Chapter 2
Trends in GHGs Emissions and Removals[1]

2.1 Description and Interpretation of Emission and Removal Trends for Aggregate Greenhouse Gases

2.1.1 Greenhouse Gas Emissions and Removals

Total greenhouse gas emission in FY2007[2] (the sum of emissions of CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6 converted to CO_2 equivalents by multiplying its global warming potential (GWP)[3] respectively; excluding for CO_2 removals) was 1,374 million tonnes (in CO_2 equivalents), an increase by 9% compared to emissions in the base year under the Kyoto Protocol (FY1990 for emissions of CO_2, CH_4, N_2O; FY1995 for emissions of HFCs, PFCs, and SF_6).

Compared to emissions (CO_2, CH_4, N_2O, excluding CO_2 removals) in FY1990, it increased by 13.8%, it should be noted that actual emissions of HFCs, PFCs, and SF_6 in the period from 1990 to 1994, have not been estimated (NE)[4].
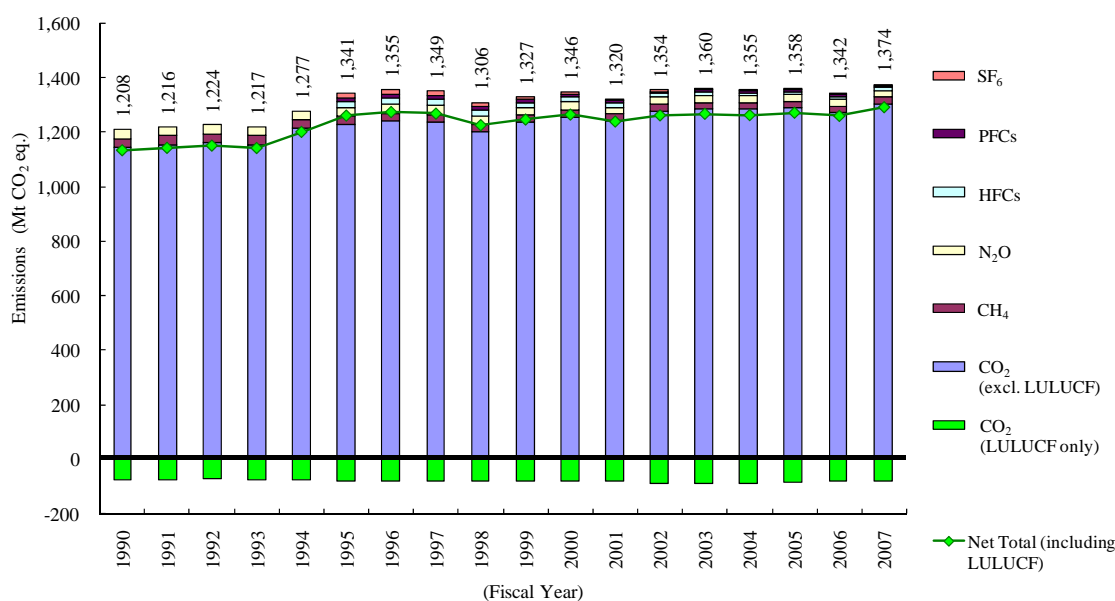

Figure 2.1 Trends in emission and removals of greenhouse gases in Japan

Emissions of CO_2 in FY2007 were 1,304 million tonnes (without LULUCF), comprising 94.9% of the total. It represents an increase by 14% from FY1990, and an increase by 2.6% in comparison

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[1] This chapter was written in accordance with the National Greenhouse Gas Inventory Report of Japan (April 2009).

[2] "FY (Fiscal Year)" is used because CO_2 is the primary GHGs emissions and estimated on the fiscal year basis; from April of the year to March of the next year. ("CY" stands for "Calendar Year")

[3] Global Warming Potential (GWP): It is the coefficients that indicate degrees of greenhouse gas effects caused by greenhouse gases converted into the proportion of equivalent degrees of CO_2. The coefficients are subjected to the *Second National Assessment Report* (1995) issued by the Intergovernmental Panel on Climate Change (IPCC).

[4] Potential emissions are reported in CRF for 1990-1994.

with the previous year. Removals of CO_2 in FY2007 were 81.4 million tonnes[5], equivalent to 5.9% of total annual greenhouse gas emissions. It represents an increase by 9.4% from FY1990, and a decrease by 0.5% in comparison with the previous year. Emissions in FY2007 of CH_4 (including LULUCF) were 22.6 million tonnes (in CO_2 eq.), comprising 1.6% of total emissions. The value represents a reduction by 30.7% from FY1990 and 1.9% in comparison with the previous year. Emissions in FY2007 of N_2O (including LULUCF) were 23.8 million tonnes (in CO_2 eq.), comprising 1.7% of total emissions. The value represents a reduction by 25.8% from FY1990, and a decrease by 3.8% in comparison with the previous year.

Emissions in CY2007 of HFCs were 13.2 million tonnes (in CO_2 eq.), comprising 1.0% of total emissions. The value represents a reduction by 34.8% on CY1995, and an increase by 13.7% in comparison with the previous year. Emissions in CY2007 of PFCs were 6.5 million tonnes (in CO_2 eq.), comprising 0.5% of total emissions. The value represents a reduction by 54.9% from CY1995, and a decrease by 12.2% in comparison with the previous year. Emissions in CY2007 of SF_6 were 4.4 million tonnes (in CO_2 eq.), comprising 0.3% of total emissions. The value represents a reduction by 74.1% from CY1995, and a decrease by 14.8% in comparison with the previous year.

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[5] In the inventory submitted under the FCCC, removals by forest planted before 1990 are contained. Therefore, this value do not correspond to 13 Mt indicated in the annex of Decision 16/CMP.1 (Land use, land-use change and forestry) adopted in COP/MOP1.

Table 2.1 Trends in emissions and removals of greenhouse gas in Japan

[Mt CO$_2$ eq.]	GWP	Base year of KP	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
CO$_2$ (excl. LULUCF)	1	1,144.1	1,143.2	1,152.6	1,160.8	1,153.6	1,213.5	1,226.6	1,238.9	1,234.9	1,198.9	1,233.9	1,254.6
CO$_2$ (incl. LULUCF)	1	NA	1,068.8	1,078.4	1,087.0	1,078.6	1,137.8	1,147.0	1,159.0	1,154.7	1,118.6	1,153.6	1,174.0
CO$_2$ (LULUCF only)	1	NA	-74.4	-74.3	-73.9	-74.9	-75.7	-79.5	-79.9	-80.1	-80.0	-80.3	-80.7
CH$_4$ (excl. LULUCF)	21	33.4	32.6	32.4	32.1	31.8	31.1	30.2	29.5	28.5	27.6	27.0	26.4
CH$_4$ (incl. LULUCF)	21	NA	32.6	32.4	32.1	31.9	31.2	30.2	29.6	28.5	27.7	27.0	26.4
N$_2$O (excl. LULUCF)	310	32.6	32.0	31.5	31.5	31.3	32.5	32.8	33.9	34.6	33.1	26.7	29.3
N$_2$O (incl. LULUCF)	310	NA	32.1	31.5	31.6	31.3	32.5	32.9	33.9	34.6	33.1	26.8	29.3
HFCs	HFC-134a : 1,300 etc.	20.2	NE	NE	NE	NE	NE	20.3	19.9	19.9	19.4	19.9	18.8
PFCs	PFC-14 : 6,500 etc.	14.0	NE	NE	NE	NE	NE	14.4	14.9	16.3	13.5	10.6	9.7
SF$_6$	23,900	16.9	NE	NE	NE	NE	NE	17.0	17.5	15.0	13.6	9.3	7.3
Gross Total (excluding LULUCF)		1,261.3	1,207.8	1,216.5	1,224.5	1,216.7	1,277.1	1,341.2	1,354.7	1,349.1	1,306.2	1,327.5	1,346.0
Net Total (including LULUCF)		NA	1,133.5	1,142.3	1,150.7	1,141.8	1,201.4	1,261.7	1,274.9	1,269.0	1,226.2	1,247.2	1,265.4

[Mt CO$_2$ eq.]	GWP	Base year of KP	2001	2002	2003	2004	2005	2006	2007	Emission increase from the base year of KP	Emission increase from 1990 (2007)	Emission increase from 1995 (2007)	Emission increase from previous year (2007)
CO$_2$ (excl. LULUCF)	1	1,144.1	1,238.8	1,276.7	1,283.9	1,282.5	1,287.3	1,270.2	1,303.8	14.0%	14.0%	-	2.6%
CO$_2$ (incl. LULUCF)	1	NA	1,158.0	1,185.6	1,192.5	1,190.9	1,201.7	1,188.4	1,222.4	-	14.4%	-	2.9%
CO$_2$ (LULUCF only)	1	NA	-80.8	-91.1	-91.4	-91.6	-85.6	-81.7	-81.4	-	9.4%	-	-0.5%
CH$_4$ (excl. LULUCF)	21	33.4	25.6	24.7	24.2	23.8	23.4	23.0	22.6	-32.3%	-30.7%	-	-1.9%
CH$_4$ (incl. LULUCF)	21	NA	25.6	24.7	24.2	23.8	23.4	23.0	22.6	-	-30.7%	-	-1.9%
N$_2$O (excl. LULUCF)	310	32.6	25.8	25.5	25.2	25.3	24.8	24.7	23.8	-27.1%	-25.6%	-	-3.8%
N$_2$O (incl. LULUCF)	310	NA	25.8	25.5	25.2	25.3	24.9	24.7	23.8	-	-25.8%	-	-3.8%
HFCs	HFC-134a : 1,300 etc.	20.2	16.2	13.7	13.8	10.6	10.6	11.6	13.2	-34.6%	-	-34.8%	13.7%
PFCs	PFC-14 : 6,500 etc.	14.0	8.1	7.5	7.3	7.5	7.1	7.4	6.5	-53.8%	-	-54.9%	-12.2%
SF$_6$	23,900	16.9	6.0	5.7	5.4	5.3	4.6	5.1	4.4	-74.1%	-	-74.1%	-14.8%
Gross Total (excluding LULUCF)		1,261.3	1,320.5	1,353.7	1,359.7	1,355.0	1,357.8	1,342.1	1,374.3	9.0%	13.8%	2.5%	2.4%
Net Total (including LULUCF)		-	1,239.7	1,262.7	1,268.4	1,263.4	1,272.3	1,260.4	1,292.9	-	14.1%		2.6%

* NA: Not Applicable, NE: Not Estimated
* CH4 and N2O emissions in Table 2.1 include emissions from Land-Use Change and Forestry based on the estimation method decided by the UNFCCC. On the contrary, since emissions from Land-Use Change and Forestry are regarded as RMU (removal unit) according to Article 3.3 of the Kyoto Protocol, they are not included in GHG emissions based on Kyoto Protocol (refer annex 8 table 1).

2.1.2 CO$_2$ Emissions Per Capita

Total CO$_2$ emissions in FY2007 were 1,304 million tonnes, with an emission of 10.20 tonnes per capita. Compared to FY1990, it represents an increase of 14.0% in total CO$_2$ emissions, and an increase of 10.3% in CO$_2$ emissions per capita. CO$_2$ emissions compared to the previous year decreased by 2.6% in total emissions and by 2.6% per capita.
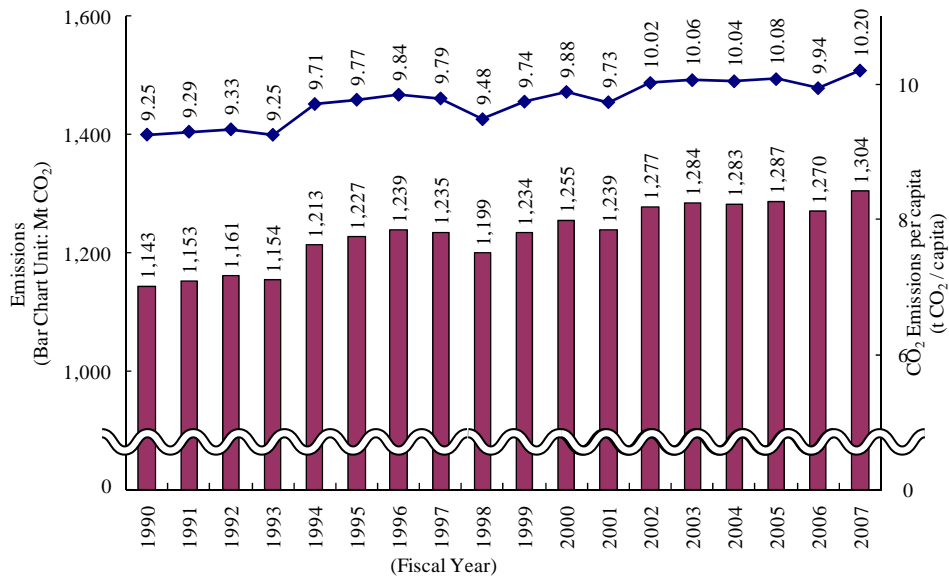
Figure 2.2 Trends in total CO_2 emissions and CO_2 emissions per capita

Source of population: Ministry of Public Management, Home Affairs, Posts and Telecommunications Japan, *Population Census*

MPMHAPTJ, *Annual Report on Current Population Estimates*

2.1.3 CO_2 Emissions Per Unit of GDP

CO_2 emissions per unit of GDP in FY2007 were 2.32 tonnes/million yen, resulting in a decrease by 8.7% since FY1990, and an increase by 0.7% from the previous year.
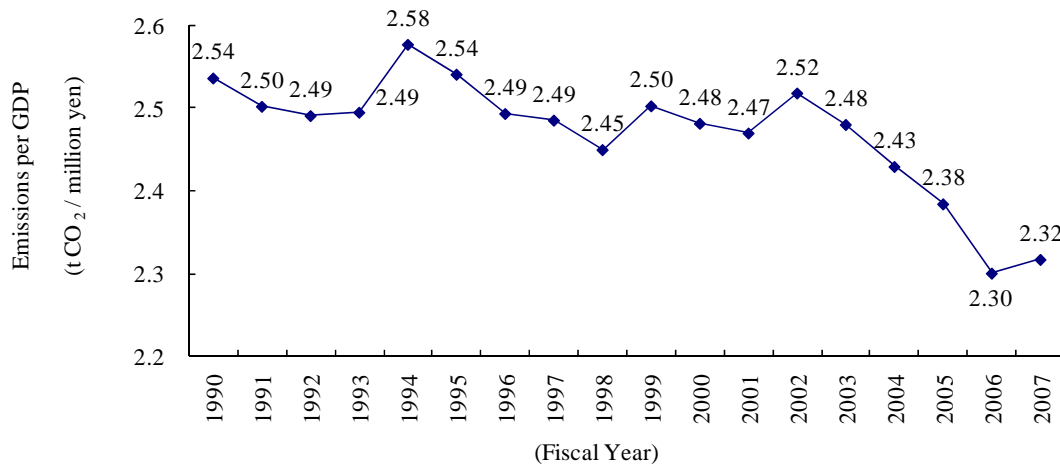

Figure 2.3 Trends in CO_2 emissions per unit of GDP

Source of GDP: (Before FY1993) Energy Conservation Center, *EDMC Handbook of Energy & Economic Statistics in Japan*

(After FY1994) Cabinet Office, Government of Japan, *Annual Report on National Accounts*

(Real Gross Domestic Product, expenditure approach, chain-linked, chained CY2000)

2.2 Description and Interpretation of Emission and Removal Trends by Gas

2.2.1 CO_2

CO_2 emissions in FY2007 were 1,304 million tonnes (excluding LULUCF), comprising 94.9% of the total. It represents an increase by 14% from FY1990, and a decrease by 2.6% in comparison with the previous year.
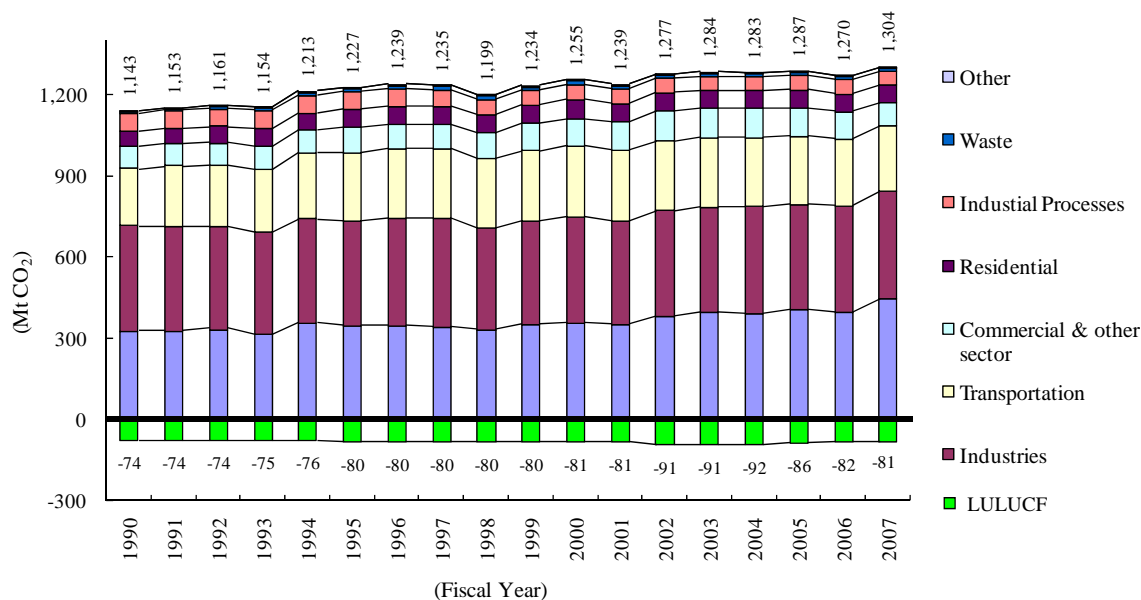

Figure 2.4 Trends in CO_2 emissions

The breakdown of CO_2 emissions in FY2007 shows that CO_2 emitted in association with fuel combustion accounted for 94.7% of the total, CO_2 from industrial processes accounted for 4.1%, and carbon dioxide from the waste sector accounted for 1.1%. The energy sector accounts for 34.4% of emissions of CO_2 from fuel combustion, making it the single largest source of emissions followed by the industrial sector at 30.3% and the transport sector at 18.5%.

Fluctuations in emissions by sector show that CO_2 emissions from fuel combustion in the energy sector, which accounts for about 30% of CO_2 emissions, increased by 38.4% compared to FY1990, and 13.4% compared to the previous year. CO_2 emissions from fuel combustion in the industrial sector increased by 0.4% compared to FY1990, and decreased by 0.2% compared to the previous year. CO_2 emissions from fuel combustion in the transport sector increased by 14.5% compared to FY1990, and decreased by 1.9% compared to the previous year. CO_2 emissions from fuel combustion in the commercial and other sectors increased by 5.1% compared to FY1990, and decreased by 12.8% compared to the previous year. CO_2 emissions from fuel combustion in the residential sector increased by 10.8% compared to FY1990, and decreased by 1.4% compared to the previous year.

Removals of CO_2 in FY2007 were 81.4 million tonnes[4], equivalent to 5.9% of total annual CO_2 emissions. It represents an increase by 9.4% from FY1990, and a decrease by 0.5% in comparison with the previous year.

Energy Industries
324Mt → 449M t (+38.4%)

Industries 393Mt → 394M t (-0.4%)

Transportation 211 M t → 242 M t (+14.5%)

Commercial and other sector
84 M t → 88M t (+5.1%)

Residential 57 M t → 63M t (+10.8%)

Industrial Processes
62 M t → 54 M t (-13.7%)

Waste 13 M t → 15M t (+16.2%)

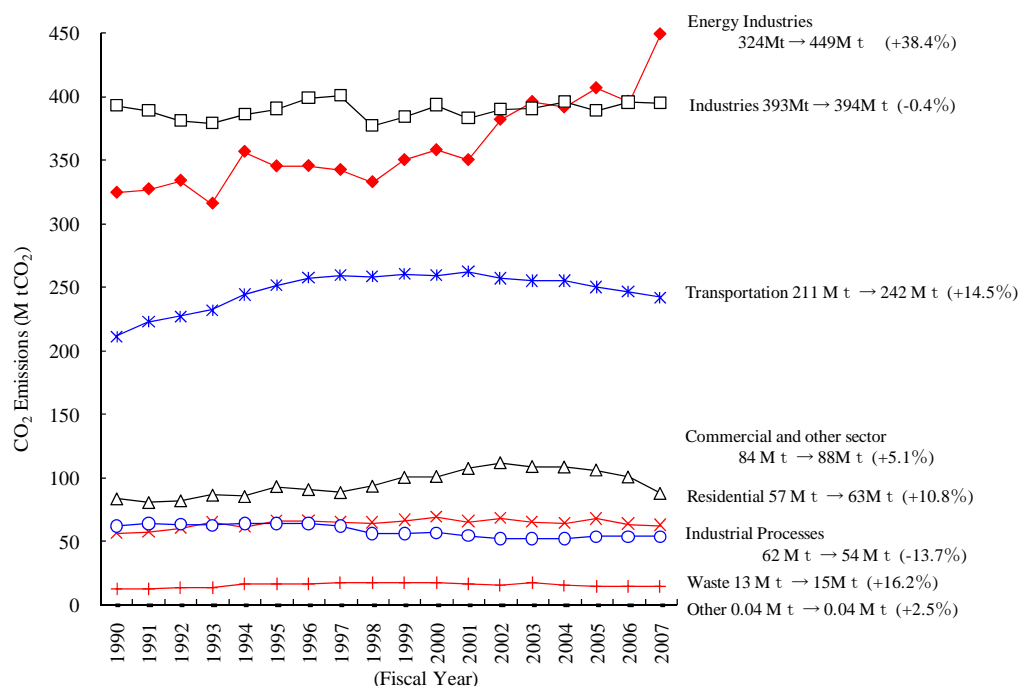Other 0.04 M t → 0.04 M t (+2.5%)

Figure 2.5 Trends in CO₂ emissions in each sector

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

Table 2.2 Trends in CO₂ emissions and removals in each sector

[Gg CO_2]

Category	1990	1995	2000	2005	2006	2007
1A. Fuel Combustion	1,068,019	1,145,682	1,180,026	1,218,738	1,201,534	1,235,227
Energy Industry	324,014	344,805	357,482	406,196	395,571	448,564
Public Electricity & Heat Production	296,835	315,256	330,772	379,078	371,477	424,862
Petroleum Refining	15,893	16,956	17,285	16,436	16,090	16,015
Manufacture of Solid Fuel and Other Energy	11,286	12,592	9,426	10,682	8,003	7,687
Industries	392,690	390,118	393,123	388,909	395,164	394,402
Manufacturing Industries & Construction	371,310	370,592	377,014	375,516	381,831	381,040
Agriculture, Forestry and Fisheries	21,380	19,526	16,109	13,393	13,333	13,362
Transport	211,054	251,161	259,204	249,534	246,335	241,587
Civil Aviation	7,162	10,278	10,677	10,799	11,178	10,876
Road Transportation	189,228	225,376	232,955	225,197	221,895	217,653
Railways	932	819	707	644	645	647
Navigation	13,731	14,687	14,865	12,895	12,616	12,411
Commercial and Residential	140,262	159,598	170,216	174,099	164,465	150,674
Commercial & other sector	83,593	93,277	101,258	106,324	100,814	87,896
Residential	56,668	66,320	68,958	67,775	63,650	62,777
Other	NO	NO	NO	NO	NO	NO
1B. Fugitive Emissions from Fuel	37	51	36	38	36	38
2. Industrial Processes	62,269	64,223	56,839	53,858	53,862	53,730
Mineral Products	57,399	59,340	52,412	50,431	50,464	50,219
Chemical Industry	4,514	4,525	4,178	3,185	3,221	3,299
Metal Production	356	357	248	242	178	212
5. LULUCF	-74,364	-79,546	-80,666	-85,608	-81,735	-81,363
6. Waste	12,877	16,619	17,735	14,702	14,745	14,786
Total (including LULUCF)	1,068,837	1,147,028	1,173,970	1,201,728	1,188,442	1,222,419
Total (excluding LULUCF)	1,143,201	1,226,575	1,254,636	1,287,335	1,270,177	1,303,781

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2.2.2 CH$_4$

CH$_4$ emissions in FY2007 were 22.6 million tonnes (in CO$_2$ eq.), comprising 1.6% of total emissions. The value represents a reduction by 30.7% from FY1990 and 1.9% in comparison with the previous year. The reduction from FY1990 is mainly a result of the reduction of the waste sector's emissions (e.g. SWDS), which decreased by 46% compared to FY1990.
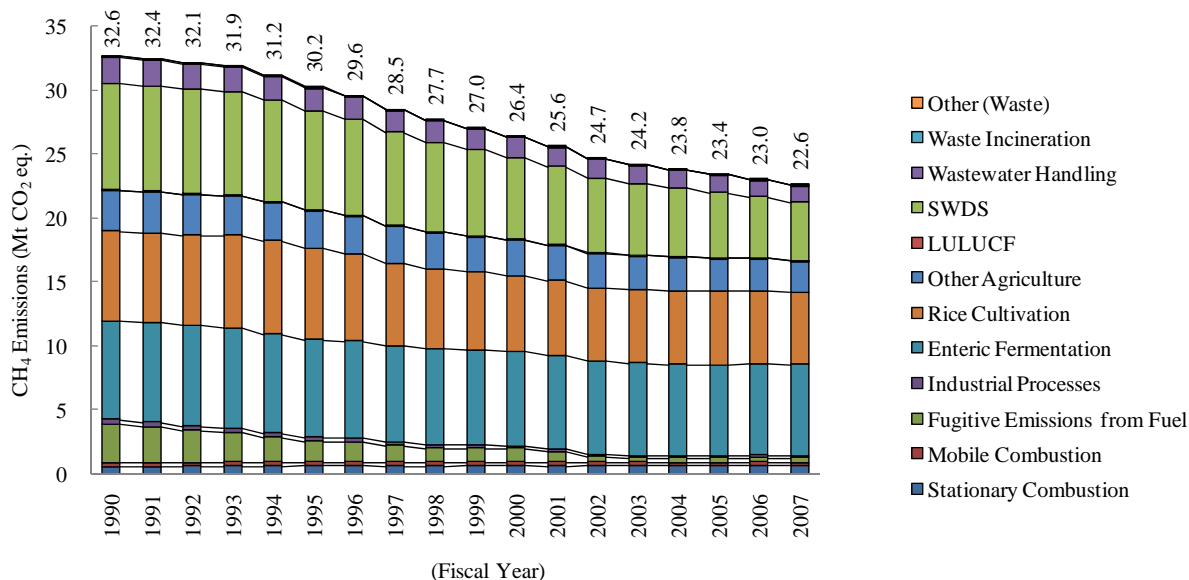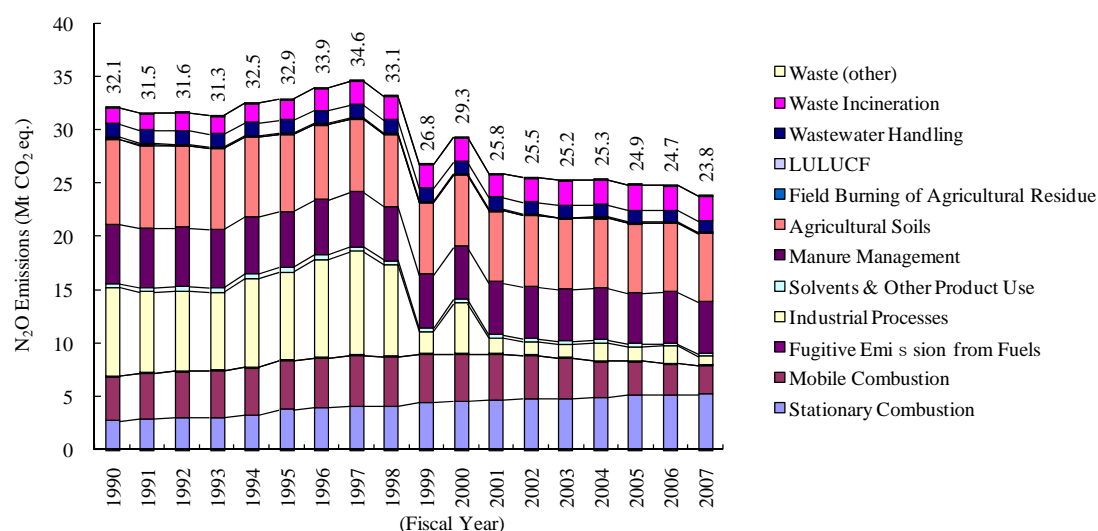

Figure 2.6 Trends in CH$_4$ emissions

The breakdown of CH$_4$ emissions in FY2007 shows that CH$_4$ emitted from enteric fermentation in livestock accounted for 31% of the total, making it the single largest source of emissions. It is followed by CH$_4$ emissions from rice cultivation at 25%, and CH$_4$ emissions from SWDS (Solid Waste Disposal Site) at 20%.

Table 2.3 Trends in CH$_4$ emissions

[Gg CO$_2$eq.]

Category	1990	1995	2000	2005	2006	2007
1A. Fuel Combustion	881	955	956	892	917	869
1A1. Energy Industries	30	34	44	43	45	50
1A2. Industries	347	358	345	358	369	369
1A3. Transport	297	308	298	238	223	209
1A4. Residential / Institutional	207	255	269	253	281	241
1B. Fugitive Emissions from Fuels	3,037	1,610	1,043	396	409	416
1B1. Solid Fuels	2,806	1,345	769	74	68	51
1B2. Oil & Natural Gas	231	265	274	322	340	365
2. Industrial Processes	358	322	181	134	133	134
4. Agriculture	17,912	17,756	16,127	15,477	15,399	15,272
4A. Enteric Fermentation	7,674	7,605	7,374	7,087	7,105	7,121
4B. Manure Management	3,105	2,903	2,688	2,513	2,448	2,394
4C. Rice Cultivation	7,003	7,127	5,956	5,775	5,743	5,654
4F. Field Burning of Agricultural	130	121	109	102	103	103
5. LULUCF	8	9	8	9	2	2
6. Waste	10,434	9,576	8,058	6,524	6,180	5,913
6A. SWDS	8,286	7,689	6,394	5,094	4,784	4,517
6B. Wastewater Handling	2,121	1,861	1,637	1,406	1,369	1,369
6C. Waste Incineration	13	15	13	10	10	10
6D. Other (Waste)	14	11	13	14	17	17
Total (including LULUCF)	32,631	30,229	26,372	23,430	23,039	22,606
Total (excluding LULUCF)	32,622	30,220	26,365	23,421	23,037	22,604

2.2.3 N$_2$O

N$_2$O emissions in FY2007 were 23.8 million tonnes (in CO$_2$ eq.), comprising 1.7% of total emissions. The value represents a reduction by 25.8% from FY1990, and a decrease by 3.8% in comparison with the previous year. The reduction from FY1990 is mainly a result of a reduction of industrial sector's emissions (e.g. adipic acid production), which decreased by 90% compared to FY1990. In March 1999, N$_2$O abatement equipment came on stream in the adipic acid production plant, causing a sharp decline in emissions from the process during the period from FY1998 to FY1999. In FY2000, N$_2$O emissions increased because of a decrease in operational rate of the abatement equipment. In 2001, N$_2$O emissions decreased with resuming the normal operation of the equipment.

Figure 2.7 Trends in N$_2$O emissions

The breakdown of N$_2$O emissions in FY2007 shows that emissions from agricultural soils comprise 27% of the total, making it the single largest source of emissions. It is followed by emissions from fuel combustion in stationary sources at 22%, and emissions from manure management at 20%.

Table 2.4 Trends in N$_2$O emissions

[Gg CO$_2$eq.]

Category	1990	1995	2000	2005	2006	2007
1A. Fuel Combustion	6,923	8,381	9,015	8,331	8,089	7,942
1A1. Energy Industries	920	1,455	1,765	1,982	1,980	2,064
1A2. Industries	1,527	1,940	2,327	2,771	2,790	2,778
1A3. Transport	4,204	4,650	4,561	3,221	2,974	2,783
1A4. Residential / Institutional	272	336	362	357	345	316
1B. Fugitive Emissions from Fuels	0.1	0.2	0.1	0.1	0.1	0.1
2. Industrial Processes	8,267	8,213	4,690	1,300	1,625	860
3. Solvent & Other Product Use	287	438	341	266	245	245
4. Agriculture	13,696	12,552	11,759	11,355	11,311	11,274
4B. Manure Management	5,661	5,246	4,984	4,849	4,854	4,861
4D. Agricultural Soils	7,931	7,218	6,694	6,433	6,382	6,337
4F. Field Burning of Agricultural	104	89	81	73	75	76
5. LULUCF	69	42	21	11	9	8
6. Waste	2,820	3,260	3,470	3,594	3,470	3,470
6B. Wastewater Handling	1,290	1,247	1,214	1,169	1,159	1,159
6C. Waste Incineration	1,518	2,003	2,245	2,413	2,296	2,296
6D. Waste (other)	13	10	12	13	15	15
Total (including LULUCF)	32,063	32,885	29,297	24,857	24,748	23,800
Total (excluding LULUCF)	31,994	32,843	29,276	24,846	24,739	23,792

2.2.4 HFCs

Emissions of HFCs in 2007[6] were 13.2 million tonnes (in CO_2 eq.), comprising 1.0% of total emissions. The value represents a reduction by 34.8% from CY1995, and an increase by 13.7% in comparison with the previous year. The reduction from CY1995 is mainly the result of a reduction in HFC-23, a by-product of HFCF-22, which decreased by 99% as compared to CY1995.
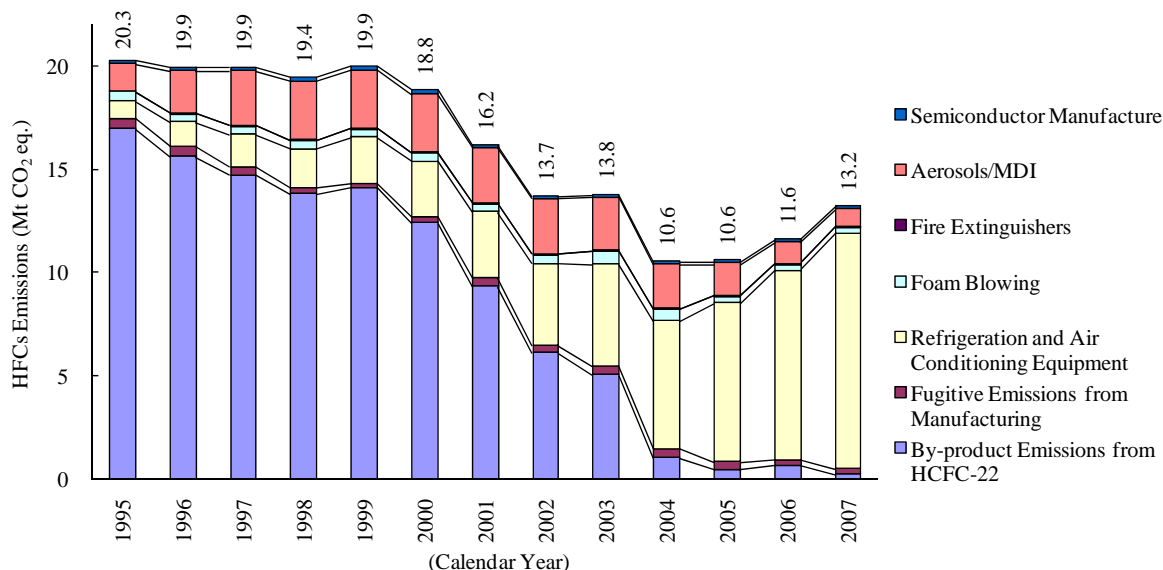
Figure 2.8 Trends in HFCs emissions

The breakdown of HFCs emissions in 2007 shows that emissions of refrigerants from refrigeration and air conditioning equipment accounted for 86% of the total, followed by emissions from aerosols / MDI at 6%.

Table 2.5 Trends in HFCs emissions

[Gg CO_2eq.]

Category	1995	2000	2005	2006	2007
2E. Productions of F-gas	17,445	12,660	816	938	498
2E1. By-product Emissions from Production of HCFC-22	16,965	12,402	463	657	218
2E2. Fugitive Emissions	480	258	353	281	280
2F. Consumption of F-gas	2,815	6,141	9,785	10,685	12,713
2F1. Refrigeration and Air Conditioning Equipment	840	2,688	7,703	9,160	11,375
2F2. Foam Blowing	452	440	364	310	317
2F2. Fire Extinguishers	NO	4	6	6	6
2F4. Aerosols/MDI	1,365	2,834	1,572	1,057	850
2F7. Semiconductor Manufacture	158	174	139	152	164
2F9. Other	NA	NA	NA	NA	NA
Total	20,261	18,800	10,601	11,623	13,210

2.2.5 PFCs

PFCs emissions in 2007 were 6.5 million tonnes (in CO_2 eq.), comprising 0.5% of total emissions. The value represents a reduction of 54.9% from CY1995, and a decrease by 12.2% in comparison with the previous year. The reduction from CY1995 is mainly a result of an emission reduction of

[6] Emissions of calendar year basis are adopted for HFCs, PFCs and SF_6.

solvents, which decreased by 81% compared to CY1995.
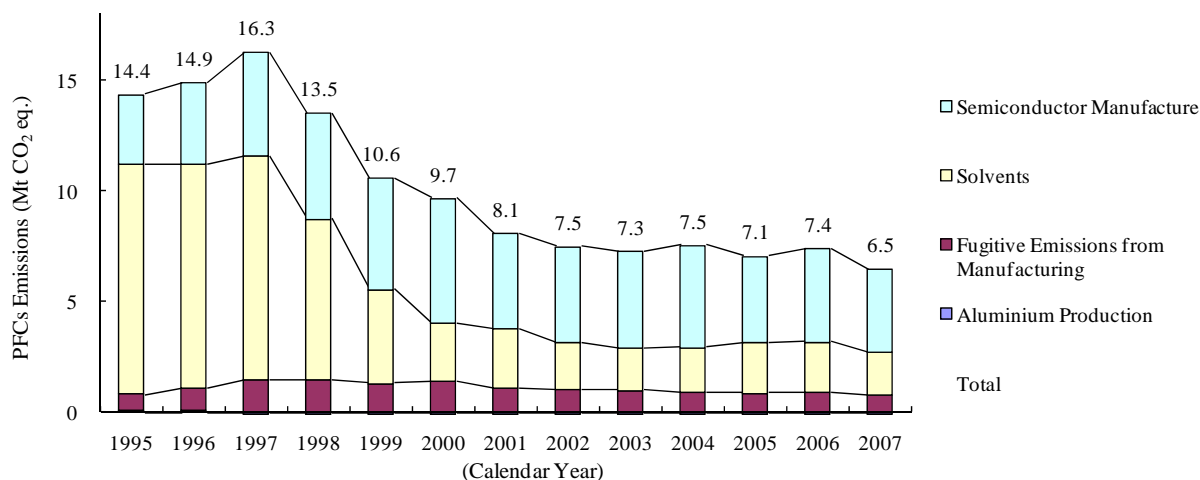
Figure 2.9 Trends in PFCs emissions

The breakdown of PFCs emissions in 2007 shows that emissions from semiconductor manufacture accounted for 58% of the total, followed by emissions from solvents in washing metals etc. at 30%, and fugitive emissions from manufacturing at 12%.

Table 2.6 Trends in PFCs emissions

[Gg CO_2eq.]

Category	1995	2000	2005	2006	2007
2C3. Aluminium Production	70	18	15	15	15
2E2. Fugitive Emissions	763	1,359	837	879	783
2F. Consumption of F-gas	13,531	8,288	6,206	6,491	5,686
2F5. Solvents	10,382	2,649	2,305	2,286	1,944
2F7. Semiconductor	3,149	5,639	3,901	4,205	3,741
Total	14,363	9,665	7,058	7,385	6,483

2.2.6 SF$_6$

Emissions of SF_6 in 2007 were 4.4 million tonnes (in CO_2 eq.), comprising 0.3% of total emissions. This value represents a reduction by 74.1% from CY1995, and 14.8% in comparison with the previous year. The reduction from CY1995 is mainly a result of an emission reduction of electrical equipment, which decreased by 92% as compared to CY1995.
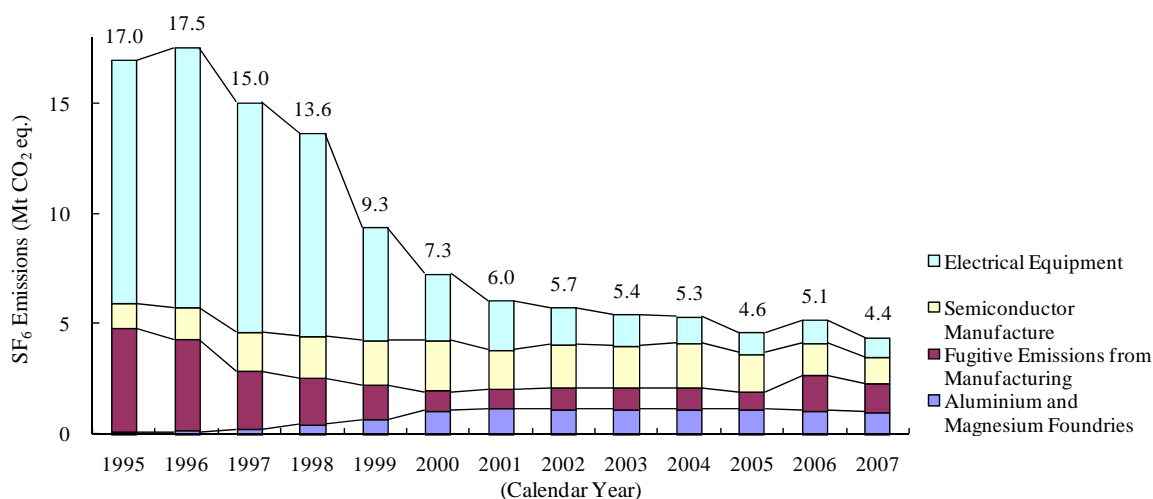
Figure 2.10 Trends in SF$_6$ emissions

The breakdown of SF$_6$ emissions in 2007 shows that fugitive emissions accounted for 29%, followed by emissions from semiconductor manufacturing at 27%, and emissions from magnesium foundries at 23%.

Table 2.7 Trends in SF$_6$ emissions

[Gg CO$_2$eq.]

Category	1995	2000	2005	2006	2007
2C4. SF$_6$ Used in Aluminium and Magnesium Found	120	1,028	1,114	1,046	996
2E2. Fugitive Emissions	4,708	932	789	1,648	1,270
2F. Consumption of F-gas	12,134	5,295	2,678	2,453	2,118
2F7. Semiconductor Manufacture	1,129	2,245	1,736	1,440	1,196
2F8. Electrical Equipment	11,005	3,050	943	1,014	922
Total	16,962	7,255	4,582	5,147	4,385

2.3 Description and Interpretation of Emission and Removal Trends by Categories

The breakdown of emissions and removals of greenhouse gases in FY2007 by sector[7] shows that the energy sector accounted for 90.6% of total annual greenhouse gas emissions, followed by the industrial sector at 5.7%, solvents and other product use at 0.02%, agriculture at 1.9% and waste at 1.8%.

Removals by land use, land-use change and forestry in FY2007 were equivalent to 5.9% of total annual greenhouse gas emissions.

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[7] It implies "Category" indicated in the *Revised 1996 IPCC Guidelines* and *CRF*.
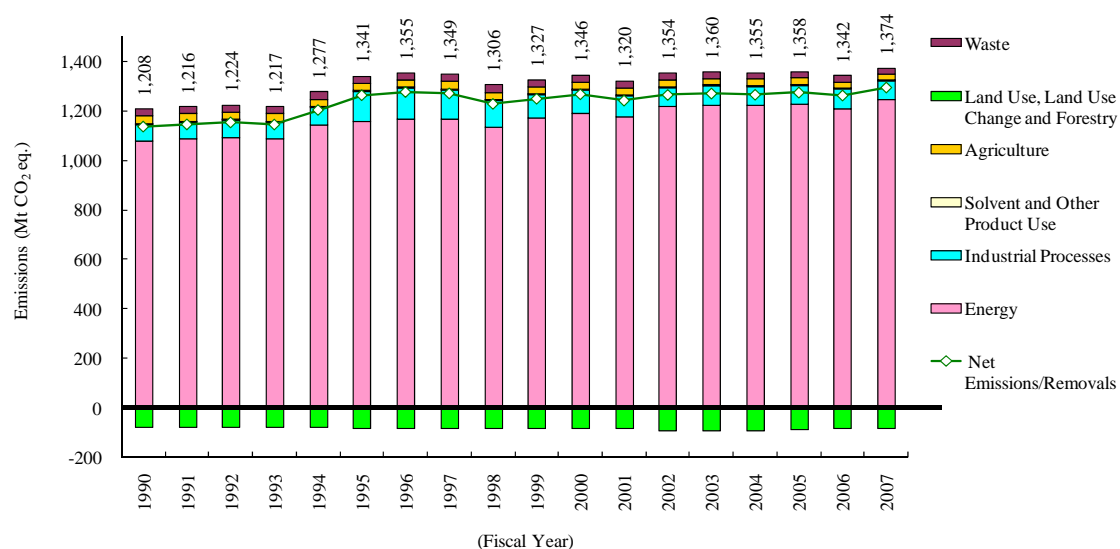
Figure 2.11 Trends in emissions and removals of greenhouse gases in each category

Table 2.8 Trends in emissions and removals of greenhouse gases in each category

[Mt CO$_2$ eq.]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Energy	1,078.9	1,086.8	1,094.2	1,087.7	1,143.8	1,156.7	1,169.0	1,166.0	1,135.8	1,171.2
Industrial Processes	70.9	71.7	71.3	70.3	72.6	124.3	125.9	123.5	111.6	98.3
Solvent and Other Product Use	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Agriculture	31.6	31.5	31.4	31.3	30.9	30.3	29.6	29.0	28.6	28.1
Land Use, Land Use Change and Forestry	-74.3	-74.2	-73.8	-74.9	-75.6	-79.5	-79.8	-80.1	-80.0	-80.3
Waste	26.1	26.1	27.2	26.9	29.3	29.5	29.8	30.2	29.9	29.5
Net Emissions/Removals	1,133.5	1,142.3	1,150.7	1,141.8	1,201.4	1,261.7	1,274.9	1,269.0	1,226.2	1,247.2
Emissions	1,207.8	1,216.5	1,224.5	1,216.7	1,277.1	1,341.2	1,354.7	1,349.1	1,306.2	1,327.5

[Mt CO$_2$ eq.]	2000	2001	2002	2003	2004	2005	2006	2007
Energy	1,191.1	1,178.4	1,218.4	1,224.2	1,224.2	1,228.4	1,211.0	1,244.5
Industrial Processes	97.4	86.6	80.9	80.0	77.8	77.5	79.8	78.8
Solvent and Other Product Use	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2
Agriculture	27.9	27.6	27.4	27.2	27.0	26.8	26.7	26.5
Land Use, Land Use Change and Forestry	-80.6	-80.8	-91.0	-91.3	-91.6	-85.6	-81.7	-81.4
Waste	29.3	27.6	26.8	28.0	25.8	24.8	24.4	24.2
Net Emissions/Removals	1,265.4	1,239.7	1,262.7	1,268.4	1,263.4	1,272.3	1,260.4	1,292.9
Emissions	1,346.0	1,320.5	1,353.7	1,359.7	1,355.0	1,357.8	1,342.1	1,374.3

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2.3.1 Energy

Emissions from the energy sector in FY2007 were 1,244 million tonnes (in CO_2 eq.), an increase of 15.3% compared to FY1990, and an increase of 2.8% in comparison with the previous year.
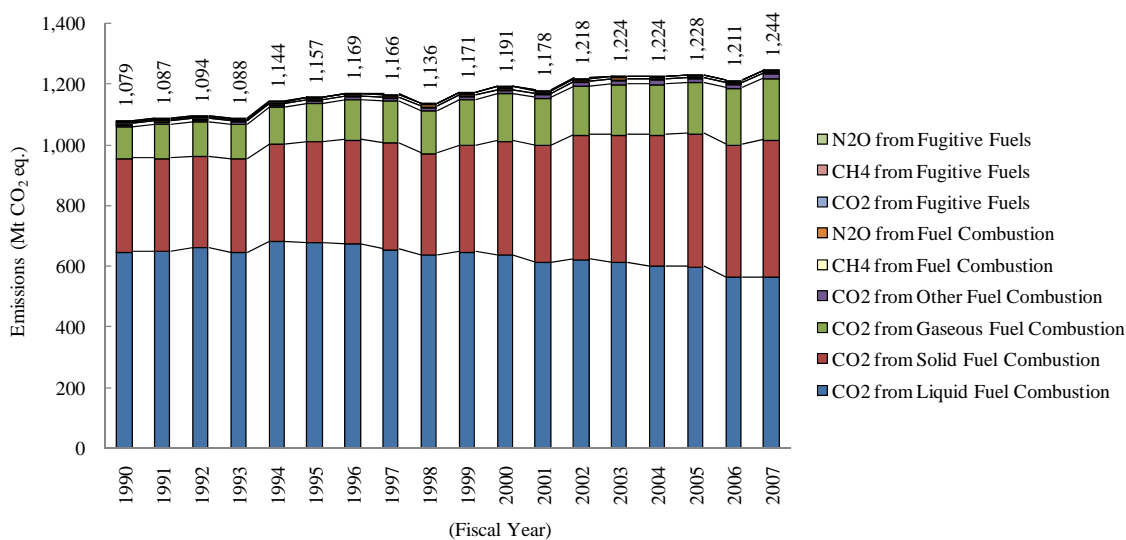
Figure 2.12   Trends in GHGs emissions from the energy sector

The breakdown of emissions of greenhouse gases from the energy sector in FY2007 shows that CO_2 emissions from liquid fuel account for 45%, making it the single largest source of emissions, followed by the CO_2 emissions from solid fuel at 36% and the CO_2 emissions from gaseous fuel at 16%.

Table 2.9 Trends in GHGs emissions from the energy sector

[Gg CO_2eq.]

Source Category	1990	1995	2000	2005	2006	2007
1A. Fuel Combustion	1,075,824	1,155,018	1,189,997	1,227,960	1,210,540	1,244,039
Liquid Euel CO_2	646,223	677,349	635,121	598,218	562,478	564,064
Solid Fuel CO_2	308,620	331,721	376,537	438,247	437,025	451,893
Gaseous Fuel CO_2	104,301	126,198	155,261	166,837	186,389	203,287
Other Fuels (Waste)	8,875	10,415	13,108	15,436	15,643	15,983
CH_4	881	955	956	892	917	869
N_2O	6,923	8,381	9,015	8,331	8,089	7,942
1B. Fugitive Emissions from Fuel	3,074	1,661	1,079	433	445	454
CO_2	37	51	36	38	36	38
CH_4	3,037	1,610	1,043	396	409	416
N_2O	0.1	0.2	0.1	0.1	0.1	0.1
Total	1,078,898	1,156,679	1,191,076	1,228,394	1,210,984	1,244,493

2.3.2 Industrial Sector

Emissions from the industrial sector in FY2007 were 78.8 million tonnes (in CO_2 eq.), an increase of 11.2% compared to FY1990, and a decrease by 1.2% in comparison with the previous year.

It should be noted that actual emissions of HFCs, PFCs, and SF_6 have not been estimated (NE) from 1990 to 1994.

Figure 2.13 Trends in GHGs emissions from the industrial sector

The breakdown of emissions of greenhouse gases from the industrial sector in FY2007 shows that emissions from mineral products, such as CO_2 emissions from the limestone in cement production, account for 64%, making it the single largest source of emissions followed by the emissions from the consumption of HFCs at 16% and the consumption of PFCs at 7%.

Table 2.10 Trends in GHGs emissions in the industrial sector

[Gg CO_2eq.]

Category	1990	1995	2000	2005	2006	2007
2A. Mineral Products (CO_2)	57,399	59,340	52,412	50,431	50,464	50,219
2B. Chemical Industry	13,119	13,043	9,032	4,602	4,962	4,276
CO_2	4,514	4,525	4,178	3,185	3,221	3,299
CH_4	338	304	164	117	116	117
N_2O	8,267	8,213	4,690	1,300	1,625	860
2C. Metal Production	356	564	1,311	1,388	1,255	1,240
CO_2	356	357	248	242	178	212
PFCs	NE	70	18	15	15	15
SF_6	NE	120	1,028	1,114	1,046	996
2E. Production of F-gas	NE	22,916	14,951	2,443	3,466	2,551
HFCs	NE	17,445	12,660	816	938	498
PFCs	NE	763	1,359	837	879	783
SF_6	NE	4,708	932	789	1,648	1,270
2F. Consumption of F-gas	NE	28,480	19,724	18,669	19,629	20,517
HFCs	NE	2,815	6,141	9,785	10,685	12,713
PFCs	NE	13,531	8,288	6,206	6,491	5,686
SF_6	NE	12,134	5,295	2,678	2,453	2,118
Total	70,874	124,344	97,430	77,533	79,775	78,802

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2.3.3 Solvent and Other Product Use

Emissions from solvents and other product use in FY2007 were 245 thousand tonnes (in CO_2 eq.), a decrease by 14.7% from FY1990, and remained the same in comparison with the previous year. The only substance included in calculations in this sector is laughing gas (N_2O), used as a general anesthetic in hospitals.
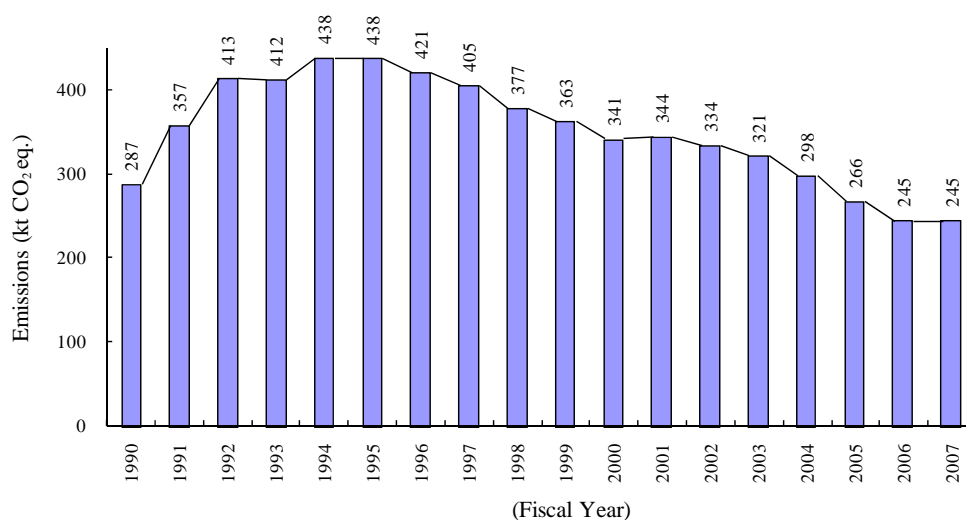
Figure 2.14 Trends in GHGs emissions from the solvent and other product use sector

2.3.4 Agricultural sector

Emissions from the agricultural sector in FY2007 were 26.5 million tonnes (in CO_2 eq.), a decrease by 16.0% compared to FY1990, and by 0.6% in comparison with the previous year.

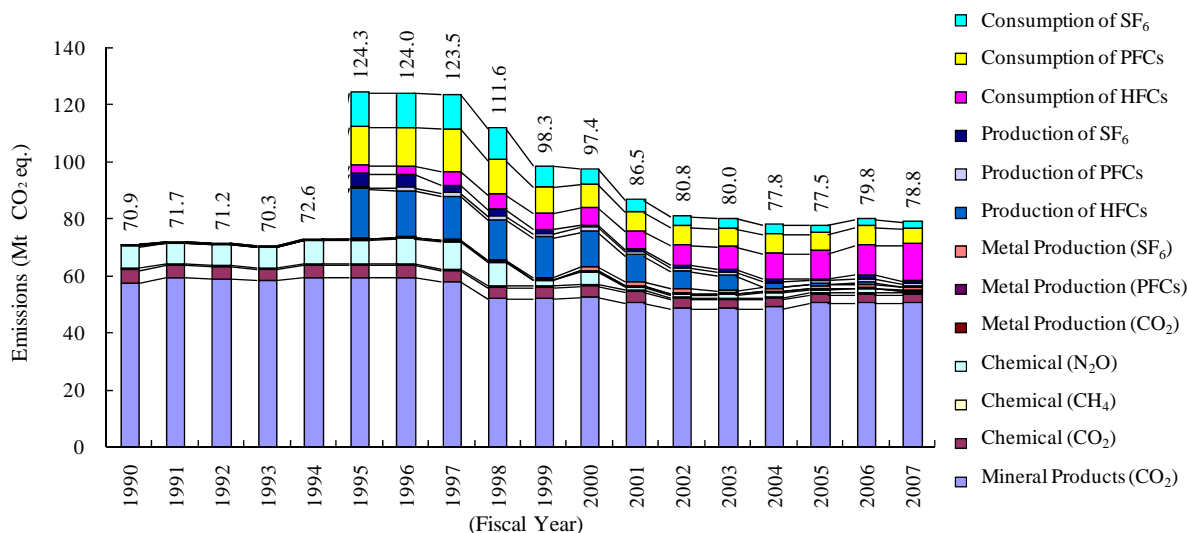**Figure 2.15 Trends in GHGs emissions from the agricultural sector**

The breakdown of emissions of greenhouse gases from agriculture in FY2007 shows that CH_4 emissions from enteric fermentation was 27%, making it the single largest source, followed by N_2O emissions from agricultural soils due to the nitrogen-based fertilizers at 24%, and CH_4 emissions from rice cultivation at 21%.

Table 2.11 Trends in GHGs emissions from the agricultural sector

[Gg CO_2eq.]

Category	1990	1995	2000	2005	2006	2007
4A. Enteric Fermentation(CH_4)	7,674	7,605	7,374	7,087	7,105	7,121
4B. Manure Management	8,766	8,149	7,671	7,361	7,303	7,255
CH_4	3,105	2,903	2,688	2,513	2,448	2,394
N_2O	5,661	5,246	4,984	4,849	4,854	4,861
4C. Rice Cultivation(CH_4)	7,003	7,127	5,956	5,775	5,743	5,654
4D. Agricultural Soils (N_2O)	7,931	7,218	6,694	6,433	6,382	6,337
4F. Field Burning of Agricultural Residues	234	210	190	175	178	179
CH_4	130	121	109	102	103	103
N_2O	104	89	81	73	75	76
Total	31,608	30,308	27,886	26,832	26,710	26,546

2.3.5 Land Use, Land-Use-Change and Forestry

Net removals (including CH_4 and N_2O emissions) in the land use, land-use change and forestry (LULUCF) in FY2007 was 81.4 million tonnes (in CO_2 eq.), an increase of 9.5% from FY1990, and a decrease by 0.5% in comparison with the previous year.
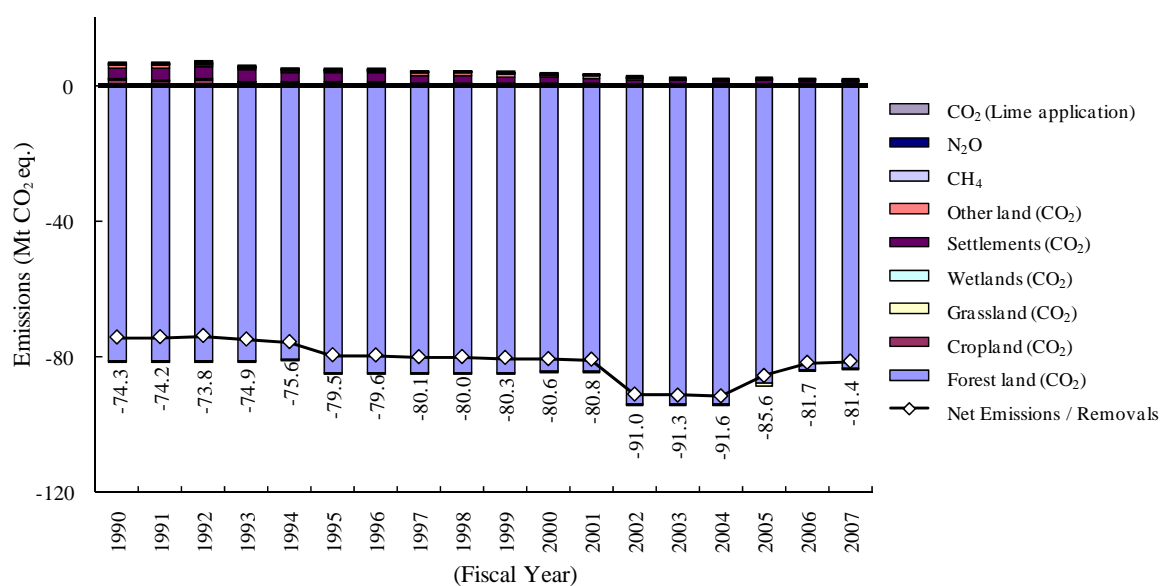
Figure 2.16 Trends in emissions and removals of GHGs from the LULUCF sector

The breakdown of emissions and removals of greenhouse gases from the LULUCF in FY2007 shows that CO_2 removals from forest land was 82.9 million tonnes, accounting for 102% of total net removals of LULUCF sector.

Note: This means emissions and removals of greenhouse gases from LULUCF sector include grassland and other land-use sectors in addition to forest land. Removals of CO_2 from forest land represent

removals from all forest land in Japan, regardless of whether sustainable forest management is undertaken. Therefore, it should be noted that this value differs from the removals based on the Kyoto Protocol, Article 3, paragraph 3 and 4.

Table 2.12 Trends in emissions and removals of GHGs from the LULUCF sector

[Gg CO_2eq.]

Category	1990	1995	2000	2005	2006	2007
5A. Forest land	-80,769	-84,355	-84,042	-87,494	-83,390	-82,865
CO_2	-80,778	-84,365	-84,050	-87,504	-83,392	-82,867
CH_4	8	9	8	9	2	2
N_2O	0.8	0.9	0.8	0.9	0.2	0.2
5B. Cropland	2,126	1,015	535	269	266	273
CO_2	2,058	974	514	259	257	265
CH_4	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
N_2O	68	41	20	10	9	8
5C. Grassland	-516	-401	-460	-593	-621	-615
CO_2	-516	-401	-460	-593	-621	-615
CH_4	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
N_2O	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
5D. Wetlands	292	355	407	142	187	167
CO_2	292	355	407	142	187	167
CH_4	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
N_2O	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
5E. Settlements	3,073	2,583	1,663	1,261	924	849
CO_2	3,073	2,583	1,663	1,261	924	849
CH_4	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
N_2O	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
5F. Other land	957	1,004	927	597	680	608
CO_2	957	1,004	927	597	680	608
CH_4	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
N_2O	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
5G. Other	550	303	333	231	230	230
CO_2	550	303	333	231	230	230
Total	-74,287	-79,496	-80,637	-85,588	-81,723	-81,353

2.3.6 Waste

Emissions from the waste sector in FY2007 were 24.2 million tonnes (in CO_2 eq.), a decrease by 7.5% compared to FY1990, and a decrease by 0.9% in comparison with the previous year[8].
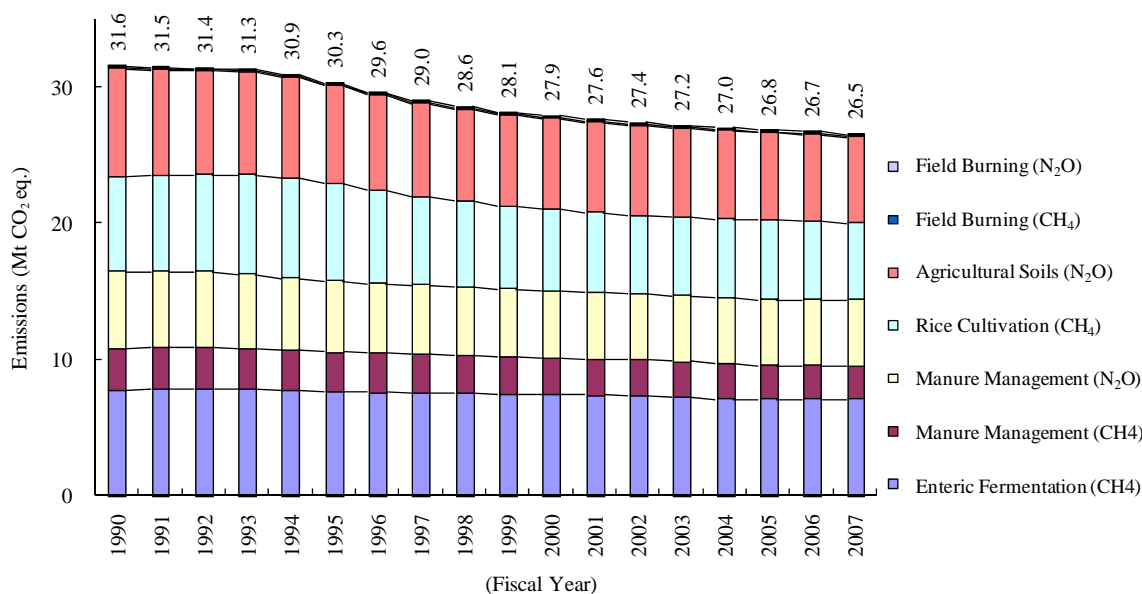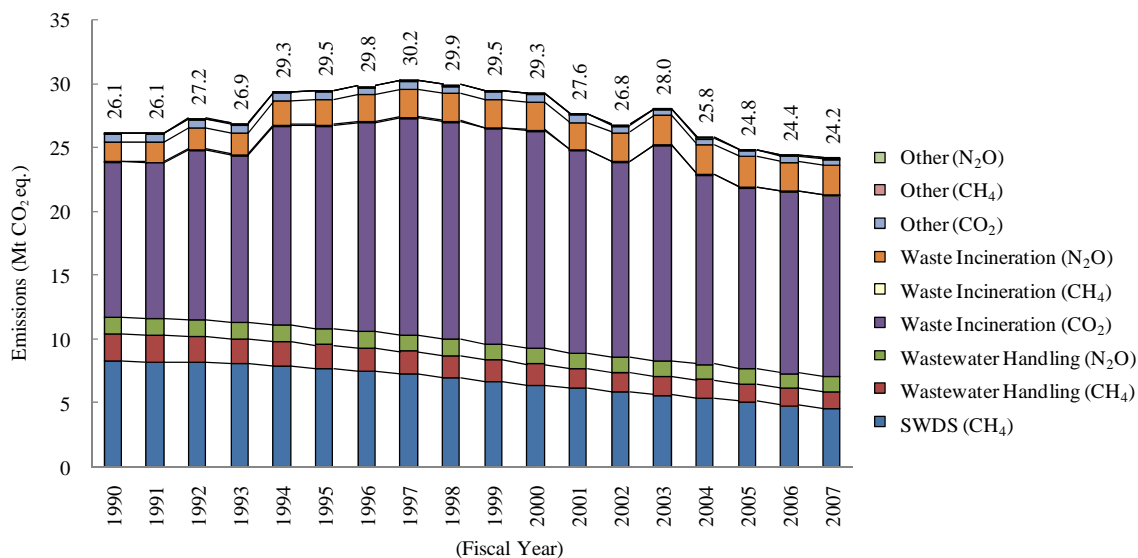

Figure 2.17 Trends in GHGs emissions from the waste sector

The breakdown of GHGs emissions from the waste sector in FY2007 shows that CO_2 emissions from waste derived from petrochemicals such as waste plastics and waste oil incineration, accounting for 59%, making it the single largest source of emissions. It is followed by CH_4 emissions from solid waste disposal sites at 19%, and N_2O emissions from combustion of waste (including waste products derived from substances other than fossil fuels) at 10%.

Table 2.13 Trends in GHGs emissions from the waste sector

[Gg CO_2eq.]

Category	1990	1995	2000	2005	2006	2007
6A. SWDS (CH_4)	8,286	7,689	6,394	5,094	4,784	4,517
6B. Wastewater Handling	3,410	3,108	2,851	2,575	2,528	2,528
CH_4	2,121	1,861	1,637	1,406	1,369	1,369
N_2O	1,290	1,247	1,214	1,169	1,159	1,159
6C. Waste Incineration	13,705	17,968	19,337	16,617	16,528	16,533
CO_2	12,174	15,951	17,079	14,195	14,222	14,227
CH_4	13	15	13	10	10	10
N_2O	1,518	2,003	2,245	2,413	2,296	2,296
6D. Other	730	689	681	534	554	591
CO_2	703	668	656	507	522	560
CH_4	14	11	13	14	17	17
N_2O	13	10	12	13	15	15
Total	26,131	29,455	29,263	24,819	24,394	24,169

[8] Starting with the 2009 inventory report, the reporting categories which fall under the "Emissions from Waste Used as Energy and the Incineration of Waste Accompanied by Energy Recovery" are moved from Incineration of Waste (Category 6.C.) to Fuel Combustion (Category 1.A.).

2.4 Description and Interpretation of Emission Trends for Indirect Greenhouse Gases and SO$_2$

Under UNFCCC, it is required to report emissions of indirect greenhouse gases (NO$_X$, CO and NMVOC) and SO$_2$, in addition to the 6 types of greenhouse gases (CO$_2$, CH$_4$, N$_2$O, HFCs, PFCs and SF$_6$) which are not controlled by the Kyoto Protocol. Emission trends of these gases are indicated below.
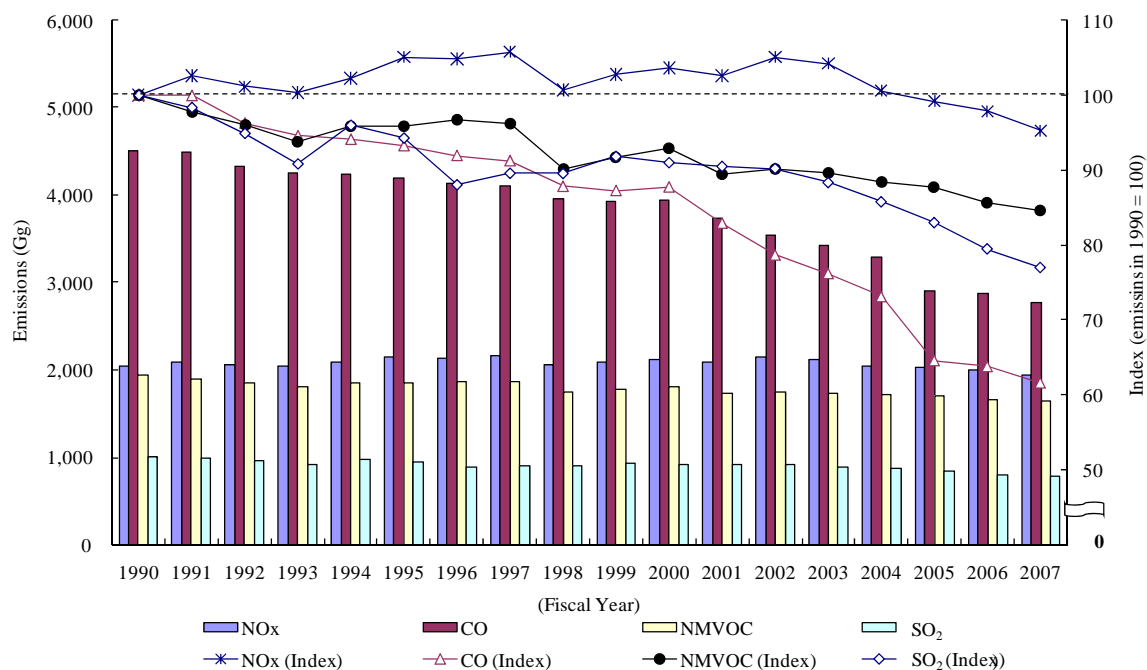
Figure 2.18 Trends in Emissions of Indirect Greenhouse Gases and SO$_2$

Nitrogen oxide (NO$_X$) emissions in FY2007 were 1,943 Gg, a decrease by 4.7% compared to FY1990, and by 2.6% compared to the previous year.

Carbon monoxide (CO) emissions in FY2007 were 2,761 Gg, a decrease by 38.1% compared to FY1990, and a decrease by 3.4% compared to the previous year.

Non-methane volatile organic compounds (NMVOC) emissions in FY2007 were 1,638 Gg, a decrease by 15.4% compared to FY1990, and a decrease by 1.1% compared to the previous year.

Sulfur dioxide (SO$_2$) emissions in FY2007 were 780 Gg, a decrease by 22.9% compared to FY1990, and a decrease by 3% compared to the previous year.

2.5 Overview of Emission Estimation Methods

The description below indicates the methods for estimating emissions in the preceding sections. This section will present an overview for methods for estimating greenhouse gas emission amounts in Japan's major emitting sectors; however, for a more detailed description of estimation methods, please refer to Chapters 3 through 9 (See NIR Attachment 3 for calculation methods for gasses including precursors (NOx, CO, NMVOC, SO$_2$)) of the National Greenhouse Gas Inventory of Japan (NIR) (April 2009).

2.5.1 Energy (CRF sector 1)

2.5.1.1 Fuel Combustion (1.A.)

This category covers GHG emissions from the combustion of fossil fuels such as coal, oil, and natural gas, and incineration of waste for energy purposes and with energy recovery.

This section includes GHG emissions from five sources: Energy Industries (1.A.1)—emissions from power generation and heat supply; Manufacturing Industries and Construction (1.A.2)—emissions from the manufacturing industry and construction; Transport (1.A.3)—emissions from aviation, railways, road transport, and shipping; Other Sectors (1.A.4)—emissions from commercial/institutional, residential, and agriculture/forestry/fishing sources; and Other (1.A.5)—emissions from other sectors. Estimation method of emissions from waste incineration with energy recovery is described in section 2.5.6.4 .

2.5.1.1.a Stationary sources (Energy Industries (1.A.1.)、Manufacturing Industries and Construction (1.A.2)、Other Sources (1.A.4))

    (1) CO_2

Tier 1 Sectoral approach has been used in accordance with the decision tree from *Good Practice and Uncertainty Management in National Greenhouse Gas Inventories (2000)* (hereafter, *Good Practice Guidance (2000))* (Page 2.10, Fig. 2.1) to calculate emissions. Country-specific emission factors are used for all types of fuel.

    (2) CH_4, N_2O

Because it is possible to use fuel-specific, sector-specific and furnace-specific activity data, and also to set country-specific emission factors for Japan, Tier 2 country-specific emission factors were used to calculate emissions in accordance with the *1996 Revised IPCC Guidelines* and *Good Practice Guidance* (2000). However, in residential and other sectors in which activity data for different furnace types cannot be used, Tier 1 IPCC default emission factors were used.

2.5.1.1.b Mobile source (Mobile Combustion (1.A.3.))

    (1) CO_2

See Section 2.5.1.1.a. Because CO_2 emissions from natural gas-powered vehicles and steam locomotives include the Commercial /Institutional section in Other Sectors (1.A.4), CO_2 emissions from these sources are reported as "IE."

    (2) CH_4, N_2O

Emissions from Civil Aviation (1.A.3.a.) have been calculated using the Tier 2a method for jet fuel and the Tier 1 for aviation gasoline, in accordance with the decision tree from *Good Practice Guidance (2000)* (Page 2.58, Fig. 2.7).

Emissions from Light Passenger Vehicles, Light Cargo Trucks, Passenger Vehicles, Buses, Small Cargo Trucks, Regular Cargo Trucks, and Special-purpose Vehicles of Road Transportation (1.A.3.b.) have been calculated as distance travelled per type of vehicle by

emission factors using the Tier 3 method, in accordance with the decision tree from *Good Practice Guidance (2000)* (Page 2.45, Fig. 2.5). The country-specific emission factors were used for some categories of vehicle, and the default emission factors were used for the other categories of vehicle. The activity data was estimated by using running mileage and fuel efficiency, which were provided from the Ministry of Land, Infrastructure, Transport and Tourism's *Statistical Yearbook of Motor Vehicle Transport.* (Refer to *1A3-car-2005.xls* for details on the calculation process).

Emissions from natural gas-powered vehicles for Road Transportation (1.A.3.b.) were calculated by multiplying the distance traveled per type of natural gas-powered vehicle by the emission factor for the type of vehicle.

Emissions from motorcycles for Road Transportation (1.A.3.b.) were estimated based on the method developed in Japan by the Ministry of Environment for the estimation of emissions from vehicles not subject to the PRTR (Pollutant Release and Transfer Register) Program. The emissions were calculated for two emission sources of "hot start" and "increment for cold start." For details of the calculation method, see the *Greenhouse Gases Estimation Methods Committee Report – Transportation* (February 2006).

Railways (1.A.3.c.) is not a key source category, and emissions were calculated by multiplying the default emission factor given in the *Revised 1996 IPCC Guidelines* by fuel consumption on a calorific basis.

Emissions from Navigation (1.A.3.d.) were calculated using the default values for methane and nitrous oxide given in the *Revised 1996 IPCC Guidelines*, in accordance with decision tree from *Good Practice Guidance (2000)* (Page 2.52, Fig. 2.6).

2.5.1.2   Fugitive Emissions from Fuels (1.B.)

The fugitive emissions sector consists of intentional and unintentional emissions of CO_2, CH_4, and N_2O from unburned fossil fuels during their mining, production, processing, refining, transportation, storage, and distribution.

There are two main source categories in this sector: Solid Fuels (1.B.1), comprised of emissions from coal mining and handling, and Oil and Natural Gas (1.B.2), comprised of emissions from the oil and natural gas industries. The main source of emissions from solid fuels is methane contained in coal beds, whereas fugitive emissions, venting, flaring, volatilization, and accidents are the main emission sources in the oil and natural gas industries.

2.5.1.2.a   Solid Fuels (1.B.1.)

Within Coal Mining and Handling (1.B.1.a.), emissions from mining activities for underground mines were drawn from actual measurements obtained from individual coal mines, in accordance with the decision tree from *Good Practice Guidance (2000)* (Page 2.72, Fig. 2.10). Emissions from post-mining activities were calculated using the Tier 1 method, which uses default emission factors in accordance with the decision tree from *Good Practice Guidance (2000)* (Page 2.73, Fig. 2.11). (Refer to *1B1-2008.xls* for the calculation process.)

Within Coal Extraction (1.B.1.a.), CH_4 emissions from mining activities for surface mines were calculated using the Tier 1 method and the default emission factor in accordance with the decision tree from *Good Practice Guidance (2000)* (Page 2.71, Fig. 2.9). CH_4 emissions from post-mining activities were calculated using the Tier 1 method and the default emission factor in accordance with the decision tree from *Good Practice Guidance (2000)* (Page 2.73, Fig. 2.11).

2.5.1.2.b   Oil and Natural Gas (1.B.2.)

(1)   Oil (1.B.2.a.)

CO_2, CH_4 and N_2O emissions associated with oil exploration and pre-production testing were calculated using the Tier 1 method in accordance with the decision tree from *Good Practice Guidance (2000)*. Emissions were calculated by multiplying the number of exploratory wells, and the number of wells tested for oil and gas during pre-production testing, by their respective emission factors.

Emissions relating to fugitive emissions from petroleum production and servicing of oilfield production wells were calculated using the Tier 1 method in accordance with the decision tree from *Good Practice Guidance (2000)* (Page 2.81, Fig. 2.13). Emissions were calculated by multiplying the amount of crude oil production by the emission factor.

Emissions relating to fugitive emissions associated with transport were calculated using the Tier 1 method in accordance with the decision tree from *Good Practice Guidance (2000)* (Page 2.81, Fig. 2.13). Emissions were calculated by multiplying the amount of crude oil or condensate production by the emission factors.

Emissions relating to fugitive emissions from refining were calculated using the Tier 1 method in accordance with the decision tree from *Good Practice Guidance (2000)* (Page 2.82, Fig. 2.14).

Emissions relating to fugitive emissions from storage should be calculated using the Tier 1 method in accordance with the decision tree from *Good Practice Guidance (2000)* (Page 2.82, Fig.2.14), but as the country-specific emission factor is available for this emissions source, it was applied to the inventories instead.

Petroleum products are distributed in Japan, and where CO_2 and CH_4 are dissolved, it is conceivable that either or both will be emitted as a result of the relevant activity. The level of CO_2 or CH_4 emitted by this activity is probably negligible, in light of the composition of the petroleum products, but because there are no examples of measurement of the CO_2 or CH_4 content of petroleum products, it is not currently possible to calculate emissions. Emissions were reported as "NE" in the absence of the default emission factors.

(2)   Natural Gas (1.B.2.b.)

There are test drillings of oil and gas fields in Japan, and it is conceivable that this activity could give rise to emissions of CO_2, CH_4, or N_2O. It is difficult, however, to distinguish between oilfields and gas fields prior to test drilling, Emissions were reported as "IE" because the calculation was combined with the subcategory of *1.B.2.a.i. Fugitive Emissions Associated with Oil Exploration*.

Fugitive emissions of the production of natural gas and processing of natural gas, such as adjusting its constituent elements, and servicing natural gas production wells was calculated using the Tier 1 method, and in accordance with the decision tree from *Good Practice Guidance (2000)* (Page 2.80, Fig. 2.12).

Fugitive emissions during natural gas production and conditioning processes were estimated by multiplying the amount of natural gas production by their respective emission factors. Fugitive emissions during gas field inspections were calculated by multiplying the number of production wells by the emission factor.

In regards to natural gas transmission leakage, total natural gas pipeline length is multiplied by a Japan-specific emission factor to calculate CH_4 emissions occurring in conjunction with releases by pipeline construction and relocation, and releases of gas used to operate pressure regulators.

With regards to leakages at LNG receiving terminals, town gas production facilities, and satellite terminals (natural gas supplies), some of the main emission sources are gas samples taken for analysis as well as residual gas emitted at times such as regular maintenance of manufacturing facilities. The Tier 1 method is employed in accordance with the decision tree from *Good Practice Guidance* (2000) (page 2.82, Fig. 2.14). However, because it is possible to use a Japan-specific emission factor, the amounts of liquefied natural gas and natural gas used as town gas feedstock were multiplied by a Japan-specific emission factor to obtain emissions.

CH_4 emissions from high-pressure pipelines and from medium- and low-pressure pipelines and holders are calculated by multiplying the total length of city gas pipeline by the emission factor. CH_4 emissions from service pipes are calculated by multiplying the number of users by the emission coefficient.

Conceivable sources of CH_4 emissions from industrial plants and power stations in the residential and commercial sectors (1.B.2.b. v.) include gas pipe works in buildings, but because these emissions are included in those of "Natural Gas Distribution" (distribution through the town gas network) (1.B.2.b.iv), CH_4 emissions from this source are reported as "IE." Additionally, because CO_2 is basically not included among town gas constituents, CO_2 emissions from this source are reported as "NA."

(3) Venting and Flaring (1.B.2.c.)

Emissions from venting in the petroleum industry were calculated using the Tier 1 Method in accordance with the decision tree from *Good Practice Guidance (2000)* (Page 2.81, Fig. 2.13) by multiplying the amount of crude oil production by the default emission factors.

CO_2 and CH_4 emissions from venting in the natural gas industry were considered only for the amount during transportation as *Good Practice Guidance* (2000) provides emissions factors only for transportation. Intentional CO_2 emissions from natural gas pipelines are reported as "NA" because CO_2 emissions during the transmission of natural gas are considered as "NA" (1.B.2.b.iii.) Intentional CH_4 emissions from natural gas pipelines are reported as "IE" because they are included in emissions during natural gas transmission (1.B.2.b.iii).

Statistical data are reported for two categories of petroleum and natural gas in Japan. As a result, fugitive emissions from venting in the combined petroleum and natural gas industries were reported as "IE" since they were accounted for in the emissions from venting in the petroleum industry (1.B.2.c.i) and the natural gas industry (1.B.2.c.ii.), respectively.

CO_2, CH_4, and N_2O emissions from flaring in the petroleum industry were calculated using the Tier 1 method in accordance with the decision tree from *Good Practice Guidance (2000)*, by multiplying the amount of crude oil production in Japan by the default emissions factors.

CO_2, CH_4, and N_2O emissions associated with flaring in the natural gas industry were calculated using the Tier 1 method in accordance with the decision tree from *Good Practice Guidance (2000)*. Emissions were calculated by multiplying the amount of production of natural gas by the emission factors. The total emissions associated with flaring both during gas production and processing were reported as the emissions from flaring in the natural gas industry.

Statistical data are reported for two categories of petroleum and natural gas in Japan. As a result, fugitive emissions from flaring in the combined petroleum and natural gas industries were reported as "IE" since they were accounted for respectively in the emissions from flaring in the Petroleum Industry (1.B.2.c.i) and the Natural Gas Industry (1.B.2.c.ii.).

2.5.2 Industrial Processes (CRF sector 2)

2.5.2.1 Mineral Products (2.A.)

This category covers CO_2 emissions from the calcination of mineral raw material such as $CaCO_3$, $MgCO_3$, Na_2CO_3, etc.

This section includes GHG emissions from six sources: Cement Production (2.A.1), Lime Production (2.A.2.), Limestone and Dolomite Use (2.A.3.), Soda Ash Production and Use (2.A.4.), Asphalt Roofing (2.A.5.), Road Paving with Asphalt (2.A.6.).

2.5.2.1.a Cement Production (2.A.1.)

Following the *Good Practice Guidance (2000)* decision tree, the CO_2 emissions from this source was estimated by multiplying the amount of clinker produced by the emission factor.

Because Japan's cement industry takes in large amounts of waste and byproducts from other industries and recycles them as substitute raw materials for cement production, clinker contains CaO from sources other than carbonates. This CaO does not go through the limestone calcination stage and so does not emit CO_2 during the clinker production process. For that reason, emission factors were determined by estimating the CaO content of clinker from carbonates, derived by subtracting CaO originating from waste and other sources from total CaO content of clinker. Because clinker productions from 1990 to 1999 are unavailable, they are estimated by the ratio between clinker productions and limestone consumptions for 2000 through 2003.

2.5.2.1.b Lime Production (2.A.2.)

CO_2 emissions are calculated according to the Tier 1 method in *Good Practice Guidance (2000)* in which amounts of high calcium quicklime and dolomitic quicklime produced are multiplied by country-specific emission factors.

2.5.2.1.c Limestone and Dolomite Use (2.A.3.)

The volumes of limestone and dolomite used in iron and steel production and as raw materials in soda-lime glass are multiplied by the emission factors to calculate emissions.

2.5.2.1.d Soda Ash Production and Use (2.A.4.)

CO_2 emissions from soda ash use are calculated according to the *Revised 1996 IPCC Guidelines* by multiplying the amount of soda ash consumed by the default emission factor.

2.5.2.1.e Asphalt Roofing (2.A.5.)

Asphalt roofing is manufactured in Japan, but information on the manufacturing process and activity data is inadequate, and it is not possible to definitively conclude that CO_2 is not emitted from the manufacture of asphalt roofing. Emissions have also never been actually measured, and as no default emission value is available, it is not currently possible to calculate emissions. Therefore, it has been reported as "NE".

2.5.2.1.f Road Paving with Asphalt (2.A.6.)

Roads in Japan are paved with asphalt, but almost no CO_2 is thought to be emitted in the process. It is not possible, however, to be completely definitive about any emissions in this process. Emissions have also never been actually measured, and as no default emission value is available, it is not currently possible to calculate emissions. Therefore, it has been reported as "NE".

2.5.2.2 Chemical Industry (2.B.)

This category covers CO_2, CH_4, and N_2O emissions from the processes of chemical productions.

This section includes GHG emissions from five sources: Ammonia Production (2.B.2), Nitric Acid Production (2.B.2.), Adipic Acid Production (2.B.3.), Carbide Production (2.B.4.), and Other (2.B.5.).

2.5.2.2.a Ammonia Production (2.B.1.)

CO_2 emissions are calculated by multiplying the amount of fuels consumed as ammonia feedstock by emission factors.

Emission of CH_4 from ammonia production has been confirmed by actual measurements. As there are currently not any sufficient enough examples to enable the establishment of an emission factor, it is not currently possible to calculate emission levels. The *Revised 1996 IPCC Guidelines* also do not give a default emission factor. Therefore, CH_4 was reported as "NE".

Emission of N_2O from ammonia production is not theoretically conceivable, and given that even in actual measurements the emission factor for N_2O is below the limits of measurement, N_2O was reported as "NA".

2.5.2.2.b Nitric Acid Production (2.B.2.)

N_2O emissions were estimated by multiplying nitric acid production volume by an emission factor, based on the method given in *Good Practice Guidance (2000)* (page 3.31, Equation 3.9).

2.5.2.2.c Adipic Acid Production (2.B.3.)

Emissions were estimated using N_2O generation rates, N_2O decomposition volume, and adipic acid production volume of the relevant operating sites, in accordance with the decision tree from *Good Practice Guidance (2000)* (Page 3.32, Fig. 3.4).

2.5.2.2.d Carbide Production (2.B.4.)

(1) Silicon Carbide (2.B.4.-)

CO_2 emissions are calculated by multiplying the amount of petroleum coke used as silicon carbide feedstock by an emission factor.

CH_4 emissions were calculated by multiplying an emission factor based on actual figures obtained in Japan by the energy consumption of electric arc furnaces. This is the same method used for calculating CH_4 emissions in the Fuel Combustion Sector (1.A. Solid Fuels).

(2) Calcium Carbide (2.B.4.-)

CO_2 emissions are calculated by multiplying calcium carbide production by the default emission factor, based on the *Revised 1996 IPCC Guidelines*.

Byproduct gases (mainly CO) generated in carbide reactions include a small amount of CH_4, all of which is recovered and burned as fuel, with none being emitted outside the system. Therefore emissions from this source are reported as "NA".

2.5.2.2.e Other (2.B.5.)

(1) Carbon Black (2.B.5.-)

CH_4 emissions from carbon black production are calculated by multiplying carbon black production volume by Japan's emission factor, in accordance with the *Revised 1996 IPCC Guidelines*.

(2) Ethylene (2.B.5.-)

CH_4 and CO_2 emissions from ethylene production were calculated by multiplying ethylene production by a Japan-specific emission factor, in accordance with the *Revised 1996 IPCC Guidelines*.

There is almost no nitrogen in naphtha, the raw material in ethylene production, and the ethylene production process takes place under conditions that are almost completely devoid of oxygen. Emissions are reported as "NA" in accordance with the judgment of experts that in principle there are no N_2O emissions.

(3) 1,2-Dichloroethane (2.B.5.-)

CH_4 emissions from 1,2-dichloroethane production are calculated by multiplying production volume by a Japan-specific emission factor, in accordance with the *Revised 1996 IPCC Guidelines*.

(4) Styrene (2.B.5.-)

CH_4 emissions from styrene production were calculated by multiplying styrene production volume by a Japan-specific emission factor, based on the method given in the *Revised 1996 IPCC Guidelines*.

(5) Methanol (2.B.5.-)

CH_4 emissions from methanol production are calculated using the method given in the *Revised 1996 IPCC Guidelines*.

According to industry organizations, the production (synthesis) of methanol stopped in Japan in 1995 due to the price difference with overseas methanol. Since then, all methanol has been imported, and methanol production plants disappeared from Japan in and around 1995. According to the Yearbook of Chemical Industries Statistics, beginning in 1997 there was also no production of refined methanol. Because the methanol refining process merely dewaters the synthesized methanol, in principle no CH_4 is generated.

Accordingly, emissions from 1990 to 1995 were reported using production volumes from industry organization statistics. For 1996 and thereafter, the report is "NO" because it is assumed that methanol has not been produced (synthesized) since 1995.

(6) Coke (2.B.5.-)

CH_4 emissions from coke production were calculated by multiplying coke production volume by a Japan-specific emission factor, based on the method given in the *Revised 1996 IPCC Guidelines*.

This category is reported as "IE" because the emissions of CO_2 from coke production are included in the coal products and production section of the Fuel Combustion Sector (1.A. Solid Fuels).

We have no measurements of the concentration of N_2O in the gas leaking from coking furnace lids, and N_2O emissions from this source are reported as "NA," since experts say that N_2O is likely not produced because the reducing atmosphere in a coke oven is normally at least 1,000°C.

2.5.2.3 Metal Production (2.C.)

This category covers CO_2, CH_4, N_2O, PFCs and SF_6 emissions from the manufacturing processes of metal production. This section includes GHG emissions from three sources: Iron and Steel Production (2.C.2), Ferroalloys Production (2.C.2.) Aluminum Production (2.C.3.) and SF_6 Used in Aluminum and Magnesium Foundries (2.C.4.).

2.5.2.4 Iron and Steel Production (2.C.1.)

(1) Steel (2.C.1.-)

Coke oxidizes when it is used as a reduction agent in steel production, and CO_2 is generated. The volume of coke used has been included under consumption of fuel in the Fuel Combustion Sector (1.A. Solid Fuels), and the CO_2 generated through the oxidization of coke used as a reducing agent has already been calculated under the Fuel Combustion Sector (1.A. Solid Fuels), as well. Therefore, it has been reported as "IE".

(2) Pig Iron (2.C.1.-)

CO_2 generated from pig iron production is emitted when coke is used as a reduction agent. The amount of coke used has been included under consumption of fuel in the Fuel Combustion Sector (1.A. Solid Fuels), and the CO_2 generated through the oxidization of coke used as a reducing agent has already been calculated under the Fuel Combustion Sector (1.A. Solid Fuels), as well. Therefore, it has been reported as "IE".
It is not theoretically possible that CH_4 will be generated in association with pig iron production, and it has been confirmed that CH_4 is not emitted from actual measurements. Therefore, emissions have been reported as "NA".

(3) Sinter (2.C.1.-)

CO_2 generated when making sinter is all generated by the combustion of coke fines; these emissions come under the Fuel Combustion Sector (1.A. Solid Fuels). As they are already calculated in this sector, they are reported as "IE".
CH_4 generated when making sinter is all generated by the combustion of coke fines; these emissions come under the Fuel Combustion Sector (1.A. Solid Fuels). As they are already calculated in this sector, they are reported as "IE".

(4) Coke (2.C.1.-)

Coke is mainly produced in iron and steel production in Japan. This category is reported as "IE" because the emissions of CO_2 from coke production are included in the coal products and production section of the Fuel Combustion Sector (1.A. Solid Fuels).
Emissions of methane were calculated at 4.2.5.6. Coke (2.B.5.-), and have been reported as "IE".

(5) Use of Electric Arc Furnaces in Steel Production (2.C.1.-)

CO_2 emissions from arc furnaces for steel production are estimated by the amount of carbon calculated by weight of production and the import of carbon electrodes minus their export weight. This difference of the carbon is assumed to be diffused into the atmosphere as CO_2. The carbon included in electric furnace gas given in the General Energy Statistics are subtracted from the CO_2 emission in this source, since this emission are included in the Fuel Combustion Sector (1.A. Solid Fuels).
Emissions were calculated by multiplying an emission factor based on actual figures obtained in Japan by the energy consumption of electric arc furnaces. This is the same method used for calculating CH_4 emissions in the Fuel Combustion Sector (1.A.).

2.5.2.4.b Ferroalloys Production (2.C.2.)

CH_4 emissions from ferroalloy production were calculated by multiplying an emission factor based on actual figures obtained in Japan by the energy consumption of electric arc furnaces. This is the

same method used for calculating CH_4 emissions in the Fuel Combustion Sector (1.A. Solid Fuels). Ferroalloys are produced in Japan, and the carbon dioxide generated in association with ferroalloy production is emitted as a result of the oxidization of coke used as a reducing agent. Consumption of coke is included in consumption of fuel under the Fuel Combustion Sector (1.A. Solid Fuels), and CO_2 generated as a consequence of the oxidization of coke used as a reduction agent has already been calculated under the Fuel Combustion Sector (1.A. Solid Fuels), as well. Residual carbon in ferroalloys is oxidized when ferroalloys are used in the production of steel, and are released to the atmosphere as CO_2. Therefore, it has been reported as "IE".

2.5.2.4.c Aluminum Production (2.C.3.)

Estimating PFC emissions involved multiplying the production volume of primary aluminum refining by Japan-specific emission factors calculated using the equation prescribed in the *Revised 1996 IPCC Guidelines*.

Aluminum refining is conducted in Japan. CO_2 generated in association with aluminum smelting is emitted in conjunction with the oxidization of the anode paste used as a reducing agent. Consumption of coke, the main ingredient in the anode paste has been included in fuel consumption under the Fuel Combustion Sector (1.A. Solid Fuels), and the CO_2 that is generated by the oxidization of coke used as a reducing agent has already been calculated under the Fuel Combustion Sector (1.A. Solid Fuels), as well. Therefore, it has been reported as "IE".

There is a small amount of hydrogen in the pitch that acts as a raw material for the anode paste used in aluminum smelting. Theoretically, therefore, it is possible that CH_4 could be generated. As there is no actual data on emissions, however, it is not possible to calculate emissions. There is also no emission factor offered in the *Revised 1996 IPCC Guidelines*, and no data on the hydrogen content of pitch. As it is not possible to estimate an emission factor, emissions have been reported as "NE".

2.5.2.4.d SF_6 Used in Aluminum and Magnesium Foundries (2.C.4.)

(1) Aluminum

Emissions from this source were reported as "NO" as it was been confirmed that Japan had no record of the use of SF_6 in aluminum forging processes.

(2) Magnesium

The data reported for emissions of SF_6 used in magnesium foundries was given in documentation prepared by the Chemical and Bio Sub-Group, Industrial Structure Council, Ministry of Economy, Trade and Industry,

2.5.2.5 Other Production (2.D.)

2.5.2.5.a Pulp and Paper (2.D.1.)

According to the CRF, it is required to report on emissions of nitrogen oxides (NO_X), carbon monoxide (CO), non-methane volatile organic compounds (NMVOC), and sulfur dioxide (SO_2).

2.5.2.5.b Food and Drink (2.D.2.)

Foods and drinks are manufactured in Japan, and because CO_2 is used in the manufacturing process (frozen CO_2, raw material for carbonated drinks, etc.), it is conceivable that CO_2 is emitted into the atmosphere in the course of manufacturing. The CO_2 used in the process of manufacturing foods and drinks, however, is a by-product gas of petrochemical products, and as these emissions have already

been incorporated into the Fuel Combustion Sector (1.A. Solid Fuels), they have been reported as "IE".

2.5.2.6 Production of Halocarbons and SF_6 (2.E.)

This category covers HFCs, PFCs and SF_6 emissions from the manufacturing processes of the production of Halocarbons and SF_6. This section includes GHG emissions from two sources: By-product Emissions: Production of HCFC-22 (2.E.1) and Fugitive Emissions (2.E.2.).

2.5.2.6.a By-product Emissions: Production of HCFC-22 (2.E.1.-)

Estimating emissions involved subtracting the recovery and destruction amount of by-product HFC-23 (measured data) from the amount of by-product HFC-23 generated at HCFC-22 production plants in Japan. The amount of by-product HFC-23 was estimated by multiplying the production of HCFC-22 by the generation rate of HFC-23 (obtained from the results of composition analysis of the interior of a reactor).

2.5.2.6.b Fugitive Emissions (2.E.2.)

Emissions were estimated based on the mass balance of measurement data at each HFCs, PFCs, and SF_6 manufacturing plant in Japan. Fugitive emissions in production from this source category were reported by subtracting the amount of production from the amount of HFCs, PFCs, SF_6 generated at each gas manufacturing facility. Emissions of HFCs for each year were given by the Japan Fluorocarbon Manufactures Association and of PFCs and SF_6 by the Japan Chemical Industry Association.

2.5.2.7 Consumption of Halocarbons and SF_6 (2.F.)

This category covers HFCs, PFCs and SF_6 emissions from the manufacturing, utilization and disposal processes of the products that use Halocarbons and SF_6. This section includes GHG emissions from nine sources: Refrigeration and Air Conditioning Equipment (2.F.1), Foam Blowing (2.F.2.), Fire Extinguishers (2.F.3.), Metered Dose Inhalers (2.F.4.-) Solvents (2.F.5.), Other applications using ODS substitutes (2.F.6.), Semiconductors (2.F.7.), Electrical Equipment (2.F.8.) and Other (2.F.9.).

2.5.2.7.a Refrigeration and Air Conditioning Equipment (2.F.1.)

(1) Domestic Refrigeration (2.F.1.-)

The collected volume of HFCs under regulation was subtracted from (1) the fugitive refrigerant ratio from production, (2) the fugitive refrigerant ratio from use (including failure of devices), and (3) refrigerant contained at the time of disposal, separately, based on production and shipment volumes and refrigerant contained. Then, all there were combined.
Emission from this source in the "production" category was reported as "NO" as Japan had no record of their use in the production. The emission was also reported as "NO" in the "use" and "disposal" categories, because it was unlikely that PFCs were used in imported products or refrigerant was refilled.

(2) Commercial Refrigeration (2.F.1.-)

i) Commercial Refrigeration

In accordance with the IPCC Guidelines, emissions of each species of F-gases from (1) manufacturing, (2) installation, (3) operation and (4) disposal are estimated for devices.

Emission from this source in the "production" category was reported as "NO" as Japan had no record of their use in the production. The emission was also reported as "NO" in the "use" and "disposal" categories, because it was unlikely that PFCs were used in imported products or refrigerant was refilled.

ii) Automatic Vending machine

Emissions of HFCs from (1) manufacturing, (2) accident and (3) disposal are estimated. Emissions of HFCs relating to automatic vending machines are estimated using values described in *Documents of Group for prevention of global warming*, Chemical and Bio Sub-Group, Industrial Structure Council, Ministry of Economy, Trade and Industry.

PFCs Emission from this source in the "production" category was reported as "NO" as Japan had no record of their use in the production. The emission was also reported as "NO" in the "use" and "disposal" categories, because it was unlikely that PFCs were used in imported products or refrigerant was refilled.

(3) Transport Refrigeration (2.F.1.-)

Emission was reported as "IE" since HFCs in this category had been included in the total reported in 2.5.2.7.a Commercial Refrigeration and Air-conditioning Equipment section (2) .

PFCs emission from this source in the "production" category was reported as "NO" as Japan had no record of their use in the production. The emission was also reported as "NO" in the "use" and "disposal" categories, because it was unlikely that PFCs were used in imported products or refrigerant was refilled.

(4) Industrial Refrigeration (2.F.1.-)

HFCs emissions have been reported as "IE", as they are included in 2.5.2.7.a Commercial Refrigeration and Air-conditioning Equipment section (2) .

PFCs emission from this source in the "production" category was reported as "NO" as Japan had no record of their use in the production. The emission was also reported as "NO" in the "use" and "disposal" categories, because it was unlikely that PFCs were used in imported products or refrigerant was refilled.

(5) Stationary Air-Conditioning (Household) (2.F.1.-)

In accordance with the IPCC Guidelines, HFCs emissions from (1) manufacturing, (2) operation, (3) disposal are estimated for devices.

PFCs emission from this source in the "production" category was reported as "NO" as Japan had no record of their use in the production. The emission was also reported as "NO" in the "use" and "disposal" categories, because it was unlikely that PFCs were used in imported products or refrigerant was refilled.

(6) Mobile Air-Conditioning (Car Air Conditioners) (2.F.1.-)

In accordance with the IPCC Guidelines, HFCs emissions from (1) manufacturing, (2) operation, (3)

maintenance, (4) accident and (5) disposal are estimated.

PFCs emission from this source in the "production" category was reported as "NO" as Japan had no record of their use in the production. The emission was also reported as "NO" in the "use" and "disposal" categories, because it was unlikely that PFCs were used in imported products or refrigerant was refilled.

2.5.2.7.b   Foam Blowing (2.F.2.)

(1)   Hard Foam (2.F.2.-)

i)   Urethane Foam (HFC-134a)

In accordance with the IPCC Guidelines (closed-cell foams), emissions were calculated assuming that 10% of the emission from foam blowing agents used each year occurred within the first year after production, with the remainder emitted over 20 years at the rate of 4.5% per year. The amount of foam blowing agents used each year was provided by the Japan Urethane Foam Association/Japan Urethane Raw Materials Association.

ii)   High Expanded Polyethylene Foam (HFC-134a, HFC-152a) (2.F.2.-)

In accordance with the IPCC Guidelines (open-cell foams), emissions were calculated assuming that all emissions from foam blowing agents occurred at the time of production. The amount of emissions from foam blowing agents used each year was provided by the High Expanded Polyethylene Foam Industry Association.

iii)   Extruded Polystyrene Foam (HFC-134a) (2.F.2.-)

Emissions were calculated assuming that 25% of emissions from foam blowing agents occurs within the first year after production, with the remainder emitted over 30 years at the rate of 2.5% per year. The amount of the emissions from foam blowing agents used each year was provided by the Extruded Polystyrene Foam Industry Association.

(2)   Soft Foam (2.F.2.-)

All foam using HFCs for forming is hard foam. Emissions have therefore been reported as "NO".

2.5.2.7.c   Fire Extinguishers (2.F.3.)

HFC-23 and HFC-227ea are used for the production of fire extinguishers. However, as of 2004, only HFC-227ea is filled in fire extinguishing equipment, and each company purchases HFC-23 fire extinguishers with HFC-23 already pre-filled.

HFCs emission from this category was reported as "NO" by expert judgment since HFC-227ea was very small amount, 0.0007(t) (= 700g) when emission from production in FY2004 was estimated.

For 1996 and following years, emissions are estimated by the HFC extinguishing agent stock.

2.5.2.7.d   Aerosols/Metered Dose Inhalers (2.F.4.)

(1)   Aerosols (2.F.4.-)

In accordance with the IPCC Guidelines, emissions were calculated on the assumption that 50% of emissions from the amount of aerosol filled in products (potential emissions) occurred in the year of production, with the remaining 50% emitted in the following year.

(2)   Metered Dose Inhalers (2.F.4.-)

In accordance with the IPCC Guidelines, emissions were calculated on the assumption that from the

amount used each year, 50% of emissions occurred in the year of production, with the remaining 50% emitted in the following year.

2.5.2.7.e Solvents (2.F.5.)

Assuming that the total amount of liquid PFC shipment was used in cleaners and for cleaning purposes each year, the entire amount was reported in the "use" category as the amount of emission. Emission during production was reported as "IE" as it was believed to be included in Fugitive Emissions (2.E.2). Emission at the time of disposal was reported as "IE" on the assumption, from a conservative point of view, that the entire amount, including that which was disposed, was emitted during use, because of the difficulty in determining the status of the disposal of PFCs. No disposal was identified in 1995.

2.5.2.7.f Other applications using ODS substitutes (2.F.6.)

Emission from this category was reported as "NE" since there is no actual data on emissions.

2.5.2.7.g Semiconductors (2.F.7.)

(1) Semiconductors(2.F.7.-)

Methods of emissions from semiconductors are in line with IPCC guidelines. These emissions are estimated with purchase of F-gas, process supply rate, use rate of F-gas, removal rate, by-product generation ratio and removal ratio for by-products. Calculation on removal equipment is based on installation or removal ratio of each technology.

(2) Liquid Crystals (2.F.7.-)

The same methods applied to semiconductors are also applied to emissions from the manufacturing of liquid crystals. The World LCD Industry Cooperation Committee (WLICC) has established a voluntary action plan to reduce PFCs emissions. In these activities, IPCC methods should be applied.

2.5.2.7.h Electrical Equipment (2.F.8.)

Emissions from producing electrical equipment were calculated by multiplying the amount of SF_6 purchased by assembly fugitive rate. Emissions from the use of electrical equipment were calculated based on the fugitive rate during the use of electrical equipment. Emissions from the inspection and disposal of electrical equipment were obtained by actual measurements of SF_6.

2.5.2.7.i Other (2.F.9.)

In this category, the emission sources of SF_6 that are considered utilized for research purposes are recognized. Judging from the actual utilization practices, however, the emissions from these sources were considered to be better included in Electrical Equipment (2.F.8.). Therefore, it is reported as "IE".

2.5.3 Solvent and Other Product Use (CRF sector 3)

2.5.3.1 Paint Application (3.A.)

Paint solvents are used in Japan, but their application is basically restricted only to mixing and they are assumed not to take part in chemical reactions. Therefore, they do not generate CO_2 or N_2O. They have been reported as "NA."

2.5.3.2　Degreasing and Dry-Cleaning (3.B.)

Degreasing and dry-cleaning are practiced in Japan. Degreasing is defined as, "washing processes that do not involve chemical reactions", and it is assumed that it does not generate CO_2. Although the CO_2 emissions may occur in association with washing methods involving dry ice or carbonic gas, such methods are not thought to be used in Japan. There are no processes in dry-cleaning in which chemical reactions may occur, and it is basically assumed that it does not generate CO_2. However washing methods using liquefied carbonic gas are being used experimentally in research facilities and it is not possible to completely negate the possibility of CO_2 emissions. As a result, these activities have been reported as "NE" due to the fact that there are no sufficient data available on the actual condition of emissions from degreasing and dry-cleaning and the absence of a default emission factor prevents any calculations from being performed.

It is also assumed that N_2O is not generated in the degreasing and dry-cleaning processes. In Japan, there are no methods which have the potential to emit N_2O used for degreasing or dry-cleaning, and they have therefore been reported as "NA".

2.5.3.3　Other (3.D.)

N_2O is emitted during anesthetic (laughing gas) use. In relation to emissions of N_2O from the use of anesthetics, the actual amount of N_2O shipped as an anesthetic by pharmaceutical manufacturers or import traders has been reported.

2.5.3.3.a　Fire Extinguishers (3.D.-)

N_2O is not installed in fire extinguishers in Japan. Therefore the N_2O emissions from this category are reported as "NO".

2.5.3.3.b　Aerosol Cans (3.D.-)

Aerosol products manufactured in Japan do not use N_2O. In principle, no N_2O is emitted, so it has been reported as "NA".

2.5.4　Agriculture (CRF sector 4)

2.5.4.1　Enteric Fermentation (4.A.)

Ruminants such as cattle, buffalo, sheep, and goats have multi-chamber stomachs. The rumen carries out anaerobic fermentation to break down cellulose and other substances, thereby releasing CH_4. Horses and swine are not ruminants and have monogastric stomachs, but fermentation in their digestive tracts produces small amounts of CH_4, which is released into the atmosphere. These methane emissions are calculated and reported in the Enteric Fermentation (4.A.) section.

2.5.4.1.a　Cattle (4.A.1.)

In accordance with the decision tree from *Good Practice Guidance (2000)* (Page 4.24 Fig. 4.2), calculations for dairy and non-dairy cattle should be performed using the Tier 2 method. The Tier 2 method requires the total energy intake of livestock to be multiplied by the methane conversion factor to derive the emission factor, although it has been the practice in Japan during livestock-related research to use volume of dry matter intake. It is considered that, by applying the results of previous researches, the estimation method using volume of dry matter intake provides

more accurate data. For that reason, a technique similar to the Tier 2 method but specific to Japan was used for the calculation of methane emissions associated with enteric fermentation by cattle. The emissions were calculated by multiplying the cattle population (dairy and non-dairy) by the emission factors established based on their dry matter intake.

2.5.4.1.b   Buffalo, Sheep, Goats, Horses & Swine (4.A.2., 4.A.3., 4.A.4., 4.A.6., 4.A.8.)

CH_4 emissions associated with enteric fermentation by buffalo, sheep, goats, horses, and swine, were calculated using the Tier 1 method in accordance with the decision tree from *Good Practice Guidance (2000)*.

2.5.4.1.c   Poultry (4.A.9.)

It is conceivable that CH_4 is emitted from enteric fermentation in poultry, but Japanese literature offers no data on emission factors, and neither the *Revised 1996 IPCC Guidelines* nor *Good Practice Guidance (2000)* offer default emission factors. Therefore, this category has been reported as "NE".
In addition, poultry other than layers and broilers are not covered by official statistics, suggesting that they may be presumed to be negligible.

2.5.4.2   Manure Management (4.B.)

Livestock manure generates CH_4 when its organic content is converted to CH_4 gas through CH_4 fermentation, or when CH_4 from enteric fermentation dissolved in manure is released by aeration or agitation. In manure management, N_2O is produced mainly by microorganism via nitrification and denitrification processes.

2.5.4.2.a   Cattle, Swine and Poultry (4.B.1., 4.B.8., 4.B.9.)

(1)   Calculation of Emissions (Cattle, Swine and Poultry in sheds and barns)

CH_4 emissions associated with the treatment of manure excreted by cattle (dairy and non-dairy), swine, and poultry (layers and broilers) in sheds and barns were calculated by multiplying the volume of organic matter contained in the manure from each type of livestock by the emission factor for each type of treatment method.

(2)   Calculation of Emissions (Cattle under grazing)

For CH_4 and N_2O emitted from pasture, range, and paddock manure, the amount of emissions was calculated for cattle by multiplying the Japan-specific emission factors by the total grazing population in accordance with the decision tree from *Good Practice Guidance (2000)* (page 4.55, Fig. 4.7).

(3)   Reporting in Common Reporting Format (CRF)

In the CRF, with regard to CH_4 emissions from this category, it is required to report emissions by each livestock. However, for N_2O emissions from this category, it is required to report emissions by AWMS (11. Anaerobic Lagoons、12. Liquid Systems、13. Solid Storage and Dry Lot、14. Other). For cattle, swine, and poultry, Japan's country-specific manure management categories as well as the implementation rates of these management categories have been established for each type of animal. The current CRF divides the reporting categories into Anaerobic Lagoons, Liquid Systems, Solid Storage and Dry Lots, and Other. In Japan, however, composting is widely practiced, particularly with respect to domestic livestock feces. Consequently the composting-related subcategories of

"Piling" and "Composting" have been established under the Other category. Additional subcategories of "Thermal drying" and "Incineration", which are practiced for the purposes of volume reduction and easier handling of dung, have been also included in the Other category, as well. Urine undergoes purification treatment as sewage with high concentrations of pollutants. Accordingly, a subcategory of "Purification" has also been added to the Other category.

Composting is widely practiced in Japan as: (1) it is essential for Japanese livestock farmers to facilitate transportation and handling, since the lack of space required for on-site reduction of manure makes it necessary to direct the manure for uses outside their farms; and (2) compost is in considerably higher demand as a fertilizer for various crops than is slurry or liquid manure in Japan where fertilizers tend to be lost by heavy rain and the expectations of the protection of water quality, prevention of odor, and sanitary management are high.

Anaerobic Lagoons have been reported as "NO". Because there are quite a small number of livestock farmers who have enough area of field to spread manure, and it is assumed that there are no livestock farmers who use anaerobic lagoons. There are cases when manure is spread to fields in Japan, but even in these cases, stirring is conducted before the spreading. Therefore, there are no anaerobic manure management systems.

(4)   Nitrogen in Livestock Manure Applied to Agricultural Soil

The percentage of application of manure-derived organic fertilizers was calculated by subtracting the nitrogen contents in the livestock manure disposed of in the "direct final disposal", the nitrogen volatized as nitrous oxide, the nitrogen volatilized as ammonia and nitrogen oxides, and the nitrogen eliminated by "incineration" and "purification", from the total nitrogen contained in livestock manure excreted in sheds and barns.

2.5.4.2.b   Buffalo, Sheep, Goats & Horses (4.B.2., 4.B.3., 4.B.4., 4.B.6.)

CH_4 emissions associated with the management of manure excreted by buffalo, sheep, goats, and horses were calculated using the Tier 1 method in accordance with the decision tree from *Good Practice Guidance (2000)* (Page 4.33, Fig. 4.3).

N_2O emissions associated with a management of the manure of sheep, goats and horses have been calculated, using the Tier 1 method in accordance with decision tree from *Good Practice Guidance* (2000) (Page 4.41, Fig. 4.4).

2.5.4.3   Rice Cultivation (4.C.)

CH_4 is generated under anaerobic conditions by the action of microbes. Therefore, paddy fields provide favorable conditions for methane generation. Intermittently and continuously flooded paddy fields are targeted in this category. In Japan, rice cultivation is practiced mainly on intermittently flooded paddy fields.

2.5.4.3.a   Intermittently Flooded (Single Aeration) (4.C.1.-)

CH_4 emissions from intermittently flooded paddy fields (single aeration) were calculated by taking the overall usage of organic fertilizers into account, since the actual measurements of emission factors per soil type for each type of organic fertilizer application existed. The amount of CH_4 generated per type of soil for each method of organic matter management was calculated by multiplying the area of intermittently flooded paddy fields by the amount of CH_4 generated per type of soil per unit area for each management method, percentage of the area of each type of soil, and

percentage of each management method.

2.5.4.3.b Continuously Flooded (4.C.1.-)

CH_4 emissions from continuously flooded paddies have been calculated using country-specific emission factors for different soil types and for different organic amendments, in accordance with decision tree from *Good Practice Guidance (2000)* (Page 4.79, Fig. 4.9).

2.5.4.3.c Rainfed & Deep Water (4.C.2., 4.C.3.)

As indicated in the IRRI (International Rice Research Institute) *World Rice Statistics 1993–94*, rain-fed paddy fields and wet bed methods do not exist in Japan. Therefore, this category has been reported as "NO".

2.5.4.3.d Other (4.C.4.)

As indicated in the IRRI (International Rice Research Institute) *World Rice Statistics 1993-94*, a possible source of emissions in this category is upland crop paddies, but since upland crop paddies are not flooded, like the soil of fields, they are acidic and do not become anaerobic. The bacteria that generate CH_4 are definitely anaerobic, and unless the soil is maintained in an anaerobic state, there will be no generation of methane. As generation of methane is not feasible, this category was reported as "NA".

2.5.4.4 Agricultural Soils (4.D.)

This section provides the estimation methods for N_2O direct emissions from soils (by applied synthetic fertilizers, organic fertilizers, nitrogen fixation by N-fixing crops, crop residue and plowing of organic soil), and for N_2O indirect emissions (by atmospheric deposition and nitrogen leaching and run-off).

2.5.4.4.a Direct Emissions (4.D.1.)

(1) Synthetic Fertilizers (4.D.1.-)

N_2O emissions associated with the application of synthetic fertilizer to farmland soil (field lands) were calculated, using country-specific emission factors, and in accordance with the decision tree from *Good Practice Guidance (2000)* (Page. 4.55 Fig. 4.7).

(2) Organic Fertilizer (Application of Animal Waste) (4.D.1.-)

Emissions of N_2O associated with the application of organic fertilizer (livestock and other compost and barnyard manure) to agricultural soils have been calculated using the country-specific emission factors, in accordance with the decision tree from *Good Practice Guidance (2000)* (Page 4.55, Fig. 4.7).

(3) N-fixing Crops (4.D.1.-)

Emissions are calculated by taking the amount of nitrogen fixed by nitrogen-fixing crops, which is estimated using Japan's observation data, and multiplying by country-specific emission factor.

(4) Crop Residue (4.D.1.-)

N_2O emissions associated with the application of crop residues to agricultural soils were calculated by multiplying the default emissions factors given in the *Revised 1996 IPCC Guidelines* by the nitrogen input through the use of crop residues for soil amendment.

(5) Plowing of Organic Soil (4.D.1.-)

Emissions of N_2O from the plowing of organic soil were calculated by multiplying the area of the plowed organic soil of paddy fields and upland fields by the emission factor in accordance with the *Revised 1996 IPCC Guidelines* and *Good Practice Guidance (2000).*

2.5.4.4.b   Pasture, Range and Paddock Manure (4.D.2.)

The method for calculating CH_4 and N_2O emissions from pasture, range, and paddock cattle manure is described in 6.3.1 "Livestock Waste Management: Cattle, Swine and Poultry (4.B.1., 4.B.8., 4.B.9.)". N_2O emissions are counted in 4.D.2.

2.5.4.4.c   Indirect Emissions (4.D.3.)

(1) Atmospheric Deposition (4.D.3.-)

N_2O emissions associated with atmospheric deposition have been calculated using default emission factors, in accordance with the decision tree from *Good Practice Guidance (2000)* (Page 4.69, Fig. 4.8).

(2) Nitrogen Leaching and Run-off (4.D.3.-)

N_2O emissions associated with leaching and run-off of nitrogen were calculated according to the decision tree from *Good Practice Guidance (2000)* (Page 4.69, Fig. 4.8), by multiplying Japan's country-specific emission factors by the amount of nitrogen that leached or ran off.

2.5.4.5   Prescribed Burning of Savannas (4.E.)

This source is given in the *Revised 1996 IPCC Guidelines* as "being for the purpose of managing pastureland in sub-tropical zones." There is no equivalent activity in Japan, and this source has been reported as "NO".

2.5.4.6   Field Burning of Agricultural Residues (4.F.)

Incomplete burning of crop residues in fields releases CH_4 and N_2O into the atmosphere. CH_4 and N_2O emissions from this source are calculated and reported in this category.

2.5.4.6.a   Rice, Wheat, Barley, Rye, and Oats (4.F.1.)

CH_4 and N_2O emissions from the field burning of crop residues of rice, wheat, barley, rye, and oats were calculated, using the default technique indicated in the *Revised 1996 IPCC Guidelines* and *Good Practice Guidance (2000)*, multiplying the amounts of carbon and nitrogen released by field burning by the methane emission rate and nitrous oxide emission rate, respectively.
Wheat, barley, rye, and oats are cultivated either as grain or green crops. The portions of the green crops which were cultivated for use of the entire above ground mass for cattle feed were excluded from the calculation of emissions.

2.5.4.6.b   Maize, Peas, Soybeans, Adzuki beans, Kidney beans, Peanuts, Potatoes, Sugarbeet & Sugar cane (4.F.1., 4.F.2., 4.F.3., 4.F.4.)

CH_4 and N_2O emissions from the field burning of crop residues of corn, peas, soy, adzuki beans, kidney beans, peanuts, potatoes and other root crops (sugarbeets), and sugar cane were calculated in accordance with the relevant decision tree in *Good Practice Guidance (2000)* (page 4.52, Fig. 4.6),

multiplying the total carbon released, as calculated by the default technique, by the default CH_4 emission rate and N_2O emission rate, respectively.

2.5.4.6.c Dry beans (4.F.2.-)

Dry beans are a type of kidney beans, and the term refers to the mature, husked vegetable. Kidney beans in Japan are eaten before ripening, however, which means there is little of this type of product. Kidney beans are included in Beans (4.F.2.), under "Other crops" and, therefore, dry beans have been reported as "IE".

2.5.4.6.d Other (4.F.5.)

It is possible that agricultural waste other than cereals, pulse, root vegetables and sugar canes are burnt in the fields. However, data on actual activity is not available and it is not possible to establish the emission factor. Therefore, these sources have been reported as "NE".

2.5.5 Land Use, Land-Use Change and Forestry (CRF sector 5)

2.5.5.1 Forest land (5.A.)

Forests absorb CO_2 from the atmosphere by photosynthesis; they fix carbon as organic substances and store these substances for a given period. In contrast, events such as logging and natural disturbances can possibly make forests a source of CO_2.
In FY2007, Japan's forest land area was about 25.0 million ha—about 66.1% of the total national land area. The net CO_2 removal by this category in FY2007 was 82,867 Gg-CO_2 (excluding 2.1 Gg-CO_2 of CH_4 and N_2O emissions resulting from biomass burning); this represents an increase of 2.6％ over the FY1990 value, and a decrease by 0.6% over the FY2006 value.
This section divides forest land into two subcategories, Forest land remaining Forest land (5.A.1.) and Land converted to Forest land (5.A.2.), and describes them separately in the following subsections.

2.5.5.1.a Forest land remaining Forest land (5.A.1.)

(1) Carbon Stock Changes in Living Biomass

In accordance with the decision tree provided in the GPG-LULUCF, carbon stock changes in living biomass in forest land remaining forest land are estimated by the Tier 2 stock change method. In this method, a biomass stock change is the difference between the absolute amount of biomass at two points in time.

(2) Carbon Stock Changes in Dead Organic Matter and Soils

In accordance with the decision tree provided in the GPG-LULUCF, carbon stock changes in dead wood, litter and soil in forest land remaining forest land are estimated by the Tier 3 model method. Carbon emissions/removals in each pool per unit area are estimated by using the CENTURY-jfos model and are multiplied by the land area of each forest management type. The sum of all forest management types is the annual change in total carbon stocks in dead wood, litter and soil.

2.5.5.1.b Land converted to Forest land (5.A.2)

(1) Carbon Stock Changes in Living Biomass

Carbon stock change in living biomass in land converted to forest land has been calculated, using the

Tier 2 stock change method in accordance with page 3.18 of the GPG-LULUCF. In this method, biomass stock change is estimated by the difference between the biomass at time t2 and time t1, with additional subtracted biomass stock change due to land conversion.

(2)　Carbon Stock Changes in Dead Organic Matter and Soils

Carbon stock changes in dead wood, litter and soils were calculated under the assumption that these carbon stocks have changed linearly from those in land-use categories other than forest land to those in forest land during the past 20 years.

2.5.5.2　Cropland (5.B)

Cropland is the land that produces annual and perennial crops; it includes temporarily fallow land. Cropland in Japan's inventory consists of rice fields, upland fields and orchards.

In FY2007, Japan's cropland area was about 4.03 million ha, which is equivalent to about 10.7% of the national land. The emissions from this category in FY2007 were 265 Gg-CO_2 (excluding 7.9 Gg-CO_2 eq. of N_2O emissions resulting from disturbance associated with land-use conversion to cropland and 230 Gg-CO_2 of CO_2 emissions resulting from lime application to cropland), which was a 87.1% decrease from the FY1990 value and a 3.4% increase over the FY2006 value.

This section divides cropland into two subcategories, Cropland remaining Cropland (5.B.1.) and Land converted to Cropland (5.B.2.), and describes them separately in the following subsections.

2.5.5.2.a　Cropland Remaining Cropland (5.B.1)

This subcategory deals with carbon stock changes in the cropland, which has remained as cropland during the past 20 years.

With respect to living biomass, the carbon stock change in perennial tree crops (fruit trees) is subject to estimation according to GPG-LULUCF. However, in Japan, tree growth is limited by trimming. In order to have high productivity, tree height is kept low, and the tree shape is managed and improved the by pruning the lateral branches. Therefore, carbon accumulation because of tree growth can not be expected, and the annual carbon fixing volume of perennial tree crops in all orchards is stated as "NA."

Although the estimation method for dead organic matter is not given in GPG-LULUCF, an estimate input cell is found in CRF. Therefore, carbon stock change in dead organic matter is reported as "NE".

With respect to soil, its carbon stock change is reported as "NA" according to Tier 1 given in GPG-LULUCF, because soil carbon stocks are assumed not to have changed during the past 20 years regardless of any changes in management practices.

2.5.5.2.b　Land Converted to Cropland (5.B.2)

(1)　Carbon Stock Changes in Living Biomass

The Tier 2 method is applied to the case of forest land converted to cropland. The Tier 1 method is used for the case of land uses other than forest land converted to cropland. Provisional and default values of the amount of biomass accumulation are used for the Tier 1 method.

(2)　Carbon Stock Changes in Dead Organic Matter and in Soils

Carbon stock changes in dead wood, litter and soils were calculated under the assumption that these carbon stocks have changed linearly from those in land-use categories other than forest land to those

in forest land during the past 20 years. Since all soils are regarded as being mineral, organic soil is reported as "IE".

2.5.5.3 Grassland (5.C)

Grassland is generally covered with perennial pasture and is used mainly for harvesting fodder or grazing.

In FY2007, Japan's grassland area was about 0.91 million ha, which is equivalent to about 2.4% of the national land. The net CO_2 removals from this category in FY2007 were 615 Gg-CO_2 (excluding 230 Gg-CO_2 of CO_2 emissions resulting from agricultural lime application), which was a 19.1% increase over the FY1990 value and a 1.0% decrease from the FY2006 value.

This section divides grassland into two subcategories, Grassland remaining Grassland (5.C.1.) and Land converted to Grassland (5.C.2.), and describes them separately in the following subsections.

2.5.5.3.a Grassland Remaining Grassland (5.C.1)

This subcategory deals with carbon stock changes in the grassland, which has remained as grassland during the past 20 years.

With respect to living biomass, its carbon stock change is assumed to be constant and reported as "NA" according to Tier 1.

Although the estimation method for dead organic matter is not given in GPG-LULUCF, an estimate input cell is found in CRF. Therefore, carbon stock change in dead organic matter is reported as "NE".

With respect to soil, its carbon stock change is reported as "NA" according to Tier 1 given in the GPG-LULUCF, because soil carbon stocks are assumed not to have changed during the past 20 years regardless of any changes in management practices.

2.5.5.3.b Land Converted to Grassland (5.C.2)

(1) Carbon Stock Changes in Living Biomass

The Tier 2 method is applied to the cases of forest land and cropland (rice fields) converted to grassland (pasture lands). The Tier 1 method is used for land uses other than forest land and cropland (rice fields) converted to grassland (pasture lands). The biomass growth is assumed to be complete during the first five years after the land-use conversion. Therefore, the annual biomass stock change in the living biomass in grassland is the sum of biomass stock changes over the last five years.

(2) Carbon Stock Changes in Dead Organic Matter and Soils

Carbon stock changes in dead wood, litter and soils were calculated under the assumption that these carbon stocks have changed linearly from those in land-use categories other than grassland to those in grassland land during the past 20 years. Since all soils are regarded as being mineral, organic soil is reported as "IE".

2.5.5.4 Wetlands (5.D)

Wetlands are the land that are covered with or soaked in water throughout the year. They do not fall under the categories of forest land, cropland, grassland, or settlements. GPG-LULUCF divides wetlands into two large groups: peat land and flooded land.

In FY2007, Japan's wetland area was about 1.33 million ha, which is equivalent to about 3.5% of the

national land. The CO_2 emissions from this category in FY2007 were 167 Gg-CO_2, which was a 42.9% decrease from the FY1990 value and a 10.6% decrease from the FY2006 value.

This section divides wetlands into two subcategories, Wetlands remaining Wetlands (5.D.1.) and Land converted to Wetlands (5.D.2.), and describes them separately in the following subsections.

2.5.5.4.a Wetlands remaining Wetlands (5.D.1)

This subcategory deals with carbon stock changes in the Wetlands, which have remained as Wetlands during the past 20 years. Carbon stock changes in organic soils that are managed for peat extraction are reported as "NO", since the peat extraction is not carried out in Japan. (Default value for Japan is not provided in GPG-LULUCF p.3.282 Table 3A3.3). Flooded land remaining flooded land is not calculated at the present time as this will be treated in an appendix, and reported as "NE".

2.5.5.4.b Land Converted to Wetlands (5.D.2)

(1) Carbon Stock Changes in Living biomass

The Tier 2 method is applied.

(2) Carbon Stock Changes in Dead Organic Matter and Soils

Carbon stock changes in dead wood, litter and soils were calculated under the assumption that these carbon stocks have changed linearly from those in land-use categories other than wetlands to those in wetlands land during the past 20 years. Since all soils are regarded as being mineral, organic soil is reported as "IE".

2.5.5.5 Settlements (5.E)

Settlements are all developed land, including transportation infrastructure and human habitats, and preclude lands that have been placed in other land-use categories. In Settlements, trees existing in urban green areas such as urban parks and special greenery conservation zones absorb carbon.

In FY2007, Japan's settlement area was about 3.68 million ha, equivalent to about 9.7% of the national land. The net CO_2 emissions by this category in FY2006 were 849 Gg-CO_2, which was 72.4% decrease from the FY1990 value, and 8.2% decrease from the previous year.

This section divides settlements into two subcategories, Settlements remaining Settlements (5.E.1.) and Land converted to Settlements (5.E.2.), and describes them separately in the following subsections.

Carbon pools estimated in settlements are living biomass and dead organic matter. Soil carbon stock changes in settlements are not estimated because their method of estimation is not described in GPG-LULUCF. Nonetheless, soil carbon stock changes will be estimated, if necessary, when data is obtained from research.

With respect to activity data, Tier 1a and Tier 1b of GPG-LULUCF assume that removals derived from biomass growth are equal to emissions derived from biomass loss where the average tree age in a green area is older than 20 years. Therefore, carbon stock changes in urban green areas more than 20 years old are regarded as zero and not estimated. Moreover, urban green areas included in the activity data are divided into two categories; urban green facilities established as urban parks and special greenery conservation zones on which conservation measures are applied and permanent protection is ensured.

2.5.5.5.a   Settlements Remaining Settlements (5.E.1)

(1)   Carbon Stock Changes in Living Biomass

Due to the different characteristics of urban green areas, the Tier 1a method is used for special greenery conservation zones that are communal green areas, and Tier 1b is used for urban green facilities that are urban parks, green areas by greenery promoting system for private green space, and green areas in roads, ports, around sewage treatment facilities, along rivers and erosion control sites, and around government buildings and public rental housing.

(2)   Carbon Stock Changes in Dead Organic Matters

This category estimates carbon stock changes in litter in urban parks and green areas in ports. Carbon stock changes in dead wood result in "IE" because they are included in carbon stock changes in living biomass. Carbon stock changes in litter in the subcategories other than urban parks and green areas in ports are not estimated due to the difficulty of obtaining their activity data.

2.5.5.5.b Land converted to Settlements (5.E.2)

(1)   Carbon Stock Changes in Living Biomass

Carbon stock changes in living biomass under the land converted to settlements are estimated by calculating the carbon stock changes before and after conversion and adding annual carbon stock changes in land converted to urban green areas. The carbon stock changes in living biomass before and after conversion are estimated by applying the equation of section 3.6.2 in GPG-LULUCF (multiplying the land area converted from each land use to settlements by the difference between the values of biomass stock before and after conversion, and by the carbon fraction). Biomass stocks in land converted to urban green areas are increased due to the growth of trees planted after conversion. Hence, carbon stock changes in living biomass in land converted to urban green areas are estimated by making carbon stock changes before and after conversion plus annual carbon stock changes after conversion that are estimated by applying the Tier 1b method from section 3A.4.1.1.1 in GPG-LULUCF.

(2)   Carbon Stock Changes in Dead Organic Matter

Carbon stock changes in dead organic matter under the land converted to settlements are estimated by summing up the carbon stock changes in settlements converted from forest land and the carbon stock changes in litter on the land (other than forest land) converted to urban parks and green areas on port.

2.5.5.6   Other Land (5.F)

Other land consists of land areas that are not included in the other five land-use categories. It includes bare land, rock, ice, and unmanaged land areas. Other land in Japan includes areas abandoned after cultivation, areas used for national defense, and the northern territories of Japan. In FY2007, Japan's other land area was about 2.86 million ha, which is equivalent to about 7.6% of the national land. The areas are determined by subtracting the summed areas of the other five land-use categories from the national land area shown in *the Land Use Status Survey* compiled by the Ministry of Land, Infrastructure, Transport, and Tourism. The CO_2 emissions from this category in FY2007 were 608 Gg-CO_2, which was a 36.5% decrease from the FY1990 value and a 10.6% decrease/increase over the FY2006 value.

This section divides other land into two subcategories, Other land remaining Other land (5.F.1.) and Land converted to Other land (5.F.2.), and describes them separately in the following subsections.

2.5.5.6.a Other Land Remaining Other Land (5.F.1)

This subcategory deals with carbon stock changes in other land, which has remained as other land during the past 20 years. However, changes in carbon stocks and non-CO_2 emissions and removals in this subcategory are not considered in accordance with GPG-LULUCF.

2.5.5.6.b Land Converted to Other Land (5.F.2)

(1) Carbon stock change in Living Biomass

The Tier 2 method is applied.

(2) Carbon Stock Change in Dead Organic Matter

The Tier 2 method is applied.
Carbon stock changes in dead wood and litter were calculated under the assumption that these carbon stocks have changed linearly from those in land-use categories other than other land to those in other land during the past 20 years.

2.5.5.7 Direct N_2O Emissions from N fertilization (5. (I))

It is assumed that volume of nitrogen-based fertilizer applied to forest soils is included in demand for nitrogen-based fertilizers in the agriculture sector, although fertilization application in forest land may not conducted in Japan. Therefore, these sources have been reported as "IE".

2.5.5.8 N_2O Emissions from Drainage of Soils (5.(II))

Regarding the N_2O emissions from soil drainage activities in forest land and wetlands, experts advised that the N_2O emissions are extremely low, because the soil drainage activities are very rarely carried out in Japan. Based on this advice, this category is reported as "NO".

2.5.5.9 N_2O emissions from disturbance associated with land-use conversion to Cropland (5.(III))

According to GPG-LULUCF, the Tier 1 method is used.

2.5.5.10 CO_2 emissions from agricultural lime application (5.(IV))

Tier 1 method is used in accordance with GPG-LULUCF (page 3.80).

2.5.5.11 Biomass burning (5.(V))

For CH_4 and N_2O emissions due to biomass burning, the Tier 1 method is used.

2.5.6 Waste (CRF Sector 6)

2.5.6.1 Solid Waste Disposal on Land (6.A.)

This category includes CH_4 and CO_2 emissions from solid waste disposal on land. The CO_2 emissions from this source category are biogenic in origin and therefore the emissions are not

included in national total emissions. Since wastes are classified into municipal and industrial solid waste, category-specific methods were used for emission estimates. Emissions from waste types in Table 2.14 were estimated for solid waste disposal on land.

Table 2.14 Categories whose emissions are estimated for solid waste disposal on land (6.A.)

Category	Waste types estimated		Treatment type
6.A.1.	Municipal solid waste	Kitchen garbage	Anaerobic landfill
			Semi-aerobic landfill
		Waste paper	Anaerobic landfill
			Semi-aerobic landfill
		Waste wood	Anaerobic landfill
			Semi-aerobic landfill
		Waste textiles (natural fiber) [a]	Anaerobic landfill
			Semi-aerobic landfill
		Sludge — Human waste treatment, Septic tank sludge	Anaerobic landfill
			Semi-aerobic landfill
	Industrial waste	Kitchen garbage	Anaerobic landfill [b]
		Waste paper	
		Waste wood	
		Waste textiles (natural fiber) [a]	
		Sludge — Sewage sludge	
		Sludge — Waterworks sludge	
		Sludge — Organic sludge from manufacturing industries	
		Sludge — Livestock waste [c]	
6.A.3.	Inappropriate disposal [d]		Anaerobic landfill

a) Only natural fiber waste textiles are included in the estimation under the assumption that synthetic fiber waste is not biologically decomposed in landfills.

b) For landfill disposal of industrial waste, the entire volume is deemed to have been disposed of in an anaerobic landfill because the percentage disposed of in semiaerobic landfill cannot be determined.

c) Although livestock waste is not classified as "sludge" under Japanese law, emissions from it were estimated within the category of sludge because of the similarities in their properties.

d) Illegally dumped waste containing biodegradable carbon is considered to include waste wood, waste paper, and sludge. However, only the emissions from waste wood were calculated, because only its state of dumping is known at present.

2.5.6.1.a Emissions from Controlled Landfill Sites (6.A.1.)

An emissions calculation method is used that complies with the 2006 IPCC Guidelines decision tree (Tier 3) and combines the revised FOD methods with parameters unique to Japan. Japan's emission coefficient is defined as the CH_4 amount produced by biodegraded waste, while the activity amount is defined as the biodegraded waste amount during the fiscal year of calculation.

2.5.6.1.b   Emissions from Unmanaged Waste Disposal Sites (6.A.2)

There are no unmanaged waste disposal sites in Japan, because landfill sites in Japan are appropriately controlled pursuant to the Waste Disposal and Public Cleansing Law. Therefore, the emission from this source category is reported as NA.

2.5.6.1.c   Emissions from Other Controlled Landfill Sites (6.A.3.)

(1)   Emissions from Inappropriate Disposal (6.A.3.a)

"Waste wood" and "waste paper" are types of waste which contain biodegradable carbon content and which are inappropriately disposed without incineration, but because the amount of waste paper that remains is very small, only waste wood is estimated.

Just as with Emissions from Controlled Disposal Sites (6.A.1.), a FOD method with unique Japanese parameters is used for estimation. Emissions from the part of the wood that is inappropriately disposed of without incineration are estimated by multiplying an emission factor by the amount of wood (dry basis) that degrades in the estimation year.

2.5.6.2   Wastewater Handling (6.B.)

The CH_4 and N_2O emissions from wastewater handling were estimated. The categories for estimation are shown in Table 2.15. Since wastewater and sludge treatment processes are combined in the emission factors used in Japan, emissions from these processes were also combined for estimation.

Table 2.15 Categories for which wastewater amount is estimated
under wastewater handling (6.B.)

Category	Type Estimated	Forms of Treatment		CH_4	N_2O
6.B.1.	Industrial wastewater	(Sewage treatment plants)		○	○
6.B.2.	Domestic/commercial wastewater	Sewage treatment plants (8.3.2.1)		○	○
		Domestic wastewater treatment facilities (mainly septic tanks) (8.3.2.2)	Community plant	○	○
			Gappei-shori johkasou	○	○
			Tandoku-shori johkasou	○	○
			Vault toilet	○	○
		Human waste treatment facilities (8.3.2.3)	High-load denitrification treatment	○	○
			Membrane separation	○	○
			Anaerobic treatment	○	○
			Aerobic treatment	○	
			Standard denitrification treatment	○	
			Other	○	
	Degradation of domestic wastewater in nature (8.3.2.4)	Discharge of untreated domestic wastewater	*Tandoku-shori johkasou*	○	○
			Vault toilet	○	○
			On-site treatment	○	○
		Sludge disposal at sea	Human waste sludge	○	○
			Sewage sludge	○	○

2.5.6.2.a   Industrial Wastewater (6.B.1.)

The *Good Practice Guidance (2000)* decision tree is followed in estimating methane emissions on a BOD basis and N_2O emissions on a nitrogen basis for industries that have much organic matter in their wastewater. As the default values set in the *Revised 1996 IPCC Guidelines* seem unsuited to Japan's situation, methane emissions were estimated by multiplying the annual amount of organic matter in industrial wastewater (BOD basis) by the emission factor per unit BOD since BOD value is used in effluent regulation in Japan. Because CH_4 is emitted in wastewater biological treatment processes, BOD-based activity data (amount of organic matter in wastewater degraded through biological treatment) is thought to be preferable to COD-based data. For this reason, CH_4 emissions are calculated in Japan using BOD. N_2O emissions were estimated by multiplying the amount of nitrogen in industrial wastewater by the emission factor of N_2O generated when treating industrial wastewater.

2.5.6.2.b   Domestic and Commercial Wastewater (6.B.2.)

(1)   Sewage Treatment Plants (6.B.2.a)

Emissions of CH_4 and N_2O from this source have been calculated using Japan's country-specific method, in accordance with the decision tree from *Good Practice Guidance (2000)* (Page 5.14, Fig. 5.2). Emissions were derived by multiplying the volume of sewage treated at sewage treatment plants by the emission factor.

(2)   Domestic Sewage Treatment Plants (mainly septic tanks) (6.B.2.b)

CH_4 and N_2O emitted from this source were calculated using Japan's country-specific method, in accordance with the decision tree from *Good Practice Guidance* (2000) (Page 5.14, Fig. 5.2). Emissions were derived by multiplying the annual population of treatment for each type of domestic sewage treatment plant by the emission factor.

(3)   Human-Waste Treatment Plants (6.B.2.c.)

CH_4 emitted from this source has been calculated using Japan's country-specific methodology, in accordance with the decision tree from *Good Practice Guidance* (2000) (Page 5.14, Fig. 5.2). Emissions were calculated by multiplying the volume of domestic wastewater treated at human waste treatment plants by the emission factor.

N_2O emitted from this source has been calculated using Japan's country-specific methodology, in accordance with the decision tree from *Good Practice Guidance* (2000) (Page 5.14, Fig. 5.2). Emissions were calculated by multiplying the volume of nitrogen treated at human waste treatment plants by the emission factor.

(4)   Emission from the Natural Decomposition of Domestic Wastewater (6.B.2.d)

The calculation method was established in accordance with the method described in the 2006 IPCC Guidelines. In the natural decomposition of wastewater, the volume of both organic matter extracted as sludge and recovered methane was zero. Accordingly, CH_4 emissions were calculated by multiplying the volume of organic matter contained in the untreated domestic wastewater that was discharged into public waters by the emission factor. The N_2O emission was calculated by multiplying the volume of nitrogen contained in the wastewater by the emission factor.

(5)　Recovery of CH_4 emitted from treating domestic and commercial wastewater (6.B.2.-)

The amount of CH_4 recovered from sludge digesters at sewage treatment plants is calculated by multiplying the amount of digester gas recovered from digesters by an emission factor that takes into account the concentration of methane in digester gas.

2.5.6.3　Waste Incineration (6.C.)

Japan uses incinerators to reduce the volume of waste. Emissions of CO_2, methane, and N_2O from the incineration of the wastes are estimated in this category.

The following reporting categories which fall under the "Emissions from Waste Used as Energy and the Incineration of Waste Accompanied by Energy Recovery" are moved from Incineration of Waste (Category 6.C.) to Fuel Combustion (Category 1.A.) in accordance with the *Revised 1996 IPCC Guidelines* and *Good Practice Guidance* (2000).

- Emissions from the Incineration of Waste in Which Energy is Recovered
- Emissions from Waste Used Directly as Fuel
- Emissions from Fuel Made from Waste

Accordingly, the emissions reported under the Incineration of Waste (Category 6.C.) are the emissions from the incineration without recovery of energy (simple incineration). Reporting categories for the calculation of emissions from the incineration of waste are summarized in Table 2.16.

As the *Revised 1996 IPCC Guidelines* stipulate, the concept for the emission factors and estimation methods used in the Waste Incineration (Category 6.C.) should be same as that applied to the calculation of emissions from the incineration of waste used as energy and that from which energy is recovered. As it is desirable to estimate emissions in a consistent manner regardless of whether energy is used or not in order to prevent duplication or omission of the emissions, the description of the methods of estimating emissions is included in the Incineration of Waste (Category 6.C.) as was the case in the past.

Table 2.16 Categories for the calculation of emissions from waste incineration (6.C.)

Incineration	Waste category	Estimation classification	Category of estimation	CO_2	CH_4	N_2O
Waste incineration (without energy recovery)	Municipal solid waste	Plastic	6.C.1	○	○	○
		Synthetic textile	6.C.1	○	Estimated in bulk	Estimated in bulk
		Other (biogenic)[a]	6.C.1	/		
	Industrial solid waste	Waste oil	6.C.2	○	○	○
		Waste plastic	6.C.2	○	○	○
		Other (biogenic)[a]	6.C.2	/	○	○
	Specially controlled industrial waste	Waste oil	6.C.3	○	○	○
		Infectious waste (plastic)	6.C.3	○	○	○
		Infectious waste (except plastic)[a]	6.C.3	/	○	○
Waste incineration with energy recovery	Municipal solid waste	Plastic	1.A.1	○	○	○
		Synthetic textile	1.A.1	○	Estimated in bulk	Estimated in bulk
		Other (biogenic)[a]	1.A.1	/		
	Industrial solid waste	Waste oil	1.A.1	○	○	○
		Waste plastic	1.A.1	○	○	○
		Other (biogenic)[a]	1.A.1	/	○	○
Direct use of waste as fuel	Municipal solid waste	Plastic	1.A.1/2	○	○	○
	Industrial solid waste	Waste oil	1.A.2	○	○	○
		Waste plastic	1.A.2	○	○	○
		Waste wood	1.A.2	/	○	○
	Waste tire	Fossil origin	1.A.1/2	○	○	○
		Biogenic origin	1.A.1/2	/		
Use of waste processed as fuel	Refuse derived fuel (RDF/RPF)	Fossil origin	1.A.2	○	○	○
		Biogenic origin	1.A.2	/		

a) The CO_2 emissions from the incineration of biomass-derived waste is not included in the total emissions in accordance with the *Revised 1996 IPCC Guidelines*; instead it is estimated as a reference value and reported under " Biogenic" in Table 6.A,C of the CRF.

Table 2.17 GHG emissions from incineration of waste (Category 6.C.) (FY2007)

Incineration type	Waste category	Estimation classification	Unit	CO_2	CH_4	N_2O
Waste incineration (without energy recovery)	Municipal solid waste	Plastics	Gg CO_2	3154.5	5.1	242.0
		Synthetic textile	Gg CO_2	455.4		
		Other (biogenic)[a]	Gg CO_2			
	Industrial solid waste	Waste oil	Gg CO_2	4577.4	0.2	5.8
		Waste plastic	Gg CO_2	4284.6	1.1	93.5
		Other (biogenic)[a]	Gg CO_2		3.2	3553.9
	Specially-controlled waste	Waste oil	Gg CO_2	1503.8	0.1	1.9
		Infectious waste plastics	Gg CO_2	432.6	0.1	9.4
		Infectious waste (except plastics)	Gg CO_2		0.1	1.5
Total			Gg CO_2	14408.3	9.8	3907.9

a) The CO_2 emissions from the incineration of biomass-derived waste is not included in the total emissions in accordance with the *Revised 1996 IPCC Guidelines*; instead it is estimated as a reference value and reported under " Biogenic" in Table 6.A,C of the CRF.

2.5.6.3.a Municipal Solid Waste Incineration (6.C.1.)

Emissions of CO_2 from this source has been calculated by using Japan's country-specific emission factors, the volume of waste incinerated (dry basis) and percentage of municipal waste incinerated at the municipal incineration facilities which recover energy, in accordance with the decision tree from *Good Practice Guidance* (2000) (Page 5.26, Fig. 5.5). Emissions from plastics and synthetic textile scraps in municipal waste were estimated for the estimation of CO_2 emissions from the incineration of fossil-fuel-derived waste[9].

$$E = EF \times A \times (1 - R)$$

E	: Emission of CO_2 from the incineration of various types of waste (kg CO_2)
EF	: Emission factor for the incineration of various types of waste (dry base) (kg CO_2/t)
A	: Volume of each type of waste incinerated (dry basis) (t)
R	: Percentage of municipal solid waste incinerated at facilities with energy recovery
E	: Emission of CO_2 from the incineration of various types of waste (kg CO_2)

CH_4 emissions from the incineration of municipal waste were calculated by taking the amount of incinerated municipal waste by incinerator type (emission basis) and multiplying by the emission factor established for each type, and then multiplying the result by the percentage of municipal waste incinerated in energy-recovering municipal incinerators.

Emissions of N_2O from the incineration of municipal solid waste were determined in accordance with the decision tree from *Good Practice Guidance* (2000) (Page 5.27, Fig. 5.6). Specifically, the emissions were calculated by multiplying the volume of the municipal solid waste incinerated (wet basis) by Japan's country-specific emission factor that was determined from the N_2O concentration of flue gas from the incinerators of municipal solid waste and by the percentage of municipal solid waste incinerated at incineration facilities with energy recovery.

2.5.6.3.b Industrial Waste Incineration (6.C.2)

Emissions of CO_2 from this source have been calculated using the volume of waste oil and waste

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[9] Emissions from the incineration of kitchen garbage, waste paper, waste natural fiber textiles and waste wood were accounted for as the reference figures of biogenic waste. Estimation methods for their emissions are the same as those for emissions from the incineration of plastics and synthetic textile scraps.

plastics incinerated, and Japan's country-specific emission factor, in accordance with the decision tree from *Good Practice Guidance* (2000) (Page 5.26, Fig. 5.5). Since industrial textile waste does not include synthetic fabric scraps under the regulation of the Waste Disposal and Public Cleansing Law, industrial textile waste is regarded as natural fiber waste. Thus the CO_2 emissions from incineration of industrial textile waste are not included in national total because of the emissions are from a biogenic source.

Emissions of CH_4 from this source have been calculated by multiplying the volume of industrial waste incinerated by Japan's country-specific emission factor and by the percentage of industrial solid waste incinerated at facilities with energy recovery.

N_2O emissions from this source were calculated by multiplying the incinerated volume of the industrial waste by Japan's country-specific emission factor and by the percentage of industrial solid waste incinerated at facilities with energy recovery. For sewage sludge, a separate emission factor was calculated for each type of flocculant and incinerator used, and where high-molecular-weight flocculants and fluidized-bed incinerators were used, separate emission factors were calculated for different combustion temperatures.

2.5.6.3.c Incineration of Specially Controlled Industrial Waste (6.C.3)

Emissions of CO_2 from the incineration of waste oil and infectious plastic waste contained in specially controlled industrial waste were calculated in accordance with the decision tree from *Good Practice Guidance* (2000) (Page 5.26, Fig 5.5) using Japan's country-specific emission factors and the incinerated volume.

Emissions of CH_4 from the incineration of waste categorized as waste oil and infectious plastic waste of specially controlled industrial waste were calculated by multiplying the volume of incinerated waste by type (wet basis) by Japan's country-specific emission factor.

Emissions of N_2O from the incineration of the waste oil and infectious plastic waste in specially controlled industrial waste were calculated by multiplying the incinerated volume of each type of waste (wet basis) by Japan's country-specific emission factor.

Because the actual state of energy recovery from the incineration of specially controlled industrial waste is not sufficiently understood, the emissions from specially controlled industrial waste are reported entirely in Waste Incineration (Category 6.C.).

2.5.6.4 Emissions from Waste Incineration with Energy Recovery (1.A.)

2.5.6.4.a Incineration of Municipal Solid Waste with Energy Recovery (1.A.1.a)

A methodology similar to that used in Incineration of Municipal Waste (6.C.1) is used.

2.5.6.4.b Incineration of Industrial Solid Waste with Energy Recovery (1.A.1.a)

A methodology similar to that used in Incineration of Industrial Waste (6.C.2) is used.

2.5.6.5 Emissions from Direct Use of Waste as Fuel (1.A.)

The reporting category for emissions for each type of waste, according to its use as fuel or raw material, is Energy Industry (Category 1.A.1.) or Manufacturing and Construction (1.A.2). The fuel type is classified as "Other fuels".

The GHG emissions during the direct use of waste as a raw material, such as plastics used as reducing agents in blast furnaces or as a chemical material in coking furnaces, or the use of

intermediate products manufactured using waste as a raw material, are calculated in this category. Waste used as raw material and waste used as fuel are combined and expressed as "Raw Material/Fuel Use" in this section.

Table 2.18 Estimation category for emissions from the direct use of waste as fuel

Emission source	Application breakdown	Major application	Reporting category of energy sector
Use of municipal solid waste (plastics) as alternative fuel or raw material	Petrochemical	Fuel	1A2f Other
	Blast furnace reducing agent	Reducing agent in blast furnace	1A2a Iron & Steel
	Coke oven chemical feedstock	Alternative fuel or raw material in coke oven	1A1c Manufacture of solid fuels
	Gasification	Fuel	1A2f Other
Use of waste oil as alternative fuel or raw material	Cement burning	Cement burning	1A2f Cement & Ceramics
	Other	Fuel	1A2f Other
Use of industrial solid waste (waste plastics) as alternative fuel or raw material	Blast furnace reducing agent	Blast furnace reducing agent	1A2a Iron & Steel
	Cement burning	Cement burning	1A2f Cement & Ceramics
Use of industrial solid waste (waste wood) as alternative fuel or material	-	Fuel	1A2f Other
Use of waste tire as alternative fuel or raw material	Cement burning	Cement burning	1A2f Cement & Ceramics
	Boiler	Fuel	1A2f Other
	Iron manufacture	Alternative fuel or raw materials in iron manufacturing	1A2a Iron & Steel
	Gasification	Fuel in iron manufacturing	1A2a Iron & Steel
	Metal refining	Fuel in metal refining	1A2b Non-ferrous metals
	Tire manufacture	Fuel in tire manufacturing	1A2c Chemicals
	Paper manufacture	Fuel in paper manufacturing	1A2d Pulp, paper and print
	Power generation	Power generation	1A1a Public electricity and heat production[*]

*1A1a was utilized when the industry category for use could not be specified.

CO_2 emissions were calculated by multiplying the incinerated volume of each type of waste used as either raw material or fuel by Japan's country-specific emission factor. The wastes included in the calculation were the portions used as raw material or fuel of: plastics in municipal solid waste; waste plastics and waste oil in industrial waste and waste tires.

CH_4 and N_2O emissions were calculated by multiplying the amount of each type of waste used as raw material or fuel by the country-specific emission factor.

2.5.6.5.a Emissions from Municipal Waste (Waste Plastics) used as Alternative Fuel (1.A.1 and 1.A.2)

CO_2 emissions were calculated by multiplying the incinerated volume of each type of waste used as raw material or fuel by Japan's country-specific emission factor.
For the estimation method and the emission factors for CH_4 and N_2O, refer to the section 2.5.6.5 .

2.5.6.5.b Emissions from Industrial Waste (Waste Plastics, Waste Oil, Waste Wood) Used as Raw Material or Alternative Fuels (1.A.2.))

For the estimation of CO_2 emission, emission factors used for incineration of industrial waste are used for waste plastics and waste oil.
For the estimation of CH_4 and N_2O emissions, refer to the section 2.5.6.5 .

2.5.6.5.c Emissions from Waste Tires Used as Raw Materials and Alternative Fuels (1.A.1 and 1.A.2)

CO_2 emissions were calculated by multiplying the incinerated amount of waste tires used as raw materials or fuels by Japan's country-specific emission factor.
For estimation of CH_4 and N_2O emissions, refer to the section 2.5.6.5 .

2.5.6.6 Emissions from Incineration of Waste Processed as Fuel (1.A.)

2.5.6.6.a Incineration of Refuse-Based Solid Fuels (RDF and RPF) (1.A.2)

CO_2 emissions were calculated by multiplying the incinerated amount of RDF and RPF by Japan's country-specific emission factor.
For the estimation method and the emission factors used in estimating CH_4 and N_2O emissions, refer to 2.5.6.5 . The standard calorific value for RPF is calculated using the Report on the Results of Discussions and Revised Values for Standard Calorific Values to be Used in FY2005 and Subsequent Years (Resources and Energy Agency).

2.5.6.7 Other (6.D.)

In this category, CO_2 emitted as a result of the decomposition of petroleum-derived surfactants and CH_4 and N_2O emissions from the composting of organic waste are calculated.

2.5.6.7.a Emissions from Composting of Organic Waste (6.D.1)

Emissions were calculated by taking the amount of organic waste composted, which was extracted from the statistical information available in Japan, and multiplying it by the default emission factor provided in the IPCC 2006 Guidelines. The calculation method is the same for both CH_4 and N_2O emissions.

2.5.6.7.b Emissions from the Decomposition of Petroleum-Derived Surfactants (6.D.2)

As neither the *Revised 1996 IPCC Guidelines* nor *Good Practice Guidance* (2000) specified a method for determining CO_2 emissions, a method specifically established in Japan was applied to the

calculation. Because carbon contained in surfactants emitted into wastewater treatment facilities and into the environment is eventually oxidized to CO_2 and emitted into the atmosphere as a result of surfactants decomposition, CO_2 emissions were estimated based on the amount of carbon contained in surfactants emitted into wastewater treatment facilities and into the environment.

The main subject of estimation was the carbon content of petroleum-derived surfactants, and it was assumed that all of the carbon contained in surfactants is ultimately decomposed into CO_2. In addition, all domestically used surfactants were assumed to be discharged into wastewater treatment facilities and into the environment. The carbon content in petroleum-derived surfactants was determined by using the amount of surfactant raw materials consumed and the amount of surfactants imported and exported.

Based on the facts stated above, the CO_2 emissions were calculated by multiplying the volume of the petroleum-derived surfactant for each type of raw material by the carbon content of each of the materials. The calculation covered synthetic alcohols, alkylbenzenes, alkylphenols, and ethylene oxide. Some of the carbon contained in surfactants discharged into wastewater treatment facilities are adsorbed and assimilated by sludge. However, this portion of carbon is not decomposed biologically. It is released into the atmosphere as CO_2 through incineration and landfilling of sludge. Therefore, the emission is included in CO_2 emission estimates.

2.5.7 Other (CRF sector 7)

The national inventory does not include the emissions and removals of gases targeted under the Kyoto Protocol (CO_2, CH_4, N_2O, HFCs, PFCs, SF_6) from the sources which are not included in the IPCC Guideline. The national inventory includes CO emissions from smoking as the emissions of indirect greenhouse gases (NOx, CO, NMVOC) and SO_2 from the sources which are not included in the IPCC Guideline.

2.6 State of Development of a National System Based on Article 5.1 of the Kyoto Protocol

2.6.1 The Government Institution Responsible for Japan's Greenhouse Gas Emissions and Removals Inventory

The government institution responsible for creating Japan's greenhouse gas emissions and removals inventory and its contact information are as follows.
　○Name of state institution: Ministry of the Environment
　○Contact: (Department) Climate Change Policy Division, Global Environment Bureau
　　　　　　(Address) 1-2-2 Kasumigaseki, Chiyoda-ku, Tokyo-to
　　　　　　(Telephone, FAX) +81-3-5521-8339, +81-3-3580-1382
　　　　　　(E-mail) chikyu-ondanka@env.go.jp
　○Responsible person: Head of the Climate Change Policy Division, Global Environment Bureau, Ministry of the Environment

2.6.2 A Description of Japan's Institutional Arrangement for the Inventory Preparation

The Ministry of the Environment (MOE), with the cooperation of relevant ministries, agencies and organizations, prepares Japan's national inventory, which is annually submitted to the UNFCCC Secretariat in accordance with the UNFCCC and the Kyoto Protocol. The MOE takes overall

responsibilities for the national inventory and therefore also makes an effort on improving its quality. For instance, the MOE organizes the Committee for the Greenhouse Gas Emission Estimation Methods (the Committee) in order to integrate the latest scientific knowledge into the inventory and to modify it based on more recent international provisions. The estimation of GHG emissions and removals, the key category analysis and the uncertainty assessment 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 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) by compiling various statistics. The relevant ministries check and verify these inventories (i.e., CRF, NIR, KP-CRF and KP-NIR) including the spreadsheets that are actually utilized for the estimation, as a part of the Quality Control (QC) activities. The checked and verified inventory data are Japan's official values. They are then made public by the MOE and the national inventory is submitted to the UNFCCC Secretariat by the Ministry of Foreign Affairs.

Figure 2.20 shows the overall institutional arrangement for inventory preparation within Japan. More detailed information on the role and responsibility of each relevant ministry, agency and organization in the inventory preparation process is described below.

2.6.2.1 Ministry of the Environment, Climate Change Policy Division, Global Environment Bureau (See section 2.6.1)

➢ The single national agency responsible for preparing Japan's inventory, which was designated pursuant to the Kyoto Protocol Article 5.1.
➢ It is responsible for editing and submitting the inventory.

2.6.2.2 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.

2.6.2.3 Relevant Ministries/Agencies

The relevant ministries and agencies have the following roles and responsibilities regarding inventory compilation.
➢ Preparation of activity data, emission factor data, and other data needed for inventory compilation, and submission of the data by the submission deadline.
➢ Quality control (QC) of the data provided to the Ministry of the Environment and the GIO.
➢ Confirmation and verification of the inventory (CRF, NIR, spreadsheets, and other information) prepared by the Ministry of the Environment and 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.

2.6.2.4 Relevant Organizations

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

➤ Preparation of activity data, emission factor data, and other data needed for inventory compilation, and submission of the data by the submission deadline.

➤ Quality control (QC) of the data provided to the Ministry of the Environment and the GIO.

➤ 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.

2.6.2.5 Committee for the Greenhouse Gas Emissions Estimation Methods

The Committee for the Greenhouse Gas Emissions Estimation Methods (the 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 are inventory working groups (WGs) that examine crosscutting issues, and breakout groups that consider sector-specific problems (Breakout group on Energy and Industrial Processes, Breakout group on Transport, Breakout group on F-gas [HFCs, PFCs, and SF_6], Breakout group on Agriculture, Breakout group on Waste, and Breakout group on LULUCF). Inventory WGs and breakout groups are comprised of experts in various fields, and consider suggestions for inventory improvements. Improvement suggestions are considered once more by the Committee before approval.
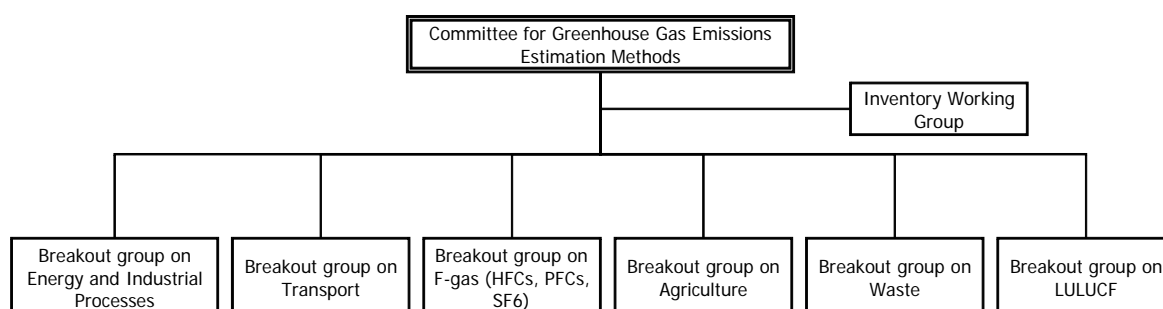
Figure 2.19 Structure of the Committee for the Greenhouse Gas Emissions Estimation Methods

2.6.2.6 GHG Inventory Quality Assurance Working Group (Expert Peer Review) (QA-WG)

The GHG Inventory Quality Assurance Working Group (the QA-WG) is an organization for QA activities, and is comprised of 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.

2.6.2.7 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, spreadsheets, and other information) 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.
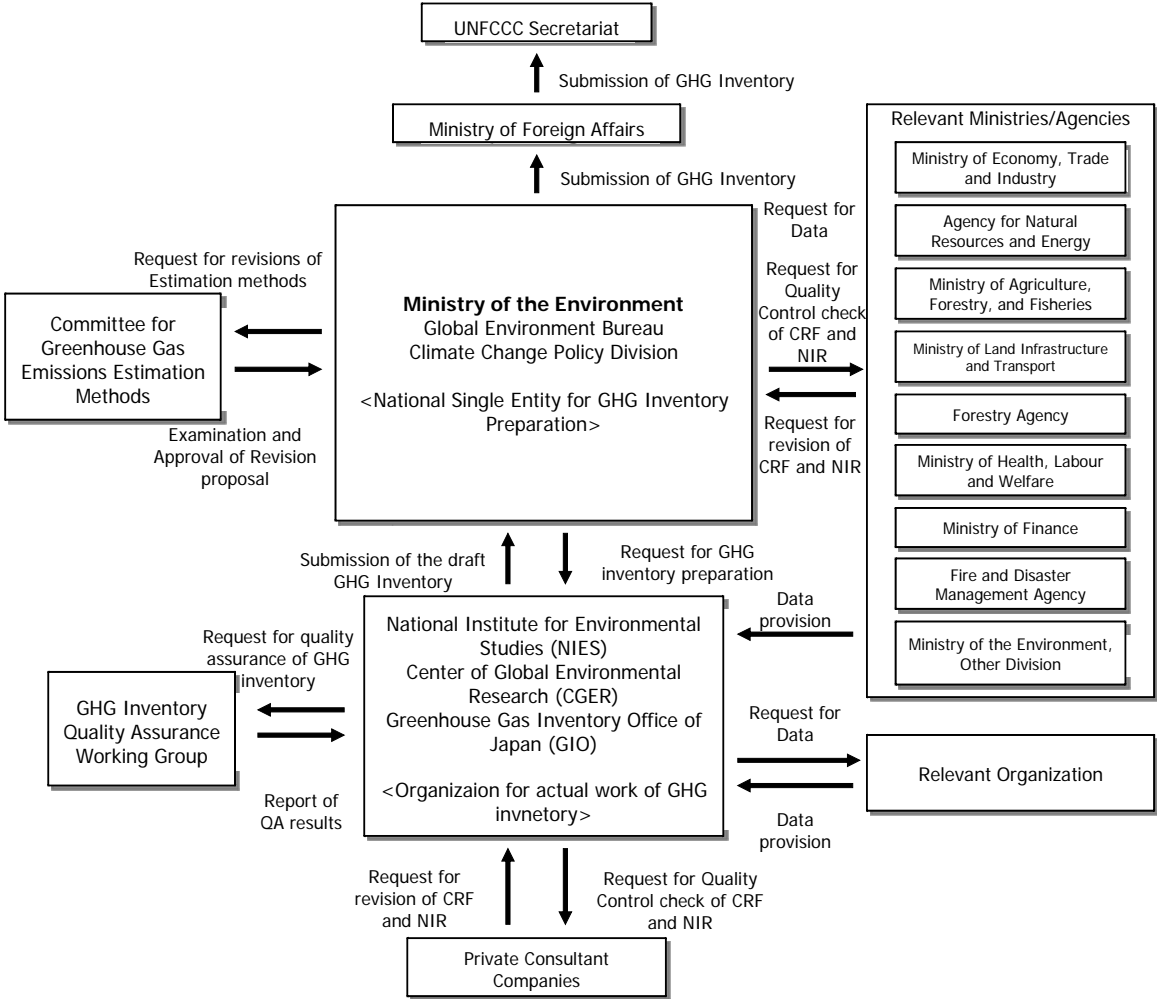
Figure 2.20 Japan's institutional arrangement for the national inventory preparation

2.6.3 Brief Description of the Inventory Preparation Process

2.6.3.1 Annual Cycle of Inventory Preparation

Table 2.19 shows the annual cycle of the inventory preparation. In Japan, in advance of the estimation of the national inventory submitted to the UNFCCC (submission deadline: April 15), preliminary figures are estimated and published as a document as an official announcement. In preliminary figures, only GHG emissions excluding removals are estimated.

Table 2.19 Annual cycle of the inventory preparation

*Inventory preparation in fiscal yaer "n"

	Process	Relevant Entities	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
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											★ Note	
9	Holding the meeting of the QA-WG	MOE, GIO	→	→	→	→								→

Calender Year n+1 (Jun–Dec), CY n+2 (Jan–May); Fiscal Year n+1 (Jun–Mar), FY n+2 (Apr–May)

Note: Inventory submission and official announcement must be implemented within 6 weeks after April 15.
MOE: Ministry of the Environment,
GIO: Greenhouse Gas Inventory Office of Japan
The Committee: The Committee for the Greenhouse Gas Emission Estimation Methods
The QA-WG: The Inventory Quality Assurance Working Group

2.6.3.2 Process of Inventory Preparation

2.6.3.2.a Discussion on 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 by the UNFCCC, the recommendations of the Inventory Quality Assurance Working Group (the QA-WG), 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.

2.6.3.2.b 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 the annual inventory and issues requiring technical reviews are discussed by experts from different scientific backgrounds (refer to Section 2.6.2.5).

2.6.3.2.c Collection of Data for the National Inventory (the final figures) (Step 3)

The required data, especially that which was not available prior to Step 3, is collected for the estimation of the final figures. A complete check of the data used for the preliminary figures, which may be updated afterwards, is also carried out.

2.6.3.2.d 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

files containing spreadsheets (JNGI: Japan National GHG Inventory files), which have inter-connecting links based on the calculation formulas for said emissions and removals. Subsequently, the key category analysis and uncertainty assessment are also carried out.

2.6.3.2.e Preparation of a Draft of NIR (Step 5)

The drafts of NIR and KP-NIR are prepared by following the general guidelines made by the MOE and the GIO. These entities identify the points which need to be revised or which require additional descriptions by taking any discussion from Step 1 into account. The GIO and selected private consulting companies prepare new NIR and KP-NIR by updating data, and by adding and revising descriptions in the previous NIR and KP-NIR.

2.6.3.2.f Implementation of the Exterior 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" draft) prepared by the GIO (exterior QC). These companies not only check the input data and the calculation formulas in the files, but also verify the estimations by re-calculating the total amounts of GHG emissions determined, utilizing the same files. Because of this cross-check, any possible data input and emission estimation mistakes are avoided. The consulting companies also check the content and descriptions of the initial draft of NIR (the "0" draft) prepared by the GIO.

Subsequently, the GIO sends out the primary drafts of the inventories as well as any official announcements as electronic computer files to the MOE and the relevant ministries and agencies, and possible revisions are carried out by them. These primary drafts include not only the drafts, to which the exterior QC was applied, but also the drafts of KP-CRF and KP-NIR that are prepared by the selected private consulting companies. The data, which is estimated based on confidential data, is only sent out for confirmation to the ministry and/or the agency which provided them.

2.6.3.2.g Correction of the Drafts of CRF and NIR (Step 7)

When revisions are requested at Step 6, the possible corrections are discussed among the MOE, the GIO and the relevant ministries and/or agencies. The corrected drafts then become the secondary drafts. These secondary drafts are sent out again to the relevant ministries and/or the agencies for conclusive confirmation. If there is no additional request for revision, they are considered to be the final versions.

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

The completed inventory is submitted by the MOE via the Ministry of Foreign Affairs to the UNFCCC Secretariat. Information on the estimated GHG emissions and removals is officially made public and is published on the MOE's homepage (http://www.env.go.jp/), complete with any additional relevant information. The inventory is also published on the GIO's homepage (http://www-gio.nies.go.jp/index-j.html).

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

The QA-WG, which is composed of experts who are not directly involved in or related to the inventory preparation process, is organized in order to guarantee the inventory's quality and to find out possible improvements. This QA-WG verifies the validation of the following information:

estimation methodologies, activity data, emission factors, and the contents of CRF and NIR.

GIO integrates the items suggested for improvement by the QA-WG into the inventory improvement program, and utilizes them in discussions on the inventory estimation methods and in subsequent inventory preparation.

2.6.4 Brief General Description of Methodologies

The methodology used in estimation of GHG emissions or removals is accordance with the *Revised 1996 IPCC Guidelines, Good Practice Guidance (2000)* and the *LULUCF-GPG*. The country-specific methodologies are also used for some categories (e.g., "4.C. Methane Emissions from Rice Cultivation") in order to reflect the actual situation of emissions in Japan.

Results of the actual measurements or estimates based on research conducted in Japan are used to determine the country-specific emissions factors. The default values given in the *Revised 1996 IPCC Guidelines*, the *Good Practice Guidance (2000)* and the *LULUCF-GPG* are used for: emissions which are assumed to be quite low (e.g., "1.B.2.a.ii Fugitive Emissions from Fuel (Oil and Natural Gas"), and where the possibility of emission from a given source is uncertain (e.g., "4.D.3. Indirect Emissions from Soil in Agricultural Land").

2.6.4.1 Collection Process of Activity Data

When the activity data needed for calculations are available from sources such as publications and the internet, the necessary data is gathered from these media. Data that is not released in publications, the internet, or in other media, and unpublished data used when compiling the inventory is obtained by the Ministry of the Environment or the GIO which request the data from the relevant ministries, agencies or organizations which control this data. The main relevant ministries, agencies and organizations that provide data are as shown in Table 2.20.

**Table 2.20 List of the main relevant ministries and agencies
and the relevant organizations (data providers)**

Ministries/Agencies/Organizations		Major data or statistics
Relevant Ministries/ Agencies	Ministry of the Environment	Research of Air Pollutant Emissions from Stationary Sources / volume of waste in landfill / volume of incinerated waste / number of people per *johkasou* facility / volume of human waste treated at human waste treatment facilities
	Ministry of Economy, Trade and Industry	General Energy Statistics / Yearbook of Production, Supply and Demand of Petroleum, Coal and Coke / Yearbook of Iron and Steel, Non-ferrous Metals, and Fabricated Metals Statistics / Yearbook of Chemical Industry Statistics / Yearbook of Ceramics and Building Materials Statistics / Census of Manufactures / General outlook on electric power supply and demand
	Ministry of Land, Infrastructure, Transport and Tourism	Annual of Land Transport Statistics / Survey on Transport Energy / Statistical Yearbook of Motor Vehicle Transport / Survey on Current State of Land Use, Survey on Current State of Urban Park Development / Sewage Statistics
	Ministry of Agriculture, Forestry and Fisheries	Crop Statistics / Livestock Statistics / Vegetable Production and Shipment Statistics / World Census of Agriculture and Forestry / Statistics of Arable and Planted Land Area / Handbook of Forest and Forestry Statistics / Table of Food Supply and Demand
	Ministry of Health, Welfare and Labor	Statistics of Production by Pharmaceutical Industry
Relevant Organizations	Federation of Electric Power Companies	Amount of Fuel Used by Pressurized Fluidized Bed Boilers
	Japan Coal Energy Center	Coal Production
	Japan Cement Association	Amount of clinker production / Amount of waste input to in raw material processing / Amount of RPF incineration
	Japan Iron and Steel Federation	Emissions from Coke Oven Covers, Desulfurization Towers, and Desulfurization Recycling Towers
	Japan Paper Association	Amount of final disposal of industrial waste / Amount of RPF incineration
	local public entity	Carbon Content of Waste by Composition

2.6.4.2 Selection Process of Emission Factors and Estimation Methods

Calculation methods for Japan's emission and removal amounts are determined by the Committee, which explores calculation methods suited to Japan's situation for all the activity categories necessary to calculate the proper results, based on the *1996 Revised IPCC Guidelines, Good Practice Guidance* (2000), LULUCF-GPG, and the 2006 IPCC Guidelines.

2.6.5 Recalculation of Previously Submitted GHG Inventory Data

In accordance with the *Good Practice and Uncertainty Management in National Greenhouse Gas Inventories (2000)* (hereafter, *Good Practice Guidance (2000)*) and the *IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry*, recalculations of previously reported emissions and removals are recommended in the cases of (1) application of new estimation methods, (2) addition of new categories for emissions and removals and (3) data refinement. Major changes in the inventory submitted last year are indicated below. See National Inventory Report Chapter 10 for the details.

2.6.5.1 General Issues

In general, activity data for the latest year available at the time of inventory compilation is often revised in the year following the submission year, because of the publication of data on a fiscal year basis. In the national inventory submitted this year, activity data in many sources for 2006 has been changed and as a result, the emissions from those sources for the inventory year have been recalculated.

2.6.5.2 Recalculations in Each Sector

The information of recalculation for sectors (energy; industrial processes; solvent and other product use; agriculture; land use, land-use change and forestry; and waste) is described separately at sections named as "Source/Sink-specific Recalculations" in Chapters 3 to 8.

2.6.5.3 Implications for Emission Levels

Compared to the values reported in the previous year's inventory, total emissions excluding LULUCF sector in the base year (1990) under the UNFCCC decreased by 0.20%, and the total emissions in year 2006 increased by 0.15% compared to the data reported in last year (Table **2.21**).

Table 2.21 Comparison of emissions and removals in the inventories submitted in 2008 and 2009

[Mt CO₂eq.]

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
CO₂	JNGI2008	1,052.2	1,062.7	1,071.9	1,064.3	1,124.5	1,134.6	1,147.8	1,143.6	1,107.7	1,143.2	1,164.1	1,148.3	1,176.0	1,183.7	1,182.2	1,194.7	1,182.1
with LULUCF[3)]	JNGI2009	1,068.8	1,078.4	1,087.0	1,078.6	1,137.8	1,147.0	1,159.0	1,154.7	1,118.8	1,153.6	1,174.0	1,158.0	1,185.6	1,192.5	1,190.9	1,201.7	1,188.4
	difference	*1.59%*	*1.48%*	*1.41%*	*1.35%*	*1.18%*	*1.09%*	*0.98%*	*0.98%*	*1.00%*	*0.91%*	*0.85%*	*0.85%*	*0.81%*	*0.75%*	*0.74%*	*0.59%*	*0.54%*
CO₂	JNGI2008	1,144.2	1,153.6	1,161.8	1,154.6	1,214.5	1,228.1	1,241.1	1,236.8	1,200.5	1,235.8	1,256.7	1,240.7	1,278.6	1,286.2	1,284.4	1,290.6	1,273.6
without LULUCF	JNGI2009	1,143.2	1,152.6	1,160.8	1,153.6	1,213.5	1,226.6	1,238.9	1,234.9	1,198.9	1,233.9	1,254.6	1,238.8	1,276.7	1,283.9	1,282.5	1,287.3	1,270.2
	difference	*-0.09%*	*-0.09%*	*-0.09%*	*-0.09%*	*-0.08%*	*-0.12%*	*-0.18%*	*-0.15%*	*-0.13%*	*-0.16%*	*-0.17%*	*-0.15%*	*-0.15%*	*-0.18%*	*-0.15%*	*-0.25%*	*-0.27%*
CH₄	JNGI2008	33.5	33.2	33.0	32.7	32.0	31.0	30.3	29.2	28.4	27.7	27.0	26.2	25.3	24.8	24.4	24.0	23.7
with LULUCF	JNGI2009	32.6	32.4	32.1	31.9	31.2	30.2	29.6	28.5	27.7	27.0	26.4	25.6	24.7	24.2	23.8	23.4	23.0
	difference	*-2.55%*	*-2.59%*	*-2.68%*	*-2.62%*	*-2.60%*	*-2.60%*	*-2.56%*	*-2.55%*	*-2.54%*	*-2.49%*	*-2.42%*	*-2.40%*	*-2.35%*	*-2.32%*	*-2.33%*	*-2.23%*	*-2.64%*
CH₄	JNGI2008	33.4	33.1	32.9	32.6	31.9	31.0	30.3	29.2	28.4	27.7	27.0	26.2	25.3	24.8	24.4	24.0	23.7
without LULUCF	JNGI2009	32.6	32.4	32.1	31.8	31.1	30.2	29.5	28.5	27.6	27.0	26.4	25.6	24.7	24.2	23.8	23.4	23.0
	difference	*-2.29%*	*-2.32%*	*-2.38%*	*-2.40%*	*-2.41%*	*-2.40%*	*-2.66%*	*-2.67%*	*-2.58%*	*-2.51%*	*-2.45%*	*-2.44%*	*-2.43%*	*-2.33%*	*-2.38%*	*-2.27%*	*-2.65%*
N₂O	JNGI2008	32.7	32.2	32.3	32.0	33.2	33.5	34.6	35.2	33.8	27.4	29.9	26.5	26.1	25.9	26.0	25.6	25.6
with LULUCF	JNGI2009	32.1	31.5	31.6	31.3	32.5	32.9	33.9	34.6	33.1	26.8	29.3	25.8	25.5	25.2	25.3	24.9	24.7
	difference	*-2.06%*	*-2.13%*	*-2.25%*	*-2.18%*	*-2.03%*	*-1.85%*	*-1.84%*	*-1.79%*	*-1.85%*	*-2.29%*	*-2.10%*	*-2.42%*	*-2.55%*	*-2.65%*	*-2.60%*	*-2.85%*	*-3.23%*
N₂O	JNGI2008	32.6	32.1	32.2	32.0	33.1	33.4	34.6	35.2	33.8	27.4	29.9	26.5	26.1	25.9	26.0	25.6	25.6
without LULUCF	JNGI2009	32.0	31.5	31.5	31.3	32.5	32.8	33.9	34.6	33.1	26.7	29.3	25.8	25.5	25.2	25.3	24.8	24.7
	difference	*-1.96%*	*-2.03%*	*-2.16%*	*-2.10%*	*-1.97%*	*-1.79%*	*-1.95%*	*-1.87%*	*-1.93%*	*-2.38%*	*-2.17%*	*-2.49%*	*-2.62%*	*-2.71%*	*-2.65%*	*-2.89%*	*-3.27%*
HFCs	JNGI2008	NE	NE	NE	NE	NE	20.2	19.8	19.8	19.3	19.8	18.6	15.8	13.1	12.5	8.3	7.3	6.6
	JNGI2009	NE	NE	NE	NE	NE	20.3	19.9	19.9	19.4	19.9	18.8	16.2	13.7	13.8	10.6	10.6	11.6
	difference	*NA*	*NA*	*NA*	*NA*	*NA*	*0.24%*	*0.31%*	*0.49%*	*0.63%*	*0.75%*	*1.15%*	*2.09%*	*4.14%*	*9.92%*	*26.36%*	*46.02%*	*75.63%*
PFCs	JNGI2008	NE	NE	NE	NE	NE	14.3	14.9	16.1	13.2	10.5	9.3	7.8	7.1	6.8	7.0	6.5	6.3
	JNGI2009	NE	NE	NE	NE	NE	14.4	14.9	16.3	13.5	10.6	9.7	8.1	7.5	7.3	7.5	7.1	7.4
	difference	*NA*	*NA*	*NA*	*NA*	*NA*	*0.43%*	*-0.07%*	*1.02%*	*2.19%*	*1.21%*	*4.25%*	*3.46%*	*6.26%*	*6.44%*	*7.12%*	*8.77%*	*16.79%*
SF₆	JNGI2008	NE	NE	NE	NE	NE	16.9	17.5	14.8	13.4	9.1	6.9	5.7	5.4	4.8	4.6	4.2	4.3
	JNGI2009	NE	NE	NE	NE	NE	17.0	17.5	15.0	13.6	9.3	7.3	6.0	5.7	5.4	5.3	4.6	5.1
	difference	*NA*	*NA*	*NA*	*NA*	*NA*	*0.19%*	*0.23%*	*1.46%*	*1.59%*	*2.19%*	*5.77%*	*5.63%*	*6.33%*	*12.17%*	*15.99%*	*8.37%*	*18.36%*
Total	JNGI2008	1,118.4	1,128.2	1,137.2	1,129.0	1,189.6	1,250.6	1,265.0	1,258.8	1,215.8	1,237.7	1,255.7	1,230.3	1,253.0	1,258.5	1,252.5	1,262.2	1,248.6
with LULUCF	JNGI2009	1,133.5	1,142.3	1,150.7	1,141.8	1,201.4	1,261.7	1,274.9	1,269.0	1,226.2	1,247.2	1,265.4	1,239.7	1,262.7	1,268.4	1,263.4	1,272.3	1,260.4
	difference	*1.36%*	*1.25%*	*1.19%*	*1.13%*	*0.99%*	*0.89%*	*0.78%*	*0.82%*	*0.85%*	*0.77%*	*0.77%*	*0.76%*	*0.77%*	*0.79%*	*0.87%*	*0.80%*	*0.95%*
Total	JNGI2008	1,210.2	1,218.9	1,227.0	1,219.1	1,279.5	1,343.9	1,358.3	1,352.0	1,308.6	1,330.3	1,348.4	1,322.8	1,355.6	1,361.0	1,354.8	1,358.1	1,340.1
without LULUCF	JNGI2009	1,207.8	1,216.5	1,224.5	1,216.7	1,277.1	1,341.2	1,354.7	1,349.1	1,306.2	1,327.5	1,346.0	1,320.5	1,353.7	1,359.7	1,355.0	1,357.8	1,342.1
	difference	*-0.20%*	*-0.20%*	*-0.20%*	*-0.20%*	*-0.19%*	*-0.20%*	*-0.27%*	*-0.21%*	*-0.18%*	*-0.21%*	*-0.18%*	*-0.17%*	*-0.14%*	*-0.10%*	*0.02%*	*-0.02%*	*0.15%*

2.6.5.4   Implication for Emission Trends, including Time Series Consistency

Total emissions excluding the LULUCF sector in the 2009 submission increased by approximately 4.2 million tonnes (in CO_2 equivalents) and increased by 0.4 points, compared to the data reported in the previous submission.

Table 2.22 Comparison of increase and decrease from the base year, between the inventories submitted in 2008 and 2009 excluding the LULUCF sector

		Trend [Mt CO_2eq.]			Trend (%)		
		JNGI2008	JNGI2009	Difference	JNGI2008	JNGI2009	Difference
CO_2	1)	129.4	127.0	-2.4	11.3%	11.1%	-0.2%
CH_4	1)	-9.7	-9.6	0.1	-29.1%	-29.4%	-0.3%
N_2O	1)	-7.1	-7.3	-0.2	-21.6%	-22.7%	-1.0%
HFCs	2)	-13.6	-8.6	5.0	-67.3%	-42.6%	24.6%
PFCs	2)	-8.0	-7.0	1.0	-55.8%	-48.6%	7.2%
SF_6	2)	-12.6	-11.8	0.8	-74.3%	-69.7%	4.7%
Total	3)	78.5	82.7	4.2	6.2%	6.6%	0.4%

1) Comparison of emissions between FY1990 and FY2006

2) Comparison of emissions between CY1995 and CY2006

3) Comparison of emissions between the base year of the Kyoto Protocol (CO_2, CH_4, N_2O: FY1990, HFCs, PFCs, SF_6: CY1995) and 2006

2.6.6   Key Category Analysis

2.6.6.1   Brief Description of Key Categories

Key category analysis is carried out in accordance with *Good Practice Guidance (2000)* and the *LULUCF-GPG* (Tier 1, Tier 2 level assessment and trend assessment, and qualitative analysis). This analysis identified 37 sources and sinks as Japan's key categories in FY2007 (Table 2.23). The same analysis was also conducted for the base year of the UNFCCC (FY1990) in response to the reviewers' recommendation. A total of 33 sources and sinks were identified as key categories in the base year (Table2.24). More detailed information is described in National Inventory Report Annex 1.

Table 2.23 Japan's key source categories in FY2007

	A IPCC Category	B Direct GHGs	L1	T1	L2	T2
#1	1A Stationary Combustion	Solid Fuels	CO_2	#1	#2	#3	#7
#2	1A Stationary Combustion	Liquid Fuels	CO_2	#2	#1	#8	#8
#3	1A3 Mobile Combustion	b. Road Transportation	CO_2	#3	#5	#4	
#4	1A Stationary Combustion	Gaseous Fuels	CO_2	#4	#3		
#5	5A Forest Land	1. Forest Land remaining Forest Land	CO_2	#5		#6	
#6	2A Mineral Product	1. Cement Production	CO_2	#6	#6	#7	#11
#7	1A Stationary Combustion	Other Fuels	CO_2	#7	#11	#14	#14
#8	6C Waste Incineration		CO_2	#8		#2	#21
#9	1A3 Mobile Combustion	d. Navigation	CO_2	#9			
#10	2A Mineral Product	3. Limestone and Dolomite Use	CO_2	#10		#13	
#11	2F(a) Consumption of Halocarbons and SF_6 (actual emissions - Tier 2)	1. Refrigeration and Air Conditioning	HFCs	#11	#8	#5	#2
#12	1A3 Mobile Combustion	a. Civil Aviation	CO_2	#12	#15		
#13	2A Mineral Product	2. Lime Production	CO_2	#13		#22	
#14	4A Enteric Fermentation		CH_4			#25	
#15	4C Rice Cultivation		CH_4			#19	#22
#16	4B Manure Management		N_2O			#12	#20
#17	1A Stationary Combustion		N_2O			#18	#17
#18	6A Solid Waste Disposal on Land		CH_4		#13	#20	#9
#19	2F(a) Consumption of Halocarbons and SF6 (actual emissions - Tier 2)	7. Semiconductor Manufacture	PFCs			#10	
#20	4D Agricultural Soils	1. Direct Soil Emissions	N_2O			#9	#12
#21	4D Agricultural Soils	3. Indirect Emissions	N_2O			#15	#18
#22	1A3 Mobile Combustion	b. Road Transportation	N_2O			#16	#10
#23	4B Manure Management		CH_4			#17	#19
#24	6C Waste Incineration		N_2O			#11	#16
#25	2F(a) Consumption of Halocarbons and SF_6 (actual emissions - Tier 2)	5. Solvents	PFCs		#9		#4
#26	5E Settlements	2. Land converted to Settlements	CO_2		#18		#25
#27	5A Forest Land	2. Land converted to Forest Land	CO_2		#12		
#28	2E Production of Halocarbons and	2. Fugitive Emissions	SF_6		#14	#21	#3
#29	6B Wastewater Handling		N_2O			#23	
#30	2F(a) Consumption of Halocarbons and SF6 (actual emissions - Tier 2)	8. Electrical Equipment	SF_6		#7		#1
#31	2E Production of Halocarbons and	2. Fugitive Emissions	PFCs			#26	
#32	2B Chemical Industry	3. Adipic Acid	N_2O		#10		#15
#33	5B Cropland	2. Land converted to Cropland	CO_2				#24
#34	2E Production of Halocarbons and SF_6	1. By-product Emissions (Production of HCFC-22)	HFCs		#4		#13
#35	1A3 Mobile Combustion	a. Civil Aviation	N_2O			#1	#5
#36	1A3 Mobile Combustion	d. Navigation	N_2O			#24	
#37	1B Fugitive Emission	1a i. Coal Mining and Handling (under gr.)	CH_4		#16		#6

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

Table 2.24 Japan's key source categories in FY1990

	A IPCC Category		B Direct GHGs	L1	L2
#1	1A Stationary Combustion	Liquid Fuels	CO_2	#1	#8
#2	1A Stationary Combustion	Solid Fuels	CO_2	#2	#4
#3	1A3 Mobile Combustion	b. Road Transportation	CO_2	#3	#6
#4	1A Stationary Combustion	Gaseous Fuels	CO_2	#4	
#5	5A Forest Land	1. Forest Land remaining Forest Land	CO_2	#5	#7
#6	2A Mineral Product	1. Cement Production	CO_2	#6	#10
#7	2E Production of Halocarbons and SF_6	1. By-product Emissions (Production of HCFC-22)	HFCs	#7	#26
#8	1A3 Mobile Combustion	d. Navigation	CO_2	#8	
#9	6C Waste Incineration		CO_2	#9	#2
#10	2A Mineral Product	3. Limestone and Dolomite Use	CO_2	#10	#19
#11	2F(a) Consumption of Halocarbons and SF_6 (actual emissions - Tier 2)	8. Electrical Equipment	SF_6	#11	#5
#12	2F(a) Consumption of Halocarbons and SF_6 (actual emissions - Tier 2)	5. Solvents	PFCs	#12	#9
#13	1A Stationary Combustion	Other Fuels	CO_2	#13	#25
#14	6A Solid Waste Disposal on Land		CH_4	#14	#15
#15	4A Enteric Fermentation		CH_4	#15	#28
#16	2B Chemical Industry	3. Adipic Acid	N_2O	#16	
#17	2A Mineral Product	2. Lime Production	CO_2	#17	#23
#18	1A3 Mobile Combustion	a. Civil Aviation	CO_2	#18	
#19	4C Rice Cultivation		CH_4		#20
#20	4B Manure Management		N_2O		#14
#21	2E Production of Halocarbons and SF_6	2. Fugitive Emissions	SF_6		#3
#22	4D Agricultural Soils	1. Direct Soil Emissions	N_2O		#11
#23	1A3 Mobile Combustion	b. Road Transportation	N_2O		#13
#24	4D Agricultural Soils	3. Indirect Emissions	N_2O		#16
#25	2F(a) Consumption of Halocarbons and SF_6 (actual emissions - Tier 2)	7. Semiconductor Manufacture	PFCs		#17
#26	4B Manure Management		CH_4		#18
#27	1B Fugitive Emission	1a i. Coal Mining and Handling (under gr.)	CH_4		#12
#28	6B Wastewater Handling		CH_4		#27
#29	6C Waste Incineration		N_2O		#21
#30	6B Wastewater Handling		N_2O		#22
#31	2B Chemical Industry	Other products except Anmonia	CO_2		#29
#32	1A3 Mobile Combustion	d. Navigation	N_2O		#24
#33	1A3 Mobile Combustion	a. Civil Aviation	N_2O		#1

N.B. Figures recorded in the column L (Level) indicate the ranking of level assessments. The data of HFCs, PFCs and SF_6 utilized for this analysis are the 1995 values.

2.6.6.2 Results of Key Category Analysis

2.6.6.2.a Key Categories

Key categories were assessed in accordance with *Good Practice Guidance (2000)* assessment methods (Tier 1 level assessment, Tier 1 trend assessment, Tier 2 level assessment and Tier 2 trend assessment).

The key category for the Land use, land-use change and forestry (LULUCF) sector were assessed in accordance with *LULUCF-GPG*. The key categories were identified for the inventory excluding LULUCF first, and then the key category analysis was repeated for the full inventory including the LULUCF categories.

As a result, 37 and 33 sources and sinks were detected as the key source categories for FY2007 and FY1990, respectively (Table 2.25 and Table 2.26).

Table 2.25 Japan's Key Categories (FY2007)

	A IPCC Category		B Direct GHGs	L1	T1	L2	T2
#1	1A Stationary Combustion	Solid Fuels	CO_2	#1	#2	#3	#7
#2	1A Stationary Combustion	Liquid Fuels	CO_2	#2	#1	#8	#8
#3	1A3 Mobile Combustion	b. Road Transportation	CO_2	#3	#5	#4	
#4	1A Stationary Combustion	Gaseous Fuels	CO_2	#4	#3		
#5	5A Forest Land	1. Forest Land remaining Forest Land	CO_2	#5		#6	
#6	2A Mineral Product	1. Cement Production	CO_2	#6	#6	#7	#11
#7	1A Stationary Combustion	Other Fuels	CO_2	#7	#11	#14	#14
#8	6C Waste Incineration		CO_2	#8		#2	#21
#9	1A3 Mobile Combustion	d. Navigation	CO_2	#9			
#10	2A Mineral Product	3. Limestone and Dolomite Use	CO_2	#10		#13	
#11	2F(a) Consumption of Halocarbons and SF_6 (actual emissions - Tier 2)	1. Refrigeration and Air Conditioning	HFCs	#11	#8	#5	#2
#12	1A3 Mobile Combustion	a. Civil Aviation	CO_2	#12	#15		
#13	2A Mineral Product	2. Lime Production	CO_2	#13		#22	
#14	4A Enteric Fermentation		CH_4			#25	
#15	4C Rice Cultivation		CH_4			#19	#22
#16	4B Manure Management		N_2O			#12	#20
#17	1A Stationary Combustion		N_2O			#18	#17
#18	6A Solid Waste Disposal on Land		CH_4		#13	#20	#9
#19	2F(a) Consumption of Halocarbons and SF6 (actual emissions - Tier 2)	7. Semiconductor Manufacture	PFCs			#10	
#20	4D Agricultural Soils	1. Direct Soil Emissions	N_2O			#9	#12
#21	4D Agricultural Soils	3. Indirect Emissions	N_2O			#15	#18
#22	1A3 Mobile Combustion	b. Road Transportation	N_2O			#16	#10
#23	4B Manure Management		CH_4			#17	#19
#24	6C Waste Incineration		N_2O			#11	#16
#25	2F(a) Consumption of Halocarbons and SF_6 (actual emissions - Tier 2)	5. Solvents	PFCs		#9		#4
#26	5E Settlements	2. Land converted to Settlements	CO_2		#18		#25
#27	5A Forest Land	2. Land converted to Forest Land	CO_2		#12		
#28	2E Production of Halocarbons and	2. Fugitive Emissions	SF_6		#14	#21	#3
#29	6B Wastewater Handling		N_2O			#23	
#30	2F(a) Consumption of Halocarbons and SF6 (actual emissions - Tier 2)	8. Electrical Equipment	SF_6		#7		#1
#31	2E Production of Halocarbons and	2. Fugitive Emissions	PFCs			#26	
#32	2B Chemical Industry	3. Adipic Acid	N_2O		#10		#15
#33	5B Cropland	2. Land converted to Cropland	CO_2				#24
#34	2E Production of Halocarbons and SF_6	1. By-product Emissions (Production of HCFC-22)	HFCs		#4		#13
#35	1A3 Mobile Combustion	a. Civil Aviation	N_2O			#1	#5
#36	1A3 Mobile Combustion	d. Navigation	N_2O			#24	
#37	1B Fugitive Emission	1a i. Coal Mining and Handling (under gr.)	CH_4		#16		#6

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

Table 2.26 Japan's Key Categories (FY1990)

	A IPCC Category		B Direct GHGs	L1	L2
#1	1A Stationary Combustion	Liquid Fuels	CO_2	#1	#8
#2	1A Stationary Combustion	Solid Fuels	CO_2	#2	#4
#3	1A3 Mobile Combustion	b. Road Transportation	CO_2	#3	#6
#4	1A Stationary Combustion	Gaseous Fuels	CO_2	#4	
#5	5A Forest Land	1. Forest Land remaining Forest Land	CO_2	#5	#7
#6	2A Mineral Product	1. Cement Production	CO_2	#6	#10
#7	2E Production of Halocarbons and SF_6	1. By-product Emissions (Production of HCFC-22)	HFCs	#7	#26
#8	1A3 Mobile Combustion	d. Navigation	CO_2	#8	
#9	6C Waste Incineration		CO_2	#9	#2
#10	2A Mineral Product	3. Limestone and Dolomite Use	CO_2	#10	#19
#11	2F(a) Consumption of Halocarbons and SF_6 (actual emissions - Tier 2)	8. Electrical Equipment	SF_6	#11	#5
#12	2F(a) Consumption of Halocarbons and SF_6 (actual emissions - Tier 2)	5. Solvents	PFCs	#12	#9
#13	1A Stationary Combustion	Other Fuels	CO_2	#13	#25
#14	6A Solid Waste Disposal on Land		CH_4	#14	#15
#15	4A Enteric Fermentation		CH_4	#15	#28
#16	2B Chemical Industry	3. Adipic Acid	N_2O	#16	
#17	2A Mineral Product	2. Lime Production	CO_2	#17	#23
#18	1A3 Mobile Combustion	a. Civil Aviation	CO_2	#18	
#19	4C Rice Cultivation		CH_4		#20
#20	4B Manure Management		N_2O		#14
#21	2E Production of Halocarbons and SF_6	2. Fugitive Emissions	SF_6		#3
#22	4D Agricultural Soils	1. Direct Soil Emissions	N_2O		#11
#23	1A3 Mobile Combustion	b. Road Transportation	N_2O		#13
#24	4D Agricultural Soils	3. Indirect Emissions	N_2O		#16
#25	2F(a) Consumption of Halocarbons and SF_6 (actual emissions - Tier 2)	7. Semiconductor Manufacture	PFCs		#17
#26	4B Manure Management		CH_4		#18
#27	1B Fugitive Emission	1a i. Coal Mining and Handling (under gr.)	CH_4		#12
#28	6B Wastewater Handling		CH_4		#27
#29	6C Waste Incineration		N_2O		#21
#30	6B Wastewater Handling		N_2O		#22
#31	2B Chemical Industry	Other products except Anmonia	CO_2		#29
#32	1A3 Mobile Combustion	d. Navigation	N_2O		#24
#33	1A3 Mobile Combustion	a. Civil Aviation	N_2O		#1

N.B. Figures recorded in the Level and Trend columns indicate the ranking of individual level and trend assessments. The data of HFCs, PFCs and SF_6 utilized for this analysis are the 1995 values.

2.6.6.2.b Level Assessment

Level assessment involves an identification of categories as key by calculating the proportion of emissions and removals in each category to the total emissions and removals. The calculated values of proportion are added from the category that accounts for the largest proportion, until the sum reaches 95% for Tier 1 and 90% for Tier 2. Tier 1 level assessment uses emissions and removals from each category directly and Tier 2 level assessment analyzes the emissions and removals of each category, multiplied by the uncertainty of each category.

The key category analysis was first conducted for the inventory excluding LULUCF and the key categories for source sectors were identified (1). Then the key category analysis was repeated again

for the full inventory including the LULUCF categories and key categories for LULUCF sector were identified (2). In accordance with the *LULUCF-GPG* (p.5.30), a source category, which was identified as key in (1) but not in (2), was still regarded as key; while a source category, which was not identified as key in (1) but was done in (2), was not regarded as key (gray rows in tables below). Tier 1 level assessment of the latest emissions and removals (FY2007) gives the following 13 sub-categories as the key categories (Table 2.27). Tier 2 level assessment of the latest emissions and removals (FY2007) gives the following 26 sub-categories as the key categories (Table 2.28).

Table 2.27 Results of Tier 1 Level Assessment (FY2007)

	A		B	D	E	F	Cumulative
	IPCC Category		Direct GHGs	Current Year Estimate [Gg CO2 eq.]	Level Assessment	% Contribution to Level	
#1	1A Stationary Combustion	Solid Fuels	CO2	451,893.02	0.309	30.9%	30.9%
#2	1A Stationary Combustion	Liquid Fuels	CO2	322,477.35	0.221	22.1%	53.0%
#3	1A3 Mobile Combustion	b. Road Transportation	CO2	217,652.78	0.149	14.9%	67.9%
#4	1A Stationary Combustion	Gaseous Fuels	CO2	203,287.27	0.139	13.9%	81.8%
#5	5A Forest Land	1. Forest Land remaining Forest Land	CO2	81,595.45	0.056	5.6%	87.4%
#6	2A Mineral Product	1. Cement Production	CO2	30,076.22	0.021	2.1%	89.4%
#7	1A Stationary Combustion	Other Fuels	CO2	15,982.70	0.011	1.1%	90.5%
#8	6C Waste Incineration		CO2	14,226.64	0.010	1.0%	91.5%
#9	1A3 Mobile Combustion	d. Navigation	CO2	12,411.48	0.008	0.8%	92.4%
#10	2A Mineral Product	3. Limestone and Dolomite Use	CO2	12,003.50	0.008	0.8%	93.2%
#11	2F(a) Consumption of Halocarbons	1. Refrigeration and Air Conditioning Equipment	HFCs	11,375.49	0.008	0.8%	94.0%
#12	1A3 Mobile Combustion	a. Civil Aviation	CO2	10,875.77	0.007	0.7%	94.7%
#13	2A Mineral Product	2. Lime Production	CO2	7,799.26	0.005	0.5%	95.2%

Table 2.28 Results of Tier 2 Level Assessment (FY2007)

	Category Code	A		B	D	I	K	Cumulative
		IPCC Category		Direct GHGs	Current Year Estimate [Gg CO2 eq.]	Source/Sink Uncertinty	Contribution to Total L2	
#1	A-17	1A3 Mobile Combustion	a. Civil Aviation	N2O	109.11	10000%	0.13	13.0%
#2	F-04	6C Waste Incineration		CO2	14,226.64	50%	0.08	21.4%
#3	A-02	1A Stationary Combustion	Solid Fuels	CO2	451,893.02	1%	0.08	29.4%
#4	A-10	1A3 Mobile Combustion	b. Road Transportation	CO2	217,652.78	2%	0.06	35.3%
#5	B-20	2F(a) Consumption of Halocarbons	1. Refrigeration and Air Conditioning	HFCs	11,375.49	42%	0.06	41.0%
#6	E-01	5A Forest Land	1. Forest Land remaining Forest Land	CO2	81,595.45	6%	0.06	46.6%
#7	B-01	2A Mineral Product	1. Cement Production	CO2	30,076.22	10%	0.04	50.3%
#8	A-01	1A Stationary Combustion	Liquid Fuels	CO2	322,477.35	1%	0.04	54.0%
#9	D-05	4D Agricultural Soils	1. Direct Soil Emissions	N2O	3,348.49	90%	0.04	57.6%
#10	B-26	2F(a) Consumption of Halocarbons	7. Semiconductor Manufacture	PFCs	3,741.32	64%	0.03	60.5%
#11	F-06	6C Waste Incineration		N2O	2,296.09	103%	0.03	63.3%
#12	D-03	4B Manure Management		N2O	4,860.72	48%	0.03	66.1%
#13	B-03	2A Mineral Product	3. Limestone and Dolomite Use	CO2	12,003.50	17%	0.02	68.4%
#14	A-04	1A Stationary Combustion	Other Fuels	CO2	15,982.70	12%	0.02	70.8%
#15	D-07	4D Agricultural Soils	3. Indirect Emissions	N2O	2,976.80	64%	0.02	73.0%
#16	A-18	1A3 Mobile Combustion	b. Road Transportation	N2O	2,490.03	71%	0.02	75.1%
#17	D-02	4B Manure Management		CH4	2,394.07	64%	0.02	76.9%
#18	A-06	1A Stationary Combustion		N2O	4,564.73	33%	0.02	78.7%
#19	D-04	4C Rice Cultivation		CH4	5,654.25	23%	0.02	80.3%
#20	F-01	6A Solid Waste Disposal on Land		CH4	4,516.93	29%	0.02	81.8%
#21	B-19	2E Production of Halocarbons	2. Fugitive Emissions	SF6	1,270.43	100%	0.02	83.3%
#22	B-02	2A Mineral Product	2. Lime Production	CO2	7,799.26	16%	0.01	84.8%
#23	F-03	6B Wastewater Handling		N2O	1,159.00	93%	0.01	86.0%
#24	A-20	1A3 Mobile Combustion	d. Navigation	N2O	101.42	1000%	0.01	87.2%
#25	D-01	4A Enteric Fermentation		CH4	7,120.61	12%	0.01	88.2%
#26	B-18	2E Production of Halocarbons	2. Fugitive Emissions	PFCs	783.02	100%	0.01	89.2%
#27	B-24	2F(a) Consumption of Halocarbons	5. Solvents	PFCs	1,944.38	40%	0.01	90.1%

Tier 1 level assessment of the latest emissions and removals (FY1990) gives the following 18 sub-categories as the key categories (Table 2.29). Tier 2 level assessment of the latest emissions and removals (FY1990) gives the following 29 sub-categories as the key categories (Table 2.30).

Table 2.29 Results of Tier 1 Level Assessment (FY1990)

	A IPCC Category		B Direct GHGs	C Base Year Estimate [Gg CO2 eq.]	E kevek Assessment	F % Contribution to Level	Cumulative to Level
#1	1A Stationary Combustion	Liquid Fuels	CO2	435,168.99	0.323	32.3%	32.3%
#2	1A Stationary Combustion	Solid Fuels	CO2	308,620.23	0.229	22.9%	55.2%
#3	1A3 Mobile Combustion	b. Road Transportation	CO2	189,227.88	0.140	14.0%	69.2%
#4	1A Stationary Combustion	Gaseous Fuels	CO2	104,300.83	0.077	7.7%	76.9%
#5	5A Forest Land	1. Forest Land remaining Forest Land	CO2	75,127.14	0.056	5.6%	82.5%
#6	2A Mineral Product	1. Cement Production	CO2	37,966.28	0.028	2.8%	85.3%
#7	2E Production of Halocarbons and SF6	1. By-product Emissions (Production of HCFC-22)	HFCs	16,965.00	0.013	1.3%	86.6%
#8	1A3 Mobile Combustion	d. Navigation	CO2	13,730.95	0.010	1.0%	87.6%
#9	6C Waste Incineration		CO2	12,173.71	0.009	0.9%	88.5%
#10	2A Mineral Product	3. Limestone and Dolomite Use	CO2	11,527.41	0.009	0.9%	89.3%
#11	2F(a) Consumption of Halocarbons and SF6 (actual emissions - Tier 2)	8. Electrical Equipment	SF6	11,004.99	0.008	0.8%	90.2%
#12	2F(a) Consumption of Halocarbons and SF6 (actual emissions - Tier 2)	5. Solvents	PFCs	10,382.05	0.008	0.8%	90.9%
#13	1A Stationary Combustion	Other Fuels	CO2	8,875.30	0.007	0.7%	91.6%
#14	6A Solid Waste Disposal on Land		CH4	8,285.86	0.006	0.6%	92.2%
#15	4A Enteric Fermentation		CH4	7,674.46	0.006	0.6%	92.8%
#16	2B Chemical Industry	3. Adipic Acid	N2O	7,501.25	0.006	0.6%	93.3%
#17	2A Mineral Product	2. Lime Production	CO2	7,321.64	0.005	0.5%	93.9%
#18	1A3 Mobile Combustion	a. Civil Aviation	CO2	7,162.41	0.005	0.5%	94.4%
#19	4C Rice Cultivation		CH4	7,002.78	0.005	0.5%	94.9%
#20	4B Manure Management		N2O	5,661.40	0.004	0.4%	95.3%

Table 2.30 Results of Tier 2 Level Assessment (FY1990)

	A IPCC Category		B Direct GHGs	C Base Year Estimate [Gg CO2eq.]	I Source/Sink Uncertinty	K Contribution to Total L2	Cumulative
#1	1A3 Mobile Combustion	a. Civil Aviation	N2O	69.75	10000%	0.08	7.5%
#2	6C Waste Incineration		CO2	12,173.71	50%	0.07	14.0%
#3	2E Production of Halocarbons	2. Fugitive Emissions	SF6	4,708.30	100%	0.05	19.1%
#4	1A Stationary Combustion	Solid Fuels	CO2	308,620.23	1%	0.05	24.1%
#5	2F(a) Consumption of Halocarbons	8. Electrical Equipment	SF6	11,004.99	40%	0.05	28.9%
#6	1A3 Mobile Combustion	b. Road Transportation	CO2	189,227.88	2%	0.05	33.6%
#7	5A Forest Land	1. Forest Land remaining Forest Land	CO2	75,127.14	6%	0.05	38.2%
#8	1A Stationary Combustion	Liquid Fuels	CO2	435,168.99	1%	0.05	42.8%
#9	2F(a) Consumption of Halocarbons	5. Solvents	PFCs	10,382.05	40%	0.04	47.2%
#10	2A Mineral Product	1. Cement Production	CO2	37,966.28	10%	0.04	51.5%
#11	4D Agricultural Soils	1. Direct Soil Emissions	N2O	4,249.46	90%	0.04	55.6%
#12	1B Fugitive Emission	1a i. Coal Mining and Handling (under	CH4	2,785.23	107%	0.03	58.8%
#13	1A3 Mobile Combustion	b. Road Transportation	N2O	3,901.71	71%	0.03	61.8%
#14	4B Manure Management		N2O	5,661.40	48%	0.03	64.7%
#15	6A Solid Waste Disposal on Land		CH4	8,285.86	29%	0.03	67.3%
#16	4D Agricultural Soils	3. Indirect Emissions	N2O	3,669.26	64%	0.03	69.8%
#17	2F(a) Consumption of Halocarbons	7. Semiconductor Manufacture	PFCs	3,148.83	64%	0.02	72.0%
#18	4B Manure Management		CH4	3,104.72	64%	0.02	74.1%
#19	2A Mineral Product	3. Limestone and Dolomite Use	CO2	11,527.41	17%	0.02	76.2%
#20	4C Rice Cultivation		CH4	7,002.78	23%	0.02	77.9%
#21	6C Waste Incineration		N2O	1,517.74	103%	0.02	79.6%
#22	6B Wastewater Handling		N2O	1,289.65	93%	0.01	80.9%
#23	2A Mineral Product	2. Lime Production	CO2	7,321.64	16%	0.01	82.1%
#24	1A3 Mobile Combustion	d. Navigation	N2O	111.31	1000%	0.01	83.3%
#25	1A Stationary Combustion	Other Fuels	CO2	8,875.30	12%	0.01	84.5%
#26	2E Production of Halocarbons	1. By-product Emissions	HFCs	16,965.00	5%	0.01	85.5%
#27	6B Wastewater Handling		CH4	2,120.57	43%	0.01	86.5%
#28	4A Enteric Fermentation		CH4	7,674.46	12%	0.01	87.4%
#29	2B Chemical Industry	other products except Anmonia	CO2	1,129.29	77%	0.01	88.4%
#30	2B Chemical Industry	1. Ammonia Production	CO2	3,384.68	23%	0.01	89.2%
#31	1A Stationary Combustion		N2O	2,332.05	33%	0.01	90.1%
#32	2E Production of Halocarbons	2. Fugitive Emissions	PFCs	762.85	100%	0.01	90.9%

2.6.6.2.c Trend Assessment

The difference between the rate of change in emissions and removals in a category and the rate of change in total emissions and removals is calculated. The trend assessment is calculated by multiplying this value by the ratio of contribution of the relevant category to total emissions and removals. The calculated results, regarded as trend assessment values, are added from the category of which the proportion to the total of trend assessment values is the largest, until the total reaches 95% for Tier 1 and 90% for Tier 2. At this point, these categories are defined as the key categories. Tier 1 level assessment uses emissions and removals from each category directly and Tier 2 level

assessment analyzes the emissions and removals of each category, multiplied by the uncertainty of each category.

The key category analysis was first conducted for the inventory excluding LULUCF and the key categories for source sectors were identified (1). Then the key category analysis was repeated again for the full inventory including the LULUCF categories and key categories for LULUCF sector were identified (2). In accordance with the *LULUCF-GPG* (p.5.30), a source category, which was identified as key in (1) but not in (2), was still regarded as key; while a source category, which was not identified as key in (1) but was done in (2), was not regarded as key (gray rows in tables below).

Tier 1 trend assessment of the latest emissions and removals (FY2007) gives the following 17 sub-categories as the key categories (Table 2.31). Tier 2 trend assessment of the latest emissions and removals (FY2007) gives the following 24 sub-categories as the key categories (Table 2.32).

Table 2.31 Results of Tier 1 Trend Assessment (FY2007)

	A IPCC Category		B Direct GHGs	C Base Year Estimate [Gg CO2 eq.]	D Current Year Estimate [Gg CO2 eq.]	H % Contribution to Trend	Cumulative
#1	1A Stationary Combustion	Liquid Fuels	CO2	435169	322477	30.3%	30.3%
#2	1A Stationary Combustion	Solid Fuels	CO2	308620	451893	23.9%	54.2%
#3	1A Stationary Combustion	Gaseous Fuels	CO2	104301	203287	18.3%	72.5%
#4	2E Production of Halocarbons and SF6	1. By-product Emissions (Production of HCFC-22)	HFCs	16965	218	3.7%	76.2%
#5	1A3 Mobile Combustion	b. Road Transportation	CO2	189228	217653	2.6%	78.8%
#6	2A Mineral Product	1. Cement Production	CO2	37966	30076	2.2%	81.0%
#7	2F(a) Consumption of Halocarbons and SF6 (actual emissions - Tier 2)	8. Electrical Equipment	SF6	11005	922	2.2%	83.2%
#8	2F(a) Consumption of Halocarbons and SF6 (actual emissions - Tier 2)	1. Refrigeration and Air Conditioning Equipment	HFCs	840	11375	2.1%	85.4%
#9	2F(a) Consumption of Halocarbons and SF6 (actual emissions - Tier 2)	5. Solvents	PFCs	10382	1944	1.9%	87.3%
#10	2B Chemical Industry	3. Adipic Acid	N2O	7501	271	1.6%	88.9%
#11	1A Stationary Combustion	Other Fuels	CO2	8875	15983	1.3%	90.1%
#12	5A Forest Land	2. Land converted to Forest Land	CO2	5651	1272	1.0%	91.1%
#13	6A Solid Waste Disposal on Land		CH4	8286	4517	0.9%	92.0%
#14	2E Production of Halocarbons and SF6	2. Fugitive Emissions	SF6	4708	1270	0.8%	92.8%
#15	1A3 Mobile Combustion	a. Civil Aviation	CO2	7162	10876	0.6%	93.4%
#16	1B Fugitive Emission	1a i. Coal Mining and Handling (under	CH4	2785	40	0.6%	94.1%
#17	1A3 Mobile Combustion	d. Navigation	CO2	13731	12411	0.5%	94.6%
#18	5E Settlements	2. Land converted to Settlements	CO2	3548	1526	0.5%	95.0%

Table 2.32 Results of Tier 2 Trend Assessment (FY2007)

	A IPCC Category		B Direct GHGs	C Base Year Estimate [Gg CO2 eq.]	D Current Year Estimate [Gg CO2 eq.]	I Source/Sink Uncertinty	M Contribution to Total T2	Cumulative
#1	2F(a) Consumption of Halocarbons	8. Electrical Equipment	SF6	11,004.99	922.41	40%	0.10	10.3%
#2	2F(a) Consumption of Halocarbons	1. Refrigeration and Air Conditioning	HFCs	840.40	11,375.64	42%	0.10	20.5%
#3	2E Production of Halocarbons	2. Fugitive Emissions	SF6	4,708.30	1,270.43	100%	0.09	29.5%
#4	2F(a) Consumption of Halocarbons	5. Solvents	PFCs	10,382.05	1,944.38	40%	0.09	38.1%
#5	1A3 Mobile Combustion	a. Civil Aviation	N2O	69.75	109.11	10000%	0.08	45.9%
#6	1B Fugitive Emission	1a i. Coal Mining and Handling (under	CH4	2,785.23	39.82	107%	0.07	53.3%
#7	1A Stationary Combustion	Solid Fuels	CO2	308,620.23	451,893.02	1%	0.04	57.4%
#8	1A Stationary Combustion	Liquid Fuels	CO2	435,168.99	322,477.35	1%	0.03	60.7%
#9	6A Solid Waste Disposal on Land		CH4	8,285.86	4,516.93	29%	0.03	63.7%
#10	1A3 Mobile Combustion	b. Road Transportation	N2O	3,901.71	2,490.03	71%	0.03	66.5%
#11	2A Mineral Product	1. Cement Production	CO2	37,966.28	30,076.22	10%	0.03	69.2%
#12	4D Agricultural Soils	1. Direct Soil Emissions	N2O	4,249.46	3,348.49	90%	0.03	71.9%
#13	2E Production of Halocarbons	1. By-product Emissions	HFCs	16,965.00	217.62	5%	0.02	74.1%
#14	1A Stationary Combustion	Other Fuels	CO2	8,875.30	15,982.70	12%	0.02	76.0%
#15	2B Chemical Industry	3. Adipic Acid	N2O	7,501.25	270.91	9%	0.02	77.6%
#16	6C Waste Incineration		N2O	1,517.74	2,296.09	103%	0.02	79.2%
#17	1A Stationary Combustion		N2O	2,332.05	4,564.73	33%	0.02	80.8%
#18	4D Agricultural Soils	3. Indirect Emissions	N2O	3,669.26	2,976.80	64%	0.01	82.3%
#19	4B Manure Management		CH4	3,104.72	2,394.07	64%	0.01	83.7%
#20	4B Manure Management		N2O	5,661.40	4,860.72	48%	0.01	85.1%
#21	6C Waste Incineration		CO2	12,173.71	14,226.64	50%	0.01	86.3%
#22	4C Rice Cultivation		CH4	7,002.78	5,654.25	23%	0.01	87.3%
#23	6B Wastewater Handling		CH4	2,120.57	1,369.21	43%	0.01	88.3%
#24	5B Cropland	2. Land converted to Cropland	CO2	2,057.84	265.44	17%	0.01	89.1%
#25	5E Settlements	2. Land converted to Settlements	CO2	3,548.45	1,526.38	15%	0.01	89.8%
#26	2B Chemical Industry	1. Ammonia Production	CO2	3,384.68	2,296.03	23%	0.01	90.6%

Data utilized for the key category analysis are shown in Table 2.33 and Table 2.34 as references.

Table 2.33 Data used for the key category analysis (FY2007)

	A IPCC Category		B Direct GHGs	C Base Year Estimate [Gg CO2eq.]	D Current Year Estimate [Gg CO2eq.]	E Level Assessment	F % Contribution to Level	G Trend Assessment	H % Contribution to Trend	I Source/Sink Uncertinty	J Level Uncertainty (x 1000)	K Contribution to Total L2	L Trend Uncertainty (x 1000)	M Contribution to Total T2
#1	1A Stationary Combustion	Liquid Fuels	CO2	435,168.99	322,477.35	0.221	22.1%	0.0941	30.3%	1%	2.13	0.04	0.91	0.03
#2	1A Stationary Combustion	Solid Fuels	CO2	308,620.23	451,893.02	0.309	30.9%	0.0742	23.9%	1%	4.64	0.08	1.11	0.04
#3	1A Stationary Combustion	Gaseous Fuels	CO2	104,300.83	203,287.27	0.139	13.9%	0.0570	18.3%	0%	0.41	0.01	0.17	0.01
#4	1A Stationary Combustion	Other Fuels	CO2	8,875.30	15,982.70	0.011	1.1%	0.0040	1.3%	12%	1.36	0.02	0.50	0.02
#5	1A Stationary Combustion		CH4	533.48	574.39	0.000	0.0%	0.0000	0.0%	47%	0.18	0.00	0.00	0.00
#6	1A Stationary Combustion		N2O	2,332.05	4,564.73	0.003	0.3%	0.0013	0.4%	33%	1.03	0.02	0.42	0.02
#7	1A Stationary Combustion		CH4	50.77	85.63	0.000	0.0%	0.0000	0.0%	105%	0.06	0.00	0.02	0.00
#8	1A Stationary Combustion		N2O	387.23	594.42	0.000	0.0%	0.0001	0.0%	37%	0.15	0.00	0.04	0.00
#9	1A3 Mobile Combustion	a. Civil Aviation	CO2	7,162.41	10,875.77	0.007	0.7%	0.0020	0.6%	3%	0.19	0.00	0.05	0.00
#10	1A3 Mobile Combustion	b. Road Transportation	CO2	189,227.88	217,652.78	0.149	14.9%	0.0080	2.6%	2%	3.43	0.06	0.18	0.01
#11	1A3 Mobile Combustion	c. Railways	CO2	932.45	647.04	0.000	0.0%	0.0002	0.1%	2%	0.01	0.00	0.01	0.00
#12	1A3 Mobile Combustion	d. Navigation	CO2	13,730.95	12,411.48	0.008	0.8%	0.0016	0.5%	2%	0.20	0.00	0.04	0.00
#13	1A3 Mobile Combustion	a. Civil Aviation	CH4	2.94	4.84	0.000	0.0%	0.0000	0.0%	200%	0.01	0.00	0.00	0.00
#14	1A3 Mobile Combustion	b. Road Transportation	CH4	266.66	179.32	0.000	0.0%	0.0001	0.0%	64%	0.08	0.00	0.04	0.00
#15	1A3 Mobile Combustion	c. Railways	CH4	1.18	0.80	0.000	0.0%	0.0000	0.0%	14%	0.00	0.00	0.00	0.00
#16	1A3 Mobile Combustion	d. Navigation	CH4	26.33	24.26	0.000	0.0%	0.0000	0.0%	200%	0.03	0.00	0.01	0.00
#17	1A3 Mobile Combustion	a. Civil Aviation	N2O	69.75	109.11	0.000	0.0%	0.0000	0.0%	10000%	7.47	0.13	2.12	0.08
#18	1A3 Mobile Combustion	b. Road Transportation	N2O	3,901.71	2,490.03	0.002	0.2%	0.0011	0.4%	71%	1.20	0.02	0.78	0.03
#19	1A3 Mobile Combustion	c. Railways	N2O	121.38	82.77	0.000	0.0%	0.0000	0.0%	11%	0.01	0.00	0.00	0.00
#20	1A3 Mobile Combustion	d. Navigation	N2O	111.31	101.42	0.000	0.0%	0.0000	0.0%	1000%	0.69	0.01	0.12	0.00
#21	1B Fugitive Emission	1a i. Coal Mining and Handling (under	CH4	2,785.23	39.82	0.000	0.0%	0.0019	0.6%	107%	0.03	0.00	2.01	0.07
#22	1B Fugitive Emission	1a ii. Coal Mining and Handling	CH4	21.20	11.65	0.000	0.0%	0.0000	0.0%	185%	0.01	0.00	0.01	0.00
#23	1B Fugitive Emission	2a. Oil	CO2	0.14	0.11	0.000	0.0%	0.0000	0.0%	21%	0.00	0.00	0.00	0.00
#24	1B Fugitive Emission	2a. Oil	CH4	28.32	28.23	0.000	0.0%	0.0000	0.0%	17%	0.00	0.00	0.00	0.00
#25	1B Fugitive Emission	2a. Oil	N2O	0.00	0.00	0.000	0.0%	0.0000	0.0%	27%	0.00	0.00	0.00	0.00
#26	1B Fugitive Emission	2b. Natural Gas	CO2	0.25	0.46	0.000	0.0%	0.0000	0.0%	25%	0.00	0.00	0.00	0.00
#27	1B Fugitive Emission	2b. Natural Gas	CH4	187.94	324.23	0.000	0.0%	0.0001	0.0%	23%	0.05	0.00	0.02	0.00
#28	1B Fugitive Emission	2c. Venting & Flaring	CO2	36.23	36.96	0.000	0.0%	0.0000	0.0%	18%	0.00	0.00	0.00	0.00
#29	1B Fugitive Emission	2c. Venting & Flaring	CH4	14.45	12.55	0.000	0.0%	0.0000	0.0%	20%	0.00	0.00	0.00	0.00
#30	1B Fugitive Emission	2c. Venting & Flaring	N2O	0.11	0.12	0.000	0.0%	0.0000	0.0%	18%	0.00	0.00	0.00	0.00
#31	2A Mineral Product	1. Cement Production	CO2	37,966.28	30,076.22	0.021	2.1%	0.0070	2.2%	10%	2.15	0.04	0.73	0.03
#32	2A Mineral Product	2. Lime Production	CO2	7,321.64	7,799.26	0.005	0.5%	0.0001	0.0%	16%	0.84	0.01	0.01	0.00
#33	2A Mineral Product	3. Limestone and Dolomite Use	CO2	11,527.41	12,003.50	0.008	0.8%	0.0003	0.1%	17%	1.36	0.02	0.05	0.00
#34	2A Mineral Product	4. Soda Ash Production and Use	CO2	583.63	339.98	0.000	0.0%	0.0002	0.1%	16%	0.04	0.00	0.03	0.00
#35	2B Chemical Industry	1. Ammonia Production	CO2	3,384.68	2,296.03	0.002	0.2%	0.0009	0.3%	23%	0.36	0.01	0.20	0.01
#36	2B Chemical Industry	other products except Ammonia	CO2	1,129.29	1,002.83	0.001	0.1%	0.0001	0.0%	77%	0.53	0.01	0.11	0.00
#37	2B Chemical Industry	2. Nitric Acid	N2O	765.70	589.27	0.000	0.0%	0.0002	0.0%	46%	0.19	0.00	0.07	0.00
#38	2B Chemical Industry	3. Adipic Acid	N2O	7,501.25	270.91	0.000	0.0%	0.0050	1.6%	9%	0.02	0.00	0.46	0.02
#39	2B Chemical Industry	4. Carbide Production	CH4	0.42	0.66	0.000	0.0%	0.0000	0.0%	100%	0.00	0.00	0.00	0.00
#40	2B Chemical Industry	5. Carbon Black, Ethylene, Ethylene Dichloride, Styrene, Methanol, Coke	CH4	337.80	115.85	0.000	0.0%	0.0002	0.1%	89%	0.07	0.00	0.14	0.01
#41	2C Metal Production	1 Iron and Steel Production	CO2	356.09	212.02	0.000	0.0%	0.0001	0.0%	5%	0.01	0.00	0.00	0.00
#42	2C Metal Production	1 Iron and Steel Production	CH4	15.47	14.97	0.000	0.0%	0.0000	0.0%	163%	0.02	0.00	0.00	0.00
#43	2C Metal Production	2. Ferroalloys Production	CH4	3.89	2.33	0.000	0.0%	0.0000	0.0%	163%	0.00	0.00	0.00	0.00
#44	2C Metal Production	3. Aluminium Production	PFCs	69.74	14.69	0.000	0.0%	0.0000	0.0%	33%	0.00	0.00	0.01	0.00
#45	2C Metal Production	4. SF6 Used in Aluminium and Magnesium oundries	SF6	119.50	996.13	0.001	0.1%	0.0005	0.2%	5%	0.03	0.00	0.03	0.00
#46	2E Production of Halocarbons and SF6	1. By-product Emissions (Production of HCFC-22)	HFCs	16,965.00	217.62	0.000	0.0%	0.0115	3.7%	5%	0.01	0.00	0.62	0.02
#47	2E Production of Halocarbons and SF6	2. Fugitive Emissions	HFCs	480.12	279.99	0.000	0.0%	0.0002	0.0%	100%	0.19	0.00	0.15	0.01
#48	2E Production of Halocarbons and SF6	2. Fugitive Emissions	PFCs	762.85	783.02	0.001	0.1%	0.0000	0.0%	100%	0.54	0.01	0.03	0.00
#49	2E Production of Halocarbons and SF6	2. Fugitive Emissions	SF6	4,708.30	1,270.43	0.001	0.1%	0.0024	0.8%	100%	0.87	0.02	2.43	0.09
#50	2F(a) Consumption of Halocarbons and SF6 (actual emissions - Tier 2)	1. Refrigeration and Air Conditioning Equipment	HFCs	840.40	11,375.49	0.008	0.8%	0.0066	2.1%	42%	3.29	0.06	2.79	0.10
#51	2F(a) Consumption of Halocarbons and SF6 (actual emissions - Tier 2)	2. Foam Blowing	HFCs	451.76	316.64	0.000	0.0%	0.0001	0.0%	51%	0.11	0.00	0.06	0.00
#52	2F(a) Consumption of Halocarbons and SF6 (actual emissions - Tier 2)	3. Fire Extinguishers	HFCs	0.00	6.24	0.000	0.0%	0.0000	0.0%	64%	0.00	0.00	0.00	0.00
#53	2F(a) Consumption of Halocarbons and SF6 (actual emissions - Tier 2)	4. Aerosols/ Metered Dose Inhalers	HFCs	1,365.00	849.75	0.001	0.1%	0.0004	0.1%	31%	0.18	0.00	0.12	0.00
#54	2F(a) Consumption of Halocarbons and SF6 (actual emissions - Tier 2)	5. Solvents	PFCs	10,382.05	1,944.38	0.001	0.1%	0.0059	1.9%	40%	0.53	0.01	2.35	0.09
#55	2F(a) Consumption of Halocarbons and SF6 (actual emissions - Tier 2)	7. Semiconductor Manufacture	HFCs	158.30	164.41	0.000	0.0%	0.0000	0.0%	64%	0.07	0.00	0.00	0.00
#56	2F(a) Consumption of Halocarbons and SF6 (actual emissions - Tier 2)	7. Semiconductor Manufacture	PFCs	3,148.83	3,741.32	0.003	0.3%	0.0002	0.1%	64%	1.64	0.03	0.13	0.00
#57	2F(a) Consumption of Halocarbons and SF6 (actual emissions - Tier 2)	7. Semiconductor Manufacture	SF6	1,128.98	1,196.04	0.001	0.1%	0.0000	0.0%	64%	0.52	0.01	0.01	0.00
#58	2F(a) Consumption of Halocarbons and SF6 (actual emissions - Tier 2)	8. Electrical Equipment	SF6	11,004.99	922.41	0.001	0.1%	0.0069	2.2%	40%	0.25	0.00	2.79	0.10
#59	3 Solvent & Other Product Use	Using Laughing Gas in Hospital	N2O	287.07	244.76	0.000	0.0%	0.0000	0.0%	5%	0.01	0.00	0.00	0.00
#60	4A Enteric Fermentation		CH4	7,674.46	7,120.61	0.005	0.5%	0.0008	0.2%	12%	0.57	0.01	0.09	0.00
#61	4B Manure Management		CH4	3,104.72	2,394.07	0.002	0.2%	0.0006	0.2%	64%	1.05	0.02	0.39	0.01
#62	4B Manure Management		N2O	5,661.40	4,860.72	0.003	0.3%	0.0008	0.3%	48%	1.60	0.03	0.39	0.01
#63	4C Rice Cultivation		CH4	7,002.78	5,654.25	0.004	0.4%	0.0012	0.4%	23%	0.88	0.02	0.28	0.01
#64	4D Agricultural Soils	1. Direct Soil Emissions	N2O	4,249.46	3,348.49	0.002	0.2%	0.0008	0.3%	90%	2.06	0.04	0.71	0.03
#65	4D Agricultural Soils	2. Pasture, Range and Paddock Manure	N2O	11.91	12.12	0.000	0.0%	0.0000	0.0%	133%	0.01	0.00	0.00	0.00
#66	4D Agricultural Soils	3. Indirect Emissions	N2O	3,669.20	2,976.80	0.002	0.2%	0.0008	0.2%	64%	1.30	0.02	0.40	0.01
#67	4F Field Burning of Agricultural		CH4	129.77	102.93	0.000	0.0%	0.0000	0.0%	142%	0.10	0.00	0.03	0.00
#68	4F Field Burning of Agricultural		N2O	103.92	76.29	0.000	0.0%	0.0000	0.0%	186%	0.10	0.00	0.04	0.00
#69	5A Forest Land	1. Forest Land remaining Forest Land	CO2	75,127.14	81,595.45	0.056	5.6%	0.0001	0.0%	6%	3.20	0.06	0.01	0.00
#70	5A Forest Land	2. Land converted to Forest Land	CO2	5,650.70	1,271.57	0.001	0.1%	0.0031	1.0%	6%	0.05	0.00	0.19	0.01
#71	5A Forest Land		CH4	8.31	1.91	0.000	0.0%	0.0000	0.0%	53%	0.00	0.00	0.00	0.00
#72	5A Forest Land		N2O	0.84	0.19	0.000	0.0%	0.0000	0.0%	89%	0.00	0.00	0.00	0.00
#73	5B Cropland	1. Cropland remaining Cropland	CO2	0.00	0.00	0.000	0.0%	0.0000	0.0%	0%	0.00	0.00	0.00	0.00
#74	5B Cropland	2. Land converted to Cropland	CO2	2,057.84	265.44	0.000	0.0%	0.0012	0.4%	17%	0.03	0.00	0.22	0.01
#75	5B Cropland		CH4	0.00	0.00	0.000	0.0%	0.0000	0.0%	0%	0.00	0.00	0.00	0.00
#76	5B Cropland		N2O	68.27	7.86	0.000	0.0%	0.0000	0.0%	76%	0.00	0.00	0.03	0.00
#77	5C Grassland	1. Grassland remaining Grassland	CO2	0.00	0.00	0.000	0.0%	0.0000	0.0%	0%	0.00	0.00	0.00	0.00
#78	5C Grassland	2. Land converted to Grassland	CO2	516.21	614.90	0.000	0.0%	0.0000	0.0%	19%	0.08	0.00	0.01	0.00
#79	5C Grassland		CH4	0.00	0.00	0.000	0.0%	0.0000	0.0%	0%	0.00	0.00	0.00	0.00
#80	5C Grassland		N2O	0.00	0.00	0.000	0.0%	0.0000	0.0%	0%	0.00	0.00	0.00	0.00
#81	5D Wetlands	1. Wetlands remaining Wetlands	CO2	0.00	0.00	0.000	0.0%	0.0000	0.0%	0%	0.00	0.00	0.00	0.00
#82	5D Wetlands	2. Land converted to Wetlands	CO2	292.33	167.06	0.000	0.0%	0.0001	0.0%	21%	0.02	0.00	0.02	0.00
#83	5D Wetlands		CH4	0.00	0.00	0.000	0.0%	0.0000	0.0%	0%	0.00	0.00	0.00	0.00
#84	5D Wetlands		N2O	0.00	0.00	0.000	0.0%	0.0000	0.0%	0%	0.00	0.00	0.00	0.00
#85	5E Settlements	1. Settlements remaining Settlements	CO2	475.77	677.60	0.000	0.0%	0.0001	0.0%	82%	0.38	0.01	0.08	0.00
#86	5E Settlements	2. Land converted to Settlements	CO2	3,548.45	1,526.38	0.001	0.1%	0.0015	0.5%	15%	0.15	0.00	0.21	0.01
#87	5E Settlements		CH4	0.00	0.00	0.000	0.0%	0.0000	0.0%	0%	0.00	0.00	0.00	0.00
#88	5E Settlements		N2O	0.00	0.00	0.000	0.0%	0.0000	0.0%	0%	0.00	0.00	0.00	0.00
#89	5F Other Land	1. Other Land remaining Other Land	CO2	0.00	0.00	0.000	0.0%	0.0000	0.0%	0%	0.00	0.00	0.00	0.00
#90	5F Other Land	2. Land converted to Other Land	CO2	956.66	607.70	0.000	0.0%	0.0003	0.1%	30%	0.12	0.00	0.08	0.00
#91	5F Other Land		CH4	0.00	0.00	0.000	0.0%	0.0000	0.0%	0%	0.00	0.00	0.00	0.00
#92	5F Other Land		N2O	0.00	0.00	0.000	0.0%	0.0000	0.0%	0%	0.00	0.00	0.00	0.00
#93	5G Other	CO2 emissions from agricultural lime application	CO2	550.22	230.34	0.000	0.0%	0.0002	0.1%	51%	0.08	0.00	0.12	0.00
#94	6A Solid Waste Disposal on Land		CH4	8,285.86	4,516.93	0.003	0.3%	0.0028	0.9%	29%	0.88	0.02	0.80	0.03
#95	6B Wastewater Handling		CH4	2,120.57	1,369.21	0.001	0.1%	0.0006	0.2%	43%	0.40	0.01	0.25	0.01
#96	6B Wastewater Handling		N2O	1,289.65	1,159.00	0.001	0.1%	0.0002	0.0%	93%	0.74	0.01	0.14	0.01
#97	6C Waste Incineration		CO2	12,173.71	14,226.64	0.010	1.0%	0.0007	0.2%	50%	4.85	0.08	0.33	0.01
#98	6C Waste Incineration		CH4	13.47	9.81	0.000	0.0%	0.0000	0.0%	86%	0.01	0.00	0.00	0.00
#99	6C Waste Incineration		N2O	1,517.74	2,296.09	0.002	0.2%	0.0004	0.1%	103%	1.62	0.03	0.42	0.02
#100	6D Other		CO2	702.83	559.75	0.000	0.0%	0.0001	0.0%	25%	0.09	0.00	0.03	0.00
#101	6D Other		CH4	14.48	16.64	0.000	0.0%	0.0000	0.0%	74%	0.01	0.00	0.00	0.00
#102	6D Other		N2O	12.83	14.74	0.000	0.0%	0.0000	0.0%	86%	0.01	0.00	0.00	0.00
	TOTAL			1,348,655.72	1,461,221.92	1.00	100.0%	0.31	100.0%		57.65	1.00	27.20	1.00

Table 2.34 Data used for the key category analysis (FY1990)

	A IPCC Category		B Direct GHGs	C Base Year Estimate [Gg CO2 eq.]	E Level Assessent	F % Contribution to Level	I Source/Sink Uncertinty	J Level Uncertainty (x 1000)	K Contribution to Total L2
#1	1A Stationary Combustion	Liquid Fuels	CO2	435,168.99	0.323	32.3%	1%	3.12	0.05
#2	1A Stationary Combustion	Solid Fuels	CO2	308,620.23	0.229	22.9%	1%	3.43	0.05
#3	1A Stationary Combustion	Gaseous Fuels	CO2	104,300.83	0.077	7.7%	0%	0.23	0.00
#4	1A Stationary Combustion	Other Fuels	CO2	8,875.30	0.007	0.7%	12%	0.82	0.01
#5	1A Stationary Combustion		CH4	533.48	0.000	0.0%	47%	0.19	0.00
#6	1A Stationary Combustion		N2O	2,332.05	0.002	0.2%	33%	0.57	0.01
#7	1A Stationary Combustion		CH4	50.77	0.000	0.0%	105%	0.04	0.00
#8	1A Stationary Combustion		N2O	387.23	0.000	0.0%	37%	0.11	0.00
#9	1A3 Mobile Combustion	a. Civil Aviation	CO2	7,162.41	0.005	0.5%	3%	0.13	0.00
#10	1A3 Mobile Combustion	b. Road Transportation	CO2	189,227.88	0.140	14.0%	2%	3.23	0.05
#11	1A3 Mobile Combustion	c. Railways	CO2	932.45	0.001	0.1%	2%	0.02	0.00
#12	1A3 Mobile Combustion	d. Navigation	CO2	13,730.95	0.010	1.0%	2%	0.24	0.00
#13	1A3 Mobile Combustion	a. Civil Aviation	CH4	2.94	0.000	0.0%	200%	0.00	0.00
#14	1A3 Mobile Combustion	b. Road Transportation	CH4	266.66	0.000	0.0%	64%	0.13	0.00
#15	1A3 Mobile Combustion	c. Railways	CH4	1.18	0.000	0.0%	14%	0.00	0.00
#16	1A3 Mobile Combustion	d. Navigation	CH4	26.33	0.000	0.0%	200%	0.04	0.00
#17	1A3 Mobile Combustion	a. Civil Aviation	N2O	69.75	0.000	0.0%	10000%	5.17	0.08
#18	1A3 Mobile Combustion	b. Road Transportation	N2O	3,901.71	0.003	0.3%	71%	2.05	0.03
#19	1A3 Mobile Combustion	c. Railways	N2O	121.38	0.000	0.0%	11%	0.01	0.00
#20	1A3 Mobile Combustion	d. Navigation	N2O	111.31	0.000	0.0%	1000%	0.83	0.01
#21	1B Fugitive Emission	1a i. Coal Mining and Handling (under	CH4	2,785.23	0.002	0.2%	107%	2.21	0.03
#22	1B Fugitive Emission	1a ii. Coal Mining and Handling	CH4	21.20	0.000	0.0%	185%	0.03	0.00
#23	1B Fugitive Emission	2a. Oil	CO2	0.14	0.000	0.0%	21%	0.00	0.00
#24	1B Fugitive Emission	2a. Oil	CH4	28.32	0.000	0.0%	17%	0.00	0.00
#25	1B Fugitive Emission	2a. Oil	N2O	0.00	0.000	0.0%	27%	0.00	0.00
#26	1B Fugitive Emission	2b. Natural Gas	CO2	0.25	0.000	0.0%	25%	0.00	0.00
#27	1B Fugitive Emission	2b. Natural Gas	CH4	187.94	0.000	0.0%	23%	0.03	0.00
#28	1B Fugitive Emission	2c. Venting & Flaring	CO2	36.23	0.000	0.0%	18%	0.00	0.00
#29	1B Fugitive Emission	2c. Venting & Flaring	CH4	14.45	0.000	0.0%	20%	0.00	0.00
#30	1B Fugitive Emission	2c. Venting & Flaring	N2O	0.11	0.000	0.0%	18%	0.00	0.00
#31	2A Mineral Product	1. Cement Production	CO2	37,966.28	0.028	2.8%	10%	2.94	0.04
#32	2A Mineral Product	2. Lime Production	CO2	7,321.64	0.005	0.5%	16%	0.86	0.01
#33	2A Mineral Product	3. Limestone and Dolomite Use	CO2	11,527.41	0.009	0.9%	17%	1.42	0.02
#34	2A Mineral Product	4. Soda Ash Production and Use	CO2	583.63	0.000	0.0%	16%	0.07	0.00
#35	2B Chemical Industry	1. Ammonia Production	CO2	3,384.68	0.003	0.3%	23%	0.58	0.01
#36	2B Chemical Industry	other products except Anmonia	CO2	1,129.29	0.001	0.1%	77%	0.65	0.01
#37	2B Chemical Industry	2. Nitric Acid	N2O	765.70	0.001	0.1%	46%	0.26	0.00
#38	2B Chemical Industry	3. Adipic Acid	N2O	7,501.25	0.006	0.6%	9%	0.51	0.01
#39	2B Chemical Industry	4. Carbide Production	CH4	0.42	0.000	0.0%	100%	0.00	0.00
#40	2B Chemical Industry	5. Carbon Black, Ethylene, Ethylene Dichloride, Styrene, Methanol, Coke	CH4	337.80	0.000	0.0%	89%	0.22	0.00
#41	2C Metal Production	1 Iron and Steel Production	CO2	356.09	0.000	0.0%	5%	0.01	0.00
#42	2C Metal Production	1 Iron and Steel Production	CH4	15.47	0.000	0.0%	163%	0.02	0.00
#43	2C Metal Production	2. Ferroalloys Production	CH4	3.89	0.000	0.0%	163%	0.00	0.00
#44	2C Metal Production	3. Aluminium Production	PFCs	69.74	0.000	0.0%	33%	0.02	0.00
#45	2C Metal Production	4. SF6 Used in Aluminium and Magnesium oundries	SF6	119.50	0.000	0.0%	5%	0.00	0.00
#46	2E Production of Halocarbons and SF6	1. By-product Emissions (Production of HCFC-22)	HFCs	16,965.00	0.013	1.3%	5%	0.68	0.01
#47	2E Production of Halocarbons and SF6	2. Fugitive Emissions	HFCs	480.12	0.000	0.0%	100%	0.36	0.01
#48	2E Production of Halocarbons and SF6	2. Fugitive Emissions	PFCs	762.85	0.001	0.1%	100%	0.57	0.01
#49	2E Production of Halocarbons and SF6	2. Fugitive Emissions	SF6	4,708.30	0.003	0.3%	100%	3.51	0.05
#50	2F(a) Consumption of Halocarbons and SF6 (actual emissions - Tier 2)	1. Refrigeration and Air Conditioning Equipment	HFCs	840.40	0.001	0.1%	42%	0.26	0.00
#51	2F(a) Consumption of Halocarbons and SF6 (actual emissions - Tier 2)	2. Foam Blowing	HFCs	451.76	0.000	0.0%	51%	0.17	0.00
#52	2F(a) Consumption of Halocarbons and SF6 (actual emissions - Tier 2)	3. Fire Extinguishers	HFCs	0.00	0.000	0.0%	64%	0.00	0.00
#53	2F(a) Consumption of Halocarbons and SF6 (actual emissions - Tier 2)	4. Aerosols/ Metered Dose Inhalers	HFCs	1,365.00	0.001	0.1%	31%	0.31	0.00
#54	2F(a) Consumption of Halocarbons and SF6 (actual emissions - Tier 2)	5. Solvents	PFCs	10,382.05	0.008	0.8%	40%	3.08	0.04
#55	2F(a) Consumption of Halocarbons and SF6 (actual emissions - Tier 2)	7. Semiconductor Manufacture	HFCs	158.30	0.000	0.0%	64%	0.08	0.00
#56	2F(a) Consumption of Halocarbons and SF6 (actual emissions - Tier 2)	7. Semiconductor Manufacture	PFCs	3,148.83	0.002	0.2%	64%	1.49	0.02
#57	2F(a) Consumption of Halocarbons and SF6 (actual emissions - Tier 2)	7. Semiconductor Manufacture	SF6	1,128.98	0.001	0.1%	64%	0.54	0.01
#58	2F(a) Consumption of Halocarbons and SF6 (actual emissions - Tier 2)	8. Electrical Equipment	SF6	11,004.99	0.008	0.8%	40%	3.28	0.05
#59	3 Solvent & Other Product Use	Using Laughing Gas in Hospital	N2O	287.07	0.000	0.0%	5%	0.01	0.00
#60	4A Enteric Fermentation		CH4	7,674.46	0.006	0.6%	12%	0.67	0.01
#61	4B Manure Management		CH4	3,104.72	0.002	0.2%	64%	1.48	0.02
#62	4B Manure Management		N2O	5,661.40	0.004	0.4%	48%	2.02	0.03
#63	4C Rice Cultivation		CH4	7,002.78	0.005	0.5%	23%	1.18	0.02
#64	4D Agricultural Soils	1. Direct Soil Emissions	N2O	4,249.46	0.003	0.3%	90%	2.84	0.04
#65	4D Agricultural Soils	2. Pasture, Range and Paddock Manure	N2O	11.91	0.000	0.0%	133%	0.01	0.00
#66	4D Agricultural Soils	3. Indirect Emissions	N2O	3,669.26	0.003	0.3%	64%	1.73	0.03
#67	4F Field Burning of Agricultural		CH4	129.77	0.000	0.0%	142%	0.14	0.00
#68	4F Field Burning of Agricultural		N2O	103.92	0.000	0.0%	186%	0.14	0.00
#69	5A Forest Land	1. Forest Land remaining Forest Land	CO2	75,127.14	0.056	5.6%	6%	3.20	0.05
#70	5A Forest Land	2. Land converted to Forest Land	CO2	5,650.70	0.004	0.4%	6%	0.26	0.00
#71	5A Forest Land		CH4	8.31	0.000	0.0%	53%	0.00	0.00
#72	5A Forest Land		N2O	0.84	0.000	0.0%	89%	0.00	0.00
#73	5B Cropland	1. Cropland remaining Cropland	CO2	0.00	0.000	0.0%	0%	0.00	0.00
#74	5B Cropland	2. Land converted to Cropland	CO2	2,057.84	0.002	0.2%	17%	0.27	0.00
#75	5B Cropland		CH4	0.00	0.000	0.0%	0%	0.00	0.00
#76	5B Cropland		N2O	68.27	0.000	0.0%	76%	0.04	0.00
#77	5C Grassland	1. Grassland remaining Grassland	CO2	0.00	0.000	0.0%	0%	0.00	0.00
#78	5C Grassland	2. Land converted to Grassland	CO2	516.21	0.000	0.0%	19%	0.07	0.00
#79	5C Grassland		CH4	0.00	0.000	0.0%	0%	0.00	0.00
#80	5C Grassland		N2O	0.00	0.000	0.0%	0%	0.00	0.00
#81	5D Wetlands	1. Wetlands remaining Wetlands	CO2	0.00	0.000	0.0%	0%	0.00	0.00
#82	5D Wetlands	2. Land converted to Wetlands	CO2	292.33	0.000	0.0%	21%	0.05	0.00
#83	5D Wetlands		CH4	0.00	0.000	0.0%	0%	0.00	0.00
#84	5D Wetlands		N2O	0.00	0.000	0.0%	0%	0.00	0.00
#85	5E Settlements	1. Settlements remaining Settlements	CO2	475.77	0.000	0.0%	82%	0.29	0.00
#86	5E Settlements	2. Land converted to Settlements	CO2	3,548.45	0.003	0.3%	15%	0.38	0.01
#87	5E Settlements		CH4	0.00	0.000	0.0%	0%	0.00	0.00
#88	5E Settlements		N2O	0.00	0.000	0.0%	0%	0.00	0.00
#89	5F Other Land	1. Other Land remaining Other Land	CO2	0.00	0.000	0.0%	0%	0.00	0.00
#90	5F Other Land	2. Land converted to Other Land	CO2	956.66	0.001	0.1%	30%	0.21	0.00
#91	5F Other Land		CH4	0.00	0.000	0.0%	0%	0.00	0.00
#92	5F Other Land		N2O	0.00	0.000	0.0%	0%	0.00	0.00
#93	5G Other	CO2 emissions from agricultural lime application	CO2	550.22	0.000	0.0%	51%	0.21	0.00
#94	6A Solid Waste Disposal on Land		CH4	8,285.86	0.006	0.6%	29%	1.75	0.03
#95	6B Wastewater Handling		CH4	2,120.57	0.002	0.2%	43%	0.67	0.01
#96	6B Wastewater Handling		N2O	1,289.65	0.001	0.1%	93%	0.89	0.01
#97	6C Waste Incineration		CO2	12,173.71	0.009	0.9%	50%	4.49	0.07
#98	6C Waste Incineration		CH4	13.47	0.000	0.0%	86%	0.01	0.00
#99	6C Waste Incineration		N2O	1,517.74	0.001	0.1%	103%	1.16	0.02
#100	6D Other		CO2	702.83	0.001	0.1%	25%	0.13	0.00
#101	6D Other		CH4	14.48	0.000	0.0%	74%	0.01	0.00
#102	6D Other		N2O	12.83	0.000	0.0%	86%	0.01	0.00
	TOTAL			1,348,655.72	1.00	100.0%		68.83	1.00

2.6.6.2.d Qualitative Analysis

Key categories identified in the qualitative analysis include the categories in which: mitigation techniques have been employed, significant variance of emissions and removals has been confirmed, a high uncertainty exists due to the solo implementation of the Tier 1 analysis of key categories, and unexpectedly high or low estimates are identified.

In Japan, the categories in which mitigation techniques have been employed, emissions and removals have been newly estimated, and estimation methods have been changed, were identified as key in terms of the qualitative analysis. In this year, the key categories were identified only based on the quantitative results of the level and trend assessments, including both Tier 1 and Tier 2.

2.6.7 Information on the QA/QC Plan including Verification and Treatment of Confidentiality Issues

The QC activities (e.g., checking estimation accuracy, archiving documents) were carried out in each step of the inventory preparation process in accordance with *Good Practice Guidance (2000)* in order to control the inventory's quality.

The evaluation and verification processes on estimation methods, which are done by experts within the Committee, were considered to be a QA activity. The experts who are not involved in any inventory preparation processes evaluated and verified the data quality from the view points of scientific knowledge and data availability.

In FY2008, the QA/QC plan was revised by taking the Expert Review Team's recommendations into consideration. Under the revised QA/QC plan, Japan reviewed the national system and process for inventory preparation including QA/QC activities, and enhanced and systematized its national system and QC activities. As a QA activity, the QA-WG was newly established in order to implement the detailed review of sources and sinks. The QA-WG is composed of experts who are not directly involved in or related to the inventory preparation process. The process includes providing and preparation of activity data, developing emission factors, estimating GHG emissions and removals, and revising the estimation methodologies.

The new aspects of the QA/QC plan are:

1. Clear descriptions of the national system for inventory preparation and the role of each relevant entity

The role and the responsibility for each entity in the inventory preparation process is clarified. The relevant entities are: MOE, GIO, relevant ministries, agencies, and organizations, the Committee, the QA-WG and selected private consulting companies.

2. New Establishment of the Inventory Quality Assurance Working Group (the QA-WG)

As a QA activity, the QA-WG is newly established in order to implement a detailed review for each source or sink. The QA-WG is composed of experts who are not directly involved in or related to the inventory preparation process.

For further information on the national system and process for inventory preparation, see sections 2.6.2 and 2.6.3 .

2.6.8 General Uncertainty Assessment, including Data on the Overall Uncertainty for the Inventory Totals

Total net GHG emissions in Japan for FY2007 were approximately 1,293 million tonnes (in CO_2

equivalents). The total emissions uncertainty was 1% and the uncertainty introduced into the trend in the total emissions was 2%. More detailed information on the uncertainty assessment is described in National Inventory Report Annex 7.

Table 2.35 Uncertainty of Japan's Total Emissions

IPCC Category	GHGs	Emissions / Removals [Gg CO_2 eq.]		Combined Uncertainty [%] [1]	rank	Combined uncertainty as % of total national emissions	rank
		A	[%]	B		C	
1A. Fuel Combustion (CO_2)	CO_2	1,235,227.4	95.5%	1%	10	0.69%	2
1A. Fuel Combustion (Stationary:CH_4,N_2O)	CH_4、N_2O	5,819.2	0.5%	27%	3	0.12%	8
1A. Fuel Combustion (Transport:CH_4,N_2O)	CH_4、N_2O	2,992.5	0.2%	371%	1	0.86%	1
1B. Fugitive Emissions from Fuels	CO_2、CH_4、N_2O	454.1	0.0%	19%	5	0.01%	9
2. Industrial Processes (CO_2,CH_4,N_2O)	CO_2、CH_4、N_2O	54,723.8	4.2%	7%	7	0.31%	7
2. Industrial Processes (HFCs,PFCs,SF_6)	HFCs、PFCs、SF_6	24,078.6	1.9%	24%	4	0.44%	4
3. Solvent & other Product Use	N_2O	244.8	0.0%	5%	9	0.00%	10
4. Agriculture	CH_4、N_2O	26,546.3	2.1%	18%	6	0.37%	5
5. LULUCF	CO_2、CH_4、N_2O	-81,352.6	-6.3%	6%	8	-0.37%	6
6. Waste	CO_2、CH_4、N_2O	24,174.8	1.9%	32%	2	0.59%	3
Total Emissions	(D)	1,292,908.9	100.0%	(E) [2] 1%			

2.6.9 General Assessment of Completeness

In this inventory report, emissions from some categories are not estimated and reported as "NE". In FY2006, GHG emissions and removals from categories that were previously reported as NE were newly estimated by analyzing categories such as those which possibly result in the emission of considerable amount of GHGs, as well as those which require substantial improvement in their estimation methodology. Also, some categories which were previously reported as "NE" were reviewed within the Committee and newly estimated.

Source categories reported as NE in this year's report include those whose emissions are thought to be very small, those whose emissions are unknown, and those for which emission estimation methods have not been developed. For these categories, further investigation on their emission possibility and the development of estimation methodologies will be carried out in accordance with Japan's QA/QC plan. See Annex 5 for a list of not-estimated emission source categories.

For some categories, dealing with the emission sources of HFCs, PFCs and SF_6, activity data is not available from 1990 to 1994.Those categories are therefore reported as "NE" during that period.

2.6.10 Process for Official Approval of Inventories

As described in section 2.6.3.2 above, confirmation and approval for the creation of an inventory for GHG emissions and removals is advanced through the exchange of information between relevant ministries and agencies. If a change is made to calculations, examinations will be conducted by the Committee for the Greenhouse Gas Emissions Estimation Methods, as noted in section 2.6.2.5.

As noted in section 2.6.3.2.f, the created inventory of greenhouse gas emissions and removals undergoes a quality check (QC) by a private commissioned company, then the first draft is viewed at the MOE and other relevant ministries and agencies, including such items as calculation sheets, and then the figures and calculation methods are finally confirmed by the relevant ministries and agencies. In the event that a request for corrections is submitted from the relevant ministry or agency following a check of the first draft, a second draft of the inventory will be created after the content is corrected, as described in section 2.6.3.2.g. The second draft created will then be sent again to the relevant ministries and agencies for a final check. During the final check, if there are no additional correction requests regarding previously corrected areas or any other area from the relevant

ministries and agencies, the second draft will become the final version and the figures therein are determined to be official.

In addition, as noted in section 2.6.3.2.i, the Greenhouse Gas Inventory Quality Assurance (QA) Working Group is held following the submission of the inventory, where a QA check is conducted on the inventory report's details by an expert that did not directly partake in the inventory's creation. In the event that areas in the report are indicated to require improvements during the QA working group, those items will be added to the inventory improvement plan, examinations will be conducted by the Committee for the Greenhouse Gas Emissions Estimation Methods, and they will be utilized to ameliorate inventory quality subsequently. The process illustrated above is the official examination and approval process of Japan.