Final Energy Consumption and Greenhouse Gas Emissions in Tokyo

(FY 2020)

March 2023

Bureau of Environment
Tokyo Metropolitan Goverment

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Note: Values in this report have been rounded, and the sum of indicated values may not agree with the indicated total.

1 Tokyo in the World

- Figure 1-1 indicates energy-derived CO_2 emissions in major countries in 2020.
- Japan emits the fifth largest quantity after China, USA, India and Russia, accounting for 3.1% of the global emissions.
- Energy-derived CO_2 emissions in Tokyo account for 5.1% of domestic emissions. This is considered to be approximately equivalent to the amount of one country, such as Austria, Greece, etc. (GHG emissions in Tokyo account for 5.1% of domestic emissions.)

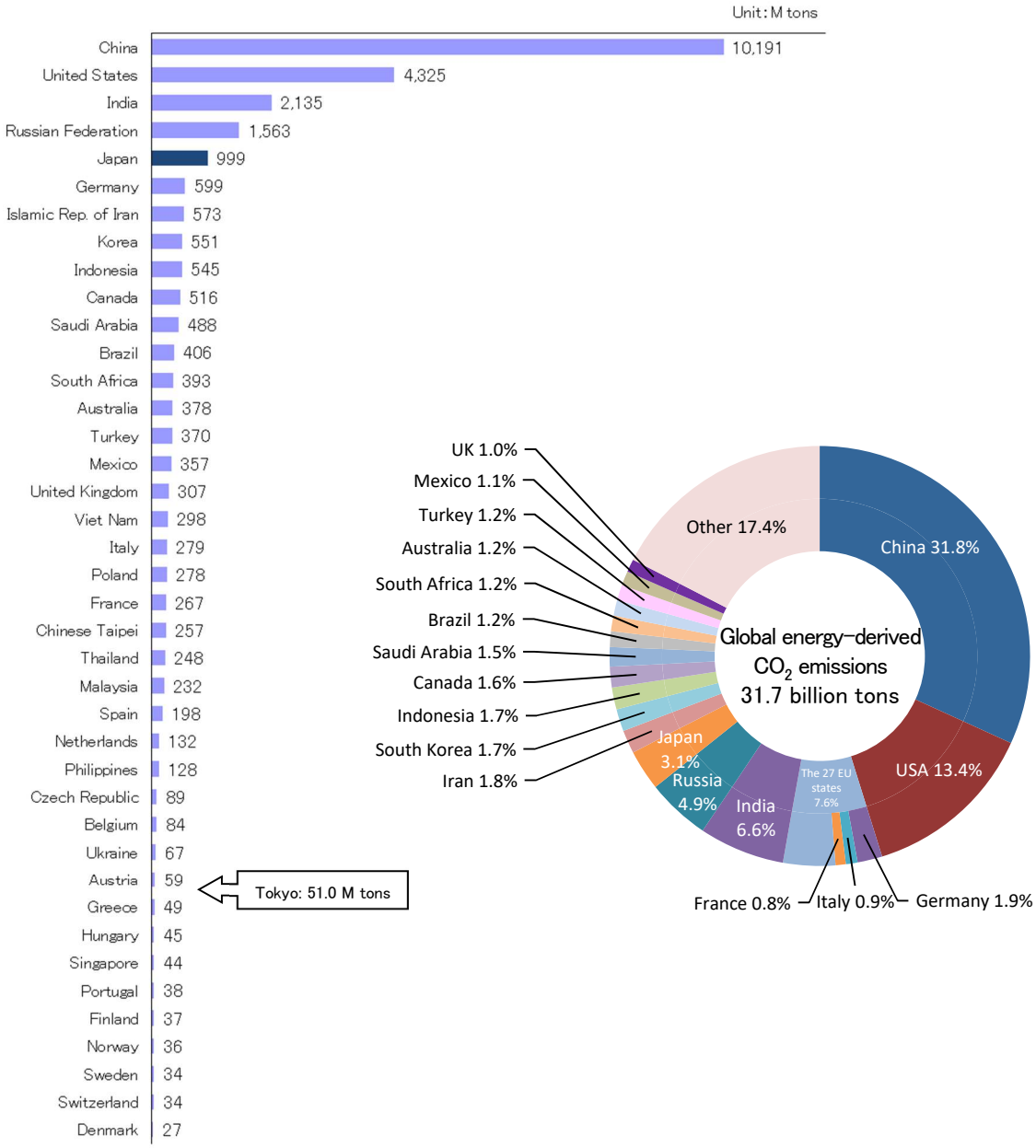


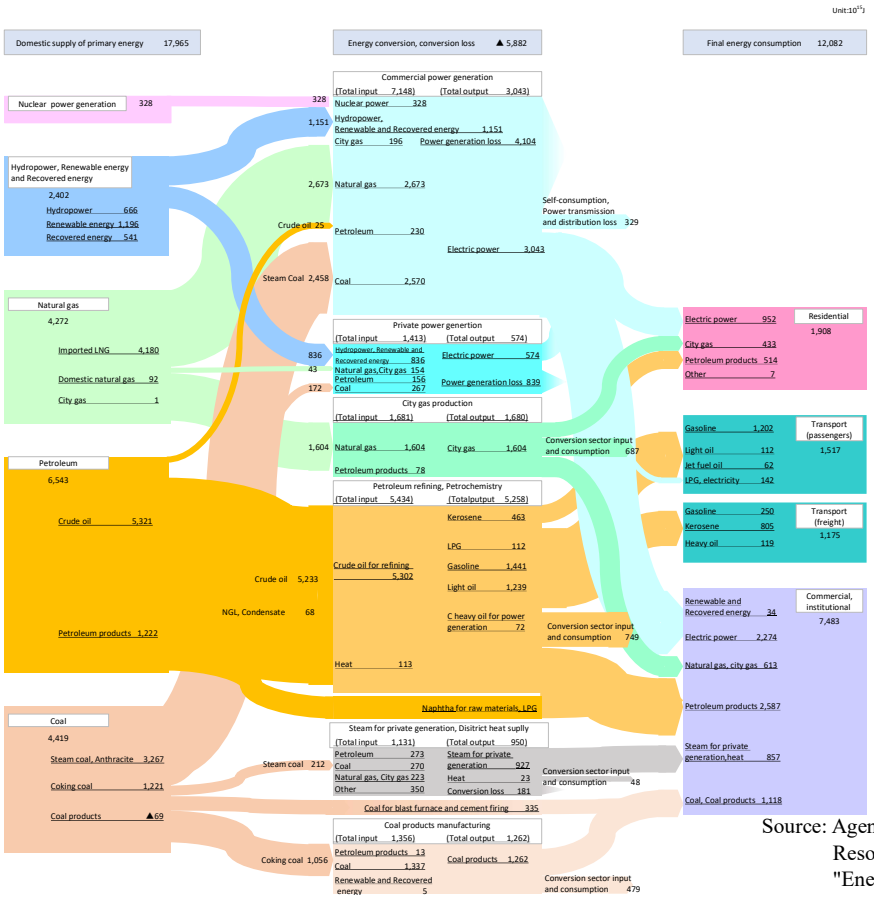
Figure 1-1 Energy-derived CO_2 emissions by country (2020)

Note: The figure indicates the 20 largest emitters, from China (1st place) to Poland (20th place), and other selected major countries.
Sources: IEA, "CO_2 Emissions From Fuel Combustion Highlights (2019 Edition)", and Ministry of the Environment, "Energy-derived CO_2 Emissions in the World"

2 Final Energy Consumption

2.1 Concepts for Calculation

- This chapter clarifies the state of energy consumption as the main cause of CO_2 emissions in Tokyo.
- Figure 2-1 indicates the flow of energy in Japan. First, the primary energy supply of petroleum, coal, natural gas, etc., is undertaken through domestic production or importation. By way of the power generation/conversion sectors (power plants, petroleum refineries, etc.), final energy consumption is undertaken by final demand sectors.
- In this survey, energy consumption excluding the losses in power generation, transmission, distribution, etc. on the final demand sectors (industrial/commercial/residential/transport sectors) (i.e. final energy consumption) in Tokyo is calculated.
- For the calculation methods for final energy consumption, an overview is indicated in Reference Material 1 (pages 34 to 35).



Source: Agency for Natural Resources and Energy, "Energy White Paper 2022"

Figure 2-1 Domestic Energy Balance and Flow (Overview) (FY 2020)

Table 2-1 Heat conversion factors used in this survey (FY 2020)

(Unit: GJ/Specific unit)

Fuel	Specific unit	Heat conversion factor	Remarks
Electricity	MWh	3.6	Secondary energy conversion
City gas	1000 m^3	45.0	See materials of Tokyo Gas
Other fuels (gasoline, kerosene, light oil, LPG, etc.)			See the energy balance table, Agency for Natural Resources and Energy, "Comprehensive Energy Statistics"

Note: Secondary energy conversion is conducted for electricity, from the perspective of calculating final energy consumption, excluding losses in power generation, transmission, distribution, etc.

2.2 Final Energy Consumption

2.2.1 Entire Tokyo

▼ The final energy consumption in Tokyo in FY 2020 stood at 584.4 PJ, which was 27.1% reduction from 802.2 PJ in FY 2000, and 2.1% reduction from 596.7 PJ in FY 2019.

▼ Respective increase rates vs. FY 2000, 9.9% increase in residential sector, for the industrial, commercial and transport sectors stood at -53.5%, -16.1%, and -55.3%.

▼ Since FY 2000, a decrease in fuel oil including gasoline has substantially contributed to overall reduction in final energy consumption. Although electricity consumption had been showing an increasing trend, after FY 2011 and on, the figures are lower than in FY 2000 due to the establishment of power conservation behavior.

▼ The final energy consumption in Tokyo peaked out around FY 2000. * The 3-year moving average peaked out in FY 2001, and the 5-year moving average peaked out in FY 2000.

Table 2-2 Final energy consumption by sector in Tokyo, and increases up to FY 2020

	Final energy consumption (PJ)						Increase rate (%)		
	FY 2000	FY 2005	FY 2010	FY 2015	FY 2019	FY 2020	Vs. FY 2000	Vs. FY 2010	Vs. FY 2019
(Industrial/ commercial sector)	359.3	366.3	339.1	294.0	283.6	265.3	△26.1%	△21.7%	△3.8%
Industrial sector	96.5	73.5	60.9	45.2	45.8	44.8	△53.5%	△26.4%	△2.2%
commercial sector	262.8	292.8	278.2	237.8	237.8	220.5	△16.1%	△20.7%	△7.3%
Residential sector	185.6	198.6	203.2	181.7	189.5	204.0	9.9%	0.4%	7.7%
Transport sector	257.4	218.3	171.5	150.1	123.7	115.1	△55.3%	△32.9%	△7.0%
Final consumption sectors total	802.2	783.3	713.8	625.8	596.7	584.4	△27.1%	△18.1%	△2.1%

Note 1: The residential sector does not include fuel consumption by family cars, which is included in the transport sector.
Note 2: In the transport sector, the scope of calculation for automobiles includes traffic in Tokyo, while that for railway, vessels, and airlines includes service in Tokyo.

Table 2-3 Final energy consumption by fuel type in Tokyo, and increases up to FY 2020

	Final energy consumption (PJ)						Increase rate (%)		
	FY 2000	FY 2005	FY 2010	FY 2015	FY 2019	FY 2020	Vs. FY 2000	Vs. FY 2010	Vs. FY 2019
Electricity	295.9	315.8	323.4	282.2	279.8	277.6	△6.2%	△14.2%	△0.8%
City gas	187.0	211.4	196.8	176.1	176.9	173.7	△7.1%	△11.7%	△1.8%
LPG	32.5	26.2	19.2	15.7	12.5	12.6	△61.4%	△34.6%	0.2%
Fuel oil	285.0	229.6	174.1	151.5	127.2	120.2	△57.8%	△31.0%	△5.5%
Other	1.8	0.3	0.1	0.3	0.3	0.3	△82.3%	121.4%	15.8%
Total	802.2	783.3	713.8	625.8	596.7	584.4	△27.1%	△18.1%	△2.1%

Note: Fuel oils: gasoline, kerosene, light oil, heavy oil A/B/C, and jet fuel; Other: oil coke, coal coke, natural gas, etc.

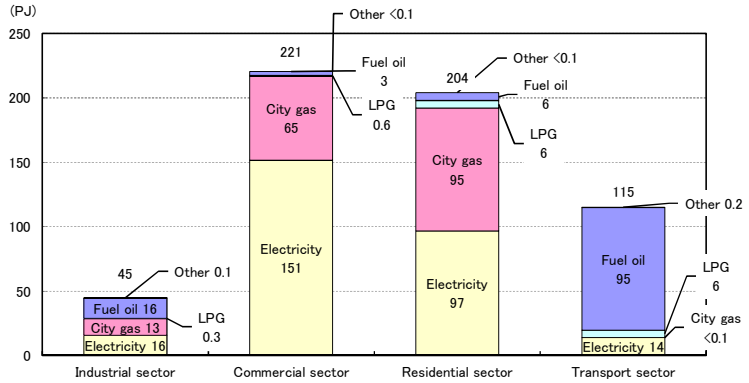


Figure 2-2 Final energy consumption by sector in Tokyo (FY 2020)

2.2.1-1 Final Energy Consumption by Sector in Entire Tokyo

- In the composition in FY 2020, the commercial sector took up the largest share (37.7%), followed by the residential sector (34.9%), transport sector (19.7%), and industrial sector (7.7%).
- As for sectoral trends in the composition since FY 2000, the residential sector indicate an increasing trend, the industrial sector and the transport sector has been showing a decreasing trend, the commercial sector showed an expansion trend in the first half of the 2000s, but has generally leveled off since then.

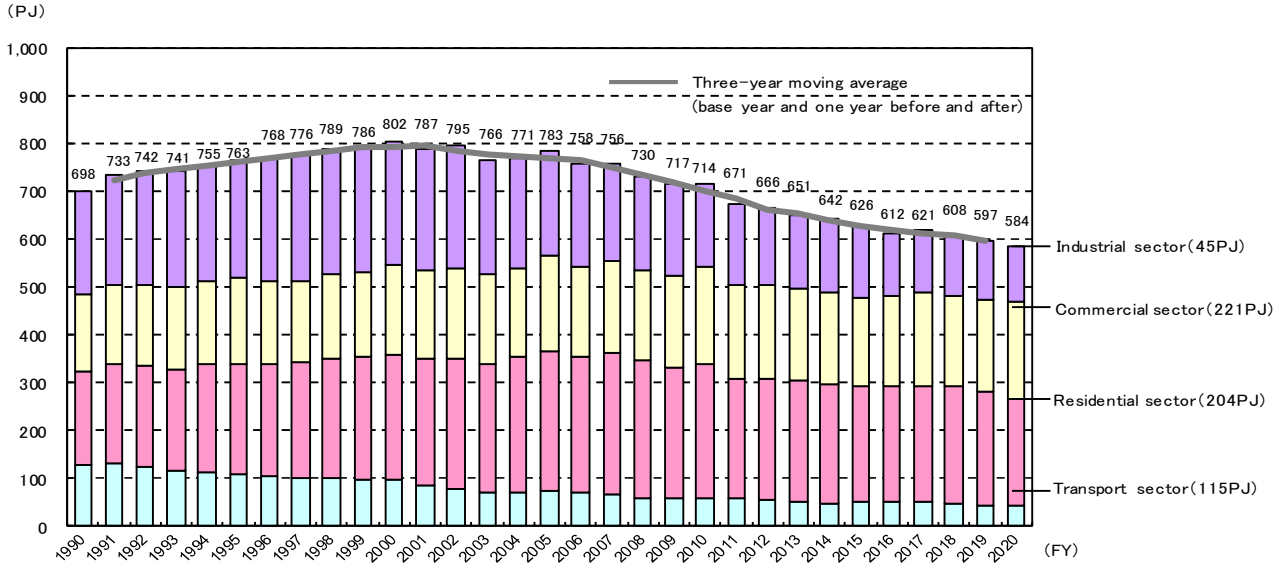


Figure 2-3 Trends in final energy consumption by sector in Tokyo

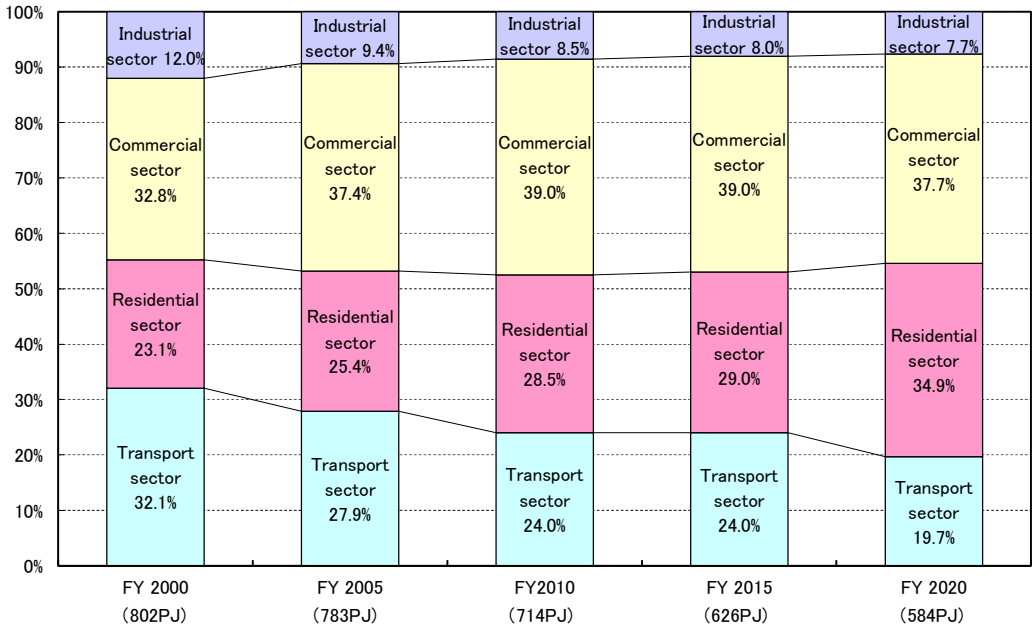


Figure 2-4 Composition ratios in final energy consumption by sector in Tokyo

2.2.1-2 Final Energy Consumption by Fuel Type in Entire Tokyo

- In the fuel type composition in FY 2020, electricity took up the largest share (47.5%), followed by city gas (29.7%) and fuel oil (20.6%).
- The composition of electric power expanded until FY2010, then remained at about the same level, but has expanded since FY2015. The composition of city gas has been expanding moderately.

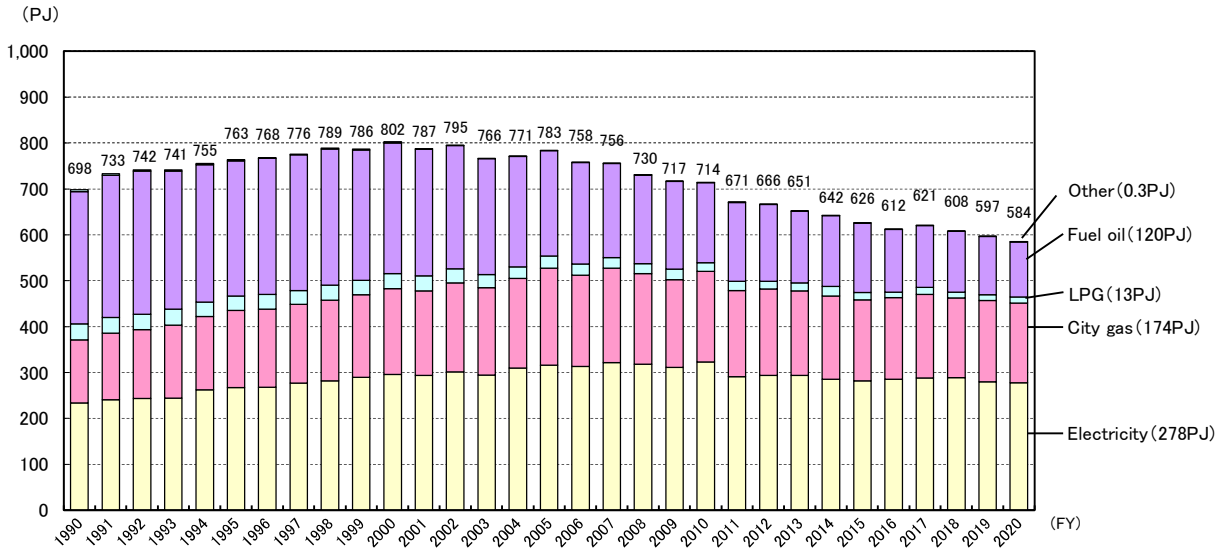


Figure 2-5 Trends in final energy consumption by fuel type in Tokyo

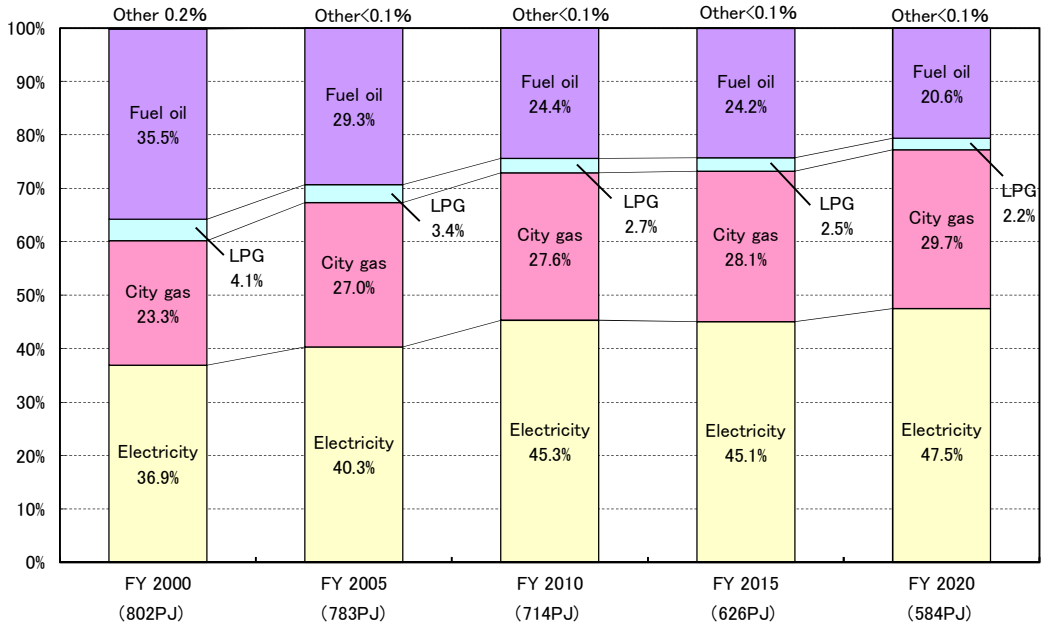


Figure 2-6 Composition ratios in final energy consumption by fuel type in Tokyo

2.2.2 Industrial Sector

▼The final energy consumption in the industrial sector in FY 2020 stood at 45 PJ, which was 53.5% reduction from 96 PJ in FY 2000. This is a 2.2% decrease compared to 46 PJ in FY 2019.

▼Final energy consumption in the industrial sector has been on a decreasing trend since FY 1990.

2.2.2-1 Final energy consumption by trade in the industrial sector

- In the trade composition in FY 2020, manufacturing took up the largest share (68.8%), followed by construction (25.5%), agriculture, forestry and fishery (5.4%), and mining (0.3%).
- Final energy consumption has been continuously decreasing in manufacturing, which accounts for approximately 70% of the industrial sector. In the construction industry, it is on the increasing trend since FY 2014.

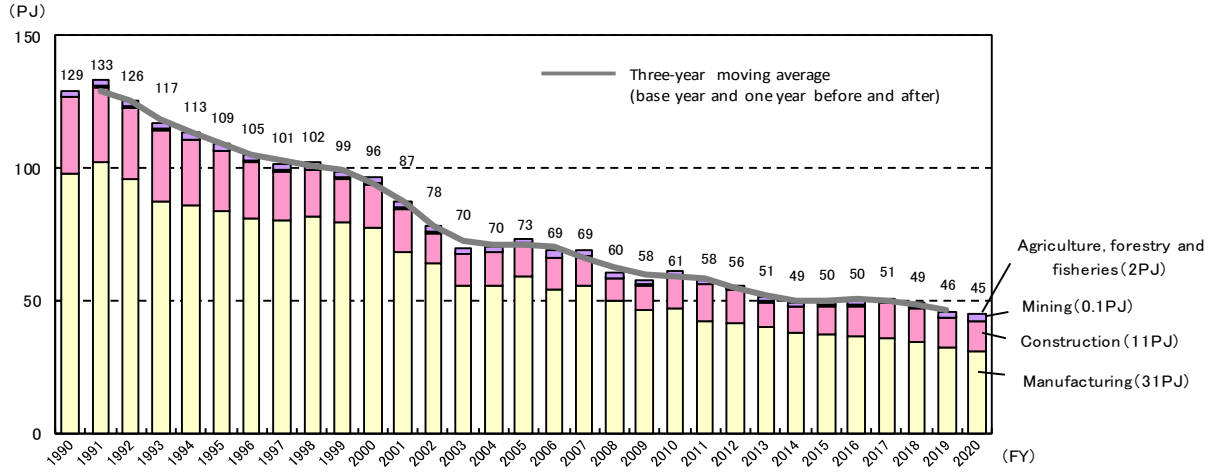


Figure 2-7 Final energy consumption by trade in the industrial sector

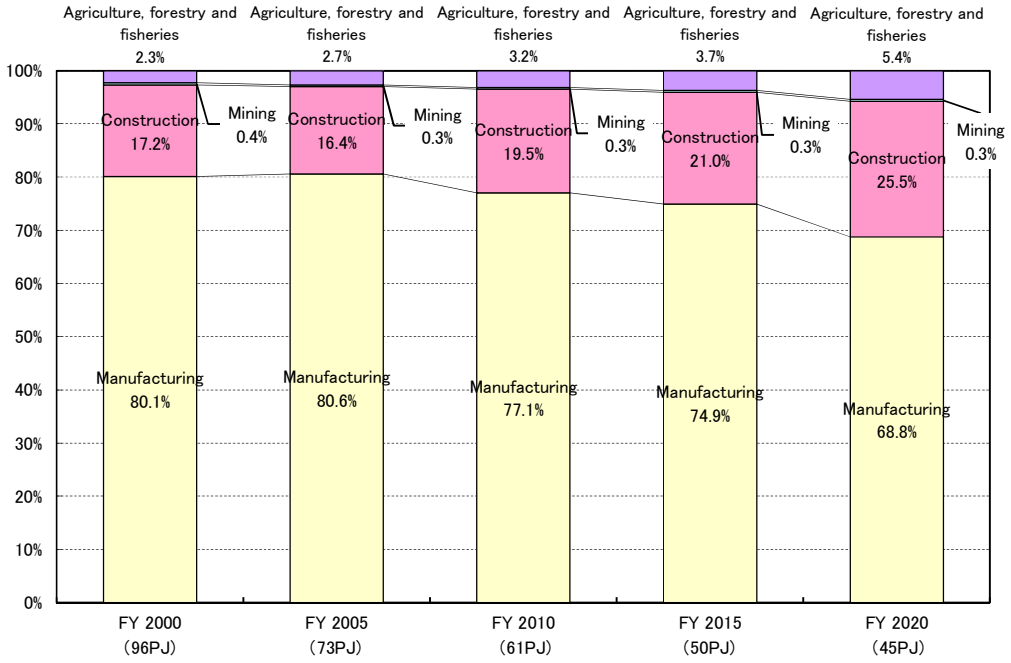


Figure 2-8 Composition ratios in final energy consumption by trade in the industrial sector

2.2.2-2 Final Energy Consumption by fuel type in the Industrial Sector

- In the fuel type composition in FY 2020, fuel oil took up the largest share (35.2%), followed by electricity(34.8%) and city gas (29.1%).
- The composition ratio of fuel oil has been on a increasing trend since FY 2010. On the other hand, composition ratio of electricity, which has been showing an increasing trend since FY 2000, but it remains at the same level in recent years.

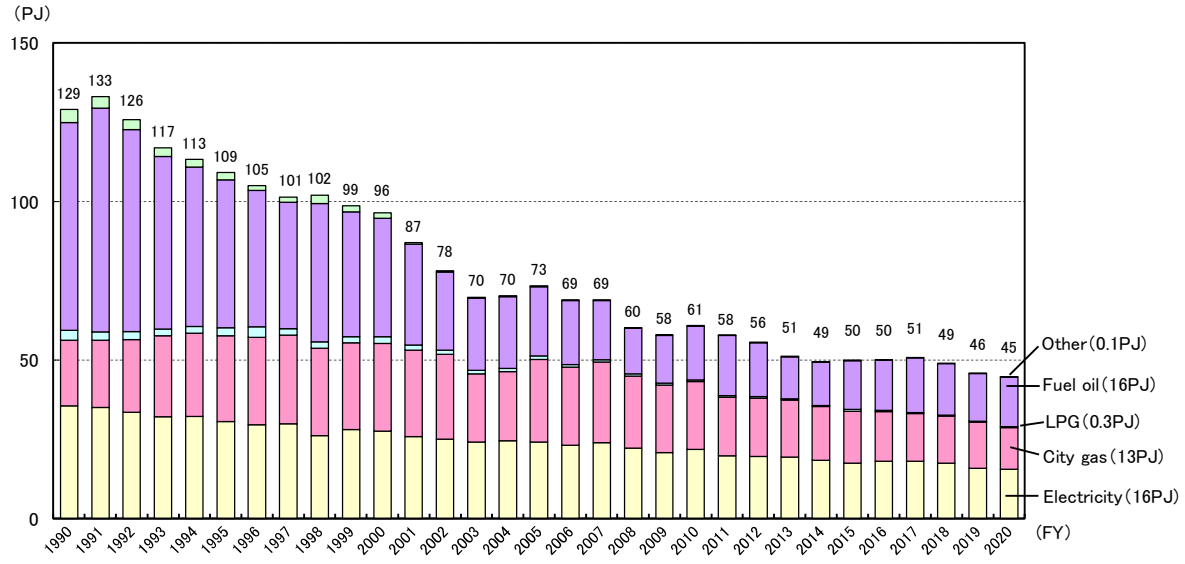


Figure 2-9 Trends in final energy consumption by fuel type in the industrial sector

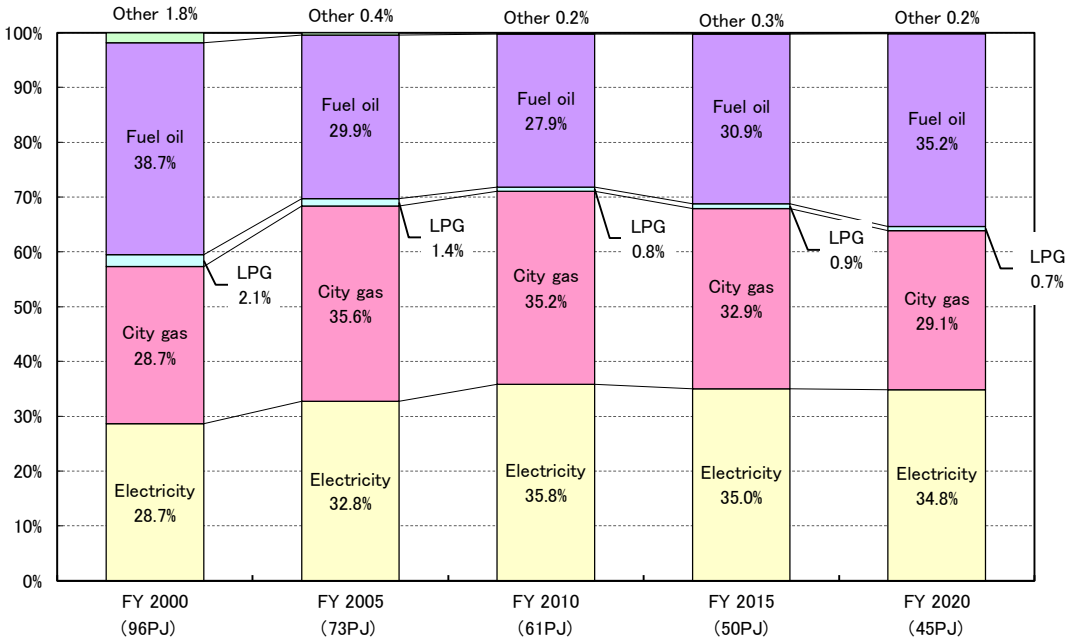


Figure 2-10 Composition ratios in final energy consumption by fuel type in the industrial sector

2.2.2-3 Factor Analysis in the Industrial Sector

- The Indices of Industrial Production (IIP)* for respective trade affect final energy consumption in manufacturing, the main trade in the industrial sector.
- Since FY 1990, IIP increase rates have been generally declining in manufacturing in Tokyo.
- In comparison with the nationwide IIP increase rates, the rates in Tokyo became smaller in FY 1994, and the gap with nationwide rates has become substantial since around FY 1998. Since FY 2008, the trend has been similar to that of the nation as a whole, but since FY 2015, while the national trend has been generally leveling off, the trend has been decreasing in Tokyo.

* The Indices of Industrial Production (IIP) are a systematic representation of various activities related to production, shipment, and inventory of domestic business sites that produce mining and industrial products. The IIP used here refers to production indices weighted by added value, which is calculated for 145 items (412 items for nationwide indices), based on the dynamic statistics of production, the Census of Manufacturers, etc.

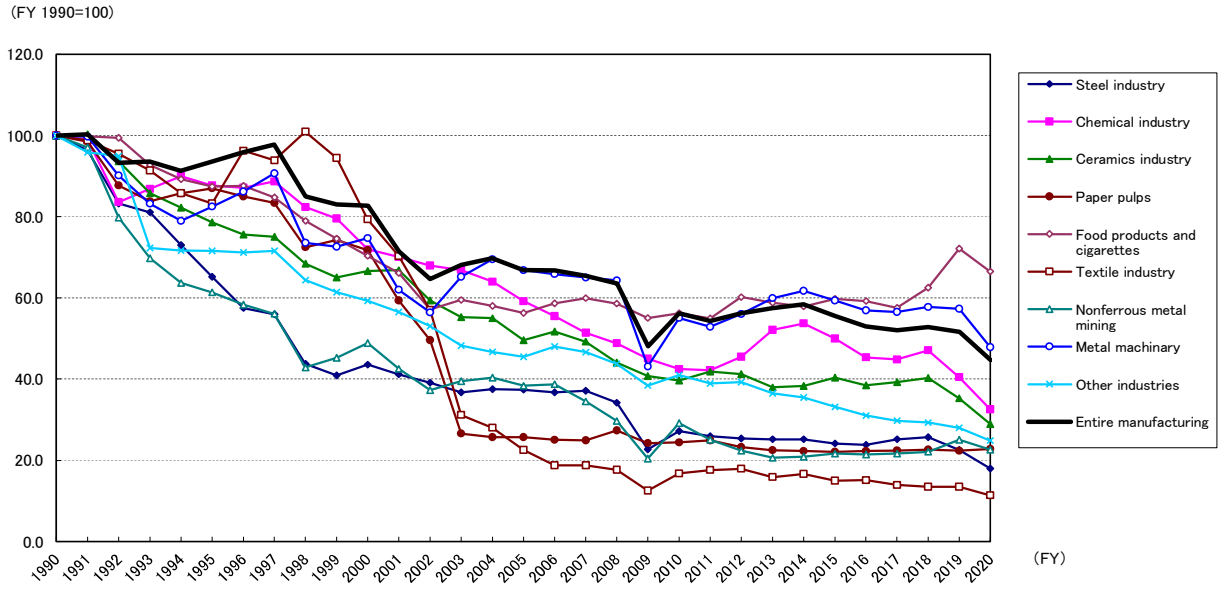


Figure 2-11 IIP increases in manufacturing in Tokyo

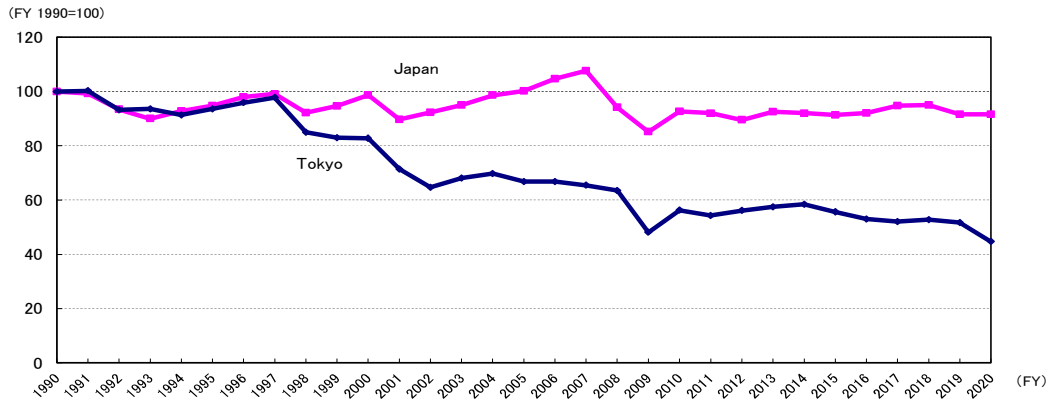


Figure 2-12 Comparison of IIP between Tokyo and Japan

Note: IIP figures are weighted by added value.
Source: Tokyo: Prepared from the Tokyo Metropolitan Government (hereinafter referred to as "TMG"), "Tokyo Industrial Indices"
Japan: Prepared from Energy Data and Modeling Center, the Institute of Energy Economics, Japan "EDMC/Energy Economics Statistics Summary"

2.2.3 Commercial Sector

▼The final energy consumption in the commercial sector in FY 2020 stood at 221 PJ, which was16.1% reduction from 263 PJ in FY 2000, This is a 7.3% decrease compared to 238 PJ in FY 2019.

▼ Final energy consumption in the commercial sector has been on an increasing trend since FY1990, but peaked around FY 2007 and has been on a declining trend since then.

2.2.3-1 Final Energy Consumption by Building Application in the Commercial Sector

- In the building application composition in FY 2020, office buildings took up the largest share (61.4%). Other applications included restaurants (8.5%), schools (7.5%), hotels (6.5%), etc.
- Since FY 2000, the share of office buildings has been rising. This indicates the structural characteristics of Tokyo, where the corporate head office buildings, tenant buildings, etc., are accumulated.

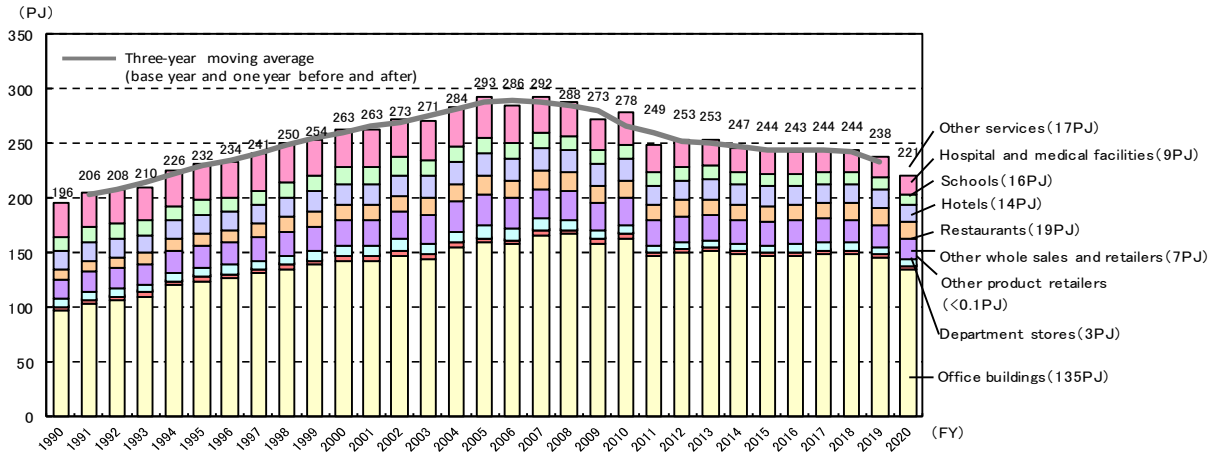


Figure 2-13 Trends in final energy consumption by building application in the commercial sector

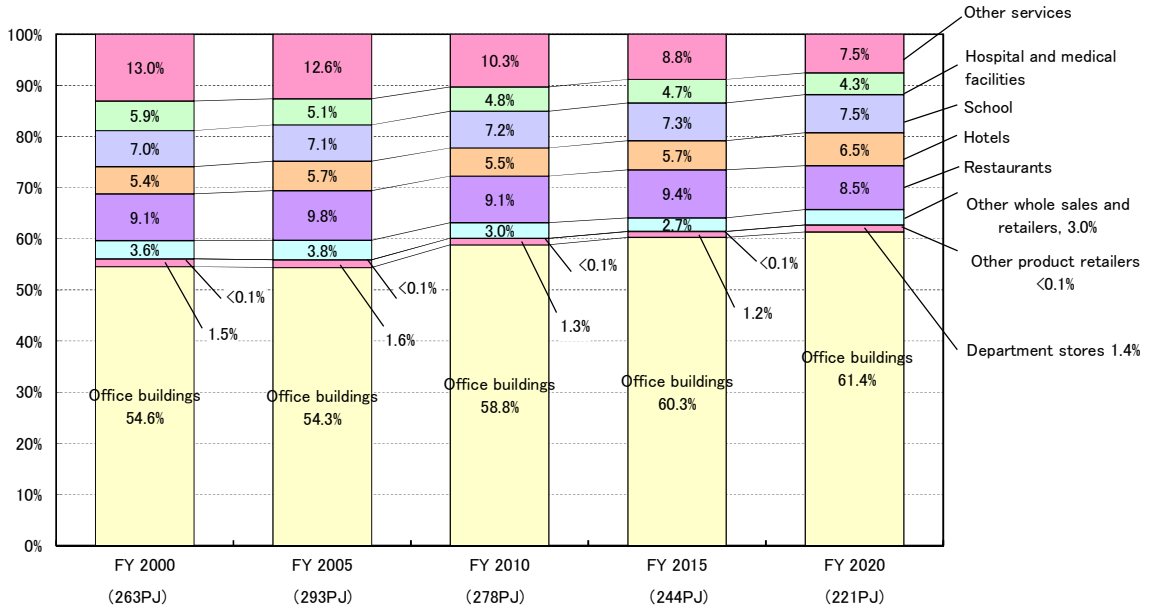


Figure 2-14 Composition ratios in final energy consumption by building application in the commercial sector

2.2.3-2 Final Energy Consumption by Fuel Type in the Commercial Sector

- In the fuel type composition in FY 2020, electricity (68.6%) and city gas (29.6%) combined accounted for 98.3% of the entire commercial sector.
- Since FY2000, the composition ratio of fuel oil has been shrinking, reflecting the reality that the shift from fuel oil to electricity and city gas has been progressing.

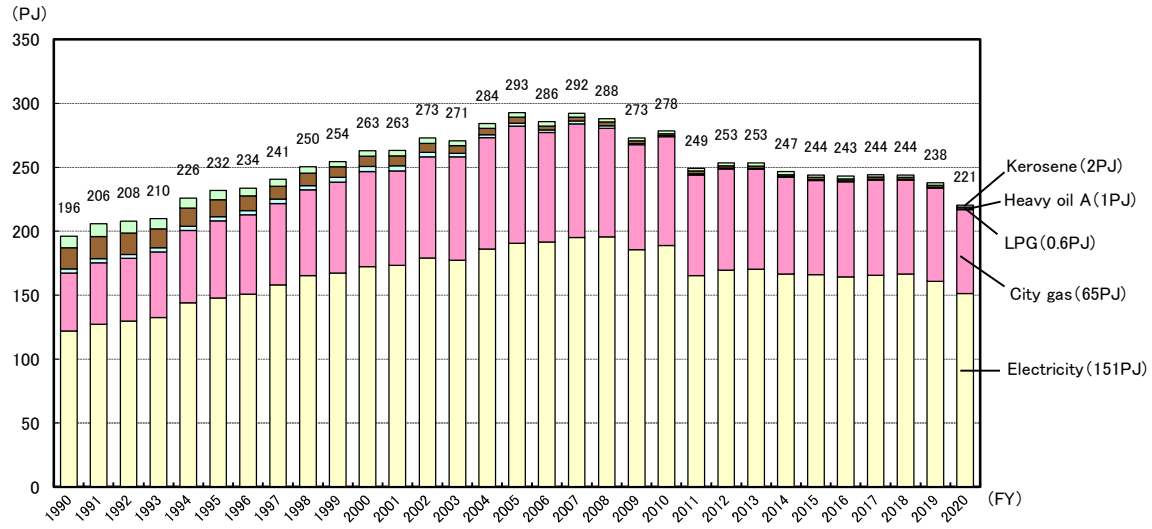


Figure 2-15 Trends in final energy consumption by fuel type in the commercial sector

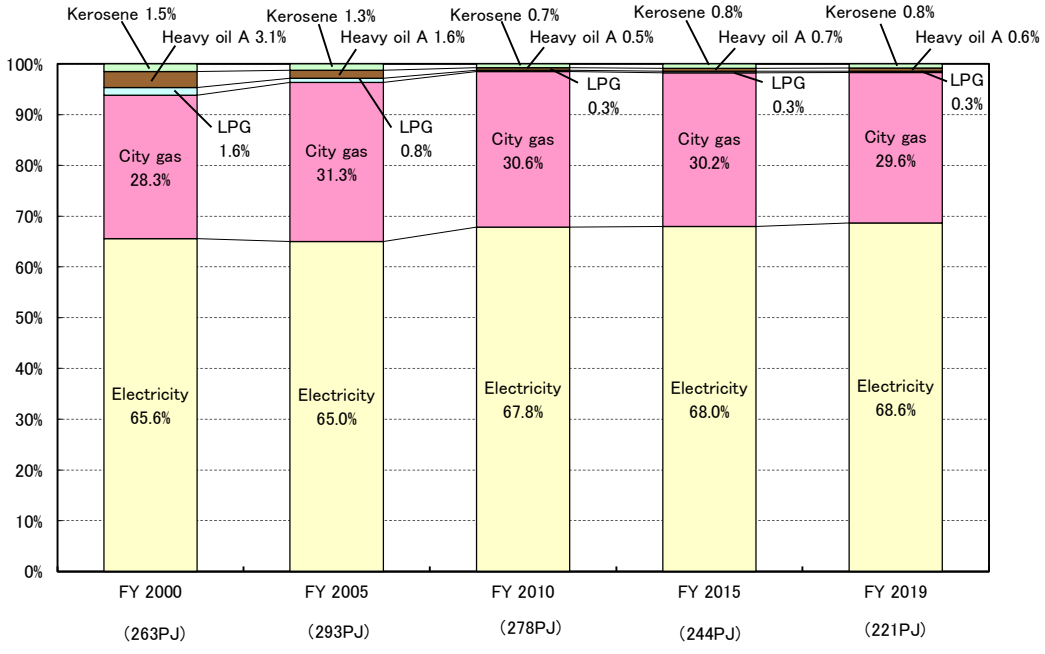


Figure 2-16 Composition ratios in final energy consumption by fuel type in the commercial sector

2.2.3-3 Factor Analysis in the Commercial Sector

- The total floor area by building application is an index that affects final energy consumption in the commercial sector.
- Since FY 1990, the total floor area has been increasing in the commercial sector. While the total floor area in the commercial sector is generally increasing across Japan, the remarkably high rate of office buildings is characteristic in Tokyo.
- The total floor area of office buildings in Tokyo has been steadily increasing since FY 1990.

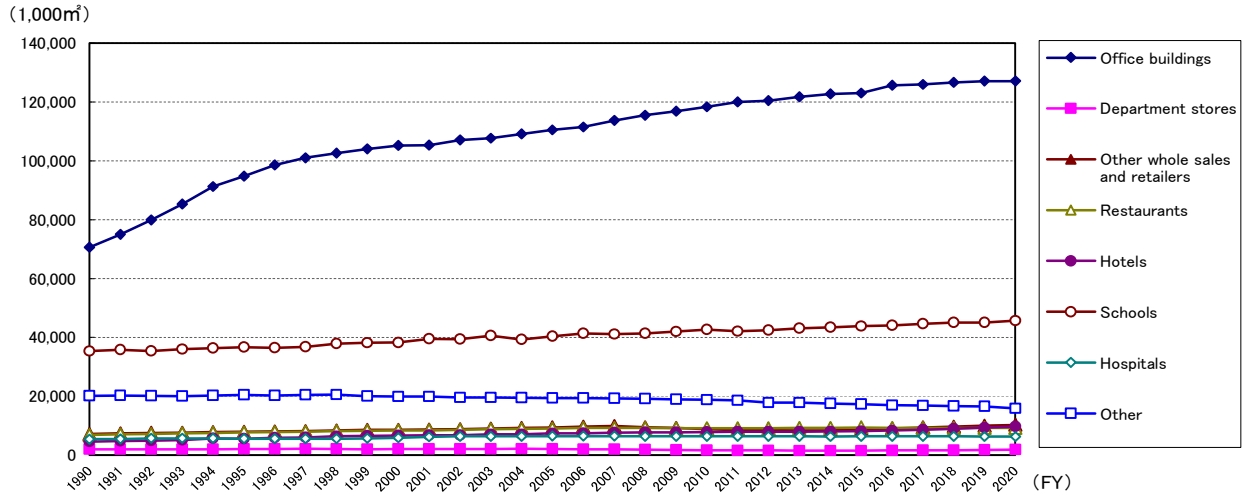


Figure 2-17 Trends in total floor area by trade in Tokyo

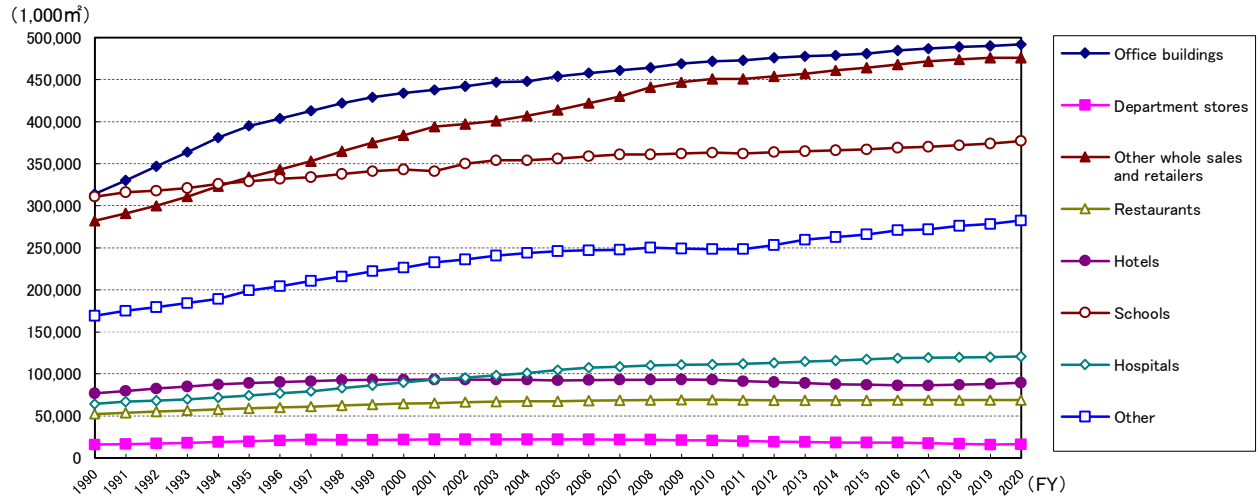


Figure 2-18 Trends in total floor area by trade in Japan

Note: "Department stores" include large-scale retail stores and supermarkets.
Source: Prepared from Energy Data and Modeling Center, the Institute of Energy Economics, Japan "EDMC/Energy Economics Statistics Summary"

2.2.4 Residential Sector

▼The final energy consumption in the residential sector in FY 2020 stood at 204 PJ, which was 9.9% increase from 186 PJ in FY 2000, and 7.7% increase from 189 PJ in FY 2019.

▼Final energy consumption in the residential sector has been on an increasing trend since FY1990, and has been on a downward trend since FY 2011, but has bottomed out in recent years. In FY2020, however, it increased due to an increase in home time caused by the spread of new coronavirus infections.

2.2.4-1 Final Energy Consumption by Household Type in the Residential Sector

- In the household type composition in FY 2020, multiple-person households accounted for 63.7%, while single-person households made up 36.3%.
- The share of single-person households has been increasing in final energy consumption, indicating increase in aged single-person households, etc.

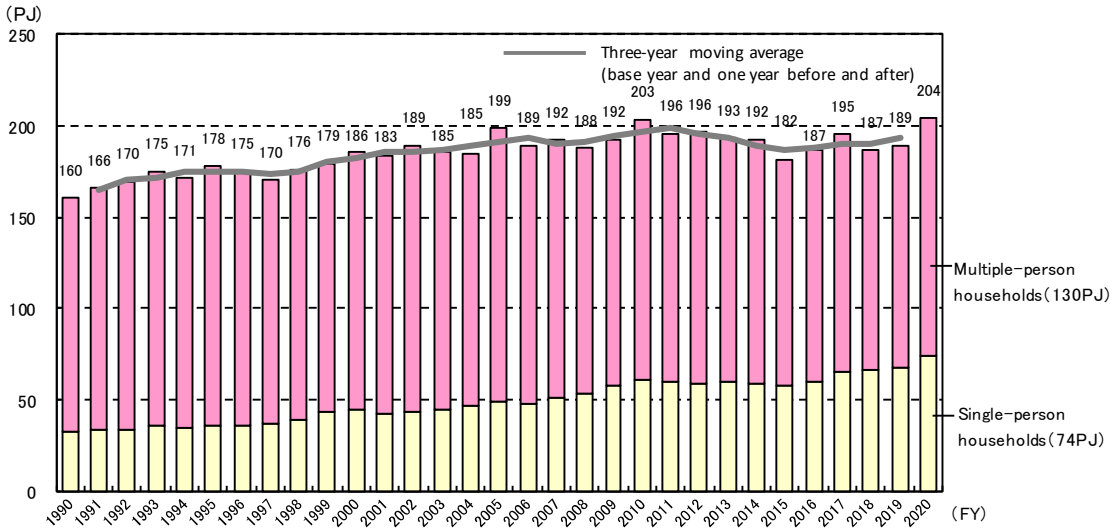


Figure 2-19 Trends in final energy consumption by household type in the residential sector

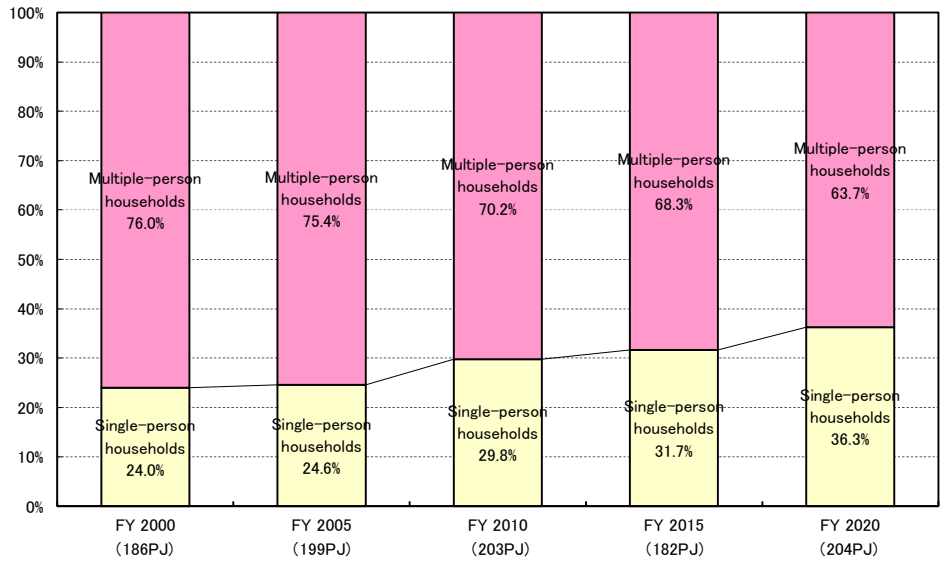


Figure 2-20 Composition ratios in final energy consumption by household type in the residential sector

2.2.4-2 Final Energy Consumption by Fuel Type in the Residential Sector

- In the fuel type composition in FY 2020, electricity (47.4%) and city gas (46.7%) combined accounted for 94.2% of the entire residential secto.
- Although the share of electricity had been increasing, power conservation behavior took roots after the Great East Japan Earthquake. In the meantime, the share of city gas extended 2.3 points from FY 2010 level in FY 2020.

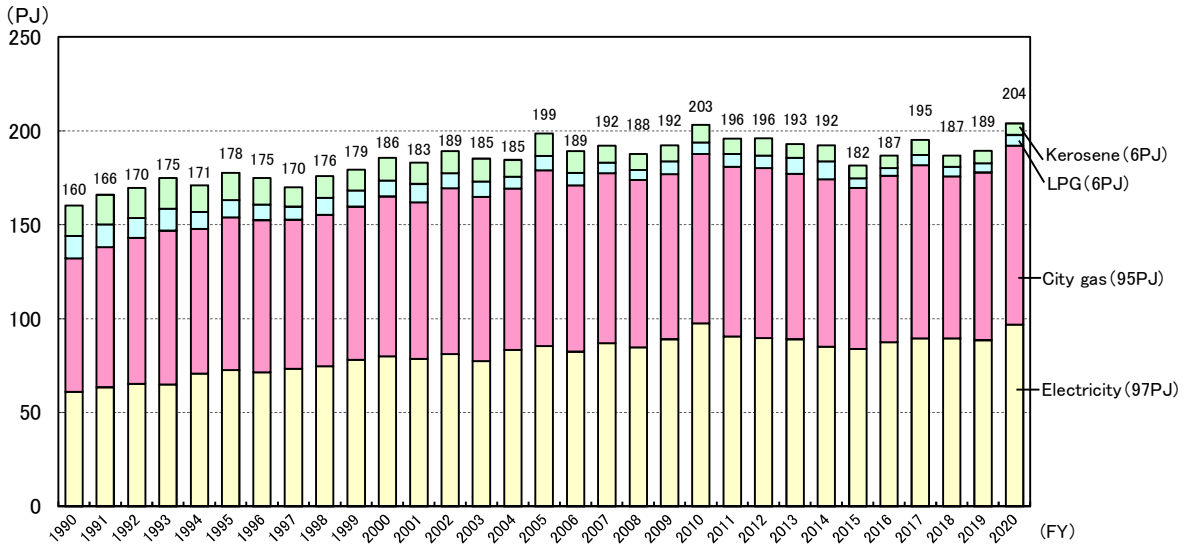


Figure 2-21 Trends in final energy consumption by fuel type in the residential sector

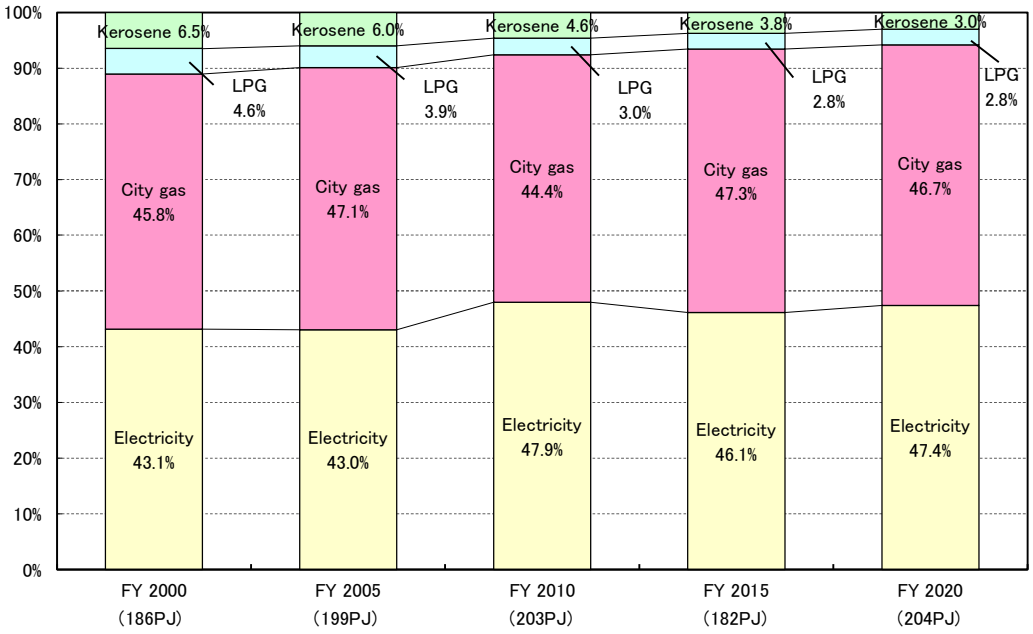


Figure 2-22 Composition ratios in final energy consumption by fuel type in the residential sector

2.2.4-3 Factor Analysis in the Residential Sector

- The number of households is an index that affects final energy consumption in the residential sector.
- Since FY 1990, an increasing trend is more remarkable in single-person households than in multiple-person households. In addition, the proportion of the number of single-person households in Tokyo is larger than in Japan.

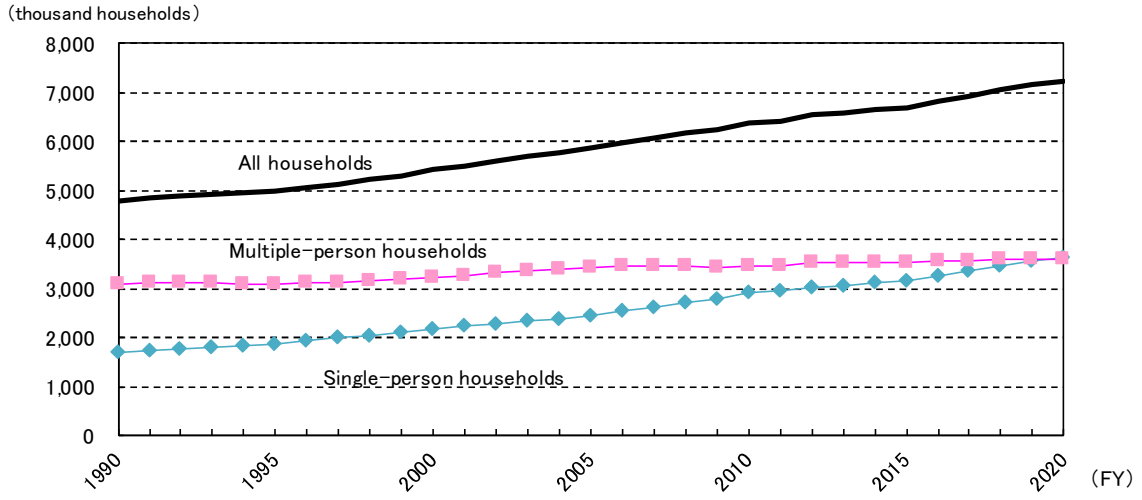
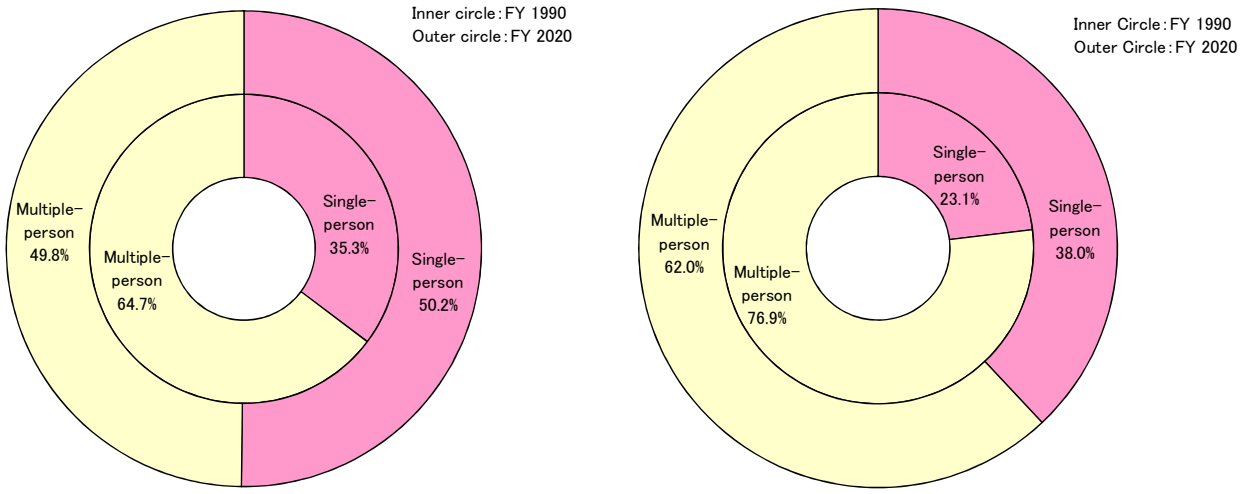


Figure 2-23 Trends in the number of households in Tokyo

Source: Prepared from Ministry of Internal Affairs and Communications (hereinafter referred to as "MIC"), "Census Report" and TMG, "Tokyo Statistical Yearbook"



Tokyo Japan

Figure 2-24 Comparison of the proportion of single-person and multiple-person households between Tokyo and Japan

Source: Prepared from MIC, "Census Report"

- The home appliance ownership rates are indices related to the shares of power consumption in the residential sector.
- In general, ownership rates of major home appliances have been increasing in Tokyo. In FY 2020, in comparison with FY 2000, the ownership rates of room air conditioners, PCs, toilets with warm water bidet, clothes dryers, etc. have remarkably increased, as it reflects the growing needs for the comfort and convenience of life.

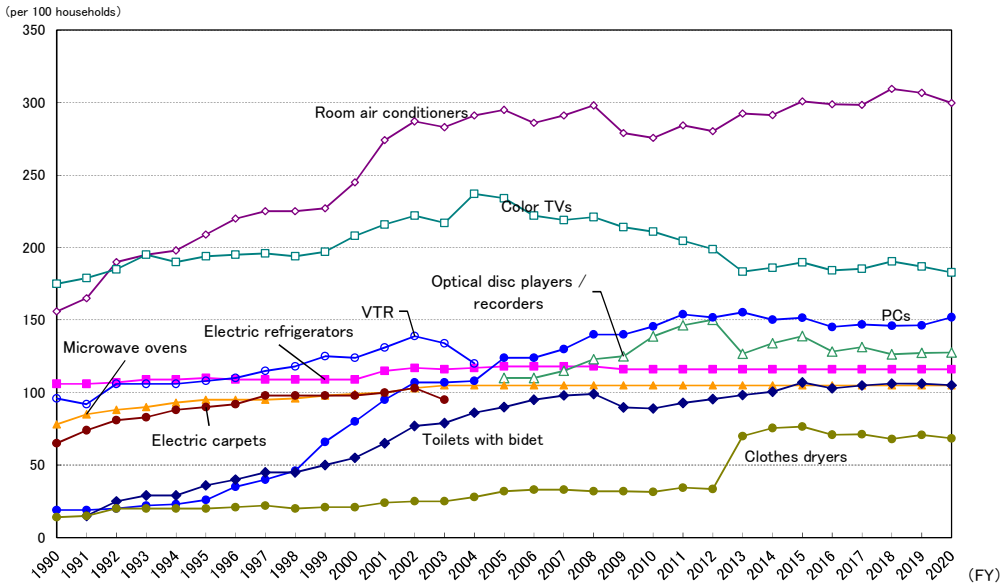


Figure 2-25 Trends in the ownership rates of home appliances in Tokyo

Note: The values for color TVs indicate the total of 29" or larger and below 29" for up to FY 2003, and the total of CRT and flat-screen (LCD, plasma, etc.) for FY 2004 and after.
Some equipment is not continuous due to equipment review by source documents.
Source: Prepared from MIC "National Consumption Survey" and Cabinet Office "Trends in Household Consumption"

Reference Data 1: Trends in energy consumption per household

(GJ/household)

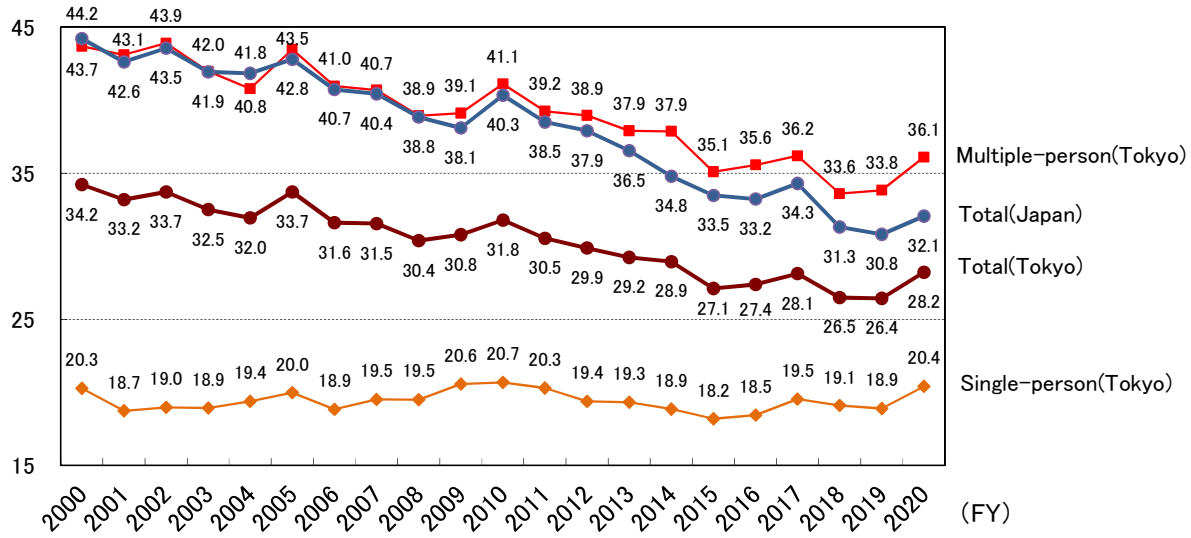


Figure 2-26 Comparison of energy consumption per household in Tokyo with Japan

Source: Prepared from TMG, "Tokyo Statistical Yearbook" and MIC, "Population, demographics and the number of households based on the Basic Resident Register"

Reference Data 2: Progress of energy saving for household electrical appliances

(1) Air Conditioners

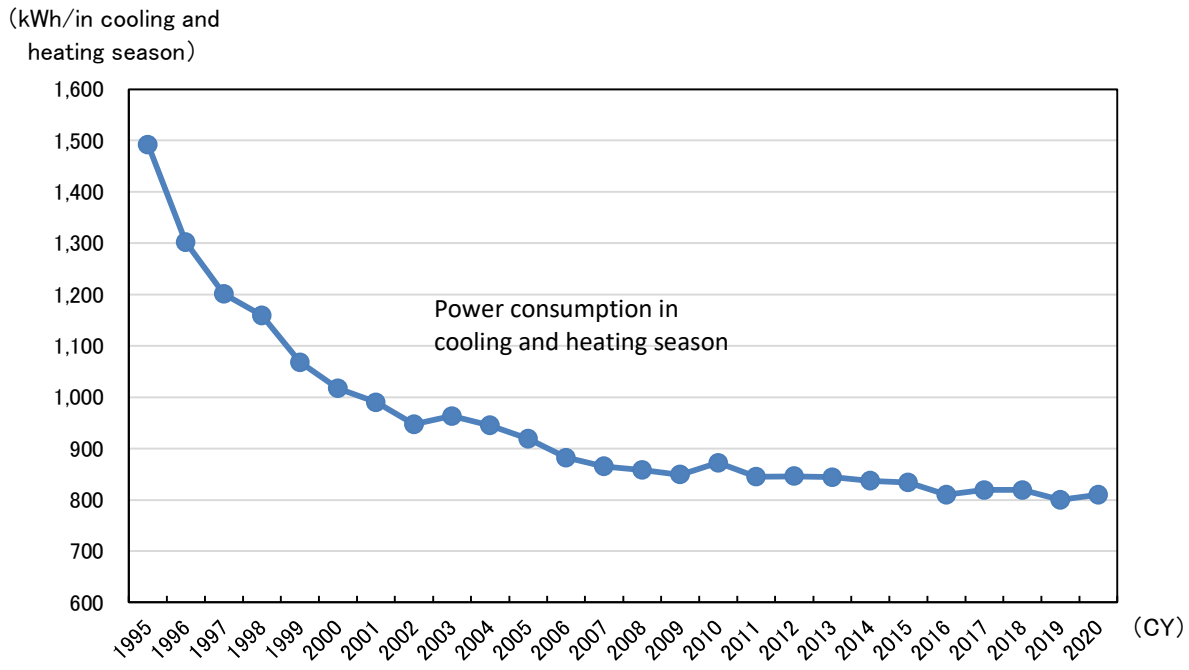


Figure 2-27 Progress of energy saving for air conditioners

Note: Simple average of the wall-mounted representative models with heating and cooling combined, cooling capacity of 2.8kW, and energy-saving function
Source: Prepared from Energy Data and Modeling Center, the Institute of Energy Economics, Japan "EDMC/Energy Economics Statistics Summary"

(2) Electric Refrigerators

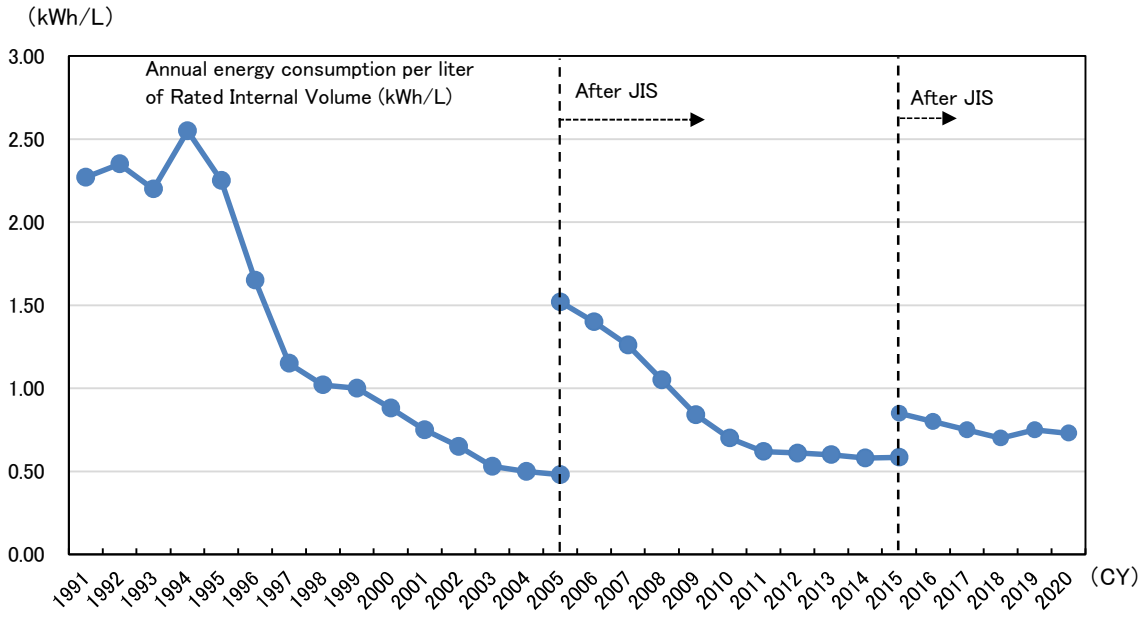


Figure 2-28 Progress of energy saving for electric refrigerators

Note: Average of the products from each company, corresponding to rated capacity of 401-450 liters since 2004
Source: Prepared from Energy Data and Modeling Center, the Institute of Energy Economics, Japan "EDMC/Energy Economics Statistics Summary"

2.2.5 Transport Sector

▼The final energy consumption in the transport sector in FY 2020 stood at 115 PJ, which was 55.3% reduction from 257 PJ in FY 2000, and 7.0% reduction from 124 PJ in FY 2019.

▼ Final energy consumption in the transport sector has been decreasing since FY 2000.

2.2.5-1 Final Energy Consumption by Means of Transportation in the Transport Sector

- In the composition in FY 2020 by means of transportation, road transportation took up the largest share (86.9%). Other means included railways (12.0%), navigation (0.8%), and civil aviation (0.2%).
- Road transportation accounts for approximately 90% of the transport sector. In addition to the decreased traffic in Tokyo, road conditions have been improved, and performance of individual automobiles have been enhanced, thereby improving the actual mileage, and leading to the continuous decrease in final energy consumption.

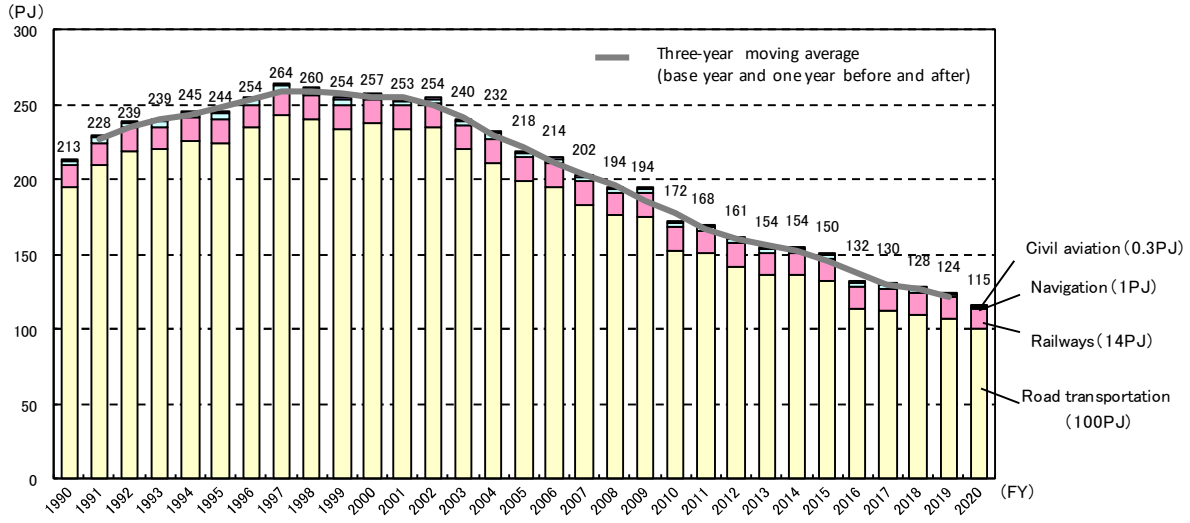


Figure 2-29 Trends in final energy consumption by means of transportation in the transport sector

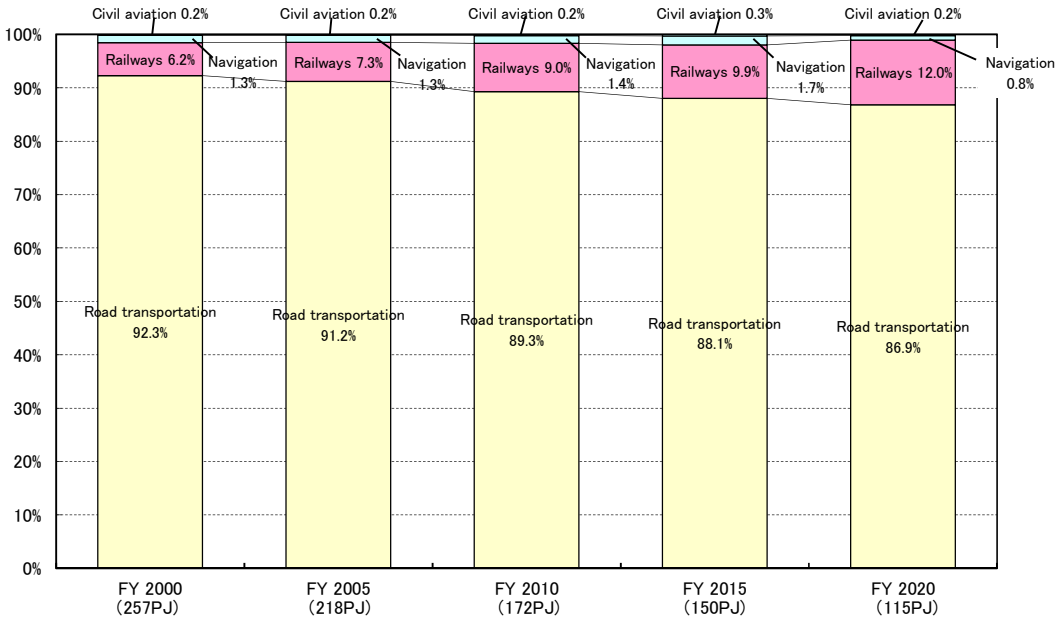


Figure 2-30 Composition ratios in final energy consumption by means of transportation in the transport sector

2.2.5-2 Final Energy Consumption by Fuel Type in the Transport Sector

- In the fuel type composition in FY 2020, gasoline contained in fuel oil took up the largest share (55.0%), followed by light oil (26.6%) and electricity consumed by railroad (12.0%).
- Since FY 2005, the share of gasoline has been decreasing.

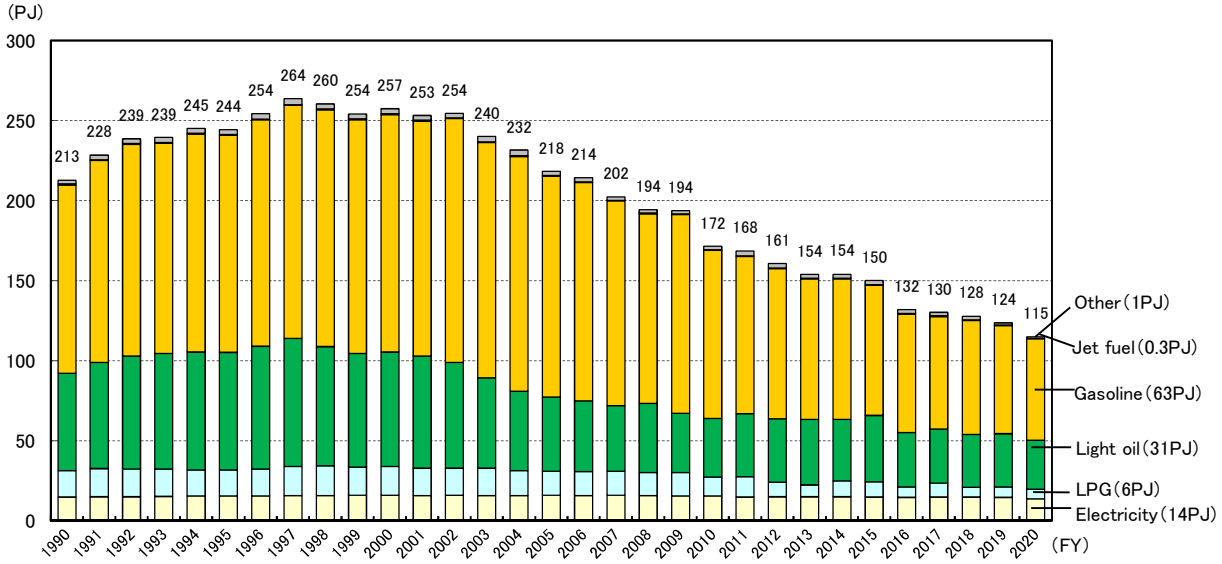


Figure 2-31 Trends in final energy consumption by fuel type in the transport sector

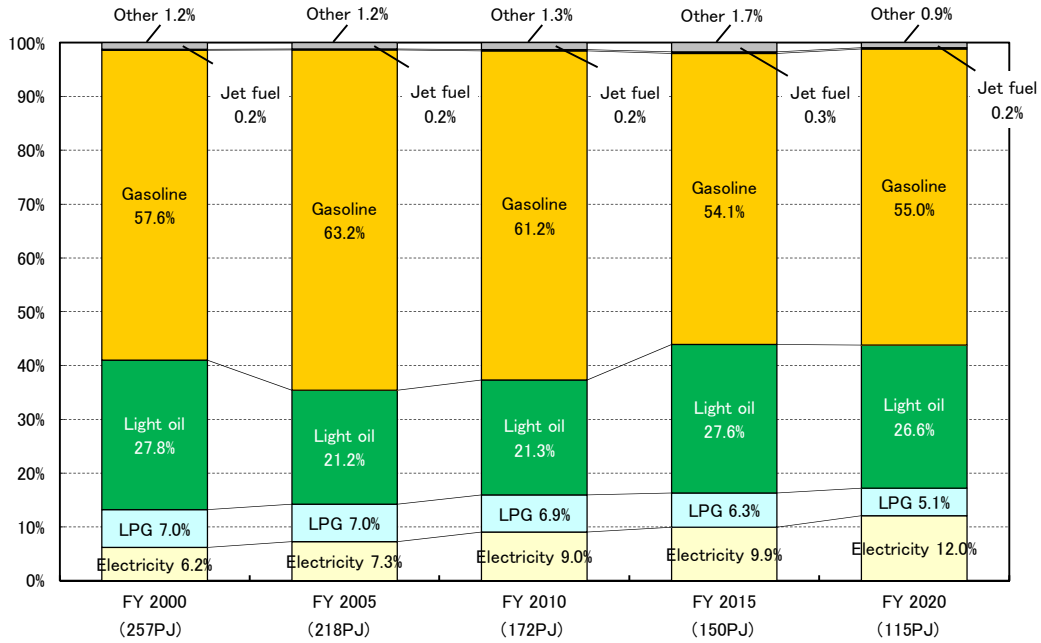


Figure 2-32 Composition ratios in final energy consumption by fuel type in the transport sector

2.2.5-3 Factor Analysis in the Transport Sector

- The number of registered vehicles and the traffic are indices that affect final energy consumption by road transportation, the main means of transportation in the transport sector.
- For the numbers of registered vehicle in Tokyo, those of passenger cars and light cars have been increasing, while those of compact passenger cars and freight vehicles have been decreasing. The overall number remains mostly at the same level, with a slight decrease.
- The traffic of passenger vehicles in Tokyo had been increasing until FY 2000, and then took a downturn. In the meantime, freight vehicles have been slowly decreasing since FY 1990.

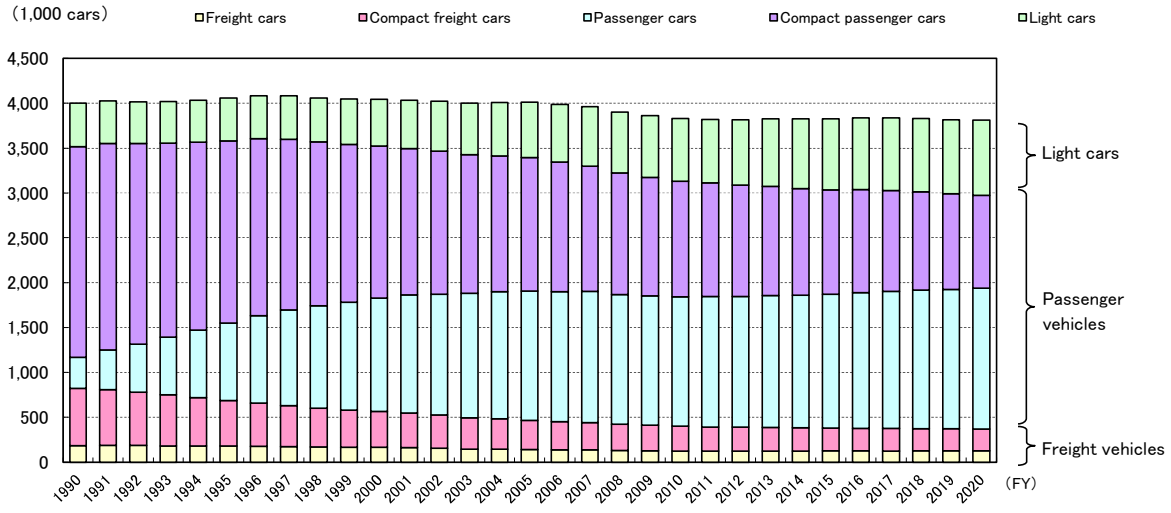


Figure 2-33 Trends in the number of registered vehicles in Tokyo

Note: "Light cars" include light passenger cars and light freight cars.
Sources: TMG "Tokyo Statistical Yearbook"
Registered Vehicles Based on Materials of the Road Transport Bureau, Ministry of Land, Infrastructure, Transport and Tourism (hereinafter referred to as "MLIT"), March 2016 (Automobile Inspection & Registration Information Association)

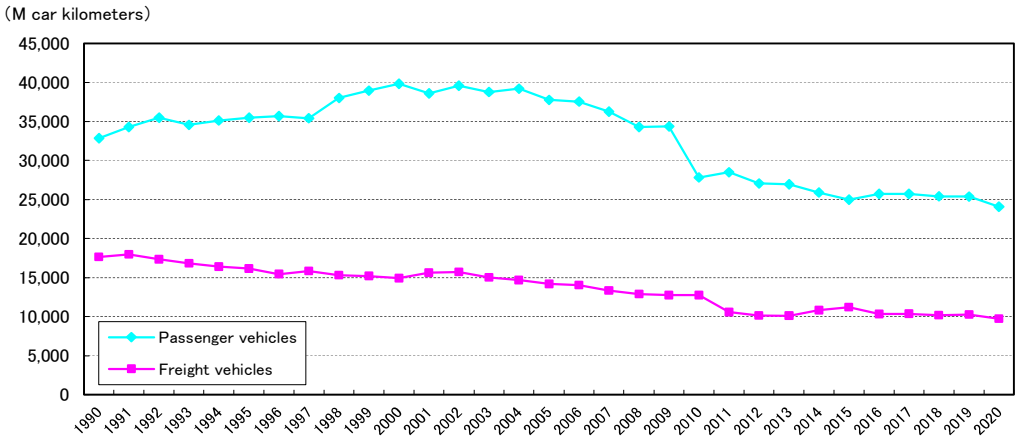


Figure 2-34 Trends in the traveling kilometers of vehicles in Tokyo

Note: Passenger vehicles: light passenger cars, compact passenger cars, passenger cars, and buses
Freight vehicles: light freight cars, compact freight cars, freight/passenger cars, freight cars, and special freight cars

3 Total Greenhouse Gas Emissions

3.1 Concepts for Calculation

3.1.1 Basic Matters

- This chapter clarifies the status of GHG emissions in Tokyo.
- The scope of GHGs includes carbon dioxide (CO_2), methane (CH_4), dinitrogen oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3). These seven types of gas are defined in the Act on Promotion of Global Warming Countermeasures.
- The GHGs other than CO_2 (CH_4, N_2O, HFCs, PFCs, SF_6, NF_3) are referred to as "Other GHGs".
- In this survey, the values are calculated based on the Ministry of the Environment, "Manual for Formulating Action Plans (Regional Measures) for Municipal Governments against Global Warming". This manual describes calculation methods for GHG emissions in each prefecture. Calculation methods used here reflect the actual status in Tokyo more accurately, incorporating information and findings that have been uniquely collected by TMG.
- For the calculation methods for GHG emissions in this survey, an overview is indicated in Reference Material 1 (pages 34 to 35).

Table 3-1 GHGs and main source(s) of emission

GHG		Global warming potential	Main source(s) of emission
CO_2	Carbon dioxide	1	Combustion of fuel, incineration of waste, industrial process, etc.
CH_4	Methane	25	Agriculture, waste, industrial process, combustion of fuel, leak from fuel, etc.
N_2O	Dinitrogen oxide	298	Agriculture, waste, industrial process, combustion of fuel, leak from fuel, etc.
HFCs	Hydrofluorocarbons	12 to 14,800	Coolant, foaming agent, heat insulation material, aerosol and MDI, etc.
PFCs	Perfluorocarbons	7,390 to 12,200	Solvents, manufacturing of semiconductors and LCDs, etc.
SF_6	Sulfur hexafluoride	22,800	Electrical equipment using insulating gas, manufacturing of semiconductors and LCDs, etc.
NF_3	Nitrogen trifluoride	17,200	Leak from manufacturing of NF_3, manufacturing of semiconductors and LCDs, etc.

Note: The "Global Warming Potential (GWP)" is a factor of the extent of greenhouse effect of a GHG, indicated in proportion to the extent of greenhouse effect of CO_2. The values indicated here are based on the Fourth Assessment Report (2007) by the Intergovernmental Panel on Climate Change (IPCC).

3.1.2 Categorization of GHGs

- GHGs are categorized into CO_2 and other GHGs. CO_2 is further categorized into energy-derived CO_2 emissions and non-energy-derived CO_2 emissions.
- "Energy-derived CO_2 emissions" refers to CO_2 that are generated through final energy consumption of electricity, etc. In this survey, non-energy-derived CO_2 emissions include CO_2 derived from incineration of waste.

Table 3-2 Categorization of carbon dioxides

Categorization	Targeted sector
Energy-derived CO_2 emissions	Final demand sectors * The amount of emission from the final energy consumption of respectively for the industrial, commercial, residential, and transport sectors
Non-energy-derived CO_2 emissions	Waste sector * The amount of emission from the incineration of waste is calculated.

3.1.3 CO_2 Emission Factor for Electricity

- The CO_2 emission factor for electricity changes every year, based on the power supply mix on the supply side.
- In this survey, "variable cases" are calculated by applying yearly emission factors for the purpose of incorporating the influence of variation in power supply mix.
- For calculation, the yearly emission factor is used for General Electricity Utility, and the yearly average emission factor is used for Power Producer and Suppliers (PPS).

Table 3-3 CO2 emission factors for electricity

(Unit: kg-CO_2/kWh)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Electricity（TEPCO）	0.380	0.385	0.390	0.367	0.378	0.358	0.336	0.335	0.315	0.326	0.328	0.317	0.381	0.461
Electricity (Average for other electricity utilities)											0.493	0.454	0.442	0.432
All power supplies in Tokyo (average)	0.380	0.385	0.390	0.367	0.378	0.358	0.336	0.335	0.315	0.326	0.328	0.318	0.381	0.460

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Electricity（TEPCO）	0.381	0.368	0.339	0.425	0.418	0.384	0.375	0.464	0.525	0.531	0.505	0.500	0.486	0.475
Electricity (Average for other electricity utilities)	0.448	0.460	0.447	0.480	0.446	0.464	0.420	0.412	0.429	0.425	0.433	0.431	0.436	0.450
All power supplies in Tokyo (average)	0.383	0.372	0.345	0.428	0.420	0.388	0.378	0.461	0.519	0.523	0.499	0.492	0.479	0.470

	2018	2019	2020
Electricity（TEPCO）	0.468	0.458	0.442
Electricity (Average for other electricity utilities)	0.449	0.420	0.416
All power supplies in Tokyo (average)	0.463	0.448	0.434

Note: "Average" refers to the weighted average calculated in this survey is used, based on emission factors and sold electricity of electricity utilities that supply power in Tokyo.

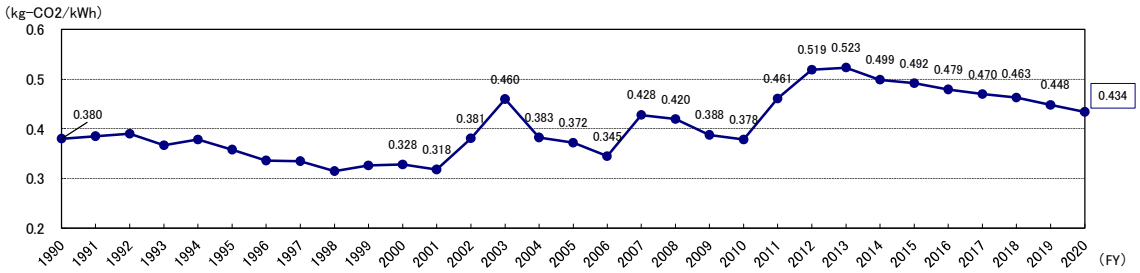


Figure 3-1 Trends in CO_2 emission factors for electricity

3.1.4 Scope of Calculation

- Most agricultural, forestry and fishery products, industrial products, etc., that are supplied in Tokyo are produced outside Tokyo, and therefore CO_2 emissions from such activities occur outside Tokyo. Such CO_2 emissions are excluded from this survey.
- CO_2 emissions through power consumption are calculated using emission factors at sale, and include emissions during power generation outside Tokyo (these emissions are allocated to the final demand sectors in accordance with the amount of power consumption).

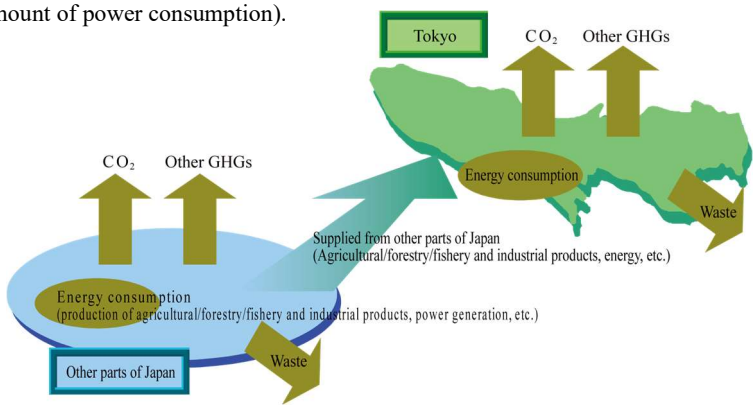


Figure 3-2 Image of GHG emissions in Tokyo

3.2 Total Greenhouse Gas Emissions

3.2.1 Entire Tokyo

▼ The total GHG emissions in FY 2020 stood at 60.1 million tons of CO_2 equivalent. This is 3.4% decrease from 62.2 million tons in FY 2000, and 3.0% decrease from 62.0 million tons in FY 2019.

▼ The total GHG emissions in Tokyo had been increasing until FY 2012, and then took a downturn.

Table 3-4 Trends in total GHG emissions in Tokyo

(Unit: 10,000 t-CO_2 eq)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
CO_2	5,458	5,748	5,869	5,687	5,925	5,830	5,698	5,759	5,684	5,775	5,895	5,675	6,265	6,716
CH_4	221	226	229	231	231	227	217	201	181	159	139	121	104	90
N_2O	85	91	92	83	87	92	96	98	98	101	99	95	95	93
HFCs						34	49	63	71	71	78	84	93	103
PFCs						32	33	40	35	9	5	4	4	4
SF_6						11	13	14	11	5	4	6	2	2
NF_3						1	1	1	1	0	0	0	0	0
Total	5,763	6,065	6,190	6,001	6,243	6,227	6,108	6,175	6,079	6,120	6,220	5,985	6,564	7,008

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
CO_2	6,142	6,131	5,723	6,473	6,244	5,867	5,811	6,091	6,554	6,521	6,189	6,034	5,844	5,855
CH_4	79	71	66	63	61	60	59	58	57	56	56	56	56	56
N_2O	88	89	81	74	71	66	59	59	58	54	56	58	53	56
HFCs	112	123	141	170	201	227	255	281	316	348	393	437	474	513
PFCs	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SF_6	2	2	3	2	2	2	2	3	3	2	2	2	2	2
NF_3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	6,423	6,416	6,014	6,782	6,580	6,221	6,186	6,491	6,988	6,982	6,697	6,587	6,428	6,482

	2018	2019	2020
CO_2	5,733	5,497	5,282
CH_4	56	56	56
N_2O	56	61	58
HFCs	543	582	611
PFCs	0	0	0
SF_6	2	2	2
NF_3	0	0	0
Total	6,390	6,198	6,009

Note: CO_2 emissions are calculated by applying yearly CO_2 emission factors for electricity.

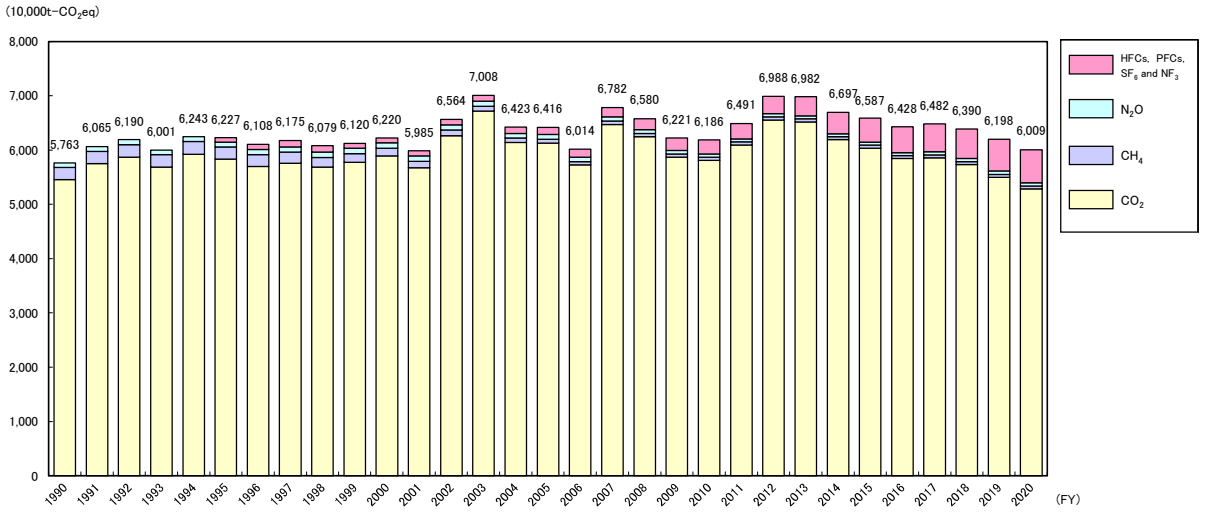
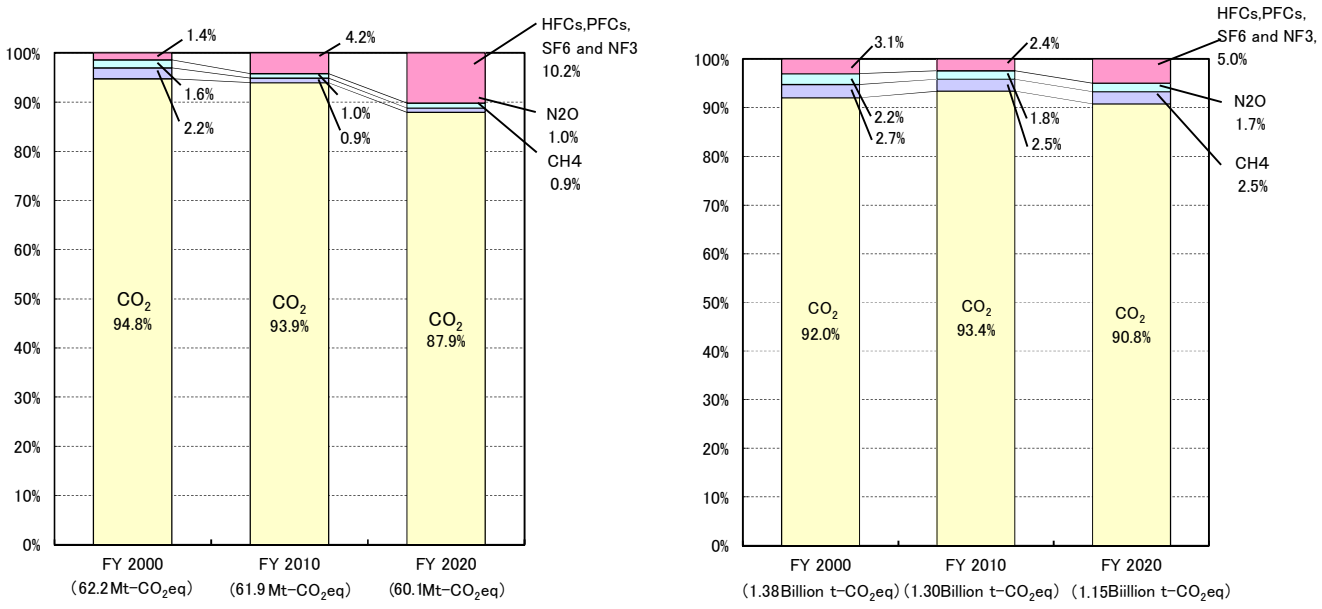


Figure 3-3 Trends in total GHG emissions in Tokyo

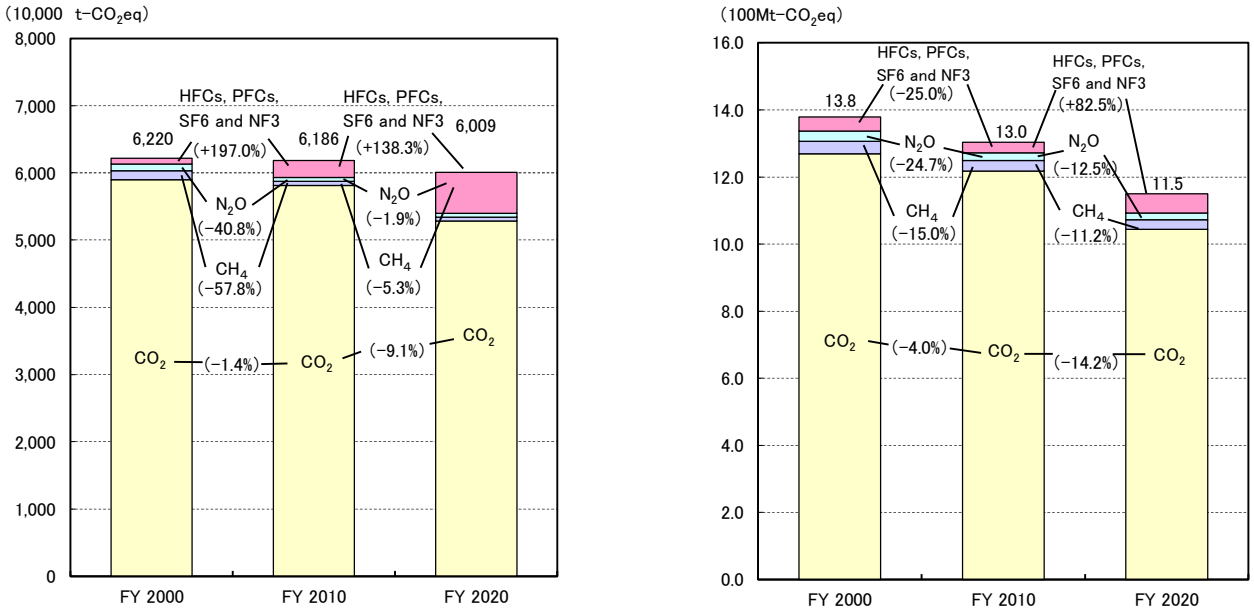
- In the total GHG emissions, CO_2 emissions account for 87.9% in FY 2020, which was 6.9-point reduction from FY 2000, and 6.0-point reduction from FY 2010.
- In comparison with the national shares by GHG in FY 2020, the share of HFCs and three other types in Tokyo is larger than that in Japan (Japan 5.0%, Tokyo 10.2%).



Tokyo Japan

Figure 3-4 Composition ratios by GHG in Tokyo and in Japan

Source: Preliminary figures for Japan's GHG Emissions Data (FY 1990 - 2020), Greenhouse Gas Inventory Office of Japan



Tokyo Japan

Figure 3-5 Increase rates by GHG in Tokyo and in Japan

Note: The values in brackets respectively indicate increase in FY 2010 from FY 2000, and increase in FY 2020 from FY 2010.
Source: Preliminary figures for Japan's GHG Emissions Data (FY 1990 - 2020), Greenhouse Gas Inventory Office of Japan

3.3 CO_2 Emissions

3.3.1 Entire Tokyo

- ▼ The total CO_2 emissions in FY 2020 total 52.8 million tons, a 10.4% decrease from the FY 2000 level of 59.0 million tons and an 3.9% decrease from the FY 2019 level of 55.0 million tons.
- ▼ The CO_2 emissions from electricity in FY 2020 decreased by 1.3% from FY 2010, due to the deteriorated emission factor after the Great East Japan Earthquake.
- ▼ Although the total CO_2 emissions in Tokyo, which have been on a mostly decreasing trend since FY2012 due to reduced energy consumption and fully elevated carbon dioxide emission factors for electricity.

Table 3-5 Total CO_2 emissions by sector and increases up to FY 2020 in Tokyo

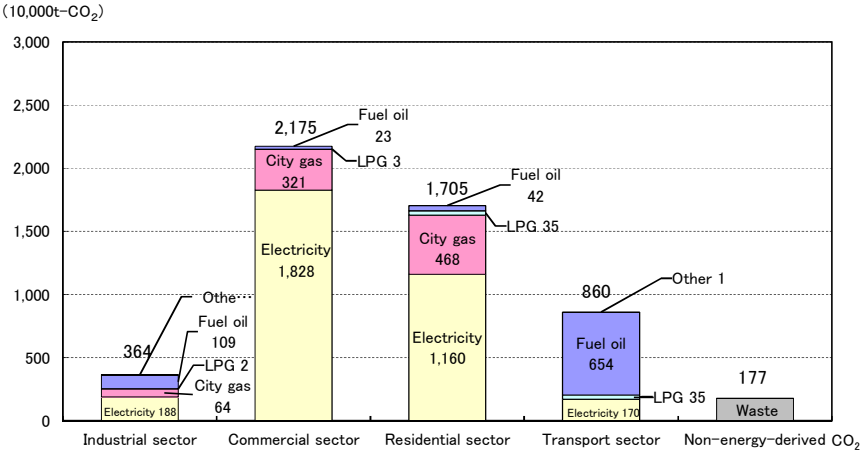
	CO_2 emissions(10,000t-CO_2)						Increase rate (%)		
	FY 2000	FY 2005	FY 2010	FY 2015	FY 2019	FY 2020	Vs. 2000	Vs. 2010	Vs. 2019
(Industrial/ commercial sector)	2,727	3,048	2,890	3,074	2,765	2,539	1.4%	△4.3%	△8.2%
Industrial sector	679	537	455	431	376	364	△46.4%	△20.0%	△3.2%
Commercial sector	2,048	2,511	2,435	2,643	2,389	2,175	6.2%	△10.7%	△9.0%
Residential sector	1,283	1,464	1,559	1,663	1,610	1,705	32.9%	9.4%	5.9%
Transport sector	1,765	1,518	1,206	1,128	930	860	△51.3%	△28.7%	△7.5%
Energy-derived CO_2 emissions	5,775	6,031	5,656	5,865	5,306	5,105	△11.6%	△9.7%	△3.8%
Non-energy-derived CO_2 emissions	120	99	156	169	191	177	47.4%	13.6%	△7.4%
Total CO_2 emissions	5,895	6,131	5,811	6,034	5,497	5,282	△10.4%	△9.1%	△3.9%

Note 1: The residential sector does not include emissions by family cars, which is included in the transport sector.
Note 2: In the transport sector, the scope of calculation for automobiles includes traffic in Tokyo, while that for railway, vessels, and airlines includes service in Tokyo.

Table 3-6 Total energy-derived CO_2 emissions by fuel type and increases up to FY 2020 in Tokyo

	CO_2 emissions(10,000t-CO_2)						Increase rate (%)		
	FY 2000	FY 2005	FY 2010	FY 2015	FY 2019	FY 2020	Vs. 2000	Vs. 2010	Vs. 2019
Electricity	2,698	3,268	3,392	3,861	3,484	3,347	24.1%	△1.3%	△3.9%
City gas	926	1,047	967	865	869	853	△7.9%	△11.7%	△1.8%
LPG	197	159	116	94	75	75	△61.7%	△35.2%	0.1%
Fuel oil	1,936	1,555	1,179	1,043	876	828	△57.2%	△29.8%	△5.5%
Other	19	3	1	3	2	2	△88.7%	43.1%	10.8%
Energy-derived CO_2 emissions	5,775	6,031	5,656	5,865	5,306	5,105	△11.6%	△9.7%	△3.8%

Note: Fuel oils: gasoline, kerosene, light oil, heavy oil A/B/C, and jet fuel; Other: oil coke, coal coke, natural gas, etc.



gure 3-6 CO_2 emissions by sector in Tokyo (FY 2020)

3.3.1-1 CO_2 Emissions in Entire Tokyo (by Sector, Total CO_2 Emissions)

- Combining energy-derived CO2 emissions (industrial, commercial, residential, and transport sectors) with non-energy-derived CO2 emissions (others), trends and composition ratios by sector in total CO2 emissions are as follows:

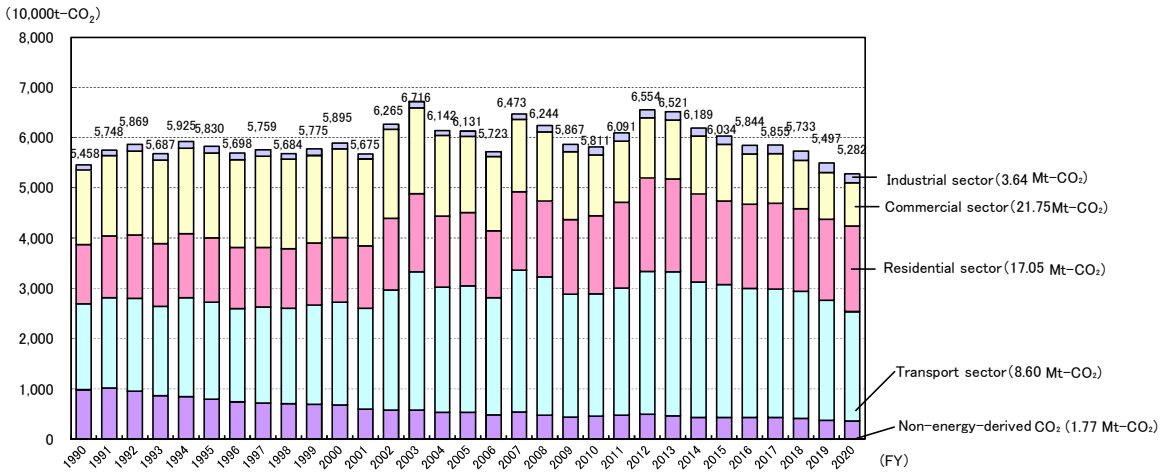


Figure 3-7 Trends in total CO_2 emissions by sector in Tokyo

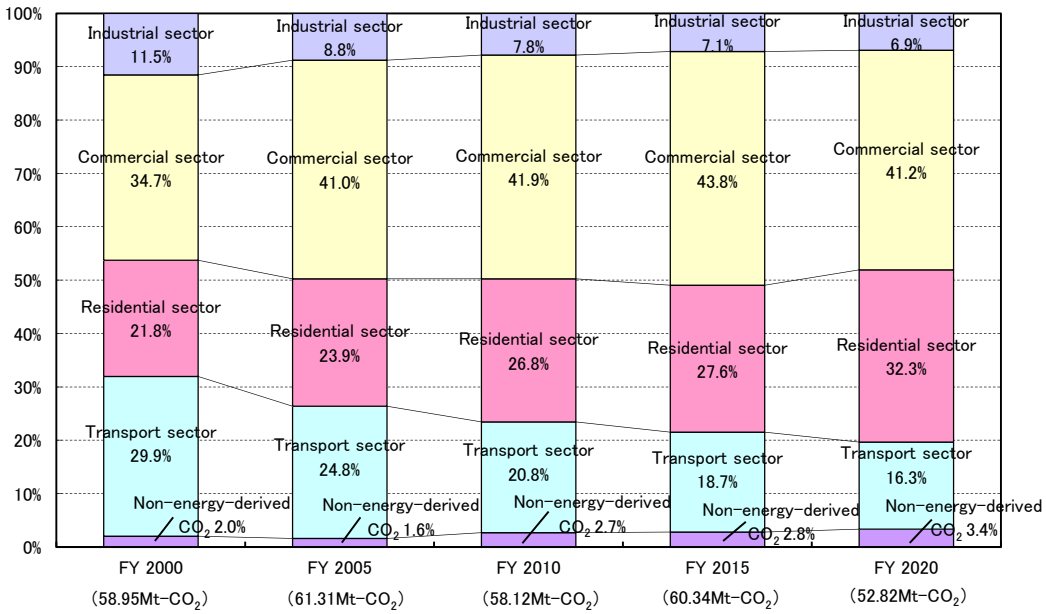


Figure 3-8 Composition ratios in total CO2 emissions by sector in Tokyo

Note 1: "Other" indicates non-energy-derived CO_2 emissions from the incineration of waste.
Note 2: Tokyo does not count the "energy conversion sector" because Tokyo allocates CO_2 emissions from the energy conversion sector to the final demand sectors in accordance with the amount of power consumption.
Note 3: Tokyo does not count the "industrial process" due to the minimal CO_2 emissions from the industrial process and its difficulty of statistical grasp.

- In comparison with the national CO_2 emission structure by sector in FY 2020, Tokyo has a smaller share of the industrial sector (6.9% vs. 34.8% nationwide), and larger shares of the commercial sector (41.2% vs. 17.3% nationwide) and the residential sector (32.3% vs. 14.6% nationwide).

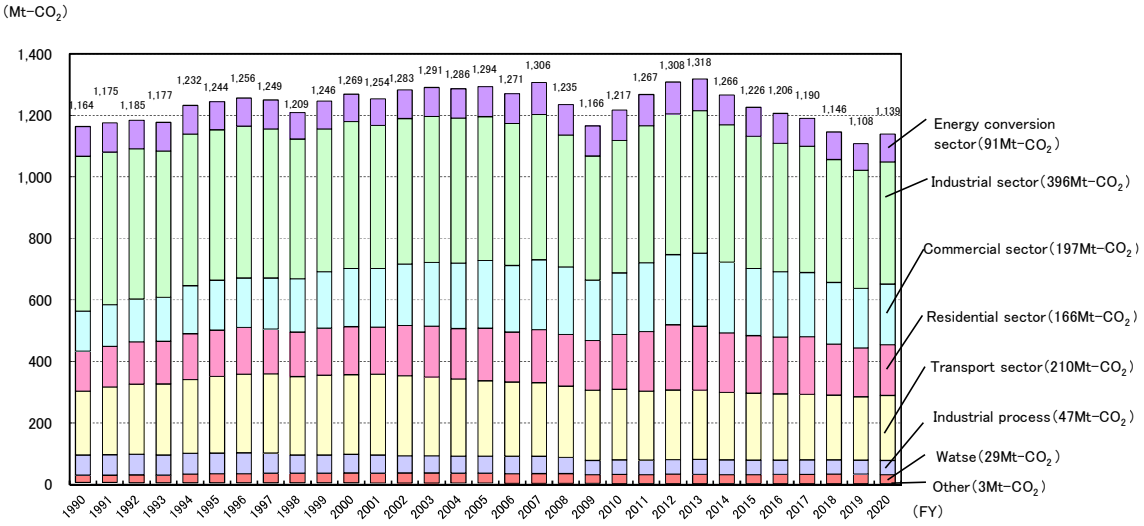


Figure 3-9 Trends in CO_2 emissions in Japan

Source: Preliminary figures for Japan's GHG Emissions Data (FY 1990 - 2019), Greenhouse Gas Inventory Office of Japan

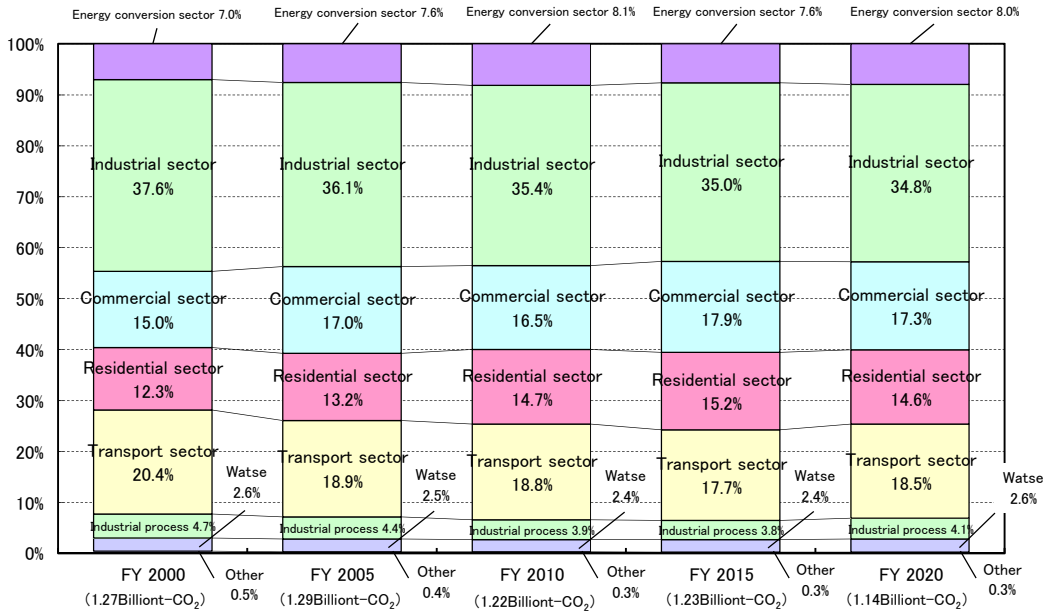


Figure 3-10 Composition ratios in CO_2 emissions in Japan

Source: Preliminary figures for Japan's GHG Emissions Data (FY 1990 - 2020), Greenhouse Gas Inventory Office of Japan

3.3.1-2 CO_2 Emissions in Entire Tokyo (by Fuel Type, Energy-derived CO_2 Emissions)

- Trends and composition ratios by fuel type in energy-derived CO_2 emissions are as follows:

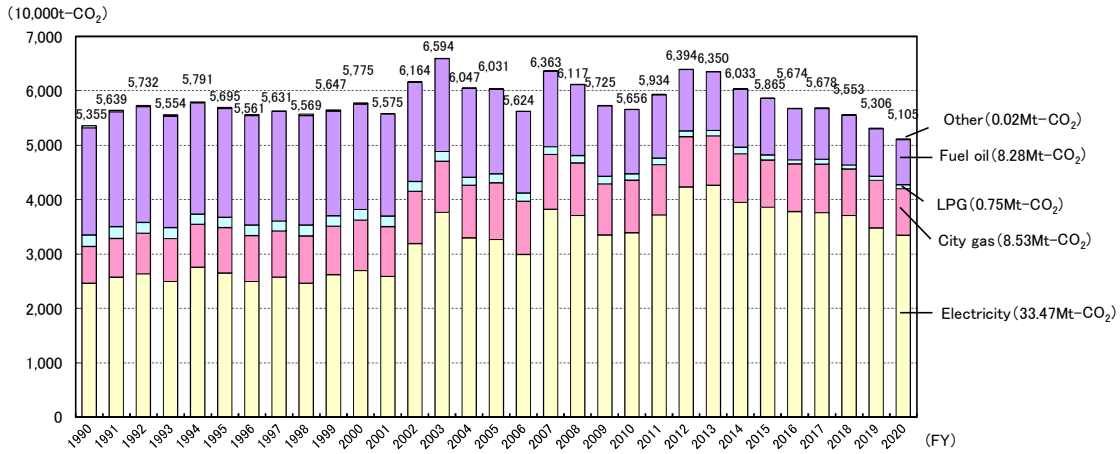


Figure 3-11 Trends in energy-derived CO_2 emissions by fuel type in Tokyo

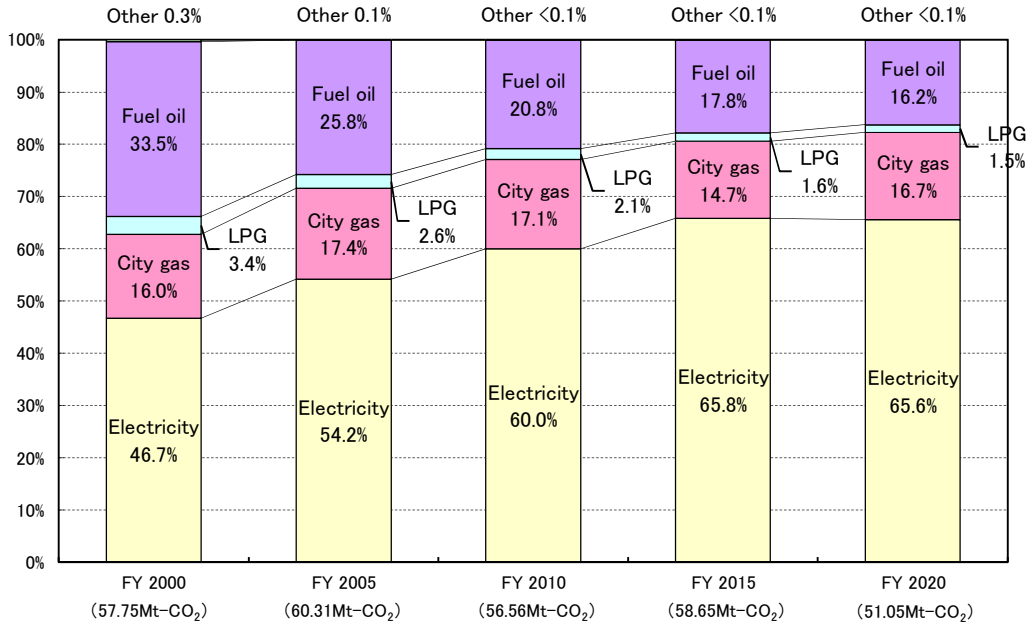


Figure 3-12 Composition ratios in energy-derived CO_2 emissions by fuel type in Tokyo

Note: Fuel oils: gasoline, kerosene, light oil, heavy oil A/B/C, and jet fuel; Other: oil coke, coal coke, natural gas, etc.

3.3.2 [Reference] Trends in Each Sector

3.3.2-1 Industrial Sector

- Trends in CO_2 emissions in the industrial sector are as follows:

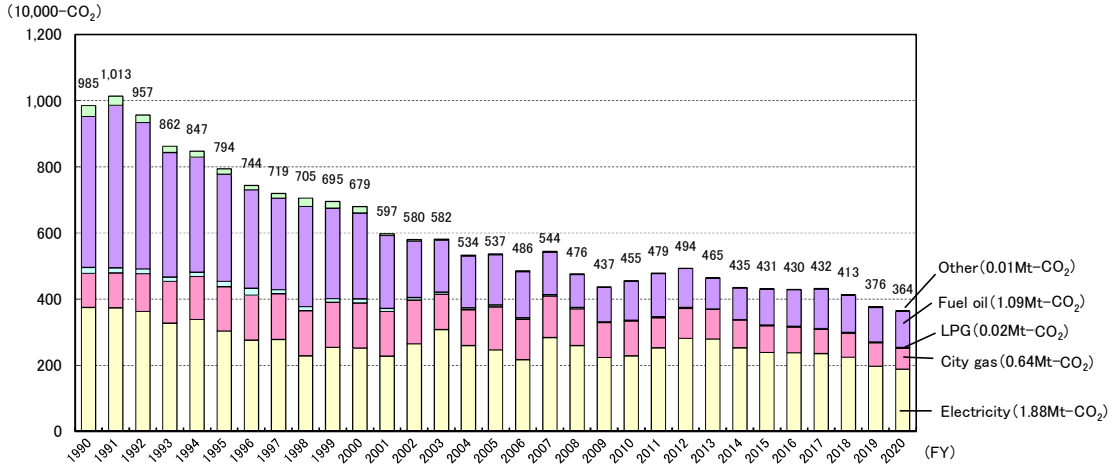


Figure 3-13 Trends in CO_2 emissions in the industrial sector

3.3.2-2 Commercial Sector

- Trends in CO_2 emissions in the commercial sector are as follows:

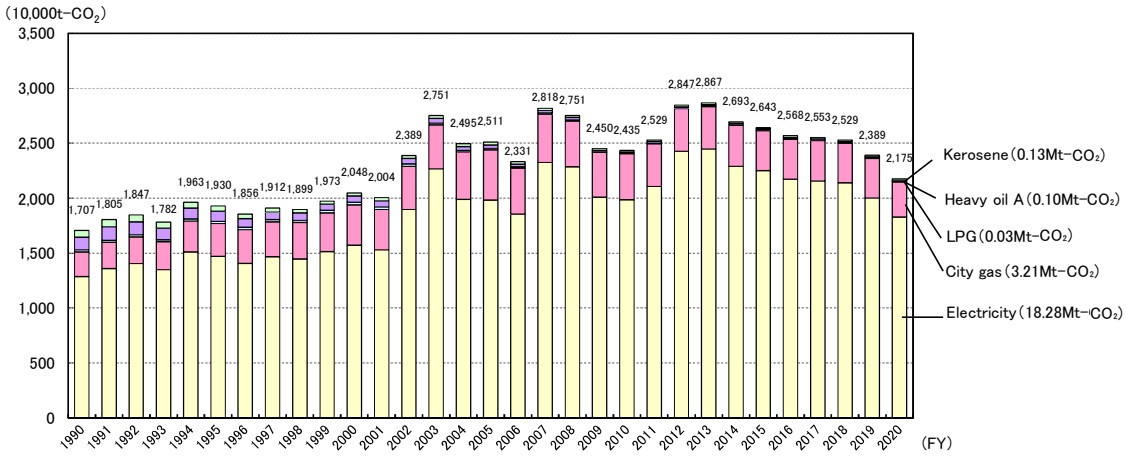


Figure 3-14 Trends in CO_2 emissions in the commercial sector

3.3.2-3 Residential Sector

- Trends in CO_2 emissions in the residential sector are as follows:

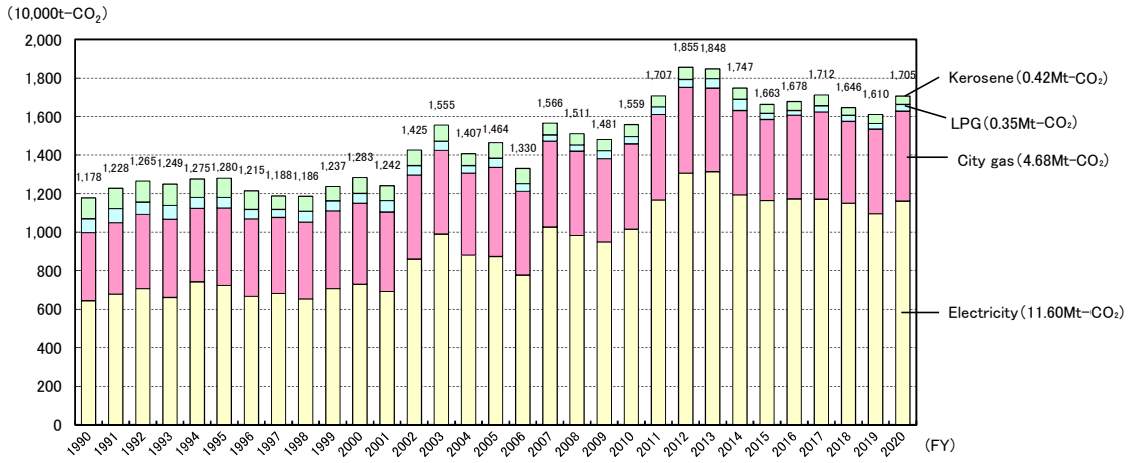


Figure 3-15 Trends in CO_2 emissions in the residential sector

3.3.2-4 Transport Sector

- Trends in CO_2 emissions in the transport sector are as follows:

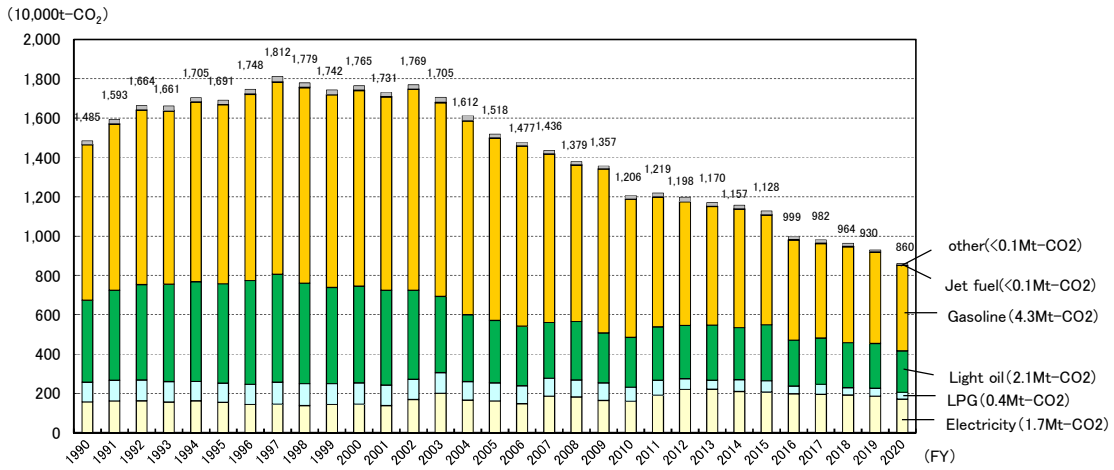


Figure 3-16 Trends in CO_2 emissions in the transport sector

3.4 Other GHG Emissions

3.4.1 Overview

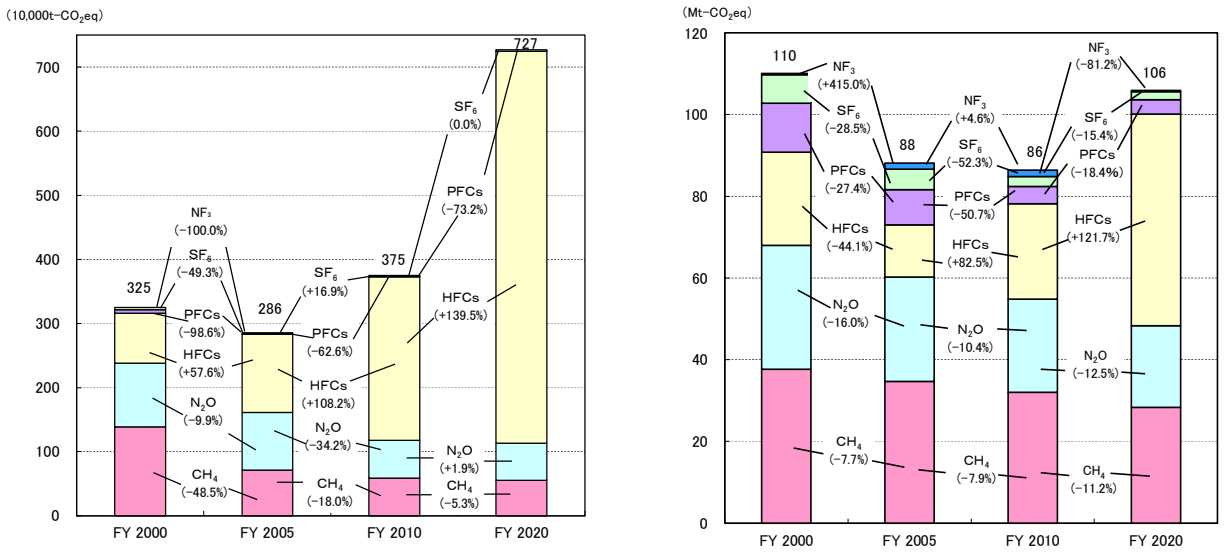
3.4.1-1 Trends in Other GHG Emissions

(Tokyo)

- Other GHG emissions in FY 2020 stood at 7.3 million t-CO_2eq, which was 123.7% increase from 3.3 million t-CO_2eq in FY 2000, and 93.8% increase from 3.8 million t-CO_2eq in FY 2010.
- HFCs increased by 57.6% from FY 2000 to FY 2005, 108.2% from FY 2005 to FY 2010, and 139.5% from FY 2010 to FY 2020. This is because the substitution of HCFCs, which are regulated under the Montreal Protocol, by HFCs has proceeded, and consequently emissions from the coolant use of HFCs have increased.
- CH_4 have shown a downward trend since FY 2000.
- N_2O has been on a downward trend since FY2000, but has recently begun to increase.

(Japan)

- Other GHG emissions in Japan in FY 2020 stood at 106 million t-CO_2eq, which was 3.8% reduction from 110 million t-CO_2eq in FY 2000, and 22.6% increase from 86 million t-CO_2eq in FY 2010.
- HFCs have declined by 44.1% from FY 2000 to FY 2005 due to a decrease in emissions of HFC-23, which is a by-product in manufacturing specific freon HCFC-22. Since then, due to an increase in the use of CFC substitute HFCs as a refrigerant application, it has increased by 82.5% from FY 2005 to FY 2010 and by 121.7% from FY 2010 to FY 2020.
- CH_4, N_2O, PFCs and SF_6 have shown a downward trend since FY 2000. On the other hand, NF_3 has shown an upward trend from FY 2000 to FY 2010, but in recent years there is a sign that starts to decrease.



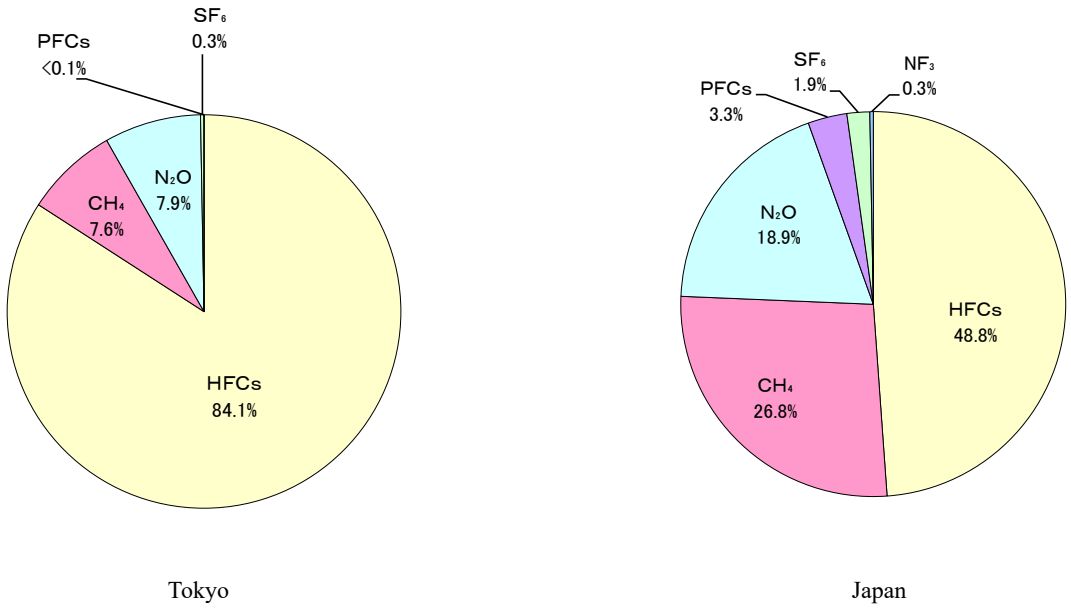
Tokyo Japan

Figure 3-17 Increase rates by GHG (other GHGs) in Tokyo and in Japan

Note: The values in brackets respectively indicate increase in FY 2005 from FY 2000, increase in FY 2010 from FY 2005, and increase in FY 2020 from FY 2010.
Source: Preliminary figures for Japan's GHG Emissions Data (FY 1990 – 2020), Greenhouse Gas Inventory Office of Japan

3.4.1-2 Composition Ratios in Other GHG Emissions

- In Tokyo, HFCs accounted for 84.1% of other GHG emissions in FY 2020, followed by N_2O (7.9%),CH_4 (7.6%), SF_6 (0.3%), and PFCs (< 0.1%).
- In Japan, HFCs accounted for 48.8% of other GHG emissions in FY 2020, followed by CH_4 (26.8%), N_2O (18.9%), PFCs (3.3%), SF_6 (1.9%), and NF_3 (0.3%).
- Compared to the nationwide composition ratios of other GHG emissions in FY 2020, Tokyo sees a larger share of HFCs, and accordingly smaller shares of the other gases.



Tokyo Japan

Figure 3-18 Composition ratios of other GHG emissions in Tokyo and in Japan (FY 2020)

Source: Preliminary figures for Japan's GHG Emissions Data (FY 1990 - 2020), Greenhouse Gas Inventory Office of Japan

3.4.1-3 Shares of Other GHG Emissions in Japan

- Other GHG emissions in FY 2020 in Tokyo account for approximately 6.9% in Japan.
- By the type of gas, Tokyo takes up the largest share in Japan with HFCs (11.8%), followed by N_2O (2.9%) , CH_4 (2.0%) and SF_6,(1.0%).

Table 3-7 Comparison of other GHG emissions in Tokyo and in Japan (FY 2020)

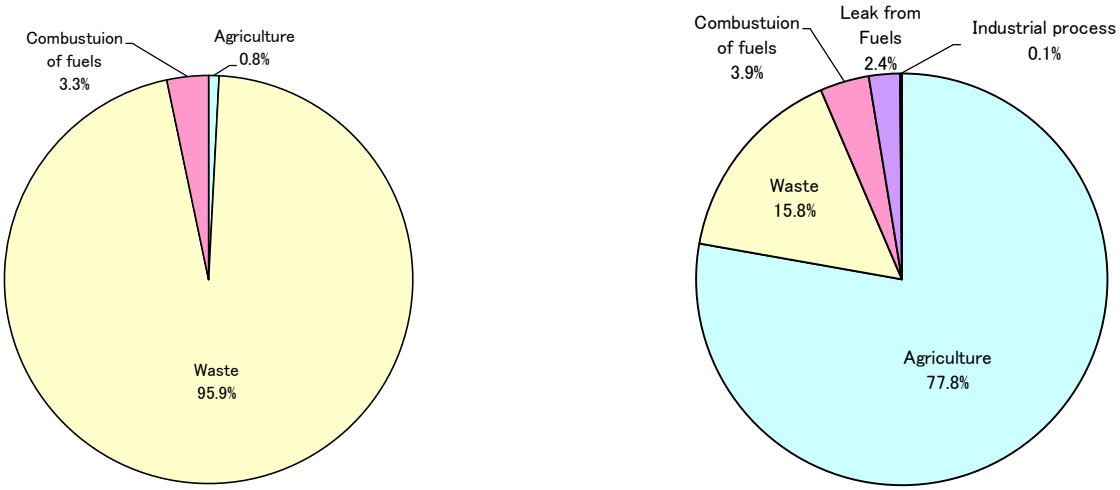
(Unit: 10,000 t-CO_2 eq)

	Tokyo	Japan	vs. Japan
CH_4	56	2,839	2.0%
N_2O	58	1,999	2.9%
HFCs	611	5,173	11.8%
PFCs	0	347	< 0.1%
SF_6	2	203	1.0%
NF_3	0	29	0.0%
Total	727	10,590	6.9%

Source: Preliminary figures for Japan's GHG Emissions Data (FY 1990 - 2020), Greenhouse Gas Inventory Office of Japan

3.4.2 CH_4

- The composition ratios of CH_4 emissions in Tokyo and in Japan in FY 2020 are indicated below.
- In Tokyo, 95.9% of CH_4 emissions are derived from waste. "Waste" mainly refers to emissions from landfill sites (inner and outer central breakwater landfill sites) and from sewage treatment.



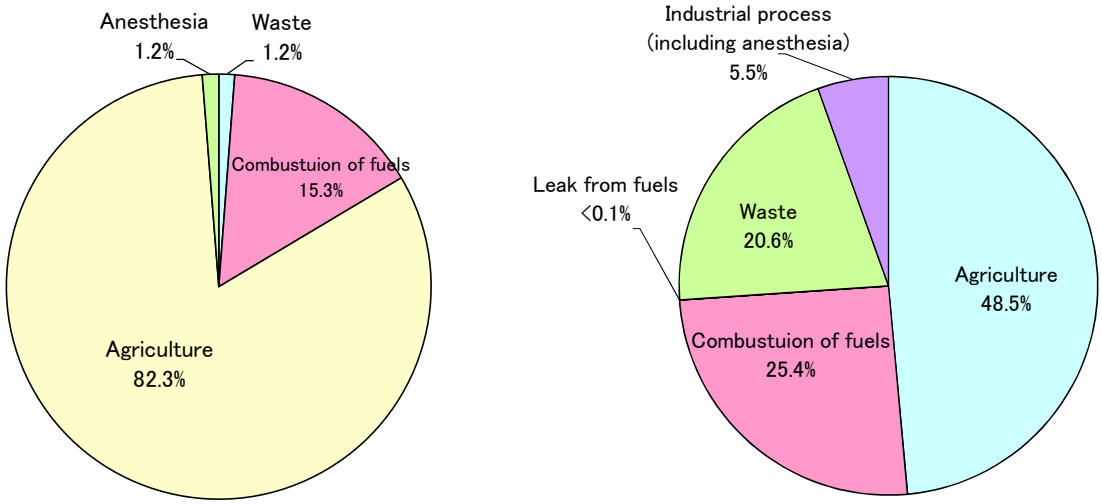
Tokyo Japan

Figure 3-19 Composition ratios of CH_4 emissions in Tokyo and in Japan (FY 2020)

Source: Preliminary figures for Japan's GHG Emissions Data (FY 1990 - 2020), Greenhouse Gas Inventory Office of Japan

3.4.3 N_2O

- The composition ratios of N2O emissions in Tokyo and in Japan in FY 2020 are indicated below.
- In Tokyo, 82.3% of N2O emissions are derived from waste. "Waste" mainly refers to emissions from the incineration of waste (general/industrial) and sewage treatm ent.



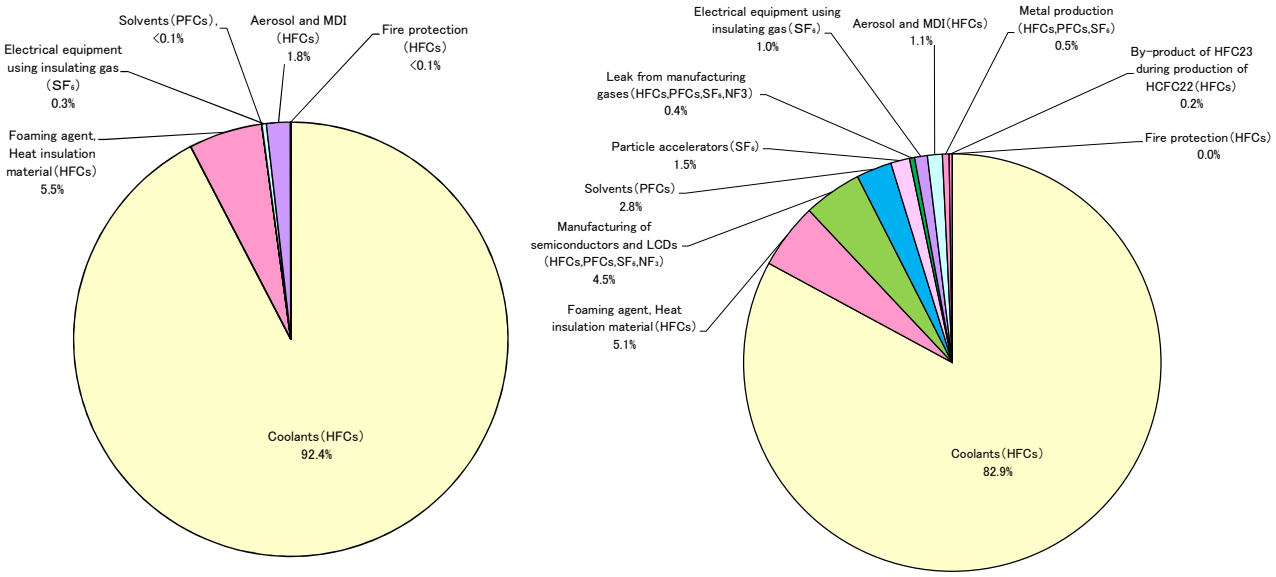
Tokyo Japan

Figure 3-20 Composition ratios of N_2O emissions in Tokyo and in Japan (FY 2020)

Source: Preliminary figures for Japan's GHG Emissions Data (FY 1990 - 2020), Greenhouse Gas Inventory Office of Japan

3.4.4 HFCs and Three Other Types

- The composition ratios of HFCs and three other types of emissions in Tokyo and in Japan in FY 2020 are indicated below.
- In Tokyo, 92.4% of the emissions of these four gases are HFCs derived from coolants. "Coolants" mainly refers to emissions at the time of production, use, disposal of freezers and air conditioners for business use, household air conditioners, car air conditioners, etc.
- Unlike in the emission composition of entire Japan, "Manufacturing of semiconductors and LCDs", "Leak from manufacturing of HFCs and three other types", and "Metal production", etc. are excluded from the emission statistics of Tokyo, because the relevant factories are considered to be very rare in Tokyo.
- The addition of NF_3 to the list of GHGs was stipulated in the Partial Amendment to the Act on Promotion of Global Warming Countermeasures (Law No. 18, May 24, 2013) which took effect on April 1, 2015, but TMG excluded NF_3 from the emission statistics of Tokyo, because the relevant factories are considered to be very rare in Tokyo.



Tokyo Japan

Figure 3-21 Composition ratios of HFCs and three other types of emissions in Tokyo and in Japan (FY 2020)

Source: Preliminary figures for Japan's GHG Emissions Data (FY 1990 - 2020), Greenhouse Gas Inventory Office of Japan

4 Reference Materials

[Material 1] Calculation Methods for Final Energy Consumption and GHG Emissions (Overview)

(1) Final energy consumption and energy-derived CO_2 emissions

■ Fuel consumption and energy consumption are estimated by sectors based on statistical data, etc., and CO_2 emissions are calculated by multiplying the consumption by the emission factor.

Sectors		Calculation methods (overview)	Key statistical data, etc.
Industrial sector	Agriculture, forestry and fishery	Estimated based on utility cost (electricity/kerosene) per farming household, fuel cost (heavy oil A) per fishing management body, etc. (The electricity consumption after FY 2012 is identified from supply side)	• MAFF "Agricultural Management Statistics Report" • MAFF "MAFF Statistics" • Sales data in Tokyo provided by electricity utilities.
	Mining	Estimated based on national mining energy consumption, fuel and electricity cost rates in Japan and in Tokyo, etc.	• Agency for Natural Resources and Energy "Comprehensive Energy Statistics" • MIC "Economic Census: Activity Survey"
	Construction	National fuel consumption in the construction industry is allocated in accordance with the construction sales rates in Japan and in Tokyo.	• Agency for Natural Resources and Energy "Comprehensive Energy Statistics" • MLIT "Comprehensive Statistical Yearbook for Construction"
	Manufacturing	Energy consumption is estimated based on energy data for business sites in Tokyo, product shipment amount by trade, etc. • Consumption for the entire manufacturing industry is estimated based on energy consumption at soot emitting facilities. • Composition of energy consumption by trade is estimated based on product shipment amount by trade, etc.	• TMG "Soot Emission Survey Report" • TMG "Industry in Tokyo: Industrial Statistics" • METI "Petroleum Consumption Structure Statistics" • MIC "Economic Census: Activity Survey"
		• Consumptions of electricity and city gas by the entire manufacturing industry are identified from supply side.	• TMG "Tokyo Statistical Yearbook" • Sales data in Tokyo as provided by electricity utilities and gas utilities
Commercial		Energy consumption is estimated by multiplying the energy consumption basic unit for each building application of business sites in Tokyo by the total floor area. • Total floor area for each building application is calculated based on national statistical materials. • The national average energy consumption basic unit for each building application has been adjusted in accordance with the actual status in Tokyo. • Energy consumption composition for each building application is estimated based on data reported by large-scale business sites under the Tokyo Metropolitan Ordinance.	• MIC "Summary Record of Prices for Fixed Assets" • Institute of Local Finance "Public Facility Status Survey" (Sources for total floor area data) • The Institute of Energy Economics, Japan "Energy Economics Statistics Summary" • TMG "Global Warming Corrective Measures Plan"
		• Consumptions of electricity and city gas by the entire commercial sector are identified from supply side.	• TMG "Tokyo Statistical Yearbook" • Sales data in Tokyo as provided by electricity utilities and gas utilities

Sectors		Calculation methods (overview)	Key statistical data, etc.
Residential		Energy consumption is estimated based on survey materials concerning household spending, etc. • Consumptions of kerosene and LPG for all households are estimated based on fuel spending per household (single- or multiple-person households), unit prices for fuels, etc. * Gasoline and other fuels used for family cars are included in the transport sector.	• TMG "Living Standards of Tokyo Metropolitan Citizens (Tokyo Livelihood Analysis Report)" • MIC "Household Economy Annual Report"
		• Consumptions of electricity and city gas by the entire residential sector are identified from supply side.	• TMG "Tokyo Statistical Yearbook" • Sales data in Tokyo as provided by electricity utilities and gas utilities
Transport sector	Road Transportation	Traffic and CO_2 emissions by car type and by fuel type are estimated based on measurement data provided by TMG. * The scope of calculation only includes traffic in Tokyo.	• TMG "Traffic and CO_2 emissions by car type and by fuel type"
	Railways	(Passengers) The basic unit is calculated based on the power consumption and passenger kilometers of each railway company. The emissions are estimated by multiplying the basic unit by the passenger kilometers in Tokyo. (Freight) The national power consumption is allocated in accordance with the transportation tons in Japan and in Tokyo. * The scope of calculation only includes transportation in Tokyo.	• TMG "Tokyo Statistical Yearbook" • MLIT "Railway Statistical Yearbook"
	Navigation	(Passengers) The national fuel consumption is allocated in accordance with the passengers in Japan and in Tokyo. (Freight) The national fuel consumption is allocated in accordance with the transportation tons in Japan and in Tokyo. * The scope of calculation only includes navigation in Tokyo. The values for navigation outside Tokyo (from other parts of Japan to Tokyo, or from Tokyo to other parts of Japan) are calculated for reference.	• MLIT "Coastal Vessel Transportation Statistics" • MLIT "Passenger Regional Fluidity Survey" • MLIT "Freight Regional Fluidity Survey"
	Civil Aviation	Fuel consumptions at airports are counted. * The scope of calculation only includes navigation in Tokyo. The values for navigation outside Tokyo (from other parts of Japan to Tokyo, or from Tokyo to other parts of Japan) are calculated for reference.	• MLIT "Airport Management Status Record" • MLIT "Air Transportation Statistical Yearbook"

(2) Non-energy-derived CO_2 emissions

■ CO_2 emissions are calculated by multiplying the incineration of waste (on a dried basis) by the emission factor.

Sectors		Calculation methods (overview)	Key statistical data, etc.
Waste sector	General waste	The incinerated amounts (on a dried basis) for waste plastics and synthetic fiber dust are estimated based on the incinerated amount (on a wet basis) in the Tokyo wards area and in the Tama area, the composition ratios of waste, the water content, etc., according to materials provided by cleaning factories and other sources.	• Clean Authority of TOKYO 23 Cities "Cleaning Service Annual Report" and "Survey Report on the Properties of Waste Delivered to Cleaning Factories" • The Institute for Tokyo Municipal Research, "Tama Area Waste Status Survey"
	Industrial waste	The incineration amounts of waste oil and waste plastics are estimated based on materials concerning the treatment of industrial waste.	• TMG "Survey Report on Changes over Time in Industrial Waste" • TMG "Performance Report on Industrial Waste Treatment "

(3) Other GHGs

■ Emissions are estimated based on statistical materials prepared by TMG and the national government.

Sectors	Calculation methods (overview)	Key statistical data, etc.
Methane (CH_4)	The main source of emission is the gas generated from waste landfill sites. The emissions at inner and outer central breakwater landfill sites are estimated using a model that assumes a state of the successive resolution of the waste.	• TMG "Survey Results on the Effective Use of Landfill Gas (LFG) (March, 2004)"
Dinitrogen oxide (N_2O)	The main sources of emission are the incineration of waste (general/industrial), sewage treatment at sewage plants, and automobile driving. Emissions are estimated based on statistical materials prepared by TMG and the national government.	• Ministry of the Environment "Survey Results on General Waste Treatment" • TMG "Survey Report on Changes over Time in Industrial Waste" • TMG "Performance Report on Industrial Waste Treatment "
HFCs and three other types (HFCs, PFCs, SF_6, and NF_3)	The main source of emission is coolants (HFCs) that are emitted during the production, use, and disposal of freezers and air conditioners. National emissions are allocated in accordance with shipment amounts in Japan and in Tokyo. * Also for HFCs that are derived from foaming agents, aerosols, etc., and for SF_6 that are derived from the use of gas insulated transformers, etc., national emissions are allocated in accordance with shipment amounts in Japan and in Tokyo.	• METI materials for the Working Group for Countermeasures against CFCs, Manufacturing Industry Subcommittee, Industrial Structure Council

[Material 2] Trends in Final Energy Consumption in Tokyo and Gross Domestic Product (GDP) in Tokyo

- To realize a vigorous sustainable city, it is necessary to aim at a state where economic growth does not link with increased energy/resource consumption ("decoupling").
- EU includes decoupling in its policy targets under the 6th Environmental Action Plan (2002). International arguments are also held at the sessions of OECD, United Nations Environment Programme (UNEP), etc.
- Trends in the final energy consumption in Tokyo and the gross product in Tokyo indicate that the decoupling has been in progress since FY 2009.

Final energy consumption and total production (in Tokyo and in Japan)

Sources: TMG "Prefectural Accounts of Tokyo"
Cabinet Office "System of National Accounts (GDP Statistics)"
Agency for Natural Resources and Energy "Energy Supply and Demand Performance"
Note: Total production in Tokyo and Gross Domestic Product uses real value/chain-linked system and chained FY 2011 price.

[Material 3] Monthly Average Temperature in Tokyo (FY 2011 - 2020)

(unit：℃)

FY	Sunner								Winter				Summer Average	Winter Average
	Apr.	May	June	July	Aur.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.		
2011	14.5	18.5	22.8	27.3	27.5	25.1	19.5	14.9	7.5	4.8	5.4	8.8	25.9	5.9
	(+0.2)	(△ 0.3)	(+0.9)	(+1.6)	(+0.6)	(+1.8)	(+1.5)	(+2.4)	(△ 0.2)	(△ 0.6)	(△ 0.7)	(△ 0.6)	(+1.0)	(△ 0.5)
2012	14.5	19.6	21.4	26.4	29.1	26.2	19.4	12.7	7.3	5.5	6.2	12.1	25.6	6.3
	(+0.2)	(+0.8)	(△ 0.5)	(+0.7)	(+2.2)	(+2.9)	(+1.4)	(+0.2)	(△ 0.4)	(+0.1)	(+0.1)	(+2.7)	(+0.8)	(△ 0.1)
2013	15.2	19.8	22.9	27.3	29.2	25.2	19.8	13.5	8.3	6.3	5.9	10.4	26.5	6.8
	(+0.9)	(+1.0)	(+1.0)	(+1.6)	(+2.3)	(+1.9)	(+1.8)	(+1.0)	(+0.6)	(+0.9)	(△ 0.2)	(+1.0)	(+1.6)	(+0.4)
2014	15.0	20.3	23.4	26.8	27.7	23.2	19.1	14.2	6.7	5.8	5.7	10.3	26.0	6.1
	(+0.7)	(+1.5)	(+1.5)	(+1.1)	(+0.8)	(△ 0.1)	(+1.1)	(+1.7)	(△ 1.0)	(+0.4)	(△ 0.4)	(+0.9)	(+1.1)	(△ 0.3)
2015	14.5	21.1	22.1	26.2	26.7	22.6	18.4	13.9	9.3	6.1	7.2	10.1	25.0	7.5
	(+0.2)	(+2.3)	(+0.2)	(+0.5)	(△ 0.2)	(△ 0.7)	(+0.4)	(+1.4)	(+1.6)	(+0.7)	(+1.1)	(+0.7)	(+0.2)	(+1.1)
2016	15.4	20.2	22.4	25.4	27.1	24.4	18.7	11.4	8.9	5.8	6.9	8.5	25.0	7.2
	(+1.1)	(+1.4)	(+0.5)	(△ 0.3)	(+0.2)	(+1.1)	(+0.7)	(△ 1.1)	(+1.2)	(+0.4)	(+0.8)	(△ 0.9)	(+0.1)	(+0.8)
2017	14.7	20.0	22.0	27.3	26.4	22.8	16.8	11.9	6.6	4.7	5.4	11.5	25.2	5.6
	(+0.4)	(+1.2)	(+0.1)	(+1.6)	(△ 0.5)	(△ 0.5)	(△ 1.2)	(△ 0.6)	(△ 1.1)	(△ 0.7)	(△ 0.7)	(+2.1)	(+0.4)	(△ 0.8)
2018	17.0	19.8	22.4	28.3	28.1	22.9	19.1	14.0	8.3	5.6	7.2	10.6	26.3	7.0
	(+2.7)	(+1.0)	(+0.5)	(+2.6)	(+1.2)	(△ 0.4)	(+1.1)	(+1.5)	(+0.6)	(+0.2)	(+1.1)	(+1.2)	(+1.4)	(+0.6)
2019	13.6	20.0	21.8	24.1	28.4	25.1	19.4	13.1	8.5	7.1	8.3	10.7	24.8	8.0
	(△ 0.7)	(+1.2)	(△ 0.1)	(△ 1.6)	(+1.5)	(+1.8)	(+1.4)	(+0.6)	(+0.8)	(+1.7)	(+2.2)	(+1.3)	(△ 0.1)	(+1.6)
2020	12.8	19.5	23.2	24.3	29.1	24.2	17.5	14.0	7.7	5.4	8.5	12.8	25.5	7.2
	(△ 1.5)	(+0.7)	(+1.3)	(△ 1.4)	(+2.2)	(+0.9)	(△ 0.5)	(+1.5)	(+0.0)	(+0.0)	(+2.4)	(+3.4)	(+0.7)	(+0.8)
Normal Value	14.3	18.8	21.9	25.7	26.9	23.3	18.0	12.5	7.7	5.4	6.1	9.4	24.8	6.4

*Normal value:30-year averege value from 1991to 2020
Source:Japan Meteorological Agency website
*Figures in parentheses in the lower row are differences from the normal.

[Material 4] Greenhouse Gas Reduction Target and Energy Consumption Reduction Target in Tokyo

- Set reduction targets for greenhouse gas emissions as a mid-term transit point, based on the long-term reduction levels required in the Intergovernmental Panel on Climate Change (IPCC) "1.5°C Special Report" (2018) and other reports.
- Energy conservation targets are set for energy consumption at the level necessary to achieve GHG reduction targets.

What it should be in 2050

- Realization of "Zero Emission Tokyo" and contribution to "virtually zero CO2 emissions" around the world

2030 Target

- Greenhouse gas emissions in Tokyo (compared to 2000 levels) 50% reduction (carbon half)
- Energy consumption in Tokyo (compared to 2000) 50% reduction

○Sectoral target

Energy-derived CO_2 emissions　　Unit：Mt-CO_{2eq}

	2000 (Baseline)	2019 (Status quo)		2030			Tokyo Environmental Master Plan in 2016 (From 2000)
	Emissions	Emissions	From 2000	Emissions (Estimate)	Sectoral targets (From 2000)	From 2019	
Industrial/ commercial sectors	27.27	27.63	1.3%	13.81	**Approx. 50% reduction**	△50.0%	Approx. 20% reduction
Industrial sector	6.79	3.81	△43.9%	2.22		△41.8%	
Commercial sector	20.48	23.82	16.3%	11.59	**Approx.45% reduction**	△51.3%	(Approx. 20% Reduction)
Residential sector	12.83	16.12	25.6%	7.28	**Approx. 45% reduction**	△54.8%	Approx. 20% reduction
Transport sector	17.65	9.40	△46.7%	6.12	**Approx. 65% reduction**	△34.9%	Approx. 60% reduction
Total	**57.75**	**53.15**	**△8.0%**	**27.21**		**△48.8%**	

Energy consumption　　Unit：PJ

	2000 (Baseline)	2019 (Status quo)		2030			Tokyo Environmental Master Plan in 2016 (From 2000)
	Consumption	Consumption	From 2000	Emissions (Estimate)	Sectoral targets (From 2000)	From 2019	
Industrial/ commercial sectors	359	284	△20.9%	233	**Approx. 35% reduction.**	△18%	Approx. 30% reduction
Industrial sector	96	46	△52.1%	36		△22%	
Commercial sector	263	237	△9.9%	197	**Approx. 25% reduction.**	△17%	(Approx. 20% reduction)
Residential sector	186	190	2.2%	130	**Approx. 30% reduction**	△32%	Approx. 30% reduction
Transport sector	257	125	△51.4%	90	**Approx. 65% reduction**	△28%	Approx. 60% reduction.
Total	**802**	**598**	**△25.4%**	**453**		**△24%**	

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Final Energy Consumption and Greenhouse Gas Emissions in Tokyo
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⇒ Greenhouse gas emissions in Tokyo can be found in the "Data (Global Environment/Energy)" section.
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