO_2 eq.), accounting for 0.2% of total GHG emissions. They decreased by 83.5% since CY1990, decreased by 58.0% compared to CY2005 and increased by 2.7% compared to the previous year. Their decrease since CY1990 is mainly a result of a decrease in electrical equipment, due to an enhancement of gas management system such as gas recovery largely in electric power companies (-92.5%).

Breakdown of the CY2015 emissions shows that the largest source is other product use (e.g. accelerator, etc.) accounting for 40%. It is followed by electrical equipment (29%) and magnesium production (11%).

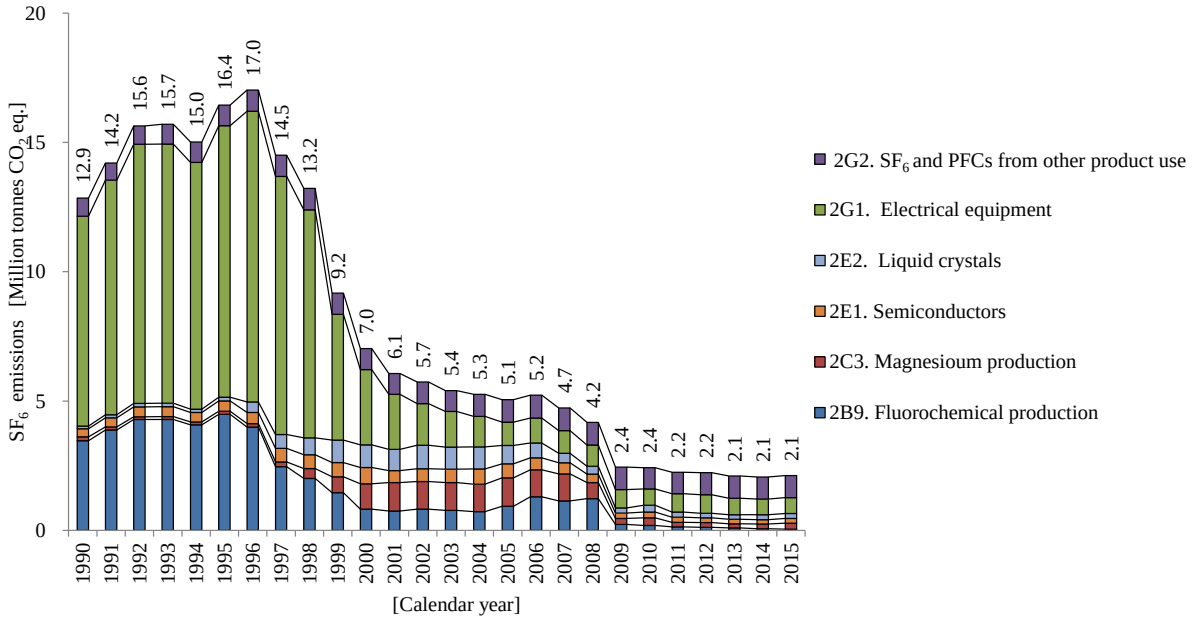


Figure 1-10 Trends in SF_6 emissions

Table 1-7 Trends in SF_6 emissions

[Thousand tonnes CO_2 eq.]

Category	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
2B9. Fluorochemical production	3,471	4,492	821	930	1,303	1,144	1,229	233	189	132	123	93	62	52
2C3. Magnesium production	147	114	980	1,104	1,041	1,039	622	228	294	182	182	160	182	228
2E. Electronics industry	419	542	1,506	1,252	1,036	796	625	410	494	394	356	351	366	375
2E1. Semiconductors	309	400	629	540	463	431	329	211	225	196	184	181	175	184
2E2. Liquid crystals	110	142	877	712	572	366	296	199	269	198	172	170	191	191
2G. Other product manufacture and use	8,814	11,300	3,724	1,767	1,849	1,754	1,701	1,576	1,447	1,539	1,573	1,498	1,455	1,466
2G1. Electrical equipment	8,112	10,498	2,910	899	967	880	828	711	622	707	719	643	602	610
2G2. SF_6 and PFCs from other product use	702	802	815	867	882	875	873	865	825	832	855	855	854	856
Total	12,850	16,448	7,031	5,053	5,229	4,733	4,177	2,447	2,424	2,248	2,235	2,102	2,065	2,122

1.1.3.7 NF_3

NF_3 emissions in CY2015 were 0.6 million tonnes (in CO_2 eq.), accounting for 0.04% of total GHG emissions. They increased by 1,651.1% since CY1990, decreased by 61.2% compared to CY2005 and decreased by 49.1% compared to the previous year. The increase since CY1990 is mainly a result of an increase in fugitives from fluorocarbon production (NF_3) (by 14,391.7% compared to CY1990).

Breakdown of the CY2015 emissions shows that the largest source is fluorochemical production accounting for 71%. It is followed by semiconductor manufacture (25%) and liquid crystal manufacture (4%).

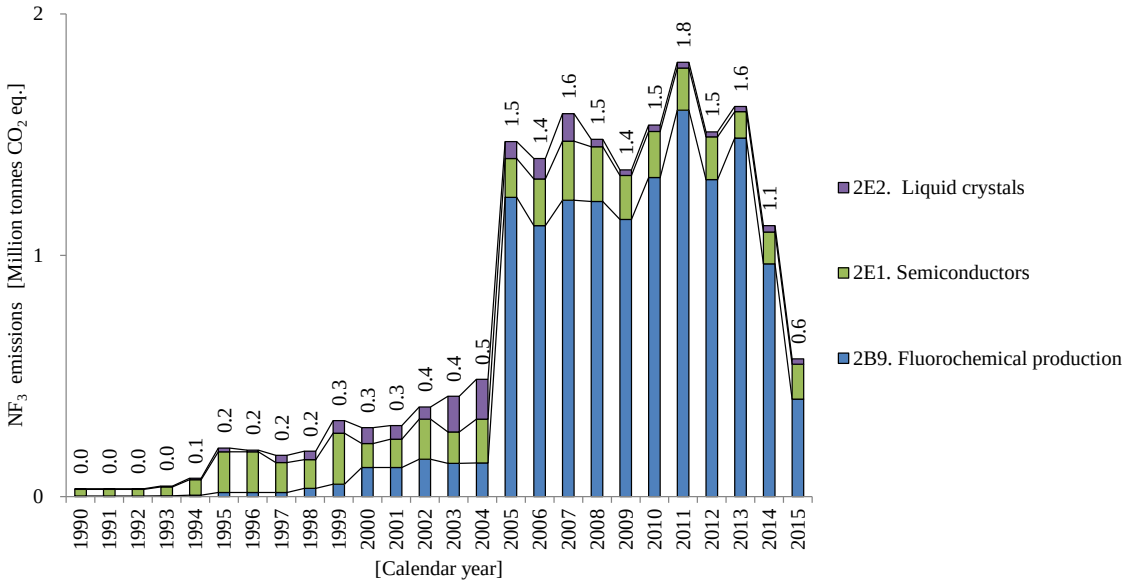


Figure 1-11 Trends in NF_3 emissions

Table 1-8 Trends in NF_3 emissions

[Thousand tonnes CO_2 eq.]

Category	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
2B9. Fluorochemical production	3	17	120	1,240	1,123	1,228	1,223	1,149	1,323	1,601	1,314	1,486	965	404
2E. Electronics industry	30	184	165	232	278	359	258	205	217	199	198	131	158	167
2E1. Semiconductors	27	168	100	161	193	245	227	182	191	175	177	110	132	145
2E2. Liquid crystals	3	16	66	71	85	114	31	23	26	24	21	21	26	22
Total	33	201	286	1,472	1,401	1,587	1,481	1,354	1,540	1,800	1,512	1,617	1,123	571

1.1.3.8 Indirect CO_2

Indirect CO_2[9] emissions in FY2015 were 2.1 million tonnes (in CO_2 eq.), accounting for 0.2% of total GHG emissions. They decreased by 59.4% since FY1990, decreased by 30.5% compared to FY2005 and increased by 1.9% compared to the previous year. Their decrease since FY1990 is due to the decrease in indirect CO_2 emissions derived from NMVOC from the use of paint by promoting the use of low VOC paint and VOC removing apparatus.

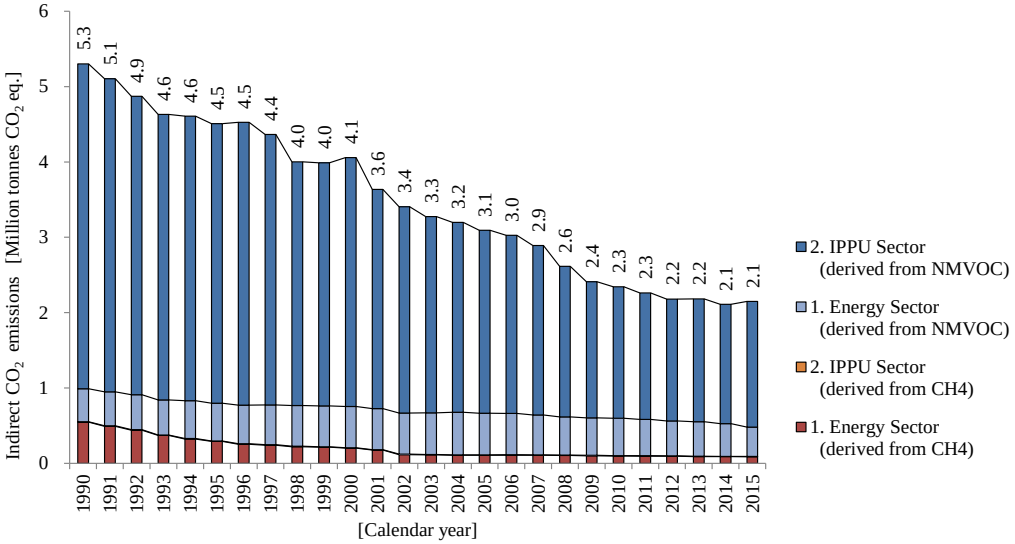


Figure 1-12 Trends in Indirect CO_2 emissions

[9] Emissions derived from combustion-origin and biomass-origin CO, CH_4, and NMVOC are excluded to avoid double counting and/or by concept of carbon neutrality.

Table 1-9 Trends in Indirect CO_2 emissions

[Thousand tonnes CO_2 eq.]

Emission Source	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Derived from CH_4	554	298	208	113	114	113	110	106	103	101	99	95	93	92
1. Energy Sector	547	291	202	107	108	107	104	101	97	95	94	90	89	87
2. IPPU Sector	7	6	6	6	6	6	5	6	6	6	5	5	5	5
Derived from NMVOC	4,747	4,210	3,850	2,979	2,911	2,777	2,506	2,304	2,240	2,160	2,082	2,088	2,017	2,058
1. Energy Sector	437	501	547	552	549	531	506	498	494	481	463	458	433	390
2. IPPU Sector	4,310	3,709	3,303	2,427	2,363	2,247	1,999	1,806	1,745	1,679	1,619	1,630	1,584	1,668
Total	5,301	4,508	4,058	3,092	3,025	2,890	2,615	2,410	2,343	2,261	2,181	2,183	2,111	2,150

1.1.4 Trends in GHG Emissions and Removals by Sectors

The breakdown of GHG emissions and removals in FY2015 by sector[10] shows that energy (excluding indirect CO_2, definition omitted below) accounts for 88.7% of total GHG emissions. It is followed by industrial processes and product use (excluding indirect CO_2, definition omitted below) (7.0%), agriculture (2.5%), waste (1.6%), and indirect CO_2 emissions (0.2%).

Removals by LULUCF in FY2015 were equivalent to 4.6% of total GHG emissions.

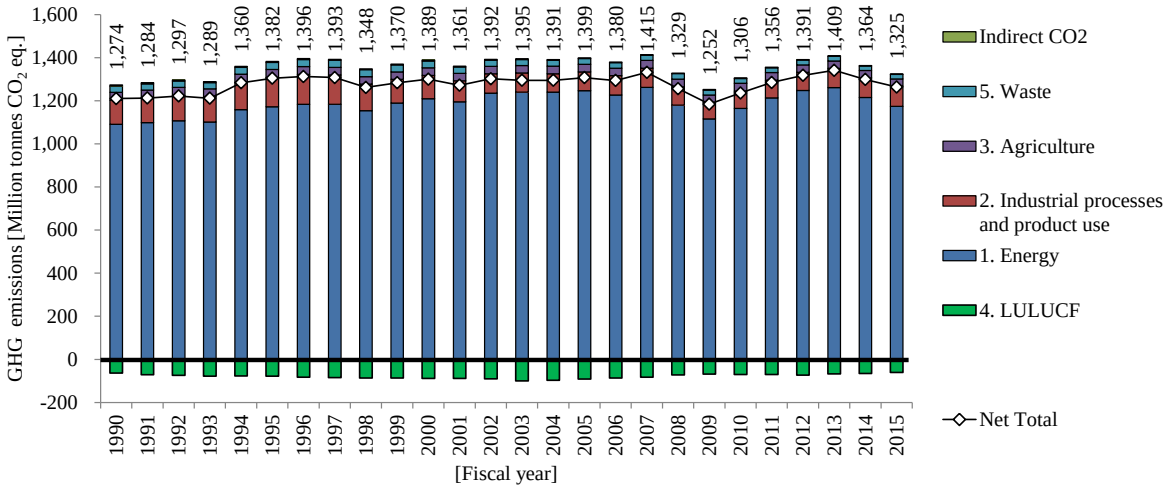


Figure 1-13 Trends in GHG emissions and removals by sector

[10] As indicated in the *2006 IPCC Guidelines* and the CRF.

Table 1-10 Trends in GHG emissions and removals by sector

[Million tonnes CO_2 eq.]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1. Energy*1	1,091.3	1,098.4	1,107.3	1,101.4	1,158.7	1,172.1	1,183.8	1,183.7	1,154.5	1,189.4
2. Industrial processes and product use*1	110.5	114.8	116.7	118.9	126.3	136.4	138.5	135.6	122.8	110.1
3. Agriculture	37.6	36.9	38.1	34.9	38.5	37.2	36.4	36.0	34.7	34.8
4. LULUCF*2	-63.5	-71.4	-74.6	-77.5	-76.7	-77.8	-82.9	-84.8	-86.2	-86.8
5. Waste	28.9	28.8	30.0	29.5	32.0	32.2	32.4	32.8	32.4	31.9
Indirect CO_2	5.3	5.1	4.9	4.6	4.6	4.5	4.5	4.4	4.0	4.0
Gross Total (excluding LULUCF, excluding indirect CO_2)	1,268.3	1,278.9	1,292.0	1,284.7	1,355.5	1,377.8	1,391.2	1,388.1	1,344.3	1,366.3
Net Total (including LULUCF, excluding indirect CO_2)	1,204.8	1,207.5	1,217.4	1,207.1	1,278.8	1,300.0	1,308.2	1,303.3	1,258.1	1,279.5
Gross Total (excluding LULUCF, including indirect CO_2)	1,273.6	1,284.0	1,296.9	1,289.3	1,360.1	1,382.3	1,395.7	1,392.5	1,348.4	1,370.3
Net Total (including LULUCF, including indirect CO_2)	1,210.1	1,212.6	1,222.3	1,211.8	1,283.4	1,304.5	1,312.7	1,307.7	1,262.2	1,283.5

[Million tonnes CO_2 eq.]	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1. Energy*1	1,209.9	1,195.5	1,235.0	1,240.6	1,240.1	1,247.1	1,227.0	1,262.4	1,180.3	1,115.6
2. Industrial processes and product use*1	108.2	97.2	90.2	88.8	85.6	86.7	89.5	88.7	84.2	76.8
3. Agriculture	35.3	34.9	35.1	34.0	35.2	35.2	35.0	36.1	35.5	34.8
4. LULUCF*2	-88.8	-88.8	-90.2	-100.1	-96.7	-91.5	-86.1	-82.7	-72.1	-67.9
5. Waste	31.7	29.8	28.7	28.4	27.5	26.7	25.4	24.7	25.9	22.8
Indirect CO_2	4.1	3.6	3.4	3.3	3.2	3.1	3.0	2.9	2.6	2.4
Gross Total (excluding LULUCF, excluding indirect CO_2)	1,385.0	1,357.3	1,389.0	1,391.7	1,388.3	1,395.7	1,376.9	1,411.9	1,326.0	1,250.0
Net Total (including LULUCF, excluding indirect CO_2)	1,296.2	1,268.5	1,298.8	1,291.6	1,291.6	1,304.2	1,290.8	1,329.1	1,253.9	1,182.0
Gross Total (excluding LULUCF, including indirect CO_2)	1,389.1	1,360.9	1,392.4	1,395.0	1,391.5	1,398.8	1,379.9	1,414.8	1,328.6	1,252.4
Net Total (including LULUCF, including indirect CO_2)	1,300.3	1,272.1	1,302.2	1,294.9	1,294.8	1,307.3	1,293.9	1,332.0	1,256.5	1,184.4

[Million tonnes CO_2 eq.]	2010	2011	2012	2013	2014	2015
1. Energy*1	1,164.9	1,213.9	1,247.4	1,261.2	1,215.0	1,174.6
2. Industrial processes and product use*1	80.2	82.1	84.6	88.9	91.5	93.0
3. Agriculture	35.9	35.4	34.8	34.8	34.2	33.7
4. LULUCF*2	-70.1	-70.7	-73.4	-67.5	-65.1	-60.9
5. Waste	22.8	22.0	22.2	21.9	21.2	21.2
Indirect CO_2	2.3	2.3	2.2	2.2	2.1	2.1
Gross Total (excluding LULUCF, excluding indirect CO_2)	1,303.7	1,353.3	1,389.0	1,406.9	1,361.9	1,322.6
Net Total (including LULUCF, excluding indirect CO_2)	1,233.6	1,282.6	1,315.6	1,339.4	1,296.8	1,261.6
Gross Total (excluding LULUCF, including indirect CO_2)	1,306.0	1,355.6	1,391.2	1,409.0	1,364.0	1,324.7
Net Total (including LULUCF, including indirect CO_2)	1,236.0	1,284.8	1,317.8	1,341.6	1,298.9	1,263.8

*1 Excluding indirect CO_2
*2 LULUCF: Land Use, Land-Use Change and Forestry

1.1.4.1 Energy

Emissions from the energy sector in FY2015 were 1,175 million tonnes (in CO_2 equivalents). They increased by 7.6% since FY1990, decreased by 5.8% compared to FY2005 and decreased by 3.3% compared to the previous year.

Breakdown of the FY2015 emissions shows that CO_2 from fuel combustion accounts for 99.2%. The largest source within fuel combustion[11] is solid fuel CO_2, which accounted for 38.5%, and is then followed by liquid fuel CO_2 (37.8%) and gaseous fuel CO_2 (21.5%).

[11] Fuel types are categorized in accordance with classification indicated in the *2006 IPCC Guidelines* and the CRF.

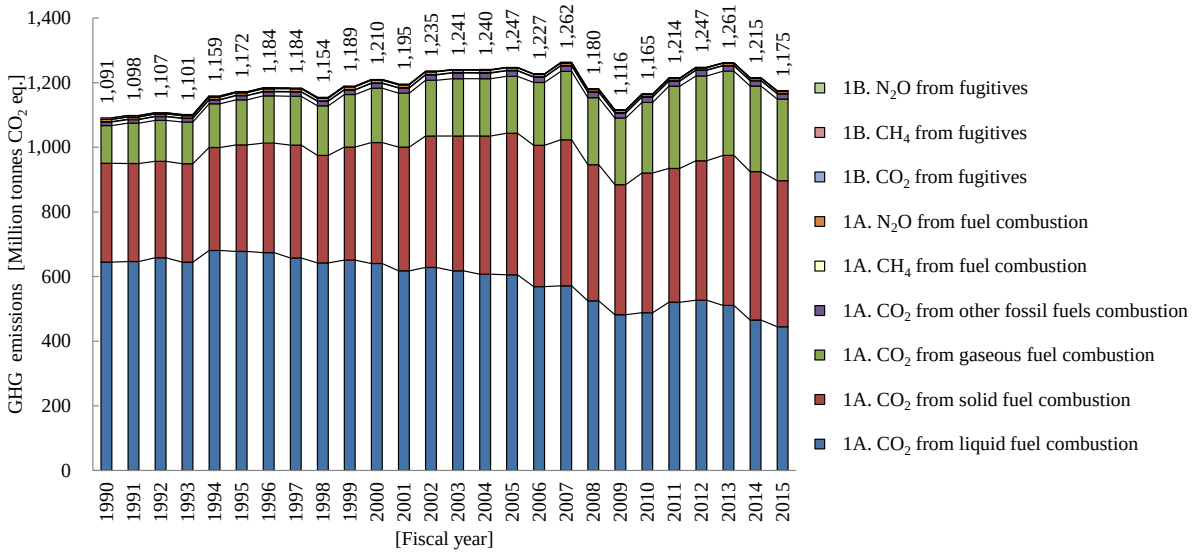


Figure 1-14 Trends in GHG emissions from the energy sector

Table 1-11 Trends in GHG emissions from the energy sector

[Thousand tonnes CO_2 eq.]

Source category	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1A. Fuel combustion	1,086,110	1,168,907	1,207,535	1,245,632	1,225,431	1,260,768	1,178,821	1,114,172	1,163,502	1,212,548	1,246,078	1,259,985	1,213,750	1,173,397
Liquid fuel CO_2	644,730	677,734	640,355	605,901	569,135	571,149	525,131	481,800	488,214	520,447	526,948	510,800	465,362	444,545
Solid fuel CO_2	305,968	329,370	374,429	437,445	437,076	451,963	420,978	402,354	432,060	414,290	431,427	464,277	459,230	451,918
Gaseous fuel CO_2	116,536	139,951	167,825	176,128	194,146	211,905	207,523	206,203	218,823	253,920	262,639	260,226	265,039	252,728
Other fossil fuels (Waste) CO_2	10,878	12,431	15,214	17,057	16,149	16,836	16,597	15,649	15,649	15,571	16,800	16,414	15,975	16,095
CH_4	1,419	1,460	1,336	1,480	1,524	1,557	1,534	1,451	2,071	1,720	1,729	1,707	1,713	1,691
N_2O	6,580	7,962	8,375	7,622	7,401	7,358	7,059	6,714	6,685	6,599	6,536	6,561	6,431	6,421
1B. Fugitive emissions from fuel	5,165	3,169	2,347	1,484	1,536	1,591	1,512	1,417	1,360	1,345	1,341	1,255	1,255	1,251
CO_2	192	521	512	508	553	616	565	501	475	477	490	438	449	462
CH_4	4,973	2,647	1,836	976	982	975	947	916	885	867	851	816	806	788
N_2O	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1C. CO_2 transport and storage	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
Total	1,091,275	1,172,076	1,209,882	1,247,116	1,226,967	1,262,359	1,180,333	1,115,589	1,164,862	1,213,893	1,247,419	1,261,239	1,215,005	1,174,648

1.1.4.2 Industrial Processes and Product Use

Emissions from the industrial processes and product use sector in FY2015 were 93.0 million tonnes (in CO_2 eq.). They decreased by 15.8% since FY1990, increased by 7.3% compared to FY2005 and increased by 1.7% compared to the previous year.

The breakdown of GHG emissions from this sector in FY2015 shows that the largest source is HFCs emissions from product uses as ODS substitutes accounting for 42%. It is followed by the mineral industry emissions such as CO_2 emissions from cement production (36%) and CO_2 emissions from the metal industry (6%).

Despite the increase in HFCs compare to FY1990, emissions from the industrial processes and product use sector decreased in the same period. The main driving factors for decrease are the decrease in emissions of HFC-23 produced as a by-product of HCFC-22 production due to regulation under the Act on the Protection of the Ozone Layer Through the Control of Specified Substances and Other Measures (chemical industry), the decrease in CO_2 emissions from cement production (mineral industry) as the clinker production declined, the decrease in N_2O emissions from adipic acid production (chemical industry) as the N_2O abatement equipment came on stream.

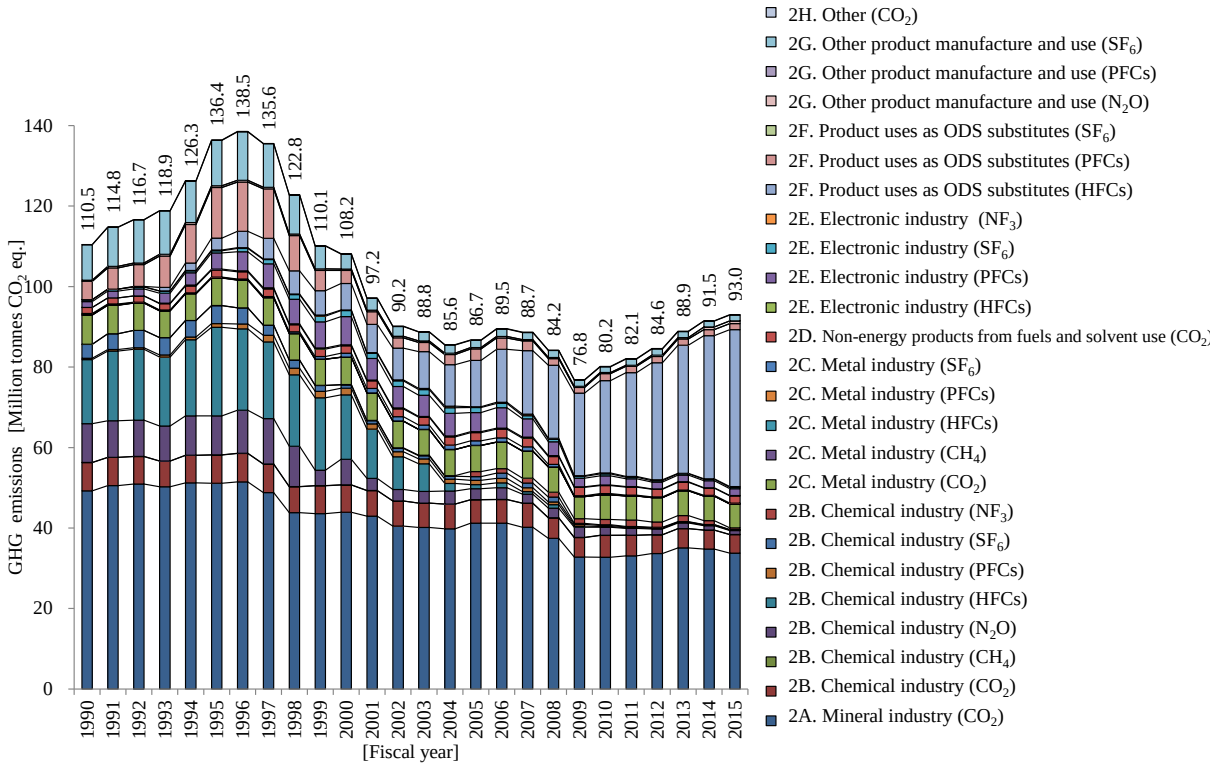


Figure 1-15 Trends in GHG emissions from the industrial processes sector

Table 1-12 Trends in GHG emissions from the industrial processes sector

Category	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
2A. Mineral industry (CO_2)	49,219	51,131	43,899	41,220	41,192	40,200	37,432	32,776	32,748	33,091	33,661	35,054	34,795	33,782
2B. Chemical industry	36,431	44,157	31,779	12,797	13,564	12,202	11,486	9,547	9,396	8,904	7,829	8,039	7,046	6,251
CO_2	7,039	7,013	6,810	5,791	5,871	5,962	5,103	4,869	5,423	5,100	4,648	4,784	4,685	4,591
CH_4	37	37	34	34	34	30	32	36	36	36	28	28	25	32
N_2O	9,620	9,665	6,348	2,726	2,944	2,228	2,350	2,518	1,995	1,661	1,429	1,389	1,078	944
HFCs	15,930	22,019	15,984	1,035	1,198	632	900	284	181	168	138	147	124	113
PFCs	331	914	1,661	1,041	1,091	977	649	459	248	206	148	111	107	115
SF_6	3,471	4,492	821	930	1,303	1,144	1,229	233	189	132	123	93	62	52
NF_3	3	17	120	1,240	1,123	1,228	1,223	1,149	1,323	1,601	1,314	1,486	965	404
2C. Metal industry	7,646	7,088	7,766	7,642	7,651	7,776	6,898	5,728	6,427	6,181	6,276	6,358	6,296	6,179
CO_2	7,273	6,850	6,740	6,496	6,568	6,695	6,237	5,468	6,101	5,965	6,061	6,170	6,093	5,934
CH_4	23	21	20	20	20	21	18	15	18	18	18	18	18	17
HFCs	NO	NO	NO	NO	NO	NO	NO	NO	NO	1	1	1	1	1
PFCs	204	104	26	22	22	22	22	16	15	15	13	10	2	0
SF_6	147	114	980	1,104	1,041	1,039	622	228	294	182	182	160	182	228
2D. Non-energy products from fuels and solvent use (CO_2)	1,531	1,709	1,822	2,047	2,175	2,149	1,949	2,051	1,968	1,995	1,842	1,944	1,781	1,765
2E. Electronic industry	1,904	5,016	8,941	6,457	6,652	5,960	4,542	2,916	3,140	2,661	2,370	2,225	2,346	2,326
HFCs	1	271	285	227	246	266	237	152	168	145	124	112	115	115
PFCs	1,455	4,020	6,986	4,746	5,092	4,540	3,422	2,148	2,261	1,922	1,692	1,631	1,707	1,669
SF_6	419	542	1,506	1,252	1,036	796	625	410	494	394	356	351	366	375
NF_3	30	184	165	232	278	359	258	205	217	199	198	131	158	167
2F. Product uses as ODS substitutes	4,551	15,496	9,783	14,334	15,977	18,187	19,796	21,922	24,677	27,363	30,668	33,352	37,062	40,491
HFCs	1	2,923	6,583	11,519	13,184	15,809	18,148	20,501	22,956	25,757	29,085	31,834	35,525	38,974
PFCs	4,550	12,572	3,200	2,815	2,793	2,377	1,648	1,420	1,721	1,605	1,583	1,518	1,537	1,517
SF_6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2G. Other product manufacture and use	9,105	11,749	4,096	2,135	2,245	2,091	2,001	1,838	1,727	1,815	1,881	1,867	2,091	2,142
N_2O	291	449	371	368	395	336	297	259	275	270	308	359	627	668
PFCs	NO	NO	NO	0.3	1	1	2	3	4	6	NO	10	9	8
SF_6	8,814	11,300	3,724	1,767	1,849	1,754	1,701	1,576	1,447	1,539	1,573	1,498	1,455	1,466
2H. Other (CO_2)	64	72	87	90	88	86	72	71	76	76	76	82	80	83
Total	110,451	136,418	108,174	86,721	89,543	88,652	84,177	76,848	80,158	82,087	84,602	88,922	91,497	93,020

1.1.4.3 Agriculture

Emissions from the agriculture sector in FY2015 were 33.7 million tonnes (in CO_2 eq.). They decreased by 10.5% since FY1990, by 4.4% compared to FY2005 and by 1.7% compared to the previous year.

Breakdown of the FY2015 emissions from this sector shows that the largest source is CH_4 emissions from rice

cultivation accounting for 41%. It is followed CH_4 emissions from enteric fermentation (22%), and N_2O emissions from the agricultural soils (16%) as a result of the nitrogen-based fertilizer applications.

The main driving factor for the decrease in emissions since FY1990 is the decrease in CH_4 emissions from enteric fermentation due to the decrease in the number of cattle, and the decrease in N_2O emissions from the agricultural soils, because the amount of nitrogen fertilizers applied and organic fertilizers from livestock manure applied had decreased.

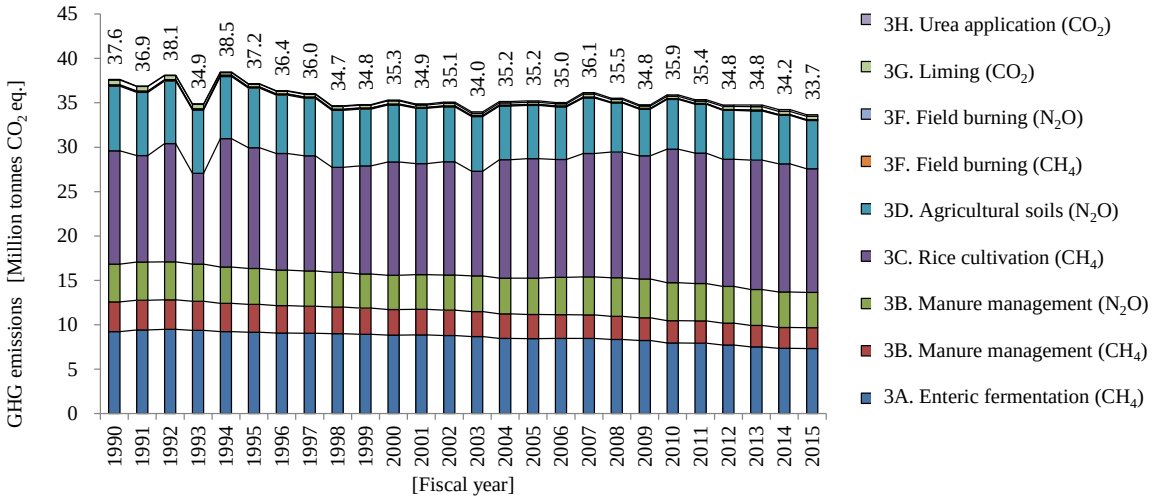


Figure 1-16 Trends in GHG emissions from the agriculture sector

Table 1-13 Trends in GHG emissions from the agriculture sector

[Thousand tonnes CO_2 eq.]

Category	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
3A. Enteric fermentation (CH_4)	9,228	9,156	8,839	8,441	8,461	8,476	8,353	8,240	7,966	7,928	7,736	7,528	7,343	7,335
3B. Manure management	7,602	7,183	6,746	6,826	6,881	6,916	6,955	6,934	6,774	6,726	6,592	6,461	6,349	6,319
CH_4	3,353	3,146	2,879	2,733	2,676	2,634	2,596	2,564	2,511	2,512	2,461	2,399	2,348	2,335
N_2O	4,249	4,038	3,867	4,093	4,206	4,282	4,358	4,369	4,264	4,215	4,130	4,062	4,001	3,985
3C. Rice cultivation (CH_4)	12,771	13,605	12,749	13,445	13,266	13,890	14,157	13,863	15,041	14,680	14,325	14,565	14,437	13,908
3D. Agricultural soils (N_2O)	7,259	6,710	6,421	5,993	5,941	6,261	5,520	5,243	5,605	5,517	5,487	5,537	5,453	5,454
3F. Field burning of agricultural residues	166	145	126	112	109	106	102	99	96	95	93	94	92	92
CH_4	127	111	96	86	83	81	78	76	74	73	71	72	70	70
N_2O	39	34	30	26	26	25	24	23	23	22	22	22	22	22
3G. Liming (CO_2)	550	304	333	231	230	325	306	270	243	247	370	380	370	370
3H. Urea application (CO_2)	59	56	110	179	153	175	134	120	160	168	150	198	189	189
Total	37,636	37,158	35,323	35,227	35,042	36,149	35,526	34,768	35,886	35,360	34,752	34,763	34,233	33,667

1.1.4.4 Land Use, Land Use Change and Forestry (LULUCF)

Net removals (including CO_2, CH_4 and N_2O emissions) from the LULUCF sector in FY2015 were 60.9 million tonnes (in CO_2 eq.). They decreased by 4.0% since FY1990, by 33.4% compared to FY2005 and by 6.4% compared to the previous year. The declining trend in removals in recent years is largely due to the maturity of Japanese forests. The emissions from cropland and settlements have decreased since FY1990, because the land-use conversions to those land-use categories decreased due to economic depression and the decline of agriculture.

Breakdown of the FY2015 emissions and removals from this sector shows that the largest sink was removals in forest land accounting for 63.1 million tonnes, 104% of this sector's net total emissions/removals.

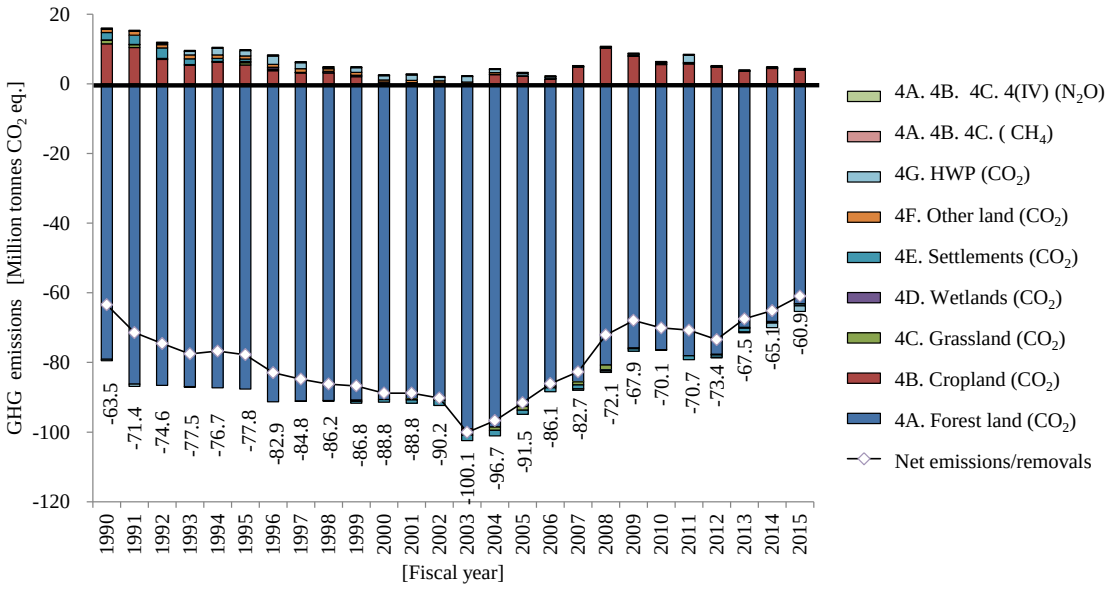


Figure 1-17 Trends in GHG emissions and removals from the LULUCF sector

Table 1-14 Trends in GHG emissions and removals from the LULUCF sector

[Thousand tonnes CO_2 eq.]

Category	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
4A. Forest land	-78,942	-87,480	-90,511	-92,531	-86,688	-85,425	-80,606	-75,732	-76,245	-77,980	-77,547	-69,837	-68,103	-62,953
CO_2	-79,074	-87,612	-90,642	-92,665	-86,813	-85,550	-80,756	-75,865	-76,372	-78,108	-77,671	-69,964	-68,252	-63,085
CH_4	10	10	9	11	3	2	26	10	5	6	2	4	23	6
N_2O	122	122	122	123	122	122	124	122	122	122	122	123.0	125.7	125.5
4B. Cropland	11,599	5,521	199	2,344	1,476	4,896	10,349	7,973	5,621	5,819	4,901	3,677	4,506	4,046
CO_2	11,506	5,437	123	2,275	1,409	4,830	10,285	7,909	5,559	5,757	4,840	3,616	4,446	3,986
CH_4	61	57	55	54	54	53	53	53	53	52	52	52	51	51
N_2O	33	27	20	15	14	13	12	11	10	10	9	9	9	9
4C. Grassland	1,032	683	43	-1,021	-491	-926	-1,329	-233	-139	201	-179	-191	-81	-122
CO_2	1,028	679	39	-1,026	-495	-931	-1,333	-237	-143	197	-183	-195	-85	-126
CH_4	2	2	2	2	2	2	2	2	2	2	2	2	2	2
N_2O	2	2	2	2	2	2	2	2	2	2	2	2	2	2
4D. Wetlands	79	311	370	42	35	47	53	72	67	48	39	43	41	52
CO_2	79	311	370	42	35	47	53	72	67	48	39	43	41	52
CH_4	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO
N_2O	,NA,NE,NO	,NA,NE,NO	,NA,NE,NO	,NA,NE,NO	,NA,NE,NO	,NA,NE,NO	,NA,NE,NO	,NA,NE,NO	,NA,NE,NO	,NA,NE,NO	,NA,NE,NO	,NA,NE,NO	,NA,NE,NO	,NA,NE,NO
4E. Settlements	2,133	739	-772	-1,207	-1,104	-1,101	-355	-702	231	-1,118	-703	-1,085	-355	-557
CO_2	2,133	739	-772	-1,207	-1,104	-1,101	-355	-702	231	-1,118	-703	-1,085	-355	-557
CH_4	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
N_2O	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO
4F. Other land	1,039	859	621	173	147	172	196	203	234	165	155	138	161	162
CO_2	1,028	849	612	166	141	166	190	198	230	161	151	134	157	159
CH_4	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
N_2O	11	10	9	7	6	6	6	5	5	4	4	4	3	3
4G. HWP (CO_2)	-436	1,548	1,205	620	506	-408	-441	457	108	2,098	-126	-253	-1,314	-1,598
4H. Other (CO_2)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4(IV) Indirect N_2O	41	39	36	33	33	32	32	31	31	31	31	31	31	31
Total	-63,455	-77,780	-88,809	-91,548	-86,085	-82,713	-72,102	-67,932	-70,091	-70,736	-73,431	-67,477	-65,114	-60,940

1.1.4.5 Waste

Emissions from the waste sector in FY2015 were 21.2 million tonnes (in CO_2 eq.). They decreased by 26.5% since FY1990, decreased by 20.4% compared to FY2005 and increased by 0.2% compared to the previous year.

Breakdown of the FY2015 emissions from this sector shows that the largest source is CO_2 emissions from waste incineration, associated with waste derived from fossil fuels such as waste plastic and waste oil, accounting for 57%. It is followed by CH_4 emissions from solid waste disposal (14%) and CH_4 emissions from wastewater treatment and discharge (8%).

The main driving factor for the decrease in emissions since FY1990 is the decrease in CH_4 emissions from solid waste

disposal on land as a result of a decrease in the amount of disposal of biodegradable waste due to improvement of volume reduction ratio by intermediate treatment under Waste Management and Public Cleansing Act (Act No.137 of 1970), Basic Law for Establishing the Recycling-based Society (Act No.110 of June 2, 2000), and other recycling laws.

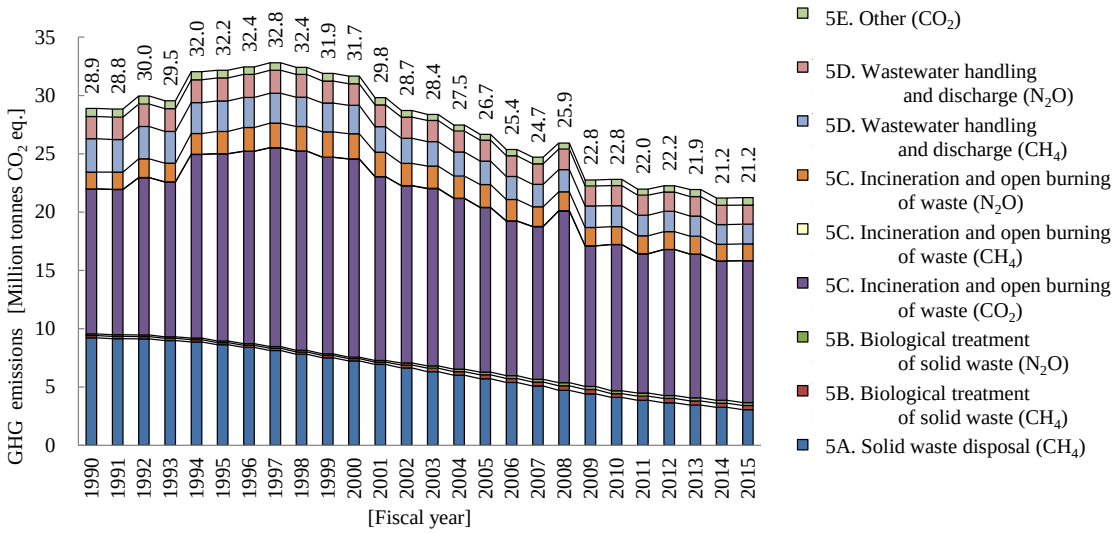


Figure 1-18 Trends in GHG emissions from the waste sector

Table 1-15 Trends in GHG emissions from the waste sector

[Thousand tonnes CO_2 eq.]

Category	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
5A. Solid waste disposal (CH_4)	9,221	8,619	7,236	5,703	5,383	5,080	4,717	4,413	4,107	3,861	3,655	3,459	3,252	3,063
5B. Biological treatment of solid waste	334	328	333	582	600	579	651	646	565	621	616	610	609	610
CH_4	195	191	194	340	350	337	380	377	329	362	359	356	355	356
N_2O	139	137	139	243	250	241	271	269	236	259	257	254	254	254
5C. Incineration and open burning of waste	13,876	17,963	19,157	16,074	15,100	14,799	16,376	13,623	14,072	13,480	14,057	13,868	13,379	13,596
CO_2	12,424	16,041	16,986	14,094	13,241	13,091	14,734	12,040	12,544	11,944	12,517	12,314	11,936	12,151
CH_4	16	18	16	17	16	14	14	12	12	11	12	12	11	11
N_2O	1,435	1,905	2,155	1,963	1,843	1,694	1,629	1,571	1,517	1,524	1,528	1,542	1,433	1,434
5D. Wastewater treatment and discharge	4,764	4,589	4,287	3,800	3,757	3,683	3,649	3,562	3,525	3,491	3,392	3,388	3,338	3,338
CH_4	2,860	2,628	2,432	2,006	1,967	1,919	1,895	1,839	1,806	1,772	1,738	1,714	1,690	1,690
N_2O	1,905	1,961	1,855	1,795	1,791	1,765	1,754	1,722	1,719	1,718	1,654	1,675	1,648	1,648
5E. Other (CO_2)	703	668	656	507	522	561	530	514	527	524	528	605	617	625
Total	28,897	32,167	31,668	26,667	25,362	24,702	25,924	22,757	22,796	21,977	22,248	21,931	21,196	21,232

1.1.5 Factor Analysis of Trend of Energy-related CO_2[12] Emissions

Since about 90% of Japan's greenhouse gas emissions are CO_2 from fuel combustion (energy-related CO_2), changes in energy-related CO_2 emissions have a major impact on total GHG emissions. Japan conducted a factor analysis of the trend of energy-related CO_2 regarding the contribution of each factor to changes in emissions and utilize it for planning and implementation of mitigation policies and measures.

Specifically, CO_2 emissions could be basically divided into three factors, "Factor of carbon intensity", "Factor of energy intensity" and "Factor of activity". Emissions are shown as the product of several factors in each sector and changes in emissions caused by changes of each factor are calculated in a quantitative manner. Energy-related CO_2 emissions by sector (excluding the energy transformation sector) used in this analysis are CO_2 emissions with electricity and heat allocated to each end-use sector in line with domestic measures, so it is not consistent with emissions by sector in GHG Inventory and BR submitted to the UNFCCC. CO_2 emissions with electricity and heat allocated to each end-use sector are shown in Table 1-16.

[12] It is defined as CO_2 emissions from fossil fuel combustion, except for CO_2 emissions from oxidation of lubricants CO_2 emissions, waste burnt for energy and CO_2 recovery by CCS in accordance with the domestic definition of .energy-related CO_2.

This section shows the summary of results of factor analysis of energy-related CO_2 for the period from FY2005 to FY2015.

Table 1-16 Energy-related CO_2 emissions with electricity and heat allocated by sector

	FY1990 emissions [Share]	FY2005 emissions [Share]	FY2013 emissions [Share]	FY2014 emissions [Share]	FY2015			
					Emissons [Share]	(Comapred to FY2005)	(Comapred to FY2013)	(Comapred to FY2014)
Total	1,067 [100%]	1,219 [100%]	1,235 [100%]	1,189 [100%]	1,149 [100%]	-5.7%	-7.0%	-3.4%
Industries (factories, etc.)	502 [47.0%]	457 [37.5%]	432 [35.0%]	424 [35.7%]	411 [35.8%]	-10.0%	-4.8%	-3.1%
Transport (cars, etc.)	206 [19.3%]	240 [19.7%]	225 [18.2%]	217 [18.3%]	213 [18.6%]	-11.0%	-5.0%	-1.7%
Commercial and other (commerce, service, office, etc.)	137 [12.8%]	239 [19.6%]	278 [22.5%]	274 [23.0%]	265 [23.1%]	-11.1%	-4.6%	-3.1%
Residential	131 [12.2%]	180 [14.8%]	201 [16.3%]	189 [15.9%]	179 [15.6%]	-0.2%	-10.9%	-5.1%
Energy transformation (power plnats, etc.)	91.1 [8.5%]	104 [8.5%]	98.9 [8.0%]	85 [7.1%]	79.5 [6.9%]	-23.3%	-19.5%	-6.4%

(Unit Mt-CO_2)

1.1.5.1 Total Energy-related CO_2 Emissions

Energy-related CO_2 emissions in FY2015 were 1,149 million t-CO_2, which decreased by 5.7% compared to FY2005 and by 3.4% compared to the previous year.

The largest decrease factor from FY2005 is “Factor of Energy intensity” due to energy saving activities, followed by “Factor of Population” by the variability of the population. On the other hand, the largest increase factor is “Factor of Carbon intensity” due to the increase of CO_2 emission factor by changing energy mix, followed by “Per unit of GDP factor” by economic development. Particularly after FY2011, the temporary suspension of all nuclear power plants in Japan due to Fukushima Daiichi nuclear power plant accident caused by the Great East Japan Earthquake on March 11th, 2011, leads to the increase in fired power generation and the increase of “Factor of Carbon intensity”. However, energy intensity per unit of GDP improves due to the conversion of industrial structure and energy and power saving activities.

The formula for factor analysis of energy-related CO_2 emissions is shown in Figure 1-19. Please refer to “(Reference) Factor analysis of energy-related CO_2 emissions (Japanese only)”[13] for the formula for factor analysis from Figure 1-22 to Figure 1-28.

$$CO_2 \text{ emissions} = \frac{CO_2 \text{ emissions}}{\text{Energy consumption}} \times \frac{\text{Energy consumption}}{GDP} \times \frac{GDP}{\text{population}} \times \text{population}$$

Factor of Carbon intensity | Factor of Energy intensity | Factor of GDP per capita | Factor of population

Figure 1-19 Formula for Factor analysis of energy-related CO_2 emissions

[13] http://www.env.go.jp/earth/ondanka/ghg-mrv/emissions/results/index.html

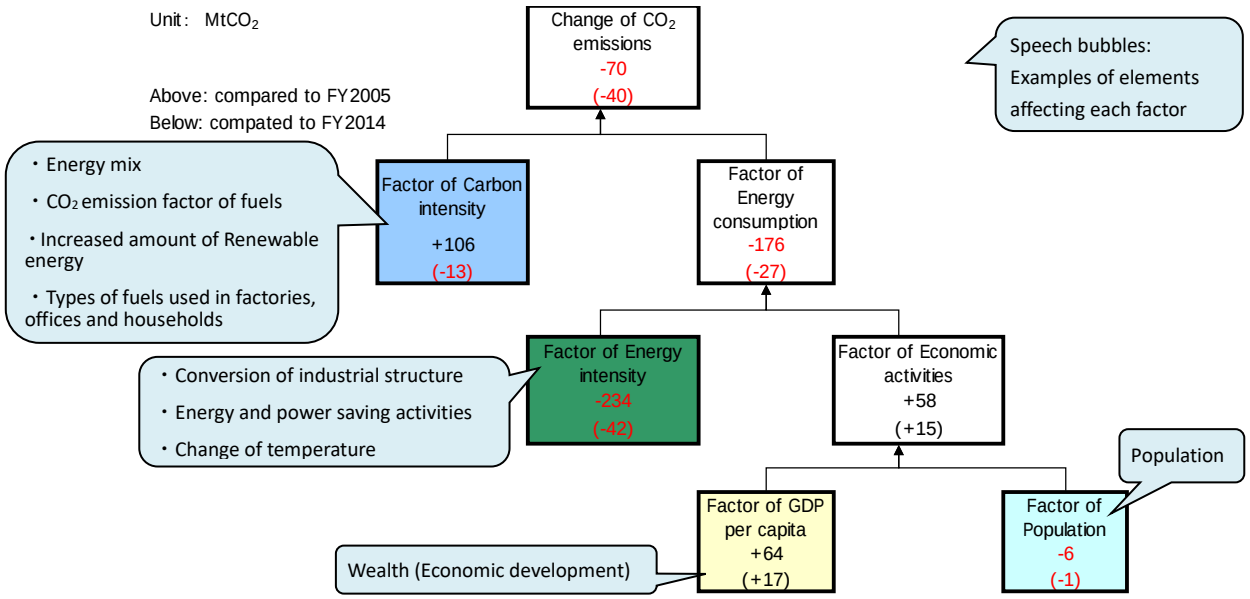


Figure 1-20 Factor of change of energy-related CO_2 emissions in FY2015

Trends in an increase or decrease factors from the previous year are shown in Figure 1-21. The largest decrease factor in energy-related CO_2 emissions from FY2014 to FY2015 was “Factor of Energy intensity” due to the reduction of energy consumption such as saving electricity, followed by “Factor of Carbon intensity” due to changes in CO_2 emission factor. On the other hand, the largest increase factor is “Factor of GDP per capita” due to the vitalization of production activities.

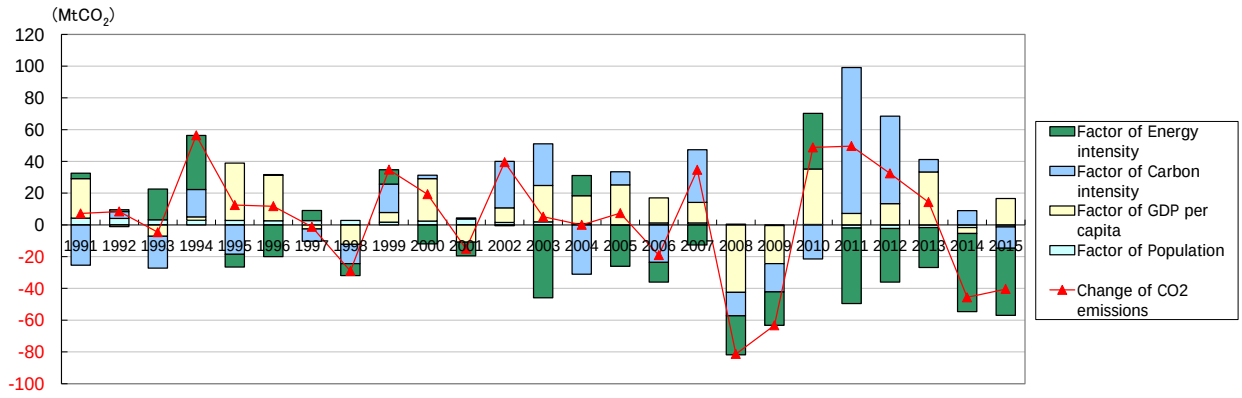


Figure 1-21 Trends of Factor of change of energy-related CO_2 emissions

1.1.5.2 Energy Transformation Sector (Power Generation)

CO_2 emissions (without electricity and heat allocated) in energy transformation sector in FY2015 were 480million tonnes. They increased by 14.7% compared to FY2005 and decreased by 4.9% compared to the previous year. Since emissions from power generation accounted for 90% of the emissions, the result of factor analysis for public electricity sector is shown below.

The largest increase factor from FY2005 is “Factor of Energy mix” due to the increase of the share of fossil fuel power generation in total power generation caused by the decrease of the operating rate of nuclear plants. The largest decrease factor is “Factor of Power generation amount” due to the decrease of the power generation amount, followed by “Factor of Power generation efficiency by power generation type” due to the improvement of power generation efficiency and “Factor of Fuel mix” due to the change in types fuel consumed for power generation.

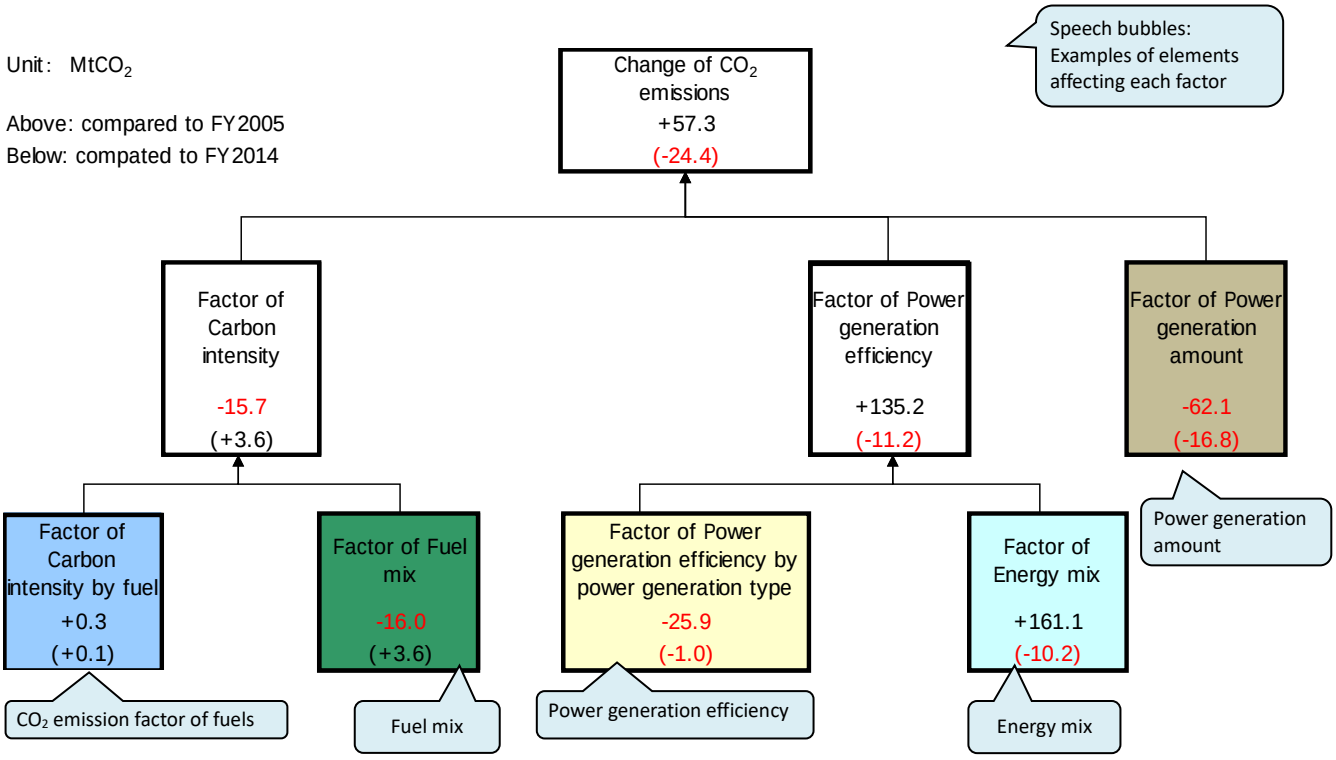


Figure 1-22 Factor of change of CO_2 emissions from Energy transformation sector (Power generation) in FY2015

1.1.5.3 Industrial Sector

(1) Manufacturing Industry

CO_2 emissions in the manufacturing industries sector in FY2015 were 394 million tonnes. They decreased by 10.5% compared to FY2005 and by 3.3% compared to the previous year.

The largest decrease factor from FY2005 is "Factor of Economic activity" due to the decrease of production activities, followed by "Factor of Energy intensity" due to the expansion of energy and power saving activities in factories and "Factor of Industrial structure" due to the structural change of manufacturing. The largest increase factor is "Factor of Carbon intensity (Purchased Electricity)" due to the change of energy mix.

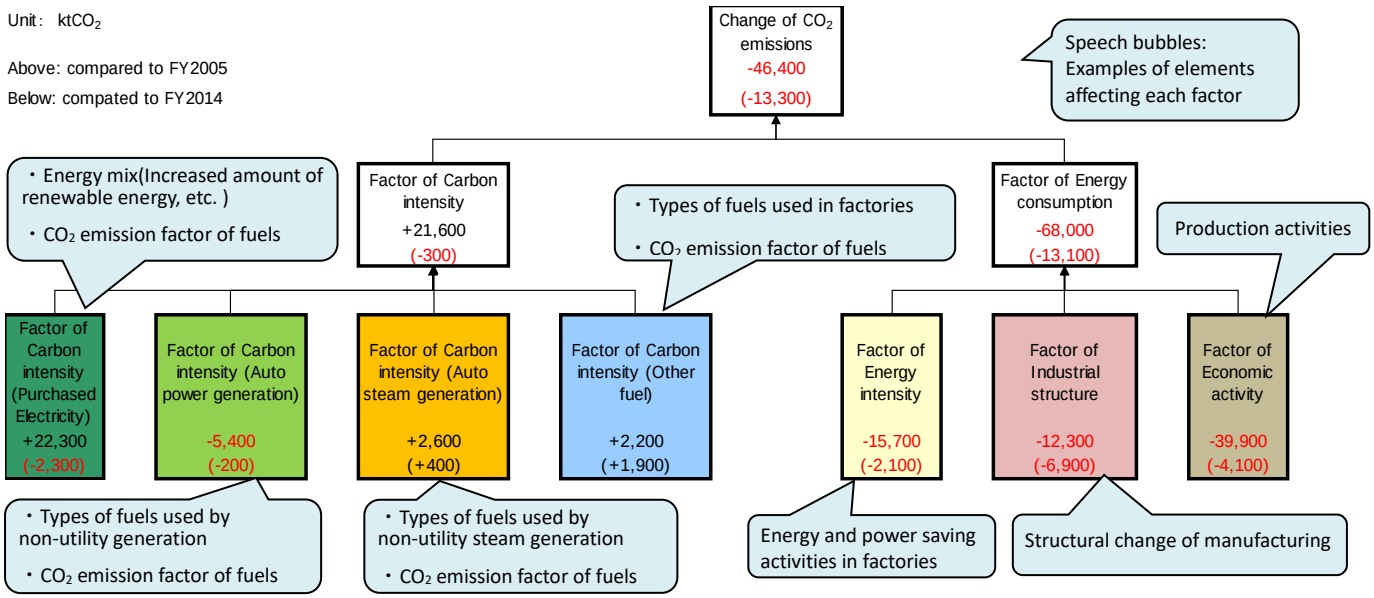


Figure 1-23 Factor of change of CO_2 emissions from Manufacturing sector in FY2015

(2) Non-manufacturing Industry

CO_2 emissions in the non-manufacturing industries sector in FY2015 were 17 million tonnes. They increased by 4.0% compared to FY2005 and 2.1% compared to the previous year.

The largest increase factor from FY2005 is "Factor of Energy intensity" due to the expansion of energy and power saving activities in factories, followed by "Factor of Carbon intensity (Electricity)" due to the change of energy mix. On the other hand, the decrease factor is "Factor of Economic activity" due to the decrease of production activities.

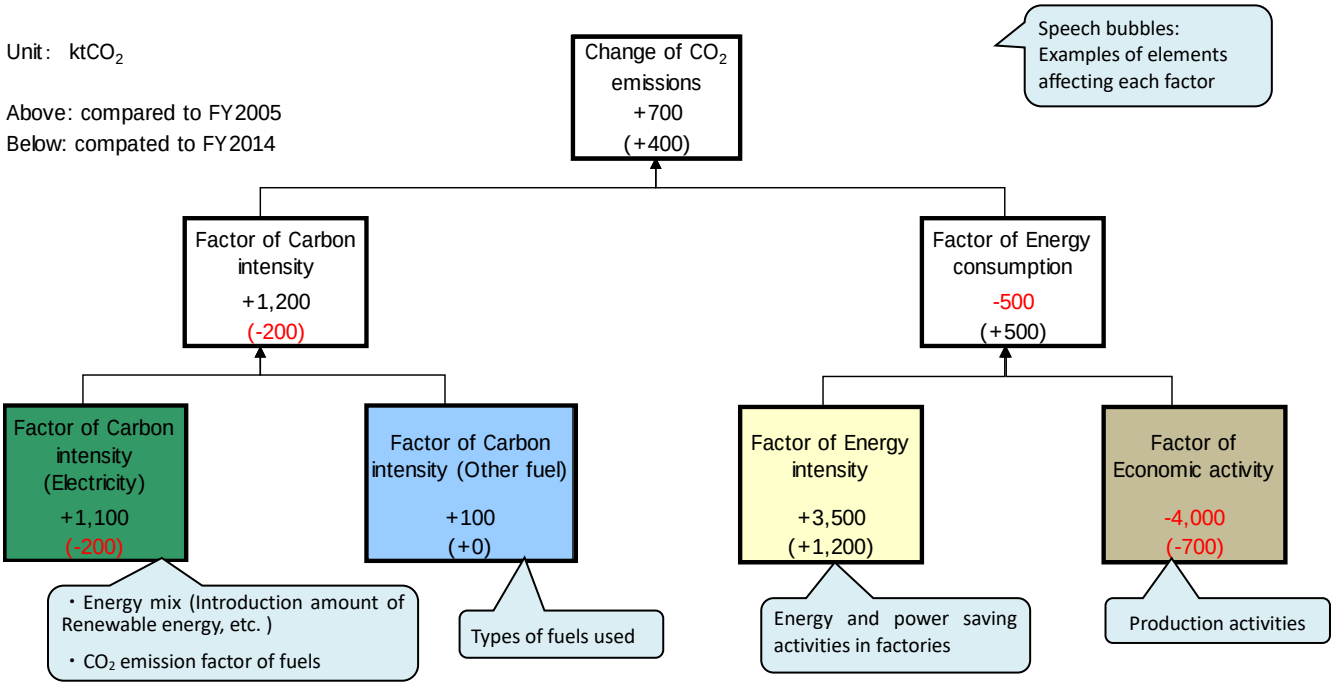


Figure 1-24 Factor of change of CO_2 emissions from Non-manufacturing sector in FY2015

1.1.5.4 Transportation Sector

(1) Passenger

CO_2 emissions in the transportation sector (passenger) in FY2015 were 128 million tonnes. They decreased by 10.5% compared to FY2005 and by 1.4% compared to the previous year.

Compared with FY2005, the largest decrease factor is “Factor of Energy intensity” due to the improvement of fuel efficiency, followed by “Factor of Modal shifts” due to the decrease of the proportion of cars in traffic volume. On the other hand, the largest increase factor is “Factor of Carbon intensity (Other fuel)”, followed by “Factor of Carbon intensity (Electricity)”.

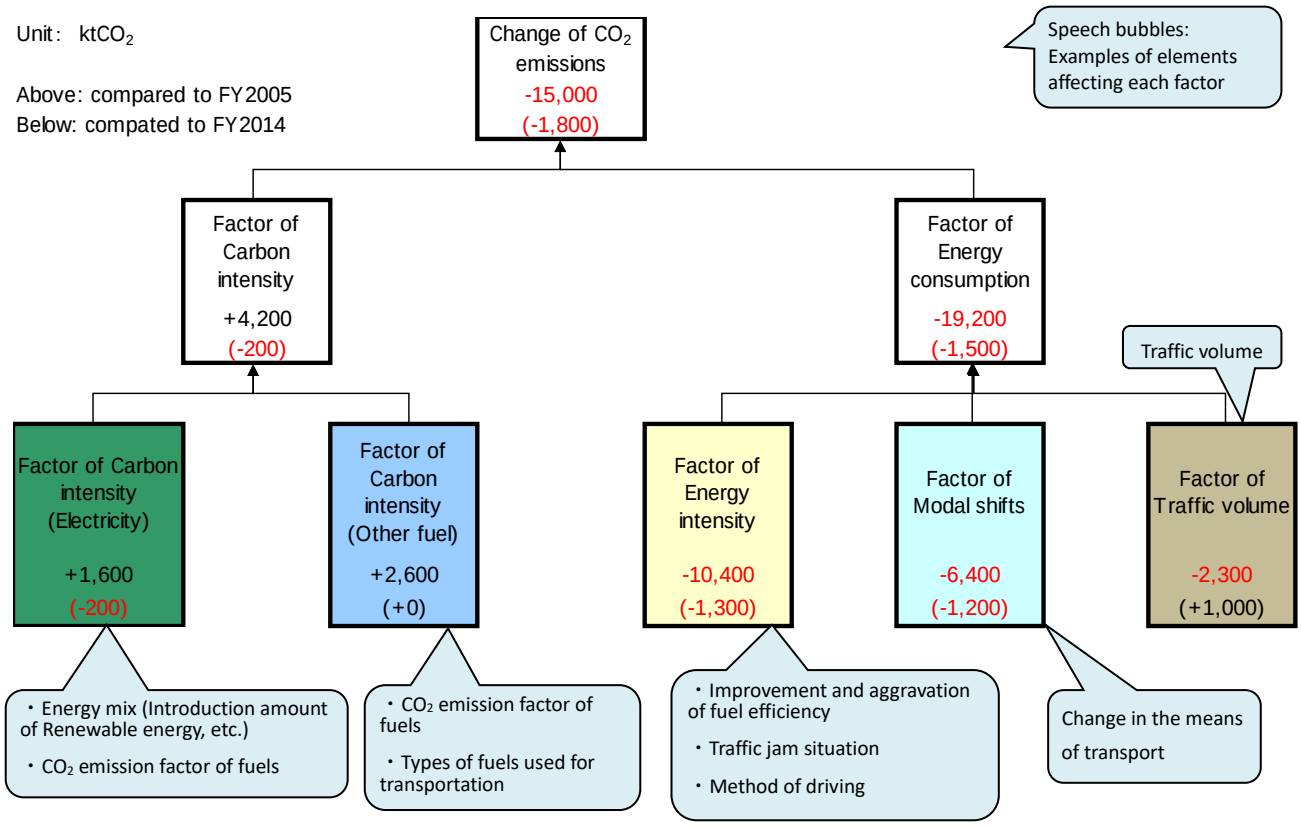


Figure 1-25 Factor of change of CO_2 emissions from Passenger sector (Transportation) in FY2015

(2) Freight

CO_2 emissions in the transportation sector (freight) in FY2015 were 85 million tonnes. They decreased by 11.8% compared to FY2005 and 2.3% compared to the previous year.

Compared with FY2005, the largest decrease factor is “Factor of Traffic volume” due to the decrease of the traffic volume. On the other hand, the largest increase factor is “Factor of Modal shifts” due to the increase of the proportion of cargo trucks in traffic volume.

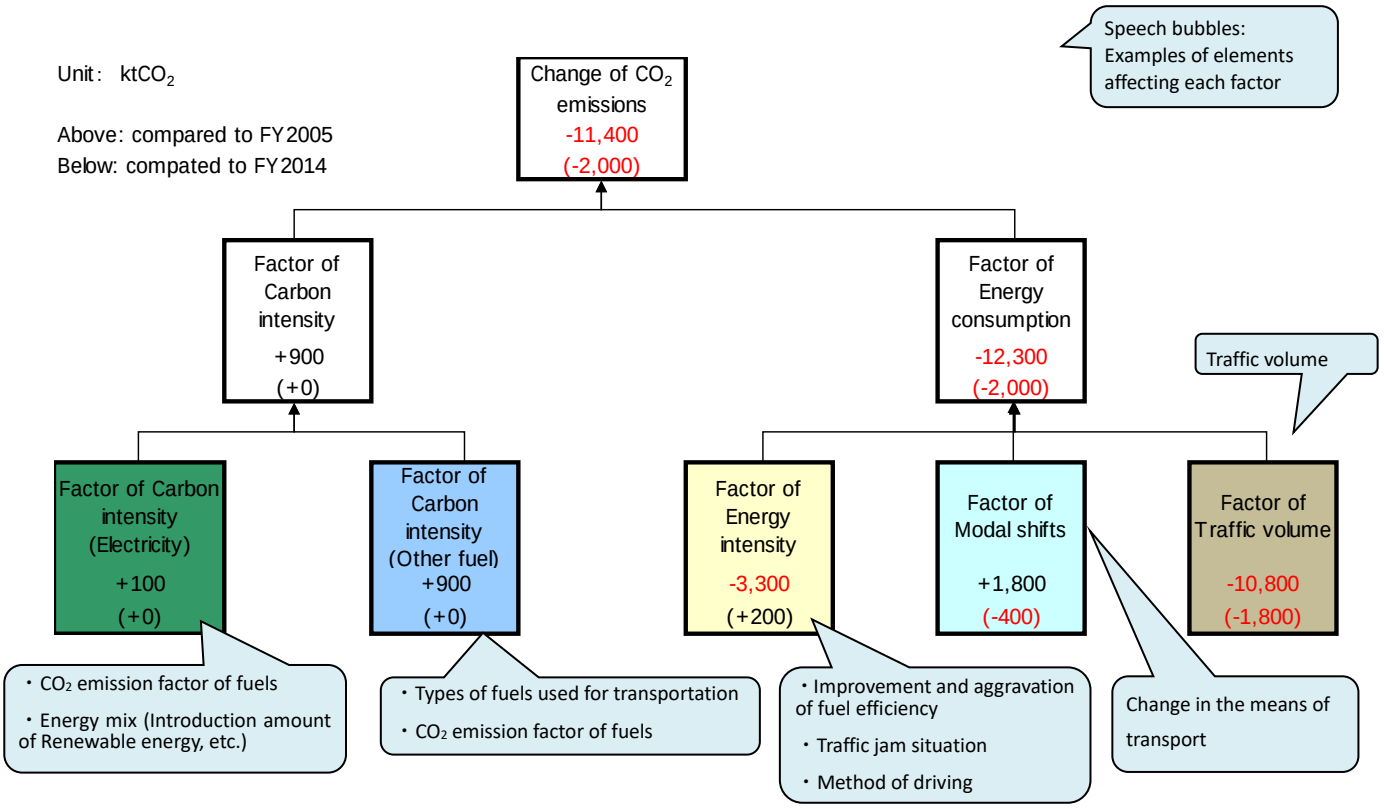


Figure 1-26 Factor of change of CO_2 emissions from Freight sector (Transportation) in FY2015

1.1.5.5 Residential Sector

CO_2 emissions in the residential sector in FY2015 were 179 million tonnes. They decreased by 0.2% compared to FY2005 and 5.1% compared to the previous year.

The largest decrease factor is "Factor of Number per household" due to the decrease in the size of household, followed by "Factor of Energy intensity (excluding Factor of Temperature)" due to the expansion of energy and power saving activities. On the other hand, the largest increase factor from FY2005 is "Factor of Carbon intensity (Electricity)" due to the change of energy mix, followed by "Factor of Number of households" due to the increase in the number of households.

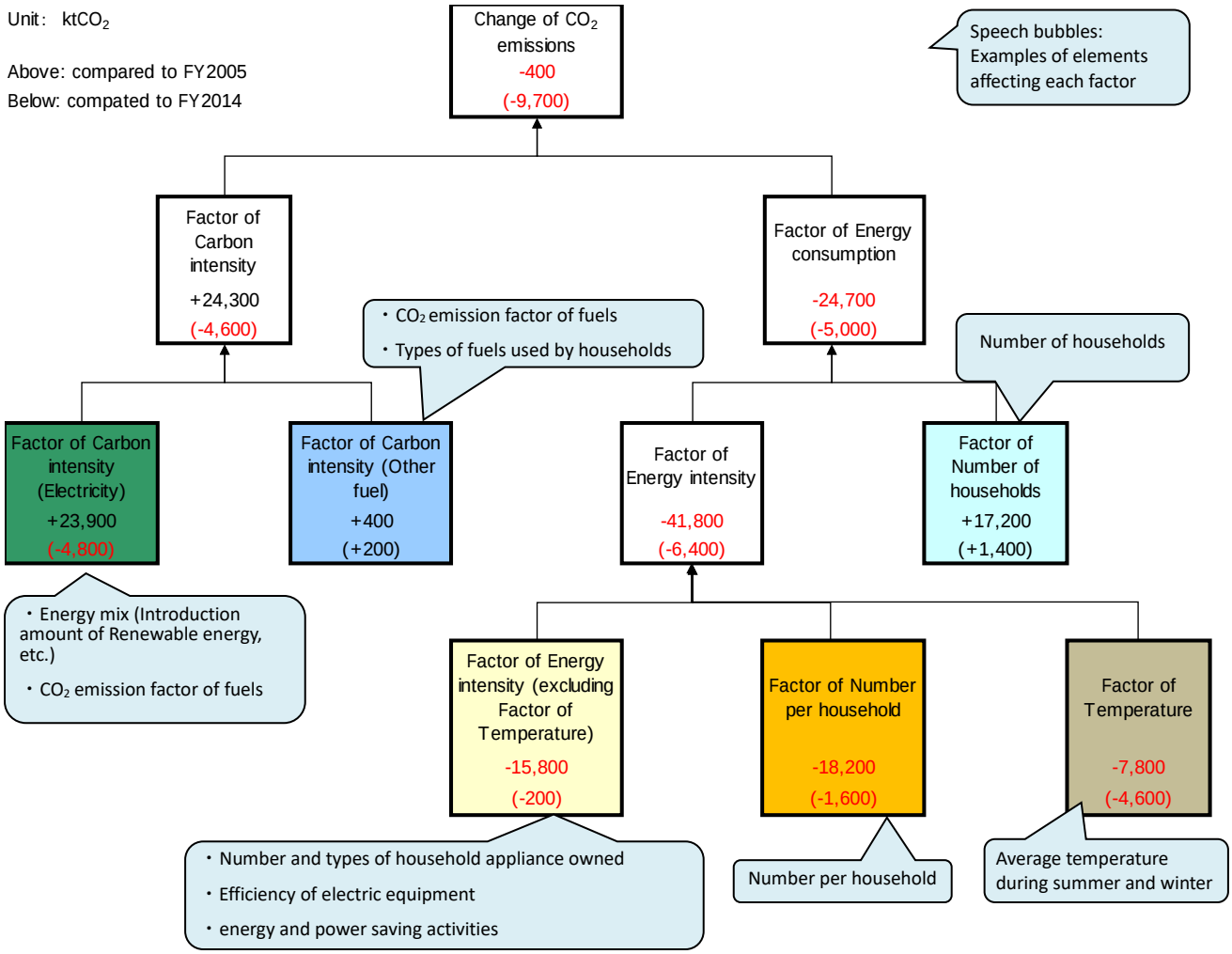


Figure 1-27 Factor of change of CO_2 emissions from Residential sector in FY2015

1.1.5.6 Commercial and Other Sector

CO_2 emissions in the commercial and other sector in FY2015 were 265 million tonnes. They increased by 11.1% compared to FY2005 and decreased by 3.1% compared to the previous year.

Compared with FY2005, the largest increase factor is "Factor of Carbon intensity (Electricity)" due to the change of energy mix, followed by "Factor of Floor space" due to the increase of the floor space.

On the other hand, the decrease factors are "Factor of Energy intensity (excluding Factor of Temperature)" due to the decrease of energy consumption per floor space resulting from the energy-savings in equipment and devices, and the expansion of energy and power saving activities, followed by "Factor of Temperature".

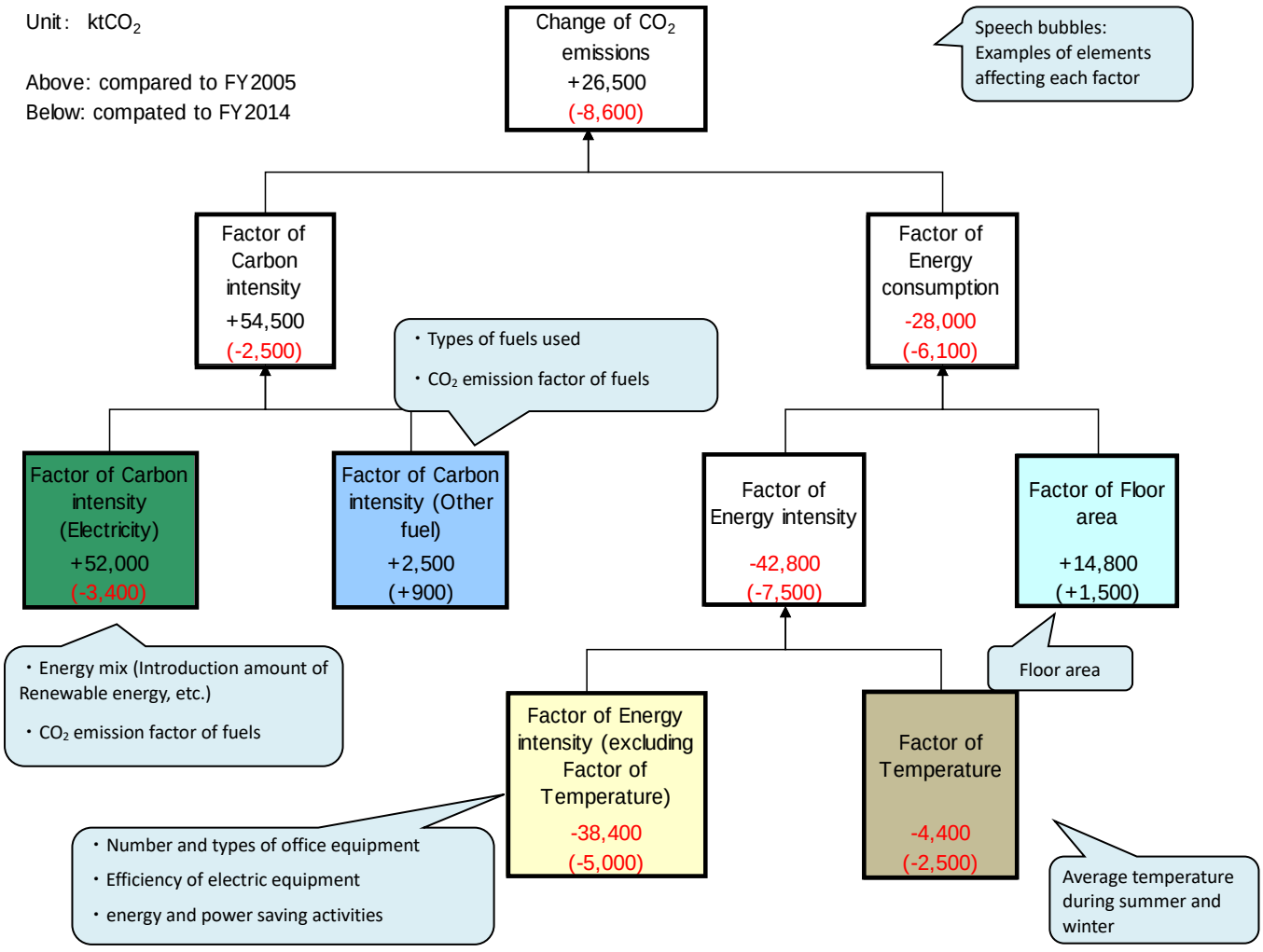


Figure 1-28 Factor of change of CO_2 emissions from Commercial and other sector in FY2015

1.1.5.7 Summary

Summary of factor analysis of energy-related CO_2 emissions by sector from FY2005 to FY2015 is shown in Table 1-17.

Table 1-17 Summary of factor analysis of energy-related CO_2 emissions by sector from FY2005 to FY2015

(Unit: $MtCO_2$)

Sector		Factor of Activity		Factor of intensity				Factor of temperature	Total change
		Indices of Activity	Change		Carbon intensity (excl. electricity)	Carbon intensity (electricity)	Energy intensity		
Residential		Number of households	+17	-10	+0.4	+24	-34	-8	-0.4
Commercial & Other		Floor area	+15	+16	+3	+52	-38	-4	+27
Industry		Indices of Industrial Production	-44	-2	-1	+23	-25	-	-46
Transport	Passenger	Traffic volume	-2	-13	+3	+2	-17	-	-15
	Freight	Traffic volume	-11	-1	+1	+0.1	-2	-	-11
Energy Transformation		Production of secondary energy	-15	-9	-9	-			-24
Total Energy-related CO_2 emissions		–	-40	-16	-3	+101	-115	-12	-70

Increase of number of households

Progress of energy saving

Increase of Floor area

Increase of carbon intensity due to the increase of fossil power generation

Decrease of production

Improvement of fuel efficiency

Improvement of transport efficiency

Note: The description in balloons are major factors that seems to influence the change of emissions. The total and the sum of factors may not match due to rounding.

1.1.6 Trends in Indirect GHGs and SOx emissions"

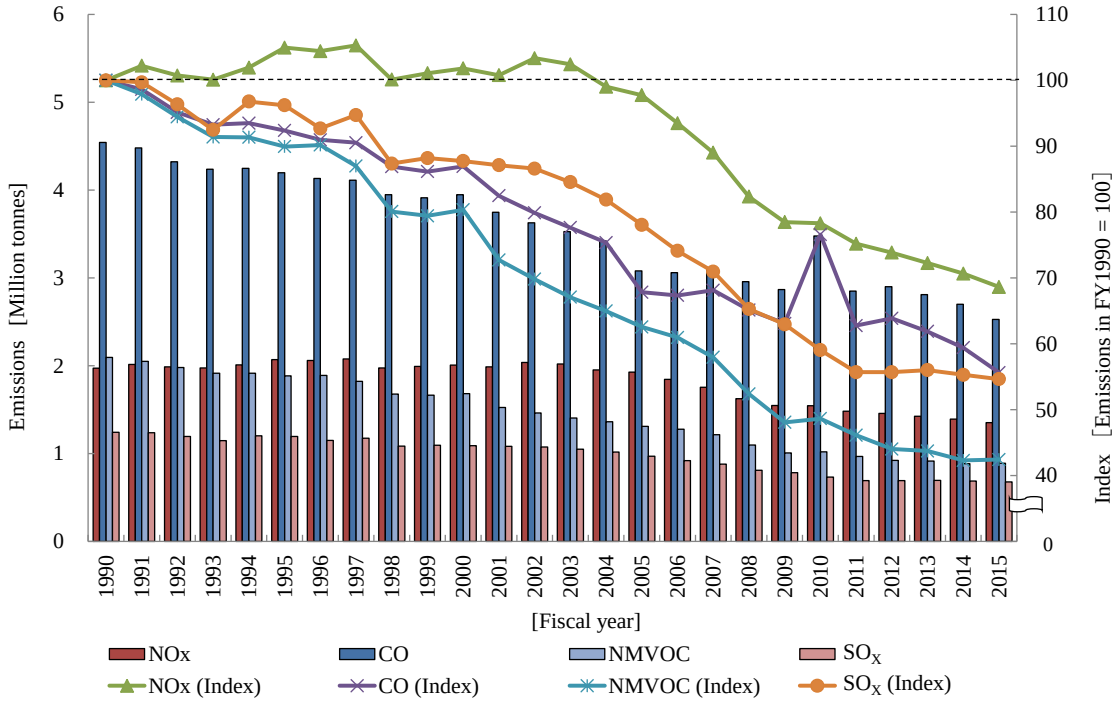
Under the revised UNFCCC reporting guidelines on annual inventories for Parties included in Annex I to the Convention (24/CP.19), it is required to report emissions not only of the 7 types of GHGs (CO_2, CH_4, N_2O, HFCs, PFCs, SF_6, and NF_3), but also emissions of indirect GHGs (NO_X, CO and NMVOC) as well as SO_X. Their emission trends are indicated below.

Nitrogen oxide (NO_X) emissions in FY2015 were 1,354 thousand tonnes. They decreased by 31.4% since FY1990, 29.8% compared to FY2005 and 2.9% compared to the previous year.

Carbon monoxide (CO) emissions in FY2015 were 2,527 thousand tonnes. They decreased by 44.4% since FY1990, increased by 31.1% compared to FY2005 and decreased by 6.4% compared to the previous year.

Non-methane volatile organic compounds (NMVOC) emissions in FY2015 were 889 thousand tonnes. They decreased by 57.6% since FY1990, by 53.9% compared to FY2005 and increased by 0.3% compared to the previous year.

Sulfur oxide (SO_X)[14] emissions in FY2015 were 678 thousand tonnes. They decreased by 45.4% since FY1990, 64.8% compared to FY2005 and 1.2% compared to the previous year.



(* The line chart shows the trend as an index of FY1990 emissions set at 100.)

Figure 1-29 Trends in emissions of indirect GHGs and SOx

[14] Most SO_X consists of SO_2. For major sources, SO_2 emissions are estimated.

1.1.7 Emissions and Removals from Activities under Article 3.3 and 3.4 of the Kyoto Protocol (KP-LULUCF)

The net removals from Kyoto Protocol Article 3.3 and 3.4 activities in FY2015 were 46.6 million tonnes (in CO_2 eq.). The breakdown of emissions and removals to each activity in the second commitment period of the Kyoto Protocol is shown in Table 1-18.

Table 1-18 Accounting summary for activities under articles 3.3 and 3.4 of the Kyoto Protocol (CRF Accounting table)

Greenhouse gas source and sink activities	Net Emissions/removals [kt CO_2 eq.]			
	1990（Base Year）	2013	2014	2015
A. Article 3.3 activities				
A.1. Afforestation/reforestation		-1,427	-1,421	-1,417
Excluded emissions from natural disturbances		NA	NA	NA
Excluded subsequent removals from land subject to natural disturbances		NA	NA	NA
A.2. Deforestation		1,459	2,104	1,803
B. Article 3.4 activities				
B.1. Forest management				
Net emissions/removals		-51,478	-52,073	-49,363
Excluded emissions from natural disturbances		NA	NA	NA
Excluded subsequent removals from land subject to natural disturbances		NA	NA	NA
Any debits from newly established forest (CEF-ne)		NA	NA	NA
Forest management reference level (FMRL)		0	0	0
Technical corrections to FMRL		667	913	1,128
Forest management cap				
B.2. Cropland management	10,258	3,543	4,273	3,876
B.3. Grazing land management	842	-284	-108	-241
B.4. Revegetation	-79	-1,223	-1,241	-1,262
B.5. Wetland drainage and rewetting (not elected)	NA	NA	NA	NA

* The total values and results of summing up each figure are not always the same because of the difference in display digit.

Table 1-19 Emission trends: summary（CTF Table 1）

GREENHOUSE GAS EMISSIONS	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	kt CO_2 eq														
CO_2 emissions without net CO_2 from LULUCF	1,157,164.51	1,157,164.51	1,165,634.62	1,175,768.64	1,168,886.54	1,230,224.70	1,243,848.87	1,256,698.02	1,254,568.19	1,219,612.02	1,254,575.01	1,275,777.13	1,259,003.58	1,296,054.66	1,301,102.95
CO_2 emissions with net CO_2 from LULUCF	1,093,427.39	1,093,427.39	1,093,934.31	1,100,931.59	1,091,059.38	1,153,205.58	1,165,799.19	1,173,458.19	1,169,470.38	1,133,149.19	1,167,567.09	1,186,712.02	1,169,928.91	1,205,567.91	1,200,780.58
CH_4 emissions without CH_4 from LULUCF	44,223.07	44,223.07	42,988.35	43,812.14	39,723.47	43,113.90	41,637.89	40,409.83	39,684.96	37,827.74	37,688.16	37,666.02	36,606.10	35,936.38	34,463.26
CH_4 emissions with CH_4 from LULUCF	44,296.05	44,296.05	43,058.16	43,878.76	39,812.82	43,195.13	41,707.78	40,502.72	39,784.31	37,898.63	37,752.17	37,732.72	36,677.85	36,017.29	34,524.19
N_2O emissions without N_2O from LULUCF	31,517.58	31,517.58	31,218.76	31,358.85	31,251.04	32,558.78	32,860.59	33,981.85	34,780.09	33,186.15	27,033.25	29,561.41	25,990.57	25,443.31	25,243.32
N_2O emissions with N_2O from LULUCF	31,726.66	31,726.66	31,425.53	31,563.78	31,456.44	32,762.32	33,060.74	34,181.06	34,977.21	33,379.35	27,224.36	29,750.62	26,178.43	25,630.16	25,426.50
HFCs	15,932.31	15,932.31	17,349.61	17,767.22	18,129.16	21,051.90	25,213.19	24,598.11	24,436.79	23,742.10	24,368.28	22,852.00	19,462.52	16,236.39	16,228.36
PFCs	6,539.30	6,539.30	7,506.92	7,617.29	10,942.80	13,443.46	17,609.92	18,258.18	19,984.28	16,568.48	13,118.06	11,873.11	9,878.47	9,199.44	8,854.21
Unspecified mix of HFCs and PFCs															
SF_6	12,850.07	12,850.07	14,206.04	15,635.82	15,701.97	15,019.96	16,447.52	17,022.19	14,510.54	13,224.10	9,176.62	7,031.36	6,066.02	5,735.48	5,406.31
NF_3	32.61	32.61	32.61	32.61	43.48	76.09	201.09	192.55	171.06	188.13	315.27	285.77	294.81	371.48	416.10
Total (without LULUCF)	1,268,259.45	1,268,259.45	1,278,936.92	1,291,992.57	1,284,678.46	1,355,488.78	1,377,819.08	1,391,160.73	1,388,135.91	1,344,348.72	1,366,274.64	1,385,046.80	1,357,302.07	1,388,977.15	1,391,714.51
Total (with LULUCF)	1,204,804.39	1,204,804.39	1,207,513.18	1,217,427.08	1,207,146.05	1,278,754.44	1,300,039.44	1,308,213.00	1,303,334.57	1,258,149.99	1,279,521.84	1,296,237.60	1,268,487.00	1,298,758.16	1,291,636.24
Total (without LULUCF, with indirect)	1,273,560.52	1,273,560.52	1,284,040.26	1,296,863.39	1,289,308.19	1,360,095.99	1,382,327.17	1,395,687.31	1,392,501.65	1,348,350.66	1,370,262.10	1,389,104.97	1,360,938.95	1,392,383.18	1,394,989.95
Total (with LULUCF, with indirect)	1,210,105.45	1,210,105.45	1,212,616.52	1,222,297.90	1,211,775.77	1,283,361.65	1,304,547.53	1,312,739.58	1,307,700.32	1,262,151.93	1,283,509.31	1,300,295.77	1,272,123.88	1,302,164.18	1,294,911.68

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	kt CO_2 eq												*kt CO_2 eq*		
1. Energy	1,091,274.60	1,091,274.60	1,098,416.44	1,107,269.78	1,101,404.02	1,158,694.53	1,172,075.50	1,183,818.55	1,183,724.44	1,154,462.47	1,189,439.18	1,209,882.07	1,195,461.41	1,235,011.36	1,240,572.94
2. Industrial processes and product use	110,451.48	110,451.48	114,807.47	116,656.22	118,864.20	126,295.56	136,418.29	138,541.56	135,570.55	122,813.58	110,147.87	108,173.62	97,152.77	90,166.14	88,783.61
3. Agriculture	37,635.95	37,635.95	36,876.92	38,101.73	34,861.18	38,461.06	37,158.50	36,362.82	36,031.34	34,658.30	34,795.78	35,322.91	34,865.88	35,080.02	33,992.30
4. Land Use, Land-Use Change and Forestryb	-63,455.06	-63,455.06	-71,423.74	-74,565.49	-77,532.42	-76,734.34	-77,779.64	-82,947.73	-84,801.34	-86,198.73	-86,752.80	-88,809.20	-88,815.07	-90,218.99	-100,078.27
5. Waste	28,897.43	28,897.43	28,836.08	29,964.84	29,549.07	32,037.62	32,166.79	32,437.80	32,809.57	32,414.38	31,891.82	31,668.20	29,822.01	28,719.62	28,365.66
6. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total (including LULUCF)	1,204,804.39	1,204,804.39	1,207,513.18	1,217,427.08	1,207,146.05	1,278,754.44	1,300,039.44	1,308,213.00	1,303,334.57	1,258,149.99	1,279,521.84	1,296,237.60	1,268,487.00	1,298,758.16	1,291,636.24

GREENHOUSE GAS EMISSIONS	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Change from base to latest reported year
													(%)
CO_2 emissions without net CO_2 from LULUCF	1,300,190.16	1,307,693.19	1,287,099.00	1,321,713.44	1,237,290.85	1,164,685.29	1,215,010.75	1,263,816.17	1,298,157.57	1,313,686.01	1,266,601.40	1,225,239.49	5.88
CO_2 emissions with net CO_2 from LULUCF	1,203,240.71	1,215,898.89	1,200,778.04	1,238,767.35	1,164,933.51	1,096,517.50	1,144,690.19	1,192,851.10	1,224,503.01	1,245,982.81	1,201,239.91	1,164,070.04	6.46
CH_4 emissions without CH_4 from LULUCF	35,484.03	35,279.25	34,762.49	35,013.48	34,719.41	33,802.46	34,855.00	33,840.16	32,982.01	32,675.28	32,068.18	31,294.94	-29.23
CH_4 emissions with CH_4 from LULUCF	35,554.43	35,346.11	34,821.18	35,071.52	34,800.45	33,867.70	34,914.69	33,900.84	33,038.00	32,733.15	32,144.52	31,354.31	-29.22
N_2O emissions without N_2O from LULUCF	25,234.54	24,829.11	24,796.05	24,191.01	23,264.00	22,689.78	22,318.20	21,785.97	21,351.01	21,400.06	20,945.10	20,829.59	-33.91
N_2O emissions with N_2O from LULUCF	25,416.68	25,008.76	24,972.95	24,365.75	23,438.30	22,860.78	22,487.68	21,954.56	21,518.32	21,568.18	21,115.76	20,999.79	-33.81
HFCs	12,420.92	12,781.83	14,627.06	16,707.19	19,284.93	20,937.33	23,305.23	26,071.50	29,348.60	32,094.56	35,765.79	39,202.80	146.06
PFCs	9,216.64	8,623.35	8,998.78	7,916.85	5,743.40	4,046.87	4,249.54	3,755.45	3,436.33	3,280.06	3,361.43	3,308.10	-49.41
Unspecified mix of HFCs and PFCs													
SF_6	5,258.70	5,053.01	5,228.90	4,733.45	4,177.17	2,446.63	2,423.87	2,247.64	2,234.54	2,101.81	2,065.07	2,121.86	-83.49
NF_3	486.04	1,471.75	1,401.31	1,586.80	1,481.04	1,354.16	1,539.74	1,800.38	1,511.85	1,617.24	1,122.87	571.03	1,651.10
Total (without LULUCF)	1,388,291.03	1,395,731.50	1,376,913.59	1,411,862.21	1,325,960.79	1,249,962.52	1,303,702.34	1,353,317.27	1,389,021.91	1,406,855.02	1,361,929.83	1,322,567.82	4.28
Total (with LULUCF)	1,291,594.13	1,304,183.69	1,290,828.23	1,329,148.92	1,253,858.80	1,182,030.95	1,233,610.94	1,282,581.46	1,315,590.67	1,339,377.80	1,296,815.34	1,261,627.94	4.72
Total (without LULUCF, with indirect)	1,391,488.49	1,398,823.62	1,379,939.06	1,414,752.38	1,328,576.03	1,252,372.78	1,306,045.28	1,355,578.63	1,391,203.02	1,409,037.65	1,364,040.64	1,324,717.74	4.02
Total (with LULUCF, with indirect)	1,294,791.59	1,307,275.82	1,293,853.70	1,332,039.08	1,256,474.04	1,184,441.21	1,235,953.89	1,284,842.83	1,317,771.78	1,341,560.43	1,298,926.15	1,263,777.87	4.44

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Change from base to latest reported year
													(%)
1. Energy	1,240,100.48	1,247,116.32	1,226,966.97	1,262,359.12	1,180,333.49	1,115,589.16	1,164,861.85	1,213,892.63	1,247,418.91	1,261,239.40	1,215,004.58	1,174,648.42	7.64
2. Industrial processes and product use	85,579.39	86,721.16	89,543.05	88,651.79	84,176.80	76,848.26	80,158.47	82,086.96	84,602.35	88,922.17	91,496.79	93,020.28	-15.78
3. Agriculture	35,152.12	35,227.10	35,041.65	36,149.19	35,526.14	34,767.85	35,885.72	35,360.47	34,752.48	34,762.88	34,232.58	33,666.91	-10.55
4. Land Use, Land-Use Change and Forestryb	-96,696.90	-91,547.81	-86,085.36	-82,713.30	-72,101.99	-67,931.57	-70,091.39	-70,735.80	-73,431.24	-67,477.22	-65,114.49	-60,939.88	-3.96
5. Waste	27,459.04	26,666.91	25,361.93	24,702.11	25,924.36	22,757.25	22,796.30	21,977.21	22,248.18	21,930.57	21,195.88	21,232.21	-26.53
6. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total (including LULUCF)	1,291,594.13	1,304,183.69	1,290,828.23	1,329,148.92	1,253,858.80	1,182,030.95	1,233,610.94	1,282,581.46	1,315,590.67	1,339,377.80	1,296,815.34	1,261,627.94	4.72

Table 1-20 Emission trends (CO_2) (CTF Table 1(a))

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	kt														
1. Energy	1,078,302.44	1,078,302.44	1,085,722.35	1,094,935.33	1,089,556.04	1,146,985.60	1,160,006.80	1,171,925.54	1,171,792.76	1,142,929.79	1,177,812.16	1,198,335.02	1,184,204.88	1,224,528.14	1,230,404.51
A. Fuel combustion (sectoral approach)	1,078,110.87	1,078,110.87	1,085,507.48	1,094,727.02	1,089,344.38	1,146,754.54	1,159,485.35	1,171,354.86	1,171,212.40	1,142,431.17	1,177,272.84	1,197,823.46	1,183,656.72	1,224,003.58	1,229,898.75
1. Energy industries	352,782.85	352,782.85	355,881.04	362,715.03	346,422.62	387,366.79	377,028.59	379,153.02	377,005.39	364,997.08	384,032.34	393,060.45	383,004.42	414,184.08	430,909.93
2. Manufacturing industries and construction	380,140.18	380,140.18	375,130.51	368,513.32	367,039.13	376,906.39	382,895.22	386,977.67	387,219.36	363,916.19	370,533.73	379,699.89	374,058.56	385,211.52	384,245.55
3. Transport	200,214.98	200,214.98	212,672.57	218,928.64	222,568.29	231,618.00	240,453.11	246,923.50	248,301.34	246,427.52	250,254.29	249,013.71	253,036.44	248,697.82	244,439.68
4. Other sectors	144,972.86	144,972.86	141,823.37	144,570.04	153,314.35	150,863.36	159,108.43	158,300.67	158,686.32	167,090.39	172,452.48	176,049.41	173,557.30	175,910.16	170,303.59
5. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Fugitive emissions from fuels	191.57	191.57	214.87	208.31	211.66	231.05	521.46	570.68	580.36	498.62	539.32	511.56	548.17	524.57	505.76
1. Solid fuels	5.32	5.32	4.80	4.28	3.60	2.96	2.41	2.11	2.00	1.82	1.75	1.60	1.35	0.75	0.67
2. Oil and natural gas and other emissions from energy production	186.25	186.25	210.07	204.03	208.06	228.10	519.05	568.57	578.36	496.80	537.57	509.97	546.82	523.81	505.09
C. CO2 transport and storage	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE
2. Industrial processes	65,125.99	65,125.99	66,220.90	66,149.52	64,863.51	66,439.76	66,774.09	67,297.68	64,691.80	58,609.94	58,899.07	59,357.43	58,041.00	55,348.27	54,560.85
A. Mineral industry	49,218.66	49,218.66	50,536.32	50,953.31	50,239.91	51,250.19	51,130.78	51,473.76	48,824.78	43,847.70	43,563.77	43,899.42	42,956.00	40,469.08	40,133.74
B. Chemical industry	7,039.03	7,039.03	7,007.49	6,823.98	6,386.88	6,805.43	7,012.82	7,067.01	7,060.47	6,419.51	6,937.15	6,809.76	6,346.24	6,247.20	6,048.64
C. Metal industry	7,272.76	7,272.76	7,091.43	6,796.03	6,652.23	6,656.19	6,849.59	6,870.52	6,834.13	6,545.54	6,463.18	6,739.53	6,762.50	6,597.90	6,366.50
D. Non-energy products from fuels and solvent use	1,531.28	1,531.28	1,518.88	1,510.94	1,524.93	1,661.15	1,709.35	1,806.71	1,886.33	1,710.69	1,845.65	1,822.21	1,898.04	1,954.22	1,926.65
E. Electronic industry															
F. Product uses as ODS substitutes															
G. Other product manufacture and use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
H. Other	64.27	64.27	66.77	65.27	59.56	66.80	71.54	79.67	86.09	86.49	89.33	86.50	78.22	79.87	85.33
3. Agriculture	608.88	608.88	547.88	493.01	523.52	342.54	359.13	349.62	371.50	376.93	370.29	442.53	367.68	408.14	430.19
A. Enteric fermentation															
B. Manure management															
C. Rice cultivation															
D. Agricultural soils															
E. Prescribed burning of savannas															
F. Field burning of agricultural residues															
G. Liming	550.24	550.24	527.37	477.14	481.58	292.76	303.53	292.74	303.65	300.00	293.57	332.90	247.35	269.92	246.40
H. Urea application	58.64	58.64	20.51	15.87	41.94	49.79	55.60	56.88	67.85	76.93	76.73	109.63	120.34	138.22	183.79
I. Other carbon-containing fertilizers	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4. Land Use, Land-Use Change and Forestry	-63,737.12	-63,737.12	-71,700.31	-74,837.04	-77,827.16	-77,019.12	-78,049.68	-83,239.83	-85,097.81	-86,462.83	-87,007.92	-89,065.11	-89,074.68	-90,486.75	-100,322.37
A. Forest land	-79,074.44	-79,074.44	-86,229.15	-86,577.51	-86,923.35	-87,267.75	-87,612.49	-91,284.18	-91,124.24	-90,963.33	-90,803.06	-90,642.49	-90,482.95	-90,322.35	-99,042.85
B. Cropland	11,506.03	11,506.03	10,470.07	7,037.34	5,413.90	6,244.31	5,437.05	3,795.18	3,176.79	3,174.33	2,091.38	123.01	49.12	173.04	-610.41
C. Grassland	1,027.72	1,027.72	802.88	74.16	-213.90	92.74	678.70	329.71	47.22	19.30	-403.92	38.97	-258.72	-527.24	-1,219.45
D. Wetlands	78.53	78.53	70.09	220.34	122.35	101.27	311.29	552.73	104.89	420.53	396.18	370.20	336.11	82.48	54.56
E. Settlements	2,132.58	2,132.58	2,673.94	3,023.52	1,674.99	896.64	738.84	146.64	-70.02	-185.39	-483.68	-772.49	-958.94	-1,516.14	-1,600.81
F. Other land	1,028.32	1,028.32	1,145.73	918.66	1,123.40	1,013.07	848.67	777.33	1,032.86	768.45	833.02	612.40	650.43	618.84	508.16
G. Harvested wood products	-435.86	-435.86	-633.89	466.44	975.46	1,900.60	1,548.27	2,442.76	1,734.69	303.28	1,362.17	1,205.29	1,590.27	1,004.61	1,588.43
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Waste	13,127.19	13,127.19	13,143.50	14,190.78	13,943.46	16,456.79	16,708.85	17,125.19	17,712.12	17,695.35	17,493.48	17,642.14	16,390.02	15,770.11	15,707.40
A. Solid waste disposal	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE
B. Biological treatment of solid waste															
C. Incineration and open burning of waste	12,424.36	12,424.36	12,457.05	13,491.88	13,262.72	15,754.88	16,041.03	16,484.72	17,056.89	17,086.23	16,840.90	16,986.23	15,759.49	15,193.07	15,190.87
D. Waste water treatment and discharge															
E. Other	702.83	702.83	686.45	698.90	680.75	701.91	667.83	640.47	655.23	609.12	652.58	655.91	630.53	577.05	516.53
6. Other (as specified in the summary table in CRF)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Memo items:															
International bunkers	30,648.25	30,648.25	32,396.42	32,756.82	34,704.57	35,873.60	37,918.27	30,844.20	35,283.04	37,151.91	35,832.05	36,274.76	33,191.18	36,273.50	37,066.48
Aviation	13,189.32	13,189.32	13,919.12	14,216.76	13,856.19	15,066.49	16,922.99	18,441.91	19,134.37	20,001.55	19,576.46	19,542.61	18,721.34	21,149.32	20,387.64
Navigation	17,458.93	17,458.93	18,477.30	18,540.06	20,848.38	20,807.11	20,995.27	12,402.30	16,148.67	17,150.36	16,255.59	16,732.15	14,469.83	15,124.18	16,678.84
Multilateral operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO2 emissions from biomass	34,860.18	34,860.18	35,601.72	35,276.68	34,581.77	35,074.70	36,442.26	36,864.07	37,932.86	36,642.46	37,795.17	39,626.44	38,229.16	40,150.13	42,091.65
CO2 captured	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Long-term storage of C in waste disposal sites	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Indirect N2O															
Indirect CO2 (3)	5,301.07	5,301.07	5,103.34	4,870.81	4,629.72	4,607.22	4,508.09	4,526.58	4,365.74	4,001.94	3,987.46	4,058.17	3,636.87	3,406.03	3,275.44
Total CO2 equivalent emissions without land use, land-use change and forestry	1,157,164.51	1,157,164.51	1,165,634.62	1,175,768.64	1,168,886.54	1,230,224.70	1,243,848.87	1,256,698.02	1,254,568.19	1,219,612.02	1,254,575.01	1,275,777.13	1,259,003.58	1,296,054.66	1,301,102.95
Total CO2 equivalent emissions with land use, land-use change and forestry	1,093,427.39	1,093,427.39	1,093,934.31	1,100,931.59	1,091,059.38	1,153,205.58	1,165,799.19	1,173,458.19	1,169,470.38	1,133,149.19	1,167,567.09	1,186,712.02	1,169,928.91	1,205,567.91	1,200,780.58
Total CO2 equivalent emissions, including indirect CO2, without land use, land-use change and forestry	1,162,465.58	1,162,465.58	1,170,737.96	1,180,639.45	1,173,516.26	1,234,831.91	1,248,356.96	1,261,224.60	1,258,933.93	1,223,613.95	1,258,562.47	1,279,835.29	1,262,640.46	1,299,460.69	1,304,378.39
Total CO2 equivalent emissions, including indirect CO2, with land use, land-use change and forestry	1,098,728.46	1,098,728.46	1,099,037.65	1,105,802.41	1,095,689.10	1,157,812.80	1,170,307.28	1,177,984.77	1,173,836.12	1,137,151.13	1,171,554.55	1,190,770.18	1,173,565.78	1,208,973.94	1,204,056.02

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Change from base to latest reported year
	kt												(%)
1. Energy	1,230,090.48	1,237,037.75	1,217,059.12	1,252,468.73	1,170,793.53	1,106,506.82	1,155,220.69	1,204,706.26	1,238,303.93	1,252,155.12	1,206,055.04	1,165,748.11	8.11
A. Fuel combustion (sectoral approach)	1,229,612.82	1,236,529.98	1,216,506.00	1,251,853.09	1,170,228.36	1,106,005.97	1,154,746.14	1,204,228.78	1,237,813.66	1,251,716.99	1,205,606.02	1,165,285.65	8.09
1. Energy industries	427,940.21	447,938.55	436,480.13	498,751.19	473,839.27	436,771.30	461,182.05	518,617.37	561,892.20	564,207.09	529,229.07	504,112.51	42.90
2. Manufacturing industries and construction	386,313.13	374,648.95	378,847.82	364,920.25	331,853.92	303,283.88	338,811.95	335,113.11	334,157.80	342,281.49	339,109.16	333,942.06	-12.15
3. Transport	238,588.32	232,726.97	229,663.36	226,722.19	218,193.17	214,763.95	215,467.45	212,651.37	217,436.48	215,803.45	208,505.39	204,951.99	2.37
4. Other sectors	176,771.16	181,215.50	171,514.70	161,459.46	146,342.00	151,186.84	139,284.69	137,846.94	124,327.18	129,424.96	128,762.41	122,279.09	-15.65
5. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
B. Fugitive emissions from fuels	477.66	507.77	553.11	615.64	565.17	500.85	474.55	477.48	490.27	438.13	449.03	462.47	141.41
1. Solid fuels	0.64	0.61	0.59	0.56	0.54	0.53	0.52	0.51	0.50	0.49	0.49	0.48	-90.94
2. Oil and natural gas and other emissions from energy production	477.02	507.16	552.52	615.09	564.63	500.32	474.03	476.97	489.77	437.64	448.53	461.99	148.05
C. CO2 transport and storage	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NE,NO	NE,NO	NO,NE	
2. Industrial processes	54,543.23	55,643.98	55,893.47	55,092.65	50,793.22	45,234.71	46,316.10	46,226.84	46,288.21	48,034.11	47,434.26	46,156.23	-29.13
A. Mineral industry	39,808.97	41,219.73	41,192.26	40,200.22	37,432.49	32,775.52	32,747.86	33,091.44	33,660.76	35,053.79	34,795.26	33,782.35	-31.36
B. Chemical industry	6,130.79	5,790.85	5,870.65	5,962.25	5,103.40	4,868.59	5,423.41	5,099.57	4,648.28	4,784.29	4,685.08	4,591.47	-34.77
C. Metal industry	6,483.04	6,496.47	6,567.97	6,694.93	6,236.57	5,468.35	6,100.70	5,964.62	6,060.79	6,169.61	6,092.97	5,933.95	-18.41
D. Non-energy products from fuels and solvent use	2,034.13	2,046.88	2,175.07	2,149.08	1,949.22	2,050.96	1,968.29	1,995.41	1,841.98	1,944.09	1,780.51	1,765.41	15.29
E. Electronic industry													
F. Product uses as ODS substitutes													
G. Other product manufacture and use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
H. Other	86.29	90.05	87.52	86.16	71.55	71.29	75.85	75.81	76.41	82.33	80.44	83.04	29.21
3. Agriculture	402.22	410.56	383.48	500.08	439.98	390.10	402.94	414.65	520.16	577.77	559.19	559.19	-8.16
A. Enteric fermentation													
B. Manure management													
C. Rice cultivation													
D. Agricultural soils													
E. Prescribed burning of savannas													
F. Field burning of agricultural residues													
G. Liming	236.30	231.29	230.36	325.00	305.74	270.15	242.88	246.78	369.97	379.58	370.20	370.20	-32.72
H. Urea application	165.92	179.27	153.12	175.08	134.24	119.95	160.06	167.88	150.19	198.19	188.99	188.99	222.27
I. Other carbon-containing fertilizers	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
4. Land Use, Land-Use Change and Forestry	-96,949.45	-91,794.30	-86,320.95	-82,946.08	-72,357.34	-68,167.80	-70,320.57	-70,965.07	-73,654.55	-67,703.20	-65,361.49	-61,169.45	-4.03
A. Forest land	-98,528.07	-92,664.68	-86,812.74	-85,549.55	-80,755.61	-75,864.70	-76,372.33	-78,108.40	-77,671.12	-69,963.65	-68,251.86	-63,084.94	-20.22
B. Cropland	2,677.31	2,274.95	1,408.99	4,830.25	10,284.51	7,909.38	5,558.77	5,757.29	4,839.60	3,616.40	4,446.05	3,985.75	-65.36
C. Grassland	-941.35	-1,025.53	-494.79	-930.61	-1,333.47	-237.33	-142.62	197.09	-182.99	-194.86	-85.15	-126.16	-112.28
D. Wetlands	49.03	41.64	34.65	46.95	53.14	72.23	67.07	47.84	38.57	42.80	41.02	52.24	-33.48
E. Settlements	-1,611.19	-1,206.60	-1,103.66	-1,100.93	-355.16	-702.29	230.84	-1,117.85	-703.08	-1,085.46	-355.23	-557.00	-126.12
F. Other land	515.92	166.02	141.04	166.29	190.14	198.09	229.86	160.78	150.65	134.28	157.22	158.54	-84.58
G. Harvested wood products	888.89	619.88	505.57	-408.47	-440.89	456.84	107.84	2,098.19	-126.17	-252.71	-1,313.55	-1,597.87	266.60
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5. Waste	15,154.23	14,600.90	13,762.93	13,651.98	15,264.11	12,553.67	13,071.02	12,468.42	13,045.27	12,919.00	12,552.90	12,775.96	-2.68
A. Solid waste disposal	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NE,NO	NO,NE	
B. Biological treatment of solid waste													
C. Incineration and open burning of waste	14,647.53	14,094.09	13,240.57	13,090.78	14,733.70	12,039.98	12,544.11	11,944.29	12,517.16	12,314.31	11,935.87	12,151.03	-2.20
D. Waste water treatment and discharge													
E. Other	506.70	506.81	522.36	561.20	530.41	513.69	526.91	524.13	528.10	604.69	617.03	624.93	-11.08
6. Other (as specified in the summary table in CRF)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
Memo items:													
International bunkers	38,595.40	40,883.54	38,383.50	36,650.20	34,259.78	30,233.94	30,732.99	31,095.50	31,727.30	32,915.15	31,845.54	33,434.72	9.09
Aviation	21,190.20	21,336.33	19,964.61	18,358.58	17,517.99	15,372.73	16,295.33	18,249.69	19,140.10	19,498.79	19,024.56	19,125.80	45.01
Navigation	17,405.20	19,547.22	18,418.88	18,291.61	16,741.79	14,861.21	14,437.66	12,845.81	12,587.20	13,416.36	12,820.98	14,308.92	-18.04
Multilateral operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
CO2 emissions from biomass	42,247.08	45,966.63	46,513.75	47,218.37	45,556.05	42,528.57	57,791.90	57,349.80	58,247.46	59,390.44	61,918.65	62,372.61	78.92
CO2 captured	0.04	0.12	0.36	0.37	NO	NO	NO	NO	NO	NO	NO	NO	
Long-term storage of C in waste disposal sites	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
Indirect N2O													
Indirect CO2 (3)	3,197.46	3,092.12	3,025.47	2,890.16	2,615.24	2,410.25	2,342.95	2,261.36	2,181.11	2,182.62	2,110.81	2,149.93	-59.44
Total CO2 equivalent emissions without land use, land-use change and forestry	1,300,190.16	1,307,693.19	1,287,099.00	1,321,713.44	1,237,290.85	1,164,685.29	1,215,010.75	1,263,816.17	1,298,157.57	1,313,686.01	1,266,601.40	1,225,239.49	5.88
Total CO2 equivalent emissions with land use, land-use change and forestry	1,203,240.71	1,215,898.89	1,200,778.04	1,238,767.35	1,164,933.51	1,096,517.50	1,144,690.19	1,192,851.10	1,224,503.01	1,245,982.81	1,201,239.91	1,164,070.04	6.46
Total CO2 equivalent emissions, including indirect CO2, without land use, land-use change and forestry	1,303,387.62	1,310,785.32	1,290,124.47	1,324,603.60	1,239,906.09	1,167,095.55	1,217,353.70	1,266,077.53	1,300,338.68	1,315,868.63	1,268,712.21	1,227,389.42	5.59
Total CO2 equivalent emissions, including indirect CO2, with land use, land-use change and forestry	1,206,438.17	1,218,991.01	1,203,803.51	1,241,657.51	1,167,548.75	1,098,927.75	1,147,033.13	1,195,112.46	1,226,684.13	1,248,165.43	1,203,350.72	1,166,219.97	6.14

Table1-21 Emission trends (CH_4) (CTF Table 1(b))

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	kt														
1. Energy	255.69	255.69	234.90	215.87	191.11	174.16	164.28	150.35	142.89	133.20	131.52	126.87	114.81	94.02	92.29
A. Fuel combustion (sectoral approach)	56.76	56.76	56.13	55.68	56.50	56.68	58.40	57.81	55.04	52.88	53.38	53.44	50.80	51.70	51.59
1. Energy industries	17.26	17.26	16.93	15.77	15.59	16.04	16.11	15.72	13.49	12.61	12.13	10.22	8.01	7.90	7.43
2. Manufacturing industries and construction	17.65	17.65	17.20	16.96	17.02	17.24	17.49	18.33	17.46	15.59	15.38	17.08	16.69	17.98	19.44
3. Transport	11.65	11.65	11.94	12.09	11.95	12.08	12.36	12.63	12.75	12.55	12.55	12.48	12.25	11.86	11.27
4. Other sectors	10.20	10.20	10.06	10.86	11.94	11.32	12.44	11.13	11.35	12.13	13.33	13.66	13.85	13.96	13.45
5. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Fugitive emissions from fuels	198.93	198.93	178.77	160.19	134.62	117.48	105.88	92.54	87.85	80.31	78.14	73.43	64.01	42.32	40.70
1. Solid fuels	190.42	190.42	169.71	151.12	125.25	107.95	95.76	82.40	77.32	69.99	67.72	62.52	53.19	30.73	28.85
2. Oil and natural gas and other emissions from energy production	8.51	8.51	9.06	9.07	9.37	9.52	10.12	10.14	10.53	10.33	10.42	10.91	10.82	11.58	11.86
C. CO_2 transport and storage															
2. Industrial processes	2.42	2.42	2.33	2.20	2.09	2.23	2.34	2.22	2.20	2.10	2.08	2.17	2.07	2.11	2.01
A. Mineral industry															
B. Chemical industry	1.50	1.50	1.46	1.35	1.29	1.40	1.48	1.35	1.33	1.34	1.31	1.37	1.32	1.32	1.22
C. Metal industry	0.92	0.92	0.87	0.85	0.80	0.83	0.85	0.87	0.87	0.77	0.77	0.80	0.75	0.79	0.79
D. Non-energy products from fuels and solvent use	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
E. Electronic industry															
F. Product uses as ODS substitutes															
G. Other product manufacture and use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
H. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3. Agriculture	1,019.17	1,019.17	996.36	1,050.31	919.38	1,078.72	1,040.69	1,016.27	1,006.73	957.06	966.24	982.51	973.55	979.39	934.84
A. Enteric fermentation	369.12	369.12	376.53	379.23	375.39	369.68	366.24	362.90	361.79	359.96	357.62	353.57	354.73	351.51	346.93
B. Manure management	134.13	134.13	134.61	133.66	130.50	126.85	125.82	124.07	122.32	120.11	117.81	115.16	114.93	114.62	112.86
C. Rice cultivation	510.84	510.84	480.53	532.56	409.08	577.57	544.18	524.98	518.42	472.97	486.87	509.95	500.08	509.55	471.54
D. Agricultural soils	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
E. Prescribed burning of savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field burning of agricultural residues	5.08	5.08	4.69	4.86	4.41	4.63	4.44	4.33	4.21	4.02	3.94	3.84	3.81	3.69	3.51
G. Liming															
H. Urea application															
I. Other carbon-containing fertilizers															
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4. Land use, land-use change and forestry	2.92	2.92	2.79	2.66	3.57	3.25	2.80	3.72	3.97	2.84	2.56	2.67	2.87	3.24	2.44
A. Forest land	0.40	0.40	0.30	0.21	1.14	0.84	0.41	1.35	1.63	0.51	0.25	0.37	0.59	0.97	0.19
B. Cropland	2.43	2.43	2.40	2.37	2.34	2.32	2.29	2.27	2.26	2.24	2.22	2.21	2.19	2.17	2.16
C. Grassland	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
D. Wetlands	NO,NA, NE	NO,NA, NE	NO,NA, NE	NO,NA, NE	NO,NA, NE	NO,NA, NE	NO,NA, NE	NO,NA, NE	NO,NA, NE	NO,NA, NE	NO,NA, NE	NO,NA, NE	NO,NA, NE	NO,NA, NE	NO,NA, NE
E. Settlements	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Other land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Harvested wood products															
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Waste	491.65	491.65	485.95	484.11	476.36	469.45	458.21	447.55	435.58	420.75	407.68	395.09	373.81	361.93	349.38
A. Solid waste disposal	368.83	368.83	366.07	365.07	359.24	354.49	344.75	335.60	325.10	312.43	300.52	289.42	277.34	265.23	252.89
B. Biological treatment of solid waste	7.79	7.79	7.65	7.67	7.69	7.63	7.65	7.67	7.72	7.68	7.71	7.76	7.82	9.90	11.64
C. Incineration and open burning of waste	0.64	0.64	0.62	0.64	0.64	0.69	0.71	0.73	0.70	0.69	0.67	0.63	0.60	0.93	0.80
D. Waste water treatment and discharge	114.39	114.39	111.61	110.73	108.79	106.64	105.10	103.56	102.06	99.95	98.78	97.27	88.06	85.88	84.05
E. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6. Other (as specified in the summary table in CRF)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total CH_4 emissions without CH_4 from LULUCF	1,768.92	1,768.92	1,719.53	1,752.49	1,588.94	1,724.56	1,665.52	1,616.39	1,587.40	1,513.11	1,507.53	1,506.64	1,464.24	1,437.46	1,378.53
Total CH_4 emissions with CH_4 from LULUCF	1,771.84	1,771.84	1,722.33	1,755.15	1,592.51	1,727.81	1,668.31	1,620.11	1,591.37	1,515.95	1,510.09	1,509.31	1,467.11	1,440.69	1,380.97
Memo items:															
International bunkers	1.75	1.75	1.85	1.85	2.08	2.08	2.11	1.31	1.67	1.77	1.68	1.73	1.50	1.59	1.73
Aviation	0.09	0.09	0.10	0.10	0.10	0.11	0.12	0.13	0.14	0.14	0.14	0.14	0.13	0.15	0.14
Navigation	1.65	1.65	1.75	1.75	1.98	1.97	1.99	1.17	1.53	1.63	1.54	1.59	1.37	1.44	1.58
Multilateral operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 emissions from biomass															
CO_2 captured															
Long-term storage of C in waste disposal sites															
Indirect N_2O															
Indirect CO_2															

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Change from base to latest reported year
	kt												(%)
1. Energy	95.32	98.26	100.27	101.28	99.22	94.71	118.23	103.49	103.17	100.95	100.75	99.17	-61.21
A. Fuel combustion (sectoral approach)	56.26	59.20	60.98	62.28	61.34	58.05	82.84	68.80	69.15	68.29	68.52	67.63	19.16
1. Energy industries	8.50	8.84	8.73	10.98	12.62	12.54	13.93	14.82	15.90	12.97	12.25	11.44	-33.70
2. Manufacturing industries and construction	20.48	20.89	22.76	23.06	22.02	21.83	24.02	19.18	19.80	20.41	21.58	21.55	22.09
3. Transport	10.55	9.90	9.30	8.77	8.00	7.47	7.13	6.81	6.55	6.24	5.93	5.72	-50.93
4. Other sectors	16.72	19.58	20.19	19.47	18.69	16.22	37.77	28.00	26.89	28.67	28.76	28.93	183.56
5. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
B. Fugitive emissions from fuels	39.06	39.06	39.30	39.00	37.87	36.66	35.40	34.69	34.02	32.65	32.23	31.54	-84.15
1. Solid fuels	26.87	26.18	25.75	24.37	23.59	23.09	22.57	22.09	21.81	21.32	21.52	20.83	-89.06
2. Oil and natural gas and other emissions from energy production	12.20	12.88	13.54	14.63	14.28	13.57	12.83	12.60	12.22	11.33	10.71	10.71	25.79
C. CO_2 transport and storage													
2. Industrial processes	2.15	2.15	2.18	2.04	1.99	2.05	2.16	2.15	1.85	1.86	1.72	1.94	-19.92
A. Mineral industry													
B. Chemical industry	1.34	1.35	1.37	1.21	1.27	1.43	1.45	1.43	1.13	1.13	1.01	1.27	-15.21
C. Metal industry	0.81	0.80	0.82	0.82	0.72	0.62	0.71	0.72	0.72	0.73	0.71	0.67	-27.59
D. Non-energy products from fuels and solvent use	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
E. Electronic industry													
F. Product uses as ODS substitutes													
G. Other product manufacture and use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
H. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3. Agriculture	986.32	988.15	979.44	1,003.22	1,007.35	989.69	1,023.65	1,007.68	983.72	982.57	967.94	945.91	-7.19
A. Enteric fermentation	339.01	337.63	338.43	339.04	334.11	329.58	318.66	317.11	309.42	301.11	293.71	293.39	-20.52
B. Manure management	110.19	109.31	107.03	105.36	103.85	102.57	100.43	100.46	98.45	95.96	93.92	93.39	-30.37
C. Rice cultivation	533.74	537.78	530.66	555.58	566.27	554.51	601.62	587.20	573.01	582.62	577.50	556.31	8.90
D. Agricultural soils	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
E. Prescribed burning of savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
F. Field burning of agricultural residues	3.38	3.43	3.32	3.23	3.11	3.02	2.94	2.91	2.83	2.88	2.80	2.81	-44.76
G. Liming													
H. Urea application													
I. Other carbon-containing fertilizers													
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
4. Land use, land-use change and forestry	2.82	2.67	2.35	2.32	3.24	2.61	2.39	2.43	2.24	2.31	3.05	2.37	-18.64
A. Forest land	0.57	0.43	0.12	0.10	1.02	0.41	0.20	0.25	0.08	0.16	0.91	0.24	-39.04
B. Cropland	2.15	2.15	2.14	2.13	2.13	2.11	2.10	2.09	2.08	2.07	2.05	2.04	-15.99
C. Grassland	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	1.10
D. Wetlands	NO,NA, NE	NO,NA, NE	NO,NA, NE	NO,NA, NE	NO,NA, NE	NO,NA, NE	NO,NA, NE	NO,NA, NE	NO,NA, NE	NO,NA, NE	NE,NA, NO	NO,NE, NA	
E. Settlements	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
F. Other land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
G. Harvested wood products													
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
5. Waste	335.57	322.60	308.60	294.01	280.23	265.65	250.16	240.28	230.54	221.64	212.32	204.78	-58.35
A. Solid waste disposal	240.35	228.12	215.32	203.19	188.69	176.51	164.29	154.46	146.20	138.37	130.06	122.51	-66.79
B. Biological treatment of solid waste	12.00	13.58	13.98	13.50	15.18	15.07	13.18	14.48	14.36	14.22	14.21	14.23	82.83
C. Incineration and open burning of waste	0.73	0.68	0.63	0.58	0.56	0.50	0.46	0.46	0.48	0.48	0.43	0.43	-33.48
D. Waste water treatment and discharge	82.49	80.22	78.67	76.74	75.79	73.58	72.23	70.88	69.50	68.56	67.62	67.61	-40.89
E. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
6. Other (as specified in the summary table in CRF)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
Total CH_4 emissions without CH_4 from LULUCF	1,419.36	1,411.17	1,390.50	1,400.54	1,388.78	1,352.10	1,394.20	1,353.61	1,319.28	1,307.01	1,282.73	1,251.80	-29.23
Total CH_4 emissions with CH_4 from LULUCF	1,422.18	1,413.84	1,392.85	1,402.86	1,392.02	1,354.71	1,396.59	1,356.03	1,321.52	1,309.33	1,285.78	1,254.17	-29.22
Memo items:													
International bunkers	1.80	2.01	1.89	1.86	1.71	1.52	1.48	1.35	1.33	1.34	1.26	1.42	-18.94
Aviation	0.15	0.15	0.14	0.13	0.12	0.11	0.12	0.13	0.14	0.13	0.13	0.13	41.22
Navigation	1.65	1.86	1.75	1.73	1.59	1.41	1.37	1.22	1.19	1.20	1.13	1.28	-22.33
Multilateral operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
CO_2 emissions from biomass													
CO_2 captured													
Long-term storage of C in waste disposal sites													
Indirect N_2O													
Indirect CO_2													

Table1-22 Emission trends (N_2O) (CTF Table 1(c))

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	kt														
1. Energy	22.08	22.08	22.89	23.28	23.73	24.68	26.72	27.30	28.05	27.53	27.98	28.11	28.14	27.29	26.38
A. Fuel combustion (sectoral approach)	22.08	22.08	22.89	23.28	23.72	24.68	26.72	27.30	28.05	27.53	27.98	28.10	28.14	27.29	26.38
1. Energy industries	4.02	4.02	4.14	4.13	4.26	4.53	5.83	6.00	6.24	6.31	6.64	6.90	7.53	7.38	7.45
2. Manufacturing industries and construction	4.68	4.68	4.91	5.04	5.36	5.80	6.10	6.32	6.67	6.35	6.49	6.68	6.65	6.77	6.71
3. Transport	12.55	12.55	13.02	13.27	13.16	13.40	13.77	14.02	14.16	13.83	13.76	13.41	12.86	12.03	11.16
4. Other sectors	0.84	0.84	0.82	0.84	0.94	0.95	1.02	0.96	0.98	1.04	1.10	1.11	1.10	1.11	1.06
5. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Fugitive emissions from fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1. Solid fuels	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE
2. Oil and natural gas and other emissions from energy production	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. CO_2 transport and storage															
2. Industrial processes	33.26	33.26	31.65	31.54	30.64	34.26	33.94	37.31	39.33	34.99	14.16	22.55	11.27	10.81	10.97
A. Mineral industry															
B. Chemical industry	32.28	32.28	30.44	30.14	29.24	32.76	32.43	35.84	37.91	33.66	12.86	21.30	10.02	9.55	9.69
C. Metal industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Non-energy products from fuels and solvent use	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
E. Electronic industry															
F. Product uses as ODS substitutes															
G. Other product manufacture and use	0.98	0.98	1.21	1.40	1.40	1.49	1.51	1.46	1.42	1.33	1.29	1.25	1.25	1.26	1.27
H. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3. Agriculture	38.75	38.75	38.32	38.09	38.10	37.42	36.18	35.59	35.21	34.75	34.46	34.62	34.09	34.19	34.20
A. Enteric fermentation															
B. Manure management	14.26	14.26	14.36	14.31	14.08	13.78	13.55	13.39	13.31	13.09	12.91	12.98	13.09	13.29	13.47
C. Rice cultivation															
D. Agricultural soils	24.36	24.36	23.84	23.65	23.90	23.52	22.52	22.09	21.79	21.56	21.45	21.55	20.90	20.80	20.63
E. Prescribed burning of savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field burning of agricultural residues	0.13	0.13	0.12	0.13	0.11	0.12	0.12	0.11	0.11	0.10	0.10	0.10	0.10	0.10	0.09
G. Liming															
H. Urea application															
I. Other carbon containing fertlizers															
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4. Land use, land-use change and forestry	0.70	0.70	0.69	0.69	0.69	0.68	0.67	0.67	0.66	0.65	0.64	0.63	0.63	0.63	0.61
A. Forest land	0.41	0.41	0.41	0.41	0.42	0.41	0.41	0.42	0.42	0.41	0.41	0.41	0.41	0.41	0.41
B. Cropland	0.11	0.11	0.10	0.10	0.10	0.10	0.09	0.08	0.08	0.08	0.07	0.07	0.07	0.06	0.06
C. Grassland	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
D. Wetlands	NO,NA, NE,IE	NO,NA, NE,IE	NO,NA, NE,IE	NO,NA, NE,IE	NO,NA, NE,IE	NO,NA, NE,IE	NO,NA, NE,IE	NO,NA, NE,IE	NO,NA, NE,IE	NO,NA, NE,IE	NO,NA, NE,IE	NO,NA, NE,IE	NO,NA, NE,IE	NO,NA, NE,IE	NO,NA, NE,IE
E. Settlements	NO,NA, IE	NO,NA, IE	NO,NA, IE	NO,NA, IE	NO,NA, IE	NO,NA, IE	NO,NA, IE	NO,NA, IE	NO,NA, IE	NO,NA, IE	NO,NA, IE	NO,NA, IE	NO,NA, IE	NO,NA, IE	NO,NA, IE
F. Other land	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
G. Harvested wood products															
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Waste	11.67	11.67	11.89	12.32	12.40	12.90	13.43	13.84	14.12	14.09	14.11	13.92	13.71	13.09	13.17
A. Solid waste disposal															
B. Biological treatment of solid waste	0.47	0.47	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.47	0.47	0.59	0.70
C. Incineration and open burning of waste	4.82	4.82	4.95	5.40	5.40	5.93	6.39	6.80	7.04	7.06	7.29	7.23	7.00	6.41	6.40
D. Waste water treatment and discharge	6.39	6.39	6.48	6.46	6.54	6.51	6.58	6.58	6.62	6.58	6.36	6.23	6.25	6.09	6.07
E. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6. Other (as specified in the summary table in CRF)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total direct N_2O emissions without N_2O from LULUCF	105.76	105.76	104.76	105.23	104.87	109.26	110.27	114.03	116.71	111.36	90.72	99.20	87.22	85.38	84.71
Total direct N_2O emissions with N_2O from LULUCF	106.47	106.47	105.45	105.92	105.56	109.94	110.94	114.70	117.37	112.01	91.36	99.83	87.85	86.01	85.32
Memo items:															
International bunkers	0.85	0.85	0.89	0.90	0.96	0.99	1.05	0.86	0.98	1.03	0.99	1.01	0.92	1.01	1.03
Aviation	0.37	0.37	0.39	0.40	0.39	0.43	0.48	0.52	0.54	0.57	0.55	0.55	0.53	0.60	0.58
Navigation	0.47	0.47	0.50	0.50	0.57	0.56	0.57	0.34	0.44	0.47	0.44	0.45	0.39	0.41	0.45
Multilateral operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 emissions from biomass															
CO_2 captured															
Long-term storage of C in waste disposal sites															
Indirect N_2O	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indirect CO_2															

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Change from base to latest reported year
	kt												(%)
1. Energy	25.59	25.58	24.84	24.69	23.69	22.53	22.43	22.14	21.93	22.02	21.58	21.55	-2.42
A. Fuel combustion (sectoral approach)	25.59	25.58	24.84	24.69	23.69	22.53	22.43	22.14	21.93	22.02	21.58	21.55	-2.42
1. Energy industries	7.45	8.19	8.14	8.35	8.19	7.91	7.97	8.59	8.64	8.79	8.57	8.61	114.24
2. Manufacturing industries and construction	6.78	6.74	6.70	6.85	6.60	6.21	6.29	6.09	6.16	6.28	6.26	6.32	35.14
3. Transport	10.23	9.45	8.85	8.39	7.88	7.34	6.88	6.54	6.28	6.04	5.85	5.76	-54.12
4. Other sectors	1.13	1.19	1.15	1.10	1.01	1.08	1.30	0.93	0.85	0.89	0.90	0.86	2.87
5. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
B. Fugitive emissions from fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-23.60
1. Solid fuels	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NE,NO	NO,NE	
2. Oil and natural gas and other emissions from energy production	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-23.60
C. CO_2 transport and storage													
2. Industrial processes	12.08	10.38	11.20	8.60	8.88	9.32	7.62	6.48	5.83	5.87	5.72	5.41	-83.74
A. Mineral industry													
B. Chemical industry	10.86	9.15	9.88	7.48	7.89	8.45	6.70	5.57	4.80	4.66	3.62	3.17	-90.19
C. Metal industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
D. Non-energy products from fuels and solvent use	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
E. Electronic industry													
F. Product uses as ODS substitutes													
G. Other product manufacture and use	1.22	1.23	1.33	1.13	1.00	0.87	0.92	0.91	1.03	1.20	2.10	2.24	129.55
H. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3. Agriculture	33.87	33.94	34.13	35.47	33.23	32.33	33.19	32.73	32.35	32.28	31.80	31.75	-18.08
A. Enteric fermentation													
B. Manure management	13.52	13.74	14.11	14.37	14.63	14.66	14.31	14.14	13.86	13.63	13.42	13.37	-6.23
C. Rice cultivation													
D. Agricultural soils	20.26	20.11	19.94	21.01	18.52	17.59	18.81	18.51	18.41	18.58	18.30	18.30	-24.87
E. Prescribed burning of savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
F. Field burning of agricultural residues	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.07	-44.76
G. Liming													
H. Urea application													
I. Other carbon containing fertlizers													
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
4. Land use, land-use change and forestry	0.61	0.60	0.59	0.59	0.58	0.57	0.57	0.57	0.56	0.56	0.57	0.57	-18.60
A. Forest land	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.42	0.42	2.50
B. Cropland	0.05	0.05	0.05	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	-73.25
C. Grassland	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-6.69
D. Wetlands	NO,NA, NE,IE	NO,NA, NE,IE	NO,NA, NE,IE	NO,NA, NE,IE	NO,NA, NE,IE	NO,NA, NE,IE	NO,NA, NE,IE	NO,NA, NE,IE	NO,NA, NE,IE	NO,NA, NE,IE	NE,NA, NO,IE	NO,NE, IE,NA	
E. Settlements	NO,NA, IE	NO,NA, IE	NO,NA, IE	NO,NA, IE	NO,NA, IE	NO,NA, IE	NO,NA, IE	NO,NA, IE	NO,NA, IE	NO,NA, IE	NA,NO, IE	NO,IE, NA	
F. Other land	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	-71.63
G. Harvested wood products													
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
5. Waste	13.14	13.43	13.03	12.42	12.26	11.95	11.65	11.75	11.54	11.65	11.19	11.20	-4.09
A. Solid waste disposal													
B. Biological treatment of solid waste	0.72	0.81	0.84	0.81	0.91	0.90	0.79	0.87	0.86	0.85	0.85	0.85	82.83
C. Incineration and open burning of waste	6.37	6.59	6.19	5.68	5.47	5.27	5.09	5.12	5.13	5.17	4.81	4.81	-0.06
D. Waste water treatment and discharge	6.05	6.02	6.01	5.92	5.89	5.78	5.77	5.77	5.55	5.62	5.53	5.53	-13.48
E. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
6. Other (as specified in the summary table in CRF)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
Total direct N_2O emissions without N_2O from LULUCF	84.68	83.32	83.21	81.18	78.07	76.14	74.89	73.11	71.65	71.81	70.29	69.90	-33.91
Total direct N_2O emissions with N_2O from LULUCF	85.29	83.92	83.80	81.76	78.65	76.71	75.46	73.67	72.21	72.38	70.86	70.47	-33.81
Memo items:													
International bunkers	1.07	1.13	1.07	1.02	0.95	0.84	0.85	0.86	0.88	0.88	0.85	0.89	5.72
Aviation	0.60	0.60	0.57	0.52	0.50	0.44	0.46	0.52	0.54	0.54	0.52	0.53	41.22
Navigation	0.47	0.53	0.50	0.50	0.45	0.40	0.39	0.35	0.34	0.34	0.32	0.37	-22.33
Multilateral operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
CO_2 emissions from biomass													
CO_2 captured													
Long-term storage of C in waste disposal sites													
Indirect N_2O	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Indirect CO_2													

Table1-23 Emission trends (HFCs, PFCs, SF_6 and NF_3) (CTF Table 1(d))

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	kt														
	22,471.61	22,471.61	24,856.54	25,384.52	29,071.96	34,495.36	42,823.11	42,856.28	44,421.08	40,310.58	37,486.34	34,725.11	29,340.99	25,435.83	25,082.57
Emissions of HFCs - (kt CO_2 equivalent)	15,932.31	15,932.31	17,349.61	17,767.22	18,129.16	21,051.90	25,213.19	24,598.11	24,436.79	23,742.10	24,368.28	22,852.00	19,462.52	16,236.39	16,228.36
HFC-23	1.08	1.08	1.17	1.19	1.13	1.24	1.45	1.33	1.26	1.18	1.21	1.06	0.80	0.52	0.43
HFC-32	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	0.00	0.01	0.02	0.05	0.08	0.14
HFC-41	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-43-10mee	NO,NE,IE	NO,NE,IE	NO,NE,IE	IE,NE,NO	NO,NE,IE	IE,NE,NO	IE,NE,NO	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE
HFC-125	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	0.00	0.01	0.02	0.05	0.08	0.14
HFC-134	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-134a	0.00	0.00	IE,NO	0.08	0.63	1.30	2.01	2.79	3.49	3.87	4.05	4.31	4.38	4.61	4.76
HFC-143	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-143a	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00	0.00	0.00	0.00	0.00	0.00
HFC-152	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-152a	0.00	0.00	NO	0.00	0.01	0.01	0.01	0.01	0.00	NO	NO	0.02	0.08	0.16	0.40
HFC-161	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-227ea	NO	NO	NO	NO	NO	NO	NO	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02
HFC-236cb	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-236ea	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-236fa	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-245ca	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-245fa	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO
HFC-365mfc	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	0.00
Unspecified mix of HFCs - (kt CO_2 equivalent)	2.24	2.24	IE,NO	67.54	440.93	768.60	876.60	877.75	854.74	763.92	705.37	899.09	1,141.08	1,510.75	2,356.16
Emissions of PFCs - (kt CO_2 equivalent)	6,539.30	6,539.30	7,506.92	7,617.29	10,942.80	13,443.46	17,609.92	18,258.18	19,984.28	16,568.48	13,118.06	11,873.11	9,878.47	9,199.44	8,854.21
CF_4	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00
C_2F_6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C_3F_8	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C_4F_{10}	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
c-C_4F_8	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C_5F_{12}	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C_6F_{14}	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00	0.00
C10F18	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
c-C3F6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Unspecified mix of PFCs - (kt CO_2 equivalent)	6,335.64	6,335.64	7,336.00	7,502.73	10,837.28	13,338.18	17,506.37	18,160.35	19,896.03	16,495.12	13,074.82	11,846.70	9,855.58	9,177.57	8,831.96
Unspecified mix of HFCs and PFCs - (kt CO_2 equivalent)															
Emissions of SF_6 - (kt CO_2 equivalent)	12,850.07	12,850.07	14,206.04	15,635.82	15,701.97	15,019.96	16,447.52	17,022.19	14,510.54	13,224.10	9,176.62	7,031.36	6,066.02	5,735.48	5,406.31
SF_6	**0.56**	**0.56**	**0.62**	**0.69**	**0.69**	**0.66**	**0.72**	**0.75**	**0.64**	**0.58**	**0.40**	**0.31**	**0.27**	**0.25**	**0.24**
Emissions of NF_3 - (kt CO_2 equivalent)	32.61	32.61	32.61	32.61	43.48	76.09	201.09	192.55	171.06	188.13	315.27	285.77	294.81	371.48	416.10
NF_3	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Change from base to latest reported year
	kt												(%)
	21,637.56	21,405.18	23,625.84	24,624.04	25,028.33	24,984.20	27,554.77	29,826.94	32,784.93	35,374.62	39,127.22	42,510.91	89.18
Emissions of HFCs - (kt CO_2 equivalent)	12,420.92	12,781.83	14,627.06	16,707.19	19,284.93	20,937.33	23,305.23	26,071.50	29,348.60	32,094.56	35,765.79	39,202.80	146.06
HFC-23	0.09	0.04	0.06	0.02	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-99.77
HFC-32	0.21	0.30	0.39	0.49	0.61	0.72	0.85	1.02	1.21	1.41	1.68	2.01	100.00
HFC-41	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
HFC-43-10mee	NO,NE,IE	IE,NE,NO	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	IE,NE,NO	NO,NE,IE	NO,NE,IE	NO,NE,IE	
HFC-125	0.22	0.31	0.40	0.50	0.62	0.74	0.86	1.04	1.23	1.40	1.58	1.75	100.00
HFC-134	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
HFC-134a	4.32	3.59	2.91	2.85	2.85	2.83	2.78	2.64	2.63	2.64	2.60	2.51	268,445.31
HFC-143	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
HFC-143a	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.04	0.04	0.04	100.00
HFC-152	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
HFC-152a	0.84	1.22	1.41	1.44	1.68	1.58	1.30	1.26	0.99	0.68	0.52	0.42	1,121,792.86
HFC-161	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
HFC-227ea	0.04	0.05	0.04	0.04	0.05	0.04	0.03	0.03	0.03	0.03	0.02	0.03	100.00
HFC-236cb	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
HFC-236ea	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
HFC-236fa	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
HFC-245ca	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
HFC-245fa	0.19	0.48	0.67	0.85	0.93	1.01	1.11	1.24	1.36	1.47	1.58	1.67	100.00
HFC-365mfc	0.08	0.17	0.25	0.31	0.35	0.41	0.46	0.51	0.59	0.66	0.70	0.73	100.00
Unspecified mix of HFCs - (kt CO_2 equivalent)	3,542.91	4,826.92	6,722.74	8,786.08	10,353.97	11,995.32	13,794.72	15,890.35	18,209.99	20,057.77	22,848.50	25,457.26	1,134,906.07
Emissions of PFCs - (kt CO_2 equivalent)	9,216.64	8,623.35	8,998.78	7,916.85	5,743.40	4,046.87	4,249.54	3,755.45	3,436.33	3,280.06	3,361.43	3,308.10	-49.41
CF_4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NO	
C_2F_6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NO	
C_3F_8	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
C_4F_{10}	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
c-C_4F_8	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
C_5F_{12}	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
C_6F_{14}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NA,NO	0.00	0.00	0.00	100.00
C10F18	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
c-C3F6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
Unspecified mix of PFCs - (kt CO_2 equivalent)	9,194.74	8,601.30	8,976.33	7,893.84	5,719.50	4,027.52	4,229.93	3,734.27	3,423.06	3,260.11	3,350.51	3,300.28	-47.91
Unspecified mix of HFCs and PFCs - (kt CO_2 equivalent)													
Emissions of SF_6 - (kt CO_2 equivalent)	5,258.70	5,053.01	5,228.90	4,733.45	4,177.17	2,446.63	2,423.87	2,247.64	2,234.54	2,101.81	2,065.07	2,121.86	-83.49
SF_6	**0.23**	**0.22**	**0.23**	**0.21**	**0.18**	**0.11**	**0.11**	**0.10**	**0.10**	**0.09**	**0.09**	**0.09**	**-83.49**
Emissions of NF_3 - (kt CO_2 equivalent)	486.04	1,471.75	1,401.31	1,586.80	1,481.04	1,354.16	1,539.74	1,800.38	1,511.85	1,617.24	1,122.87	571.03	1,651.10
NF_3	0.03	0.09	0.08	0.09	0.09	0.08	0.09	0.10	0.09	0.09	0.07	0.03	1,651.10

1.1.8 Key Category Analysis

key category is one that is prioritized within the national inventory system because its estimate has a significant influence on a country`s total inventory of greenhouse gases in terms of the absolute level, the trend, or the uncertainty in emissions and removals.

Key category analyses in FY2015 and the base year of the UNFCCC (1990) which were carried out in accordance with the 2006 IPCC Guidelines (Approach 1 level assessment [15] and trend assessment [16], Approach 2 level assessment and level assessment and trend assessment) are shown in Table 1-24 and Table 1-25 .46 sources and sinks were identified as Japan's key categories in FY2015 and 41 sources and sinks were identified as key categories in FY1990.

[15] The calculated values of proportion are added from the category that accounts for the largest proportion, until the sum reaches 95% for Approach 1, 90% for Approach 2. Approach 1 level assessment uses emissions and removals from each category directly and Approach 2 level assessment analyzes the emissions and removals of each category, multiplied by the uncertainty of each category.

[16] The calculated results, regarded as trend assessment values, are added from the category whose proportion to the total of trend assessment values is the largest, until the total reaches 95% for Approach 1, 90% for Approach 2. Approach1 level assessment uses emissions and removals from each category directly and Approach 2 level assessment analyzes the emissions and removals of each category, multiplied by the uncertainty of each category.

Table 1-24 Japan's key categories in FY2015

	A IPCC Category		B GHGs	Ap1-L	Ap1-T	Ap2-L	Ap2-T
#1	1.A.1. Energy Industries	Solid Fuels	CO2	#1	#1	#1	#2
#2	1.A.2. Manufacturing Industries and Construction	Solid Fuels	CO2	#2	#12	#3	#30
#3	1.A.3. Transport	b. Road Transportation	CO2	#3		#4	
#4	1.A.1. Energy Industries	Gaseous Fuels	CO2	#4	#3	#12	#14
#5	1.A.1. Energy Industries	Liquid Fuels	CO2	#5	#2	#8	#7
#6	1.A.4. Other Sectors	Liquid Fuels	CO2	#6	#5	#11	#15
#7	1.A.2. Manufacturing Industries and Construction	Liquid Fuels	CO2	#7	#4	#13	#8
#8	4.A Forest Land	1. Forest Land remaining Forest Land	CO2	#8	#8	#2	#6
#9	1.A.2. Manufacturing Industries and Construction	Gaseous Fuels	CO2	#9	#7	#34	#25
#10	1.A.4. Other Sectors	Gaseous Fuels	CO2	#10	#10		
#11	2.F Product uses as substitutes for ODS	1. Refrigeration and Air conditioning	HFCs	#11	#6	#7	#4
#12	2.A Mineral Product	1. Cement Production	CO2	#12	#11	#22	#19
#13	3.C Rice Cultivation		CH4	#13		#27	
#14	5.C Incineration and Open Burning of Waste		CO2	#14		#9	
#15	1.A.3. Transport	d. Domestic Navigation	CO2	#15	#20		
#16	1.A.3. Transport	a. Domestic Aviation	CO2	#16			
#17	1.A.2. Manufacturing Industries and Construction	Other Fossil Fuels	CO2	#17	#17	#14	#16
#18	3.A Enteric Fermentation		CH4	#18		#10	#20
#19	1.A.1. Energy Industries	Other Fossil Fuels	CO2	#19		#24	
#20	3.B Manure Management		N2O			#6	#29
#21	4.B Cropland	1. Cropland remaining Cropland	CO2		#15	#17	#5
#22	3.D Agricultural Soils	1. Direct Emissions	N2O			#25	#23
#23	1.A.4. Other Sectors	Solid Fuels	CO2		#22		
#24	5.A Solid Waste Disposal		CH4		#16	#29	#9
#25	2.B Chemical Industry	Other products except Anmonia	CO2			#15	#18
#26	1.A.1. Energy Industries		N2O			#26	#22
#27	2.F Product uses as substitutes for ODS	2. Foam Blowing Agents	HFCs		#23	#18	#12
#28	1.A.2. Manufacturing Industries and Construction		N2O			#31	
#29	3.D Agricultural Soils	2. Indirect Emissions	N2O			#5	#13
#30	2.D Non-energy Products from Fuels and Solvent		CO2			#30	
#31	5.D Wastewater Treatment and Discharge		CH4				#28
#32	2.E Electronics Industry		PFCs			#16	
#33	4.E Settlements	1. Settlements remaining Settlements	CO2			#32	
#34	5.D Wastewater Treatment and Discharge		N2O			#28	
#35	4.G Harvested Wood Products		CO2			#33	#24
#36	2.F Product uses as substitutes for ODS	5. Solvents	PFCs		#21		#27
#37	1.A.3. Transport	b. Road Transportation	N2O			#23	#10
#38	2.G Other Product Manufacture and Use		SF6		#13	#20	#1
#39	5.C Incineration and Open Burning of Waste		N2O			#21	
#40	4.E Settlements	2. Land converted to Settlements	CO2		#24		#21
#41	1.B Fugitive Emission from Fuel	1.Fugitive emissions from Solid Fuels	CH4		#18		#3
#42	2.B Chemical Industry	4. Caprolactam, Glyoxal and Glyoxylic Acid Production	N2O			#35	#11
#43	2.E Electronics Industry		SF6			#19	
#44	2.B Chemical Industry	3. Adipic Acid Production	N2O		#14		#17
#45	2.B Chemical Industry	9. Fluorochemical Production (Fugitive Emissions)	HFCs		#9		#26
#46	2.B Chemical Industry	9. Fluorochemical Production (Fugitive Emissions)	SF6		#19		

N.B.1) Ap1-L: Approach 1-Level Assessment, Ap1-T: Approach 1-Trend Assessment,
Ap2-L: Approach 2-Level Assessment, Ap2-T: Approach 2-Trend Assessment

N.B.2) Figures recorded in the Level and Trend columns indicate the ranking of individual level and trend assessments.

Table 1-25 Japan's key categories in FY1990

	A IPCC Category		B GHGs	Ap1-L	Ap2-L
#1	1.A.2. Manufacturing Industries and Construction	Solid Fuels	CO2	#1	#2
#2	1.A.3. Transport	b. Road Transportation	CO2	#2	#4
#3	1.A.1. Energy Industries	Liquid Fuels	CO2	#3	#6
#4	1.A.2. Manufacturing Industries and Construction	Liquid Fuels	CO2	#4	#7
#5	1.A.4. Other Sectors	Liquid Fuels	CO2	#5	#12
#6	1.A.1. Energy Industries	Solid Fuels	CO2	#6	#11
#7	1.A.1. Energy Industries	Gaseous Fuels	CO2	#7	#26
#8	4.A Forest Land	1. Forest Land remaining Forest Land	CO2	#8	#1
#9	2.A Mineral Product	1. Cement Production	CO2	#9	#19
#10	1.A.4. Other Sectors	Gaseous Fuels	CO2	#10	
#11	2.B Chemical Industry	9. Fluorochemical Production (Fugitive Emissions)	HFCs	#11	
#12	1.A.3. Transport	d. Domestic Navigation	CO2	#12	
#13	1.A.2. Manufacturing Industries and Construction	Gaseous Fuels	CO2	#13	
#14	3.C Rice Cultivation		CH4	#14	#27
#15	5.C Incineration and Open Burning of Waste		CO2	#15	#17
#16	4.B Cropland	1. Cropland remaining Cropland	CO2	#16	#8
#17	3.A Enteric Fermentation		CH4	#17	#14
#18	5.A Solid Waste Disposal		CH4	#18	#15
#19	2.G Other Product Manufacture and Use		SF6	#19	#3
#20	2.C Metal Production	1 Iron and Steel Production	CO2	#20	
#21	2.B Chemical Industry	3. Adipic Acid Production	N2O	#21	#29
#22	1.A.3. Transport	a. Domestic Aviation	CO2	#22	
#23	1.A.1. Energy Industries	Other Fossil Fuels	CO2	#23	#24
#24	2.A Mineral Product	2. Lime Production	CO2	#24	
#25	1.A.4. Other Sectors	Solid Fuels	CO2	#25	
#26	3.D Agricultural Soils	1. Direct Emissions	N2O	#26	#20
#27	1.B Fugitive Emission from Fuel	1.Fugitive emissions from Solid Fuels	CH4		#9
#28	3.B Manure Management		N2O		#10
#29	1.A.2. Manufacturing Industries and Construction	Other Fossil Fuels	CO2		#30
#30	2.B Chemical Industry	Other products except Anmonia	CO2		#16
#31	4.E Settlements	2. Land converted to Settlements	CO2		#28
#32	1.A.3. Transport	b. Road Transportation	N2O		#13
#33	3.B Manure Management		CH4		#33
#34	5.D Wastewater Treatment and Discharge		CH4		#31
#35	3.D Agricultural Soils	2. Indirect Emissions	N2O		#5
#36	5.D Wastewater Treatment and Discharge		N2O		#25
#37	2.B Chemical Industry	4. Caprolactam, Glyoxal and Glyoxylic Acid Production	N2O		#18
#38	2.D Non-energy Products from Fuels and Solvent		CO2		#32
#39	2.E Electronics Industry		PFCs		#22
#40	5.C Incineration and Open Burning of Waste		N2O		#23
#41	2.E Electronics Industry		SF6		#21

N.B.1) Ap1-L: Approach 1-Level Assessment, Ap2-L: Approach 2-Level Assessment

N.B.2) Figures recorded in the Level and Trend columns indicate the ranking of individual level and trend assessments.

1.2 Brief Description of National Inventory Arrangements

1.2.1 Description of Japan's Institutional Arrangement for GHG Inventory Preparation

The government of Japan is to calculate the emissions and removals of GHGs for Japan and disclose the results every year, in accordance with Article 7 of Chapter 1 General Provisions, the Act on Promotion of Global Warming Countermeasures [17], which determines the domestic measures for the UNFCCC and Kyoto Protocol. The Ministry of the Environment (MOE), with the cooperation of relevant ministries, agencies and organizations, prepares Japan's national inventory and compiles supplementary information required under Decision 2/CMP.8 etc., which is annually submitted in accordance with the UNFCCC and the Kyoto Protocol.

The MOE takes overall responsibilities for the national inventory and therefore makes every effort on improving the quality of inventory. The MOE organizes the "Committee for the Greenhouse Gas Emission Estimation Methods (Committee)" in order to integrate the latest scientific knowledge into the inventory, to meet international requirements. The estimation of GHG emissions and removals are then carried out by taking the decisions of the Committee into consideration. Substantial activities, such as the estimation of emissions and removals and the preparation of Common Reporting Format (CRF) and National Inventory Report (NIR), are done by the Greenhouse Gas Inventory Office of Japan (GIO), which belongs to the Center for Global Environmental Research of the National Institute for Environmental Studies. The relevant ministries, agencies and organizations provide the GIO the appropriate data (e.g., activity data, emission factors, GHG emissions and removals) through compiling various statistics and also provide relevant information on supplementary information required under Decision 2/CMP.8 etc. The relevant ministries and agencies check the inventories (i.e., CRF, NIR), including the spreadsheets that are actually utilized for the estimation (Japan National Greenhouse gas Inventory files, hereinafter referred to as JNGI files), as a part of the Quality Control (QC) activities.

The checked inventories are determined as Japan's official GHG emission/removal values. The inventories are then published by the MOE and are submitted to the UNFCCC Secretariat by the Ministry of Foreign Affairs.

Figure 1-30 shows the overall institutional arrangement for Japan's inventory preparation. More detailed information on the role and responsibility of relevant ministries, agencies and organizations in the inventory preparation process is described below.

[17] Enacted in October, 1998. The latest amendment was made on May 27th, 2016.

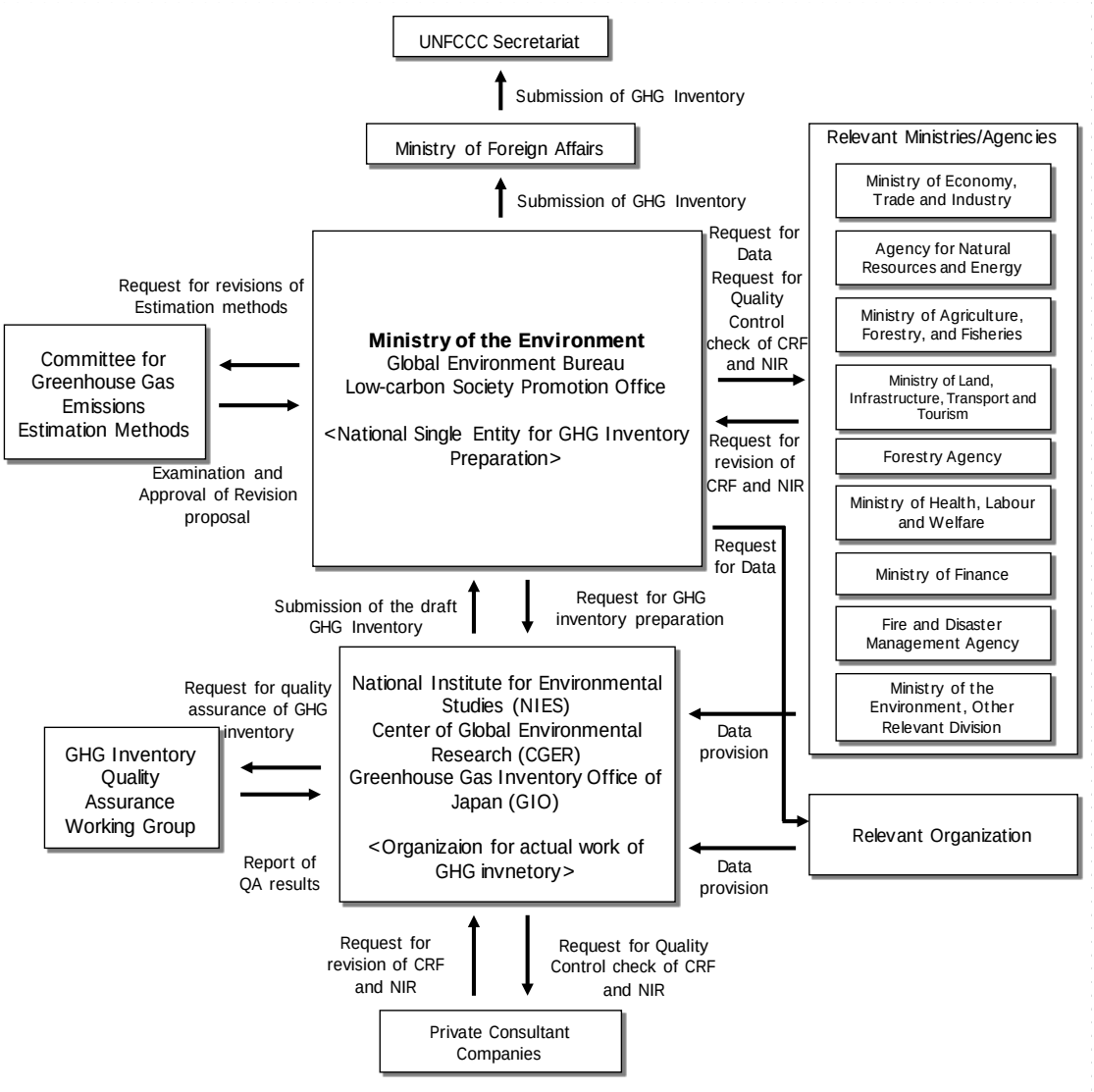


Figure 1-30 Japan's Institutional Arrangements for the National Inventory Preparation

1.2.2 Roles and Responsibilities of Each Entity Involved in the Inventory Preparation Process

Followings are the agencies involved in the inventory compilation process, and the roles of those agencies.

(1) Ministry of the Environment (Low-carbon Society Promotion Office, Global Environment Bureau)

- The single national agency responsible for preparing Japan's inventory, which was designated pursuant to the UNFCCC Inventory Reporting Guidelines and the Kyoto Protocol Article 5.1.
- It is responsible for editing and submitting the inventory.
- It coordinates the QA/QC activities for the inventory.
- It prepares, confirms, and approves the QA/QC plan.
- It prepares, confirms, and approves the inventory improvement plan.

(2) Greenhouse Gas Inventory Office of Japan (GIO), Center for Global Environmental Research, National Institute for Environmental Studies

- Performs the actual work of inventory compilation. Responsible for inventory calculations, editing, and the archiving and management of all data.

(3) Relevant Ministries/Agencies

The relevant ministries and agencies have the following roles and responsibilities regarding inventory compilation.

- Confirmation of data provided for the preparation of the inventory.
- Confirmation of the inventory (CRF, NIR, JNGI files, and other information) (Category-specific QC) prepared by the GIO.
- (When necessary), responding to questions from expert review teams about the statistics controlled by relevant ministries and agencies, or about certain data they have prepared, and preparing comments on draft reviews.
- (When necessary), responding to visits by expert review teams.

(4) Relevant Organizations

Relevant organizations have the following roles and responsibilities regarding inventory compilation.

- Confirmation of data provided for the preparation of the inventory.
- (When necessary), responding to questions from expert review teams about the statistics controlled by relevant organizations, or about certain data they have prepared, and preparing comments on draft reviews.

(5) Committee for the Greenhouse Gas Emissions Estimation Methods

The Committee for the Greenhouse Gas Emissions Estimation Methods (Committee) is a committee created and run by the Ministry of the Environment. Its role is to consider the methods for calculating inventory emissions and removals, and consider the selection of parameters such as activity data and emission factors. Under the Committee, the inventory working group (WG) that examines cross-cutting issues, and breakout groups that consider sector-specific problems (Breakout group on Energy and Industrial Processes, Breakout group on Transport, Breakout group on F-gases [HFCs, PFCs, SF_6, and NF_3], Breakout group on Agriculture, Breakout group on Waste, and Breakout group on LULUCF) are set up. In addition, the Taskforce on NMVOC is set up as an additional sub-group under the Inventory WG, and the Taskforce examines methodologies of NMVOC emission estimation. The inventory WG, breakout groups and taskforce comprise experts in various fields, and consider suggestions for inventory improvements.

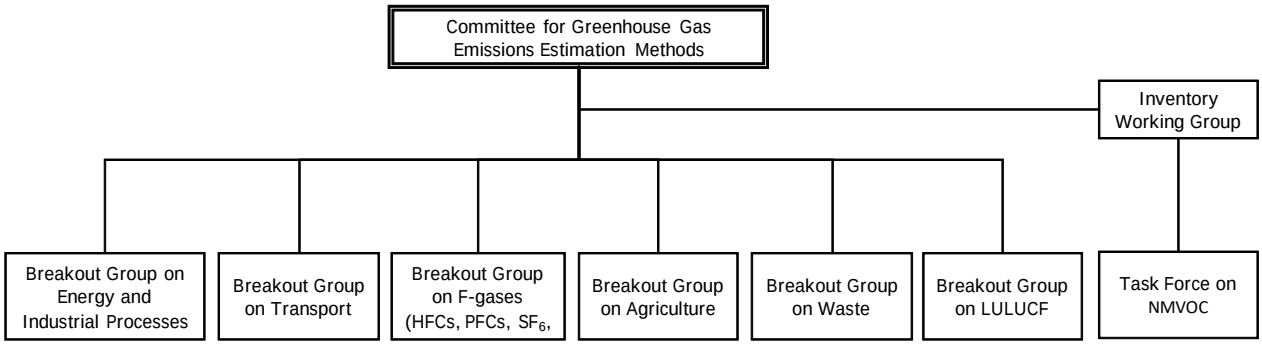


Figure 1-31 Structure of the Committee for the Greenhouse Gas Emissions Estimation Methods

(6) Private Consulting Companies

Private consultant companies that are contracted by the Ministry of the Environment to perform tasks related to inventory compilation play the following roles in inventory compilation based on their contracts.

- Quality control (QC) of inventory (CRF, NIR, JNGI files) compiled by the Ministry of the Environment and the GIO.
- (When necessary), providing support for responding to questions from expert review teams and for preparing comments on draft reviews.
- (When necessary), providing support for responding to visits by expert review teams.

(7) GHG Inventory Quality Assurance Working Group (Expert Peer Review) (QAWG)

The GHG Inventory Quality Assurance Working Group (the QAWG) is an organization that is for QA activities, and comprises experts who are not directly involved in inventory compilation. Its role is to assure inventory quality and to identify places that need improvement by conducting detailed reviews of each emission source and sink in the inventory.

1.2.3 Brief Description of the Inventory Preparation Process

1.2.3.1 Annual Inventory Preparation Cycle

Table 1-26 shows the annual cycle of the inventory preparation. The inventory preparation cycle is set in conjunction with Japan's fiscal year calendar (starting April 1st and ending March 31 the next year) In Japan, in advance of the estimation of national inventory submitted to the UNFCCC (submission deadline: 15th April), preliminary figures are estimated and published as a document for an official announcement. (In preliminary figures, only GHG emissions excluding removals are estimated.)

Table 1-26 Annual Inventory Preparation Cycle

*Inventory preparation in fiscal yaer "n"

	Process	Relevant Entities	Calender Year n+1								CY n+2			
			Fiscal Year n+1											FY n+2
			May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
1	Discussion on the inventory improvement	MOE, GIO		→	→	→	→							
2	Holding the meeting of the Committee	MOE, (GIO, Private consultant)		→	→	→	→	→	→	→	→			
3	Collection of data for the national inventory	MOE, GIO, Relevant Ministries/Agencies, Relevant organization, Private consultant								→	→	→	→	
4	Preparation of a draft of CRF	GIO, Private consultant									→	→	→	
5	Preparation of a draft of NIR	GIO, Private consultant									→	→	→	
6	Implementation of the exterior QC and the coordination with the relevant ministries and agencies	MOE, GIO, Relevant Ministries/Agencies, Private consultant										→	→	→
7	Correction of the drafts of CRF and NIR	MOE, GIO, Private consultant											→	→
8	Submission and official announcement of the national inventory	MOE, Ministry of Foreign Affairs, GIO												★
9	Holding the meeting of the QA-WG	MOE, GIO	→	→	→	→								

MOE: Ministry of the Environment
GIO: Greenhouse Gas Inventory Office of Japan
Committee: Committee for the Greenhouse Gas Emission Estimation Methods
QAWG: Inventory Quality Assurance Working Group

1.2.3.2 Process of the Inventory Preparation

(1) Discussion on the Inventory Improvement (Step 1)

The MOE and the GIO identify the items, which need to be addressed by the Committee, based on the results of the previous inventory review of the UNFCCC, the recommendations of the “Inventory Quality Assurance Working Group (QAWG)”, the items needing improvement as identified at former Committee’s meetings, as well as any other items, requiring revision, as determined during previous inventory preparations. The schedule for the expert evaluation (step 2) is developed by taking the above-mentioned

information into account.

(2) Holding the Meeting of the Committee for the Greenhouse Gas Emission Estimation Methods [Evaluation and Examination of Estimation Methods by Experts] (Step 2)

The MOE holds the meeting of the Committee, in which estimation methodologies for an annual inventory and the issues that require technical reviews are discussed by experts with different scientific backgrounds.

(3) Collection of Data for the National Inventory (Step 3)

The data required for preparing the national inventory and the supplementary information required under Decision 2/CMP.8 are collected.

(4) Preparation of a Draft of CRF [Including the Implementation of the Key Category Analysis and the Uncertainty Assessment] (Step 4)

The data input and estimation of emissions and removals are carried out simultaneously by utilizing JNGI files, which have inter-connecting links among themselves based on the calculation formulas for emissions and removals. Subsequently, the key category analysis and the uncertainty assessment are also carried out.

(5) Preparation of a Draft of NIR (Step 5)

The draft of NIR is prepared by following the general guidelines made by the MOE and the GIO. The MOE and the GIO identify the points, which need to be revised or require an additional description by taking the discussion at step 1 into account. The GIO and the selected private consulting companies prepare new NIR by updating data, and by adding and revising descriptions in the previous NIR.

(6) Implementation of the External QC and the Coordination with the Relevant Ministries and Agencies (Step 6)

As a QC activity, the selected private consulting companies check the JNGI files and the initial draft of CRF (the 0^{th} draft) prepared by the GIO (external QC). The companies not only check the input data and the calculation formulas in the files, but also check the estimations by re-calculating the total amounts of GHG emissions and removals determined by utilizing the same files. Because of this cross-check, any possible data input and emission estimation mistakes are avoided. They also check the content and descriptions of the initial draft of NIR (the 0^{th} draft) prepared by the GIO. JNGI files, draft CRF and draft NIR, which have been checked by the private consulting companies, are regarded as the primary drafts of inventories.

Subsequently, the GIO sends out the primary drafts of the inventories and official announcements as electronic computer files to the MOE and the relevant ministries and agencies, and requests them to check contents of the primary drafts. The data, which are estimated based on confidential data, are only sent out for confirmation to the ministry and/or agency which provided these confidential data.

(7) Correction of the Drafts of CRF and NIR (Step 7)

When revisions are requested as a result of the check of the primary drafts of the inventories and official announcements by the relevant ministries and agencies (step 6), the MOE, GIO and relevant ministries and/or agencies that submit requests for revision coordinate contents of revision and then revise the primary drafts and prepare the secondary drafts. The secondary drafts are sent out again to the relevant ministries and/or agencies for conclusive confirmation. If there is no additional request for revision, the secondary drafts are considered to be the final versions.

(8) Submission and Official Announcement of the National Inventory (Step 8)

The MOE submitted the completed inventory to the Ministry of Foreign Affairs, and the Ministry of Foreign Affairs submitted the inventory to the UNFCCC Secretariat. At the same time of the submission, information on the estimated GHG emissions and removals are officially announced and published on the MOE's website [18] with additional relevant information. The inventory is also published on the GIO's website [19].

(9) Holding the Meeting of the Greenhouse Gas Inventory Quality Assurance Working Group (Step 9)

The QAWG, which is composed of experts who are not directly involved in or related to the inventory preparation process, is organized in order to perform peer review and assure the inventory's quality and to find out possible improvements.

The QAWG reviews the appropriateness of the estimation methodologies, activity data, emission factors, and the contents of CRF and NIR. GIO integrates the items identified for improvement by the QAWG into the inventory improvement plan, and utilizes them in discussions on the inventory estimation methods and in subsequent inventory preparation.

1.2.4 Process for the Inventory Recalculations

In accordance with the UNFCCC Reporting Guidelines and the 2006 IPCC Guidelines, Annex I Parties should recalculate their inventories for the base year and all subsequent years of the time series in the cases of 1) application of new estimation methods, 2) addition of new categories for emissions and removals, and 3) data refinement.

In Japan, improvements in calculation methods are considered in accordance with necessity whenever an inventory item requiring improvement is identified because of, for example, a UNFCCC review or an observation by the QAWG, progress in international negotiations such as the creation of new guidelines, progress or changes in scientific research or in the compilation of statistics, or the acquisition of new information by the system for calculating, reporting, and publishing GHG emissions. Proposals for improving the estimation of emissions and removals are considered by scientific research or the Committee, and the results are incorporated into the inventory. Figure 1-32 is a diagram of the inventory improvement process.

[18] http://www.env.go.jp/

[19] http://www-gio.nies.go.jp/index-j.html

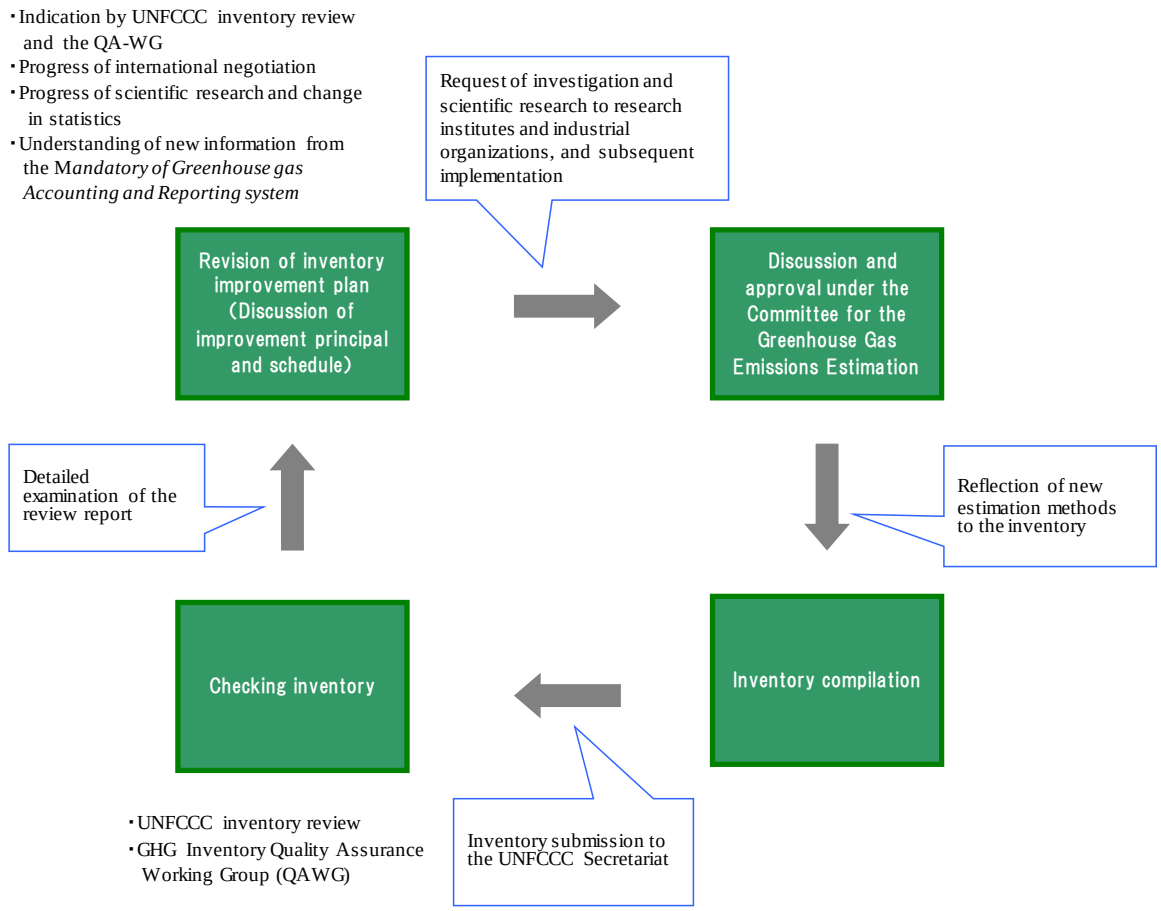


Figure 1-32 Diagram of the inventory improvement process

1.2.5 Information on the QA/QC Process

When compiling the inventory in Japan, inventory quality is controlled by performing quality control (QC) activities (such as checking the correctness of calculations and archive of documents) at each step in accordance with 2006 IPCC Guidelines. In Japan, the quality control activities relating to inventory compilation performed by personnel belonging to agencies involved in inventory compilation—that is, the Ministry of the Environment (including the GIO and private consultant companies), relevant ministries and agencies—are considered to be QC. External reviews by experts who are outside the inventory compilation system (QAWG) are considered to be QA (quality assurance). They assess data quality from the perspectives of scientific knowledge and data availability with respect to current calculation methods. Table 1-27 sketches Japan's QA/QC activities.

Table 1-27 Summary of Japan's QA/QC activity

	Implementing entity	Main contents of activity
QC (Quality Control)	Ministry of the Environment (Low-carbon Society Promotion Office, Global Environment Bureau)	・Coordinating QA/QC activities for inventory preparation ・Establishing, revising, and approving QA/QC plan ・Developing, checking, and approving inventory improvement plan
	Greenhouse Gas Inventory Office of Japan, Center for Global Environmental Research, National Institute for Environmental Studies (GIO)	・Conducting general QC check ・Archiving QA/QC activity records and relevant data and documents ・Developing inventory improvement plan ・Revising QA/QC plan
	Relevant Ministry and Agencies	・Checking data necessary for inventory preparation ・Checking JNGI files and inventory prepared by GIO (Category-specific QC)
	Committee for the Greenhouse Gas Emissions Estimation Methods	・Discussing and assessing estimation methods, emission factors, and activity data (Category-specific QC)
	Private Consultant Companies	・Checking JNGI files and inventory prepared by GIO (Category-specific QC)
QA (Quality Assurance)	Inventory Quality Assurance Working Group (QAWG)	・Conducting expert peer review of inventory (QA)

1.2.6 Changes in National inventory Arrangements since BR2

There is no change in National inventory arrangements since Japan's second Biennial Report (BR2) which Japan submitted in December 2015.

Chapter 2

Quantified Economy-Wide Emission Reduction Targets

Japan's greenhouse gas emission reduction and removal target is a 3.8% or more emission reduction in 2020 compared to the 2005 level. This target was resubmitted to the UNFCCC secretariat on May 13, 2016.

For the LULUCF sector, Japan will use net removals by LULUCF activities in accordance with the accounting rule under the second commitment period of the Kyoto Protocol by continually implementing necessary policies and measures. Of them, the targets of the amount of net removals by forest carbon sinks and revegetation are to ensure approximately 38 million t-CO_2 or more, 1.2 million t-CO_2, respectively. The amount of net removals by agricultural soils is estimated at approximately 7.7 million t-CO_2.

Japan establishes and implements the "Joint Crediting Mechanism (JCM)" in order both to appropriately evaluate contributions from Japan to GHG emission reductions or removals in a quantitative manner achieved through the diffusion of low carbon technologies, products, systems, services, and infrastructure as well as implementation of mitigation actions in developing countries, and to use them to achieve Japan's emission reduction target.

【Base year】(CTF Table 2(a))

Base year	FY2005
Emission reduction target	3.8% or more of base year
Period for reaching target	FY2020

【Gases, sectors covered and GWP】(CTF Table 2(b), (c))

Gases covered	Base year for each gas	GWP values
CO_2	FY2005	IPCC Fourth Assessment Report (AR4)
CH_4	FY2005	IPCC Fourth Assessment Report (AR4)
N_2O	FY2005	IPCC Fourth Assessment Report (AR4)
HFCs	CY2005	IPCC Fourth Assessment Report (AR4)
PFCs	CY2005	IPCC Fourth Assessment Report (AR4)
SF_6	CY2005	IPCC Fourth Assessment Report (AR4)
NF_3	CY2005	IPCC Fourth Assessment Report (AR4)

Sector covered	Energy Transport Industrial Processes Agriculture LULUCF Waste

【Approach to counting emissions and removals from the LULUCF sector】(CTF Table 2(d))

LULUCF in base year level and target	Included	Japan will use net removals by LULUCF activities in accordance with the accounting rule under the second commitment period of the Kyoto Protocol. Of them, the targets of the amount of net removals by forest carbon sinks and revegetation by net-net accounting approach (Base year: FY1990) will correspond with approximately 38 million t-CO_2 or more, 1.2 million t-CO_2, respectively. The amount of removals by agricultural soils is estimated at approximately 7.7 million t-CO_2 by net-net accounting approach (Base year: FY1990).
Contribution of LULUCF is calculated using	Activity-based approach	

【Market based mechanisms】(CTF Table 2(e)I, II)

Possible scale of contributions of market based mechanisms under the Convention (Estimated ktCO_2 eq.)	CERs	NE
	ERUs	NE
	AAUs	NE
	Carry-Over units	NE
	Other mechanism units under the Convention	NE
Possible scale of contributions of other market based mechanisms (Estimated ktCO_2 eq.)	JCM	NE

【Other information】(CTF Table 2(f))

Other information	—

Chapter 3

Progress in Achievement of Quantified Economy-Wide Emission Reduction Targets and Relevant Information

3.1 Policy Making Process

3.1.1 Overall Framework of Promotion of Policies and Measures

In "Basic Environment Law (19 of Nov. 1993, Act No.91)" that defines basic principles regarding environment conservation in Japan and indicates the basic direction of national policy, the proactive promotion regarding 'Global environment conservation' is regulated. The national government formulates "Basic Environment Plan [20]" based on Article 15, paragraph 1 in the Law to promote measures related to the environment conservation comprehensively and strategically. In the Plan, the global warming countermeasure is set as one of the important fields for environment policy.

Additionally, regarding the promotion of global warming countermeasures, "Act on Promotion of Global Warming Countermeasures (1998, Act No. 117)" is formulated as an individual law. The government established the Plan for Global Warming Countermeasures (Cabinet Decision on May 13, 2016) based on Article 8, paragraph 1, of the Act and the Action Policy for Global Warming Countermeasures based on the Paris Agreement (decision by the Global Warming Prevention Headquarters on December 22, 2015) in order for the national government, local governments, businesses and citizens to promote global warming countermeasures in a comprehensive and strategic manner. The Plan for Global Warming Countermeasures is the only general plan regarding global warming in Japan. This plan covers targets for reducing greenhouse gas emissions and removals, basic matters concerning measures that businesses and citizens should implement, and basic matters concerning measures that the national government and local governments should implement in order to achieve the target.

3.1.2 Promotion System of Global Warming Countermeasure Plan

The Government has the Global Warming Prevention Headquarters with the Prime Minister as the director and all ministers as members and the executive committee of the Global Warming Prevention Headquarters, the director-level committee of government ministries. These organizations take the initiative in maintaining close communication among relevant government ministries and agencies and work on tasks. They gather opinions of intellectuals and experts in relevant councils at a proper timing and proper manner and maintain coordination with relevant organizations.

In regions, relevant government ministries and agencies use the Regional Energy and Global Warming Mitigation Councils installed in individual regional blocks for them to follow up on and support regional efforts with local governments and Regional Councils for the Mitigation of Global Warming.

3.1.3 Progress Management of Global Warming Countermeasure Plan

The Global Warming Prevention Headquarters inspects target achievement status by types of greenhouse gases and other categories, relevant indexes, and the progress of individual actions and measures every year based on stringent rules and regular evaluations and examinations by relevant councils. Accurate inspections require the identification of the latest conditions. Thus, relevant government ministries and agencies strive to calculate quickly necessary values used for the inspection of the amount of emissions reductions, indexes to evaluate effects of measures, and relevant indexes (hereinafter referred to as "the indexes to evaluate measures").

Specifically, the Global Warming Prevention Headquarters or the executive meeting of the Global Warming Prevention Headquarters clarifies the actual values of all indexes from one year before the inspection (or actual values from two years ago if values from one year before are unavailable). They also present the outlooks of the indexes to evaluate individual measures (outlook for each year if data are available) from the year of the progress inspection to FY 2030. They also clarify the status of measures implemented one year before as the grounds for setting the outlook of the indexes to evaluate measures and the contents of

[20] The Forth Basic Environment Plan decided by the Cabinet on April 27, 2012 is the latest as of October 2017.

measures being implemented for the current year. Furthermore, they present policies and measures on budget proposals, tax reform proposals, and bills that will be implemented in the next fiscal year or later. These data and information are used to evaluate individual policies and measures. If policies and measures showing slow progress are identified, improvement and reinforcement for these policies and measures will be considered. In such cases, new policies and measures are explored without being limited to strengthening policies and measures already included in the Plan for Global Warming Countermeasures.

When necessary, the progress inspection includes a detailed examination of the relationship between indexes to evaluate individual measures and the amount of emissions reductions that are the effects of implementing the applicable measures. Proper evaluation methods should be quickly established for fields without sufficient evaluation methods at this point, such as the indexes to evaluate policies and measures that will lead to the reform of socio-economic systems.

The grounds for the estimated emissions reductions for individual measures and the outcomes of progress inspections are made available to the public on the Internet so that the public can receive proper information about measures and their progress.

In addition to the annual progress inspections, targets and measures set in the Plan for Global Warming Countermeasures are examined at least every three years based on the data such as the amount of greenhouse gas emissions (final values) of two years ago, which is released around April every year; the amount of greenhouse gas emissions (preliminary values) of the last year, which is released around December every year; the results of review for the Biennial Report (BR) and the National Communication (NC) that the Government of Japan submits to the secretariat of the United Nations Framework Convention on Climate Change, taking into account the situation of the amount of greenhouse gas emissions and removals and other circumstances in Japan. The outcomes of the examination are used to reevaluate the Plan for Global Warming Countermeasures when necessary, and the Cabinet Decision is prepared for any revision.

The outlook discussed above is prepared based on the provisions set in the Paris Agreement and COP 21 decisions until 2020. After 2020, the outlook will be prepared based on the provisions of the five-year cycle of target submission and update set in the Agreement and the decisions. Information of efforts will be reported and reviewed internationally in accordance with the transparency system under the Paris Agreement in the future.

3.2 Policies and Measures on Mitigation Actions and Their Effects

3.2.1 Direction of global warming countermeasures that Japan aims for

Japan initiates global warming countermeasures based on scientific knowledge under international cooperation.

3.2.1.1 Actions to achieve the midterm target (reduction target for FY 2030)

Japan ensures domestic emission reductions and removals based on Japan's NDC submitted to the Secretariat of the UNFCCC. Japan thereby makes steady progress toward achieving the midterm target which is at the level of reduction of 26.0% by FY 2030 compared to FY 2013 (25.4% reduction compared to FY 2005).

3.2.1.2 Strategic actions to achieve long-term targets

The Leaders' Declaration of the G7 Summit in Elmau, Germany, in June 2015 stated the following. "We emphasize that deep cuts in global greenhouse gas emissions are required with decarbonization of the global economy over the course of this century. Accordingly, as a common vision for a global goal of greenhouse gas emissions reductions, we support sharing with all parties to the UNFCCC the upper end of the latest IPCC recommendation of 40% to 70% reductions by 2050 compared to 2010 recognizing that this challenge can only be met by a global response. To this end, we also commit to developing long-term low-carbon strategies."

The Paris Agreement also aims to hold the increase in the global average temperature to well below 2°C and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels. In addition, countries need to aim to reach the global peaking of greenhouse gas emissions as soon as possible. It also aims for "rapid reductions in accordance with best available science, so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century." Provisions of the Paris Agreement also provide, "Each Party shall communicate a nationally determined contribution (NDC) every five years," and "All parties should strive to formulate and communicate long-term low greenhouse gas emission development strategies," taking note of the objective of the Agreement. Under such circumstances, Japan takes initiative in international society so that major emitters would strive to reduce emissions in accordance with their capabilities under a fair and effective international framework in which all major emitters participate, and aims to achieve the 80% reduction of greenhouse gas emissions by 2050 as a long-term target while pursuing the global warming countermeasures and the economic growth at the same time, based on the Paris Agreement. Such drastic emission reductions are difficult to realize with only conventional initiatives. Therefore, Japan committedly pursues overcoming the challenge through innovation, such as the development and diffusion of innovative technologies that enable fundamental emissions reductions. At the same time, Japan encourages domestic investment in this field, builds up international competitiveness and gathers knowledge and ideas from citizens to achieve drastic emissions reductions through long-term and strategic efforts, and contributes to the global emissions reductions.

3.2.1.3 Global efforts to reduce greenhouse gas emissions

The development of innovative technologies is the key to pursue the global warming countermeasures and the economic growth at the same time. Effective emissions reductions around the world are necessary to reduce global greenhouse gas emissions. Japan promotes developments and experiments based on the Innovation Plan for Environmental Technology (September 13, 2013, Council for Science and Technology Policy). At the same time, Japan is going to reinforce the research and development of innovative technologies in promising fields not limited to the course of conventional initiatives based on the National Energy and Environment Strategy for Technological Innovation towards 2050 (April 19, 2016, Council for Science, Technology and Innovation). In addition, Japan uses advanced Japanese technologies to make maximum contributions to reducing global greenhouse gas emissions.

3.2.2 Basic concept of the global warming countermeasures

3.2.2.1 Integrated improvement of the environment, economy, and society

Japan promotes global warming countermeasures that would also benefit the comprehensive improvement of environment, economy, and society, utilizing regional resources, technological innovation, and creative ideas, so that the global warming countermeasures would also boost the economy of Japan, create employment, and solve regional problems.

Specific actions include drastic measures in the intensive promotion of energy efficiency, maximum use of renewable energy, acceleration of the development and application of technologies, and reform of lifestyles and workstyles so as to realize economic growth and the high quality lives of citizens and to promote the reduction of greenhouse gas emissions while boosting regional economies.

3.2.2.2 Steady implementation of measures listed in Japan's NDC

The mid-term target in Japan's NDC was established on the basis of the sum of measures, policies, and technologies supported by thorough examination of the various issues of technological limitations and costs so that it would remain in alignment with the energy mix. Therefore, steady implementation of measures listed in Japan's NDC is important to achieving the midterm target. Japan therefore strives for the steady implementation of various policies and measures, such as voluntary approach, regulatory approach, economic approach, and information approach while effectively using their characteristics.

3.2.2.3 Response to the Paris Agreement

Japan communicates and updates its NDC in a five-year cycle, and implements the reporting and reviews related to the progress of implementation and achievement towards the target stipulated in the Paris Agreement. Japan also makes an active contribution to the development of international and detailed rules for the implementation of the Paris Agreement. Japan also responds to the reporting and reviewing of activities by other Parties under the Paris Agreement.

The Paris Agreement requires that all Parties should strive to formulate and communicate long-term low greenhouse gas emission development strategies. The decision at COP 21 also invites Parties to submit the strategies by 2020. Japan contributes to the achievement of the 2°C target, the global goal set in the Paris Agreement. Thus, Japan continues to explore long-term and strategic efforts of the research and development of innovative technologies mentioned in the National Energy and Environment Strategy for Technological Innovation towards 2050, as well as the application of the technologies and reform of social structures and lifestyles to achieve long-term drastic reductions in greenhouse gas emissions. Japan also additionally reinforces the efforts to produce innovations with developing countries based on “Actions for Cool Earth 2.0 (ACE 2.0)”.

3.2.2.4 Contribution to reducing the global greenhouse gas emissions through the reinforcement of research and development, and the diffusion of advanced low-carbon technologies

Development of innovative technologies is the key to purse global warming countermeasures and the economic growth at the same time.

Japan reinforces the research and development of innovative technologies in promising fields based on the National Energy and Environment Strategy for Technological Innovation towards 2050. Japan also promotes the diffusion of advanced low-carbon technologies and activities to mitigate global warming through the Joint Crediting Mechanism and other efforts.

3.2.2.5 Reform of the awareness of all actors, invoking actions, and reinforcement of cooperation

The problem of global warming is deeply related to socioeconomic activities, regional societies, and the lives of citizens. Thus, all actors including the national government, local governments, businesses, and citizens need to get involved with and cooperate in mitigation activities.

Therefore, Japan actively distributes and shares knowledge of exacerbating global warming, specific actions that require greater efforts to achieve the reduction target, and actions that individual citizens must take so that individuals can perceive and understand the necessary information. Japan then trains people who can distribute the necessary information and puts it into practice and implements public campaigns to change awareness at all levels by Japanese citizens to lead them to take action.

In addition, Japan encourages individual actors to actively become involved with policies and measures and reinforces cooperation among them by frequently distributing and sharing information concerning the progress of global warming countermeasures.

3.2.2.6 Importance of assessment and review processes (PDCA)

To constantly monitor and maintain the effectiveness of this plan after its establishment, Japan inspects the annual progress of individual measures implemented by the national government based on indexes to evaluate measures and revises the plan when necessary.

3.2.3 Information on policies and measures

3.2.3.1 Policies and Measures for Greenhouse Gas Emissions Reductions and Removals

(1) Policies and Measures for Greenhouse Gas Emissions Reductions

a) Energy-related CO_2

Japan works to realize an energy mix through thorough energy conservation, full use of renewable energy while suppressing the burdens on the people, improvement of the efficiency of thermal power generation, use of nuclear power generations whose safety is approved, and diversification of fuels in different categories by shifting to natural gas in the industry sector based on the policies in the Strategy for Energy Reform (April 18, 2016 decision of Ministry of Economy, Trade and Industry).

Japan strengthens public campaigns to facilitate all types and classes of people to work on mitigating global warming together, change their awareness, and encourage them to make wise choices by selecting low-carbon products, services, and initiatives so that the lifestyles of Japanese people will be appropriate as members of a low-carbon society.

The national government, local governments, business operators, and general public participate and cooperate in developing low-carbon cities and regions by building compact cities and reconstructing public transportation networks.

1) Policies and Measures by Sectors (Industrial, Residential & Commercial, Transport, etc.)

A. Initiatives in the Industrial Sector (Manufacturers, etc.)

(a) Promotion and Enhancement of Voluntary Action Plans of Industry

✓ **Steady Implementation of Industry's Action Plans towards a Low-carbon Society and Evaluation and Verification of Progress**

The Japan Business Federation and industries have voluntarily established Greenhouse Gas Emissions Reduction Plans (hereinafter referred to as "the Voluntary Action Plans" including plans up to FY 2012 set by individual industry types) and have been evaluated for making high achievements to reduce emissions. Based on the reduction initiatives conducted under the Voluntary Action Plans and the evaluation and verification of the initiatives in the process of initiatives under the Kyoto Protocol Target Achievement Plan, business operators are expected to continue voluntary initiatives as the central players in ensuring steady emissions reductions in the industries.

Voluntary methods like this have benefits from the perspective of improving the transparency, reliability, and the possibility of achieving targets, such as that they require a certain level of involvement of the government while allowing individual parties to select better measures using creativity and ideas, and they encourage parties to work toward higher targets. Thus, it is extremely important for the industry to keep working to reduce greenhouse gas emissions while taking advantage of these benefits. Therefore, each business operator in industrial community establish and implement the contents and objectives of Greenhouse Gases Emissions Reduction Plans as initiatives after FY2013 and review them when necessary based on regular evaluations and verifications by paying attention to the following viewpoints to respond to social demands while recognizing the benefits of respecting the dependency of the industries. (In the Industry, commercial, transport and energy conversion sectors, the Greenhouse Gas Emissions Reduction Plans refer to plans to reduce greenhouse gas emissions set by industry group as members of the Japan Business Federation and non-member industry group. Plans set by individual industry group are hereinafter called "the Industry's Action Plans towards a Low Carbon Society.")

(i) Industry groups which have not set the Industry's Action Plan towards a Low-carbon Society are expected to establish new plans nevertheless that they are participating in the Voluntary Action Plans under the Kyoto Protocol Target Achievement Plan. Industry groups not

participating the Kyoto Protocol Target Achievement Plan should also consider establishing a new plan.

(ii) The Industry's Action Plans towards a Low Carbon Society provides CO_2 reduction targets with the perspective of reducing greenhouse gas emissions based on the full use of best available technologies (BATs) and active efforts to commit to energy conservation. Industry group explains to external stakeholders that targets are the highest level they can possibly achieve. The important point is to gather data that will enable the comparison of energy efficiency and CO_2 emissions between Japan and other countries so that they can evaluate the difficulty of achieving target level and the level of efforts required by industry group. Also, BAT and best practices, when presented in advance, enable to evaluate efforts done by each industry group, in addition to the progress toward achieving target level. Targets should be continuously re-evaluated by flexibly raising numerical targets when more BATs become available through technological advancement, for example.

* Indicators of target mainly include energy consumption intensity, energy consumption, CO_2 emission intensity, CO_2 emissions, and reduction from business as usual (BAU) that are selected on the basis of autonomous decisions by each industry group. Methods of setting targets need continuous exploration.

(iii) The Industry's Action Plans towards a Low Carbon Society is implemented on the basis of the PDCA cycle as practiced before to ensure effectiveness, transparency, and reliability. Plans targeting 2030 require a long-term commitment. Thus, assumptions need to be clarified, and various factors, such as social and industrial structures, as well as technological advancement, must be taken into account while ensuring transparency.

(iv) In addition to the emissions reduction targets (commitments) raised in (ii) above, business operators contribute to a reduction in CO_2 emissions by supplying low-carbon products and services while cooperating with relevant industry groups. Business operators also work on improving the awareness and knowledge of the public on the mitigation of global warming.

(v) Each industry group actively works on global warming countermeasures through the overseas development of low-carbon products and services, transfer of technologies and know-how to developing countries with the motivation to mitigate global warming based on international rules, and reinforcement of international cooperation by the private sector from the perspective of contributing to the worldwide effort to mitigate global warming. They must also present how they contribute to reductions with initiatives based on their business types.

(vi) Individual industry groups actively develop and commercialize innovative technologies from the mid-to-long-term perspective that might extend beyond 2030.

(vii) Individual business operators also conduct international comparisons based on reliable data and actively distribute the information to the outside in order to provide logical information to overseas markets and consumers in regards to transactions based on the Industry's Action Plan towards a Low Carbon Society.

Based on the above perspectives from (i) to (vii), the Government organizes relevant councils and committees to strictly and regularly assess and verify initiatives implemented on the basis of the Industry's Action Plan towards a Low Carbon Society established by individual industry groups and the Industry's Action Plan towards a Low Carbon Society for 2030.

✓ **Initiatives in the Commercial, Residential, Transport Categories in the Industry**

The industry contributes to a reduction in CO_2 emissions in the commercial, residential and the transport sector through weight saving and functional improvement of materials, development and supply of energy efficient low-carbon products, improvement of the efficiency of logistic systems through modal shifts, promotion of the use of next-generation automobiles and public transportation, and participation in public campaigns to mitigate global warming.

(b) Promotion of Introduction of Highly Energy-efficient Equipment and Devices

✓ **Thorough Energy Management at Factories and Buildings**

Japan promotes thorough energy management and the introduction of energy efficient equipment and devices based on the Act on the Rational Use of Energy (1979, Act No. 49).

Specifically, business operators are classified into four classes(S, A, B and C) and evaluated by periodic reports submitted based on the Act on the Rational Use of Energy. Stagnating business operators are intensively investigated, and the names of operators with excellent performances are publicized by business types and praised. Through these measures, Japan intensively promotes energy efficiency using various initiatives under the Act on the Rational Use of Energy.

In addition, Benchmark system that sets energy efficiency targets at the level that 10% to 20% of business operators among the same business types can achieve is extended from the manufacturing industry to the retail and service industries. The goal is to expand to include 70% of the energy consumed by all industries by fiscal year 2018.

✓ **Promotion of Introduction of Highly Energy-efficient Equipment and Devices (cross-industrial)**

The industry sector promotes the introduction of energy efficient equipment and devices for main energy-consuming devices used in a variety of business types, such as air conditioners, lighting devices, industrial furnaces, boilers, and cogeneration systems.

✓ **Promotion of Introduction of Highly Energy-efficient Equipment and Devices (manufacturing sector)**

(Iron and steel industry)

As introduction of cutting-edge technologies, the iron and steel industry promotes the spread of high-efficient power demand facilities, waste heat recovery systems, and power generation systems and expand the use of waste plastics to alternate coal to be charged into coke oven.

The industry also develops highly-efficient and low-carbon innovative production process technologies and promotes energy conservation and reduction of CO_2 emissions with practical use of such technologies by around 2030.

(Chemical industry)

The chemical industry, in accordance with the characteristics of each process, promotes to reduce CO_2 emissions by spreading best practice technologies (BPT) listed by the International Energy Agency (IEA) as commercially utilized advanced technologies, recovering emitted energies, and rationalization of process. The industry also contributes to reducing CO_2 emissions by promoting the development and introduction of new innovative energy-saving technologies.

(Ceramic, stone and clay manufacturing industry)

The industry introduces highly energy-efficient equipment and promotes to use waste as alternate of thermal energy to improve the energy efficiency in cement production process. The industries also aim to improve the energy efficiency of cement and glass production processes while maintaining the equivalent quality as existing products by practical use and introduction of advanced processing.

(Pulp, paper, and paper products industry)

The installation of pulpers that allow more efficient pulping of recovered paper than existing ones in deinked pulp manufacturing process will be supported in order to reduce the consumption.

Also, at the renewal timing of recovery boilers used to generate steam by incinerating concentrated

black liquor (pulp waste liquor), the installation of the ones with more elevated features in temperature, pressure and energy efficiency will be supported.

✓ **Promotion of Introduction of Highly Energy-efficient Equipment and Devices (construction and fields that use special motor vehicles)**

The industry certifies fuel-efficient construction machinery so that the operators could choose easily excellent fuel-performance machinery. Carbon dioxide emissions are also reduced in construction work and fields that use special motor vehicles to support the introduction of certified machinery.

✓ **Promotion of Introduction of Highly Energy-efficient Equipment and Devices (Greenhouse horticulture, agricultural machinery, and fishery sector)**

Development and the diffusion of efficient and low-cost energy consumption technologies (e.g. heat pumps, heating systems using woody biomass) are promoted as a measure to reduce greenhouse gas emissions in greenhouse horticulture. Energy efficiency improvements are also promoted through the reduction of CO_2 emissions from agricultural machinery and energy conservation measures in fishing vessels with LED fishing lights and energy efficient outboard engines.

(c) Implementation of thorough Energy Management

✓ **Implementation of thorough Energy Management using FEMS**

The industry sector is already conducting a certain level of energy management due to the mandatory energy management required by the Act on the Rational Use of Energy. More energy efficiency and CO_2 emissions reductions are realized through additional energy efficiency actions based on objective data by making energy consumption visible by promoting the introduction of Factory Energy Management System (FEMS) with Internet of Things (IoT).

✓ **Promotion of Emissions Reduction Measures among Small and Medium-sized Business Operators**

To reinforce energy efficiency and emission reductions measures among small and medium-sized business operators, public relations to raise awareness of energy saving, boosting the potential capacity of energy efficiency and CO_2 reductions through energy efficiency diagnoses, and CO_2 emission reduction potential diagnoses, the implementation of detailed lectures to energy managers of companies, the horizontal spreading of best practices to promote energy efficiency. In addition, focusing on the improvement of energy consumption per unit, support is provided for small and medium-sized business operators to introduce emission reductive equipment.

Regional organizations, financial institutions, chambers of commerce, and local governments construct platforms together to provide detailed regional supports for small and medium-sized business operators to take energy efficiency actions. With the platforms, they provide a wide range of supports for finding small and medium-sized business operators trying to take energy efficiency actions and providing follow-ups to assist operational improvement and capital investment. Japanese Government constructs platforms so that offices to support energy efficiency actions will be available throughout Japan by fiscal year 2017.

(d) Promotion of Energy Efficiency Actions through Alliance between Industry Groups

Additional energy efficiency becomes possible when factory owners and building owners cooperate with each other in energy trading. Therefore energy efficiency actions conducted through the cooperation of multiple business operators are supported.

In addition, the evaluation system based on the Act on the Rational Use of Energy are constructed to encourage factory owners and building owners to cooperate in accommodating and using the waste heat which can't be used and is released by factories.

B. Initiatives in the Commercial and Other Sector

(a) Promotion and Enhancement of Voluntary Action Plans of Industry (Reprinted p66)

✓ **Steady Implementation of Industry's Action Plans towards a Low-carbon Society and Evaluation and Verification of Progress (Reprinted p66)**

(b) Improvement of the Energy Efficiency of buildings

✓ **Promotion of Mandatory Compliance with Energy Conservation Standards Targeting New Construction**

The Act on the Improvement of Energy Consumption Performance of Buildings (2015, Act No. 53, hereinafter referred to as "the Building Energy Efficiency Act") stipulates mandatory compliance with energy efficiency standards for large construction projects. Japan aims to smoothly start the mandatory compliance as provided in the Act. In addition, the compliance with energy efficiency standards will gradually become requirements for new construction projects by 2020 while taking into account of the necessity of the regulations, their scopes, and balances of regulations. The environment will be prepared for the smooth start of the requirements. Specifically, support is provided for the diffusion of energy conservation measures and the development of new technologies, services, and construction methods that will improve the energy efficiency of buildings, construction materials, and machinery. Support is also provided to encourage voluntary investment in energy conservation by the private sector.

✓ **Improvement of Energy Efficiency of Existing Buildings (Renovation)**

Mandatory compliance with energy efficiency standards will gradually become applicable to newly constructed buildings. On the other hand, mandatory compliance with energy conservation standards is difficult for existing buildings. Thus, the important thing is to accelerate renovation to improve energy efficiency. Specifically, through enhancement and diffusion of energy conservative performance and environmental efficiency for verifying and labeling systems are used to promote the renovation of existing buildings for better energy efficiency and lower carbon footprints so that energy efficiency will be an additional asset value of buildings and reflected in the rents and so on.

✓ **Promotion of Net-Zero-Energy Building (ZEB)**

ZEB guidelines are prepared for major commercial building types such as hospitals and schools to realize and diffuse ZEBs. The goal of the diffusion of ZEBs is to demonstrate ZEBs among newly-constructed public buildings by 2020 and to realize ZEBs as the average of new constructions by 2030.

✓ **Promotion of Diffusion of Certified Low-carbon Building**

Certified low-carbon construction projects (construction projects that consume more than 10% less than the energy efficiency standards) under the Low Carbon City Act (2012, Act No. 84) will be increased. Associated standards are revised based on the progress of implemented measures.

✓ **Promotion of Enhancement and Diffusion of Verifying and Labeling System for Energy**

Conservation and Environmental Performance

Energy efficiency labeling system based on the Building Energy Efficiency Act, dwelling performance labeling system and CASBEE and other systems that evaluate comprehensive environmental performance will be improved and promoted.

(c) Promotion of Introduction of Highly Energy-efficient Equipment and Devices

- ✓ **Thorough Energy Management at Factories and Buildings (Reprinted p69)**
- ✓ **Diffusion of Advanced Highly Energy-efficient Equipment and Devices**

Development of energy conservation technologies will be accelerated to further improve the efficiency of individual devices and systems. The diffusion of high efficiency, energy conservative devices is also promoted.

The goal is to increase the use of high-efficiency lighting devices, such as LED lamps, to 100% in the flow by 2020 and 100% in the stock by 2030. To achieve these goals, the diffusion of high-efficiency lighting devices will be promoted by expanding the top-runner standards of lighting devices and by applying the top runner program to incandescent lamps in FY 2016.

The introduction of energy efficient industrial water heaters, such as heat-pump water heaters and latent heat recovery type water heaters, will be supported. The energy efficiency will also be improved for refrigeration air conditioners by improving coolant management technologies. Necessary information will be distributed through Leading Low-carbon Technology (L2-Tech) and other systems.

- ✓ **Improvement of Energy Efficiency of Equipment and Devices through Top Runner Programs**

The top runner program was established in FY 1998 under the Act on the Rational Use of Energy. Target equipment and devices have gradually increased since then. The number of energy consuming devices targeted in this system was 28 items in FY 2015. Additional devices for this system will continue to be explored. At the same time, standards of targeted devices which reached to the targeted years will be revised to improve their energy efficiency.

(d) Implementation of thorough Energy Management

- ✓ **Thorough Energy Management through the Use of BEMS and Consultation on Energy Conservation**

Building Energy Management System (BEMS) is designed to display energy consumption status and support optimum operations of equipment and devices, such as lighting devices and air conditioners to support energy efficiency and CO_2 emissions reductions in an entire building. BEMS will be introduced to about half of the buildings by 2030. In addition, energy consumption data obtained through BEMS will be used to enable more efficient and effective energy management in buildings.

In addition, the implementation of diagnoses on potential capacity of GHG emissions reduction and the introduction of devices utilized the results of the diagnoses will be promoted. Actions conducted beyond the boundaries of individual stakeholders, such as building owners, tenants, and energy suppliers, will be promoted. Furthermore, with the promotion of “Eco-tuning” which conducts the appropriate operational improvement of the equipment, devices, and systems, greenhouse gas emissions will be reduced with ensuring the comfort and productivity of buildings.

The introduction of energy efficiency equipment and devices, and downsizing, or the optimization of equipment and devices, will be promoted using businesses (ESCO) that provide comprehensive energy efficiency services and warrant energy efficiency effects based on the results of visualizing energy consumption and energy efficiency diagnoses.

The efficient use of lighting will also be promoted by setting proper lighting intensity based on indoor

conditions.

✓ **Promotion of Emissions Reduction Policies among Small and Medium-sized Business Operators (Reprinted p69)**

(e) Expansion of Holistic and Efficient Use of Energy

✓ **Expansion of Holistic and Efficient Use of Energy**

Large energy conservation and CO_2 emissions reductions effects are expected when multiple facilities and buildings share energies, such as electricity and heat, and use unused energies. Such practices are also desirable from the viewpoint of disaster management and the promotion of regional development. Thus, opportunities for urban development will be seized to promote holistic and efficient use of energy at district levels to realize area-wide energy conservation and CO_2 emissions reductions while simultaneously using renewable energy.

A variety of stakeholders, such as the national government, local governments, energy suppliers, and regional developers, must work together to provide support for the use of urban development systems, conduct simulations to find areas where holistic and efficient use of energy will be effective, compute the expected energy conservation and CO_2 emissions reductions effects, and install and use of facilities and systems that contribute to the efficient use of energy.

(f) Other Policies and Measures

✓ **Development of Low-carbon Cities through the Improvement of Thermal Environment by Preventing Heat Island Effects**

Japan promotes comprehensive carbon reduction in cities through the improvement of the thermal environment by implementing measures associated with heat island effects, such as the reduction of anthropogenic heat, improvement of urban surfaces, improvement of urban structure, improvement of lifestyles, and implementation of proper measures to reduce the effects on human health using knowledge obtained through the observation, investigation, and study of heat island effects mainly in urban areas. Specific initiatives include the promotion of the improvement of energy efficiency by energy consuming devices, promotion of the diffusion of low-carbon buildings, promotion of the development and diffusion of next-generation automobile technologies, promotion of traffic flow measures, and the promotion of the use of unutilized energy to reduce the emissions of anthropogenic heat from human activities, such as from air conditioning systems and automobiles in order to reduce overall CO_2 emissions in cities. The ground coverages are also improved in entire areas by securing green spaces through the park maintenance greening of public spaces and government facilities, greening of building lots using green region systems, and the conservation of privately owned green spaces and farmlands to counteract the reduced evapotranspiration caused by expanding artificial ground coverages and to prevent heating of the ground surface. Urban conditions are also improved by promoting the development of water and green networks and development of nature-oriented river works from the perspective of securing the flow of wind from green spaces and water surfaces. In addition, citizens are encouraged to improve their lifestyles with the public campaign to mitigate global warming named “COOL CHOICE” including Cool Biz and Warm Biz while using proper temperature setups for cooling and heating. Local governments and business operators are also encouraged to implement proper measures depending on characteristics of their regions, districts, and business practices.

✓ **Introduction of Renewable Energy and Energy-saving in Water Supply and Sewage Systems**

Energy conservation facilities such as energy-saving and high-efficiency devices and inverter control of pumps will be introduced to water supply systems. Renewable power generation systems such as

small-scale hydropower generators and solar power generators will also be introduced.

Energy saving is promoted in sewage systems by the improvement of facility operations and introduction of high-efficiency devices in aeration systems of reaction tanks and sludge dehydrators. Promotion of substitution of fossil fuel to solid fuels made from sewage sludge. Power generation using biogas from sewage sludge, and effective use of heat exchanged from sewage and treated sewage water are also conducted.

✓ **Initiatives in Waste Management**

The 3Rs initiatives that contribute to a reduction in greenhouse gas emissions are promoted. In addition, more energy is recovered from waste disposal facilities, such as generating power using waste. Energy conservation measures are implemented at waste disposal facilities and recycling facilities. Greenhouse gases emitted from refuse collecting truck are also reduced.

✓ **Schematic Promotion of Joint Measures Implemented by Multiple Government Ministries and Agencies**

Cooperation among relevant government agencies is established based on plans to effectively and efficiently implement initiatives in all fields in order to ensure that reduction targets for FY 2030 in the Commercial and other sector will be achieved. They are going to cooperate in thorough energy conservation, use of renewable energy, and low-carbonizing of buildings.

(g) Development of Public Campaigns (Discussed later p96)

✓ **Promotion of Public Campaigns (Discussed later p96)**

(h) Initiatives by Public Organizations (Discussed later p94)

C. Initiatives in the Residential Sector

(a) Development of Public Campaigns (Discussed later p96)

✓ **Promotion of Public Campaigns (Discussed later p96)**

(b) Improvement of Energy Efficiency of Housing

✓ **Promotion of Compliance with Energy Conservation Standards Targeting New Housing**

The obligation to conform to the energy consumption performance standards will gradually start targeting newly constructed housing by 2020 while sufficiently taking into account the necessity of the regulations, their scopes, and balances. The environment will be established for smooth implementation of the regulations while paying sufficient attention to the improvement of construction technologies of small to medium-sized contractors and carpenters and the position of traditional wooden housing. Specifically, support is provided to accelerate energy conservation measures and the development of new technologies, services, and construction methods that will contribute to energy conservation in housing, construction materials, and devices.

✓ **Promotion of Renovation of Thermal Insulation for Existing Housing**

The obligation to conform the energy consumption standards will gradually promote with newly constructed housing. Meanwhile, the promotion of energy conservation renovation becomes

important for existing housing. Specifically, subsidies are provided for installing high-performance insulation materials and windows to improve the thermal insulation of existing housing. Housing renovated to improve energy efficiency can also receive tax cut. In addition, energy efficiency performance and environmental performance evaluation and labeling system will be improved and promulgated so that energy efficiency will become reflected in the asset value of housing. Improvement of energy efficiency and CO_2 emissions reductions in housing will be promoted through these measures. The number of energy conservation reforms of existing housing will be doubled by 2020 with these measures.

In addition, more information will be provided for residents in regards to the benefits of installing energy efficient devices, facilities, and construction materials depending on the conditions of energy consumption.

✓ **Support of Energy Conservation and Low-CO_2 Models Housing**

Support is provided for housing that act as energy conservation and low-CO_2 models such as Zero Energy Houses (ZEH), Life Cycle Carbon Minus housing (LCCM), and certified low-carbon housing to promote the construction of housing with higher performances. The goal of this measure is to turn more than half of newly-constructed custom-built detached houses constructed by housing manufacturers into ZEHs by 2020.

✓ **Promotion of the Diffusion of Certified Low-carbon Housing**

Tax breaks are provided for newly constructing or purchasing certified low-carbon housing. Technical support is also provided for small and medium-sized contractors. The goal is to diffuse their effects to other housing and increase the number of certified low-carbon housing including existing housing.

✓ **Promotion of Enhancement, and Diffusion of Evaluation and Labeling System for Energy Efficiency and Environmental Performances**

Energy efficiency labeling system and housing performance labeling system based on the Building Energy Efficiency Act, and CASBEE and other systems that evaluate comprehensive environmental performance, including the perspectives of Non-Energy Benefit (NEB) will be improved and promoted for more uses.

(c) Promotion of Introduction of Highly Energy-efficient Equipment and Devices

✓ **Diffusion of Highly Energy-efficient Equipment and Devices**

The development of energy conservation technologies will be further accelerated for more improvement of the efficiency of individual devices and systems. The use of high efficiency, energy conservative devices is also promoted.

The goal is to increase the use of high-efficiency lighting devices, such as LED lamps to 100% in the flow by 2020 and 100% in the stock by 2030. To achieve these goals, the diffusion of high-efficiency lighting devices will be promoted by expanding the top-runner standards of lighting devices such as applying top runner program to the incandescent lamps in fiscal year 2016. The introduction of energy efficient water heating systems, such as heat-pump type water heaters and latent heat recovery type water heaters, are also promoted.

Household fuel cells (Ene-Farm) are a decentralized energy system that produces hydrogen from city gas and LP gas and generates electricity through the chemical reaction between the hydrogen and the oxygen in the air. It also effectively uses the heat released from the electricity generation process to achieve up to more than 90% of total energy efficiency. The public-private joint initiative to support the market by lowering the price of the system in order to introduce 1.40 million units in 2020 and

5.30 million units in 2030.

They also distribute necessary information through Leading Low-carbon Technology (L2-Tech) and other systems.

✓ **Improvement of Energy Efficiency of Equipment and Devices through Top Runner Programs (Reprinted p71)**

(d) Implementation of thorough Energy Management

✓ **Implementation of thorough Energy Management using HEMS and Smart Meters**

The Home Energy Management System (HEMS) is designed to display energy consumption to encourage users to engage in the optimal use of air conditioners, lighting and other energy-consuming equipment/appliances to promote energy conservation and CO_2 emissions reductions by an entire house. Japan aims for the installation of the HEMS in almost all households by 2030. Japan also accelerates the installation of smart meters that measure household energy consumption in detail and make energy consumption visible when connected to the HEMS. More efficient energy management is promoted in households by effectively using the energy consumption data of the HEMS.

(e) Other Policies and Measures

✓ **Schematic Promotion of Joint Measures Implemented by Multiple Government Ministries and Agencies**

Cooperation among relevant government agencies is established based on plans to effectively and efficiently implement initiatives in all fields in order to ensure that the reduction targets for FY 2030 in the residential sector will be achieved through thorough energy conservation, use of renewable energy, and low-carbonizing of housing.

D. Initiatives in the Transport Sector

(a) Promotion and Enhancement of Voluntary Action Plans of Industry (Reprinted p66)

✓ **Steady Implementation of Industry's Action Plans towards a Low-carbon Society and Evaluation and Verification of Progress (Reprinted p66)**

(b) Measures concerning Vehicles

✓ **Diffusion of Next-generation Vehicles and Improvement of Fuel Efficiency**

Japan promotes the diffusion of energy efficient next-generation vehicles (e.g. hybrid vehicles (HV), electric vehicles (EV), plug-in hybrid vehicles (PHV), fuel cell vehicles (FCV), clean diesel vehicles (CDV), and compressed natural gas vehicles (CNGV)). Support through subsidies and tax cut is provided for vehicles that are new to the market and have challenges such as high cost. It aims to increase the share of these vehicles in the new car sales from 50% to 70% by 2030 by promoting measures to create initial demand, support research and development to improve performance and build efficient infrastructure. Special considerations are made for trucks and buses for which the market size is smaller than passenger vehicles, and the diffusion of development and mass-use is slower.

The problem of the short cruising range of electric vehicles and plug-in hybrid vehicles is the key to improve user satisfaction and increase the use of these vehicles. Therefore, research and development will be conducted aiming to double the energy density, the performance indicator directly linked to the cruising range, by the early 2020s. Charging facilities will also be constructed to compensate for

battery performance.

Support is provided systematically to put in place the hydrogen stations, the necessary facility for the diffusion of fuel-cell vehicles. Research and development of technologies are conducted to lower the cost of hydrogen stations. In addition, the necessity of revising relevant regulations is examined while taking into account the improvement of the safety and reliability of relevant technologies.

The top runner program is used to encourage automobile manufacturers to strategically accelerate technological innovations to improve fuel efficiency. The fuel efficiency will be further improved while revising preferential tax treatment whenever necessary. Technological developments are conducted for the commercial application of cellulose nano-fibers and other advanced materials that can improve fuel efficiency by reducing the weight of automobile materials.

✓ **Promotion of Development of Biofuel Supply System**

The biofuel supply system will continuously be constructed with a presumption that they ensure enough greenhouse gas emissions reduction effects, stable supply, and economic feasibility by providing support for using biofuel and constructing supply infrastructures.

(c) Measures to Traffic Flow Improvements

Efforts to ensure the smart use of roads are implemented when constructing roads with the recognition of the possibility of causing so-called induced and diverted traffic congestion. Such efforts include the enhancement of ring roads and other arterial road networks, which also ultimately help reduce CO_2 emissions and pinpoint measures to reduce traffic bottlenecks based on scientific data such as the big-data gathered with ETC2.0. The road environment is also improved to encourage the use of bicycles.

Road traffic improvements include the promotion of Intelligent Transport Systems (ITS), including the promotion of centrally controlled signals, the improvement of traffic lights, the development of traffic safety facilities using LED traffic lights, the promotion of automated driving, and the improvement of traffic flows to reduce CO_2 emissions.

Necessary systems will be developed to allow automated driving on highways in 2020.

(d) Development of Public Campaigns (Discussed later p96)

✓ **Promotion of Public Campaigns (Discussed later p96)**

(e) Greening of Vehicle Transport Operators by Promoting the Environmentally-friendly Usage of Vehicles

Vehicle transport operators are encouraged to use the Eco-drive Management System (EMS) to promote eco-driving of commercial vehicles, such as trucks, buses, and taxis. Four relevant government ministries and agencies take the initiative in promoting the use of EMS through Eco-drive Promotion Liaison Council.

They also promote the use of the Green Management Certification System that certifies vehicle transport operators committed to excellent environmental practices such as the improvement of fuel efficiency.

(f) Promotion of Public Transport Utilization and Bicycles

Transportation services and convenience will continuously be improved through the development of

public transportation, such as new railways, light-rail transit (LRT), bus rapid transit (BRT), enhancement of connections (modal connect) among modes of transportation through joint development by the government and the private sector, use of existing public transportations, acceleration of digitalization using integrated circuit (IC) cards for transportation, improvement of transits, and the use of park and ride services. Seamless public transportation networks are also constructed at the same time.

The environment for using bicycles is also developed by building a network of bicycle lanes, constructing bicycle parking lots, and increasing the use of community bicycles while coordinating the necessary safety measures.

Business operators also engage in relevant voluntary initiatives through commuter transport management and publicity to raise the awareness of citizens to guide people to shift from traveling in private cars to public transportation, such as trains and buses, or the use of bicycles. The Government workers also actively use public transportation and bicycles for official work.

The excessive dependency on private cars is also reduced to build environmentally sustainable transport (EST).

(g) Measures of Utilization of Railway, Vessel, and Aviation

✓ **Energy Efficiency Improvement in Railways**

The introduction of energy efficient railway cars, such as lightweight cars and cars with VVVF devices, has recently started in the railway sector and will be further accelerated. The energy efficiency of railways will be further improved through the promotion of the eco rail line project that supports the introduction of advanced energy conservative devices.

✓ **Energy Efficiency Improvement in Vessels**

The vessel sector has promoted the use of vessels that reduce energy consumption by experimenting with innovative energy conservation technologies. It will continue to further diffuse energy-saving vessels.

✓ **Low Carbonization in Aviation**

The aircraft sector has introduced energy efficient aircraft materials and advanced air traffic control systems, and promoted carbon reduction in airport facilities. The industry will continue to promote these policies, increase the use of alternative jet fuels, and improve the efficiency of airfreight transportation.

(h) Promotion of Low-Carbonized Logistics Systems

✓ **Promotion to Improve Truck Transport Efficiency and Cooperative Transport and Delivery**

Efforts to promote activities against global warming and to push forward the greening of the entire logistics system by improved transportation efficiency and load efficiency shall be achieved through promotion of shared transportation and delivery of clients who order deliveries and logistics service providers who carry the goods of such clients.

Thus, the clients and distributors continue to cooperate with each other in energy management under the Act on the Rational Use of Energy. In addition, the Green Logistics Partnership Conference recognizes and awards the activities with outstanding outcomes, such as (1) the reduction of environmental load from logistics, such as modal shift achieved through the joint efforts of shippers and logistics providers, as well as improvement of truck transportation efficiencies; and (2) the establishment of sustainable logistics systems, including the improvement of logistics productivity. The

awards motivate business operators to voluntarily engage in environmentally friendly operations and to expand green logistics. An integrated method or guideline is elaborated for the calculation of CO_2 emissions from distribution so that both the clients and distributors can use it to streamline cooperation among them. A system to objectively evaluate effects of individual efforts is also established.

In addition, the number of home deliveries has been steadily increasing in recent years due to the rapid expansion of e-commerce (EC). Yet, about 20% of deliveries are ending up being redelivered. The increasing number of redeliveries is expected to result in increased CO_2 emissions as well as shortage of truck drivers. Therefore, measures are being implemented to reduce the number of redeliveries by diversifying ways to receive packages, such as picking them up at train stations and convenience stores through the development of delivery boxes and other tools.

The transportation efficiency is also improved through the ease the regulations to increase the length of full trailers for transportation on arterial roads, improvement of accessibility by building direct connections between highways and private facilities, simplification of permission for driving special vehicles using ETC2.0, and support for operational management.

In addition, based on Act on Advancement of Integration and Streamlining of Distribution Business (2005, Act No. 85), measures are implemented to streamline transportation systems through the construction of truck stations adjacent to logistics facilities where cargos are stored, sorted, and processed for distribution, as well as the implementation of measures to rationalize transport through the introduction of truck reservation systems. The delivery networks are thereby integrated and rationalized. At the same time, the carbon emission reduction in logistics is accelerated by providing support for business operators engaging in truck transportation without standby time, and the promotion of shared transportation and delivery.

✓ **General Measures for the Greening of Marine Transport and Promotion of Modal Shift to Rail Freight Transport**

Stakeholders are encouraged to shift from truck transportation to coastal shipping and/or railway transportation that will emit lower amounts of CO_2 for the greening of the entire logistics system.

Domestic terminals that accommodate combined and integrated transportation will be constructed to increase the competitiveness of coastal shipping that is to take over some of the load from vehicle transportation. Transportation costs are thereby reduced while improving the quality of service. The use of energy efficient coastal vessels is also increased and expanded. The modal shift to coastal shipping is also accelerated through the introduction of truck with separable trailers and the “Eco-Ship Mark”, as well as the improvement of the efficiency of transport using refrigerated containers.

The competitiveness of rail freight transport also needs to be improved. Thus, the modal shift to rail freight transport is accelerated through the following measures: the increased volume of rail freight transport, the use of innovative time schedules; the improvement of transport equipment, such as refrigerated containers with advanced features to keep contents fresh because they are effective when switching from trucks; the reduction of the cost of user-end transport; and the promotion of the use of “Eco-Rail Mark”.

In addition, modal shift will be promoted through its support based on Act on Advancement of Integration and Streamlining of Distribution Business.

The efficiency of truck transport will be further promoted. This initiative includes the shift from private trucks to commercial trucks and the use of larger trucks, and trailers. Other initiatives include the promotion of load efficiency through carrying loads on return trips.

✓ **Improvement of Energy Conservation at Facilities of Distribution Bases**

Distribution warehouses are functioning as the core facility of distribution. The carbon footprints of distribution bases are reduced by supporting efforts to integrate the energy conservation of

distribution facilities, such as the use of solar energy generation systems and energy conservative lighting devices with the improvement in the efficiency of distribution operations.

✓ **Initiatives at Harbors**

Harbors are crowded with freight ships and passenger ships and function as the base of industrial activities where marine and land distribution systems intersect each other. Since ports and harbors emit large amounts of greenhouse gases, the emissions can be effectively reduced. The emissions reduction efforts are conducted from the perspective of maintaining necessary functions in case of emergencies, such as large-scale natural disasters, and remaining resilient during the tight supply of electricity.

Specific initiatives include the construction of international marine container terminals, international distribution terminals, and domestic distribution bases that can accommodate combined and integrated transport systems. These facilities enable marine transport to the nearest ports and shorten the driving distance of truck transport.

Other efforts include supporting the introduction of energy efficient equipment, promotion of modal shifts and improved transportation efficiency using marine transport for reverse logistics systems, examination of the development of onshore power supply systems for vessels in ports, facilitation of renewable energy introduction and its use, development of green areas in harbors and seaweed beds to absorb CO_2, and examination of technological development to reduce CO_2 emissions in harbors.

(i) Other Policies and Measures

✓ **Schematic Promotion of Joint Measures Implemented by Multiple Government Ministries and Agencies**

Cooperation among relevant government ministries and agencies is established on the basis of plans to effectively and efficiently implement initiatives in all fields in order to ensure the reduction targets for 2030 in the transportation sector, including carbon reduction in individual modes of transportation and the promotion of modal shifts.

The initiatives also include special regulatory measures implemented through the Special Zone System for Structural Reform.

E. Initiatives in the Energy Conversion Sector

(a) Promotion and Enhancement of Voluntary Action Plans of Industry (Reprinted p66)

✓ **Steady Implementation of the Industry's Action Plans towards a Low-carbon Society and Evaluation and Verification of Progress (Reprinted p66)**

(b) Maximum Introduction of Renewable Energy

[Renewable Energy Generation]

Renewable energy does not emit greenhouse gases when generating electricity. Thus, promoting further introduction of renewable energy is vital for conducting measures in the energy conversion sector. In addition, renewable energy is promising, diversified, and important because low-carbon domestic energy sources in Japan contribute to energy security. Therefore, the renewable energy will be expanded their introduction to the maximum extent in accordance with their characteristics while reducing the burden on the people by properly responding to issues such as stable supply, cost, and environmental aspects.

✓ **Appropriate Operation and Revision of the Feed-in Tariff Scheme**

The feed-in tariff scheme implemented under the Act on Special Measures Concerning Procurement of Electricity from Renewable Energy Sources by Electricity Utilities (2011, Act No. 108) is accelerating the renewable energy. The proper operation of the system will be continued. The system is also revised when necessary in order to expand to the maximum of renewable energy in a good balance while reducing the burdens on people, as well as based on a mid-to-long-term perspective of maintaining autonomous energy sources.

✓ **Development of the Business Environment for the Expansion of Introduction and Long-term and Stable Power Generation**

The business environment is established to gain the understanding of people toward renewable energy and to realize the long-term and stable use of renewable energy. The development includes the establishment of systems and rules for system operations, the efficiency improvement and cost reduction of power generation facilities, and rationalization of relevant regulations as necessary.

The following initiatives are going to be implemented taking into consideration the characteristic of fuel type.

-Solar energy generation

The solar energy generation enables mid-to-small scale power generation near consumers. It is expected to reduce the loads on systems and function as emergency power supplies. Still, it faces challenges such as high cost of power generation and problems in stable supply as it is associated with unstable output.

When the cost of solar energy is lowered from a mid-to-long term perspective, it can fill the gap for peak demand of the afternoon using decentralized energy system and contribute to the realization of a consumer participatory energy management. Technological developments and other efforts are conducted to achieve these visions by improving the efficiency and lowering the cost of power generation facilities and advancing the system operations.

-Wind energy generation

The economic feasibility may become achievable if large-scale wind energy generation systems can be developed. The technological development is thus conducted to improve the efficiency and to lower the cost of wind energy generation facilities. The speed of environmental impact assessments is increased so that wind energy generation facilities can be more quickly and smoothly installed and used while maintaining a good balance with the environment and local communities. The Government and local governments work together to select areas for installing wind energy facilities so as to reduce the uncertainties of the project while ensuring environmental conservation.

In addition, sufficient system regulation capacity is not necessarily available in appropriate land for wind energy generation such as Hokkaido and northern Tohoku. Technological developments are conducted to develop systems, such as inter-district power system, and to sophisticate system operations.

From the mid-to-long-term perspective, the expansion of offshore floating offshore wind energy generation systems is essential because Japan has limited availability of land-based installation of wind energy systems. Therefore, the installation of bottom-mounted wind energy is accelerated in harbors areas. In addition, trial research will be conducted to realize the world's first full-scale business operation of floating offshore wind energy.

-Geothermal power generation

Japan has the third largest geothermal heat resources in the world. Geothermal power is an energy source that can become the baseload power supply for realizing low-cost and stable power generation. On the other hand, geothermal power development requires time and cost. Measures will be implemented to more quickly and smoothly introduce geothermal power facilities by reducing investment risks, promoting understanding of people in the local level, streamlining the procedure of environmental impact assessment, and rationalize regulations and institutions as necessary. Sustainable development that coexists with regional features is thereby conducted while protecting the natural environment and local communities.

-Hydropower generation

Hydropower is an energy source that offers excellent stability as a power supply, except when drought occurs. Hydropower generation facilities will be installed in dams where no hydropower generation is conducted. Existing hydropower generation facilities in dams will also be replaced with new ones. Meanwhile, medium to small-scale hydropower generation is often installed in undeveloped locations. These facilities are going to be utilized as the energy source to become the foundation of regionally distributed energy supply-demand structure while facing challenges in the business environment, such as the use of high-cost structures.

-Biomass energy generation

Biomass energy is an energy source that can deliver stable power supply and support the regional economy. However, it uses various materials such as wood and waste in various forms and such variation causes challenges such as high cost. Thus, conflicts with existing business need to be arranged, and the stable supply of raw materials needs to be secured. Based on these measures including measures in the forestry industry such as pursuing an advantage of expansion of industry size and the use of mixed combustion in existing thermal power generation plants, the long-term and steady expansion of the introduction of biomass energy generation can be achieved.

Individually, measures such as support to ensure a stable and efficient supply of unused materials and the recovery of energy from waste heat such as the methane fermentation of waste biomass and/or combustion heat will be implemented.

[Renewable Heat Energy]

Renewable heat energy sources that are specific to particular regions, such as solar heat, biomass heat, geo-heat, hot springs heat, river heat, sewage heat and ice melt heat. It is important to increase the use of renewable heat energy; biomass heat from sewage, sludge, waste, unused materials; biofuels that can replace some oil products used as fuel in the transport sector; and waste heat generated in the process of waste disposal depending on economic efficiencies and regional characteristics. Support will be provided for the introduction of renewable heat energy supply systems. The use of renewable heat energy is also going to be expanded by testing and creating models for the effective use of various thermal energies in different regions.

- ✓ **Initiatives In Water Supply and Sewage System (Reprinted p72)**
- ✓ **Initiatives in Waste Management (Reprinted p73)**

[Full Use of Electricity and Heat from Regional Renewable Energy Source and Unused Heat]

- ✓ **Expansion of Holistic and Efficient Use of Energy (Reprinted p72)**

(c) Reduction of CO_2 emission intensity in the Power Sectors

[Persuasion of High Efficiency of Thermal Power Generation]

✓ **Initiatives of the Power Sectors to Low-carbonization**

The voluntary framework of the power sectors in which major business operators participate and the Industry's Action Plan toward a Low-carbon Society was announced in July 2015. (The Action Plan toward a Low-carbon Society aims to achieve about 0.37 kg-CO_2/kWh as the emission factor that matches the national energy mix and the CO_2 reduction target.) The Electric Power Council for a Low Carbon Society was launched in February 2016. The Council established individual reduction plans and announced mechanisms and rules of the entire industry to implement PDCA.

Policies are going to be established to accelerate activities to achieve targets of the voluntary framework based on the Act on the Rational Use of Energy and the Act on Promotion of Use of Non-fossil Energy Sources and Effective Use of Fossil Energy Materials by Energy Suppliers (2009, Act No. 72, hereinafter referred to as "the Advancement Act"). The effectiveness of the efforts of the entire power sectors is ensured under the energy deregulation.

Specifically, the policies include the following categories. Effective activities will be continued based on the Summary of Director-level Meeting on the Bid on Thermal Power Supply of Tokyo Electric Power Company (April 25, 2013, Ministry of Economy, Trade and Industry and Ministry of the Environment).

<Voluntary framework>

- Continuous improvement of effectiveness and transparency is promoted. Participating business operators are also expected to sincerely achieve listed targets.
- The national council (Natural Resources and Energy WG, Global Environment Subcommittee, Committee on Industrial Science and Technology Policy and Environment, Industrial Structure Council) also follows up on activities conducted under the voluntary framework of the power industry.

<Policy responses>

- Power suppliers are required to satisfy the standard of expected power generation efficiency in the energy mix set for individual power generation facilities when they install and use new power generation facilities (42.0% or more for coal, 50.5% or more for LNG, and 39.0% or more for oil). Individual power suppliers are also required to satisfy the actual power generation efficiency expected in the energy mix when they use currently installed power generation facilities. (The presumed standard to achieve in index A of thermal power generation efficiency is 1.00 or more (target of power generation efficiency: 41% for coal, 48% for LNG, and 39% for oil) (all at the power generation end, HHV). The standard expected to achieve in index B of the thermal power generation efficiency is 44.3% or more (at the power generation end, HHV).)
- Electricity retailers are required to ensure that the ratio of energy generated from non-fossil energy sources is 44% or more of all the electricity they sell based on the Advancement Act.
- Guidelines for electricity retail operations regard the labeling of post-adjustment emission factor as a desirable practice.
- The Ministerial Ordinance under the Act on Promotion of Global Warming Countermeasures requests all electricity retailers to report actual emission factors for the greenhouse gas emissions accounting, reporting and disclosure system. Reported emission factors are released to the public. (Actual emission factors over the past two fiscal years and other data are added to the reporting requirement to enrich the contents of the reports).

The effectiveness and transparency of efforts in the entire power sector will be secured through these activities and measures. The progress of these activities and measures is evaluated every year to see whether they remain effective in reaching the emission factor target of 0.37 kg-CO_2/kWh in FY 2030 that matches the reduction target and energy mix set for FY 2030.

Emissions from the power sector such as the amount of emissions and emissions factor are evaluated. Revision of policies and other measures are considered if the evaluation finds that the goal of 0.37 kg of CO_2/kW cannot be achieved.

✓ **Promotion to Introduce the Latest Thermal Power Generation Facilities**

An important point of introducing power generation facilities is to constantly encourage the advancement of power generation technologies through competition, to maintain and improve the technological superiority of Japan in the power generation business, to improve Japan's competitiveness on the international stage, and to contribute to environmental protection. Based on this idea, Japan promotes the use of BAT while taking into account the trend of the development of power generation technologies in the future.

✓ **Carbon Dioxide Capture and Storage (CCS)**

Japan works on CCS based on decisions including the Summary of Director-level Meeting on the Bid on Thermal Power Supply of Tokyo Electric Power Company and the Strategic Energy Plan in looking ahead to after 2030.

✓ **Responses to Small-scale Thermal Power Generation**

The number of plans is increasing to construct small-scale thermal power plants that are smaller, especially ones that are only slightly smaller than the minimum size covered in the regulation of the Environmental Impact Assessment Act (1997, Act No. 81). The Act on the Rational Use of Energy will become applicable to power suppliers that are planning to construct such plants to require them to satisfy high standards of power generation efficiency that contribute to the energy mix.

[Utilizing Nuclear Power Generations whose Safety is Approved]

✓ **Initiatives of the Power Sectors to Low-carbonization (Reprinted p82)**

✓ **Utilizing of Nuclear Power Generations whose Safety is Approved**

Nuclear power is a low-carbon baseload power source that does not emit greenhouse gases during operation. The safety of nuclear power plants is overseen by the Nuclear Regulation Authority, whose decisions are based on scientific and technical judgments. Upon approval by the Nuclear Regulation Authority that the regulatory standards are met, the government will respect its judgment and will proceed with the restart of the nuclear plant. In this case, the Government will make efforts to obtain understanding and cooperation of relevant parties including the municipality of each nuclear facility site.

[Maximum Introduction of Renewable Energy]

✓ **Initiatives of the Power Sectors to Low-carbonization (Reprinted p82)**

✓ **Maximum Introduction of Renewable Energy (Reprinted p79)**

(d) Promotion of Energy Conservation Policies in the Oil Product Manufacturing Sector

✓ **Initiatives in the Oil Refinery Industry**

Japan promotes oil refiners to reduce one million kiloliters of energy in crude oil equivalent from business as usual (BAU) in the oil product manufacturing field, based on the Industry's Action Plan toward a Low Carbon Society through the following initiatives: (i) effective use of heat, (ii) introduction of advanced control and high efficient devices, (iii) improvement of the motors system operation, and (iv) major improvement and advancement of processes.

b) Non Energy-related CO_2

✓ **Increasing the Use of Blended Cements**

The production proportion and use of blended cement, which is made by mixing blast furnace slag with clinker, an intermediate cement product is increased.

In public works administrated by the government, the use of blended cement will be promoted in accordance with the Act on Promotion of Procurement of Eco-Friendly Goods and Services by the State and Other Entities (2000, Act No. 100, hereinafter referred to as "Act on Green Purchasing").

✓ **Diffusion of Biomass Plastics**

CO_2 emissions from the combustion of waste plastics are reduced by increasing the use of plastics made from biomass as the replacement for plastics made from oil (intended to reduce CO_2 from the oil-originated carbon in waste plastics).

✓ **Reduction of the Amount of Waste Incineration**

Through the promotion of 3Rs initiatives for achieving the targets set out in the Basic Plan for Establishing a Recycling-Based Society (Cabinet Decision on May 31, 2013, hereinafter referred to as "Basic Recycling Plan"), formulated in accordance with the "Basic Act on Establishing a Sound Material-Cycle Society (Law No. 110, 2000; hereinafter referred to as "the Basic Recycling Law") as well as the waste reduction targets set out in the "Waste Management and Public Cleansing Law" in line with the target set in Basic Recycling Law. (1970, Law No. 137, hereinafter referred to as "the Waste Management Law"). The incineration of waste plastics made from oil is thereby reduced. Specific measures to reduce the amount of waste, promote reuse, and reduce CO_2 emissions from the incinerated waste plastics include the thorough waste sorting and collection as well as imposition of charges for waste collection by municipal governments, and actions complying with individual recycling laws.

✓ **Promotion of Public Campaigns (Discussed later p96)**

c) Methane (CH_4)

✓ **Measures to Reduce Greenhouse Gas Emissions in relation to Agricultural Soil**

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 the application of compost.

✓ **Reduction of the Amount of Wastes in Final Disposal**

Initiatives are conducted for achieving the targets set out in the Basic Recycling Plan formulated in accordance with the Basic Recycling Law and the waste reduction targets stipulated in the Waste

Management Law in line with the targets in the Basic Recycling Law. Specifically, 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.

✓ **Adoption of Semi-aerobic Landfill Structure in Final Waste Disposal Sites**

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.

d) Nitrous Oxide (N_2O)

✓ **Measures to Reduce Greenhouse Gas Emissions in Relation to Agricultural Soil**

The Government will aim at the emissions reduction of nitrous oxide associated with the application of fertilizers with lower fertilizer application rates, split-application regimes and slow-release fertilizers.

✓ **Advancement of Combustion in Sewage Sludge Incineration Facilities**

The amount of nitrous oxide emissions from incineration of sewage sludge is reduced through introducing high temperature combustion and the replacement with the incinerators that emit less nitrous oxide or facilities that produce solid fuel by carbonizing sewage sludge.

✓ **Reduction of the Amount of Municipal Wastes Incinerated**

The amount of waste incinerated in municipal waste incinerators is reduced by promoting the 3R initiatives to achieve the targets set in the Basic Recycling Plan formulated in accordance with the Basic Recycling Law and waste reduction target stipulated in the Waste Management Law. The combustion technology at municipal waste incineration facilities is advanced by shifting to continuous incinerators and increasing the ratio of continuous operation of waste disposal in municipal waste incineration facilities under wide-area waste disposal systems. The combustion in municipal waste incineration facilities is thereby advanced, and the amount of nitrous oxide emissions from waste incineration is reduced.

e) Fluorinated Gases: HFCs, PFCs, SF_6, and NF_3

✓ **Practical Efforts on Phasing Down of Fluorocarbons**

Gas manufacturers and relevant business operators (business operators producing and importing fluorocarbons) are encouraged to use fluorocarbons with lower GWP and switch to gases other than fluorocarbons including reducing their production and recycle them in order to increase the low recovery rate and decrease the environmental load from fluorocarbons.

Therefore, gas manufacturers are expected to set plans and reduce the amount of fluorocarbons they produce based on the projection of the use of fluorocarbons the Government established on the basis of the Fluorocarbons Emissions Reduction Law.

✓ **Promotion of Eliminating Fluorocarbons and Lowering GWP of Products**

The following measures are implemented to gradually and steadily switch to non-fluorocarbons and reduce the GWP of refrigeration and air conditioners and other products containing fluorocarbons

while taking into account technological progress in Japan and in the world and market trends.

(i) Business operators producing and importing fluorocarbons are required to meet standards within the target year based on proper product categories provided in the Fluorocarbons Emissions Reduction Law in order to promote switching to non-fluorocarbons and lower global warming potential (GWP) with sufficient consideration for the actual conditions of individual products.

(ii) Labeling of products containing fluorocarbons is improved to make labels easier to understand for users and consumers in order to increase recognition of the global warming effect of fluorocarbons and encourage consumers to select non-fluorocarbons and low-GWP products.

(iii) Measures beside the improvement of systems include technological development and measures to install and use the technologies to encourage product manufacturers and users, measures to promote the use of energy efficient devices containing natural refrigerants, training people who install and maintain devices compatible with new alternative refrigerants, securing the quality of contractors, and measures to raise the public awareness.

✓ **Preventing Leakage of Fluorocarbons from Use of Refrigeration and Air conditioning Equipment for Business Use**

The leakage of fluorocarbons during the use of refrigeration and air conditioning equipment for business use is prevented in cooperation with prefectural governments through compliance with the decision criteria of management that stipulates the device inspection rules, use of systems to report and release calculated amount of leaked fluorocarbons, and compliance with proper filling procedures based on the Fluorocarbons Emissions Reduction Law.

Beside device users, contractors who maintain devices play important roles in preventing the leakage of fluorocarbons during the use of refrigeration and air conditioning equipment. The contractors are encouraged to improve technological levels for device maintenance and management to detect the leakage of refrigerants in the early phases, and secure and train workers who are knowledgeable in the management of refrigeration and air conditioning equipment.

✓ **Recovery and Proper Disposal of Fluorocarbons from Refrigeration and Air Conditioning Equipment**

Fluorocarbons are recovered from refrigeration air conditioners and properly disposed of based on the Fluorocarbons Emissions Reduction Law, the Act on Recycling, etc. of End-of-Life Vehicles (2002 Act No. 87), and the Act on Recycling of Specified Kinds of Home Appliances (1998, Act No.97).

Refrigeration and air conditioning equipment for business use (except for automobile air conditioners) account for about 70% of HFCs emissions from refrigeration and air conditioning equipment. The rate of recovery from these devices will continuously be increased through the cooperation with prefectural governments based on the Fluorocarbons Emissions Reduction Law.

✓ **Promotion of Voluntary Initiatives in Industries**

Measures that industries implement as their voluntary action plans to prevent the leakage of fluorocarbons are evaluated and verified. At the same time, business operators are assisted in emissions reduction efforts by providing subsidies for installing and using devices that reduce emissions.

✓ **Use and Examination of Economic Approaches**

Technological development of fluorocarbon-free and low-GWP products is supported, and support is provided for the introduction of such technologies. Tax cut is also provided for these activities.

The other economic approaches will be continued to examine as they both have benefits and

challenges.

(2) Greenhouse Gas Sink Policies and Measures

a) Measures for Managing Forest Carbon Sink

Measures, such as proper forest management and conservation designed to achieve the objectives regarding fulfillment of the multiple roles of forests as well as the supply and use of forest products, are outlined in the "Basic Plan for Forest and Forestry" approved by the Japanese Cabinet in accordance with the Forest and Forestry Basic Act (1964, Act No. 161). These measures include activities under Article 3.3 of the Kyoto Protocol, namely afforestation, reforestation and deforestation since 1990 and forest management, such as proper forest management and conservation through thinning and designation of protection forests under Article 3.4. Through implementation of these measures, the targeted amount of carbon sinks in forests (about 38 million t-CO_2 or more in FY 2020 and about 27.8 million t-CO_2 in FY 2030) will be achieved. Therefore, while collaborating with various entities including local governments, forest owners, forestry and lumber industries and business operators, and citizens, the following measures including cross-sectoral ones will be comprehensively implemented. Besides, these measures addressing promotion of activities under Article 3.3 and 3.4 of the Kyoto Protocol contribute to promoting conservation of forest and sustainable forest management, conservation of biodiversity, and sustainable use of forest resources.

✓ **Healthy Forest Management**

A. Implementation of necessary thinning, and promotion of diversified forest practices aiming at multi-storied forests and/or longer rotations

B. Promotion of additional thinning through more efforts from the municipalities based on the Act on Special Measures concerning Advancement of Implementation of Forest Thinning (2008, Act No. 32)

C. Proper combination of different types of roads used for forestry operation including forest roads and construction of road networks with due consideration for nature conservation

D. Promotion of the development of mixed conifer-broadleaf forests through thinning and introducing broad-leaved trees, depending on natural conditions.

E. Promotion of reforestation after final cutting through lowering reforestation cost, development and securement of seeds and seedlings that grow well, and prevention of damage caused by wild animals

F. Ensuring reforestation through proper operation of logging and afforestation notification system

G. Restocking of treeless lands within headwater forests in the back regions, and restoration of degraded forests nearby human habitats

✓ **Promotion of the Proper Management and Conservation of Protection Forests**

A. Proper conservation and management through regulations of Protection Forest System,, planned designation of Protection forest, and operation of Protected Forest System, and promotion of conservation and restoration of natural vegetation in cooperation with NPOs

B. Planned promotion of forest conservation projects in areas vulnerable to mountain disasters and devastated forests in the back regions

C. Prevention of pest and animal damage in forests, and promotion of the measures to prevent forest fire

D. Expansion of natural parks and natural environment conservation zones, and reinforcement of conservation management in these areas

✓ **Development of Efficient and Stable Forest Management**

A. Identification of forest owners, clarification of boundaries, and integration of forestry operations

B. Gathering of the information on forest owners in municipalities

C. Preparation of forest management plans and implementation of low cost and efficient practices based on the plans

D. Improvement of productivity in log production with efficient operation systems based on proper combination of construction of road networks and use of advanced forestry machinery

E. Promotion of efforts to train and secure people who are to play the leading role in forests and forestry sector

F. Promotion of entrusting forest operation and management to motivated forestry workers, promotion of forest management by public bodies

✓ **Promotion of People's Participation in Forest Management**

A. Promotion of the public relations activities for People's Participation in Forest Management through nationwide greening events, such as the National Tree-Planting Festival

B. Promotion of afforestation programs by a variety of organizations including participation of private companies in growing forests, through the National Campaign for Beautiful Forest Development and other events

C. Improvement of skills of forest volunteers and securing working conditions

D. Promotion of forest environmental education

E. Promotion of forest conservation and management, and the use of forest resources in cooperation with local residents, forest owners and other stakeholders

F. Promotion of Ecosystem Maintenance and Recovery Project to conserve forest ecosystem and Green Workers Project in national parks and reserves

G. Fostering of the awareness of citizens to recognize rich environment as an important supporter for their lives

✓ **Promotion of the Use of Lumber and Woody Biomass**

Lumber is a renewable resource and can store carbon. Encouraging the use of lumber results in reducing use of fossil fuels and CO_2 emissions. It also contributes to sustainable forest management. The following measures are thus implemented for the use of lumber.

A. Promotion of the use of locally sourced lumber in housing

B. Promotion of the use of lumber in public buildings and non-residential buildings based on the Act for Promotion of Use of Wood in Public Buildings (2010, Act No. 36)

C. Research, development, and commercialization of new technologies for the use of forest products and new wooden materials

D. Development of systems to ensure stable supply of domestically produced lumber to respond to demand, such as construction of efficient processing and distribution facilities

E. Establishment of efficient and low-cost collection and transportation systems of woody biomass and promotion of the use of wooden materials as energy and products

F. Promotion of the "Kizukai (due care for wood use)", an initiative to disseminate the importance of wood use to consumers and expand the use of wood

b) Measures to Increase Carbon Sinks in Agricultural Soils

It is proven that the carbon storage in cropland and grassland soils in Japan can be increased by continuous usage of organic matter such as compost and green manure. Thus, carbon stock in the soil of cropland and grasslands is increased by promoting soil development by applying organic matter, such as compost and green manure. The activities contribute to the LULUCF activities under article 3, paragraph 4 of the Kyoto Protocol (cropland management and grassland management)

c) Promotion of Urban Greening

Urban greening is the closest carbon sink improvement measure in the daily lives of the public, including revegetation as LULUCF activities under article 3, paragraph 4 of the Kyoto Protocol. Promotion of urban greening is highly effective in raising public awareness of global warming mitigation rather than the actual effects of increasing carbon sinks.

Therefore, the actions will be continuously promoted such as urban park maintenance, greening in roads, rivers, and sand control facilities, bays, sewage treatment facilities, public housing, and government buildings, along with the increase of new green spaces on the rooftops of buildings. These initiatives are conducted based on general plans to maintain and increase green spaces established by the national government and local governments, such as the Outline of Green Policies and the Basic Plan of Greening established by municipalities.

Meaning and effects of urban greening are widely publicized for all types of the public as a part of these initiatives. Support will also be provided to create new green spaces in cities using various methods and by various organizations through urban greening projects conducted with various participants including the public, business operators, and NPOs, as well as the use of three-dimensional urban park systems.

Improvement in report and verification system of removals by the urban greening will also be strategically carried out.

3.2.3.2 Cross-sectional Strategies

(1) Cross-section measures to achieve targets

(a) Promotion of J-Credit Scheme

✓ **Promotion of J-Credit Scheme**

Active promotions are needed to reduce emissions through the introduction of energy conservation facilities and the use of renewable energy by various parties in Japan, as well as to increase carbon sinks through appropriate forest management. Therefore, the J-Credit Scheme is going to be steadily implemented to certify credits that can be used to achieve the Industry's Action Plan toward a Low Carbon Society and carbon offsets.

(b) Development of Public Campaigns (Discussed later p96)

✓ **Promotion of Public Campaigns (Discussed later p96)**

(c) Formulation of Low-carbon Urban/Regional Structures and Socioeconomic Systems

✓ **Formulation of Low-carbon Urban/Regional Structures and Transportation Systems**

Urban/regional structures and transportation systems will continue to influence CO2 emissions in the mid- and long-term periods through increases/decreases in traffic and commercial floor areas. Therefore, low-carbon urban/regional development needs to be promoted through compact city

planning, rebuilding public transportation networks, and efficiency improvement of urban energy system in order to transform from existing diffusional system.

Support is thus provided to encourage the establishment of urban functions based on appropriate location plans and low-carbon city development based on the Low Carbon City Act. Measures and enterprises are also promoted based on integrated urban/regional transportation strategies and shared use of energy at the district level. Green areas that remove greenhouse gases are also preserved and expanded. Local government action plans are implemented while coordinating with urban planning and agricultural development area planning and compatibility with low carbon urban development plans. Other promotional measures are also considered to increase the use of public transportations linked to land use measures, as well as the optimization of retail floor areas and the promotion of area-wide use of natural resources. The decarbonization of housing, buildings and infrastructures are also promoted.

Advanced low-carbon urban/regional developments are also accelerated for projects to build environmental future cities and environmental model cities. The experience and know-how gained through these projects are applied for other cases throughout Japan.

- ✓ **Development of Innovative Energy Management Systems by Effectively Using Distributed Energy Resources on the Electricity Consumer Side**

"Demand response" is expected to provide energy resources to make balance in energy supply and demand in the energy system through electricity consumers save electricity consumption. In order that electric power utilities can purchase the amount of electricity that consumers saved upon request from them, which is called “Negawatt”, the “Negawatt trading market” has surely been inaugurated in April 2017.

In addition to this, the national demonstration project has developed regulation system using IoT technologies, as if they form one power plant, which collectively manages and controls electricity utilizations in distributed energy resources on the consumer side, such as solar photovoltaic systems, storage batteries and demand responses. The project will create a new type of energy business (energy resource aggregation business), so as to accelerate introduction of renewable energy and promote additional energy conservation.

- ✓ **Expansion of Holistic and Efficient Use of Energy (Reprinted p72)**

- ✓ **Development of Low-carbon Cities through the Improvement of Thermal Environment by Preventing Heat Island Effects (Reprinted p72)**

(2) Other relevant Cross-section measures

(a) Realization of Hydrogen Society

Hydrogen is associated with many excellent features, such as being convenient and energy efficient, no emission of greenhouse gases during the consumption phase, useful during emergencies, and produced from various energies including renewable energy Hydrogen energy will be the trump card for energy security and measures to address global warming.

Many entities have conducted research, development, and experiments in the elemental technologies to expand the use of hydrogen. Still, there are many challenges in regards to technology, cost, system, and infrastructure to realize a so-called “hydrogen society” in which people use hydrogen in their daily lives and industrial activities. To collectively overcome these challenges, Japan promotes various technological developments and cost reduction efforts while strategically creating systems and infrastructures to start social applications of technologies starting with the feasible ones.

Necessary technological developments will specifically be conducted in regards to Ene-Farm and fuel cell vehicles (FCVs) to lower their costs and improve performance. In addition, hydrogen stations, the necessary infrastructure for the diffusion of FCVs, will be installed while expecting the use of hydrogen derived from renewable energy in the future. Technological developments are also conducted to lower costs related to hydrogen stations. Relevant regulations will be streamlined if necessary in preparation for the improvement of safety and the reliability of relevant technologies.

Technological developments and experiments are also conducted in regards to the other uses of hydrogen and fuel cells, such as fuel cells for business use and industrial power generation.

Technological developments will be conducted to realize low cost and stable hydrogen production and transportation so that the demand for hydrogen will be further expanded in the future. Development and experiments will also cover hydrogen production, transport, and storage technologies with the lowest possible CO_2 emissions, such as the production of hydrogen from renewable energy and conversion of unused energy into hydrogen.

(b) Initiatives based on the Guidelines for Controlling Greenhouse Gas Emissions

In regards to emissions reduction the guidelines for controlling greenhouse gas emissions based on the Act on Promotion of Global Warming Countermeasures, menus of measures will be expanded for selecting energies with lower carbon footprints based on technological trends such as BAT. Guidelines will be established and released as soon as possible for areas without guidelines. Business operators are encouraged to voluntarily and actively practice environmentally friendly business activities by providing assistances and distributing information to drive them to implement the measures stipulated in the applicable guidelines.

(c) GHG Emissions Accounting, Reporting and Disclosure Program

Greenhouse gas emitters compute the amount of greenhouse gases they emit. The foundation of voluntary initiatives for global warming countermeasures is thereby established, and the amounts of emissions are made visible to the public. In addition, emitters that exceed a given threshold of emission to report their emission quantities to the Government on an annual basis which are collected and disclosed it to the public in order to increase the incentive and motivation for the public and business operators to engage in voluntary efforts. The implementation of these initiatives will be continued. At the same time, business operators are expected to actively reduce greenhouse gas emissions by properly reevaluating their initiatives based on IPCC Guidelines, as well as through accurate report, prompt collection and disclosure of emission information.

(d) Promotion of Environmental Considerations in Business Initiatives

Japan properly includes the perspective of committing to environmental friendliness in economic activities and promotes investments and technological developments in business activities to reduce greenhouse gas emissions.

Specifically, Japan develops a foundation where business operators engaging in environmentally friendly practices can enjoy benefits through the series of the following actions. (i) The value of the environment is recognized in products, services, and the financial market, and business operators adopt attitudes to pursue environmental friendliness. (ii) Suppliers engage in environmentally friendly business activities while distributing information to improve the understanding of customers. (iii) Customers who receive accurate information come to recognize the value of environmentally friendly business operators products, and services and select them as a consequence.

Therefore, Japan encourages business operators to implement environmentally-conscious business activities on a voluntary and active basis by formulating and publishing the Guidelines. By releasing stakeholder environmental reports in accordance with the Act Concerning the Promotion of Business Activities with Environmental Consideration by Specified Corporation, etc. by Facilitating Access to

Environmental Information, and Other Measures (Law No. 77, 2004), Japan encourages the use of environmental information by stakeholders and by the general public and provide the conditions for business activities with environmental consideration to be highly valued by society and by markets. To realize such conditions, Japan develops the foundation for identifying and managing the amount of greenhouse gas emissions throughout the entire supply chain, supports development and implementation of corporate's target consistent with Paris 2-degree target (Science-Based Target, SBT), promulgates and encourages the use of the idea of the carbon footprint, develops the foundation to release information using ICT, and improves the comparability and reliability of environmental information.

Japan also diffuses the use of environmental management systems equipped with the PDCA cycle, including ISO 14001 and Eco Action 21 designed for small and medium-sized businesses, to improve the effectiveness of environmental business practices. At the same time, Japan promotes even more environmentally friendly business practices by promoting employee education in companies.

(e) Joint Crediting Mechanism (JCM)

Implementing of emission reductions or removals through diffusion of advanced low carbon technologies can contribute to mutual low carbon development of both recipient countries and Japan.

Thus, Japan establishes and implements the JCM in order both to appropriately evaluate contributions from Japan to GHG emission reductions or removals in a quantitative manner achieved through the diffusion of low carbon technologies, products, systems, services, and infrastructure as well as implementation of mitigation actions in developing countries, and to use them to achieve Japan's emission reduction target. Apart from contributions achieved through private-sector based projects, accumulated emission reductions or removals by FY 2030 through governmental JCM programs to be under taken within the government's annual budget are estimated to be ranging from 50 to 100 million t-CO_2. The JCM is not included as a basis of the bottom-up calculation of Japan's emission reduction target, but the amount of emission reductions and removals acquired by Japan under the JCM will be appropriately counted as Japan's reduction.

Japan will, for the purpose of further implementation of actual emission reductions or removal projects, support further formulation of projects through measures including appropriate operation of the JCM. These include development of measurement, reporting and verification methodologies; formation of projects and feasibility studies through utilization of city-to-city cooperation and the JCM Special Financing Scheme (JSF) in collaboration with Japan Bank for International Cooperation (JBIC) and Nippon Export and Investment Insurance (NEXI); appropriate operation of internal institutional arrangements in order to promote utilization of the JCM; and collaboration with relevant organizations such as New Energy and Industrial Technology Development Organization (NEDO), Japan International Cooperation Agency (JICA) and Asian Development Bank (ADB).

(f) Measures for Greening Tax Scheme and Effective Utilization of Tax for Climate Change Mitigation

Greening environmentally-related taxes proposed in the plan is an important policy for global warming countermeasures, including promoting a low-carbon society. The Government of Japan is to proceed global warming countermeasures through carrying out comprehensive and systemic research and analysis on environmental effectiveness of environmentally-related taxes, with investigating policies and measures in other countries

Utilizing revenues from Tax for Climate Change Mitigation, which was introduced in October 2012, the Government of Japan is to steadily implement measures to curb energy-oriented CO_2 including promotion of energy saving, diffusion of renewable energy, and utilization of cleaner and more efficient fossil fuels.

(g) Greening Finance

The proper supply of private finance for the necessary greenhouse gas emission reduction measures is essential to drastically cut greenhouse gas emissions and create a low-carbon society. In addition, an increasing number of institutional investors around the world are adopting the environmental friendliness of companies as one of their decision-making criteria. Therefore, Japan uses financial measures, or greening finance, to promote initiatives to develop the green economy by providing proper incentives for being environmentally friendly.

Specifically, Japan provides financial supports to mobilize private funds into low-carbon projects. More specifically, it provides equity finance into low-carbon projects where private financial resources are not sufficient, encourages leasing of low-carbon equipment to reduce the burden of up-front costs, and spurs issuance of and investment in Green Bonds in Japan.

Japan also promotes environmentally friendly actions to reduce greenhouse gas emissions, such as the loans based on environmental responsibility ratings that incentivize the environmentally friendly actions of investment candidate companies by evaluating corporate activities based on their financial aspects and environmental aspects to reflect the findings in investment activities; ESG investment that takes into account environmental contributions, social contributions, and governance of companies; and releases of the policies on ESG activities of institutional investors.

(h) Domestic Emissions Trading Scheme

Japan considers an emission trading scheme carefully, taking into consideration the burden on domestic industry and associated impacts on employment; ongoing developments of emission trading schemes overseas; evaluation of existing major climate change policy measures such as voluntary actions implemented by the industry sector.

3.2.3.3 Fundamental measures

(1) Development of National System for Estimating Greenhouse Gas Emissions and Removals based on the United Nations Framework Convention on Climate Change (UNFCCC)

Government ministries and agencies, mainly the Ministry of the Environment, have been closely working for: development of national system to aggregate, estimate, and disclosure statistics concerning emissions and removals; quality assurance and quality control of data; and responding to reviews implemented by expert review teams dispatched on the basis of the Kyoto Protocol in order to estimate greenhouse gas emissions and removals based on the UNFCCC and the Kyoto Protocol and submit data to the Secretariat of the UNFCCC. Japan continues to improve and elaborate estimation methods and process of emission factors and activity data to estimate emissions and removals taking into account global trends in reinforcing MRV.

More accurate identification of emissions by sector and refined methods to evaluate the implementation of measures by individual entities are needed. Thus, Japan promotes investigations and research concerning the development of statistics to measure activity data, the estimation of energy consumption intensity and CO_2 emission intensity, and methods to monitor greenhouse gas emissions. Japan also additionally refines methods to estimate greenhouse gas emissions and removals. Specifically, Japan develops the necessary statistics for estimating detailed CO_2 emissions in the residential sector.

Japan also responds to the submission of biennial reports required based on decisions at COP17 as well as the international assessment and reviews.

Meanwhile, Japan is estimating emissions and removals when measuring, monitoring, and reporting removals (or emissions) by sinks under the 2006 IPCC Guidelines and the 2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol. Necessary data for MRV concerning the activity data and changes in land uses will be gathered to improve data precision. Research and study projects on greenhouse gas emission and removals mechanisms in forests are also conducted.

(2) Technology Development for Global Warming Countermeasures and Application of These Technologies in Society

Developing and verifying technologies for global warming countermeasures are initiatives to realize the future reduction of a large amount of greenhouse gas emissions by promoting the expansion of greenhouse gas emission reductions and the decrease of reduction costs and thereby widely diffusing them in society. Therefore, Japan promotes the technological development and verification in order to realize the lower cost, higher efficiency and longer life of renewable energy and energy conservation from the early phases and assists in the social application of these technologies based on the Environmental Energy Technology Innovation Plan (September 13, 2013, Council for Science and Technology Policy) for solar power generation, wind power generation, geothermal power generation, hydropower generation, biomass energy, ocean energy, the use of other renewable heat energy, and energy conservation technologies.

(3) Strengthening Promotion, Observation, and Monitoring System of Climate Change

The accumulation of the latest scientific information from research projects inside and outside of Japan is necessary to promote global warming countermeasures in the future from long-term and global perspectives. The research, observation, and monitoring of climate change are extremely important initiatives that build the foundation of such knowledge. Japan conducts global warming research based on past research initiatives and through international cooperation to clarify the mechanisms of climate change, identify current conditions of global warming, forecast global warming, promote the necessary technological developments, implement measures to reduce greenhouse gas emissions and adapt to global warming, and assess the effects of global warming on the environment, society, and economy.

3.2.3.4 Initiatives by Public Organizations

✓ **Initiative of the National Government**

The national government takes the initiative in purchasing and using of building construction and management, financial services and other administration and projects, based on the national government action plan established under the Act on Promotion of Global Warming Countermeasures and ministerial action plans established based on the national government action plan.

Specifically, the national government implements the following:

- Improvement of operations based on results of energy conservation diagnosis and the development of cost-effective and rational infrastructures;
- Visualization of energy consumption and thorough energy management (e.g. introduction of BEMS);
- Taking initiatives in introduction of LED lamps when replacing currently installed lighting devices;
- Taking initiatives in introduction and use of energy efficient devices;
- Establishment of work systems to reduce CO_2 emissions such as the reduction of overtime work;
- Carbon reduction of using energies;
- Taking initiatives in introduction of next-generation vehicles;
- Aiming to realize ZEBs in Buildings;
- Using recycled products such as recycled paper and lumbers;
- Active utilization of bicycles in daily communication work.

The national government action plan is designed to firmly implement measures specified in the Plan.

The Plan targets a reduction of 40% in the total amount of greenhouse gases directly and indirectly emitted from the administration and projects of the national government by FY 2030 from the level of FY 2013. An interim target is to cut the emissions from the entire government by 10% by FY 2020.

The Central Environment Council evaluates and verifies the progress of the national government action plan. The executive meeting of the Global Warming Prevention Headquarters then inspects the progress every year and releases the outcome of the inspection to the public. To ensure transparency and the diffusion of the effects of the initiatives, the inspection outcomes are released along with evaluations of indexes specified in the national government action plan, such as the total emission of greenhouse gases and the progress of individual categories in comparison to target values and past data, in addition to cross-section comparative evaluation of planned actions and the progress of individual actions.

The national government also signs contracts for reducing greenhouse gas emissions from their undertakings mainly in six sectors, including electricity, automobiles, ships, ESCO, construction, and industrial waste based on the Act on Promotion of Contracts of the State and Other Entities, Which Show Consideration for Reduction of Emissions of Greenhouse Gases, etc. (2007, Act No. 56, hereinafter referred to as "the Environmental Friendliness Contract Act") and basic policies specified in the Act. The national government thereby ensures the achievement of targets specified in the national government action plan and realizes additional reductions.

In regards to the national government buildings, the national government continues to promote the visualization of energy consumption and the proper energy operation and management, including environmental load reduction and the construction of government buildings in a way to protect the nearby environment (green government buildings) along with the use of life cycle energy management (LCEM) for air conditioning devices. In order to spur demands for products that contribute to greenhouse gas emissions reduction and other eco-friendly goods and services, the national government takes the initiative in procuring such goods and services based on the “Act on Green Purchasing”. Furthermore, the national government promotes wood use in public buildings based on the Act for Promotion of Use of Wood in Public Buildings.

✓ **Actions Led by Local Governments and Promotions by the National Government**

Local governments establish and implement the Local Government Action Plan, Administration and Projects, in regards to their own administration and projects based on the Plan for Global Warming Countermeasures. They are expected to take the initiative to become the role models of business operators and residents in their regions.

Local government agencies are to establish and use so-called PDCA systems with responsible participation of the bureaus assigned to individual undertakings targeting all administration and projects in principle. They thereby engage in effective and lasting reduction of greenhouse gases.

Upon the establishment of the PDCA system, the local governments pay special attention to the following points while referring to manuals for establishing local government action plans that the national government has prepared.

Additionally, the national government promotes wood use in public buildings, many of which are not currently built with wood based on the Act for Promotion of Use of Wood in Public Buildings.

✓ **Promotion of the Initiatives of Public Organizations besides the National Government and Local Governments**

The national government and local governments provide information concerning effective global warming mitigation measures to public organizations, such as independent administrative institutions. The public organizations thereby promote to establish action plans to reduce greenhouse gas emissions from their administration and projects in accordance with the national government action plan and local government action plans. They promote the initiative in taking action based on their

action plans. The national government regularly grasps the state of their initiatives whenever possible.

Public organizations, such as independent administrative institutions, special corporations, and national university corporations, use environmental friendliness contracts to reduce greenhouse gas emissions.

3.2.3.5 Development of Public Campaigns

✓ **Promotion of Public Campaigns**

The Government provides clear and useful information to the public associating with their generation and lifestyles about the critical conditions of global warming and its effects on the society using reliable domestic and international information based on the latest scientific knowledge presented in the IPCC Assessment Reports, Climate Change Adaptation Plans, and other documents to reform consciousness and instill crisis awareness against the global warming on the public.

Specifically, information is continuously distributed through various media or word-of-mouth about future effects that serious, extended, and irreversible effects will occur to us and to the ecosystem in the future if global warming mitigation initiatives are not strengthened. Such information is expected to improve the understanding toward the problem of climate change and drive people to voluntarily act to mitigate global warming.

Also, relevant government ministries and agencies work as a team and cooperate with the industry, labor circle, local governments, NPOs, and other entities to stimulate the understanding of the public toward the mitigation of global warming, foster a momentum of understanding and cooperation towards the global warming countermeasures and boost consumer behaviors. Through these initiatives, government ministries and agencies promote a public campaign named COOL CHOICE that is intended to encourage the public to choose all possible smart choices to contribute to global warming prevention, such as replacement of products, services and lifestyle which are energy conservative and low-carbon. The public is encouraged to actively and voluntarily change their behavior. These will result in the development of markets for energy efficient and low-carbon products and change their lifestyle towards the ones appropriate for suitable low-carbon social systems and innovations in lifestyles.

Specifically, relevant government ministries and agencies work together and implement the public campaign named “COOL CHOICE” with the support of private organizations associated with energy consumption in various categories such as consumer electronics, housing and building, automobiles, energy services, and transportation and traffic services. Mass media, such as the television, newspaper, and the Internet, are actively used to distribute proper information through various means to strongly affect the awareness of the public. The public is thus steered toward voluntary efforts to mitigate global warming and make active choices.

The Government recruit and train communicators who are close to the public to transmit information about global warming in scenes close to the public to motivate them.

✓ **Promotion of Environmental Education**

Providing knowledge alone is not enough to drive people to take action to solve the problem of global warming. Specialized viewpoints of environmental education become important for learners to gain a scientific understanding of the mechanism of global warming and make them think and come up with specific solutions, including what they and their regions can do.

Environmental education is already being provided in schools and other educational facilities so that the public can deepen their understanding of environmental conservation through all types of opportunities depending on their growth stages from the childhood. In addition to that, Regional Environmental Partnership Offices and other organizations are utilized to more effectively provide environmental education in schools, as well as workplaces, households, and all scenes of regions to

support the training of instructors who teach the problem of global warming and develop educational programs.

Table 3-1 Progress in achievement of the quantified economy-wide emission reduction target: Information on mitigation actions and their effects (CTF Table 3)

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implementation	Brief Description	Start year of implementation	Implementing entity of entities	Estimate of mitigation impact (not cumulative, in kt CO2 eq)	
									2020	2030
Industrial Sector/Commercial and other Sector										
Steady implementation of Industry's action plans towards a low-carbon society and evaluation and verification of progress	Energy	CO2	Steady implementation of Industry's action plans towards a low-carbon society and evaluation and verification of progress	Voluntary Agreement	Implemented	Individual industries set reduction targets and work to reduce the emission of greenhouse gases through the emission reduction measures by the improvement of energy efficiency, development and spread of low-carbon products, and the transfer of technologies for international contributions.	Since 1997 (Depends on a group)	METI	-	-
Industry Sector										
Promotion of introduction of highly energy-efficient equipment and devices (cross industrial)	Energy	CO2	Introduction of highly energy-efficient air conditioners	Budget/Subsidy Financing	Implemented	Promote the introduction and use of energy-efficient facilities and devices across industries. Try to spread the use of these devices by achieving targets for top-runner standards and providing support for their Introduction and use.	2008	METI	480	890
			Introduction of industrial heat pump (Heating and drying)	Budget/Subsidy Financing	Implemented		2008	METI	150	1,350
			Introduction of industrial lighting devices	Budget/Subsidy Financing	Implemented		2008	METI	3,490	4,300
			Introduction of low-carbon industrial furnaces	Budget/Subsidy Financing	Implemented		2008	METI	22,810	30,930
			Introduction of industrial motors	Budget/Subsidy Financing	Implemented		2008	METI	3,760	6,610
			Introduction of highly energy-efficient boilers	Budget/Subsidy Financing	Implemented		2008	METI	2,306	4,679
			Introduction of cogeneration systems	Budget/Subsidy Financing	Implemented		2008	METI	2,940	10,200
Promotion of introduction of highly energy-efficient equipment and devices (Iron and steel industry)	Energy	CO2	Energy efficiency improvements of power demand facilities	Budget/Subsidy Financing Awareness rising	Implemented	Update and replace electricity-consuming facilities in ironworks with more energy-efficient facilities (e.g. replacement of oxygen plants with ones with higher efficiency, changing millmotor to AC systems, reduction of the power of air blowers and fan pumps, introduction of energy efficient lighting devices, and updating motors and transformers to models with higher efficiency).	2008	METI	800	650
			Expanding the chemical recycling of waste plastics at ironworks	Budget/Subsidy Financing Awareness rising	Implemented	Reduce the use of coal by effectively using the waste plastics collected on the basis of the Act on the Promotion of Sorted Collection and Recycling of Containers and Packaging (Act #112, 1995) by decomposing them in coke ovens.	2008	METI	2,120	2,120
			Introduction of next generation coke production technology	Budget/Subsidy Financing Awareness rising	Implemented	Reduce energy consumption from coke production by installing a pretreatment process for coal in coke production processes.	2008	METI	170	1,300
			Improvement of power generation efficiency	Budget/Subsidy Financing Awareness rising	Implemented	Update power generating systems for private power generators and joint thermal power plants to more efficient facilities.	2008	METI	840	1,100
			Enhancement of energy-efficient equipment	Budget/Subsidy Financing Awareness rising	Implemented	Increase systems to use waste heat, such as the top pressure recovery turbine (TRT) and Coke Dry Quenching(CDQ) and strengthen energy-conservation facilities.	2008	METI	990	1,220
			Introduction of innovative steel processing (ferrocoke)	Budget/Subsidy Financing Awareness rising	Implemented	Introduce innovative iron-making processes with using innovative coke alternative (ferrocoke) .	2013	METI	-	820
			Introduction of environmentally friendly steel processing	Budget/Subsidy Financing Awareness rising	Implemented	Introduce innovative iron-making processes with technologies to reduce CO2 emissions from blast furnace and CO2 capture.	2008	METI	-	110

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implementation	Brief Description	Start year of implementation	Implementing entity of entities	Estimate of mitigation impact (not cumulative, in kt CO2 eq)	
									2020	2030
Industrial Sector/Commercial and other Sector										
Promotion of introduction of highly energy-efficient equipment and devices (Chemical industry)	Energy,Waste Management / Waste	CO2	Introduction of energy-efficient processing technology for petrochemical industry	Budget/Subsidy Financing	Implemented		2009	METI	192	192
			Introduction of energy-efficient processing technology for other chemical products	Budget/Subsidy Financing	Implemented	Promote the use of Best Practice Technologies (BPT) that the International Energy Agency (IEA) organizes as the advanced technology used in commercial scale in the field of petrochemical and caustic soda.	2013	METI	851	1,612
			Introduction of energy-efficient distillation processing technology by membrane	Budget/Subsidy Financing	Implemented		2009	METI	5.7	335
			Introduction of CO2 using technology for material	Budget/Subsidy Financing	Implemented	Reduce energy use and improve energy efficiency through exhaust energy recovery and rationalization of processes.	2013	METI	-	800
			Introduction of chemical manufacturing technology by inedible plant-derived raw material	Budget/Subsidy Financing	Implemented	Promote the development and introduction of new and innovative energy conservation technologies. Establish energy-efficient material production technology with high production efficiency using botanical functions to reduce CO2 emissions from material production processes. Develop technologies to directly use recycled plastic flakes to reduce the thermal processes for producing pellet materials.	2013	METI	-	136
			Introduction of waste water treatment technology with electric power generation by microbial catalyst	Budget/Subsidy Financing	Implemented		2013	METI	-	55
			Introduction of enclosed plant factory	Budget/Subsidy Financing	Implemented		2011	METI	-	215
			Utilization of recycled plastic flakes	Budget/Subsidy Financing	Implemented		2014	METI	11	59
Promotion of introduction of highly energy-efficient equipment and devices (Ceramic, stone and clay manufacturing industry)	Energy	CO2	Existing energy-efficient technology	Budget/Subsidy Financing	Implemented	Improve the energy efficiency of the cement production processes by promoting the introduction and use of facilities to effectively use thermal energy and electricity.	2008	METI	26	57
			Waste utilization technology as alternate of heat energy	Budget/Subsidy Financing	Implemented	Promote the use of waste as an alternative to thermal energy to improve the energy efficiency of the cement production process.	2008	METI	-	35
			Relevant technology of low-temperature calcination in cement production process	Budget/Subsidy Financing	Implemented	Improve the energy efficiency of cement production processes through the practical application of the cutting-edge technologies while maintaining the same level of quality as conventional products.	2010	METI	16	408
			Glass fusing processing technology	Budget/Subsidy Financing	Implemented	Improve the energy efficiency of glass production processes through the practical application of the cutting-edge technologies while maintaining the same level of quality as conventional products.	2008	METI	26	134
Promotion of introduction of highly energy-efficient equipment and devices (Pulp, paper, and paper products industry)	Energy	CO2	Introduction of highly energy-efficient used paper pulping manufacturing technology	Budget/Subsidy Financing	Implemented	The installation of pulpers that allow more efficient pulping of recovered paper than existing ones in deinked pulp manufacturing process will be supported in order to reduce the consumption.	2008	METI	100	100
			Introduction of black liquor recovery boilers that operate with higher temperatures and higher pressures	Budget/Subsidy Financing	Implemented	At the renewal timing of recovery boilers used to generate steam by incinerating concentrated black liquor (pulp waste liquor), the installation of the ones with more elevated features in temperature ,pressure and energy efficiency will be supported.	2008	METI	110	160
Promotion of introduction of highly energy-efficient equipment and devices(Construction and construction and fields that use special motor vehicles)	Energy	CO2	Promotion of introduction of highly energy-efficient equipment and devices(Construction sector)	Budget/Subsidy Financing Other	Implemented	Certify fuel-efficient construction machinery to make it easier for contractors to select energy efficient construction machinery for construction projects. Also support the Introduction and use of such machinery.	2010	METI	130	440

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implementation	Brief Description	Start year of implementation	Implementing entity of entities	Estimate of mitigation impact (not cumulative, in kt CO2 eq)	
									2020	2030
Industrial Sector/Commercial and other Sector										
Promotion of introduction of highly energy-efficient equipment and devices(Greenhouse horticulture, agricultural machinery, and fishery sector)	Energy	CO2	Introduction of energy-efficient equipment and devices in greenhouse horticulture	Budget/Subsidy Awareness Raising	Implemented	Install and use energy efficient heating facilities for greenhouse horticulture to reduce the consumption of fuel oil and CO2 emissions from the combustion of fuel oil (mainly A heavy oil) in heating facilities.	2007	MAFF	590	1,240
			Introduction of energy-efficient agricultural machinery	Budget/Subsidy Awareness Raising	Implemented	Reduce the consumption of fuel oil in agricultural machinery.	2007	MAFF	0.5	1.3
			Switch to energy-efficient fishing vessels	Budget/Subsidy Awareness Raising Technology Development	Implemented	Switch to energy efficient fishing vessels.	2007	MAFF	67	162
Implementation of thorough energy management using FEMS	Energy	CO2	Implementation of thorough energy management using FEMS	Budget/Subsidy Awareness Raising	Implemented	Start using factory energy management system (FEMS) and reduce energy consumption through energy management based on the FEMS.	2013	METI	1,230	2,300
Promotion of energy conservation initiatives through alliance between industry groups	Energy	CO2	Promotion of energy conservation initiatives through alliance between different industry groups	Budget/Subsidy Awareness Raising	Implemented	Promote energy conservation activities through the cooperation among multiple businesses.	2013	METI	210	370
Commercial and Other Sector										
Improvement of the energy efficiency of buildings	Energy	CO2	Promotion of mandatory compliance with energy conservation standards targeting new construction	Law/Standard Budget/Subsidy Other	Implemented	Increase the ratio of building stocks that satisfy the energy conservation standards to reduce CO2 emissions from the energy consumed in the buildings. Require buildings to comply with energy conservation standards based on the Act on the Improvement of Energy Consumption Performance of Buildings (issued on July 8, 2015). Also accelerate the construction of energy efficient buildings by mandating the notification of energy efficiency of buildings.	2003 (When the reporting period of energy-saving performance started, based on the Energy Saving Law)	MLIT	-	10,350
			Improvement of energy efficiency of existing buildings (renovation)	Law/Standard Budget/Subsidy Other	Implemented	Increase the ratio of building stocks that satisfy the energy conservation standards to reduce CO2 emissions from the energy consumed in buildings. Provide tax incentives and financial support promoting investment in energy conservation to accelerate the energy conservation renovation in already constructed buildings.	2003 (When the reporting period of energy-saving performance started, based on the Energy Saving Law)	MLIT	-	1,220
Diffusion of highly energy-efficient equipment and devices (Commercial and Other Sector)	Energy	CO2	Introduction of highly energy-efficient water heating systems	Budget/Subsidy Financing	Implemented	Reduce energy consumption by increasing the use of energy efficient water heaters.	2008	METI	640	1,550
			Introduction of highly energy-efficient lighting devices	Budget/Subsidy Financing	Implemented	Reduce energy consumption by increasing the use of energy efficient lighting devices such as LED lamps.	2008	METI	8,030	9,910
			Introduction of coolant management technologies	Law/Standard	Implemented	Increase energy efficiency by implementing refrigerant leak prevention measures through the spread of proper management technologies.	2014	METI	416	24

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implementation	Brief Description	Start year of implementation	Implementing entity of entities	Estimate of mitigation impact (not cumulative, in kt CO2 eq)	
									2020	2030
Commercial and Other Sector										
Improvement of energy efficiency of equipment and devices through Top Runner Programs (Commercial and Other Sector)	Energy	CO2	Improvement of energy efficiency of equipment and devices through top runner programs (Commercial and Other Sector)	Law/Standard Budget/Subsidy	Implemented	Reduce energy consumption of devices used in industries by increasing the energy efficiency of top-running devices.	1998	METI	5,640	17,060
Thorough energy management through the use of BEMS and consultation on energy conservation	Energy	CO2	Thorough energy management through the use of BEMS and consultation on energy conservation	Taxation Budget/Subsidy Other	Implemented	Reduce energy consumption through the introduction of BEMS and detailed identification of energy consumption in industrial facilities (such as buildings) using energy conservation diagnosis, as well as the control of devices based on the diagnosis.	1998 (Energy Use Rationalization Business support Program) 2012 (Subsidy to promote innovative energy conservation technology implementation in housing and buildings)	METI	4,450	10,050
Expansion of holistic and efficient use of energy	Energy	CO2	Expansion of holistic and efficient use of energy	Budget/Subsidy Awareness Raising	Implemented	Support the construction of systems for spatial use of energy.	2008	METI	73	164
Development of low-carbon cities through the improvement of thermal environment by Preventing Heat Island Effects	Other	CO2	Development of low-carbon cities through the improvement of thermal environment by preventing heat island effects	Other	Implemented	Promote low-carbon cities through the improvement of the thermal environment by mitigating the urban heat island such as through roof-top greening.	2008	MLIT	4.4 ～ 20.2	4.1 ～ 19.1
Introduction of renewable energy and energy-saving in water supply and sewage system	Energy	CO2	Promotion of energy saving and energy creation measures in sewage system	Budget/Subsidy	Implemented	Reduce CO2 emissions by promoting energy saving in sewage treatment plants. Also reduce CO2 emissions by generating power using biogas from sewage sludge and submitting fossil fuel to solid fuel made from sewage sludge.	2016	MLIT	900	1,340
			Promotion of energy saving and renewable energy measures in water service business	Budget/Subsidy	Implemented	Reduce CO2 emissions from the use of electricity as water service companies all around Japan and water suppliers implement energy conservation activities and start using renewable energies.	2016	MHLW	284	336

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implementation	Brief Description	Start year of implementation	Implementing entity of entities	Estimate of mitigation impact (not cumulative, in kt CO2 eq)	
									2020	2030
Commercial and Other Sector										
Initiatives in waste management	Waste Management /Waste, Energy	CO2	Promotion of sorting, collection and recycling of waste plastic containers and packaging	Law/standard/Budget/ Subsidy/Awareness raising/	Implemented	Promote sorted collection and recycling (recycling of materials and chemical recycling) of plastic containers and packaging materials based on the Act on the Promotion of Sorted Collection and Recycling of Containers and Packaging.	2000	MOE	25	62
			Introduction of waste power generation at municipal solid waste incineration facilities	Budget/Subsidy Other	Implemented	Reduce CO2 emissions from energy uses associated with electricity consumption by installing the proper sizes of high-efficient power generation facilities when constructing new waste incineration facilities or updating or renovating currently operating facilities.	2016(National Plan for Adaptation to the Impacts of Climate Change)	MOE	860 ～ 1,360	1,350 ～ 2,140
			Introduction of waste power generation at industrial waste incineration facilities	Budget/Subsidy	Implemented	Reduce CO2 emissions from energy uses associated with electricity consumption by installing proper sizes of high-efficient power generation facilities when constructing new waste incineration facilities or updating or renovating currently operating facilities.	2003	MOE	25	28
			Promotion of producing fuels from waste and energy-efficiency measures in waste disposal business	Budget/Subsidy	Implemented	Produce fuels from waste, such as waste plastics and paper scraps, and use the fuel as the alternative to fossil fuel in manufacturing industries to reduce CO2 emissions from energy associated with the combustion of fuel. Promote energy conservation measures, such as the Introduction of fuel efficient waste collection and transportation vehicles and treatment facilities and energy conservation activities to reduce CO2 emissions from energy associated with fuel uses.	2016	MOE	77	230
Actions led by local governments and promotions by the national government	Cross-Cutting	CO2,CH4,N2O,HFCs,PFCs,SF6,NF3	Actions led by local governments and promotions by the national government	Law/Standard	Implemented	Reduce greenhouse gas emissions by establishing local municipality action plans (office work version) based on the Global Warming Mitigation Plan and promote the implementation of activities based on the action plans.	2001	MOE	-	-
Initiatives of the national government	Cross-Cutting	CO2,CH4,N2O,HFCs,PFCs,SF6,NF3	Initiatives of the national government	Law/Standard	Implemented	Implement and inspect the National Government Action Plan. Implement and inspect implementation plans at relevant government agencies.	2001	MOE	115	461

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implementation	Brief Description	Start year of implementation	Implementing entity of entities	Estimate of mitigation impact (not cumulative, in kt CO2 eq)	
									2020	2030
Residential Sector										
Improvement of energy efficiency of equipment and devices through top runner programs(Residential Sector)	Energy	CO2	Improvement of energy efficiency of equipment and devices through top runner programs(Residential Sector)	Law/Standard Budget/Subsidy	Implemented	Reduce energy consumption from devices at household sector by improving the energy efficiency of top-running devices.	1998	METI	3,000	4,830
Improvement of energy efficiency of housing	Energy	CO2	Promotion of compliance with energy conservation standards targeting new housing	Law/Standard Taxation Budget/Subsidy Financing Technology Development Awareness Raising Other	Implemented	Reduce CO2 emissions from energy consumed in households by increasing the ratio of household devices that satisfy energy conservation standards. Promote the supply of energy efficient houses by mandating the notification of energy efficiency of houses based on the Act on the Improvement of Energy Consumption Performance of Buildings (issued on July 8, 2015).	2003 (When the reporting period of energy-saving performance started, based on the Energy Saving Law)	MLIT	-	8,720
			Promotion of renovation of thermal insulation for existing housing	Law/Standard Taxation Budget/Subsidy Financing Technology Development Awareness Raising Other	Implemented	Reduce CO2 emissions from energy consumed in households by increasing the ratio of houses that satisfy energy conservation standards. Support the promotion of energy conservation renovation of already constructed houses through tax incentives, subsidies, and loans.	2003 (When the reporting period of energy-saving performance started, based on the Energy Saving Law)	MLIT	-	1,190
Diffusion of highly energy-efficient equipment and devices (Residential Sector)	Energy	CO2	Introduction of highly energy-efficient water heating systems	Budget/Subsidy Awareness Raising	Implemented	Reduce energy consumption through the Introduction of high-efficient water heaters.	2013	METI	2,260	6,170
			Introduction of highly energy-efficient lighting devices	Budget/Subsidy Awareness Raising	Implemented	Reduce energy consumption through the Introduction of high-efficient lighting devices such as LED lamps.	2013	METI	7,110	9,070
			Energy efficiency improvement of septic tanks	Budget/Subsidy Awareness Raising	Implemented	Reduce CO2 emissions from electricity uses by reducing the electricity consumption of blowers through the Introduction of septic tanks with 10% lower electricity consumption compared to the current low-carbon septic tanks when installing a new purification tank or when updating a current one.	2013	MOE	19	39
Implementation of thorough energy management using HEMS and smart meters in the residential sector	Energy	CO2	Implementation of thorough energy management using HEMS and smart meters in the residential sector	Budget	Implemented	Identify detailed household energy consumption using HEMS or smart meters and reduce electricity consumption through the control of devices based on identified data.	2010	METI	2,020	7,100

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implementation	Brief Description	Start year of implementation	Implementing entity of entities	Estimate of mitigation impact (not cumulative, in kt CO2 eq)	
									2020	2030
Transport Sector										
Diffusion of next-generation vehicles and improvement of fuel efficiency	Transport	CO2	Diffusion of next-generation vehicles and improvement of fuel efficiency	Law/Standard Taxation Budget/Subsidy Technology Development	Implemented	Reduce CO2 emissions by reducing energy consumption through the diffusion of next-generation automobiles and improved fuel efficiency.	1979 (When the Fuel Efficiency Standards were determined based on the Energy Saving Law)	METI	7,025	23,790
Measures to traffic flow improvements	Transport	CO2	Promotion of the measures to traffic flow improvements	Budget/Subsidy Awareness Raising	Implemented	Build the network of arterial roads, including ring roads, to increase driving speed and implement measures to promote the smart use of roads by promoting the use of ETC2.0.	2012 (Priority Plan for Social Infrastructure Development)	MLIT	-	1,000
			Promotion of the use of Intelligent Transport Systems (the promotion of centrally controlled signals)	Budget/Subsidy Awareness Raising	Implemented	Realize not congested traffic flows with centralized control of traffic lights to improve fuel efficiency and reduce CO2 emissions from automobiles.	2012 (Priority Plan for Social Infrastructure Development)	NPA	1,400	1,500
			Development of traffic safety facilities (Improvement of traffic lights)	Budget/Subsidy Awareness Raising	Implemented	Realize not congested traffic flows by improving of traffic lights to improve fuel efficiency and reduce CO2 emissions from automobiles.	2012 (Priority Plan for Social Infrastructure Development)	NPA	520	560
			Development of traffic safety facilities (Promotion of the use of LED traffic lights)	Budget/Subsidy Awareness Raising	Implemented	Switch from light bulbs to LED lights in traffic lights to reduce energy consumption and CO2 emissions.	2012 (Priority Plan for Social Infrastructure Development)	NPA	155	160
			Promotion of automated driving	Budget/Subsidy Awareness Raising	Implemented	Improve energy efficiency in the transport sector using automatic driving technologies such as ACC/CACC technologies.	2012 (Priority Plan for Social Infrastructure Development)	METI	270	1,400
Greening of vehicle transport operators by promoting the environmentally friendly usage of Vehicles	Transport	CO2	Greening of vehicle transport operators by promoting the environmentally friendly usage of Vehicles	Budget/Subsidy Awareness Raising	Implemented	Reduce CO2 emissions by promoting the use of environmentally friendly automobiles.	2012 (Priority Plan for Social Infrastructure Development)	MLIT	300	660
Promotion of public transport utilization and bicycles	Transport	CO2	Promotion of public transport utilization	Taxation Budget/Subsidy Awareness Raising	Implemented	Reduce CO2 emissions from the use of private cars by providing subsidies and tax incentives for the construction of new rail roads, promotion for the use of current train services (e.g. improved convenience of railroad stations), promotion for the use of buses (e.g. the introduction of BRT and bus location system), promotion of the spread of eco-commute, as well as by reconstructing regional public transportation networks and improving the convenience for users.	1992	MLIT	980	1,780

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implementation	Brief Description	Start year of implementation	Implementing entity of entities	Estimate of mitigation impact (not cumulative, in kt CO2 eq)	
									2020	2030
Transport Sector										
Energy efficiency improvement in Railways	Transport	CO2	Improvement of energy efficiency of railways	Taxation Budget/Subsidy Financing Technology Development	Implemented	Promote the use of energy-efficient vehicles, such as vehicles with VVVF systems, vehicles with storage batteries, and hybrid vehicles. Also promote the introduction and use of energy conservation systems in railroad facilities.	2005	MLIT	768	1,776
Energy efficiency improvement in Vessels	Transport	CO2	Promotion of the use of vessels that reduce energy consumption	Taxation Budget/Subsidy Financing Technology Development	Implemented	Reduce CO2 emissions associated with fuel combustion in vessels by promoting the use of energy efficient vessels.	2005	MLIT	640	1,570
Low carbonization in Aviation	Transport	CO2	Promotion of low carbonization in Aviation	Taxation Budget/Subsidy Financing Technology Development	Implemented	Promote of low carbonization in social infrastructures of the airline industry by promoting the introduction and use of new devices with better energy efficiency, advancement of airline traffic systems, energy conservation and CO2 reduction measures at airports, and increasing the use of alternative jet fuels.	2005	MLIT	395	1,012
Promotion to improve truck transport efficiency and cooperative transport and delivery	Transport	CO2	Improvement of the efficiency of truck transportation	Taxation Budget/Subsidy Financing Awareness Raising	Implemented	Reduce CO2 emissions by improving the efficiency of truck transportation.	2001	MLIT	2,020	2,060
			Promotion of cooperative transport and delivery	Budget/Subsidy Awareness Raising	Implemented	Reduce CO2 emissions and labor shortages by promoting cooperative transport and delivery through the cooperation among owners and distributors involved with the truck transport that accounts for the majority of land transport to improve transport efficiency and load efficiency.	2001	MLIT	-	21
General measures for the greening of marine transportation and promotion of modal shifts to rail freight transport	Transport	CO2	General measures for the greening of marine transportation	Taxation Budget/Subsidy Awareness Raising	Implemented	Modal shift to costal shipping will be promoted through support for business based on Act on Advancement of Integration and Streamlining of Distribution Business, as well as by introduction of facilities which supports shipping and promotion of “Eco-Ship Mark”.	2001	MLIT	788	1,724
			Promotion of modal shifts to railfreight transport	Taxation Budget/Subsidy Awareness Raising	Implemented	Modal shift to costal shipping will be promoted through support for business based on Act on Advancement of Integration and Streamlining of Distribution Business, as well as by introduction of facilities which supports rail freight and promotion of “Eco-Rail Mark”.	2001	MLIT	589	1,334

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implementation	Brief Description	Start year of implementation	Implementing entity of entities	Estimate of mitigation impact (not cumulative, in kt CO2 eq)	
									2020	2030
Transport Sector										
Initiatives at Harbors	Transport	CO2	Reduction in the total distance of land transport through the optimum ports selection	Budget/Subsidy	Implemented	The construction and improvement of ports where vessels can touch at would enable coastal transport to the nearest ports, which can reduce the driving distance of truck transport.	2016	MLIT	960	960
			Promotion of introduction of energy-efficient cargo handling machinery	Budget/Subsidy	Implemented	Promote the introduction and use of energy efficient cargo handling machinery.	2016	MLIT,MOE	7.3	7.3
			Promotion of modal shifts and the improvement of transportation efficiency in the reverse logistics	Other	Implemented	Promote modal shift and the improvement of transport efficiency related to the reverse logistics.	2016	MLIT,MOE	15.2	15.2
Schematic promotion of joint measures implemented by multiple Government Ministries and Agencies (Transport Sector)	Transport	CO2	Use of Special Zone System for Structural Reform regarding global warming mitigation measures	Law/Standard	Implemented	Reduce CO2 emissions by decreasing the number of vehicles transporting steel products to public wharfs under special measures on regulations (port and harbor distribution streamlining project using special large transportation vehicles). Also reduce CO2 emissions using special measures on regulations for special project using pipelines for the transport of industrial wastes requiring special management.	2016	CAO	53	53
Energy Conversion Sector										
Maximum introduction of renewable energy	Energy	CO2	Expanded use of electricity generated by renewable energy	Law Budget/Subsidy Taxation Technology Development	Implemented	Reduce CO2 emissions from the combustion of fossil fuels by increasing the use of renewable energies as the source of energy for power generation and heat uses to replace fossil fuels.	n/a	METI	-	156,160 ～ 165,990
			Expanded use of heat generated by renewable energy	Law Budget/Subsidy Taxation Technology Development	Implemented		n/a	METI	-	36,180
Reduction of CO2 emission intensity in the Power Sectors	Energy	CO2	Persuasion of High Efficiency in Thermal Power Generation	Law/Standard Budget/Subsidy Technology Development	Implemented	The voluntary framework of the electricity industry (aiming to achieve the emission coefficient of about 0.37 kg-CO2/kWh, which is consistent with the energy mix and CO2 reduction targets of the national government) was announced in July 2015 with the participation of main electricity companies. The Electric Power Council for a Low Carbon Society was then established in February 2016. The Council established reduction targets of individual companies and announced systems and rules for the entire industry to implement PDCA. The effectiveness of the activities of the entire electricity industry is going to be ensured under the deregulation of electricity systems by establishing policies under the Act on the Rational Use of Energy and the Act on the Advancement of Energy Supply Structures to promote activities to achieve targets set in the voluntary framework.	n/a	METI	7,000	11,000
			Improvement of the efficiency of thermal power generation, use of nuclear power generations whose safety is approved and full use of renewable energy	Law/Standard Budget/Subsidy Technology Development	Implemented		n/a	METI	-	188,000
Promotion of introduction of highly energy-efficient equipment and devices (Oil Product Manufacturing sector)	Energy	CO2	Promotion of introduction of highly energy-efficient equipment and devices (Oil Product Manufacturing sector)	Awareness Raising	Implemented	Japan promotes oil refiners to reduce one million kiloliters of energy in crude oil equivalent from business as usual (BAU) in the oil product manufacturing field, based on the Industry's Action Plan toward a Low Carbon Society through the following initiatives: (i) effective use of heat, (ii) introduction of advanced control and high efficient devices, (iii) improvement of the motors system operation, and (iv) major improvement and advancement of processes.	2013	METI	810	2,080

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implementation	Brief Description	Start year of implementation	Implementing entity of entities	Estimate of mitigation impact (not cumulative, in kt CO2 eq)	
									2020	2030
Non-energy related CO_2										
Increasing the use of blended cements	Industry/Industrial Processes	CO2	Increasing the use of blended cements	Law/Standard Awareness Raising	Implemented	Reduce CO2 emitted from decarbonation of limestone in the clinker production process by increasing the use of blended cements. It leads to decrease the production of clinker, the intermediate product of cement.	Year 2001 (Based on Act on Green Purchasing, blended cements is are designated as the eco-friendly goods.)	METI,MLIT,MOE	44	388
Diffusion of biomass plastics	Waste Management / Waste	CO2	Diffusion of biomass plastics	Other	Implemented	Reduce non-energy oriented CO2 emissions from the combustion of plastics that are nonindustrial and industrial waste by increasing the use of biomass plastic, a carbon-neutral product, to replace the plastic made from petroleum used in products.	2016	MOE	720	2,090
Reduction of the amount of waste incineration	Waste Management / Waste	CO2	Reduction of the amount of waste incineration.	Law/Standard Awareness Raising Other	Implemented	Reduce the amount of incineration and non-energy oriented CO2 emissions from the combustion of plastics by reducing the emission of plastics of municipal solid waste and by promoting the recycled uses through the sorted collection and recycling of plastic containers and wrapping products based on the Act on the Promotion of Sorted Collection and Recycling of Containers and Packaging. Also reduce non-energy oriented CO2 emissions from the incineration of industrial plastic waste by decreasing its amount through the promotion of 3R activities.	2016(National Plan for Adaptation to the Impacts of Climate Change)	MOE	320	440
Methane										
Measures to reduce greenhouse gas emissions from agricultural soil	Agriculture	CH4	Reduction of methane emissions associated with rice cultivation	Law/Standard Budget/Subsidy	Implemented	Reduce methane emission from paddy fields by promoting soil preparation based on the conversion from the plowing-in of rice straw of which the methane emission factor is relatively large to the application of compost of which the emission factor is lower.	2007	MAFF	330～920	640～2430
Reduction of the amount of wastes in final disposal	Waste Management / Waste	CH4	Reduction of the amount of wastes in final disposal	Law/Standard Other	Implemented	Reduce the direct landfilling of organic municipal solid waste by banning the direct landfilling of such waste. Reduce methane emissions associated with the biological decomposition of organic municipal solid waste in landfill sites. Continuously reduce the final disposal of industrial wastes through the promotion of 3R activities.	2016(National Plan for Adaptation to the Impacts of Climate Change)	MOE	180	520
Adoption of semi-aerobic landfill structure in final waste disposal sites	Waste Management / Waste	CH4	Adoption of semi-aerobic landfill structure in final waste disposal sites	Law/Standard Other	Implemented	Reduce methane emissions associated with the biological decomposition of organic waste to realize lower emissions from anaerobic landfill structure by selecting semi-aerobic landfill structure for the new construction of landfill sites and managing the ends of wastewater pipes in open systems.	2016(National Plan for Adaptation to the Impacts of Climate Change)	MOE	10	30

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implementation	Brief Description	Start year of implementation	Implementing entity of entities	Estimate of mitigation impact (not cumulative, in kt CO2 eq)	
									2020	2030
Nitrous Oxide (N_2O)										
Measures to reduce greenhouse gas emissions from agricultural soil	Agriculture	N2O	Emissions reduction of nitrous oxide associated with the application of inorganic fertilizers	Law/Standard Budget/Subsidy	Implemented	Reduce N2O emissions from the application of inorganic fertilizers by reducing the use of fertilizers, practicing divided fertilization, and using slow-acting fertilizers.	2007	MAFF	70	100
Advancement of combustion in sewage sludge incineration facilities	Waste Management / Waste	N2O	Advancement of combustion in sewage sludge incineration facilities	Taxation Budget/Subsidy Technology Development	Implemented	Reduce N2O emissions from the incineration of sludge generated from wastewater treatment by advancement of incineration systems.	2001 (the level of sophistication of combusting sewage sludge at sewage treatment facilitie was standardized)	MLIT	500	780
Fluorinated Gases (HFCs, PFCs, SF_6, and NF_3)										
Measures to fluorinated gases	Other	HFCs,PFCs,SF6,NF3	Promote eliminating fluorocarbons and lowering GWP in gases and products manufacture	Law/Standard Budget/Subsidy Technology Development Awareness Raising	Implemented	Promote eliminating fluorocarbons and lowering GWP by following up on target achievement status for designated products and supporting the use of energy efficient devices with natural refrigerant.	2015 (Act on Rational Use and Proper Management of Fluorocarbons came into force)	MOE,METI	3,500	11,200
			Preventing leakage of fluorocarbons from use of refrigeration and air conditioning equipment for business use	Law/Standard	Implemented	Reduce leaks of fluorocarbons while using products through the effective use of fluorocarbons leakage report system and public announcement system, the support for prefectures to instruct and supervise relevant activities and to implement awareness-raising activities.	2015 (Act on Rational Use and Proper Management of Fluorocarbons came into force)	MOE,METI	6,500	20,100
			Promotion of recovery of fluorocarbons from refrigeration and air conditioning equipment for business use in disposal	Law/Standard Budget/Subsidy Awareness Raising	Implemented	Achieve a high recover rate by supporting prefectures to give instructions, supervise, and raise awareness for relevant activities.	2001 (Fluorocarbons Recovery and Destruction Law was adopted)	MOE,METI	7,900	15,700
			Promotion of voluntary initiatives in industries	Voluntary Agreement	Implemented	Reduce the emissions of HFCs and other three gases from various fields by following up on the progress of autonomous action plans.	1998	MOE,METI	550	1,220

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implementation	Brief Description	Start year of implementation	Implementing entity of entities	Estimate of mitigation impact (not cumulative, in kt CO2 eq)	
									2020	2030
Carbon Sink										
Forest Sink Strategies	LULUCF	CO2	Forest Sink Strategies	Law/Standard Budget/Subsidy Technology Development Awareness Raising	Implemented	Maintain the CO2 removals in forests by promoting the maintenance of healthy forests through proper forest thinning and forest building, properly managing and protecting conservation forests, implementing activities to train people to engage in efficient and stable forestry business, encouraging forest development with the participation of citizens, and promoting measures to conserve forest absorption sources by controlling the use of lumbers and wooden biomass, using various methods based on the Forest and Forestry Basic Plan.	2007	MAFF	approx. 38,000	approx. 27,800
Measures for Sinks in Agricultural Soils	LULUCF	CO2	Measures for Sinks in Agricultural Soils	Law/Standard Budget/Subsidy Technology Development Awareness Raising	Implemented	Promote carbon storage in cropland and grassland soils by promoting soil development using organic matter such as compost and green manure.	2008	MAFF	7,080 ～ 8,280	6,960 ～ 8,900
Promotion of Urban Greening	LULUCF	CO2	Promotion of Urban Greening	Law/Standard Budget/Subsidy Technology Development Awareness Raising	Implemented	Build parks in cities and increase green areas around roads, harbors, etc.	2006	MLIT	1,190	1,240

Name of mitigation action	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implementation	Brief Description	Start year of implementation	Implementing entity of entities	Estimate of mitigation impact (not cumulative, in kt CO2 eq)	
									2020	2030
Cross-sectional Strategies										
Promotion of J-Credit Scheme	Cross-Cutting	CO2,CH4,N2O,HFCs,PFCs,SF6,NF3	Promotion of J-Credit Scheme	Budget/Subsidy	Implemented	Certify credits for the reduction of greenhouse gas emissions and the removals of greenhouse gas which are achieved by reduction measures, such as the use of energy efficient facilities and the use of renewable energies, and removal measures implementing proper forest management. Also promote the use of the credit to achieve the Industry's Action Plan toward a Low Carbon Society and carbon offset.	2013	MOE,METI,MAFF	3,210	6,510
Development of public campaigns	Energy	CO2	Promotion of thorough implementation of Cool Biz (Commercial Sector)	Budget/Subsidy Awareness Raising	Implemented		2005	MOE	73	145
			Promotion of thorough implementation of Cool Biz (Residential Sector)	Budget/Subsidy Awareness Raising	Implemented		2005	MOE	77	150
			Promotion of thorough implementation of Warm Biz(Commercial Sector)	Budget/Subsidy Awareness Raising	Implemented	Among the energy conservation measures implemented to achieve the INDC of Japan, CO2 emissions reduction measures in the public and consumer sector are extremely important as the emission is increasing in this sector. The CO2 emissions need to be reduced by about 40% in the household and commercial sector and about 30% in the transport sector. In order to achieve these goals, the public needs to improve their understanding on the critical conditions of global climate change and its negative effects on the society. In addition, energy-efficient attires, shift to energy efficient devices, Home CO2 advisor service, and efficient use of lighting devices are also promoted. The practice of eco-driving and car sharing is also encouraged to reduce environmental load.	2005	MOE	77	116
			Promotion of thorough implementation of Warm Biz(Residential Sector)	Budget/Subsidy Awareness Raising	Implemented		2005	MOE	158	291
			Promotion of equipment replacement (electric dehumidifier(compression type) and full automatic washing with drying machine)	Budget/Subsidy Awareness Raising	Implemented		2005	MOE	110	112
			Home CO2 advisor service	Budget/Subsidy Awareness Raising	Implemented		2005	MOE	11	137
			Efficient use of lighting devices	Budget/Subsidy Awareness Raising	Implemented		2005	MOE	1,150	1,680
			Eco driving (private cars、private freight car)	Budget/Subsidy Awareness Raising	Implemented		2005	MOE	1,930	2,440
			Car sharing	Budget/Subsidy Awareness Raising	Implemented		2005	MOE	430	550
Promotion of measures based on Local Government Action Plan for Regional Measures	Energy,Transport,Industry/Industrial Processes,Agriculture,LULUCF,Waste Management/Waste,Other	CO2,CH4,N2O,HFCs,PFCs,SF6,NF3	Promotion of measures based on Local Government Action Plan for Regional Measures	Law/Standard Budget/Subsidy Awareness Raising	Implemented	Promote the establishment of regional municipality action plans (regional measures edition) to accelerate measures to mitigate climate change at regional levels and reduce the emission of greenhouse gases.	2008	MOE	-	-

Table 3-2 Target indicator and target level of each industry in Industry's Action Plans towards a Low-carbon Society

Type of industry	2020			2030		
	Target indicator	Base year/BAU	Target level of 2020	Target indicator	Base year/BAU	Target level of 2030
Industry Sector						
Industry under Ministry of Finance						
Brewers Association of Japan	CO2 emissions	BAU	-54kt-CO2(Comparison to BAU)	CO2 emissions	BAU	-102kt-CO2(Comparison to BAU)
Japan Tobacco Inc.	GHG emissions	2009	- 20%	-	-	-
Indeustry under Ministry of Health, Labour and Welfare						
The Federation of Pharmaceutical Manufacturers' Associations of Japan	CO2 emissions	2005	-23%	CO2 emission intensity (amount of sales/CO2 emissions)	2005	3 times
				CO2 emissions		-40%
Industry under Ministry of Fisheries, Forestry and Agriculture						
Japan Soft Drink Association	CO2 emission intensity	1990	-10%	CO2 emission intensity	2012	-18%
Japan Starch & Sweeteners Industry Association	CO2 emission intensity	2005	-3%	CO2 emission intensity	2005	-5%
Japan Dairy Industry Association	energy consumption intensity	2012	-1%(Annual rate)	energy consumption intensity	2012	-1%(Annual rate)
Japan Baking Industry Association	CO2 emission intensity	2009	-1%(Annual rate)	-	-	-
Japan Canners Association	energy consumption intensity	2009	-1%(Annual average)	-	-	-
All Nippon Kashi Association	CO2 emissions	2013	-7%	CO2 emissions	2013	-17%
Japan Beet Sugar Association	energy consumption intensity	2010	-15%	energy consumption intensity	2010	-15%
Japan Oilseed Processors Association	CO2 emission intensity	1990	-16%	CO2 emission intensity	1990	-16%
	CO2 emissions	1990	-8%	CO2 emissions	1990	-8%
Japan Frozen Food Association	energy consumption intensity	2013	-6.8%	energy consumption intensity	2013	-15.7%
Japan Sugar Refiners' Association	CO2 emissions	1990	-33%	CO2 emissions	1990	-33%
Flour Millers Association	CO2 emission intensity	1990	-16.5%	-	-	-
Japan Ham & Sausage Processors Cooperative Association	energy consumption intensity	2011	-5%	energy consumption intensity	2011	-1%(Annual average)
All Japan Coffee Association	CO2 emission intensity	2005	-15%	CO2 emission intensity	2005	-25%
Japan Convenience Foods Industry Association	CO2 emission intensity	1990	-30%	CO2 emission intensity	1990	-21%
Japan Soy-sauce Association	CO2 emissions	1990	-18%	CO2 emissions	1990	-23%
Nihon Hamburg & Hamburger Association	energy consumption intensity	2011	-5%	energy consumption intensity	2011	-1%(Annual average)
Japan Rice Millers Association	energy consumption intensity	2005	-10%	energy consumption intensity	2005	-12%
Japan Association of Mayonnaise & Dressings	CO2 emissions	2012	-8.7%	CO2 emissions	2012	-21.1%
	CO2 emission intensity		-4.8%	CO2 emission intensity		-17.9%

Type of industry	2020			2030		
	Target indicator	Base year/BAU	Target level of 2020	Target indicator	Base year/BAU	Target level of 2030
Industry Sector						
Industry under Ministry of Economy, Trade and Industry						
The Japan Iron and Steel Federation	CO2 emissions	BAU	-5000kt-CO2(Comparison to BAU)	CO2 emissions	BAU	-9000kt-CO2(Comparison to BAU)
Japan Chemical Industry Association	CO2 emissions	BAU	-1500kt-CO2(Comparison to BAU)	CO2 emissions	BAU	-2000kt-CO2(Comparison to BAU)
Japan Paper Association	CO2 emissions	BAU	-1390kt-CO2(Comparison to BAU)	CO2 emissions	BAU	-2860kt-CO2(Comparison to BAU)
Japan Cement Association	energy consumption intensity	2010	-1.10%	energy consumption intensity	2010	-1.40%
Liaison Group of Japanese Electrical and Electronics Industries for Global Warming Prevention	energy consumption intensity	2012	-7.73%	energy consumption intensity	2012	-16.55%
Japan Auto Parts Industries Association	CO2 emission intensity	2007	-13%	CO2 emission intensity	2007	-20%
Japan Automobile Manufacturers Association / Japan Auto-Body Industries Association	CO2 emissions	1990	-28%	CO2 emissions	1990	-33%
Japan Mining Industry Association	CO2 emission intensity	1990	-15%	CO2 emission intensity	1990	-18%
Lime Manufacture Association	CO2 emissions	BAU	-150kt-CO2(Comparison to BAU)	CO2 emissions	BAU	-120kt-CO2(Comparison to BAU)
The Japan Rubber Manufactures Association	CO2 emission intensity	2005	-15%	CO2 emission intensity	2005	-21%
Japan Aluminium Association	energy consumption intensity	BAU	-0.8GJ/t(Comparison to BAU)	energy consumption intensity	BAU	-1.0GJ/t(Comparison to BAU)
Japan Federation of Printing Industries	CO2 emissions	2010	-85kt-CO2	CO2 emissions	2010	-180kt-CO2
Japan Textile Finishers' Association	CO2 emissions	1990	-39%	CO2 emissions	1990	-40%
Flat Glass Manufacturers Association of Japan	CO2 emissions	1990	-35%	CO2 emissions	1990	-49%
Japan Glass Bottle Association	CO2 emissions	1990	724kt-CO2	CO2 emissions	1990	700kt-CO2
	energy consumption		343GL	energy consumption		341GL
The Japanese Electric Wire & Cable Makers' Association	(Copper・Aluminum) energy consumption	1990	-34%	(Copper・Aluminum) energy consumption	1990	-36%
	(Optical fiber) energy consumption	1990	-80%	(Optical fiber) energy consumption	1990	-80%
The Japan Bearing Industry Association	CO2 emission intensity	1997	-23%	CO2 emission intensity	1997	-28%
The Japan Society of Industrial Machinery Manufacturers	energy consumption intensity	2008～2012(average of 5 years)	-1%(Annual average)	CO2 emissions	2013	-6.50%
Japan Copper and Brass Association	energy consumption intensity	BAU	-1 %(Comparison to BAU)	energy consumption intensity	BAU	-1 %(Comparison to BAU)
Japan Construction Equipment Manufacturers Association	energy consumption intensity	2008～2012(average of 5 years)	-8%	energy consumption intensity	2013	-17%
Limestone Association of Japan	CO2 emissions	BAU	-4,300t-CO2(Comparison to BAU)	CO2 emissions	BAU	-5,800t-CO2(Comparison to BAU)
Japan Machine Tool Builders' Association	energy consumption intensity	2008～2012(average of 5 years)	-7.70%	energy consumption intensity	2008～2012(average of 5 years)	-12.20%

Type of industry	2020			2030		
	Target indicator	Base year/BAU	Target level of 2020	Target indicator	Base year/BAU	Target level of 2030
Industry Sector						
Industry under Ministry of Economy, Trade and Industry						
Japan Petroleum Development Association	CO2 emission intensity	1990	-25%	CO2 emissions	2005	-60kt-CO2
	CO2 emissions	2005	-60kt-CO2			
Japan Sanitary Equipment Industry Association	CO2 emissions	1990	-35%	CO2 emissions	2005	-49%
Japan Prefabricated Construction Suppliers & Manufacturers Association	CO2 emission intensity	2010	-10%	CO2 emission intensity	2010	-10%
Japan Industrial Vehicles Association	CO2 emissions	2005	51kt-CO2	CO2 emissions	2005	49kt-CO2
Industry under Ministry of Land, Infrastructure, Transport and Tourism						
Japan Federation of Construction Contractors	CO2 emission intensity	1990	-20%	CO2 emission intensity	1990	-25%
Japan Federation of Housing Organizations	CO2 emissions of construction phase (whole of life cycle)	1990	2700kt-CO2 (158,100kt-CO2)	Environmental performance of new housing	—	Realization of ZEH with new housing average
The Shipbuilders' Association of Japan/The Cooperative Association of Japan Shipbuilders	CO2 emission intensity	2012	-5%	CO2 emissions	2013	-6.5%
Japan Ship Machinery and Equipment Association	energy consumption intensity	1990	-27%	energy consumption intensity	1990	-30%
Japan Marine Industry Association	CO2 emissions	2010	-1%(Annual rate)	CO2 emissions	2010	-0.5%(Annual rate)
Japan Association of Rolling Stock Industries	CO2 emissions	1990	-33%	CO2 emissions	1990	-35%
Commercial and Other Sector						
Industry under Financial Services Agency						
Japanese Bankers Association	energy consumption intensity	2009	-10.5%	energy consumption intensity	2009	-19%
The National Association of Shinkin Banks	energy consumption	2009	-10.5%	energy consumption	2009	-19%
Japan Securities Dealers Association	energy consumption intensity	2009	-10%	energy consumption intensity	2009	-20%
The Life Insurance Association of Japan	energy consumption	2009	-1%(Annual average)	energy consumption	2020	-1%(Annual average)
The General Insurance Association of Japan	energy consumption intensity	2009	-10.5%	energy consumption intensity	2009	-14.8%
Community Bank Shinyo Kumiai	energy consumption	2006	-10%	energy consumption	2009	-18%

Type of industry	2020			2030		
	Target indicator	Base year/BAU	Target level of 2020	Target indicator	Base year/BAU	Target level of 2030
Commercial and Other Sector						
Industry under Ministry of Internal Affairs and Communications						
Telecommunications Carriers Association	energy consumption intensity	2010	-1%	energy consumption intensity	2010	-1%
The Japan Commercial Broadcasters Association	CO2 emission intensity	2012	-8%	-	-	-
Japan Broadcasting Corporation	-	-	-	-	-	-
Telecom Services Association	-	-	-	-	-	-
Japan Cable and Telecommunications Association	-	-	-	-	-	-
Japan Satellite Broadcasting Association	energy consumption intensity	2010	-10%	energy consumption intensity	2010	-15%
Japan Internet Providers Association	-	-	-	-	-	-
Industry under Ministry of Education, Culture, Sports, Science and Technology						
The Federation of All Japan Private Schools' Associations	CO2 emissions	2015	-1%(Annual rate)	-	-	-
Industry under Ministry of Health, Labour and Welfare						
Japan Medical Association / Council of 4 Hospitals	-	-	-	CO2 emission intensity	2006	-25.0%
Japanese Consumers Co-operative Union	CO2 emissions	2005	-15%	-	-	-
Industry under Ministry of Fisheries, Forestry and Agriculture						
Japan Foodservice Association	energy consumption intensity	2013	-6.8%	energy consumption intensity	2013	-15.7%
Japan Processed Foods Wholesalers Association	energy consumption intensity	2011	-5%	-	-	-
Industry under Ministry of Economy, Trade and Industry						
Japan Chain Stores Association	energy consumption intensity	1996	-24%	energy consumption intensity	1996	-24%
Japan Franchise Association	energy consumption intensity	2010	-10%	energy consumption intensity	2010	-10%
Japan Council of Shopping Centers	energy consumption intensity	2005	-13%	energy consumption intensity	2005	-23%
Japan Department Stores Association	energy consumption intensity	1990	-20%	energy consumption intensity	1990	-38%
Japan Association of Chain Drug Stores	energy consumption intensity	Average from 2005 to 2013	-8%	energy consumption intensity	Average from 2005 to 2013	-11%
Ote Kaden Ryutsu Kyoukai (home appliances retail)	energy consumption intensity	2006	-44%	energy consumption intensity	2006	-49.1%
Japan Information Technology Services Industry Association	（Office） energy consumption	2006	-2%	（Office） energy consumption	2006	-5.1%
	（Data center） energy consumption	2006	-5.5%	（Data center） energy consumption	2006	-7.1%
Japan DIY Industry Association	energy consumption intensity	2004	-15%	energy consumption intensity	2004	-25%
Japan Foreign Trade Council, Inc.	energy consumption intensity	2009	-15.3%	energy consumption intensity	2009	-19.0%
Japan LP Gas Association	energy consumption	2010	-5%	energy consumption	2010	-9%
Japan Leasing Association	energy consumption intensity	2009	-10%	energy consumption intensity	2009	-20%

Type of industry	2020			2030		
	Target indicator	Base year/BAU	Target level of 2020	Target indicator	Base year/BAU	Target level of 2030
Commercial and Other Sector						
Industry under Ministry of Land, Infrastructure, Transport and Tourism						
Japan Automobile Service Promotion Association	-	-	-	-	-	-
The Japan Warehousing Association Inc.	energy consumption intensity	1990	-16%	energy consumption intensity	1990	-20%
Japan Association of Refrigerated Warehouses	energy consumption intensity	1990	-15%	energy consumption intensity	1990	-20%
Japan Hotel Association	energy consumption intensity	2010	-10%	energy consumption intensity	2010	-15%
Japan Ryokan & Hotel Association	-	-	-	-	-	-
The Real Estate Companies Association of Japan	energy consumption intensity	2005	-25%	energy consumption intensity	2005	-30%
Japan Building Owners and Managers Association	energy consumption intensity	2009	-15%	energy consumption intensity	2009	-20%
Industry under Ministry of the Environment						
National Federation of Industrial Waste Management Associations	GHG emissions	2010	±0%	-	-	-
The Japan Newspaper Publishers & Editors Association	energy consumption	2005	-13%	-	-	-
Zenkoku Pet Kyoukai (pet retail)	CO2 emission intensity	2012	±0%	CO2 emission intensity	2012	±0%
Industry under National Police Agency						
All Japan Pachinko Association	CO2 emissions	2007	-18%	CO2 emissions	2007	-22%
All Nippon Amusement Machine Operators' Union	CO2 emissions	2012	-8.9%	CO2 emissions	2012	-16.6%

Type of industry	2020			2030		
	Target indicator	Base year/BAU	Target level of 2020	Target indicator	Base year/BAU	Target level of 2030
Transport Sector						
Industry under Ministry of Land, Infrastructure, Transport and Tourism						
The Japanese Shipowners' Association	CO2 emission intensity	1990	-20%	CO2 emission intensity	1990	-30%
Japan Trucking Association	CO2 emission intensity	2005	-22%	CO2 emission intensity	2005	-31%
The Scheduled Airlines Association of Japan	CO2 emission intensity	2005	-21%	CO2 emission intensity	2012	-16%
Nihon Bus Association	CO2 emission intensity	2010	-6%	-	-	-
Japan Federation of Hire-Taxi Associations	CO2 emissions	2010	-20%	CO2 emissions	2010	-25%
Japan Passengerboat Association	CO2 emission intensity	1990	-6%	CO2 emission intensity	2012	-3.6%
Japan Federation of Coastal Shipping Associations	CO2 emissions	1990	-31%	CO2 emissions	1990	-34%
The Association of Japanese Private Railways	energy consumption intensity	2010	-5.7%	energy consumption intensity	2010	-5.7% or more
East Japan Railway Company	energy consumption	2010	-8%	energy consumption	2010	-25%
	CO2 emission intensity of Private power generation	1990	-30%			
West Japan Railway Company	energy consumption	2010	-3%	energy consumption	2010	-2%
Central Japan Railway Company	energy consumption intensity	1995	-25%	energy consumption intensity	1995	-25%
Japan Freight Railway Company	energy consumption intensity	2013	-8%	energy consumption intensity	2013	-15%
The Japan Harbor Transportation Association	CO2 emission intensity	2005	-12%	-	-	-
Kyushu Railway Company	energy consumption intensity	2011	-2.5%	energy consumption intensity	2011	-2.5%
	Introduction ratio of energy saving vehicles	-	83%	Introduction ratio of energy saving vehicles	-	83%
Hokkaido Railway Company	energy consumption intensity	1995	-14%	-	-	-
	Possession ratio of energy saving vehicles	1995	85%	-	-	-
All Japan Freight Forwarders Association	CO2 emissions	2009	-11%	CO2 emissions	2009	-20.2%
Shikoku Railway Company	energy consumption	2010	-8%	energy consumption	2010	-8%

Type of industry	2020			2030		
	Target indicator	Base year/BAU	Target level of 2020	Target indicator	Base year/BAU	Target level of 2030
Energy Conversion Sector						
Industry under Ministry of Economy, Trade and Industry						
The Electric Power Council for a Low Carbon Society	CO2 emissions	BAU	-7000kt-CO2(Comparison to BAU)	CO2 emission intensity	-	about 0.37kg-CO2/kWh
				CO2 emissions	BAU	-1100kt-CO2(Comparison to BAU)
Petroleum Association of Japan	energy reduction	BAU	-530GL(Comparison to BAU)	energy reduction	BAU	-1000GL(Comparison to BAU)
The Japan Gas Association	CO2 emission intensity	1990	9.9g-CO2/m3	CO2 emission intensity	1990	10.4g-CO2/m3
	energy consumption intensity	1990	0.26MJ/m3	energy consumption intensity	1990	0.27MJ/m3

3.3 Estimates of emission reductions and removals and the use of units from the market-based mechanisms and land use, land-use change and forestry activities

The information on the estimates of emission reductions and removals and the use of units from the market-based mechanisms and land use, land-use change and forestry activities between FY2010 and FY2015 related to the progress in achievement of quantified economy-wide emission reduction targets of Japan is the follows.

Total GHGs emissions in FY2015 (excluding LULUCF) were 1,325 million t-CO_2 eq. They were 9.4% below compared to the emissions in the base year (FY2005) if units from LULUCF activities (57.6 million t-CO_2) [21] are taken into account.

As for units from the market mechanism, 0.36 kt-CO_2 eq. was acquired by Government of Japan through the Joint Crediting Mechanism (JCM) in FY2016 [22].

Table 3-3 Reporting of progress (CTF Table 4)

	Year	Base year/period (FY2005)	2010	2011	2012	2013	2014	2015	2016
Total emissions excluding LULUCF	(kt CO_2 eq)	1,398,823.62	1,306,045.28	1,355,578.63	1,391,203.02	1,409,037.65	1,364,040.64	1,324,717.74	NE
Contribution from LULUCF	(kt CO_2 eq)	NA	NA	NA	NA	-60,431.22	-59,487.29	-57,624.95	NE
Quantity of units from market based mechanisms under the Convention	(number of units)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(kt CO_2 eq)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Quantity of units from other market based mechanisms	(number of units)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(kt CO_2 eq)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

[21] The value does not reflect the technical correction of FM. The value reflected the technical correction of FM is 58.8 million t-CO_2.

[22] JCM website (https://www.jcm.go.jp/projects/issues)

Table 3-4 Further information on mitigation actions relevant to the counting of emissions and removals from the LULUCF sector in relation to activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol (CTF Table 4(a)II) [23]

GREENHOUSE GAS SOURCE AND SINK ACTIVITIES	Base year	Net emissions/removals									Accounting Parameters	Accounting Quantity
		2013	2014	2015	2016	2017	2018	2019	2020	Total		
	(kt CO_2 eq)											
A. Article 3.3 activities												
A.1. Afforestation/reforestation		-1,426.68	-1,420.71	-1,417.31						-4,264.70		-4,264.70
Excluded emissions from natural disturbances		NA	NA	NA						NA		NA
Excluded subsequent removals from land subject to natural disturbances		NA	NA	NA						NA		NA
A.2. Deforestation		1,459.29	2,104.35	1,802.85						5,366.50		5,366.50
B. Article 3.4 activities												
B.1. Forest management												-156,298.01
Net emissions/removals		-51,478.48	-52,073.28	-49,362.62						-152,914.38		
Excluded emissions from natural disturbances		NA	NA	NA						NA		
Excluded subsequent removals from land subject to natural disturbances		NA	NA	NA						NA		
Any debits from newly established forest (CEF-ne)		NA	NA	NA						NA		
Forest management reference level (FMRL)											0.00	
Technical corrections to FMRL											1,127.88	
Forest management cap											0.00	
B.2. Cropland management (if elected)	10,257.97	3,543.05	4,272.82	3,876.27						11,692.14		-19,081.78
B.3. Grazing land management (if elected)	842.39	-284.35	-107.95	-240.55						-632.85		-3,160.02
B.4. Revegetation (if elected)	-78.98	-1,222.66	-1,241.14	-1,262.20						-3,726.01		-3,489.08
B.5. Wetland drainage and rewetting (if elected)	NA	NA	NA	NA						NA		NA

Table 3-5 Information on the use of units from the market-based mechanisms (CTF Table 4(b))

Units of market based mechanisms			Year	
			2015	2016
Kyoto Protocol units	*Kyoto Protocol units*	*(number of units)*	0.00	0.00
		(kt CO_2 eq)	0.00	0.00
	AAUs	*(number of units)*	0.00	0.00
		(kt CO_2 eq)	0.00	0.00
	ERUs	*(number of units)*	0.00	0.00
		(kt CO_2 eq)	0.00	0.00
	CERs	*(number of units)*	0.00	0.00
		(kt CO_2 eq)	0.00	0.00
	tCERs	*(number of units)*	0.00	0.00
		(kt CO_2 eq)	0.00	0.00
	lCERs	*(number of units)*	0.00	0.00
		(kt CO_2 eq)	0.00	0.00
Other units	*Units from market-based mechanisms under the Convention*	*(number of units)*	0.00	0.00
		(kt CO_2 eq)	0.00	0.00
	Units from other market-based mechanisms	*(number of units)*	0.00	0.00
		(kt CO_2 eq)	0.00	0.00
	JCM	*(number of units)*	0.00	0.00
		(kt CO2eq)	0.00	0.00
Total		*(number of units)*	0.00	0.00
		(kt CO_2 eq)	0.00	0.00

[23] Based on the accounting table of CRF 2017. The way of representing a figure of technical correction in the CRF accounting table is under consideration as input data was not correctly shown in the table.

Chapter 4

Projections

4.1 Projections

4.1.1 Projected scenarios

The future level of emissions and removals of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6) and nitrogen trifluoride (NF_3) for FY2020 and FY2030 are estimated as follows.

Based on the outlook on macro frame shown in 4.4.1, the projections for FY2020 and FY2030 are estimated under a 'with measures' scenario taking into account future emission reduction by each policy and measure described in 3.1.2.

The energy supply structure satisfying the energy demand (Primary energy supply) without measures was not estimated in Japan. 'With measures' scenario is taking into account the policy measures already implemented in FY2013 and policy measures to be implemented by FY2030.

4.1.2 Overall projections of GHG emissions

The estimated total GHG emissions in FY2020 under a 'with measures' scenario are approximately 1,399 million t-CO_2 equivalent, which are an increase by 0.2% from the base year FY2005 (1,397million ton). However, they aim at a target of 3.8% or more emission reduction in FY2020 compared to the FY2005 level by implementing additional mitigation measures and using removals from LULUCF sector [24].

The estimated total GHG emissions in FY2030 under a 'with measures' scenario is approximately 1,079 million t-CO_2 equivalent. It is a decrease by 23.4% and 22.7% from FY2013 and FY2005, respectively. Taking into the account the projections of removals (removals from forests (approximately 27.8 million t-CO_2), agricultural soils (approximately 7.9 million t-CO_2) and revegetation (approximately 1.2 million t-CO_2)) in FY2030, they decrease by 26.0% and 25.4% from FY2013 and FY2005, respectively, as shown in Japan's NDC.

[24] The projections of removals in FY2020 are expected to be removals from forests (approximately 38 million t-CO_2), agricultural soils (approximately 7.7 million t-CO_2) and revegetation (approximately 1.2 million t-CO_2).

Table 4-1 Information on greenhouse gas projections under a 'with measures' scenario (CTF Table 6(a))

	GHG emissions and removals (kt CO_2 eq)							GHG emission projections (kt CO_2 eq)	
	Base year (2005)	1990	1995	2000	2005	2010	2015	2020	2030
Sector									
Energy	1,009,693.34	887,029.05	927,209.22	956,559.13	1,011,324.63	947,165.71	967,837.99	1,053,578.32	784,200.00
Transport	235,977.66	204,245.55	244,866.29	253,322.94	235,791.69	217,696.14	206,810.43	194,840.61	165,500.00
Industry/industrial processes	84,728.60	110,451.48	136,418.29	108,173.62	86,721.16	80,158.47	93,020.28	93,001.43	74,800.00
Agriculture	40,015.02	37,635.95	37,158.50	35,322.91	35,227.10	35,885.72	33,666.91	38,723.08	37,500.00
Forestry/LULUCF	-89,643.58	-63,455.06	-77,779.64	-88,809.20	-91,547.81	-70,091.39	-60,939.88	-36,404.03	-25,900.00
Waste management/waste	26,095.94	28,897.43	32,166.79	31,668.20	26,666.91	22,796.30	21,232.21	19,321.96	17,300.00
Gas									
CO_2 emissions including net CO_2 from LULUCF	1,214,416.17	1,093,427.39	1,165,799.19	1,186,712.02	1,215,898.89	1,144,690.19	1,164,070.04	1,261,710.51	971,600.00
CO_2 emissions excluding net CO_2 from LULUCF	1,304,375.96	1,157,164.51	1,243,848.87	1,275,777.13	1,307,693.19	1,215,010.75	1,225,239.49	1,298,375.21	997,800.00
CH_4 emissions including CH_4 from LULUCF	39,029.18	44,296.05	41,707.78	37,732.72	35,346.11	34,914.69	31,354.31	33,988.76	31,700.00
CH_4 emissions excluding CH_4 from LULUCF	38,962.32	44,223.07	41,637.89	37,666.02	35,279.25	34,855.00	31,294.94	33,932.91	31,600.00
N_2O emissions including N_2O from LULUCF	25,760.31	31,726.66	33,060.74	29,750.62	25,008.76	22,487.68	20,999.79	21,762.11	21,300.00
N_2O emissions excluding N_2O from LULUCF	25,510.95	31,517.58	32,860.59	29,561.41	24,829.11	22,318.20	20,829.59	21,557.28	21,100.00
HFCs	12,724.24	15,932.31	25,213.19	22,852.00	12,781.83	23,305.23	39,202.80	38,300.00	21,600.00
PFCs	8,623.35	6,539.30	17,609.92	11,873.11	8,623.35	4,249.54	3,308.10	4,000.00	4,200.00
SF_6	5,063.86	12,850.07	16,447.52	7,031.36	5,053.01	2,423.87	2,121.86	2,400.00	2,700.00
NF_3	1,249.87	32.61	201.09	285.77	1,471.75	1,539.74	571.03	1,000.00	500.00
Total with LULUCF	1,306,866.97	1,204,804.39	1,300,039.44	1,296,237.60	1,304,183.69	1,233,610.94	1,261,627.94	1,363,061.37	1,054,000.00
Total without LULUCF	1,396,510.56	1,268,259.45	1,377,819.08	1,385,046.80	1,395,731.50	1,303,702.34	1,322,567.82	1,399,465.40	1,079,000.00

*Projected emissions of Transport sector for FY2020 and FY2030 include CO_2 emissions from electricity consumption from railways which is typically included in the energy sector.

*For FY 2020, the Total does not match the sum of the gases because of rounding.

For FY 2030, the Total does not match the sum of the sectors because of rounding.'Base year (2005)' shows value in reduction targets agreement.

*For projections in FY 2020 and 2030 in Forestry/LULUCF, projections relating to managing forest carbon sink, carbon sinks in agricultural soils, and urban greening are derived from activity-based assumption in line with KP-LULUCF.

4.1.3 Projections by gas

4.1.3.1 Energy-related CO_2

Energy-related CO_2 covers approximately 90% of Japan's GHG emissions. Based on statistics, it can be broken down into the following 5 sectors: Industry; Commercial and other; Residential; Transport; and Energy conversion. The effects of policies and measures can be observed in each sector as well. Table 4-2 shows emission projection for each sector.

The estimated emissions in FY2020 increase by 0.4% (approximately 1,224 million t-CO_2) compared to the emissions in FY2005. A significant reduction is expected in the Transport sector, meanwhile estimated emissions increase in Industry, Commercial and other sectors due to vitalization of economic activities. However, actual emissions in FY2015 shows a reduction by 5.7% (approximately 1,149 million t-CO_2) compared to the emissions in FY2005. It is especially contributed by the reduction in Industry, Transport and Energy conversion sectors.

In FY2030, a significant reduction is estimated in Commercial and other, Residential, Energy conversion and Transport sectors. And it is estimated decrease by 25.0% (approximately 924 million t-CO_2) compared to the emissions in FY2013.

Table 4-2 Estimated emissions of energy-related CO_2 by sector

	Actual emissions			Estimated emissions			
	FY2005	FY2013	FY2015	FY2020		FY2030	
	(Mt-CO_2)	(Mt-CO_2)	(Mt-CO_2)	(Mt-CO_2)	(Changes from FY2005)	(Mt-CO_2)	(Changes from FY2013)
Industry	457	432	411	490	+7.3%	401	-6.6%
Commercial and Other	239	278	265	267	+11.6%	168	-39.7%
Residential	180	201	179	178	-0.9%	122	-39.4%
Transport	240	225	213	193	-19.7%	163	-27.4%
Energy conversion	104	99	80	96	-7.1%	73	-27.5%
Total	**1,219**	**1,235**	**1,149**	**1,224**	**+0.4%**	**927**	**-25.0%**

*Actual emissions in the base year (FY2005 and FY2013) were revised due to GHG inventory recalculations after the time of the decision of the emission reduction target. Estimated emissions (FY2020 and FY2030) and change ratio from base year (from FY2005 and FY2013) show the values at the time of the decision of the emission reduction target.

4.1.3.2 Non-energy-related CO_2

The estimated emissions of non-energy-related CO_2 in FY2020 decrease by 13.0% compared to FY2005 (approximately 74.3 million t-CO_2).

The estimated emissions in FY2030 decrease by 6.7% compared to FY2013 (by 17.0% from FY2005) (approximately 70.8 million t-CO_2).

Main emission sources in FY2015 are cement production (the Industrial Processes and Product Use sector (IPPU)) and waste incineration (the Waste sector) and so on. Reduction rate in the IPPU sector is the largest in FY2020, followed by the Waste sector (Excluding 'the Other sector'). On the contrary, the largest reduction rate in FY2030 is in the Waste sector, followed by the IPPU sector.

Table 4-3 Estimated emissions of Non -energy-related CO_2 by sector

	Actual emissions			Estimated emissions			
	FY2005	FY2013	FY2015	FY2020		FY2030	
	(Mt-CO_2)	(Mt-CO_2)	(Mt-CO_2)	(Mt-CO_2)	(Changes from FY2005)	(Mt-CO_2)	(Changes from FY2013)
Fugitive emissions from fuels	0.5	0.4	0.5	0.7	+31.9%	0.9	+96.4%
Industrial Processes and Product Use	55.6	48.0	46.2	45.6	-15.4%	44.0	-5.5%
Agriculture	0.4	0.6	0.6	0.6	+39.1%	0.6	+13.3%
Waste	31.7	29.3	28.9	27.2	-9.6%	25.0	-11.1%
Other	0.5	0.3	0.2	0.3	-36.2%	0.3	+16.3%
Indirect CO_2	3.1	2.2	2.1	–	–	–	–
Total	**91.8**	**80.8**	**78.4**	**74.3**	**-13.0%**	**70.8**	**-6.7%**

*Actual emissions in the base year (FY2005 and FY2013) were revised due to GHG inventory recalculations after the time of the decision of the emission reduction target. Estimated emissions (FY2020 and FY2030) and change ratio from base year (from FY2005 and FY2013) show the values at the time of the decision of the emission reduction target.

*Indirect CO_2 was not estimated at the time of the decision of the emission reduction target.

4.1.3.3 Methane

The estimated emissions of for methane in FY2020 decrease by 12.9% compared to FY2005 (approximately 33.9 million t-CO_2 eq.).

The estimated emissions in FY2030 decrease by 12.3% compared to FY2013 (by 18.8% from FY2005) (approximately 31.6 million t-CO_2 eq.).

Main emission sources in FY2015 are rice cultivation, enteric fermentation of livestock (the Agriculture sector), waste landfill (the Waste sector) and so on. The largest reduction rate is in the Waste sector, followed by the Fugitive emission from fuels sector in both FY2020 and FY2030.

Table 4-4 Estimated emissions of methane by sector

	Actual emissions			Estimated emissions			
	FY2005	FY2013	FY2015	FY2020		FY2030	
	($Mt\text{-}CO_2$)	($Mt\text{-}CO_2$)	($Mt\text{-}CO_2$)	($Mt\text{-}CO_2$)	(Changes from FY2005)	($Mt\text{-}CO_2$)	(Changes from FY2013)
Fuel combustion	1.4	1.6	1.5	1.5	+9.3%	1.5	-2.1%
Fugitive emissions from fuels	1.0	0.8	0.8	0.8	-21.0%	0.7	-10.9%
Industrial Processes and Product Use	0.1	0.0	0.0	0.0	-15.6%	0.0	-4.5%
Agriculture	24.7	24.6	23.6	27.1	-4.3%	26.0	-7.1%
Waste	8.1	5.7	5.3	4.4	-45.6%	3.4	-40.7%
Total	**35.3**	**32.7**	**31.3**	**33.9**	**-12.9%**	**31.6**	**-12.3%**

*Actual emissions in the base year (FY2005 and FY2013) were revised due to GHG inventory recalculations after the time of the decision of the emission reduction target. Estimated emissions (FY2020 and FY2030) and change ratio from base year (from FY2005 and FY2013) show the values at the time of the decision of the emission reduction target.

4.1.3.4 Nitrous oxide

The estimated emissions of nitrous oxide in FY2020 decrease by 15.5%compared to FY2005 (approximately 21.6 million t-CO_2 eq.).

The estimated emissions in FY2030 decrease by 6.1% compared to FY2013 (by 17.4% from FY2005) (approximately 21.1 million t-CO_2 eq.).

Main emission sources in FY2015 are agricultural soils, manure management (the Agriculture sector) and Fuel combustion sector and so on. Reduction rate in the IPPU sector is the largest, followed by the Waste sector in FY2020. The largest reduction rate in FY2030 is in the Waste sector, followed by the Fuel combustion sector.

Table 4-5 Estimated emissions of nitrous oxide by sector

	Actual emissions			Estimated emissions			
	FY2005	FY2013	FY2015	FY2020		FY2030	
	($Mt\text{-}CO_2$)	($Mt\text{-}CO_2$)	($Mt\text{-}CO_2$)	($Mt\text{-}CO_2$)	(Changes from FY2005)	($Mt\text{-}CO_2$)	(Changes from FY2013)
Fuel combustion	7.2	6.2	6.1	6.2	-16.2%	5.9	-7.1%
Fugitive emissions from fuels	0.0	0.0	0.0	0.0	-20.2%	0.0	+0.0%
Industrial Processes and Product Use	3.1	1.7	1.6	1.8	-42.9%	1.9	+7.0%
Agriculture	10.1	9.6	9.5	11.0	-2.0%	10.9	-0.9%
Waste	4.4	3.8	3.7	2.6	-31.8%	2.3	-28.9%
Total	**24.8**	**21.4**	**20.8**	**21.6**	**-15.5%**	**21.1**	**-6.1%**

*Actual emissions in the base year (FY2005 and FY2013) were revised due to GHG inventory recalculations after the time of the decision of the emission reduction target. Estimated emissions (FY2020 and FY2030) and change ratio from base year (from FY2005 and FY2013) show the values at the time of the decision of the emission reduction target.

Table 4-6 Estimated emissions of non-energy-related CO_2, methane and nitrous oxide

	Actual emissions			Estimated emissions			
	FY2005	FY2013	FY2015	FY2020		FY2030	
	($Mt\text{-}CO_2$)	($Mt\text{-}CO_2$)	($Mt\text{-}CO_2$)	($Mt\text{-}CO_2$)	(Changes from FY2005)	($Mt\text{-}CO_2$)	(Changes from FY2013)
Non-energy-related CO2	91.8	80.8	78.4	74.3	-13.0%	70.8	-6.7%
Methane	35.3	32.7	31.3	33.9	-12.9%	31.6	-12.3%
Nitrous oxide	24.8	21.4	20.8	21.6	-15.5%	21.1	-6.1%

*Actual emissions in the base year (FY2005 and FY2013) were revised due to GHG inventory recalculations after the time of the decision of the emission reduction target. Estimated emissions (FY2020 and FY2030) and change ratio from base year (from FY2005 and FY2013) show the values at the time of the decision of the emission reduction target.

4.1.3.5 Fluorinated gases

The estimated emissions of fluorinated gases (HFCs, PFCs, SF_6, NF_3) in CY2020 increase by 64.6%from CY2005 (approximately 45.6 million t-CO_2 eq.). The estimated emissions in CY2030 decrease by 25.1% from CY2013 (increase by 4.5% from CY2005)(approximately 28.9 million t-CO_2 eq.).

Main emission sources in CY2015 are fugitive emission during production, use and disposal of HFCs used as refrigerants in refrigerators and air conditioners. Since refrigerants in refrigerators and air conditioners have shifted from Hydrochloro-fluorocarbons (HCFCs), which are ozone-depleting substances, to HFCs, it is expected that the emissions of fluorinated gases are projected to increase. The estimated emissions of HFCs in CY2020 increase approximately threefold compared to the emissions in CY2005, meanwhile it will fall below compared to the actual emissions in CY2015. The estimated emissions of HFCs in CY2030 decrease by 32.1% compared to CY2013 with the measures such as eliminating fluorocarbons, lowering GWP and leakage prevention.

Table 4-7 Estimated emissions of fluorinated gases and each gas

	Actual emissions			Estimated emissions			
	CY2005	CY2013	CY2015	CY2020		CY2030	
	(Mt-CO_2)	(Mt-CO_2)	(Mt-CO_2)	(Mt-CO_2)	(Changes from CY2005)	(Mt-CO_2)	(Changes from CY2013)
HFCs	12.8	32.1	39.2	38.3	+201.6%	21.6	-32.1%
PFCs	8.6	3.3	3.3	4.0	-53.5%	4.2	+27.2%
SF_6	5.1	2.1	2.1	2.4	-52.9%	2.7	+23.5%
NF_3	1.5	1.6	0.6	1.0	-16.7%	0.5	-64.8%
Total	**27.9**	**39.1**	**45.2**	**45.6**	**+64.6%**	**28.9**	**-25.1%**

*Actual emissions in the base year (CY2005 and CY2013) were revised due to GHG inventory recalculations after the time of the decision of the emission reduction target. Estimated emissions (CY2020 and CY2030) and change ratio from base year (from CY2005 and CY2013) show the values at the time of the decision of the emission reduction target.

4.1.4 Projections by sector

4.1.4.1 Energy

The estimated emissions of the Energy sector in FY 2020 are an increase of approximately 0.2% compared to FY 2005 (approximately 1,248.4 million t-CO_2 eq.). In FY 2030, it is a decrease of approximately 24.6% compared to FY2013 and a decrease by 23.8% compared to FY2005 (approximately 949.7 million t-CO_2 eq.).

Almost all emissions in the Energy sector are CO_2 derived from fuel combustion. See "4.1.3.1 Energy-related CO_2" for the increase and decrease of the future estimated emissions.

4.1.4.2 Industrial Processes and Product Use (IPPU)

The estimated emissions of the Industrial Processes and Product Use (IPPU) sector in FY 2020 (approximately 93.0 million t-CO_2 eq.) are an increase of approximately 9.8% compared to FY 2005. In FY 2030 (approximately 74.8 million t-CO_2 eq.), it is a decrease of approximately 14.0% level as compared to FY2013 and a decrease by 11.7% compared to FY2005.

Main emission sources are mineral industry (CO_2), refrigerants (HFCs), metal production (CO_2, CH_4) and chemical industry (CO_2, CH_4, N_2O). The main driver is an increase of emissions in refrigerants sector since refrigerants have shifted from Hydrochloro-fluorocarbons (HCFCs), which are ozone-depleting substances, to HFCs. The main factor of the emission decrease in FY2030 is an emission reduction in refrigerants sector by leakage prevention of fluorocarbons from use of refrigerators and air conditioners, promotion of recovery of fluorocarbons in disposal and promotion of eliminating fluorocarbons and lowering GWP.

4.1.4.3 Agriculture

The estimated emissions of the Agriculture sector in FY 2020are a decrease of approximately 3.2% compared to FY 2005 (approximately 38.7 million t-CO_2 eq.). In FY2030, it is a decrease of approximately 5.1% as compared to FY2013 and a decrease by 6.3% compared to FY2005 (approximately 37.5 million t-CO_2 eq.).

Main emission sources in FY2015 are rice cultivation (CH_4), enteric fermentation (CH_4), manure management (CH_4, N_2O) and agricultural soils (N_2O). The main driver of the emission decrease in FY2020 and FY2030 is an emission reduction from rice cultivation by the implementation of emission reduction measures.

4.1.4.4 LULUCF

The estimated removals of the LULUCF sector in FY 2020 are approximately 36.4 million t-CO_2. In FY2030, it is approximately 25.9 million t-CO_2 [25].

The LULUCF sector covers CO_2 emissions and removals resulting from carbon stock change and non-CO_2 emissions in forest land, cropland, grassland, wetlands, settlements, and other land. Major parts of removals attribute to forest land sinks.

4.1.4.5 Waste

The estimated emissions of the Waste sector in FY 2020 are a decrease of approximately 26.0% compared to FY 2005 (approximately 19.3 million t-CO_2 eq.). In FY2030, it is a decrease of approximately 20.7% compared to FY2013 and decrease of approximately 33.7% compared to FY2005 (approximately 17.3 million t-CO_2 eq.).

Main emission sources are waste incineration and incineration with energy recovery (CO_2, CH_4, N_2O), final disposal (CH_4) and wastewater treatment (CH_4, N_2O). Main drivers of the emission decrease in FY2020 and FY2030 are a decrease of the amount of waste incineration, final disposal and treated wastewater by depopulation and promotion of 3R, and CO_2 emission reduction in plastics incineration by the introduction of biomass plastics.

4.1.5 Indirect CO_2

Since total emissions of GHG have come to include the emissions of indirect CO_2 in GHG inventory submitted to the UNFCCC in 2017, the future projected value is not estimated yet.

Table 4-8 Estimated emissions in FY2020 and FY2030 by sector (without LULUCF)

	Actual emissions			Estimated emissions			
	FY2005	FY2013	FY2015	FY2020		FY2030	
	(Mt-CO_2)	(Mt-CO_2)	(Mt-CO_2)	(Mt-CO_2)	(Changes from FY2005)	(Mt-CO_2)	(Changes from FY2013)
Energy	1,247.1	1,261.2	1,174.6	1,248.4	+0.2%	949.7	-24.6%
Industrial Processes and Product Use	86.7	88.9	93.0	93.0	+9.8%	74.8	-14.0%
Agriculture	35.2	34.8	33.7	38.7	-3.2%	37.5	-5.1%
Waste	26.7	21.9	21.2	19.3	-26.0%	17.3	-20.7%
Indirect CO_2	3.1	2.2	2.1	–	–	–	–
Total	**1,398.8**	**1,409.0**	**1,324.7**	**1,399.5**	**+0.2%**	**1,079.0**	**-23.4%**

*Actual emissions in the base year (FY2005 and FY2013) were revised due to GHG inventory recalculations after the time of the decision of the emission reduction target. Estimated emissions (FY2020 and FY2030) and change ratio from base year (from FY2005 and FY2013) show the values at the time of the decision of the emission reduction target.

[25] These estimated removals are not directly used for archiving reduction target in FY2020 and 2030. The emission and removal sources in FY 2020 and 2030 don't completely correspond with those in FY2005 and 2013.

4.2 Assessment of total effect of policies and measures

The reductions achieved by emission reduction measures have been quantified for methane, nitrous oxide and fluorinated 4 gases. Reduced emissions in FY2020 consists of methane reduction amounted to 0.8 Mt-CO_2 eq., followed by nitrous oxide (0.6 Mt-CO_2 eq.), and fluorinated gases (18.5 Mt-CO_2 eq.) for a total of 19.8 Mt-CO_2 eq. In addition, reduced emissions in FY2030 consists of methane reduction amounted to 2.1 Mt-CO2 eq., followed by nitrous oxide (0.9 Mt-CO_2 eq.), and fluorinated gases (48.2 Mt-CO_2 eq.) for a total of 51.2 Mt-CO_2 eq. (Table 4-9)

For CO_2, the estimation of mitigation impact except some measures is shown in CTF Table3. However, since it is difficult to quantify the estimation of mitigation impact for all measures and definition of the estimation in CTF Table3 is not the same for all measures, the total level of reduced emissions cannot be calculated.

Table 4-9 Future level of reduced emissions by mitigation actions

	reduced emissions	
	FY2020	FY2030
	(Mt-CO_2)	(Mt-CO_2)
Methane	0.8	2.1
Nitrous oxide	0.6	0.9
Fluorinated gases	18.5	48.2
Total	**19.8**	**51.2**

4.3 Methodology

4.3.1 Key parameters and assumptions

The outlook on the macro frame below based on estimated economic growth rate, population and other parameters is considered for projections.

Table 4-10 Key assumptions on the macro frame (key parameters and assumptions) (CTF Table 5)

item	unit	Actual values						estimated values			
		FY1990	FY1995	FY2000	FY2005	FY2010	FY2011	FY2015	FY2020	FY2025	FY2030
real GDP	trillion(2005)yen			477	507	512	514	NE	611	NE	711
population	10^3people	123,611		126,926	127,766	128,058	127,799	NE	124,100	NE	116,618
household	10^3households	40,670		46,782	49,063	51,842	52,055	NE	53,053	NE	51,231
crude steel production	10^6t	112		107	113	111	106	NE	NE	NE	120
cement production	10^6t	87		79	74	56	58	NE	NE	NE	56
ethylene production	10^6t	6		7	8	7	6	NE	NE	NE	6
paper and paperboard production	10^6t	29		30	31	27	27	NE	NE	NE	27
Commercial floor area	10^6m^2				1,759	1,831	1,828	NE	NE	NE	1,971

*Projections compiled from "Economic and Fiscal Projections for Medium to Long Term Analysis", "Medium projection (National Institute of Population and Social Security Research)", "Long-term Energy Supply and Demand Outlook relevant material (July, 2015) (Agency for Natural Resources and Energy)" and other sources.

4.3.2 Estimation method for energy-related CO_2 emissions

4.3.2.1 Fuel combustion (CO_2)

Future projected values of energy consumptions and CO_2 emissions are calculated based on the energy supply and demand model. The entire structure of the energy supply and demand model is shown in Figure 4-1. Table 4-11 shows description for primary sub models included in the energy supply and demand model.

Table 4-11 Primary sub models included in the energy supply and demand model

Sub models	Details
Macroeconomic model	Estimates economic activity indices which influence energy demand directly /indirectly on the basis of calculation consistently balanced macro frames such as income distribution, production market, labor market and general prices
Secondary energy price model	Estimates energy purchase prices which influence energy demand and selection behavior using import prices of energy such as crude oil and LNG and domestic general price index.
Optimum generation planning model	For electric power demand estimated by the energy supply and demand model, the economic and optimum generation mix (electric power generation and installed capacity) is estimated by dynamically minimizing total system cost (equipment cost and fuel expenses) after conversion into discounted current value within a target period. The optimum method is dynamic programming.
Elements bottom-up model	Estimates energy conservation indicators such as efficiency of home appliances and fuel consumption of vehicles to reflect an effect clearly based on top runner standard which is difficult to be dealt with in regression macroeconomic model.
Energy supply and demand model	Estimates energy demand in each final consumption sector using economic activity indices, price indices, and energy conservation indicators which are calculated from above-mentioned models. Secondly, primary energy supply is estimated through energy conversion such as electric power generation. Finally, CO_2 emissions are calculated based on the consumption by energy sources.

Reference: Energy environment integrated strategy investigation (research about the future structure of energy supply and demand) investigation report (The Institute of Energy Economics, Japan)

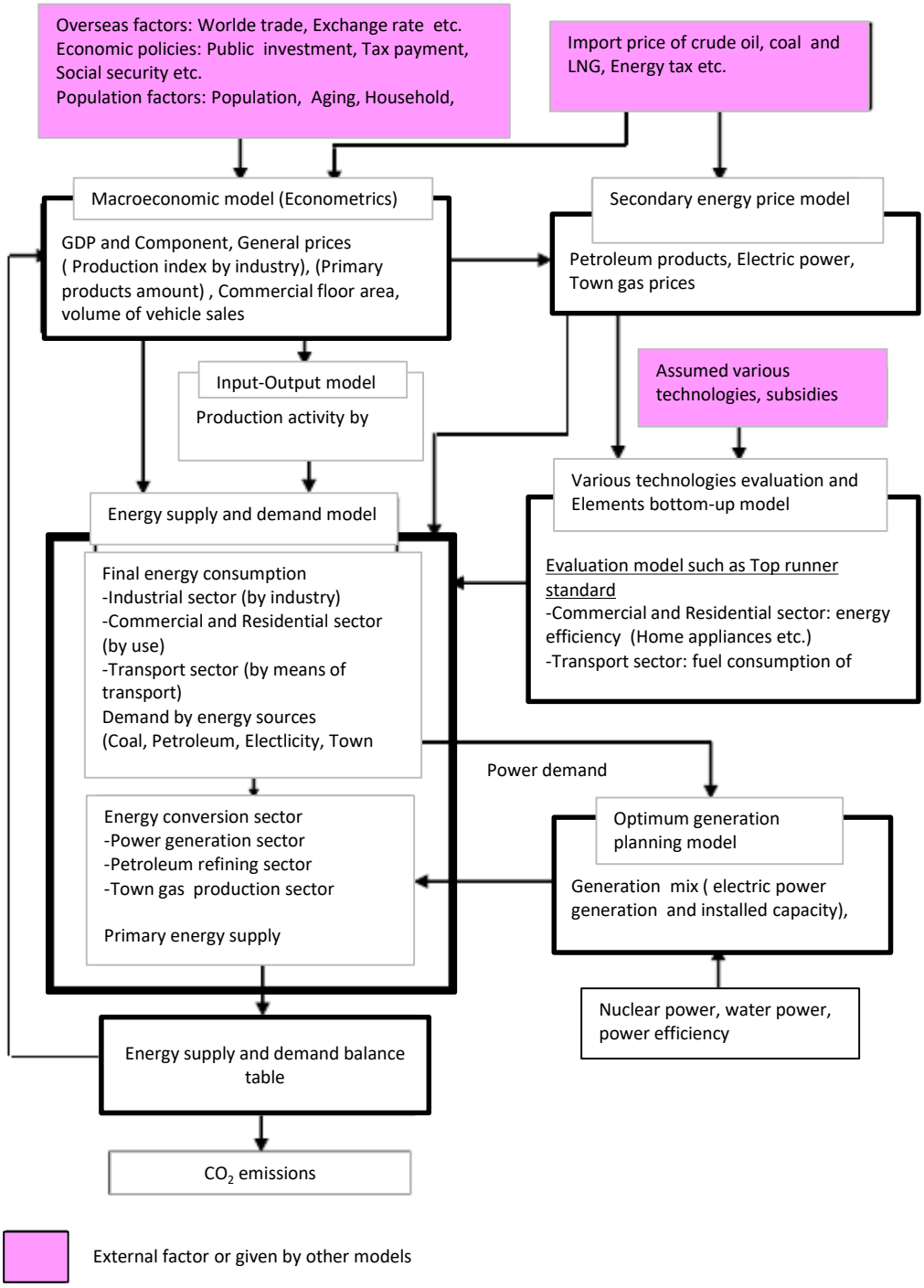


Figure 4-1 Overall structure for energy supply and demand model

Reference: Energy environment integrated strategy investigation (research about the future structure of energy supply and demand) investigation report (The Institute of Energy Economics, Japan)

Primary parameters used in the energy supply and demand models are shown in Table 4-10. Structure of power generation (Energy Mix) is shown in Table 4-12. These data are entered as exogenous values. In the model, in order to maintain consistency with the energy mix, the energy consumptions and the emissions in future are calculated based on sound policies and measures and technologies taking into account technical constraints and cost-related issues.

Table 4-12 Energy mix used for 2030 emission projection

	FY2030
●Final energy consumption	326 10^6kl
(Reduction of energy saving)	50 10^6kl
●Total electric power generation	approximately 1,065 TWh
Renewable energy	approximately 22%～24%
Nuclear	approximately 22%～20%
Coal	approximately 26%
LNG	approximately 27%
Oil	approximately 3%
(Breakdown of Renewable energy)	
Solar	approximately 7.0%
Wind	approximately 1.7%
Geothermal	approximately 1.0%～1.1%
Hydropower	approximately 8.8%～9.2%
Biomass	approximately 3.7%～4.6%

4.3.2.2 Fuel combustion (CH_4, N_2O)

Based on the GHG inventory, projections of CH_4 and N_2O emissions from fuel combustion cover 5 sectors: Industry; Commercial and Other; Residential; Transport; and Energy conversion.

The projected future emissions are based on calculation multiplying projected fuel consumption for each sector by projected emission factor in accordance with estimation method of the GHG inventory.

The projected future activity data is established based on the future estimated indices in the associated sectors, such as the projected future Indices of Industrial Production in the industrial sector, the projected future commercial floor area in the Commercial and Other sector, and the projected future number of households in the Residential sector.

The projected emission factors are the same as those used as current emission factors assuming that the present emission level is supposed to continue in the future.

4.3.2.3 Fugitive emissions from fuels

Based on the GHG inventory, projections of fugitive emissions from fuels cover 2 sub sectors: solid fuel (CO_2, CH_4) and fugitive emissions from oil, natural gas and other energy (CO_2, CH_4, N_2O).

The projected future emissions are based on calculation multiplying projected activity data (for example, Coal, crude oil and natural gas outputs, crude oil refining volume and natural gas sales) by projected emission factor for each emission source in accordance with estimation method of the GHG inventory.

The projected future activity data is established based on the future estimated domestic energy supply and demand in the fuel combustion sector. Activity data associated with the domestic production of fossil fuels such as the amount of production of coal, crude oil and natural gas is established supposing that current activity level is supposed to continue in the future.

The projected emission factors are the same as those used as current emission factors assuming that the present emission level is supposed to continue in the future.

4.3.2.4 CO_2 transport and storage

In Japan, current and future CO_2 emissions and removals from this sector are not calculated.

4.3.3 IPPU sector

4.3.3.1 CO_2, CH_4, and N_2O

Based on estimation in the GHG inventory, projected future emissions from IPPU sector cover 5 sub sectors: mineral industry (CO_2), chemical industry (CO_2, CH_4, N_2O), metal production (CO_2, CH_4) non-energy products from fuels and solvent use (CO_2) and other product manufacture and use (N_2O).

The projected future emissions are based on calculation multiplying projected activity data (for example, clinker production and ethylene production) by projected emission factor for each emission source in accordance with estimation method of the GHG inventory.

The projected future activity data is established based on the future production of various industrial products and the projected future Indices of Industrial Production. However, activity data varies in accordance with the level of measures when implementation of measures influences activity data.

The projected emission factors are the same as those used as current emission factors assuming that the present emission level is supposed to continue in the future.

4.3.3.2 Fluorinated gases

Based on estimation in the GHG inventory, projected future emissions from fluorinated gases cover 5 sectors: chemical industry (HFCs, PFCs, SF_6, NF_3), metal production (HFCs, PFCs, SF_6), electronic industry (HFCs, PFCs, SF_6, NF_3), use of ozone-depleting substance alternative (HFCs, PFCs) and other product manufacture and use (PFCs, SF_6).

The projected future emissions are based on calculation multiplying projected activity data (for example, the amount of charged refrigerant by type of refrigerant) by projected emission factor for each emission source in accordance with estimation method of the GHG inventory.

4.3.4 Agriculture sector

Based on estimation in the GHG inventory, projected future emissions from agriculture sector cover 7 sub sectors: enteric fermentation(CH_4), manure management(CH_4, N_2O), rice cultivation(CH_4), agricultural soil(N_2O), field burning of agricultural waste(CH_4, N_2O), lime application (CO_2)and urea application (CO_2).

The projected future emissions are based on calculation multiplying projected activity data (for example, number of domestic animals and area of cropland) by projected emission factor for each emission source in accordance with estimation method of the GHG inventory.

The projected future activity data is established based on the future number of livestocks and area of cropland in “The Basic Plan for Food, Agriculture and Rural Areas (Ministry of Agriculture, Forestry and Fisheries, Cabinet decision on March 31, 2015)”. However, activity data varies in accordance with the level of measures when implementation of measures influences activity data.

The projected emission factors are the same as those used as current emission factors assuming that the present emission level is supposed to continue in the future. As for the resource which emission reduction measures is implemented, current emission factors decrease in accordance with the level of reduction measures.

4.3.5 LULUCF sector

Based on estimation in the GHG inventory, projected future emissions and removals from LULUCF sector covers CO_2 emissions and removals resulting from carbon stock change and non-CO_2 emissions on forest land, cropland, grassland, wetlands, settlements, and other land.

The projection of LULUCF sector covers all the GHG inventory categories and is based on accumulation of four assumptions; 1) target of measures for managing forest carbon sink, 2) target of measures to increase

carbon sinks in agricultural soils, 3) target of urban greening, and 4) projected amount of emissions and removals from other sources and sinks which are not covered in 1) to 3).

1) The projected net removals of forest land are consistent with the targets amount of carbon sinks in forests through implementing measures for managing forest carbon sinks, including activities of afforestation, reforestation and deforestation under Article 3.3 and forest management under Article 3.4 of the Kyoto Protocol. These removals by forest land are calculated by conversion of the net carbon stock changes of the envisaged state of forests that comes from KP-LULUCF activities such as appropriate forest development and conservation based on the Basic Plan for Forest and Forestry forests into CO_2 equivalent by multiplying a coefficient.

2) The projection of carbon sinks in agriculture soil is represented as net emissions and which are consistent with the projected amount of net emissions from mineral soils of cropland and grassland used for preparing the target amounts of measures to increase carbon sinks in agricultural soils. The scope of this projection is in line with the activities contribute to the LULUCF activities under article 3, paragraph 4 of the Kyoto Protocol (cropland management and grassland management). These estimations are based on mathematical model (revised Roth-C, Rothamsted Carbon Model), future temperature and future cultivated area provided in the Basic Plan for Food, Agriculture and Rural Areas.

3) The net removals of urban greening in settlements are consistent with the targets amount of carbon sinks due to promotion of urban greening, including revegetation as LULUCF activities under article 3, paragraph 4 of the Kyoto Protocol. These are calculated, estimating the area of urban green areas under 30 years (activity data), in accordance with estimation method of the GHG inventory.

4) The emissions and removals not contained in 1) to 3) (about net emissions of 200 kt CO_2 as total) are estimated in each most detailed category and pool level. Estimations relating to cropland and grassland (not covered 2)) e calculated by using future cultivated area based on the value provided in the Basic Plan for Food, Agriculture and Rural Areas, in accordance with estimation method of the GHG inventory.. Other small sources of emissions are estimated by simple extrapolation, etc., without the assumption of scenarios, because the contribution of these emissions and removals are not large.

4.3.6 Waste sector

Based on estimation in the GHG inventory, projected future emissions from waste sector cover 4 sectors: solid waste disposal (CH_4), biological treatment of solid waste (CH_4, N_2O), incineration and open burning of waste (CO_2, CH_4, N_2O) and wastewater treatment and discharge (CH_4, N_2O).

The projected future emissions are based on calculation multiplying projected activity data (for example, the amount of municipal waste and industrial waste, and amount of domestic wastewater and Industrial wastewater) by projected emission factor for each emission source in accordance with estimation method of the GHG inventory.

The future projected activity data is established based on future population (Municipal Waste) and industrial activity (Industrial waste). However, activity data varies in accordance with the level of measures when implementation of measures influences activity data.

The projected emission factors are the same as those used as current emission factors assuming that the present emission level is supposed to continue in the future.

4.4 Sensitivity Analysis

As a sensitivity analysis, the estimation of impact on the energy-related CO_2 and cost in accordance with the changes of the generation mix is calculated. The result is shown in Table 4-13. In the case of changes of power supply resource by 1.0%, if coal-fired power generation decreases by 1.0% and nuclear power generation increases by 1.0% for example, CO_2 emissions decrease 8.4Mt CO_2 and the power generation cost decreases by 34 billion yen.

Table 4-13 Impact on the energy-related CO_2 and cost in the case of fluctuation in the generation mix

	Coal ▲1%	LNG ▲1%	Nuclear ▲1%	Renewable Energy ▲1%
Coal +1%		+4.4MtCO$_2$ ▲64 billion yen	+8.4MtCO2 +34 billion yen	+8.4MtCO2 ▲184 billion yen
LNG +1%	▲4.4MtCO2 +64 billion yen		+4.0MtCO2 +98 billion yen	+4.0MtCO2 ▲120 billion yen
Nuclear +1%	▲8.4MtCO2 ▲34 billion yen	▲4.0MtCO2 ▲98 billion yen		±0MtCO2 ▲ 218 billion yen
Renewable Energy +1%	▲8.4MtCO2 +184 billion yen	▲4.0MtCO2 +120 billion yen	±0MtCO2 +218 billion yen	

*Values are rounded numbers

Reference: Long-term Energy Supply and Demand Outlook relevant material (July 2015) (Agency for Natural Resources and Energy.)

4.5 Differences from the projections reported in the BR2

4.5.1 Changes in projection methodologies

No changes in projection methodologies have been made after Japan's Second Biennial Report (BR2) was submitted in December, 2015.

In BR2, projection methodologies were changed from those in Japan's 6th National Communication Report (NC6) and Japan's First Biennial Report (BR1) submitted in December, 2013. As for changes in BR2, refer to BR2.

4.5.2 Comparison of projections

Future projected emission results in FY2020 and FY2030 are the same as those in BR2.

In BR2, future projected value changed in accordance with the changes in projection methodologies from NC6 and BR1 submitted in December, 2013. For comparison result of future projected value in NC6/BR1 and BR2, refer to BR2.

Chapter 5

Financial, Technological and Capacity-building Support

5.1 Overview

Japan has implemented various support projects to assist developing countries, especially those making efforts to reduce GHG emissions as well as those which are vulnerable to the negative impacts of climate change. As reported in the second biennial report, Japan developed the "Proactive Diplomatic Strategy for Countering Global Warming (ACE: Actions for Cool Earth)" in November 2013, and announced to provide for developing countries total 1.6 trillion yen (approx. USD 16 billion) by mobilizing Official Development Assistance (ODA), Other Official Flows (OOF), and Private Finance (PF) for mitigation and adaptation during the 3-year period between 2013 and 2015 to strengthen "partnership" with various countries and stakeholders. This commitment was achieved in approximately one year and a half.

In November 2015, at COP21, Japan announced the "Actions for Cool Earth (ACE) 2.0" and committed to providing approximately 1.3 trillion yen of public and private climate finance to developing countries in 2020. Japan continues its efforts toward a goal of mobilizing jointly USD 100 billion per year including both public and private finance by 2020 as the long-term finance.

In addition, at the 7th Pacific Islands Leaders Meeting, Japan held "climate change and development forum" and the participants exchanged their views on the ways to use climate finance effectively in Pacific islands. Further, in 2017, in order to establish a decarbonised and a resilient society, Japan announced "Japan's Assistance initiatives to Address Climate Change 2017", which shows Japan's vision and specific programs to accelerate climate change measures and sustainable development in developing countries.

Under these efforts, financial support from Japan in two years from 2015 to 2016 reached approximately USD 23.3 billion (public finance amounted approximately USD 19.5 billion, private finance amounted approximately USD 3.8 billion).

Furthermore, at the G20 summit in November 2014, Japan announced USD 1.5 billion contributions to the Green Climate Fund (GCF). After approval of a bill stipulating the necessary measures for the contribution, Japan signed an agreement with the GCF secretariat to contribute 1.5 billion USD. This enabled GCF to start funding.

5.2 National Approach to Tracking and Reporting Provision of Support to non-Annex Parties

The main types of climate change finance from Japan are as follows (1) grant aid; (2) loan; (3) technical assistance; (4) contribution to international organizations; (5) OOF; and (6) private finance. The Ministry of Foreign Affairs, Ministry of Finance, Ministry of Agriculture, Forestry and Fisheries, Ministry of Economy, Trade and Industry, Ministry of the Environment and Japan International Cooperation Agency (JICA) are implementing agencies of the types (1)-(3). The type (4) is contributions to the environment related funds and development organizations such as Global Environment Facility (GEF), Green Climate Fund(GCF), the World Bank, United Nations Development Programme (UNDP), which are implementing agencies of this type of assistance. Regarding type (5), relevant Japanese ministries and Japan Bank for International Cooperation (JBIC) are the main implementing agencies and type (6) is private finance mobilized by co-finance of JBIC. The Ministry of Foreign Affairs gathers abovementioned information from the relevant ministries and institutions and compiles the Japanese climate change finance information.

Japan made a list of tangible examples of projects which contribute to climate change mitigation and adaptation in developing countries using the OECD Rio marker as one of the references. Based on the above list, Japan councils and reports projects contributing to climate change mitigation and adaptation. The scope of Japan's support in addressing climate change is non-Annex I countries of the UNFCCCC. Climate-specific funds are specifically those assessed to support climate change measures (mitigation, adaptation and cross-cutting).

In this report, Japan's climate finance is newly committed or contributed during the reporting period, in 2015 and 2016, therefore, it is "new and additional". Japan defines new and additional climate finance as newly committed or disbursed finance which contributes to climate change measures in developing countries. Japan seeks new funding from the Diet on an annual basis. Climate finance reported by Japan is

newly committed or disbursed finance during a given period. In other words, we do not include previously committed or disbursed climate finance. In addition, funds reported as committed are those that have been appropriated by Congress or cabinet decisions, or for which a commitment is made by a diplomatic agreement but not yet actually paid during the reporting period. Funds reported as disbursed are those that have been actually transferred to recipient countries.

5.3 Finance

5.3.1 Measures to Ensure the Resources to Address the Needs of non-Annex I Parties

434 projects have been implemented in as many as 91 countries as of December 2016. Through the Japanese Embassies and JICA's overseas offices stationed in a number of developing countries, the Japanese Government has been developing projects in close consultation with the government of developing countries and international organizations in response to the needs of recipient countries. Japan has been providing assistance through various channels, including grant aid, concessional loan and technical assistance, taking into account local economic situations and content of projects.

In addition, Japan has actively engaged in adaptation support for Pacific islands which are especially vulnerable to the negative impacts of climate change and implemented 44.1 million USD to address climate change in those areas.

5.3.2 Assistance through Bilateral and Regional Frameworks and Multilateral Channels

5.3.2.1 Overview

The main components of our assistance which amount to USD 22.3 billion as of December 2016 are as follows. It should be noted that Japan’s assistance for developing countries accords importance to establishing a mechanism that not only ensures the effective use of public financing, but also facilitates the mobilization of private financing. Large-scale projects on infrastructure, such as the introduction of facilities with high energy efficiency and for renewable energy, and the construction of electric power transmission facilities, will require massive investment, and thus leveraging the private financing would be crucially important (this is why Japanese private financing of over USD 3.8 billion had been mobilized for assistance to developing countries, as of December 2016). Japan will also assist the capacity building to improve access to funds such as Green Climate Fund (GCF), Least Developed Countries Fund (LDCF) and Special Climate Change Fund (SCCF) by providing study and training sessions.

a. Mitigation: USD 21.13 billion

Assisting developing countries in such areas as the promotion of renewable energy including solar energy, biomass and geothermal, and the introduction of facilities with high energy efficiency, to contribute to reducing GHG emissions.

- Geothermal power plant planning (Kenya, Bolivia and Turkey : USD 942 million)
- Projects for solar electricity generation system (Jordan, Egypt :USD 178 million)
- Promotion of biomass energy (Indonesia,: USD 0.24 million)
- Electric transmission installment planning (8 countries including Myanmar, Viet Nam, India, Sri Lanka : USD 1.92 billion)

b. Adaptation: USD 1.9 billion

Strengthening developing countries’ capability to cope with natural disasters caused by climate change, and providing necessary equipment and facilities to take precautionary measures against and to recover from natural disasters including floods and droughts.

- Improvement of capabilities to cope with natural disasters caused by climate change (17 countries including Myanmar, Lao PDR, Cambodia and Philippines: USD 116 million)
- Flood control measures (Pakistan, Colombia: USD 5.97 million)
- Development of Irrigation facilities and capacity building for irrigated agriculture (India, Afghanistan, Tanzania and Madagascar: USD 35 million)
- Water supply planning (14 Countries including Iraq, Sri Lanka: USD 100 million)

c. Mitigation and Adaptation: USD 537 million

Assisting developing countries to tackle climate change issues (both mitigation and adaptation) by providing contribution to the multilateral fund and program loan to address climate change.

- Climate Change Program Loan (USD 218 million)

d. REDD+: USD 7.07 million

Assisting developing countries to conduct a survey on forest resources, formulate forest management plan and facilitate afforestation including through the provision of equipment necessary for such activities.

- Implementation of Forest conservation and capacity building (Asia, Africa, Peru, Guatemala : USD 2.86 million)

Table 5-1 Provision of public financial support: summary information in 2015 (CTF Table 7)

Allocation channels	*Year*									
	Japanese yen - JPY					*USD*				
	Core/ general	*Climate-specific*				*Core/ general*	*Climate-specific*			
		Mitigation	*Adaptation*	*Cross-cutting*	*Other*		*Mitigation*	*Adaptation*	*Cross-cutting*	*Other*
Total contributions through multilateral channels:	247,676.99	2,576.51	84.09	11,411.53	0.00	2,155.22	22.42	0.73	99.40	0.00
Multilateral climate change funds	15,000.00	2,576.51	84.09	10,719.97	0.00	130.53	22.42	0.73	93.38	0.00
Other multilateral climate change funds	NE	2,576.51	84.09	273.42	0.00	NE	22.42	0.73	2.38	0.00
Multilateral financial institutions, including regional development banks	196,780.76	NE	NE	NE	NE	1,712.33	NE	NE	NE	NE
Specialized United Nations bodies	35,896.23	NE	NE	691.56	NE	312.36	NE	NE	6.02	NE
Total contributions through bilateral, regional and other channels		860,218.00	120,838.00	34,649.00			7,485.36	1,051.50	301.51	
Total	247,676.99	862,794.51	120,922.09	46,060.53		2,155.22	7,507.78	1,052.23	400.91	

Footnotes

The unit of JPY is "million yen" and the unit of USD is "million dollars".

The exchange rate is 114.92 JPY/USD.

Each Party shall provide an indication of what new and additional financial resources they have provided, and clarify how they have determined that such resources are new and additional. Please provide this information in relation to table 7(a) and table 7(b).

Documentation Box:

New and Additional Climate Finance

Japan defines new and additional climate finance as newly committed or disbursed finance which contributes to climate change measures in developing countries. Japan seeks new funding from the Diet on annual basis. Climate finance reported by Japan is newly committed or disbursed finance during a given period. In other words, we do not include previously committed or disbursed climate finance.

Table 5-2 Provision of public financial support: summary information in 2016 (CTF Table 7)

Allocation channels	Year									
	Japanese yen - JPY					USD				
	Core/ general	Climate-specific				Core/ general	Climate-specific			
		Mitigation	Adaptation	Cross-cutting	Other		Mitigation	Adaptation	Cross-cutting	Other
Total contributions through multilateral channels:	249,982.13	2,576.51	174.59	18,851.55	0.00	2,175.28	22.42	1.52	164.06	0.00
Multilateral climate change funds	15,000.00	2,576.51	174.59	18,418.12	0.00	130.53	22.42	1.52	160.29	0.00
Other multilateral climate change funds	NE	2,576.51	79.02	249.07	0.00	NE	22.42	0.69	2.18	0.00
Multilateral financial institutions, including regional development banks	197,595.73	0.00	0.00	NE	NE	1,719.42	0.00	0.00	NE	NE
Specialized United Nations bodies	37,386.40	0.00	0.00	433.43	0.00	325.33	0.00	0.00	3.77	0.00
Total contributions through bilateral, regional and other channels		1,137,860.00	63,650.00	27,851.00			9,901.31	553.85	242.36	
Total	249,982.13	1,140,436.51	63,824.59	46,702.55		2,175.28	9,923.73	555.37	406.42	

Footnotes

The unit of JPY is "million yen" and the unit of USD is "million dollars"

The exchange rate is 114.92 JPY/USD.

Each Party shall provide an indication of what new and additional financial resources they have provided, and clarify how they have determined that such resources are new and additional. Please provide this information in relation to table 7(a) and table 7(b).

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5.3.2.2 Multilateral Channels

a. Cooperation with International Organizations

・Cooperation with UNDP (Adaptation)

Through UNDP, Japan has been implementing a grant aid project including activities such as providing technical support for managing natural disaster risk to climate change in Haiti.

・Cooperation with the Global Adaptation Network (GAN) and the Asia Pacific Adaptation Network (APAN) (Adaptation)

Supports GAN and APAN, established according to proposed by UNEP, to enhance collaboration and to share knowledge on climate change adaptation among policy-makers and practitioners in the Asia-Pacific region and the world.

・ Contribution to GEF (Mitigation/Adaptation)

Japan made a contribution to the Global Environment Facility (GEF), which is a multilateral financial mechanism to support developing countries' efforts to preserve and improve the global environment.

・ Contribution to GCF (Mitigation/Adaptation)

Japan made a contribution to the Global Climate Fund (GCF), which is a fund for supporting reduction of greenhouse gases and addressing impacts of climate change in developing countries

Table 5-3 Provision of public financial support: contribution through multilateral channels in 2015 (CTF Table 7(a))

Donor funding	Total amount				Status	Funding source	Financial instrument	Type of support	Sector
	Core/general		Climate-specific						
	Japanese yen - JPY	USD	Japanese yen - JPY	USD					
Total contributions through multilateral channels	247,676.99	2,155.22	14,072.13	122.55					
Multilateral climate change funds	15,000.00	130.53	13,380.57	116.53					
1. Global Environment Facility	15,000.00	130.53	NE	NE	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
2. Least Developed Countries Fund									
3. Special Climate Change Fund									
4. Adaptation Fund									
5. Green Climate Fund	NE	NE	10,319.92	89.90	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
6. UNFCCC Trust Fund for Supplementary Activities	NE	NE	126.63	1.10	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
7. Other multilateral climate change funds	NE	NE	2,934.02	25.53					
(1) The Multilateral Fund for the Implementation of the Montreal Protocol	NE	NE	2,515.96	21.89	Disbursed	ODA	Grant	Mitigation	Cross-cutting
(2) Vienna Convention and the Montreal Protocol	NE	NE	60.55	0.53	Disbursed	ODA	Grant	Mitigation	Cross-cutting
(3) Asia Pacific Adaptation Network(APAN) and Global Adaptation	NE	NE	84.09	0.73	Disbursed	ODA	Grant	Adaptation	Cross-cutting
(4) Asia-Pacific Network for Global Change Research(APN)	NE	NE	273.42	2.38	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
Multilateral financial institutions, including regional development banks	196,780.76	1,712.33	NE	NE					
1. World Bank	15,021.46	130.71	NE	NE	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
2. International Finance Corporation	703.99	6.13	NE	NE	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
3. African Development Bank	768.10	6.68	NE	NE	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
4. Asian Development Bank	8,484.98	73.83	NE	NE	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
5. European Bank for Reconstruction and Development	131.76	1.15	NE	NE	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
6. Inter-American Development Bank	708.10	6.16	NE	NE	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
7. Other	170,962.37	1,487.67							
(1) International Development Association	111,398.55	969.36	NE	NE	Disbursed	ODA	Equity	Cross-cutting	Cross-cutting
(2) African Development Fund	14,420.82	125.49	NE	NE	Disbursed	ODA	Equity	Cross-cutting	Cross-cutting
(3) Asian Development Fund	39,269.74	341.71	NE	NE	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
(4) Fund for Special Operations (IDB)	736.76	6.41	NE	NE	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
(5) African Development Bank	3,137.15	27.30	NE	NE	Disbursed	ODA	Equity	Cross-cutting	Cross-cutting
(6) Inter-American Development Bank	1,999.35	17.40	NE	NE	Disbursed	ODA	Equity	Cross-cutting	Cross-cutting
Specialized United Nations bodies	35,896.23	312.36	691.56	6.02					
1. United Nations Development Programme	34,687.80	301.84	NE	NE	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
2. United Nations Environment Programme	1,208.43	10.52	NE	NE	Disbursed	ODA, OOF	Grant	Cross-cutting	Cross-cutting
3. Other	NE	NE	691.56	6.02					
United Nations Framework Convention on Climate Change	NE	NE	670.68	5.84	Disbursed	OOF	Grant	Cross-cutting	Cross-cutting
Intergovernmental Panel on Climate Change	NE	NE	20.88	0.18	Disbursed	OOF	Grant	Cross-cutting	Cross-cutting
Other									

Footnotes

The unit of JPY is "million Yen". The unit of USD is "million dollars"

The exchange rate is 114.92 JPY/USD. Values converted from Japanese Yen to USD using the 114.92 yen/US dollar rate may not match the total USD amount reported due to rounding.

Table 5-4 Provision of public financial support: contribution through multilateral channels in 2016 (CTF Table 7(a))

Donor funding	Total amount				Status	Funding source	Financial instrument	Type of support	Sector
	Core/general		Climate-specific						
	Japanese yen - JPY	USD	Japanese yen - JPY	USD					
Total contributions through multilateral channels	249,982.13	2,175.28	21,602.65	188.00					
Multilateral climate change funds	15,000.00	130.53	21,169.22	184.23					
1. Global Environment Facility	15,000.00	130.53	NE	NE	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
2. Least Developed Countries Fund	NE	NE	95.57	0.83	Disbursed	ODA	Grant	Adaptation	Cross-cutting
3. Special Climate Change Fund									
4. Adaptation Fund									
5. Green Climate Fund	NE	NE	18,021.35	156.82	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
6. UNFCCC Trust Fund for Supplementary Activities	NE	NE	147.70	1.29	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
7. Other multilateral climate change funds	NE	NE	2,904.60	25.29					
(1) The Multilateral Fund for the Implementation of the Montreal	NE	NE	2,515.96	21.89	Disbursed	ODA	Grant	Mitigation	Cross-cutting
(2) Vienna Convention and the Montreal Protocol	NE	NE	60.55	0.53	Disbursed	ODA	Grant	Mitigation	Cross-cutting
(3) Asia Pacific Adaptation Network(APAN) and Global Adaptation	NE	NE	79.02	0.69	Disbursed	ODA	Grant	Adaptation	Cross-cutting
(4) Asia-Pacific Network for Global Change Research(APN)	NE	NE	249.07	2.18	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
Multilateral financial institutions, including regional development banks	197,595.73	1,719.42	NE	NE					
1. World Bank	15,913.15	138.47	NE	NE	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
2. International Finance Corporation	2,904.67	25.28	NE	NE	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
3. African Development Bank	751.66	6.54	NE	NE	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
4. Asian Development Bank	6,758.01	58.81	NE	NE	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
5. European Bank for Reconstruction and Development	296.76	2.58	NE	NE	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
6. Inter-American Development Bank	1,261.59	10.98	NE	NE	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
7. Other	169,709.89	1,476.76	NE	NE					
(1) International Development Association	111,843.45	973.23	NE	NE	Disbursed	ODA	Equity	Cross-cutting	Cross-cutting
(2) African Development Fund	14,485.30	126.05	NE	NE	Disbursed	ODA	Equity	Cross-cutting	Cross-cutting
(3) Asian Development Fund	39,269.74	341.71	NE	NE	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
(4) African Development Bank	3,207.81	27.91	NE	NE	Disbursed	ODA	Equity	Cross-cutting	Cross-cutting
(5) Inter-American Investment Corporation	903.59	7.86	NE	NE	Disbursed	ODA	Equity	Cross-cutting	Cross-cutting
Specialized United Nations bodies	37,386.40	325.33	433.43	3.77					
1. United Nations Development Programme	36,221.19	315.19	NE	NE	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
2. United Nations Environment Programme	1,165.21	10.14	NE	NE	Disbursed	ODA, OOF	Grant	Cross-cutting	Cross-cutting
3. Other	NE	NE	433.43	3.77					
United Nations Framework Convention on Climate Change	NE	NE	413.02	3.59	Disbursed	OOF	Grant	Cross-cutting	Cross-cutting
Intergovernmental Panel on Climate Change	NE	NE	20.41	0.18	Disbursed	OOF	Grant	Cross-cutting	Cross-cutting
Other									

Footnotes

The unit of JPY is "million Yen". The unit of USD is "million dollars"

The exchange rate is 114.92 JPY/USD. Values converted from Japanese Yen to USD using the 114.92 yen/US dollar rate may not match the total USD amount reported due to rounding.

5.3.2.3 Bilateral and Regional Frameworks Channels

a. Grant Aid in Bilateral Cooperation

・Prevention of Disaster and Rehabilitation (Adaptation)

In 38 countries, Japan provided a variety of assistance such as measures taken for adaptation to climate change including large scale typhoon or cyclone; supports for introduction of meteorological observing equipment and system for building emergency information transmission structure, including relevant technical assistance, promotion of economic and social development efforts by vulnerable countries which are working on the improvement of the disaster preventing ability, the rehabilitation from natural disasters and disaster prevention, through providing grant aids for the provision of necessary materials and equipment, etc.

In Mauritius, Bangladesh and Pakistan, Japan has provided support in the installation of meteorological observing equipment and others as a part of measures against climate change and disaster prevention. In addition, in Myanmar and Sri Lanka, Japan held seminars on the development of disaster resilient communities for educational institutions, community residents and the others. Japan provided emergency relief supplies including foods, Non-Food Items, learning support goods and others for flood victims in Myanmar and Malawi.

・Water Supply (Adaptation)

Japan supports constructing and repairing the water supply facilities in the areas which have been suffering from drought caused by climate change. For example, in Rwanda, Japan has been cooperating in constructing and repairing the water supply facilities and providing equipment including two intake facilities, one deep-well water supply facility, distribution pipelines and public tap stand in Eastern three provinces where the safe water access rate remains at 66.6%. In addition, in Rwanda, Japan supports to provide educational activities for promoting sanitation awareness and improve capacity for their maintenance and management. In Koror State, the biggest city in Palau, Japan supports to improve the stability of water supply through the rehabilitation of old water supply and sewage systems.

・Support for Agriculture (Adaptation)

In the southwest of Alaotra Lake located in Madagascar, Japan supports to ensure a stable supply of irrigation water through rehabilitating irrigation facilities and contributed to expansion in rice production and improvement of the living environment. In Afghanistan, Japan has been cooperating in developing organizational capacity of the Ministry of Agriculture Irrigation and Livestock (MAIL), expanding and improving irrigation facilities, and spreading elite plant potatoes.

・Training of human resources in climate change field (Mitigation/Adaptation)

Japan supports to create a Pacific Climate Change Center (PCCC) at the main office of the Secretariat of the Pacific Regional Environment Programme (SPREP) in Samoa. The PCCC will function as a base for human resource training in the field of climate change in Oceania to improve the resiliency of the region to environmental and climate change.

b. Loan Support in Bilateral Cooperation

・Introduction of Renewable Energy (Mitigation)

Japan contributes to sustainable development through the introduction of renewable energy to mitigate climate change effects as well as enhancing power supply. Japan has been cooperating in the construction of geothermal power plants in Laguna Colorada, Bolivia, and in Olkaria, middle area of Kenya. In Egypt, Japan supports to construct photovoltaic power plant and related facilities at the Hurghada Wind Power Plant, which is located in Hurghada City, in order to increase power supply, stabilize the network, and encourage the use of renewable energy. In Honduras, Japan contributes to stabilize electricity supply through rehabilitating and empowering the facilities of the existing Cañaveral and Río Lindo Hydroelectric Power Plants which provides 24% of the total electricity in Honduras.

・Improvement of Energy Access through the Maintenance of Electricity Transmission Equipment (Mitigation)

Japan has been cooperating in reducing GHG emissions by electrification of local areas and the improvement of transmission efficiency, while aiming for a transfer to clean energy. In Myanmar, in order to achieve reduction of power distribution loss rate and contribute to reducing GHG, Japan contributed to achieving stable power supply in Yangon area where there is the biggest electricity demand through rehabilitation and improvement of substations for distributions and development of substation equipment. In Odisha, India, in order to meet the expanding power demand due to the strong economic growth, Japan has been cooperating in improving transmission efficiency and stabilize power supply through repairing and reinforcing transmission lines and substations. In Sri Lanka, Japan supports to reduce transmission losses through constructing transmission lines on which Japan has a comparative advantage, in Greater Colombo and surrounding areas.

・Climate Change Program Loan (Mitigation/Adaptation)

Japan's ODA loan aid is implemented by JICA, and one of its characteristic programs is Climate Change Program Loan (CCPL). This project helps to develop a multi-year national climate change policy of developing countries (the "policy matrix") based on policy dialogues, and supports the implementation of those policies. In this process, Japan applies various ODA schemes such as loan aid or technical assistance. Japan monitors the implementation of the policy matrix every year, and considers the possibilities of extending loans. Japan is currently implementing the operation in Vietnam, using the Program Loan.

c. Technical Assistance in Bilateral Cooperation

・Prevention of Disaster and Rehabilitation (Adaptation)

In Colombia, Japan supports to develop a national disaster risk management system to reduce disaster risks including measures to address flood risks. In Mozambique, Japan supported to enhance the capacity for weather forecasting and early warning service, based on quality-controlled data.

・Water Supply (Adaptation)

In Rwanda and Kenya, Japan contributed to improving their capacity to reduce non-revenue water (NRW) through capacity building of planning for NRW reduction and supported to obtaining necessary knowledge and skills.

・Introduction of Energy Saving and Renewable Energy (Mitigation)

In Pakistan, Japan has been supporting the development of policy actions for Minimum Energy Performance Standard (MEPs) and Labelling systems in order to promote energy efficiency to meet the expanding demand for power. In Ethiopia, Japan supports to develop stable geothermal power source by improving capacity of public institutes on test drilling management and potential analysis. In Indonesia, Japan implemented technology development to cultivate grass plants suitable for bio-energy and useful materials in degraded Alang-alang grasslands, through rehabilitation of the degraded fields and conservation to productive agricultural or biomass production fields. In Fiji, Kiribati, Marshall, Tuvalu and Micronesia, Japan supported to capacity enhancement to formulate appropriate policy actions for introducing and expanding renewable energy and also improved the efficiency of the Hybrid Power Generation System that consists of Diesel Engine Generators (DGs) and renewable energy generators. Moreover in Fiji, Japan provided regional energy efficiency capacity development support for Pacific Countries, aiming to reduce the overall fuel consumption in the Region.

・Promotion of REDD+ Efforts (Adaptation/Mitigation)

In Cambodia and Myanmar, Japan provides technical supports to monitor forest carbon stocks for REDD+. In Peru and Kenya, Japan provides assistance in building capacity for sustainable forest management through improving the capacity of REDD+ implementing agencies. In addition, in Guatemala, Japan supports to implement capacity building for indigenous people to conserve forests in a sustainable way in order to prevent deforestation and forest degradation due to population expansion and agriculture

toward implementation of pilot projects for forest conservation and improvement of administrative function on REDD+ as well as the formulation of REDD+ projects.

Table 5-5 Provision of public financial support : contribution through bilateral, regional and other channels in 2015 (CTF Table 7(b))

No.	Recipient country/ region/project/programme	Total amount		Status	Funding source	Financial instrument	Type of support	Sector	Additional information
		Climate-specific							
		Japanese yen - JPY	USD						
	Total contributions through bilateral, regional and other channels	1,015,705.00	8,838.37						
1	Afganistan	2,687.00	23.38	Committed, Disbursed	ODA	Grant	Adaptation	Prevention and resoration of disaster, Agriculture	
2	Afcanistan, Kyrgyzstan, Tajikistan	596.00	5.19	Committed	ODA	Grant	Adaptation	Agriculture	
3	Antigua and Barbuda	584.00	5.08	Committed	ODA	Grant	Mitigation	Fishing	
4	Antigua and Barbuda	100.00	0.87	Disbursed	ODA	Grant	Adaptation	Prevention and resoration of disaster	
5	Africa	23.00	0.20	Disbursed	ODA	Grant	Mitigation	Energy, Forestry	
6	Asia	2,221.00	19.33	Committed, Disbursed	ODA,OOF	Grant	Mitigation	Cross-cutting	
7	Asia	36.00	0.31	Committed	ODA	Grant	Cross-cutting	Forestry	
8	Asia, Pacific	64.00	0.56	Disbursed	ODA,OOF	Grant	Adaptation	Cross-cutting	
9	Asia, Pacific	5,179.00	45.07	Disbursed	OOF	Grant	Mitigation	Cross-cutting, Energy	
10	Bangladesh	45,284.00	394.05	Committed	ODA,OOF	Grant, Concessional loan	Mitigation	Energy, Transport, Water and sanitation, Cross-cutting	
11	Bangladesh	44,351.00	385.93	Committed, Disbursed	ODA,OOF	Grant, Concessional loan	Adaptation	Prevention and resoration of disaster	
12	Bhutan	1,956.00	17.02	Committed	ODA	Grant	Adaptation	Prevention and resoration of disaster	
13	Bolivia	50.00	0.44	Committed	ODA	Grant	Adaptation	Prevention and resoration of disaster	
14	Brazil	15,125.00	131.61	Committed, Disbursed	OOF	Non-Concessional loan	Mitigation	Energy	
15	Brukina Faso, Paraguay	33.00	0.29	Committed	ODA	Grant	Mitigation	Agriculture	
16	Cambodia	41.00	0.36	Committed, Disbursed	OOF	Grant	Mitigation	Cross-cutting	
17	Cambodia	3,008.00	26.17	Committed, Disbursed	ODA,OOF	Grant	Adaptation	Water and sanitation, Forestry	
18	Cambodia	72.00	0.63	Committed	OOF	Grant	Cross-cutting	Forestry	
19	Cambodia, Viet Nam	69.00	0.60	Disbursed	OOF	Grant	Mitigation	Energy, Cross-cutting	
20	Cameroon	173.00	1.51	Disbursed	ODA	Grant	Cross-cutting	Forestry	
21	Chile	61.00	0.53	Committed, Disbursed	OOF	Grant	Mitigation	Energy	
22	China	107.00	0.93	Disbursed	ODA, OOF	Grant	Mitigation	Water and sanitation, Cross-cutting	
23	Cook Islands	100.00	0.87	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting	
24	Colombia	8.00	0.07	Committed	OOF	Grant	Mitigation	Agriculture	
25	Colombia	91.00	0.79	Disbursed	ODA	Grant	Adaptation	Prevention and resoration of disaster	

No.	Recipient country/ region/project/programme	Total amount		Status	Funding source	Financial instrument	Type of support	Sector	Additional information
		Climate-specific							
		Japanese yen - JPY	USD						
26	Costa Rica	29.00	0.25	Committed	OOF	Grant	Mitigation	Cross-cutting	
27	Developing countries	249.00	2.17	Committed, Disbursed	ODA,OOF	Grant	Mitigation	Energy, Cross-cutting, Forestry, Prevention and resoration of disaster	
28	Developing countries	16.00	0.14	Disbursed	ODA	Grant	Adaptation	Cross-cutting	
29	Developing countries	50.00	0.44	Disbursed	ODA	Grant	Cross-cutting	Forestry, Cross-cutting	
30	Global	93.00	0.81	Disbursed	OOF	Grant	mitigation	Energy	
31	Djibouti	32.00	0.28	Disbursed	OOF	Grant	Adaptation	Prevention and resoration of disaster	
32	Dominica	166.00	1.44	Committed	ODA	Grant	Mitigation	Fishing	
33	Dominican Republic	300.00	2.61	Disbursed	ODA	Grant	Adaptation	Prevention and resoration of disaster	
34	Ecuador	500.00	4.35	Disbursed	ODA	Grant	Mitigation	Transport	
35	El Salvador	5,000.00	43.51	Committed	ODA	Concessional loan	Adaptation	Prevention and resoration of disaster	
36	Ethiopia	16.00	0.14	Disbursed	ODA	Grant	Mitigation	Energy	
37	Fiji, Vanuatu, Samoa	22.00	0.19	Disbursed	OOF	Grant	Adaptation	Cross-cutting	
38	Fiji, Vanuatu, Samoa, Tonga, Solomon	124.00	1.08	Disbursed	OOF	Grant	Adaptation	Prevention and resoration of disaster	
39	Georgia	500.00	4.35	Disbursed	ODA	Grant	Mitigation	Transport	
40	Haiti	4,233.00	36.83	Committed, Disbursed	ODA	Grant	Adaptation	Prevention and resoration of disaster	
41	Honduras	16,000.00	139.23	Committed	ODA	Concessional loan	Mitigation	Energy	
42	India	124,321.00	1,081.80	Committed, Disbursed	ODA,OOF	Concessional loan	Mitigation	Transport, Agriculture, Prevention and resoration of disaster	
43	India	34,001.00	295.87	Committed, Disbursed	ODA	Grant, Concessional loan	Adaptation	Agriculture, Prevention and resoration of disaster	
44	India	19,064.00	165.89	Committed	ODA	Concessional loan	Cross-cutting	Water and sanitation	
45	Indonesia	638.00	5.55	Committed, Disbursed	ODA,OOF	Grant	Mitigation	Energy, Forestry, Water and sanitation, Cross-cutting	
46	Indonesia	120.00	1.04	Committed, Disbursed	ODA,OOF	Grant	Adaptation	Agriculture, Prevention and resoration of disaster, Cross-cutting	
47	Indonesia	9.00	0.08	Committed	ODA	Grant	Cross-cutting	Forestry	
48	Indonesia, Paraguay	46.00	0.40	Disbursed	ODA	Grant	Adaptation	Agriculture	
49	Iran	30.00	0.26	Disbursed	OOF	Grant	Mitigation	Cross-cutting	
50	Iraq	34,417.00	299.49	Committed	ODA	Concessional loan	Mitigation	Water and sanitation	

No.	Recipient country/ region/project/programme	Total amount		Status	Funding source	Financial instrument	Type of support	Sector	Additional information
		Climate-specific							
		Japanese yen - JPY	USD						
51	Jamaica	100.00	0.87	Committed	ODA	Grant	Adaptation	Prevention and resoration of disaster	
52	Jordan	9,323.00	81.13	Disbursed	ODA,OOF	Grant, Non-Concessional loan	Mitigation	Energy	
53	Kenya、Ethiopia	340.00	2.96	Committed, Disbursed	OOF	Grant	Mitigation	Energy,cross-cutting	
54	Kenya	272.00	2.37	Committed, Disbursed	ODA,OOF	Grant	Adaptation	Forestry, Prevention and resoration of disaster	
55	Kyrgyz Republic	11,915.00	103.68	Committed	ODA	Concessional loan	Adaptation	Prevention and resoration of disaster	
56	Lao Peple's Democratic Republic	2,182.00	18.99	Committed, Disbursed	OOF	Grant	Mitigation	Prevention and resoration of disaster	
57	Lao Peple's Democratic Republic	58.00	0.50	Committed	ODA	Grant	Cross-cutting	Forestry	
58	Lao People's Democratic Republic, Cambodia	32.00	0.28	Committed	ODA	Grant	Adaptation	Prevention and resoration of disaster	
59	Central and South America, Pacific	75.00	0.65	Committed	OOF	Grant	Mitigation	Cross-cutting	
60	Malawi	272.00	2.37	Disbursed	ODA	Grant	Adaptation	Prevention and resoration of disaster	
61	Malaysia	30.00	0.26	Committed	OOF	Grant	Mitigation	Cross-cutting	
62	Maldives	21.00	0.18	Disbursed	OOF	Grant	Mitigation	Energy	
63	Maldives	500.00	4.35	Disbursed	ODA	Grant	Adaptation	Prevention and resoration of disaster	
64	Marshall Islands	100.00	0.87	Disbursed	ODA	Grant	Adaptation	Cross-cutting	
65	Mauritius	190.00	1.65	Committed	ODA	Grant	Adaptation	Prevention and resoration of disaster	
66	Mexico	86.00	0.75	Committed, Disbursed	ODA,OOF	Grant	Mitigation	Agriculture, Cross-cutting	
67	Micronesia	100.00	0.87	Disbursed	ODA	Grant	Adaptation	Cross-cutting	
68	Mongolia	85.00	0.74	Committed, Disbursed	ODA, OOF	Grant	Mitigation	Cross-cutting	
69	Mongolia	40.00	0.35	Disbursed	OOF	Grant	Adaptation	Cross-cutting	
70	Mozambique	17.00	0.15	Disbursed	ODA	Grant	Adaptation	Prevention and resoration of disaster	
71	Myanmar	71,992.00	626.45	Committed, Disbursed	ODA,OOF	Grant, Concessional loan	Mitigation	Energy, Cross-cutting	
72	Myanmar	2,719.00	23.66	Committed, Disbursed	ODA	Grant	Adaptation	Prevention and resoration of disaster, Water and sanitation	
73	Myanmar	29.00	0.25	Committed	ODA	Grant	Cross-cutting	Forestry	
74	Nepal	9.00	0.08	Committed	ODA	Grant	Adaptation	Prevention and resoration of disaster	
75	Pacisic Islands	7.00	0.06	Disbursed	ODA	Grant	Mitigation	Energy	

No.	Recipient country/ region/project/programme	Total amount		Status	Funding source	Financial instrument	Type of support	Sector	Additional information
		Climate-specific							
		Japanese yen - JPY	USD						
76	Pakistan	4,239.00	36.89	Committed, Disbursed	ODA	Grant	Mitigation	Water and sanitation, Energy	
77	Pakistan	3,037.00	26.43	Committed	ODA	Grant	Adaptation	Prevention and resoration of disaster, Agriculture	
78	Pakistan, Sri lanka, Mongolia, Nepal, Bangladesh	60.00	0.52	Disbursed	OOF	Grant	Mitigation	Energy	
79	Palau, Indonesia, Fiji, Samoa	10.00	0.09	Disbursed	ODA	Grant	Adaptation	Cross-cutting	
80	Palau	1,843.00	16.04	Committed	ODA	Grant	Adaptation	Water and sanitation	
81	Papua New Guinea	26,942.00	234.44	Committed	ODA	Concessional loan	Mitigation	Energy	
82	Papua New Guinea	300.00	2.61	Disbursed	ODA	Grant	Adaptation	Prevention and resoration of disaster	
83	Indonesia, Papua New Guinea, Peru	9.00	0.08	Disbursed	ODA	Grant	Mitigation	Forestry	
84	Philippines	242,020.00	2,105.99	Committed	ODA,OOF	Concessional loan	Mitigation	Transport, Energy	
85	Philippines	13.00	0.11	Disbursed	ODA	Grant	Adaptation	Prevention and resoration of disaster, Forestry	
86	Rwanda	1,013.00	8.81	Committed	ODA	Grant	Adaptation	Water and sanitation	
87	Sain Kitts and Nevis	184.00	1.60	Committed	ODA	Grant	Mitigation	Fishing	
88	Sain Kitts and Nevis	100.00	0.87	Disbursed	ODA	Grant	Adaptation	Prevention and resoration of disaster	
89	Samoa	13.00	0.11	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting	
90	Saudi Arabia	80.00	0.70	Disbursed	OOF	Grant	Mitigation	Water and sanitation,cross-cutting	
91	Senegal	788.00	6.86	Committed	ODA	Grant	Adaptation	Water and sanitation	
92	Singapore	6.00	0.05	Disbursed	ODA	Grant	Mitigation	cross-cutting	
93	Singapore	6.00	0.05	Disbursed	ODA	Grant	Adaptation	Prevention and resoration of disaster	
94	South Africa	15,125.00	131.61	Committed	OOF	Non-Concessional loan	Mitigation	Energy	
95	Sri Lanka	70,358.00	612.23	Committed	ODA	Concessional loan	Mitigation	Energy, Transport	
96	Sri Lanka	68.00	0.59	Disbursed	ODA	Grant	Adaptation	Prevention and resoration of disaster	
97	Tanzania	21,232.00	184.75	Committed	OOF	Non-Concessional loan	Mitigation	Energy	
98	Tajikistan	265.00	2.31	Committed	ODA	Grant	Adaptation	Water and sanitation	
99	Thaniland	38,924.00	338.71	Committed, Disbursed	ODA, OOF	Grant, Concessional loan	Mitigation	Energy, Transport, cross-cutting	
100	Turkey	19,176.00	166.86	Committed, Disbursed	OOF	Non-Concessional loan	Mitigation	Energy	

No.	Recipient country/ region/project/programme	Total amount		Status	Funding source	Financial instrument	Type of support	Sector	Additional information
		Climate-specific							
		Japanese yen - JPY	USD						
101	Tuvalu	100.00	0.87	Disbursed	ODA	Grant	Adaptation	Cross-cutting	
102	Vanuatu, Kiribati, Tuvalu, Solomon Islands	136.00	1.18	Disbursed	ODA	Grant	Adaptation	Prevention and resoration of disaster	
103	Uganda	38.00	0.33	Disbursed	ODA	Grant	Adaptation	Prevention and resoration of disaster	
104	Uganda, Tanzanisa, Djibouti, Ethiopia	8.00	0.07	Disbursed	ODA	Grant	Mitigation	Energy	
105	Uzbekistan	11,872.00	103.31	Committed	ODA	Concessional loan	Mitigation	Agriculture	
106	Viet Nam	80,148.00	697.42	Committed, Disbursed	ODA, OOF	Grant	Mitigation	Energy, Water and sanitation, Cross-cutting, Other	
107	Viet Nam	58.00	0.50	Disbursed	ODA	Grant	Adaptation	Agriculture	
108	Viet Nam	15,045.00	130.92	Committed, Disbursed	ODA	Grant, Concessional loan	Cross-cutting	Forestry, Cross-cutting	

Custom Footnotes

The unit of JPY is "million Japanese Yen", and the unit of USD is "million US dollars".

The exchange rate is 114.92 JPY/USD. Values converted from Japanese Yen to USD using the 114.92 yen/US dollar rate may not match the total USD amount reported due to rounding.

Table 5-6 Provision of public financial support : contribution through bilateral, regional and other channels in 2016 (CTF Table 7(b))

No.	Recipient country/ region/project/programme	Total amount		Status	Funding source	Financial instrument	Type of support	Sector	Additional information
		Climate-specific							
		Japanese yen - JPY	USD						
	Total contributions through bilateral, regional and other channels	1,229,361.00	10,697.52						
1	Afganistan	47.00	0.41	Disbursed	ODA	Grant	Adaptation	Prevention and resoration of disaster	
2	Africa	333.00	2.90	Committed, Disbursed	ODA	Grant, Equity	Mitigation	Energy	
3	Asia	1,260.00	10.96	Disbursed	OOF	Grant	Mitigation	Cross-cutting	
4	Asia Pacific	35.00	0.30	Disbursed	OOF	Grant	Adaptation	Cross-cutting	
5	Asia Pacific	16.00	0.14	Disbursed	OOF	Grant	Cross-cutting	Cross-cutting	
6	Bahamas	200.00	1.74	Disbursed	ODA	Grant	Adaptation	Prevention and resoration of disaster	
7	Bangladesh	97,059.00	844.58	Committed, Disbursed	ODA, OOF	Concessional Loan, Non-Concessional Loan	Mitigation	Energy, Water and sanitation	
8	Bangladesh	16,996.00	147.89	Committed	ODA	Concessional Loan	Adaptation	Prevention and resoration of disaster	
9	Barbados	100.00	0.87	Disbursed	ODA	Grant	Adaptation	Prevention and resoration of disaster	
10	Benin	60.00	0.52	Disbursed	OOF	Grant	Mitigation	Forestry	
11	Bolivia	61,485.00	535.02	Committed	ODA	Concessional Loan	Mitigation	Energy	
12	Cambodia, Myanmar, Peru	70.00	0.61	Committed	OOF	Grant	Cross-cutting	Forestry	
13	Cambodia	2,325.00	20.23	Committed, Disbursed	ODA, OOF	Grant, Other	Mitigation	Transport, Energy, Cross-cutting	
14	Cambodia	8.00	0.07	Disbursed	OOF	Grant	Adaptation	Forestry	
15	China	22.00	0.19	Disbursed	ODA	Grant	Mitigation	Cross-cutting	
16	Columbia	8.00	0.07	Committed	OOF	Grant	Mitigation	Agriculture	
17	Pacific	28.00	0.24	Disbursed	OOF	Grant	Mitigation	Energy	
18	Costa Rica	300.00	2.61	Disbursed	ODA	Grant	Mitigation	Transport	
19	Developing countries	8,400.00	73.09	Committed, Disbursed	OOF	Grant	Mitigation	Cross-cutting	
20	Dominica Republic	200.00	1.74	Disbursed	ODA	Grant	Adaptation	Prevention and resoration of disaster	
21	Egypt	95,274.00	829.05	Committed	ODA	Concessional Loan	Mitigation	Transport, Energy	
22	El Salvador	226.00	1.97	Disbursed	ODA	Grant	Adaptation	Transport	
23	Ethiopia	4.00	0.03	Disbursed	ODA	Grant	Mitigation	Energy	
24	Ethiopia	789.00	6.87	Disbursed	ODA	Grant	Adaptation	Water and sanitation, Prevention and resoration of disaster	
25	Fiji, Vanuatu, Samoa	37.00	0.32	Disbursed	OOF	Grant	Adaptation	Cross-cutting	

No.	Recipient country/ region/project/programme	Total amount		Status	Funding source	Financial instrument	Type of support	Sector	Additional information
		Climate-specific							
		Japanese yen - JPY	USD						
26	Fiji	9.00	0.08	Disbursed	ODA	Grant	Mitigation	Energy	
27	Fiji	300.00	2.61	Disbursed	ODA	Grant	Adaptation	Prevention and resoration of disaster	
28	Global	309.00	2.69	Disbursed	ODA, OOF	Grant	Mitigation	Transport, Energy, Forestry, Cross-cutting	
29	Global	37.00	0.32	Disbursed	ODA	Grant	Adaptation	Prevention and resoration of Disaster, Cross-cutting	
30	Global	76.00	0.66	Disbursed	ODA	Grant	Cross-cutting	Forestry	
31	Guatemala	48.00	0.42	Disbursed	OOF	Grant	Mitigation	Forestry	
32	Grenada	100.00	0.87	Disbursed	ODA	Grant	Adaptation	Prevention and resoration of disaster	
33	Haiti	468.00	4.07	Disbursed	ODA	Grant	Adaptation	Water and sanitation, Prevention and resoration of disaster	
34	India, Nepal, Samoa, Sri Lanka, Thailand, Bangladesh	38.00	0.33	Disbursed	OOF	Grant	Adaptation	Cross-cutting	
35	India	103,669.00	902.10	Committed, Disbursed	ODA	Grant, Concessional Loan	Mitigation	Transport, Energy	
36	India	4,652.00	40.48	Committed	ODA	Concessional Loan	Adaptation	Agriculture	
37	Indonesia, Lao P.D.R., Cambodia	28.00	0.24	Committed	ODA	Grant	Cross-cutting	Forestry	
38	Indonesia, Nepal, Senegal, Brazil	56.00	0.49	Committed	ODA	Grant	Cross-cutting	Forestry	
39	Indonesia Philippines	35.00	0.30	Disbursed	OOF	Other	Mitigation	Energy	
40	Indonesia	267,190.00	2,325.01	Committed, Disbursed	ODA, OOF	Grant, Non-Concessional Loan	Mitigation	Energy, Forestry, Cross-cutting	
41	Indonesia	143.00	1.24	Disbursed	ODA, OOF	Grant	Adaptation	Prevention and resoration of disaster, Cross-cutting	
42	Indonesia, Paraguay	39.00	0.34	Disbursed	OOF	Grant	Adaptation	Agriculture	
43	Iran	27.00	0.23	Disbursed	OOF	Other	Mitigation	Cross-cutting	
44	Iran	5.00	0.04	Disbursed	OOF	Other	Adaptation	Prevention and resoration of disaster	
45	Kenya, Ethiopia, Mexico, Chile, Costa Rica, Palau, Maldives	80.00	0.70	Committed	ODA	Grant	Mitigation	Cross-cutting	
46	Kenya	45,733.00	397.96	Committed, Disbursed	ODA, OOF	Concessional Loan, Other	Mitigation	Energy	
47	Kenya	89.00	0.77	Disbursed	ODA	Grant	Adaptation	Water and sanitation	
48	Kenya	82.00	0.71	Disbursed	ODA	Grant	Cross-cutting	Forestry	
49	Kenya, Ethiopia,	100.00	0.87	Disbursed	OOF	Grant	Mitigation	Energy	
50	Kiribati	3,805.00	33.11	Committed	ODA	Grant	Adaptation	Transport	

No.	Recipient country/ region/project/programme	Total amount		Status	Funding source	Financial instrument	Type of support	Sector	Additional information
		Climate-specific							
		Japanese yen - JPY	USD						
51	Lao P.D.R., Cambodia	27.00	0.23	Committed	ODA	Grant	Adaptation	Prevention and resoration of disaster	
52	Lao P.D.R., Philippines, Thailand, Viet Nam, Indonesia, Malaysia	77.00	0.67	Disbursed	OOF	Other	Mitigation	Cross-cutting	
53	Lao People's Democratic Republic	40.00	0.35	Committed	OOF	Other	Mitigation	Forestry	
54	Lao People's Democratic Republic	7.00	0.06	Disbursed	OOF	Other	Adaptation	Agriculture	
55	Latin America and the Caribbean	5,440.00	47.34	Committed	OOF	Non-Concessional Loan	Mitigation	Energy	
56	Madagascar	106.00	0.92	Committed	ODA	Grant	Adaptation	Agriculture	
57	Malawi	593.00	5.16	Disbursed	ODA, OOF	Grant	Adaptation	Forestry, Prevention and resoration of disaster	
58	Malaysia	7.00	0.06	Disbursed	OOF	Other	Mitigation	Cross-cutting	
59	Maldives	36.00	0.31	Disbursed	OOF	Other	Mitigation	Energy	
60	Maldives	600.00	5.22	Disbursed	ODA	Grant	Adaptation	Prevention and resoration of disaster	
61	Mexico	5,484.00	47.72	Committed, Disbursed	OOF	Non-Concessional Loan	Mitigation	Energy, Cross-cutting	
62	Micronesia	1,193.00	10.38	Committed	ODA	Grant	Mitigation	Energy	
63	Mongolia, Bangladesh, Viet Nam, Lao PDR, Cambodia, Myanmar	100.00	0.87	Committed	ODA	Grant	Mitigation	Cross-cutting	
64	Mongolia	6,665.00	58.00	Committed, Disbursed	ODA, OOF	Grant, Concessional Loan	Mitigation	Energy, Cross-cutting	
65	Mongolia	32.00	0.28	Disbursed	OOF	Grant	Adaptation	Cross-cutting	
66	Morocco	16,347.00	142.25	Committed	ODA	Concessional Loan	Cross-cutting	Agriculture	
67	Myanmar	60.00	0.52	Disbursed	OOF	Other	Mitigation	Energy, Water and sanitation, Cross-cutting	
68	Myanmar	65.00	0.57	Disbursed	ODA, OOF	Grant, Other	Adaptation	Agriculture, Prevention and resoration of disaster	
69	Myanmar	26.00	0.23	Committed	ODA	Grant	Cross-cutting	Forestry	
70	Nigeria	1,317.00	11.46	Committed	ODA	Grant	Mitigation	Transport	
71	North and Latin America	15.00	0.13	Disbursed	ODA	Grant	Mitigation	Energy	
72	Oman	6.00	0.05	Disbursed	OOF	Other	Adaptation	Agriculture	
73	Pakistan	5,994.00	52.16	Committed	ODA	Grant, Concessional Loan	Mitigation	Energy	
74	Panama	29,575.00	257.35	Committed	ODA	Concessional Loan	Mitigation	Transport	
75	Papua New Guinea	620.00	5.40	Disbursed	ODA	Grant	Adaptation	Prevention and resoration of disaster	

No.	Recipient country/ region/project/programme	Total amount		Status	Funding source	Financial instrument	Type of support	Sector	Additional information
		Climate-specific							
		Japanese yen - JPY	USD						
76	Peru	170.00	1.48	Disbursed	ODA,OOF	Grant	Cross-cutting	Forestry	
77	Philippines	50.00	0.44	Disbursed	OOF	Other	Mitigation	Energy, Transport	
78	Philippines	45.00	0.39	Disbursed	ODA	Grant	Adaptation	Prevention and resoration of disaster	
79	Philippines	10.00	0.09	Disbursed	OOF	Grant	Cross-cutting	Cross-cutting	
80	Qatar	138,067.00	1,201.42	Disbursed	OOF	Non-Concessional Loan	Mitigation	Energy	
81	Rwanda	2,219.00	19.31	Committed	ODA	Grant	Mitigation	Transport	
82	Rwanda	101.00	0.88	Disbursed	ODA	Grant	Adaptation	Water and sanitation	
83	Saint Kitts and Nevis	200.00	1.74	Disbursed	ODA	Grant	Adaptation	Prevention and resoration of disaster	
84	Saint Vincent and the Grenadines	200.00	1.74	Disbursed	ODA	Grant	Adaptation	Prevention and resoration of disaster	
85	Samoa	962.00	8.37	Committed	ODA	Grant	Cross-cutting	Cross-cutting	
86	Senegal	27,663.00	240.72	Committed, Disbursed	ODA	Grant, Concessional Loan	Adaptation	Water and sanitation	
87	Singapore	5.00	0.04	Disbursed	ODA	Grant	Adaptation	Cross-cutting	
88	South Africa	4.00	0.03	Disbursed	ODA	Grant	Mitigation	Energy	
89	Sri Lanka	76.00	0.66	Disbursed	ODA	Grant	Adaptation	Prevention and resoration of disaster	
90	Sudan	3,248.00	28.26	Committed, Disbursed	ODA	Grant	Adaptation	Water and sanitation	
91	Tajikistan	1,172.00	10.20	Disbursed	ODA	Grant	Adaptation	Prevention and resoration of disaster	
92	Thailand	167,475.00	1,457.32	Committed, Disbursed	ODA, OOF	Grant, Concessional Loan	Mitigation	Energy, Transport, Water and sanitation, Cross-cutting	
93	Timor Leste	102.00	0.89	Disbursed	ODA	Grant	Adaptation	Forestry	
94	Uganda	50.00	0.44	Disbursed	ODA	Grant	Adaptation	Prevention and resoration of disaster	
95	United of Republic of Tanzania	118.00	1.03	Disbursed	ODA	Grant	Adaptation	Water and sanitation	
96	Viet Nam, Lao P.D.R.	8.00	0.07	Committed	ODA	Grant	Cross-cutting	Forestry	
97	Viet Nam	90,284.00	785.62	Committed, Disbursed	ODA, OOF	Grant, Concessional Loan	Mitigation	Transport, Cross-cutting	
98	Viet Nam	300.00	2.61	Disbursed	ODA	Grant	Adaptation	Prevention and resoration of disaster	
99	Viet Nam	10,000.00	87.02	Committed	ODA	Concessional Loan	Cross-cutting	Cross-cutting	

Custom Footnotes

The unit of JPY is "million Japanese Yen", and the unit of USD is "million US dollars".

The exchange rate is 114.92 JPY/USD. Values converted from Japanese Yen to USD using the 114.92 yen/US dollar rate may not match the total USD amount reported due to rounding.

5.3.2.4 Private Financial Flows

In order to further promote climate change action, Japan has also been working on establishing a mechanism to leverage private investment by use of public finance. Co-financing by JBIC with the private sector and trade insurance by NEXI are the examples of utilizing private finance. Private finance also plays an important role to tackle climate change as its total amount is over USD 3.8 billion as of December 2016.

a. Other Official Flow, Including Co-funding with Private Sector

In April 2010, JBIC launched a new operation named 'GREEN' (Global action for Reconciling Economic growth and Environmental preservation) of which primary purpose is to support projects with favorable impact on the preservation of the global environment. Under the 'GREEN' operation, JBIC implements support through utilizing united loans, guarantees and equity investment while mobilizing private funds.

<Features>

In every project under the 'GREEN' operation, JBIC conducts its own accounting measures named 'J-MRV Guidelines' for reduction impact of GHG emission. The objective of this accounting method is to quantify and to check the amount of reducing GHGs by relevant projects in developing countries.

<Examples>

JBIC has provided finance needed for the environment-related projects (improving energy efficiency project or renewable energy project) to financial institutions, such as Türkiye Kalkınma Bankası A.Ş. in Turkey, Banco Nacional de Comercio Exterior, S.N.C. in Mexico, Banco Nacional de Desenvolvimento Econômico e Social in Brazil and The Standard Bank of South Africa Limited in South Africa. In funding of JBIC, co-finance with private finance institutions is applied as its principle, by which further mobilization of private financing has been facilitated.

5.4 Technology Development and Transfer

Japan will contribute to solve the climate change problem all over the globe through the development of technologies of environment and energy fields (Innovation), and taking a leadership on international diffusion of the technologies (Application) based on the proactive diplomatic initiatives for countering global warming which is called "Actions for Cool Earth Japan" which was announced in November 2013.

5.4.1 Innovation of low-carbon technology and promotion of its dissemination

In order to contribute to significant global emission reduction through innovation, based upon National Energy and Environment Strategy for Technical Innovation towards 2050 adopted in April 2016, Japan will promote the development of innovative technology with great reduction potential and impact in a long-term perspective. For example, Japan will promote research and development, demonstration, and model projects regarding manufacturing, transporting/storing and utilizing energy carriers such as hydrogen, the future power electronics using gallium nitride (GaN), Carbon Capture and Storage (CCS), and Carbon Capture and Utilization (CCU).

Japan will also accelerate innovation through "Innovation for Cool Earth Forum (ICEF)", the global platform to promote discussions and cooperation on innovation in energy and environmental technology among worldwide academic, industrial and public sectors. Furthermore, Japan will promote demonstration projects to create innovations for drastically reconstructing advanced low-carbon technology in accordance with specific characteristics of developing countries. Japan also will create co-innovation projects by incorporating the needs of developing countries and the seeds provided by Japanese industries, taking an

initiative of dispatching business missions to developing countries, and accelerate collaboration of private companies and local governments on both sides. Japan will foster further innovation by sharing information on dissemination of innovative technology and its effectiveness.

Japan will promote the dissemination of advanced low-carbon technology with public-private partnership through Joint Crediting Mechanism (JCM), in which Japan has established partnerships with 17 partner countries and supported more than 100 projects. Japan will also support both the introduction of waste power generations as one of the environmental infrastructure and waste management system as a package. Japan will support the optimization of existing infrastructure and operation and maintenance (O&M) by private companies thorough utilizing Internet of Things (IoT), which contributes to emission reduction and the visualization of reduction effects. In addition, in order to implement large-scale projects and wider dissemination of low-carbon technology, Japan will enhance collaboration with public finance of, among others, JICA and JBIC, and will enhance capacities and carry out feasibility studies for project formation to improve the access to GCF. As the chair of the Global Research Alliance on Agricultural Greenhouse Gases (GRA), Japan will promote the improvement of low-carbon irrigation technology and its dissemination in developing countries. Regarding emission reduction of fluorocarbons, Japan will provide support based upon its knowledge and promote understanding of the importance of the programs implemented in developing countries.

5.4.2 Implementation of adaptation projects

Through collaboration with Japanese cooperation organizations or governmental financial institutions including Japan International Cooperation Agency (JICA) and Japan Bank of International Cooperation (JBIC) and international development and financial institutions, Japan will support adaptation projects based on priorities and needs of each country, while diversifying the financial resources, including mobilization of private finance.

In order to enhance the resilience to climate change, Japan will support the infrastructure development, including the fields of irrigation, waterworks, and disaster risk reduction. Japan will also support the development and dissemination of drought-resistant and short-duration rice varieties for sustainable and stable food supply, provide the support to agricultural insurance for smallholder farmers vulnerable to climate change. Japan's support extends to ecosystem-based adaptation for coastal protection by utilizing ecosystems such as coral reefs and mangroves. Being mindful of the situation among SIDS, which are vulnerable to climate change, Japan will carry out comprehensive support focused on disaster risk reduction by integrating the provision of necessary equipment, such as meteorological observation and disaster early warning equipment, and technical cooperation.

5.4.3 Emissions Reduction in Oversea Countries by Diffusing Technologies

Japan will promote the global "application" of existing low-carbon technologies. Accelerating the diffusion of such technologies and verifying the reduction effect by the technologies will realize the further emission reduction of greenhouse gasses and new economic growth simultaneously.

5.4.3.1 Joint Crediting Mechanism (JCM)

Japan establishes and implements the JCM in order both to appropriately evaluate contributions from Japan to GHG emission reductions and removals in a quantitative manner achieved through the diffusion of low carbon technologies, products, systems, services, and infrastructure to developing countries as well as implementation of mitigation actions in developing countries, and to use them to achieve Japan's emission reduction target.

Since Japan and Mongolia signed a bilateral document in January 2013 for the first time to start the JCM, the number of partner countries has increased to 17. There are more than 120 GHG emission reduction projects being implemented on the ground so far and the accumulated emission reductions from these projects are expected to be about 7 Mt-CO_2 (Preliminary estimation towards the period by 2030FY). At this

point there are about 20 registered projects among which 8 projects issued JCM credits. Furthermore, more than 40 MRV methodologies (methods for calculating GHG emission reductions) have been approved as a step towards project registration. Japan will continue to support the further formulation of JCM projects in collaboration with relevant ministries and agencies.

5.4.3.2 Development of the Basic Framework to Diffuse Technologies

- Support for International Standardization and Institutional Arrangement

  The government has contributed to the international standardization of measuring CO_2 emissions through steel processing. The government will also propose assessing measures of energy efficiencies of LED lightings etc. thus will contribute to the international standardization onwards. In addition, the government will provide supports on institutional arrangements for enhancing abilities of appropriate measuring and developing standards of energy savings in developing countries.

- Support for Formulating Low-Carbon Strategies and Enhancing Adaptive Ability in Developing Countries with Technologies and Know-How of Japan

- Utilization of Satellites

  The government aims to launch a new GHG observing satellite GOSAT-2 which has the state-of-the-art technologies (successor to GOSAT) in FY 2018. The government will provide supports on usage of satellite GHG data for the validation of national GHG inventions in each country by monitoring GHG emission at country level or mega-city regions and large scale point sources, leading to enhance the technology of MRV (Measurement, Reporting and Verification).

- Assessments

  Technological needs will be identified and the direction of technology creation and diffusion will be effectively verified based on verification of the effectiveness of the introduced low-carbon technologies and technology assessment (assessment of utility and environmental impact of technologies).

5.4.3.3 Other Supports for Developing Countries

In developing countries in particular, addressing deforestation and forest degradation due to illegal logging, expanding agricultural land and other factors are urgent issues. Leveraging its knowledge and expertise, Japan will actively support Reducing Emissions from Deforestation and Forest Degradation (REDD+) including sustainable management of forests in developing countries, which will contribute to forest conservation in those countries.

Furthermore, in order to achieve compatibility between environmental protection and economic growth in developing countries, Japan will promote cooperation through a co-benefits approach that will contribute to both environmental pollution reduction and greenhouse gas emissions reduction, which is a global concern.

5.4.4 Projects related to provision of support for technology development and transfer

Information on Japan's projects on the provision of support for technology development and transfer is shown in Table 5-7.

In addition, as an example of success story related to project to facilitate the transfer of environmentally sound technologies, the description of "Promotion of Green Hospital by improving efficiency and environment in national hospitals in Vietnam" and "Introduction and expansion of Amorphous high efficiency transformer usage in power distribution systems in Viet Nam (JCM Model project)" implemented by Japan is shown in Table 5-8.

Table 5-7 Provision of support for technology development and transfer (CTF Table 8)

No.	Recipient country and/or region	Targeted area	Measures and activities related to technology transfer	Sector	Source of the funding for technology transfer	Activities undertaken by	Status	Additional information
1	Cambodia	Mitigation and Adaptation	Project for Facilitating the Implementation of REDD+ Strategy and Policy	Agriculture	Public	Public	Implemented	The Project aims for formulation of the REDD+ systems and the roadmaps in Cambodia to implement the environmental management in accordance with the strategies and policies of REDD+.
2	Cambodia, Laos	Adaptation	Study for rural disaster prevention plan in research projects on global environment problem in agriculture and rural villages overseas	Disaster prevention	Public	Private and Public	Implemented	To improve the disaster prevention effect in rural villages in developing countries, develop a system for disaster prevention adapted to climate change and a method to develop a rural disaster prevention plan.
3	Cambodia, Myanmar	Mitigation and Adaptation	Project to accelerate REDD-plus activities by private sector	Forestry	Public	Private and Public	Implemented	This project aims to promote and accelerate full-scale REDD-plus activities by Japanese private sector through developing scientific solutions of the entry barriers
4	India	Mitigation	Study for Sophistication of efficiency management of thermal power plants (Implementation of real-time unit performance management service using IoT)	Energy	Public	Private and Public	Planned	This project aims to introduce the real-time unit performance management service to two 500MW subcritical units recommended by the Ministry of Power of India and to apply the service to coal-fired power plants throughout India. This will contribute to international CO2 emission reductions.
5	Indonesia	Mitigation	Application of a Tribrid System to Base Transceiver Stations	Industry	Public	Private and Public	Implemented	Applying tribrid technology to BTSs in Indonesia can reduce CO2 emissions by suppressing the usage of electric generators powered by diesel fuel and grid-supplied electricity.
6	Indonesia	Mitigation	Study for CCUS (CO2-EOR) projects development in the South Sumatra region on the Republic of Indonesia under Joint Crediting Mechanism(JCM)	Energy	Public	Private and Public	Planned	To conduct a CCUS (CO2-EOR) utilizing WAG technology in South Sumatra, as a major CCUS player in Indonesia. Additionally, any carbon credit acquired through the project shall be applied for JCM.
7	Indonesia, Philippine, Uzbekistan, Botswana, Colombia	Mitigation and Adaptation	Project for promoting sustainable forest management in developing countries	Forestry	Public	Private and Public	Planned	Japan disseminates business models on forest conservation through sustainable utilization of forest resources in a way that will create added economic value in developing countries.
8	Lao PDR	Mitigation	Sustainable Forest Management and REDD+ Support Project	Forestry	Public	Public	Implemented	This Project aims for contribution of strengthening the capacity of forest management in Lao PDR through renovation of REDD+ strategy and the establishment of Forest Resource Information database in order to enhance sustainable forest management.
9	Laos	Mitigation	FY2015 JCM Feasibility Study (Programme for the Establishment of Low-Carbon Historic City in Vientiane, based on City-to-City Cooperation between Vientiane Capital and Kyoto City)	Cross-cutting	Public	Public	Implemented	Conducting feasibility studies for creating JCM projects (renewable energy and waste management) and establishing Action Plan in collaboration with public-private partnerships in order to provide comprehensively experiences and systems of Kyoto City, which is globally known as historic and environment-friendly city, as well as Japanese environmental technology to Vientiane city, the capital of Laos. Through this initiative, it aims to build a low-carbon historic city model using JCM.
10	Laos	Mitigation	Laos Energy Efficient Datacenter (LEED) Project In Lao People's Democratic Republic	Industry	Public	Private and Public	Implemented	GHG emission has been dramatically increased in the IT industry. The project called 'LEED' aims to demonstrate effectiveness of Japanese high energy efficiency technologies in developing countries whose IT demand is expected to increase, facilitating their diffusion and contributing to GHG emission reduction.

No.	Recipient country and/or region	Targeted area	Measures and activities related to technology transfer	Sector	Source of the funding for technology transfer	Activities undertaken by	Status	Additional information
11	Laos, Philippines, Thailand, Viet Nam, Indonesia, Malaysia	Mitigation	Feasibility Study of Project to Demonstrate to Advanced Low-carbon Technology Innovation for Further Development in Developing Countries in Asia Region	Cross-cutting	Public	Private and Public	Implemented	Feasibility study for creating projects through consideration of technology change and matching between specific needs in developing countries in Asia region and seeds of Japanese low-carbon technologies.
12	Maldives	Mitigation	Study for Wind Energy Project for Remote islands in the Maldives	Energy	Public	Private and Public	Implemented	To examine the feasibility of the project to install Japanese 300kW wind turbines along with the micro-grid system founded in the ample experience in Japanese islands to islands in Maldives, which leads to the decrease on the dependency on diesel oils and to the emission reduction of GHG. The scope of study includes the examination of the site conditions such as wind resource assessment, basic system design, drafting of preliminary project plans and the development of MRV.
13	Myanmar	Mitigation	FY2015 JCM Feasibility Study (JCM Project Formulation Study through City-to-City Collaboration in Yangon)	Cross-cutting	Public	Public	Implemented	Providing support for developing the low carbon development policy society in Yangon and conducting feasibility study of JCM projects based on the technologies and experiences of Kawasaki City which has a lot of practices in low carbon city development in domestically and internationally. In addition, it aims to produce projects which contribute to low carbonization in collaboration with Green Innovation Cluster established by Kawasaki City.
14	Philippines	Mitigation	Study for Small-Scale Geothermal Power Generation Project in the Philippines and Other Countries	Energy	Public	Private and Public	Implemented	Small-scale geothermal plants will be introduced to unutilized geothermal wells in the Philippines and other countries which have significant geothermal resources and considerable experience with utilizing geothermal power, a power source known to help reduce CO2 emissions.
15	Saudi Arabia	Mitigation	Feasibility Study on CCUS projects in Saudi Arabia	Energy	Public	Private and Public	Implemented	This Study embraces examination of feasibility of 1) policies related to JCM that will contribute to CCS(Carbon dioxide Capture and Storage) technology diffusion, and 2) applicability of CCUS project in East region of Kingdom of Saudi Arabia and Riyadh area, where the implementation of CO2 emission reduction project through CCS is expected.
16	Saudi Arabia	Mitigation	Feasibility study on JCM Project using solar panel cleaning robot for arid region	Energy	Public	Private and Public	Planned	This study is to introduce a solar panel cleaning robot in Saudi Arabia's large-scale photovoltaic power plant and automatically clean up dust without using water, minimizing energy consumption for cleaning and maintaining power generation efficiency.
17	Thailand	Mitigation	FY2015 JCM Feasibility Study (Promotion of Decarbonizing of Municipal Waste Management and Ecological Industrial Town in Rayong Prefecture (Kitakyushu-Rayong Cooperation Project))	Cross-cutting	Public	Private and Public	Implemented	Pursue a compatible model which can strike a balance between CO2 emission reduction and securement of profit by selling electricity through conversion of waste incineration facility which Rayong Prefecture is planning to the waste to energy facility. In addition, pursue total management of waste and low-carbonization by energy and water saving in two industrial associations which is promoting ecological industrial town.
18	Thailand	Mitigation	Introduction of Energy Conservation Equipment and Energy Management Systems in Automobile Factories	Energy	Public	Private and Public	Implemented	This study is designed to verify the feasibility of introducing leading Japanese high-efficiency heat source machine technologies, such as heat pump technology and energy management systems (EMS), thereby contributing to greenhouse gas emissions reduction in Thailand.
19	Thailand	Mitigation	Study for Improvement of power generation efficiency by upgrading gas turbine in Thailand	Energy	Public	Private and Public	Planned	The study is to be conducted for the project to improve power generation efficiency by introducing "Upgrade Blade" and remote monitoring system to optimize O&M of the existing GTCC (gas turbine combined cycle) .
20	Thailand	Mitigation	Feasibility Study of Development and Standardization of Power Digital Solution for Utilities in ASEAN region (Thailand)	Energy	Public	Private and Public	Planned	This study is to figure out the reduction of emissions for NOx/SOx/CO2/etc. and to optimize the plant performance through the development of the Power Digital Solution at the existing coal fired power plant(s). Power Digital Solution will generally include Boiler Operation Optimization, Asset Performance Management, etc.

No.	Recipient country and/or region	Targeted area	Measures and activities related to technology transfer	Sector	Source of the funding for technology transfer	Activities undertaken by	Status	Additional information
21	Thailand, Myanmar, Uzbekistan	Mitigation and Adaptation	Project to disseminate forest regeneration technologies in developing countries	Forestry	Public	Private and Public	Planned	Japan disseminates forest regeneration technologies in devastated land or semiarid land of developing countries.
22	Viet Nam	Mitigation	FY2015 JCM Feasibility Study (The whole city low carbonization in Hai Phong City (Kitakyushu-Hai Phong Cooperation Project))	Cross-cutting	Public	Public	Implemented	Based on the cooperation framework between Hai phong city and Kitakyushu city, it aims to large reduction of GHG emissions with projects in the following 4 sectors: Energy sector, Cat Ba Island sector, Energy-Waste fusion sector and Greening growth promotion plan follow-up sector in order to promote low-carbonization of whole Hi phong city, .
23	Viet Nam	Mitigation	FY2015 JCM Feasibility Study (Ho Chi Minh City – Osaka City Cooperation Programme for Developing Low Carbon City)	Cross-cutting	Public	Public	Implemented	In order to discover JCM projects and encourage large-scale development, utilizing experience of Osaka city, provide support to develop Climate Change Countermeasure Action Plan of Ho Chi Minh city and conduct feasibility study to start promptly a large-scale JCM project. Low-carbon city formulation by integration of inter-city and public-private cooperation as well as development and realization of JCM projects are promoted.
24	Viet Nam	Mitigation	Energy Saving and Work Efficiency Improvement by Introducing a New Chip-on-Board LED System in Vietnam	Transport	Public	Private and Public	Implemented	Making to the energy conservation with the fishing boat in the Vietnamese country central part is proven by developing, and introducing highly effective and a high endurance special LED technology as fishing light.
25	Viet Nam	Mitigation	Study for demand response by high efficiency air conditioner cooperate with power sector	Energy	Public	Private and Public	Planned	This is an investigation of contribution to greenhouse gas (GHG) reduction by the combination of proposals for Vietnamese regulation and Japanese technologies , such as high efficiency air conditioner, energy management system, monitoring and control system of power company and demand response (DR) management. It will contribute disseminating the DR in Vietnam by consistent support for the construction, the operation and the settlement of these complex systems.
26	Viet Nam	Mitigation	Feasibility study of floating PV generation projects on existing hydroelectric dams	Energy	Public	Private and Public	Planned	The project introduces floating photovoltaic (PV) generation systems on the existing dam lakes in central to central-south of Vietnam. Conventional floating PV systems are located on stable ponds and their capacities are within several megawatts. In this study, the target is a bigger system with 20 MW capacity, considering how to solve following the technical issues and disseminate the project using a large number of dam lakes in Vietnam.
27	Viet Nam	Adaptation	The Project for Emergency Reservoir Operation and Effective Flood Management Using Water-related Disaster Management Information System	Water and sanitation	Public	Public	Planned	The Project will construct hydrological observation facilities to monitor the water level of rivers and dams and the rainfall in the basin of the Huong River, which flows through Central Vietnam, and will also construct a water-related disaster management information system to mitigate flood disasters in the general Huong River Basin.
28	Vietnam	Adaptation	DRR/CCA project in Dong Thap province（Phase1）	Disaster prevention	Public	Private	Implemented	This project aims to strengthen local capacity for disaster risk reduction (DRR) and climate change adaptation (CCA) in Dong Thap Province, Mekong Delta region of Vietnam. The project supports to establish a community-based disaster risk management system, improve safety of schools, and enhance the capacity of local government officials in charge.

Table 5-8 Description of project to facilitate the transfer of environmentally sound technologies

Project/programme title:

Promotion of Green Hospital by improving efficiency and environment in national hospitals in Vietnam (demonstration project)

Purpose:

This demonstration project has introduced about 1,000 energy efficient inverter air conditioners (ACs) at two state-owned hospitals in Vietnam, along with energy management systems to optimize these ACs efficiently. The project aims to demonstrate and verify these technologies as well as CO_2 emission reduction effects, anticipating a 35% energy saving as well as better ventilation of the entire hospital.

Recipient country:	Sector:	Total funding:	Years in operation:
Vietnam	Energy	USD 5M	2014-2017(4 years)

Description:

In this demonstration project, high efficiency performance inverter ACs, compliant to the energy efficiency labeling standard in Vietnam, are introduced in two state-owned hospitals, one located in Hanoi and the other in Ho Chi Minh City. Not only the inverter ACs were installed, but energy management system (EMS) was developed and installed to enhance the energy efficiency of the entire hospital.

Together with the EMS, improving the ventilation will lead to a better indoor air quality, thus contributing to modifying these hospitals into environmental friendly “Green Hospitals”. As one of the JCM Projects, the amount of CO_2 emission reduction as well as energy efficiency in the project is monitored and verified.

Factors that led to project/programme success:

The project contributes inclusive and sustainable climate action (energy efficiency, indoor air quality and proper treatment of wasted refrigerant) through much consultation with local stakeholders such as the hospitals, related ministries and governmental agencies such as Ministry of Natural Resources and Environment, Ministry of Industry and Trade, and test center of energy efficiency labelling standard in charge.

Technology transferred:

In this demonstration project, high efficiency performance inverter ACs, compliant with the energy efficiency labeling standard in Vietnam, were introduced in two state-owned hospitals, one located in Hanoi and the other in Ho Chi Minh City. Not only was the inverter ACs installed, but energy management system (EMS) was developed and installed to enhance the energy efficiency of the respective hospitals. Together with the EMS, improving the air ventilation with total enthalpy heat exchanger leads to a better indoor air quality free from heat loss, thus contributing to changing these hospitals into environmentally friendly “green hospitals”.

In Vietnam, Cooling Seasonal Performance Factor (CSPF) was introduced subsequent to the launch of the energy efficiency labeling standard. CSPF is a measure of the cooling efficiency calculated from total load and total energy consumption per year of operation. Using this method, the energy efficiency of inverter ACs can be evaluated accurately in public facilities such as hospitals, where air conditioning is needed all year round. Accordingly, this project includes the installation of CSPF-supporting Balanced Room-type Calorimeter at Testing and Verifications Centre for Industry/Institute of Energy and Mining Machine (TVCI/IEMM), the sole certification authority in Vietnam where efficiency of ACs will be verified.

In replacing ACs, a prevention plan is required to be prepared and implemented in order to ensure that hydro chlorofluorocarbon (HCFC) used as refrigerants are not released into the atmosphere when they are removed from conventional ACs. In consideration of environment integrity, such Eligibility Criteria has been established through the efforts of Japan and Vietnam, both of which are highly conscious of climate change issues. The removed refrigerant (HCFC) were depleted properly at a certified destruction plant in Vietnam.

Impact on greenhouse gas emissions/removals (optional):

878t-CO_2e/year (estimated amount of the credit issuance, not including the emission reduction through EMS, air ventilation with total enthalpy heat exchanger and HCFC depletion)

In fact, there must be regarded more GHG emission reduction effect such as EMS, air ventilation with total enthalpy heat exchanger and HCFC depletion.

Project/programme title:

Introduction and expansion of Amorphous high efficiency transformer usage in power distribution systems in Viet Nam (JCM Model project)

Purpose:

This project aims to reduce greenhouse gas emissions through introducing and expanding high-efficient Amorphous Distribution Transformers (AMDTs) in power networks of Vietnam.

Recipient country:	Sector:	Total funding:	Years in operation:
Vietnam	Energy	19 million USD (1USD=100JPY)	From 2014

Description:

This project has introduced more than 13,000 units of AMDTs in distribution power networks of southern, central and northern Vietnam, owned by local power companies of Electricity of Vietnam (EVN) and provincial based power companies. This helps reduce the country's CO_2 emissions from power generation source by reducing distribution losses.

Factors that led to project/programme success:

Steady outreach activities about benefits of AMDTs to local power companies was conducted,

Steady outreach activities to local and regional power companies that are involved in distribution development in Vietnam was conducted,

Improvement of distribution losses through the installation of AMDTs was well understood by technical officers of the local companies,

Support by Vietnam's policies for improving energy efficiency in its power distribution networks was in line with development of this project,

Self-manufacture and sales of AMDTs by Vietnamese venders were developed,

Environmental consciousness for stopping global warming was proposed and imbedded in the local power companies through JCM activities, in addition to energy saving, etc.,

Technology transferred:

The installed equipment is high efficient distribution transformers with Amorphous Core (non-crystalline metal) which can reduce up to one-third of no-load loss in power distribution line compared to conventional transformer with silicon steel lamination. AMDT has higher efficiency of electrical energy transformation compared to the silicon based transformers, contributing to stable power supplies of Vietnam by increasing total power generation outputs to meet the increased power demand.

AMDT is expected to contribute to a big energy saving effect by reducing no-load losses. For example, it is assumed that about 18MWh/year of power use can be reduced by replacing silicon based transformers (2,000kVA, 50Hz 22kV/6.6kV) with the same size AMDTs. (based on the same calculation, this project is expected to reduce a total 18,000MWh/year of power outputs by 2019. This equal to about 1,200,000 USD/year of energy cost saving).

Impact on greenhouse gas emissions/removals (optional):

9,532t-CO_2/year (estimated amount of the credit issuance)

5.5 Capacity-Building

5.5.1 Vision

With the early entry into force of the Paris Agreement in November 2016, the world is now moving toward its implementation. In order to achieve the 2-degree goal (1.5-degree pursued) of the Paris Agreement and to establish a decarbonised society with balancing anthropogenic emissions by sources and removals by sinks of greenhouse gases (GHG), in the second half of this century, we must diminish the GHG emission extensively worldwide. Such efforts will also reduce vulnerability deriving from climate change and contribute to establishing a resilient society. In addition, it is essential to pursue the Sustainable Development Goals (SDGs) through economic growth, increased employment, infrastructure development and improved access to water, food and energy.

In order to transform the world into such state, innovation of technology and social and economic systems are indispensable. The immediate action will enable developing countries to address their infrastructure needs and avoid lock-in effect.

In order to accelerate climate change measures and sustainable development in developing countries, Japan will collaborate with them by utilizing its advanced technology and know-how, create “co-innovation” reflecting on their challenges and needs, and contribute to the global reduction of the GHG emissions. Japan will incorporate the needs of each country and the seeds of technology and know-how acquired by Japanese private companies and local governments, and promote the creation of specific projects to find solutions that lead to co-innovation among Japan and developing countries. Moreover, further opportunities of co-innovation should be enhanced by visualizing those needs and seeds. It is important to develop institutions and capacities in developing countries and promote the engagement of private companies and local governments for implementing climate change activities. For this purpose, Japan has established “Partnership to Strengthen Transparency for Co-Innovation (PaSTI)”.

For achieving this vision, Japan will coordinate closely within its relevant ministries, organizations, companies, and local governments, and continue to enhance collaboration with international organizations and international initiatives such as the NDC Partnership.

5.5.2 Specific programs related to adaptation

5.5.2.1 Science-based development of adaptation plans and strategies

Risk evaluations based upon scientific knowledge and their reflection upon the adaptation plans are essential for implementing adequate adaptation plans. Implementing adaptation measures also requires innovation of policy processes in both developed and developing countries. Through providing latest technology and know-how obtained by its industry-government-academia partnership, Japan will support consolidation and dissemination of information on climate risk, establishment of risk evaluation methods, and development of national adaptation plans in developing countries.

More specifically, Japan will support impact assessment on climate change and development of national adaptation plans through bilateral collaboration. For example, Japan has promoted the establishment of the long-term risk evaluation methods on storm tides and waves caused by cyclones in small island developing states (SIDS) including the Republic of Fiji, the Republic of Vanuatu, and Samoa. Japan has supported to develop the system of Analysis and Mapping of Impacts under Climate Change for Adaptation and Food security (AMICAF)”. In addition, Japan will promote human resource developments in the field of climate change by supporting construction and institutional development of the Pacific Climate Change Center in cooperation with the Secretariat of the Pacific Regional Environment Programme (SPREP), and strengthening the Climate Change International Technical and Training Center (CITC) in Thailand.

Japan will cooperate with developing countries in the Asia-Pacific region and the Asian Development Bank (ADB) to establish “Asia-Pacific Climate Change Adaptation Platform (AP-PLAT),” as the information base on climate risk and adaptation measures. Japan will also collaborate with the Global Centre of Excellence on Climate Adaptation (GCECA) to contribute to developing global bases for information on climate risk. As the foundation of these programs, Japan will also continue promoting research and development to upgrade climate models and establishment of global environment information platforms.

In order to promote international discussion on climate change and security, Japan will promote the findings of its recent report, “Analysis and Proposal of Foreign Policies Regarding the Impact of Climate Change on Fragility in the Asia-Pacific Region – With focus on natural disasters in the Region –”, published in September 2017, in various diplomatic fields.

Japan will widely share these programs and the knowledge and lessons acquired through them by using international networks, including the Asia-Pacific Adaptation Network (APAN), the Global Adaptation Network (GAN) and the Global Earth Observation System of Systems (GEOSS) Asia-Pacific Symposium, and enhance further cooperation with each country.

5.5.2.2 Promotion of adaptation actions by non-state stakeholders

Private sector and local governments play important roles to respond to diverse needs of each country and implement adequate adaptation actions according to the local circumstances.

The Japanese government will enhance engagement with the private sector and promote adaptation business through matching of the needs of developing countries and its advanced technology and service by private companies in Japan, including disaster risk reduction infrastructure technology, early-warning technology and weather index insurance utilizing rainfall data estimated by satellites. Japan will promote adaptation actions of local governments in developing countries by supporting impact assessment and development of local adaptation plans, while involving local researchers, local governments, and communities.

5.5.3 Specific programs related to mitigation

5.5.3.1 Capacity building on development, implementation, and progress management of NDC

The Paris Agreement requires each country to prepare and submit nationally determined contribution (NDC) as well as pursue domestic mitigation measures to achieve the emission reduction target presented in NDC. Under the enhanced transparency framework to promote effective implementation, each country needs to monitor and report the status of implementation of measures. Toward implementation of the Paris Agreement, the needs have been increasing for institutional development and the capacity building in developing countries.

Japan will support institutional and capacity development to prepare GHG emission inventory as the prerequisite of mitigation measures, develop concrete plans and measures as well as review their progress, and establish policies to achieve the target. This support will encompass a system for mandatory accounting, report and disclosure of GHG emissions and the mechanism for development of emission reduction plans by private entities and evaluation of those plans by governments through utilization of ISO. Japan will provide those supports by utilizing its experience and know-how and collaborating with JICA, National Institute for Environmental Studies (NIES) and international initiatives such as NDC Partnership. Japan will promote the active engagement of companies and local governments in developing countries for mitigation measures and provide incentives for their actions through these programs.

In this regard, Japan will carry out some workshops and trainings to support the construction of the domestic systems to prepare GHG emission inventories and the improvement of its precision. Japan will also support submission, update and implementation of each country’s NDC through development of the precise emission reduction scenario and specification of the programs and the technology necessary to achieve successful reduction by utilizing evaluation models. In order to promote the improvement of transparency, Japan contributed to the Capacity Building Initiative for Transparency (CBIT). From now on, Japan will promote the effective utilization of CBIT by collaborating with the Global Environment Facility (GEF) in order to strengthen capacity of developing countries. Moreover, through continuous global monitoring by utilizing a series of GHG Observing Satellite "IBUKI" (GOSAT) and the development and dissemination of the monitoring methods by utilizing ICT, Japan will continue its scientific endeavor for measuring the amount of emissions of each country and securing the transparency of their reduction actions.

5.5.3.2 Promotion of mitigation actions taken by non-state actors

In order to enhance actions and innovation by cities and private sectors, Japan will implement cooperation projects and nurture mutual learning among cities in developing countries and Japan, and promote the private companies’

investment in low-carbon technologies in developing countries.

Japan will provide technical support to prepare GHG emission inventories at the city level, develop master plans and institutions towards low-carbon cities in developing countries by utilizing experiences and know-how of Japanese local governments and the coordination among cities both in developing countries and Japan. To assist Japanese companies working on climate change programs, Japan will support development and implementation of corporate's target consistent with Paris 2-degree target (Science-Based Target, SBT) as well as their activities to contribute to global emission reduction based on industry's action plan towards a low-carbon society, and promote emission reduction in the global value chain of Japanese companies in addition to domestic emission reduction.

Moreover, Japan will collaborate with the alliances of the private sector, including the Japan Climate Leaders Partnership (Japan-CLP), which reckons climate change measures as business chances, and back up programs led by private sectors. Japan will also promote Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD+) through public-private partnerships.

5.5.4 Partnership to Strengthen Transparency for Co-Innovation (PaSTI)

As mentioned above, Japan has established “Partnership to Strengthen Transparency for Co-Innovation (PaSTI) (Visualization Partnership),” in cooperation with developing countries and international organizations.

Based on the discussion during the COP23 preparation workshop, one of the official events of COP23 held in Fiji on September 25-26 in 2017, this partnership will combine concrete programs presented in the previous sections and provide support focusing on the following items to respond needs and urgent issues in developing countries. .

- Development and implementation of NDC and evaluation of its progress. (See 5.5.3.1 for the concrete programs.)
- Establishment and operation of climate risk information to improve transparency of adaptation activities. (See 5.5.2.1 for the concrete programs.)

Under these themes, Japan intends to start with the implementation of a pilot project with a couple of partnership countries in collaboration with other donors and international organizations.

In addition, Japan will conduct analysis and research for visualization of impacts of supports including the amount of financial support regarding transparency of support in order to enhance further mobilization of finance and cooperation with a view to the development of PaSTI.

5.5.5 Projects related to provision of capacity-building support

The detailed information on projects/programmes to promote capacity building in developing countries is shown in Table 5-9.

Table 5-9 Provision of capacity-building support (CTF Table 9)

No.	Recipient country and/or region	Targeted area	Programme or project title	Description of programme or project
1	Asia/Pacific	Multiple Areas	Asia-Pacific joint research /observation work of the Global Environment	Supports the Asia-Pacific Network for Global Change Research (APN) which is an intergovernmental network in the Asia-Pacific region to foster global change research, increase developing country participation in that research, and strengthen interactions between the science community and policy-makers.
2	Asia/Pacific	Adaptation	The Global Adaptation Network (GAN), the Asia-Pacific Adaptation Network (APAN)	Supports UNEP lead the Global Adaptation Network (GAN) and the Asia-Pacific Adaptation Network (APAN), to enhance capacity of policy-makers, practitioners and researchers in the Asia-Pacific region by sharing knowledge on climate change adaptation.
3	Asia/Pacific	Mitigation	The 14th and 15th Workshop on Greenhouse Gas Inventories in Asia (WGIA14, 15)	WGIA has been held organized by the Ministry of the Environment of Japan, National Institute for Environmental Studies and host countries' governments since 2003 for the purpose of the quality improvement of Greenhouse gas inventories in Asian countries and promotion of regional cooperation.
4	Bangladesh	Adaptation	Disaster Risk Management Enhancement Project	In Bangladesh where many natural disasters occur, this project aims to enhance the comprehensive disaster risk management of the Government of Bangladesh by recovering and rehabilitating infrastructure at high risk for natural disasters, providing equipment for emergency communication and relief, and establishing and implementing a scheme for the quick and effective recovery and rehabilitation, thereby contributing to the sustainable development of Bangladesh with the development of a disaster-resilient society.
5	East Timor	Adaptation	The Project for Community-Based Sustainable Natural Resource Management(CBNRM) PhaseII	This project contributes to enhance the capacity of key operational actors such as the NDFWM, NGOs and other relevant stakeholders through developing human resources, strengthening existing rules and establishing roadmaps aiming for community-based sustainable natural resource management.
6	El Salvador	Adaptation	The Project for Capacity Development of the Department of Climate Change Adaptation and Strategic Risk Management for Strengthening of Public Infrastructure, Phase II	This project aims to improve disaster risk management of road infrastructure through developing a standard document/manual on road disaster risks, implementing pilot projects and strengthening of the capacity of the Department of Climate Change Adaptation and Strategic Risk Management (DACGER)
7	Indonesia	Adaptation	Cooperation on Climate Change Impact Assessment for Local Adaptation Planning in the Republic of Indonesia	This project aims to cooperate on climate change impact assessment to formulate the local climate change adaptation plans under National Action Plan for Climate Change Adaptation (RAN-API) through capacity building for local authorities.
8	Mongolia	Adaptation	Supporting Impact Assessment and Adaptation planning on Climate Change in Mongolia	This project aims to support practical formulation for national climate change adaptation planning by cooperation of scientific technical impact assessment in Mongolia.
9	Mongolia, Bangladesh, Vietnam, Laos, Indonesia, Cambodia, Thailand, Myanmar, Malaysia, the Philippines, India, etc.	Mitigation	FY2015 Capacity Building for the Joint Crediting Mechanism	Capacity-building to implement JCM
10	Pakistan	Mitigation	The project for developing effective phasing out strategy/program of inefficient appliances to support energy standards and labeling regime in the Islamic Republic of Pakistan	This project contributes to establishing visions, strategies and action plans to make energy labelling mandatory.
11	Papua New Guinea	Mitigation	The Project for Enhancing Capacity to Develop a Sustainable GHG Inventory System for PNG	This project contributes to the capacity development of Climate Change and Development Authority (CCDA) to periodically prepare GHG inventories and promoting the understanding for GHG inventories in relevant organizations.
12	Peru	Multiple Areas	Project on Capacity Development for Forest Conservation and REDD+ Mechanisms	This project supports REDD+ activities and sustainable forest management through enhancing the capacity of target groups, including the Ministry of Environment and implementing agencies on REDD+, improving satellite technology, and through implementing pilot projects on forest protection.
13	Samoa	Multiple Areas	The Project for Construction of the Pacific Climate Change Center	Japan supports to build a Pacific Climate Change Center(PCCC) at the main office of the Secretariat of the Pacific Regional Environment Programme (SPREP) in Samoa. The PCCC will function as a base for human resource training in the field of climate change in Oceania to improve the resiliency of the region to environmental and climate change.
14	Samoa	Multiple Areas	Adviser for Pacific Climate Change	This project supports the development of seminar programs, based on the demands of capacity building for climate change measures in SPREP and Oceania countries.
15	Sri Lanka	adaptation	Capacity Building for community based rink reduction project	This project aims to strengthen community-disaster risk reduction system. It supports to implement community-level workshops for improving capacity of disaster risk reduction, making pamphlets and posters for making awareness of local residence, and implementing follow-up of the activities of the year before.
16	Tanzania	Adaptation	Project on the Revision of National Irrigation Master Plan	This project contributes to sustainable irrigation development through revising the National Irrigation Master Plan and formulating implementation plans.
17	Thailand	Multiple Areas	Project for Capacity Development to accelerate Low Carbon and Resilient Society realization in the Southeast Asia region	This project contributes to promoting climate change measures in Thailand and in the Southeast Asia region through capacity development for planning and implementing mitigation/adaptation training programmes in the Climate Change International Technical and Training Center (CITC).
18	Thailand	Adaptation	Supporting Adaptation planning on Climate Change in Thailand	This project aims to develop collaborating structure between related ministries and organizations to continuously gather, process and provide climate change risk and adaptation data which contribute to adaptation planning and implementation through capacity building.
19	Thailand, India, Vietnam, Indonesia, China, the Philippines, Hungary, Egypt, Mexico, Peru, etc.	Mitigation	Human resources development program for promoting export of low-carbon technologies	Support technical training using actual worksites in companies in Japan and send experts to overseas companies to promote the international application of Japanese infrastructures and businesses that are based on advanced low-carbon societies and reduce greenhouse gas emissions.
20	World	Multiple Areas	Capacity Building for National Forest Monitoring System to Promote REDD+ and Sustainable Forest Management	This project supports to implement seminars about national forest monitoring systems to realize REDD+ project.

Acronyms and Abbreviations

	Terms	Definition
A	AAU	Assigned Amount Units
	ACE	Actions for Cool Earth
	AD	Activity Data
	ADB	Asian Development Bank
	APAN	Asia Pacific Adaptation Network
	AR4	IPCC Fourth Assessment Report
	ARD	Afforestation, Reforestation and Deforestation
B	BAT	Best Available Technology
	BAU	Business As Usual
	BCP	Business Continuity Planning
	BEMS	Building Energy Management System
	BPT	Best Practice Technologies
	BR	Biennial Report
	BRT	Bus Rapid Transit
C	CASBEE	Comprehensive Assessment System for Built Environment Efficiency
	CBIT	Capacity Building Initiative for Transparency
	CCPL	Climate Change Program Loan
	CCS	Carbon Capture and Storage
	CCU	Carbon Capture and Utilization
	CDV	Clean Diesel Vehicle
	CERs	Certified Emission Reductions
	CFC	Chlorofluorocarbons
	CH_4	Methane
	CM	Cropland Management
	CNG	Compressed Natural Gas
	CNGV	Compressed Natural Gas Vehicle
	CO	Carbon monoxide
	CO_2	Carbon dioxide
	CO_2 eq.	Gas Emission in CO_2 equivalent
	COP	Conference of Parties
	CRF	Common Reporting Format
	CTF	Common Tabular Format
	CY	Calendar Year
D	DAC	Development Assistance Committee
E	EF	Emission Factor
	EMS	Eco-drive Management Systems
	EMS	Energy Management System
	ERUs	Emission Reduction Units
	ESCO	Energy Service Company
	ESG	Environmental, Social, Governance
	EST	Environmentally Sustainable Transport
	EV	Electric Vehicle
F	FCV	Fuel Cell Vehicle
	FM	Forest Management
	FEMS	Factory Energy Management System
	FY	Fiscal Year
G	GAN	Global Adaptation Network
	GCF	Green Climate Fund
	GDP	Gross Domestic Product
	GEF	Global Environment Facility
	GHG	Greenhouse Gas
	GIO	Greenhouse Gas Inventory Office
	GM	Grazing Land Management

	Terms	Definition
	GRA	Global Research Alliance
	GREEN	Global action for Reconciling Economic growth and Environmental preservation
	GWP	Global Warming Potential
H	HCFC	Hydrochlorofluorocarbon
	HFCs	Hydrofluorocarbons
	HEMS	Home Energy Management System
	HHV	Higher Heating Value
	HOB	Heat Only Boiler
	HV	Hybrid Vehicle
	HWP	Harvested Wood Products
I	ICAO	International Civil Aviation Organization
	ICEF	Innovation for cool earth Forum
	ICT	Information and Communication Technology
	IGFC	Integrated coal gasification fuel cell combined cycle
	IMO	International Maritime Organization
	IoT	Internet of Things
	IPCC	Intergovernmental Panel on Climate Change
	IPPU	Industrial Processes and Product Use
	ISO	International Organization for Standardization
	ITS	Intelligent Transport System
	ITTO	The International Tropical Timber Organization
J	JBIC	Japan Bank of International Cooperation
	JCM	Joint Crediting Mechanism
	JICA	Japan International Cooperation Agency
	JNGI	Japanese National GHG Inventory
K	KP	Kyoto Protocol
L	LCCM	Life Cycle Carbon Minus
	LED	Light Emitting Diode
	LNG	Liquefied Natural Gas
	LPG	Liquid Petroleum Gas
	LRT	Light Rail Transit
	LULUCF	Land-Use, Land-Use Change and Forestry
M	MAFF	Ministry of Agriculture, Forestry and Fisheries
	MEPS	Minimum Energy Performance Standards
	METI	Ministry of Economy, Trade and Industry
	MIC	Ministry of Internal Affairs and Communications
	MLIT	Ministry of Land, Infrastructure and Transport and Tourism
	MOE	Ministry of the Environment
	MOFA	Ministry of Foreign Affairs of Japan
	MRV	Measurement, Reporting and Verification
N	N_2O	Nitrous oxide
	NAMA	Nationally Appropriate Mitigation Action
	NC	National Communication
	NDC	Nationally Determined Contribution
	NEB	Non-Energy Benefit
	NF_3	Nitrogen trifluoride
	NIES	National Institute for Environmental Studies
	NIR	National Inventory Report
	NMVOC	Non-methane volatile organic compounds
	NOx	Nitrogen oxides
O	O&M	Operation and Maintenance
	ODA	Official Development Assistance
	ODS	Ozone Depleting Substance
	OOF	Other Official Flow
P	PDCA	Plan–Do–Check–Act
	PF	Private Flows

	Terms	Definition
	PFCs	Perfluorocarbons
	PHV	Plug-in Hybrid Vehicle
Q	QA/QC	Quality Assurance / Quality Control
	QAWG	Quality Assurance Working Group
	QC	Quality Control
R	R&D	Research and Development
	REDD+	Reducing Emissions from Deforestation and Forest Degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries
	RV	Revegetation
S	SBI	Subsidiary Body for Implementation
	SDGs	Sustainable Development Goals
	SF_6	Sulfur hexafluoride
	SIDS	Small Island Developing States
	SO_2	Sulfur Dioxide
	SOx	Sulfur Oxides
U	UN	United Nations
	UNDP	United Nations Development Programme
	UNEP	United Nations Environment Programme
	UNFCCC	United Nations Framework Convention on Climate Change
	USD	United States Dollar
V	VOC	Volatile Organic Compounds
	VVVF	Variable Voltage Variable Frequency
W	WG	Working Group
	WGIA	Workshop on Greenhouse Gas Inventories in Asia
	WMO	World Meteorological Organization
Z	ZEB	(Net) Zero Energy Building
	ZEH	(Net) Zero Energy House

Notation Key	Definition
NO	Not Occurring
NE	Not Estimated
NA	Not Applicable
IE	Included Elsewhere
C	Confidential

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