Japan's
First Biennial Transparency Report

October
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Introduction

Prior to the United Nations Framework Convention on Climate Change (UNFCCC) adopted in 1992, Japan formulated the *Action Program to Arrest Global Warming* in 1990 and has been implementing measures to address climate change issues. Subsequently, the Kyoto Protocol was adopted at the third session of the Conference of the Parties (COP3) in 1997, and Japan established the Global Warming Prevention Headquarters at the Cabinet, and comprehensive and systematic measures have been implemented under the Act on Promoting Global Warming Countermeasures and the *Kyoto Protocol Target Achievement Plan*. As a result of the implementation of those measures, the greenhouse gas (GHG) emission reduction target in the first commitment period of the Kyoto Protocol (2008-2012) was achieved. After the first commitment period of the Kyoto Protocol, Japan announced its GHG emission reduction target for FY 2020 at COP19 and continued its efforts to reduce GHG emissions. In addition, Japan ratified the Paris Agreement in 2016 and submitted its Nationally Determined Contribution (NDC), including a mid-term emission reduction target for FY 2030, to the UNFCCC secretariat in March 2020. In November 2020, then Prime Minister Yoshihide Suga declared a goal of achieving net zero by 2050, and Japan decided and submitted its new NDC consistent with the 2050 net zero goal to the secretariat in October 2021. At the same time, Japan formulated the *Long-Term Strategy as a Growth Strategy Based on the Paris Agreement*, which presents the basic concept and vision toward net zero in 2050, and submitted it to the UNFCCC secretariat.

In order to contribute to the achievement of the long-term goal set in the Paris Agreement, which is to hold the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit it to 1.5°C, Japan has been accelerating efforts to reduce GHG emissions by all entities through the revision of the Act on Promoting Global Warming Countermeasures and the *Plan for Global Warming Countermeasures* to achieve the GHG emission reduction target for FY 2030 indicated in its NDC and net zero goal by 2050. In addition, Japan has been providing a variety of financial, technological, and capacity-building support to developing countries in order to reduce GHG emissions and improve their adaptive capacity to climate change on a global scale.

The Paris Agreement established the Enhanced Transparency Framework (ETF) to build mutual trust and confidence among Parties and promote the implementation of effective climate change action (Article 13 of the Paris Agreement). The ETF, together with the NDCs, which are Parties' emission reduction targets, and the global stocktake (GST), which assesses the collective progress towards achieving the long-term goals of the Paris Agreement, are essential elements of the mechanism of the Paris Agreement for enhancing ambition.

Under the ETF, each Party needs to submit Biennial Transparency Report (BTR) every two years, which includes a national inventory report on anthropogenic GHG emissions and removals, information necessary to track progress in implementing and achieving NDCs under Article 4 of the Paris Agreement, information related to climate change impacts and adaptation under Article 7 of the Paris Agreement, and information on financial, technology transfer and capacity-building support provided to developing country Parties under Articles 9, 10 and 11 of the Paris Agreement. This is Japan's first BTR (BTR1) submitted in accordance with the Paris Agreement and related provisions, and it comprehensively describes the climate actions that Japan is currently implementing and plans to implement in the future to achieve its NDC and the global long-term goal of the Paris Agreement.

All Parties need to establish a PDCA cycle for climate change policies and actions through the preparation of the BTR and implement effective climate change measures to achieve their NDCs. GST, BTR, and NDC are the components that will enhance the effectiveness of the Paris Agreement, and it is important for each Party to cooperate to make the BTRs more effective.

Japan monitors its GHG emissions and removals every year through the preparation of GHG inventory, which is a key component of the BTR, and manages the progress of policies and measures outlined in the *Plan for*

Global Warming Countermeasures. The greenhouse gas emissions and removals from Japan have been steadily decreasing by about 23% in fiscal year (FY) 2022 against the NDC's emission reduction target of a 46% reduction in FY 2030 compared to the FY 2013 level.

Furthermore, in order to achieve the 2030 NDC and achieve net zero emissions in 2050, it is necessary to reform every aspect of the industrial structure, infrastructure, and people's lifestyles. Japan has formulated the *Green Transformation (GX) Promotion Strategy* to promote the GX and implemented initiatives actively based on the strategy. In addition, Japan will compile the *GX2040 Vision* toward the end of 2024 as a national GX strategy, looking ahead to around 2040.

As a member of the international community, Japan will continue to submit BTRs and will also contribute to global decarbonization by widely sharing the results and knowledge gained through its efforts to achieve its NDC.

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Executive summary

Japan's First Biennial Transparency Report

under the Paris Agreement

Chapter I National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases

Japan reported greenhouse gas (GHG) inventories in April 2024 that contain information on GHG emissions and removals in Japan from FY 1990 to FY 2022 based on Articles 4 and 12 of the United Nations Framework Convention on Climate Change (UNFCCC) and Article 13 of the Paris Agreement.

Japan submitted the national inventory document prescribed in the *Modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement* (Annex to Decision 18/CMA.1) as a stand-alone report as described above. For the details, please refer to the national inventory document[1].

- Total GHG emissions in fiscal year (FY) 2022 (excluding LULUCF[2], including indirect CO_2) were 1,135 million tonnes CO_2 eq. (Mt CO_2 eq.), which decreased by 10.9% compared to the emissions in FY1990 and by 19.3% compared to FY 2013 as the base year of Japan's emission reduction target for FY 2030.
- Between FY 1990 and FY 2022, CO_2 emissions (excluding LULUCF and indirect CO_2) decreased by 10.6%, CH_4 emissions (excluding LULUCF) decreased by 40.0%, and N_2O (excluding LULUCF) decreased by 40.3%.
- Between calendar year (CY) 1990 and CY 2022, HFC emissions increased by 244%, PFC emissions decreased by 50.5%, SF_6 emissions decreased by 84.5%, and NF_3 emissions increased by 1,100%.
- In FY 2022, CO_2 emissions accounted for 91.1% of total GHG emissions. The breakdown of CO_2 emissions shows that emissions from fuel combustion account for 94.9%, followed by industrial processes and product use (4.0%) and waste (1.1%). As for the breakdown of CO_2 emissions within fuel combustion, energy industries accounted for 42.0%, followed by manufacturing industries and construction (22.7%), transport (17.9%), and other sectors (12.3%).
- Net removals (including CO_2, CH_4 and N_2O emissions) from the LULUCF sector in FY 2022 were 53.2 Mt CO_2 eq.

Chapter II Information necessary to track progress made in implementing and achieving nationally determined contributions under Article 4 of the Paris Agreement

(National circumstances and institutional arrangements)

- The population of Japan as of October 1, 2020, is approximately 126 million. It is predicted that the population of Japan will decline rapidly and reach around 101 to 108 million by 2050.
- As of fiscal year (FY) 2022, Japan's land area equaled 37.80 million hectares, or 0.3% of the total global land area, of which nearly 80% was accounted for as 24.97 million hectares (66.1%) of forests and 3.99 million hectares (10.5%) of agricultural land.
- Japan's GDP for FY 2022 was approximately 558 trillion yen, and GDP per capita was approximately 4.49 million yen.
- The final energy consumption by different sectors in Japan in FY 2022 was 45% for the industrial sector,

[1] https://unfccc.int/documents/637879

[2] Land Use, Land-Use Change and Forestry

including non-energy use, 31% for the commercial and residential sector, and 24% for the transport sector. The energy mix in electricity generation in FY 2010 was 29.0% for LNG thermal, 25.1% for nuclear, and 27.8% for coal thermal. However, because of the Great East Japan Earthquake in 2011, the nuclear power plants in Japan stopped, and the energy mix in electricity generation has significantly changed after FY 2011. In FY 2022, the energy mix in electricity generation was 33.8% for LNG thermal and 30.8% for coal thermal.

- Japan is one of the most forested countries in the world, and its forested area remains about 25 million hectares, or two-thirds of the country's total land area. Of this, 10 million hectares are planted forests. More than half of them are over 50 years old, and the amount of CO_2 removals is declining because of the maturation of the forests.
- Regarding the promotion of global warming countermeasures, there is specific legislation, the Act on the Promotion of Global Warming Countermeasures. Article 2, paragraph 2 of the Act states that global warming countermeasures must be promoted through close cooperation among citizens, the national government, local governments, businesses, and private organizations to realize a decarbonized society by 2050 while integrally promoting environmental conservation and economic and social development. Furthermore, the government established the *Plan for Global Warming Countermeasures* based on Article 8, paragraph 1, of the Act to promote global warming countermeasures towards the achievement of the Nationally Determined Contribution (NDC) comprehensively and systematically. The *Plan for Global Warming Countermeasures* is the only general plan regarding global warming in Japan. This plan sets targets for reducing GHG emissions and removals, basic matters concerning measures that businesses and citizens should implement, and basic matters concerning measures that the national government and local governments should implement in order to achieve the target.
- In the government, the Global Warming Prevention Headquarters, which is headed by the Prime Minister and includes all cabinet ministers as members, and the Executive Committee of the Global Warming Prevention Headquarters, which is a committee of the director-general level of each ministry and agency, play a central role in close coordination with the relevant ministries and agencies.
- In order to constantly monitor and ensure the effectiveness of the *Plan for Global Warming Countermeasures*, Japan strictly checks progress with respect to the measures implemented by the government for each countermeasure each year by assessing the emission reductions, the evaluation indicators for countermeasures, and other relevant indicators for greenhouse gas and category, and flexibly review the plan as required.

(Description of a Party's NDC under Article 4 of the Paris Agreement)

- Japan's GHG emission reduction target under the Paris Agreement is a reduction of 46% in national total greenhouse gas emissions in fiscal year (FY) 2030 from its FY 2013 levels, setting an ambitious target that is aligned with the long-term goal of achieving net zero by 2050. Furthermore, Japan will continue strenuous efforts in its challenge to meet the lofty goal of cutting its emissions by 50%. This target was submitted to the UNFCCC on October 22, 2021, as the update of Japan's NDC.
- Japan's long-term goal is to reduce greenhouse gas emissions to net zero, that is, to realize carbon neutrality.

(Information necessary to track progress made in implementing and achieving NDCs under Article 4 of the Paris Agreement)

- The total GHG emissions selected as an indicator to track progress made in implementing and achieving

NDCs are the economy-wide national total GHG emissions, including indirect CO_2 and excluding LULUCF. In tracking and evaluating the progress of implementing and achieving the NDC, the total GHG emissions, the contribution from the LULUCF sector based on an activity-based approach, and the internationally transferred mitigation outcomes (ITMOs) consistent with Article 6 of the Paris Agreement will be considered.

- Total greenhouse gas emissions (excluding LULUCF) in FY 2022 were approximately 1,135 Mt CO_2 equivalent, a 19.3% reduction from the base year of FY 2013. Considering the contribution from LULUCF activities (approximately 50.2 Mt CO_2), the total greenhouse gas emissions in FY 2022 were approximately 1,085 Mt CO_2 eq., which is a 22.9% decrease from the base year. The net total GHG emissions in FY 2022 are the lowest since FY 1990, and Japan is making steady progress toward its 2030 emission reduction target and 2050 net-zero goal.

(Mitigation policies and measures, actions and plans, related to implementing and achieving a NDC under Article 4 of the Paris Agreement)

- For the energy conversion sector under the energy sector, initiatives such as the reduction of CO_2 emission intensity in power sectors, the maximum introduction of renewable energy, and the promotion of the introduction of facilities and equipment with high energy-saving performance in the petroleum product manufacturing sector will be promoted.
- For the industry sector, initiatives such as the promotion of voluntary effort by industry, the promotion of the introduction of facilities and equipment with high energy-saving performance, the implementation of thorough energy management, and the promotion of emissions reduction measures for small and medium businesses will be promoted.
- For the commercial sector, initiatives such as the improvement of the energy efficiency of buildings, the promotion of the introduction of facilities and equipment with high energy-saving performance, the greening of digital equipment and industry, and the implementation of thorough energy management will be promoted.
- For the residential sector, initiatives such as the improvement of energy efficiency of housing, the promotion of the introduction of facilities and equipment with high energy-saving performance, and the implementation of thorough energy management will be promoted.
- For the transport sector, initiatives such as the diffusion of next-generation vehicles and improvement of fuel efficiency, the measures for road traffic flow, the promotion of the use of public transportation and bicycles, the measures for railways, ships, and aviation, and the promotion of decarbonized logistic systems will be promoted.
- For the industrial processes and product use (IPPU) sector, reduction of fluorinated gas emissions such as the promotion of non-fluorocarbons and low GWP products, the preventing leakage of fluorocarbons from the use of refrigeration and air-conditioning equipment for business use, and the recovery and proper disposal of fluorocarbons from refrigeration and air-conditioning equipment, and the reduction of CO_2 emissions from cement production by an expansion of the use of blended cement will be promoted.
- For the agriculture sector, measures for CH_4 emission reduction from rice cultivation and N_2O emission reduction associated with fertilization will be promoted.
- Regarding the forest carbon sinks measures in the land use, land use change and forestry (LULUCF) sector, initiatives to be implemented will include the maintenance of healthy forests, the promotion of appropriate management and conservation of protection forests, natural parks, and other areas, the fostering efficient and stable forest management, the promotion of people's participation in forest management, and the

promotion of the use of wood and woody biomass. For measures to increase carbon removals in agricultural soils, carbon sequestration in cropland and grassland soils will be promoted through the continuous application of organic matter, such as compost and green manure to the soil. Also, urban greening and initiatives related to blue carbon will be promoted.

- For the waste sector, initiatives such as the diffusion of biomass plastics, the reduction of waste incineration, and the advancement of incineration at sewage sludge incineration facilities will be implemented.
- As cross-cutting measures, Green Transformation (GX) to fulfill Japan's international commitments and simultaneously enhancement of Japan's industrial competitiveness and economic growth, the dissemination of DECOKASTU, which is a national movement to create new and affluent lifestyles towards decarbonization, the activation of the J-Credit scheme, the promotion of the Joint Crediting Mechanism (JCM), the creation of urban/regional structures and socioeconomic systems contributing to decarbonization, the realization of a hydrogen society, the promotion of sustainable finance will be promoted.

(Summary of greenhouse gas emissions and removals)

- An overview of GHG emissions and removals is outlined in Chapter I and is therefore omitted here.

(Projections of greenhouse gas emissions and removals)

- The future projections of GHG emissions and removals of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3) for FY 2030 are estimated by gas and sector.
- The projected total GHG emissions (excluding the net GHG removal contribution of the LULUCF sector) in FY 2030 under a with measures scenario is approximately 813 Mt CO_2 eq., which is a decrease of 42% from FY 2013. Considering the projections for the GHG removals contribution of LULUCF (removals by forest carbon sinks [approximately 38 Mt CO_2], carbon sinks in agricultural soils [approximately 8.5 Mt CO_2], and urban greening [approximately 1.2 Mt CO_2]) and the Joint Crediting Mechanism (JCM) in FY 2030, the projected total GHG emissions for FY 2030 will be a reduction of 46% from FY 2013.

Chapter III Climate Change Impacts and Adaptation under Article 7 of the Paris Agreement

(Institutional and legal framework for climate change adaptation measures)

- In Japan, the *National Plan for Adaptation to the Impacts of Climate Change* was formulated and approved by the Cabinet in November 2015. Subsequently, in order to define the legal position of climate change adaptation and to promote climate change adaptation more strongly in collaboration with a variety of stakeholders, including the national government, local governments, business operators, and citizens, the *Climate Change Adaptation Act* was promulgated in June 2018 and has been in force since December 2018. This was followed by the formulation of the *Climate Change Adaptation Plan* in November of the same year based on the *Climate Change Adaptation Act*. After that, the *Climate Change Adaptation Plan* was revised in October 2021 based on the *Assessment Report on Climate Change Impacts in Japan,* published in December 2020, etc. Thereafter, the *Climate Change Adaptation Act* was also revised in April 2023 to promote government-wide heat illness countermeasures, followed by formulation of the *Heat Illness Prevention Action Plan* and partial revision of the *Climate Change Adaptation Plan* (adding basic matters

of the Heat Illness Prevention Action Plan) in May of the same year.

(Objectives and progress management)

- The objective of Japan's adaptation measures is to comprehensively and systematically promote climate change adaptation policies based on scientific findings. This aims to prevent and mitigate damage from the impact of climate change; to promote the stable life of citizens, sound development of society and the economy, conservation of the natural environment, and achievement of resilient national land; and to build a safe, comfortable, and sustainable society.
- The progress of adaptation measures is to be periodically checked under the Climate Change Adaptation Promotion Council, which is chaired by the Minister of the Environment and composed of the relevant ministries and agencies.

(Major climate change impacts assessments and adaptation measures on individual sectors)

- In the *Assessment Report on Climate Change Impacts in Japan* that was published in December 2020, the impact that climate change could have on Japan is assessed for 71 categories covering seven sectors (agriculture, forestry, and fisheries; water environment and water resources; natural ecosystems; natural disasters and coastal areas; human health; industrial and economic activities; and life of the citizenry and urban life) from three perspectives, including the degree and possibility of the impact (significance), the expression time of the impact, the time when adaptation efforts need to be started, and when an important decision needs to be made (urgency) and the certainty of evidence (confidence). The result of the assessment indicates that the impacts of climate change are significant and urgent.
- The *Climate Change Adaptation Plan*, which was revised in October 2021 (and also revised partially in May 2023), sorted the climate change impacts for each category and the basic concept of adaptation measures in consideration of the climate change impacts assessment in the aforementioned report.

(Adaptation efforts by local governments)

- In local governments as of March 2024, 315 local governments have formulated *Local Climate Change Adaptation Plans* and are implementing adaptation measures based on local circumstances in a planned manner. As of March 2024, 63 local governments established Local Climate Change Adaptation Centers that serve as the bases to collect, organize, analyze, and provide information related to local climate change impacts and climate change adaptation and to provide technical advice.

(Cross-sectoral efforts and international cooperation)

- Regarding cross-sectoral efforts, the *Climate Change Adaptation Plan* stipulates the fundamental measures for the enhancement and utilization of scientific knowledge on climate change and other related issues; fundamental measures related to ensuring the system for collection, organization, analysis, and provision of information related to climate change; fundamental measures related to the promotion of measures related to climate change adaptation with local governments; fundamental measures related to the promotion of climate change adaptation by business operators and business activities contributing to climate change adaptation; and fundamental measures for securing international collaboration and promoting international cooperation related to climate change.
- Concerning international cooperation, the *Climate Change Adaptation Plan* positions the "contribution to increasing the adaptive capacity of developing countries" as one of its basic strategies. For this reason, Japan built the Asia-Pacific Climate Change Adaptation Information Platform (AP-PLAT), which was

established to support decision-making in consideration of climate change risks and highly effective climate change adaptation in the Asia-Pacific region and promotes, through cooperation with relevant institutions and others, the enhancement of scientific findings related to climate change risks, development and provision of publicly available tools to assist in the formulation of climate change adaptation plans, and development of capacities related to the climate change impact assessment and climate change adaptations.

Chapter IV Information on financial, technology development and transfer and capacity-building support provided and mobilized under Articles 9–11 of the Paris Agreement

（Finance）

- Japan has provided a variety of climate change support through multilateral and bilateral frameworks to support the implementation of the Paris Agreement by developing countries.
- Japan's climate change support to developing countries during the two-year period from 2021 to 2022 (both calendar years) reached approximately 26.9 billion USD (public financing amounted to approximately 22.4 billion USD and private financing amounted to approximately 4.5 billion USD). Regarding the Green Climate Fund (GCF), Japan, in addition to its contributions of 1.5 billion USD to the GCF for initial resource mobilization (2015–2018) and 1.5 billion USD for the First Replenishment (2020–2023), has committed to making contributions of up to 165 billion JPY for the Second Replenishment (2024–2027) of the GCF.
- Moreover, based on the decision at COP27, related to the decision on operationalization of the new funding arrangements, including a fund, for responding to loss and damage, which was adopted at COP28, Japan announced that it was ready to contribute 10 million USD to commence the operationalization of the fund and became the first country in the world to disburse the fund in March 2024.
- In addition, in November 2022, Japan contributed to the launch of the Just Energy Transition Partnership (JETP) Indonesia as one of the co-lead countries with the United States and participated in JETP Vietnam as one of the partner countries.
- Based on these achievements, a new climate finance commitment from 2021 was announced by former Prime Minister Suga at the G7 Cornwall Summit in June 2021 to provide climate-related assistance to developing countries totaling 6.5 trillion JPY in both public and private sectors over the five years from 2021 to 2025. In addition, at COP26 in November 2021, Prime Minister Kishida announced up to 10 billion USD in the five years starting from 2021 to 2025 on top of the 6.5 trillion JPY announced at the G7 Cornwall Summit in order to take the initiative in fulfilling the financial gap in the annual 100 billion USD joint mobilization goal of climate finance by developed countries. Furthermore, as part of these financial commitments, Japan announced at COP26 that it would double its assistance for adaptation, totaling approximately 1.6 trillion yen from both public and private financing for adaptation in the five years starting from 2021 to 2025. These commitments were on track in 2022.
- As a major developed country, Japan will continue to support actions to address climate change in developing countries by steadily implementing its financial commitments.

（Technology Development and Transfer）

- Based on the Plan for Global Warming Countermeasures, Japan expanded cooperation based on collaboration with partner countries and promoted international deployment of environmentally friendly technologies and products by leveraging Japan's strengths in technology to make the greatest possible contribution to global emission reductions.
- For technology transfer, Japan is contributing by deepening discussions on innovation creation through international platforms and other means to promote discussion. In addition, Japan promotes demonstration projects to create innovations for radically restructuring excellent decarbonizing technologies to meet the characteristics of developing countries while also creating opportunities for new innovations through the dissemination of innovative technologies and sharing the effects of such technologies with developing countries.
- Japan also promotes the Joint Crediting Mechanism (JCM), which facilitates the diffusion of advanced decarbonizing technologies, products, systems, services, and infrastructure through investments by Japanese entities, as well as the City-to-City Partnership (C2C), which supports the introduction of superior decarbonizing technologies, including systems and know-how, based on the experience of local governments in Japan.
- As a cross-sectoral effort, technical development assistance to various developing countries is also provided for agriculture, forestry, and fisheries.
- In the field of adaptation, we are working with domestic and international organizations to diversify funding and provide support for adaptation projects based on the priority areas and the needs of each country.

（Capacity building）

- Based on the global warming countermeasures plan, Japan is expanding cooperation based on collaboration with partner countries and further improving the environment by creating markets, fostering human resources, and building institutions.
- In the field of mitigation, Japan supports the formulation of a long-term strategy and the update of NDCs by assessing policy options and quantifying the various future scenarios using the Asia-Pacific Integrated Model (AIM). In the field of adaptation, Japan supports climate change impact assessment and capacity building on climate change adaptation, including the development of early warning systems by the private sector. Additionally, various seminars are provided to enhance adaptation capacity by sharing information and knowledge. As capacity-building support for transparency, Japan contributes to capacity building and the institutional development of a measurement and reporting system, especially in Asia, by hosting the Workshop on Greenhouse Gas Inventories in Asia and the Partnership to Strengthen Transparency for Co-Innovation (PaSTI).

Chapter

National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases

Japan's First Biennial Transparency Report

under the Paris Agreement

A. Overview

Japan reported greenhouse gas (GHG) inventories in April 2024 that contain information on GHG emissions and removals in Japan from FY 1990 to FY 2022 based on Articles 4 and 12 of the United Nations Framework Convention on Climate Change (UNFCCC) and Article 13 of the Paris Agreement.

Japan submitted the national inventory document prescribed in the *Modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement* (Annex to Decision 18/CMA.1) as a stand-alone report as described above. For the details, please refer to the national inventory document[3].

- Total GHG emissions in fiscal year (FY) 2022 (excluding LULUCF[4], including indirect CO_2) were 1,135 million tonnes CO_2 eq. (Mt CO_2 eq.), which decreased by 10.9% compared to the emissions in FY1990 and by 19.3% compared to FY 2013 as the base year of Japan's emission reduction target for FY 2030.
- Between FY 1990 and FY 2022, CO_2 emissions (excluding LULUCF and indirect CO_2) decreased by 10.6%, CH_4 emissions (excluding LULUCF) decreased by 40.0%, and N_2O (excluding LULUCF) decreased by 40.3%.
- Between calendar year (CY) 1990 and CY 2022, HFC emissions increased by 244%, PFC emissions decreased by 50.5%, SF_6 emissions decreased by 84.5%, and NF_3 emissions increased by 1,100%.
- In FY 2022, CO_2 emissions accounted for 91.1% of total GHG emissions. The breakdown of CO_2 emissions shows that emissions from fuel combustion account for 94.9%, followed by industrial processes and product use (4.0%) and waste (1.1%). As for the breakdown of CO_2 emissions within fuel combustion, energy industries accounted for 42.0%, followed by manufacturing industries and construction (22.7%), transport (17.9%), and other sectors (12.3%).
- Net removals (including CO_2, CH_4 and N_2O emissions) from the LULUCF sector in FY 2022 were 53.2 Mt CO_2 eq.

[3] https://unfccc.int/documents/637879

[4] Land Use, Land-Use Change and Forestry

B. Description of GHG emissions and removals

1 Overview of greenhouse gas inventory

1.1 Background information on Japan's greenhouse gas inventory

Japan reported greenhouse gas (GHG) inventories in April 2024 that contain information on emissions and removals of GHGs, including precursors (nitrogen oxides [NO_X], carbon monoxide [CO], non-methane volatile organic compounds [NMVOC]), and sulfur oxides [SO_X] in Japan from FY 1990 to FY 2022[5] based on Articles 4 and 12 of the United Nations Framework Convention on Climate Change (UNFCCC) and Article 13 of the Paris Agreement.

Japan submitted the national inventory document prescribed in the *Modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement* (Annex to Decision 18/CMA.1, hereinafter referred to as the "MPGs") as a stand-alone report as described above. Therefore, this chapter provides only a summary of the information in the report.

Estimation methodologies for the GHG inventories are required to be in line with the *2006 IPCC Guidelines for National Greenhouse Gas Inventories (2006 IPCC Guidelines)*, which were made by the Intergovernmental Panel on Climate Change (IPCC), and Japan's estimation methodologies are basically in line with these guidelines. In order to enhance transparency, consistency, comparability, completeness, and accuracy of the inventory, Japan also applies the *2013 Supplement to the 2006 IPCC Guidelines: Wetlands (Wetlands Guidelines)*, the *2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol (KP Supplement [2013])* and the *2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (2019 Refinement)*.

Japan's national inventory was reported in accordance with the MPGs decided by the Conference of the Parties.

1.2 Brief general description of methodologies

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

The results of the actual measurements or estimates based on research conducted in Japan are used to determine the EFs (country-specific emission factors). The default values given in the *2006 IPCC Guidelines* are used for the estimation of emissions, which are assumed to be quite low and are not investigated well.

1.3 Sectors

Japan's national GHG inventory is composed of GHG emissions and removals (CO_2, CH_4, N_2O, HFCs, PFCs, SF_6, and NF_3) and precursors (NO_x, CO, NMVOC, and SO_x). These emissions are estimated by five sectors (Energy, Industrial Processes and Product Use (IPPU), Agriculture, Land Use, Land-Use Change and Forestry (LULUCF), and Waste).

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

(1) Energy

Emissions from the energy sector consist of two main categories: fuel combustion (1.A) and fugitive emissions (1.B) from fuels. Fuel combustion (1.A) includes emissions released into the atmosphere when fossil fuels (e.g., coal, oil products, and natural gas) are combusted. Fugitive emissions are intentional or unintentional releases of gases from fossil fuels by anthropogenic activities. In particular, the emissions from fuel combustion (1.A) are a significant emission source, accounting for nearly 90% of total GHG emissions (excluding LULUCF). It is composed of five subcategories: Energy industries (1.A.1), including emissions from mainly public electricity and heat production; Manufacturing industries and construction (1.A.2), including emissions from the manufacturing and construction industries; Transport (1.A.3), including emissions from the transport of passengers and freight; Other sectors (1.A.4), including commercial/institutional, residential, agriculture/forestry/fishing; and Other (1.A.5).

In Japan, fossil fuels are used to produce energy for a wide variety of purposes (e.g., production, transportation, and consumption of energy products), and CO_2, CH_4, N_2O, NOx, CO, and NMVOC are emitted in the process.

(2) Industrial Processes and Product Use (IPPU)

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

(3) Agriculture

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

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

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

(5) Waste

In the waste sector, GHG emissions from the treatment and disposal of waste are estimated for solid waste disposal, biological treatment of solid waste, incineration (waste incineration that involves the use of energy is covered in the energy sector) and open burning of waste, wastewater treatment and discharge, and others[6] in accordance with treatment processes. The waste to be covered in this sector is waste as defined under the *2006 IPCC Guidelines*. In the case of Japan, the waste does not only include municipal waste and industrial waste as defined by the Waste Management and Public Cleansing Act (Act No. 137, 1970), but also include recyclables and valuables that are re-used within a company.

2 Trends in GHG emissions and removals

Total GHG emissions in FY 2022[7] (excluding LULUCF, including indirect CO_2[8]) were 1,135 Mt CO_2 eq. They decreased by 10.9% compared to FY 1990 and decreased by 19.3% compared to FY 2013.

Net removals[9] (including CO_2, CH_4, and N_2O emissions) from the LULUCF sector in FY 2022 were 53.2 MtCO_2 eq., which accounted for 4.7% of total GHG emissions. They decreased by 26.9% compared to FY 1990 and by 27.5% compared to FY 2013. The long-term declining trend in removals from 2003 was mainly due to the progression in the maturity of Japanese forests.

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[6] Data for some emission source categories in the waste sector are complemented by estimations when statistical data or related data are not available. The methodologies for this estimation are not described in this chapter. For details, refer to the Report of *the Waste Panel on Greenhouse Gas Emission Estimate* (2006) and the website of the Ministry of the Environment, Review of Greenhouse Gases Emissions Estimation Methods (http://www.env.go.jp/earth/ondanka/santeiho/kento/index.html).

[7] The sum of CO_2, CH_4, N_2O, HFCs, PFCs, SF_6, and NF_3 emissions converted to CO_2 equivalents multiplied by their respective global warming potential (GWP). The GWP is a coefficient by means of which greenhouse gas effects of a given gas are made relative to those of an equivalent amount of CO_2. The coefficients are subjected to the *Fifth Assessment Report* (2013) issued by the IPCC.

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

[9] Since the inventory reports all GHG emissions and removals from the LULUCF sector, these values do not correspond to emissions and removals in the NDC.

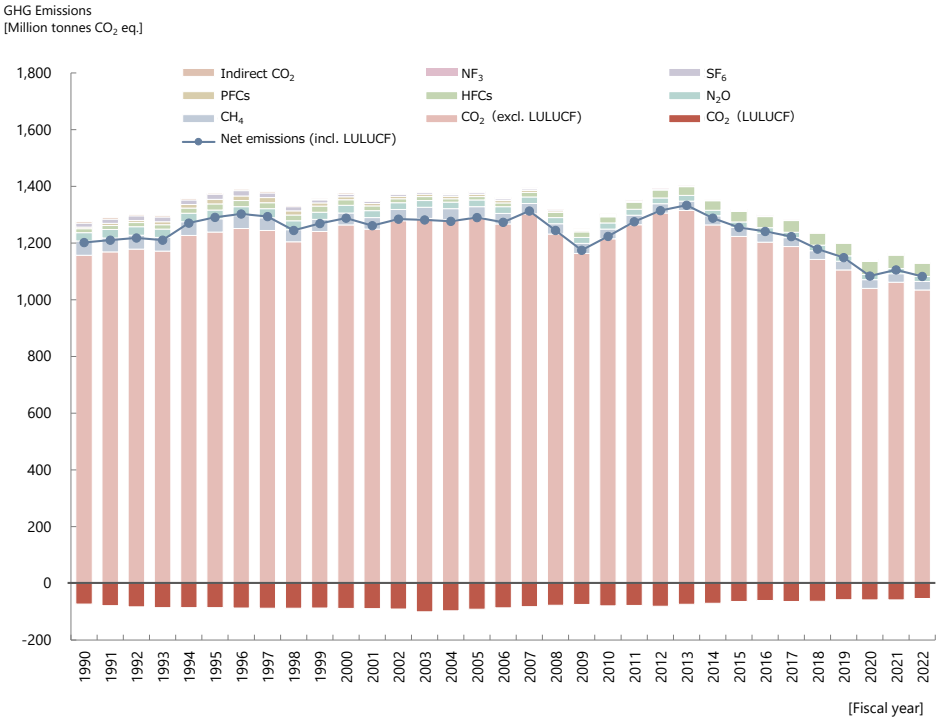


Figure I-1 Trends in GHG emissions and removals in Japan

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

[Mt CO_2 eq.]	GWP	GHG emissions [Mt CO_2 eq.]																			
		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
CO_2 (excl. LULUCF) *1	1	1157.4	1169.1	1178.9	1171.9	1226.9	1239.2	1251.7	1244.4	1204.6	1241.2	1264.0	1249.4	1279.0	1287.5	1282.9	1290.3	1267.3	1303.0	1232.2	1163.4
CO_2 (incl. LULUCF) *1	1	1083.7	1089.8	1095.8	1085.6	1140.7	1153.4	1164.7	1156.6	1116.6	1153.8	1175.5	1160.2	1188.2	1186.9	1185.7	1198.7	1180.3	1220.7	1154.5	1088.3
CO_2 (LULUCF only)	1	-73.7	-79.2	-83.0	-86.3	-86.2	-85.9	-87.0	-87.9	-88.0	-87.4	-88.5	-89.2	-90.8	-100.6	-97.2	-91.6	-87.0	-82.3	-77.7	-75.0
CH_4 (excl. LULUCF)	28	49.8	49.1	49.0	48.0	48.1	46.7	45.3	44.8	42.9	42.5	41.7	40.4	39.5	38.5	38.2	38.2	37.5	36.8	35.9	35.3
CH_4 (incl. LULUCF)	28	49.9	49.2	49.1	48.1	48.2	46.8	45.4	44.9	43.0	42.6	41.8	40.5	39.6	38.6	38.3	38.2	37.6	36.9	36.1	35.4
N_2O (excl. LULUCF)	265	28.9	28.6	28.7	28.6	29.6	29.9	30.7	31.4	30.1	24.6	26.9	23.7	23.0	23.2	23.0	22.7	22.7	22.3	21.5	20.9
N_2O (incl. LULUCF)	265	29.7	29.4	29.5	29.4	30.4	30.7	31.5	32.2	30.9	25.4	27.6	24.4	23.7	23.8	23.6	23.3	23.3	22.9	22.0	21.4
HFCs	HFC-134a: 1,430 etc.	13.4	14.6	15.0	15.4	18.0	21.6	21.1	21.1	20.5	21.1	19.8	17.0	14.4	14.5	11.4	11.8	13.6	15.6	18.0	19.7
PFCs	PFC-14: 7,390 etc.	6.2	7.0	7.1	10.1	12.4	16.2	16.7	18.2	15.0	11.8	10.5	8.7	8.2	8.0	8.3	7.8	8.2	7.2	5.2	3.7
SF_6	23,500	13.8	15.2	16.8	16.8	16.1	17.6	18.3	15.8	14.5	10.3	8.2	6.9	6.6	6.2	6.2	5.8	5.9	5.4	4.7	2.8
NF_3	16,100	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.1	0.2	0.3	0.3	0.3	0.3	0.4	0.4	1.4	1.3	1.5	1.4	1.3
Indirect CO_2	1	5.5	5.3	5.0	4.8	4.8	4.7	4.7	4.6	4.2	4.2	4.2	3.8	3.6	3.4	3.3	3.3	3.2	3.0	2.7	2.5
Gross Total (excluding LULUCF, excluding indirect CO_2)		1269.4	1283.6	1295.4	1290.9	1351.1	1371.4	1384.1	1375.9	1327.8	1351.8	1371.3	1346.4	1371.0	1378.2	1370.4	1378.0	1356.5	1391.8	1318.9	1246.9
Net Total (including LULUCF, excluding indirect CO_2)		1196.7	1205.4	1213.3	1205.6	1265.9	1286.4	1297.9	1289.0	1240.7	1265.2	1283.7	1258.0	1281.0	1278.4	1273.9	1287.2	1270.2	1310.2	1241.9	1172.6
Gross Total (excluding LULUCF, including indirect CO_2)		1274.9	1288.9	1300.4	1295.7	1355.9	1376.1	1388.8	1380.5	1332.0	1355.9	1375.6	1350.2	1374.6	1381.6	1373.7	1381.3	1359.6	1394.8	1321.6	1249.5
Net Total (including LULUCF, including indirect CO_2)		1202.2	1210.7	1218.4	1210.4	1270.7	1291.1	1302.6	1293.5	1244.9	1269.4	1287.9	1261.8	1284.6	1281.8	1277.3	1290.4	1273.4	1313.2	1244.7	1175.1

[Mt CO_2 eq.]	GWP	GHG emissions [Mt CO_2 eq.]													Change in emissions	
		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	1990-2022	2013-2022
CO_2 (excl. LULUCF) *1	1	1214.8	1264.8	1306.0	1315.3	1263.8	1223.2	1203.2	1187.5	1142.5	1105.5	1040.5	1061.9	1034.9	-10.6%	-21.3%
CO_2 (incl. LULUCF) *1	1	1135.5	1186.5	1224.8	1241.4	1193.5	1158.8	1142.7	1123.5	1079.2	1047.7	981.7	1003.1	981.2	-9.5%	-21.0%
CO_2 (LULUCF only)	1	-79.3	-78.3	-81.2	-73.9	-70.3	-64.4	-60.5	-64.0	-63.3	-57.7	-58.8	-58.8	-53.7	-27.2%	-27.4%
CH_4 (excl. LULUCF)	28	34.8	33.5	32.7	32.7	32.1	31.7	31.6	31.4	30.9	30.6	30.4	30.4	29.9	-40.0%	-8.6%
CH_4 (incl. LULUCF)	28	34.9	33.6	32.8	32.7	32.2	31.8	31.7	31.5	31.0	30.7	30.5	30.5	29.9	-40.0%	-8.5%
N_2O (excl. LULUCF)	265	20.6	20.2	19.9	19.9	19.5	19.2	18.7	19.0	18.5	18.0	17.7	17.6	17.3	-40.3%	-13.3%
N_2O (incl. LULUCF)	265	21.1	20.7	20.4	20.3	19.9	19.6	19.1	19.4	18.9	18.4	18.1	18.0	17.7	-40.6%	-12.8%
HFCs	HFC-134a: 1,430 etc.	22.0	24.6	27.7	30.3	33.8	37.1	39.5	41.0	42.3	44.5	46.1	46.9	46.1	+244.0%	+52.1%
PFCs	PFC-14: 7,390 etc.	3.8	3.4	3.1	3.0	3.1	3.0	3.1	3.2	3.2	3.2	3.2	2.9	3.0	-50.5%	+2.1%
SF_6	23,500	2.8	2.5	2.5	2.3	2.3	2.4	2.4	2.3	2.3	2.2	2.2	2.2	2.1	-84.5%	-8.9%
NF_3	16,100	1.4	1.7	1.4	1.5	1.0	0.5	0.6	0.4	0.3	0.3	0.3	0.3	0.3	+1102.4%	-77.6%
Indirect CO_2	1	2.4	2.4	2.3	2.3	2.2	2.2	2.2	2.1	2.1	2.0	1.9	1.8	1.8	-66.8%	-20.5%
Gross Total (excluding LULUCF, excluding indirect CO_2)		1300.2	1350.7	1393.3	1405.0	1355.6	1317.1	1299.1	1284.8	1240.0	1204.2	1140.5	1162.2	1133.6	-10.7%	-19.3%
Net Total (including LULUCF, excluding indirect CO_2)		1221.5	1273.0	1312.7	1331.7	1285.9	1253.2	1239.1	1221.3	1177.2	1147.0	1082.2	1103.9	1080.5	-9.7%	-18.9%
Gross Total (excluding LULUCF, including indirect CO_2)		1302.6	1353.1	1395.6	1407.3	1357.8	1319.3	1301.2	1286.9	1242.1	1206.2	1142.3	1164.0	1135.5	-10.9%	-19.3%
Net Total (including LULUCF, including indirect CO_2)		1223.9	1275.4	1315.0	1334.0	1288.1	1255.4	1241.2	1223.4	1179.3	1149.0	1084.1	1105.8	1082.3	-10.0%	-18.9%

3 Trends in GHG emissions and removals by gas

In FY 2022, CO_2 emissions (excluding indirect CO_2) were 1,035 Mt CO_2, accounting for 91.1% of total GHG emissions (excluding LULUCF). CH_4 emissions (excluding LULUCF) were 29.9 Mt CO_2 eq. (2.6%), N_2O emissions (excluding LULUCF) were 17.3 MtCO_2 eq. (1.5%), indirect CO_2 emissions were 1.8 Mt CO_2 eq. (0.2%), and total emissions of HFCs, PFCs, SF_6, and NF_3 in CY 2022 were 51.7 Mt CO_2 eq. (4.5%).

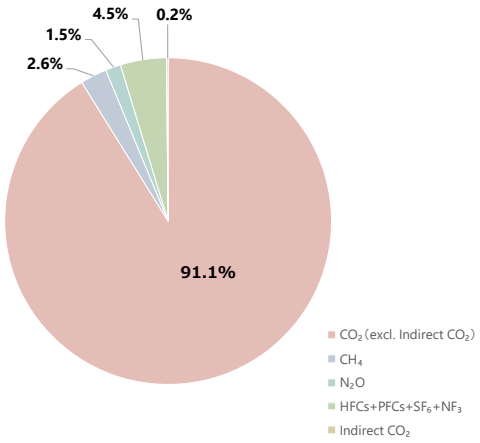


Figure I-2 Proportion of GHG emissions (FY 2022, excluding LULUCF)

Table I-2 Trends in GHG emissions (excluding LULUCF)

GHGs	GHG emissions [Mt CO_2 eq.]									Changes in emissions	
	1990	1995	2000	2005	2013	2015	2020	2021	2022	1990-2022	2013-2022
CO_2(excluding Indirect CO_2)	1,157.4	1,239.2	1,264.0	1,290.3	1,315.3	1,223.2	1,040.5	1,061.9	1,034.9	**-10.6%**	**-21.3%**
CH_4	49.8	46.7	41.7	38.2	32.7	31.7	30.4	30.4	29.9	**-40.0%**	**-8.6%**
N_2O	28.9	29.9	26.9	22.7	19.9	19.2	17.7	17.6	17.3	**-40.3%**	**-13.3%**
HFCs	13.4	21.6	19.8	11.8	30.3	37.1	46.1	46.9	46.1	**+244.0%**	**+52.1%**
PFCs	6.2	16.2	10.5	7.8	3.0	3.0	3.2	2.9	3.0	**-50.5%**	**+2.1%**
SF_6	13.8	17.6	8.2	5.8	2.3	2.4	2.2	2.2	2.1	**-84.5%**	**-8.9%**
NF_3	0.0	0.2	0.3	1.4	1.5	0.5	0.3	0.3	0.3	**+1102.4%**	**-77.6%**
Indirect CO_2	5.5	4.7	4.2	3.3	2.3	2.2	1.9	1.8	1.8	**-66.8%**	**-20.5%**
Total	1,274.9	1,376.1	1,375.6	1,381.3	1,407.3	1,319.3	1,142.3	1,164.0	1,135.5	**-10.9%**	**-19.3%**

3.1 CO_2

(1) Trends in CO_2 emissions

CO_2 emissions in FY 2022 were 1,035 Mt CO_2, accounting for 91.1% of total GHG emissions. They decreased by 10.6% compared to FY 1990 and decreased by 21.3% compared to FY 2013.

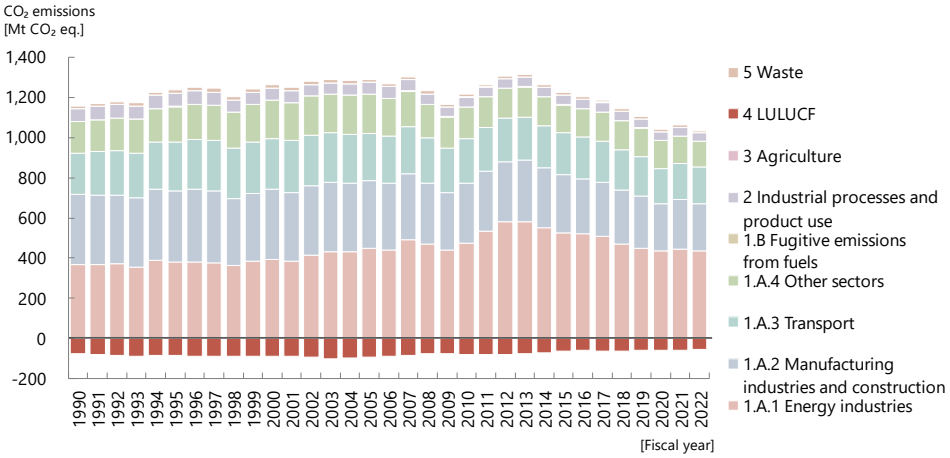


Figure I-3 Trends in CO_2 emissions

The breakdown of CO_2 emissions in FY2022 shows that fuel combustion accounts for 94.9% and is followed by industrial processes and product use (4.0%) and waste sectors (1.1%). As for the breakdown of CO_2 emissions within the fuel combustion category, energy industries account for 42.0% and are followed by manufacturing industries and construction at 22.7%, transport at 17.9%, and other sectors[10] at 12.3%. The main driving factor for the decrease in CO_2 emissions compared to the previous year is the decrease in CO_2 emissions from the manufacturing industries and construction sector.

By looking at the changes in emissions by sector, emissions from fuel combustion in the energy industries increased by 18.2% since FY1990 and decreased by 25.4% compared to FY 2013. The main driving factor for the increase compared to the emissions in FY1990 was the increased emissions from solid and gaseous fuel consumption for electricity power generation, despite the decreased emissions from liquid fuel consumption. Emissions from manufacturing industries and construction decreased by 32.9% since FY1990 and decreased by 23.0% compared to FY 2013. The main driving factor for the decrease compared to the emissions in FY 1990 was the decreased emissions from solid fuel consumption for the iron and steel industry. Emissions from transport decreased by 8.5% compared to FY1990 and decreased by 14.0% compared to FY 2013. The main driving factor for the decrease compared to the emissions in FY 1990 was the decrease in emissions from diesel fuel in road transportation. Emissions from other sectors decreased by 19.3% since FY1990 and decreased by 14.5% compared to FY 2013. The main driving factor for the decrease compared to the emissions in FY 1990 was the decreased emissions from liquid fuel consumption for the commercial/institutional sub-sectors. CO_2 removals in FY 2022 were 53.7 Mt, which were equivalent to 4.7% of total GHG emissions. They decreased by 27.2% since FY1990 and decreased by 27.4% compared to FY 2013.

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

Table I-3 Trends in CO_2 emissions and removals in each sector

Category	GHG emissions [Mt CO_2 eq.]										Changes in emissions	
	1990	1995	2000	2005	2010	2013	2015	2020	2021	2022	1990-2022	2013-2022
1 Energy	1,078.4	1,154.9	1,185.8	1,218.2	1,153.7	1,252.7	1,163.2	986.8	1,006.2	982.7	-8.9%	-21.6%
1.A Fuel combustion	1,078.2	1,154.3	1,185.2	1,217.7	1,153.2	1,252.2	1,162.8	986.3	1,005.8	982.3	-8.9%	-21.6%
1.A.1 Energy industries	368.2	378.5	395.0	449.1	473.3	582.9	526.8	436.1	442.7	435.1	+18.2%	-25.4%
1.A.2 Manufacturing industries and construction	349.7	357.6	346.9	334.5	301.0	304.8	288.0	233.2	250.4	234.6	-32.9%	-23.0%
1.A.3 Transport	202.1	242.8	253.1	238.1	222.0	215.1	208.9	176.6	177.9	185.0	-8.5%	-14.0%
1.A.4 Other sectors	158.2	175.4	190.3	196.0	156.9	149.3	139.2	140.5	134.8	127.6	-19.3%	-14.5%
1.B Fugitive emissions from fuels	0.2	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.3	+71.8%	-24.5%
2 Industrial processes and product use	65.2	67.2	60.2	57.0	47.7	49.3	47.2	42.3	43.7	40.9	-37.3%	-17.0%
3 Agriculture	0.7	0.5	0.5	0.4	0.4	0.6	0.5	0.4	0.4	0.4	-43.8%	-30.8%
4 LULUCF	-73.7	-85.9	-88.5	-91.6	-79.3	-73.9	-64.4	-58.8	-58.8	-53.7	-27.2%	-27.4%
5 Waste	13.0	16.7	17.5	14.7	13.0	12.8	12.3	11.0	11.5	10.9	-16.4%	-15.0%
Total (including LULUCF)	1,083.7	1,153.4	1,175.5	1,198.7	1,135.5	1,241.4	1,158.8	981.7	1,003.1	981.2	-9.5%	-21.0%
Total (excluding LULUCF)	1,157.4	1,239.2	1,264.0	1,290.3	1,214.8	1,315.3	1,223.2	1,040.5	1,061.9	1,034.9	-10.6%	-21.3%

(2) CO_2 emissions per capita, CO_2 emissions per unit of GDP

CO_2 emissions per capita in FY 2022 were 8.28 tonnes. They decreased by 11.5% since FY 1990 and decreased by 19.8% compared to FY 2013.

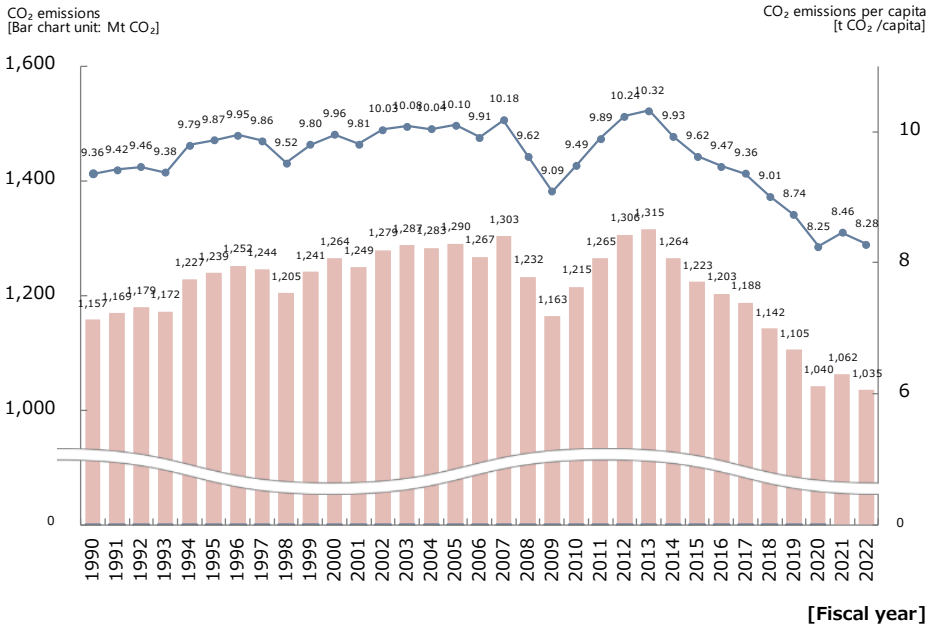


Figure I-4 Trends in total CO_2 emissions and CO_2 emissions per capita

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

CO_2 emissions per unit of Real GDP (million yen) in FY2022 were 1.88 tonnes. They decreased by 30.2% since FY 1990 and decreased by 24.2% compared to FY 2013.

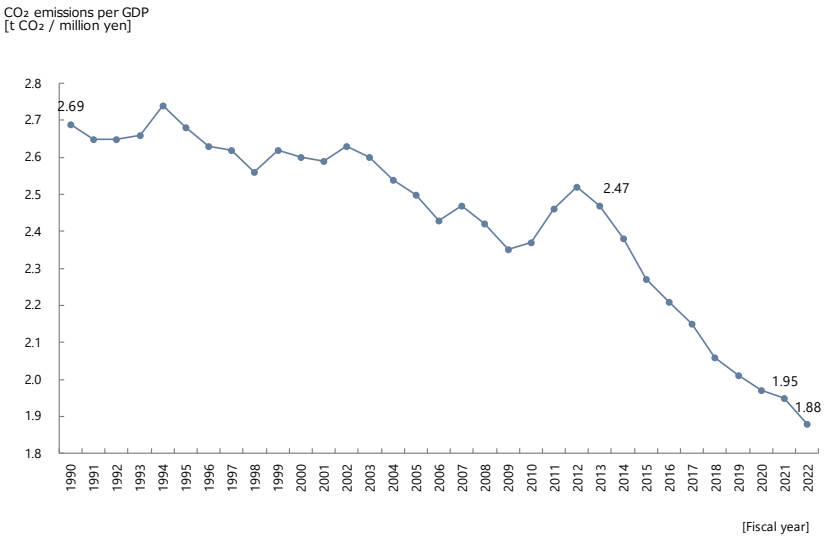


Figure I-5 Trend in CO_2 emissions per unit of Real GDP

Reference of Real GDP data: *Annual Report on National Accounts* (Cabinet Office, Government of Japan)
(Expenditure Approach, chained 2015 yen)

3.2 CH_4

CH_4 emissions, including LULUCF, in FY 2022 were 29.9 $MtCO_2$ eq., accounting for 2.6% of total GHG emissions. They decreased by 40.0% since FY1990 and decreased by 8.5% compared to FY 2013. Their decrease since FY 1990 was mainly a result of a 76.1% decrease in emissions from the waste sector (e.g., solid waste disposal). The breakdown of the FY 2022 emissions showed that the largest source was rice cultivation, which accounted for 43.6%. It was followed by enteric fermentation (28.9%) and manure management (9.0%).

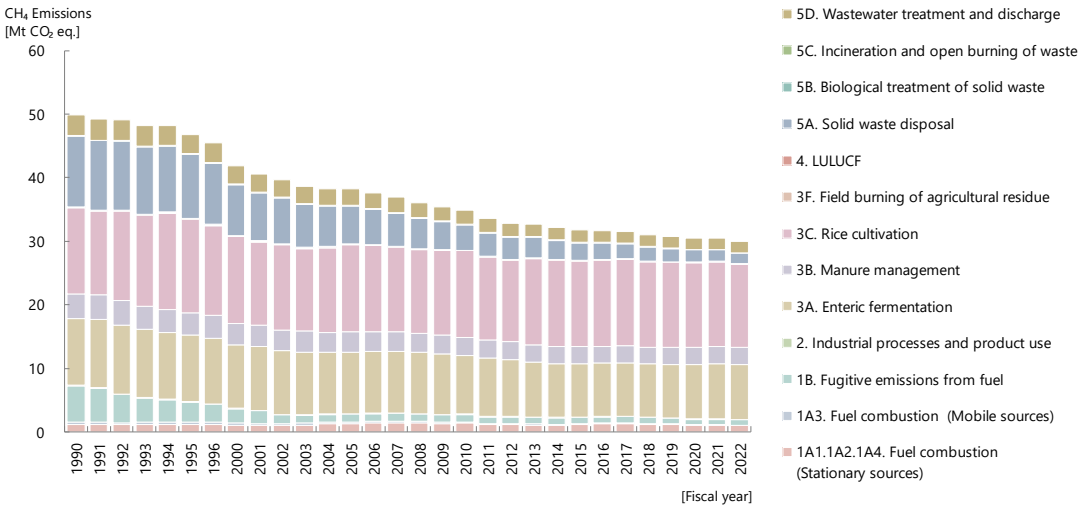


Figure I-6 Trends in CH_4 emissions

Table I-4 Trends in CH_4 emissions

Category	Emissions [Mt CO_2 eq.]										Changes in emissions	
	1990	1995	2000	2005	2010	2013	2015	2020	2021	2022	1990-2022	2013-2022
1 Energy	7.3	4.7	3.6	2.8	2.7	2.3	2.3	2.0	2.0	1.9	-74.0%	-16.4%
1.A Fuel combustion	1.5	1.5	1.4	1.6	1.6	1.2	1.3	1.1	1.1	1.1	-27.5%	-12.1%
1.A.1 Energy industries	0.5	0.4	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	-57.6%	-18.5%
1.A.2 Manufacturing industries and construction	0.4	0.4	0.4	0.5	0.6	0.6	0.6	0.5	0.5	0.5	+30.5%	-5.2%
1.A.3 Transport	0.3	0.3	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	-66.6%	-32.2%
1.A.4 Other sectors	0.3	0.3	0.4	0.6	0.5	0.3	0.2	0.3	0.2	0.2	-13.8%	-8.8%
1.B Fugitive emissions from fuels	5.8	3.2	2.2	1.2	1.1	1.0	1.0	0.9	0.9	0.8	-85.9%	-21.4%
2 Industrial processes and product use	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.04	0.05	0.04	-35.9%	-16.3%
3 Agriculture	28.0	28.8	27.1	26.6	25.7	25.0	24.6	24.7	24.8	24.5	-12.6%	-2.1%
4 LULUCF	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-31.4%	-4.3%
5 Waste	14.5	13.2	11.0	8.7	6.3	5.4	4.8	3.7	3.6	3.5	-76.1%	-35.3%
Total (including LULUCF)	49.9	46.8	41.8	38.2	34.9	32.7	31.8	30.5	30.5	29.9	-40.0%	-8.5%
Total (excluding LULUCF)	49.8	46.7	41.7	38.2	34.8	32.7	31.7	30.4	30.4	29.9	-40.0%	-8.6%

3.3 N_2O

N_2O emissions, including LULUCF, in FY 2022 were 17.7 Mt CO_2 eq., accounting for 1.6% of total GHG emissions. They decreased by 40.6% since FY 1990 and decreased by 13.2% compared to FY 2013. Their decrease since FY 1990 was mainly a result of a 90.5% decrease in emissions from industrial processes and product use (e.g., adipic acid production in the chemical industry). There was a sharp decline in emissions from the industrial processes and product use from FY 1998 to 1999, as N_2O abatement equipment came on stream in the adipic acid production plant in March 1999. However, the N_2O emissions increased in FY 2000 because of a decrease in the equipment's operation rate due to mechanical failure; the emissions decreased again in FY 2001 with the resumption of normal operation. The breakdown of the FY 2022 emissions showed that the largest source was agricultural soils accounting for 29.5%. It was followed by manure management (19.4%) and fuel combustion (stationary sources) (18.3%)

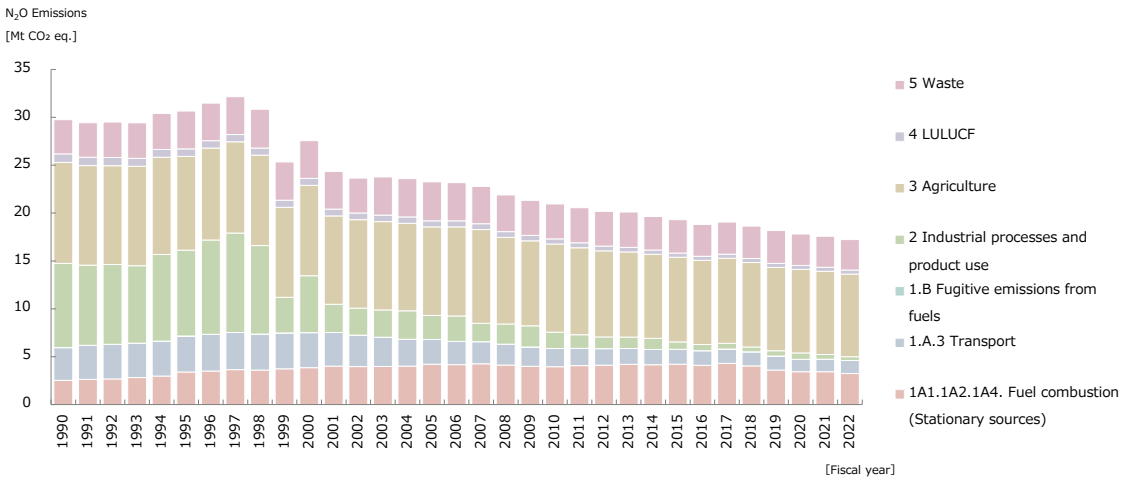


Figure I-7 Trends in N_2O emissions

Table I-5 Trends in N_2O emissions

Category	Emissions [Mt CO_2 eq.]										Changes in emissions	
	1990	1995	2000	2005	2010	2013	2015	2020	2021	2022	1990-2022	2013-2022
1 Energy	5.9	7.2	7.5	6.8	5.9	5.9	5.8	4.7	4.7	4.6	-22.6%	-21.4%
1.A Fuel combustion	5.9	7.2	7.5	6.8	5.9	5.9	5.8	4.7	4.7	4.6	-22.6%	-21.4%
1.A.1 Energy industries	0.8	1.2	1.4	1.9	1.8	2.1	2.1	1.6	1.7	1.6	+107.1%	-21.9%
1.A.2 Manufacturing industries and construction	1.1	1.5	1.7	1.7	1.5	1.6	1.5	1.3	1.3	1.2	+2.8%	-26.4%
1.A.3 Transport	3.4	3.8	3.7	2.6	1.9	1.7	1.6	1.3	1.3	1.4	-59.9%	-17.1%
1.A.4 Other sectors	0.6	0.7	0.7	0.7	0.6	0.5	0.5	0.5	0.5	0.4	-28.0%	-17.6%
1.B Fugitive emissions from fuels	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.0005	0.0005	-75.6%	-40.6%
2 Industrial processes and product use	8.8	9.0	6.0	2.6	1.9	1.4	1.1	1.0	0.9	0.8	-90.5%	-41.6%
3 Agriculture	10.5	9.8	9.4	9.2	9.2	8.9	8.8	8.7	8.7	8.6	-18.2%	-3.1%
4 LULUCF	0.9	0.8	0.7	0.6	0.5	0.5	0.4	0.4	0.4	0.4	-52.6%	-10.0%
5 Waste	3.6	3.9	3.9	4.1	3.6	3.7	3.5	3.3	3.2	3.2	-11.0%	-14.1%
Total (including LULUCF)	29.8	30.7	27.6	23.4	21.1	20.4	19.6	18.1	18.0	17.7	-40.6%	-13.2%
Total (excluding LULUCF)	28.9	29.9	26.9	22.7	20.6	19.9	19.2	17.7	17.6	17.3	-40.3%	-13.3%

3.4 HFCs

HFC emissions[11] in CY 2022 were 46.1 Mt CO_2 eq., accounting for 4.1% of total GHG emissions. They increased by 244% since CY 1990 and increased by 52.1% compared to CY 2013. Their increase since CY 1990 was mainly a result of an increase in emissions from refrigeration and air conditioning (+42.8 Mt CO_2 eq.) substituting for HCFCs (ozone-depleting substances), despite a decrease in emissions of HFC-23 (-100%) as a by-product of HCFC-22 production due to regulation under the Act on the Protection of the Ozone Layer Through the Control of Specified Substances and Other Measures (Act No.53, 1988). In 2022, emissions began to decline for the first time since 2004, mainly from the decrease in leakage during operation from commercial refrigeration and air conditioning equipment. The breakdown of the CY 2022 emissions showed that the largest source was refrigerants of refrigeration and air conditioning equipment, accounting for 92.8%. It was followed by foam blowing agents (5.6%).

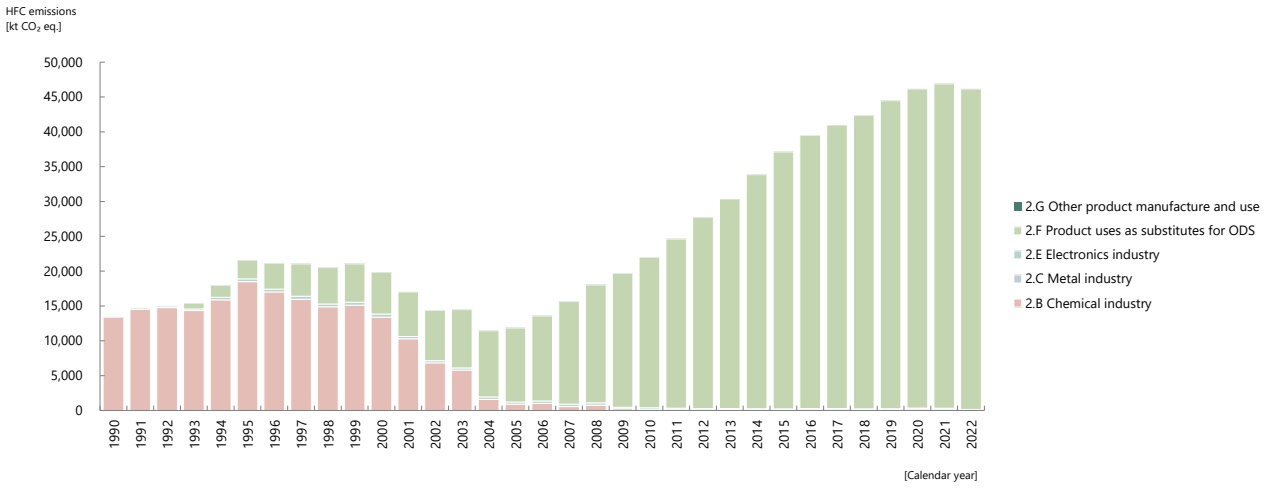


Figure I-8 Trends in HFC emissions

[11] HFC emissions are estimated on a calendar year (CY) basis.

Table I-6 Trends in HFC emissions

Category	Emissions [kt CO_2 eq.]										Changes in emissions	
	1990	1995	2000	2005	2010	2013	2015	2020	2021	2022	1990-2022	2013-2022
2.B Chemical industry	13,347	18,483	13,408	898	160	132	100	187	220	66	-99.5%	-49.9%
2.C Metal industry	NO	NO	NO	NO	NO	1.2	0.8	1.2	1.6	1.2	-	0.00%
2.E Electronics industry	55	416	434	315	220	131	126	151	111	97	+76.4%	-25.8%
2.F Product uses as substitutes for ODS	1.2	2,657	5,993	10,631	21,581	30,070	36,893	45,799	46,559	45,966	+3764838.8%	+52.9%
2.G Other product manufacture and use	6.5	5.4	6.5	4.4	3.3	2.3	2.4	5.3	5.5	5.7	-11.2%	+148.6%
Total	13,410	21,561	19,841	11,848	21,964	30,337	37,122	46,144	46,896	46,137	+244.0%	+52.1%

3.5 PFCs

PFC emissions[12] in CY 2022 were 3.0 $MtCO_2$ eq., accounting for 0.3% of total GHG emissions. They decreased by 50.5% since CY 1990 and increased by 2.1% compared to CY 2013. Their decrease since CY 1990 was mainly the result of a decrease in emissions from the solvents (-66.7%). The breakdown of the CY 2022 emissions showed that the largest source was semiconductor manufacturing, accounting for 47.6%. It was followed by solvents such as those for washing metals (46.1%).

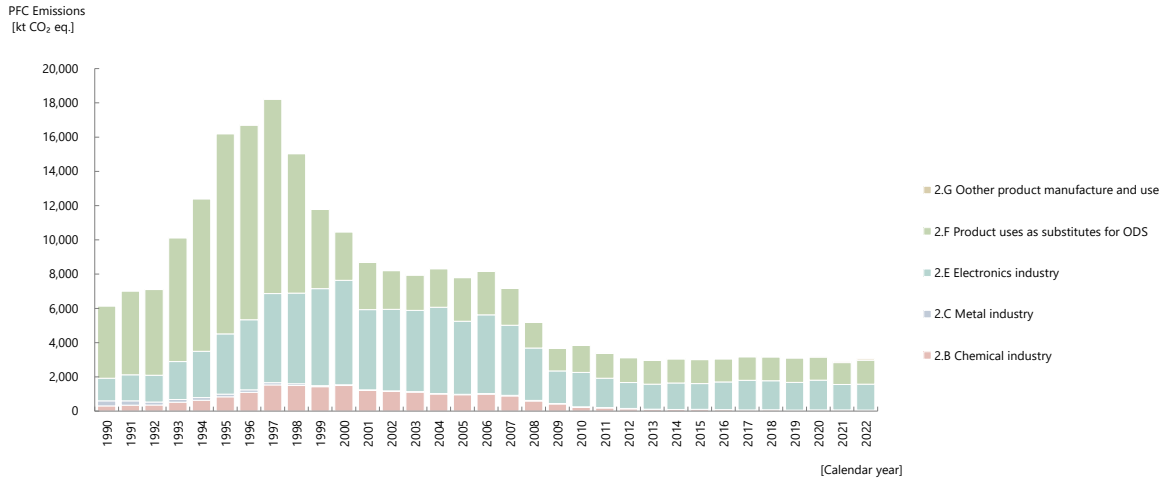


Figure I-9 Trends in PFC emissions

Table I-7 Trends in PFC emissions

Category	Emissions [kt CO_2 eq.]											Changes in emissions	
	1990	1995	2000	2005	2010	2013	2015	2020	2021	2022	1990	1990-2022	2013-2022
2.B Chemical industry	304	840	1,499	955	227	100	104	67	72	67		-78.1%	-33.6%
2.C Metal industry	301	153	39	32	23	14	NO	NO	NO	NO	NO	-	-
2.E Electronics industry	1,314	3,521	6,097	4,263	2,015	1,461	1,507	1,744	1,483	1,503		+14.4%	+2.9%
2.F Product uses as substitutes for ODS	4,228	11,684	2,834	2,542	1,567	1,395	1,394	1,343	1,279	1,406		-66.7%	+0.8%
2.G Other product manufacture and use	15	12	15	10	11	14	12	60	71	72		-	+416.5%
Total	6,163	16,210	10,483	7,802	3,843	2,985	3,017	3,214	2,905	3,049		-50.5%	+2.1%

3.6 SF_6

SF_6 emissions[13] in CY 2022 were 2.1 Mt CO_2 eq., accounting for 0.2% of total GHG emissions. They decreased by 84.5% since CY 1990 and decreased by 8.9% compared to CY 2013. Their decrease since CY1990 was mainly

[12] PFC emissions are estimated on a calendar year (CY) basis.

[13] SF_6 emissions are estimated on a calendar year (CY) basis.

a result of a decrease from electrical equipment, due to an enhancement of gas management systems, such as gas recovery largely in electric power companies (-93.1%). The breakdown of the CY2022 emissions showed that the largest source was other product use (e.g., accelerator, etc.), accounting for 38.2%. It was followed by electrical equipment (27.2%) and semiconductor (14.0%).

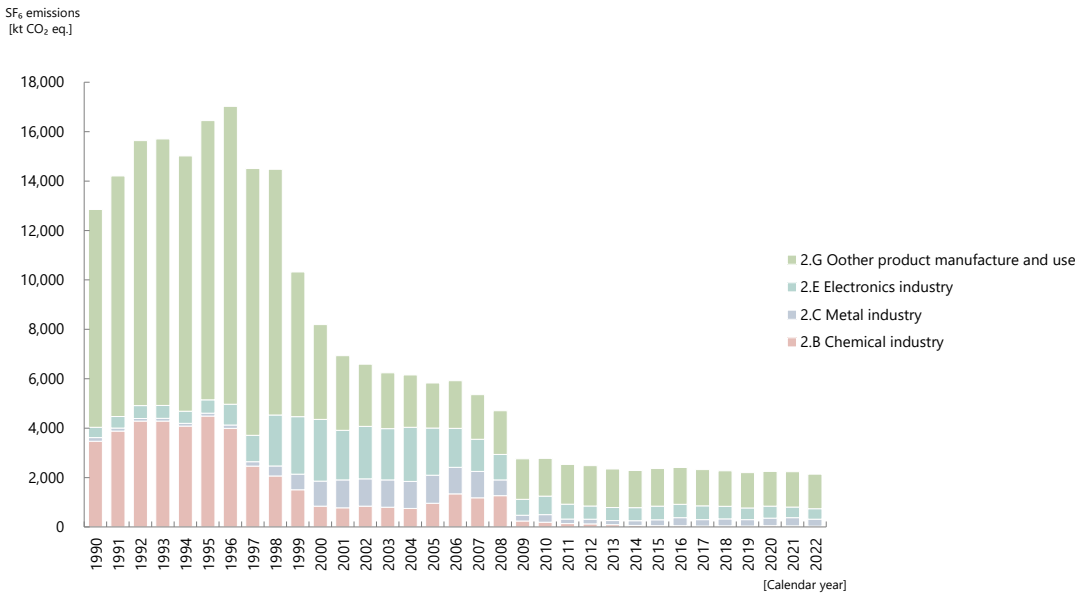


Figure I-10 Trends in SF_6 emissions

Table I-8 Trends in SF_6 emissions

Category	Emissions [kt CO_2 eq.]										Changes in emissions	
	1990	1995	2000	2005	2010	2013	2015	2020	2021	2022	1990-2022	2013-2022
2.B Chemical industry	3,577.3	4,629.5	846.0	958.8	195.1	95.6	54.1	53.6	47.0	33.7	-99.1%	-64.7%
2.C Metal industry	151.0	117.5	1,010.5	1,137.9	302.8	164.5	235.0	305.5	329.0	282.0	+86.7%	+71.4%
2.E Electronics industry	950.7	1,230.4	2,495.9	1,907.3	750.4	531.0	553.9	486.1	432.8	423.1	-55.5%	-20.3%
2.G Other product manufacture and use	9,084.6	11,647.0	3,838.5	1,823.9	1,530.9	1,554.7	1,522.9	1,401.0	1,429.3	1,397.1	-84.6%	-10.1%
Total	13,763.8	17,624.4	8,190.9	5,828.0	2,779.1	2,345.9	2,365.8	2,246.2	2,238.2	2,136.0	-84.5%	-8.9%

3.7 NF_3

NF_3 emissions[14] in CY 2022 were 0.3 Mt CO_2 eq., accounting for 0.03% of total GHG emissions. They increased by 1,102 % since CY 1990 and decreased by 77.6% compared to CY 2013. The increase since CY 1990 was mainly a result of an increase in emissions from semiconductor manufacture, owing to shifts to use NF_3 (by 1,220%). The breakdown of the CY 2022 emissions showed that the largest source was semiconductor manufacture, accounting for 90.1%. It was followed by fluorochemical production (5.7%) and liquid crystal manufacture (4.2%).

[14] NF_3 emissions are estimated on a calendar year (CY) basis.

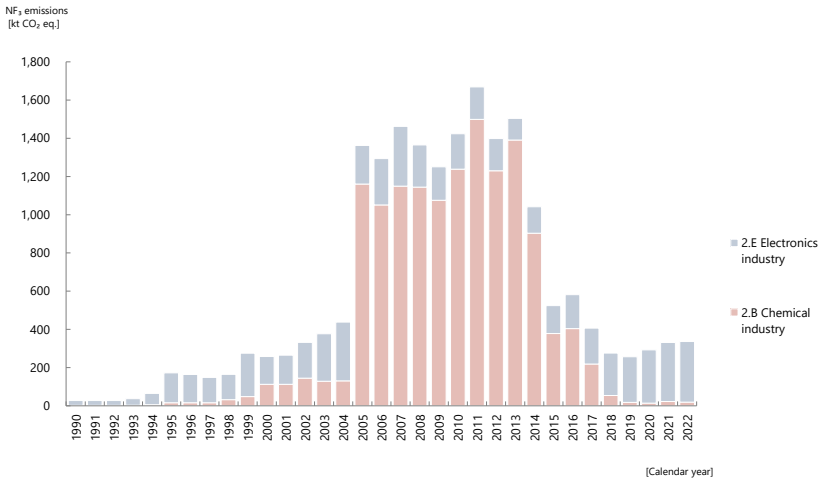


Figure I-11 Trends in NF_3 emissions

Table I-9 Trends in NF_3 emissions

Category	Emissions [kt CO_2 eq.]										Changes in emissions	
	1990	1995	2000	2005	2010	2013	2015	2020	2021	2022	1990-2022	2013-2022
2.B Chemical industry	2.6	16.1	112.7	1,160.8	1,238.1	1,391.0	378.4	14.1	22.4	19.2	+633.8%	-98.6%
2.E Electronics industry	25.4	156.4	145.5	201.7	185.3	113.2	146.1	278.6	309.2	317.1	+1150.6%	+180.1%
総計	28.0	172.5	258.2	1,362.6	1,423.4	1,504.3	524.4	292.8	331.5	336.3	+1102.4%	-77.6%

3.8 Indirect CO_2

Indirect CO_2 emissions[15] in FY 2022 were 1.8 Mt CO_2, accounting for 0.2% of total GHG emissions. They decreased by 66.8% since FY 1990 and decreased by 20.5% compared to FY 2013. Their decrease since FY 1990 was due to the decrease in emissions from the use of paint through the wider use of low VOC paint and VOC removal by adsorption devices.

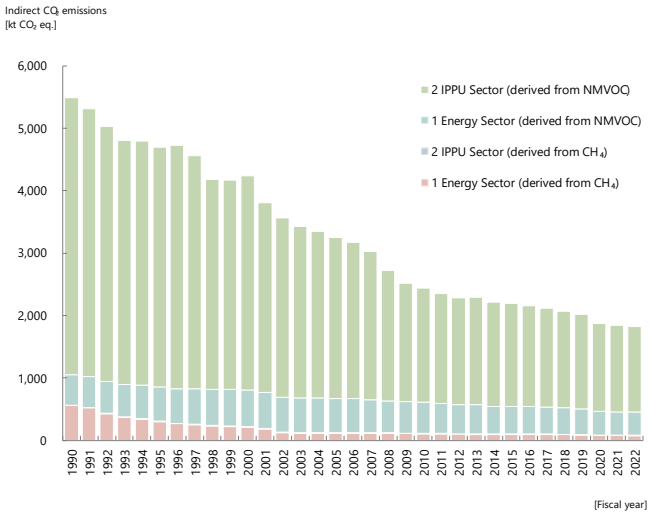


Figure I-12 Trends in Indirect CO_2 emissions

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

Table I-10 Trends in Indirect CO_2 emissions

Emission Source	Emissions [kt CO_2 eq.]										Changes in emissions	
	1990	1995	2000	2005	2010	2013	2015	2020	2021	2022	1990-2022	2013-2022
Derived from CH_4	565.5	310.0	217.4	122.8	113.4	103.9	100.4	85.9	86.9	82.6	-85.4%	-20.5%
1. Energy Sector	558.8	303.5	211.4	116.9	107.5	98.8	95.0	81.7	82.1	78.3	-86.0%	-20.7%
2. IPPU Sector	6.7	6.4	6.0	5.9	5.9	5.1	5.3	4.2	4.8	4.3	-35.9%	-16.3%
Derived from NMVOC	4,924.4	4,383.2	4,024.7	3,128.0	2,328.1	2,185.2	2,094.1	1,789.2	1,757.0	1,738.0	-64.7%	-20.5%
1. Energy Sector	482.1	546.8	591.4	549.1	498.0	464.4	444.6	381.2	371.5	377.6	-21.7%	-18.7%
2. IPPU Sector	4,442.3	3,836.4	3,433.4	2,578.9	1,830.1	1,720.8	1,649.5	1,408.0	1,385.5	1,360.4	-69.4%	-20.9%
Total	5,489.9	4,693.1	4,242.1	3,250.8	2,441.5	2,289.1	2,194.5	1,875.1	1,843.9	1,820.6	-66.8%	-20.5%

4 Trends in GHG emissions and removals by sector

The breakdown of GHG emissions and removals in FY 2022 by sector[16] showed that energy (excluding indirect CO_2, hereinafter, definition omitted) accounted for 87.1% of total GHG emissions. It was followed by industrial processes and product use (excluding indirect CO_2, hereinafter, definition omitted) (8.2%), agriculture (3.0%), waste (1.5%), and indirect CO_2 emissions (0.2%). Removals by LULUCF in FY 2022 were equivalent to 4.7% of total GHG emissions.

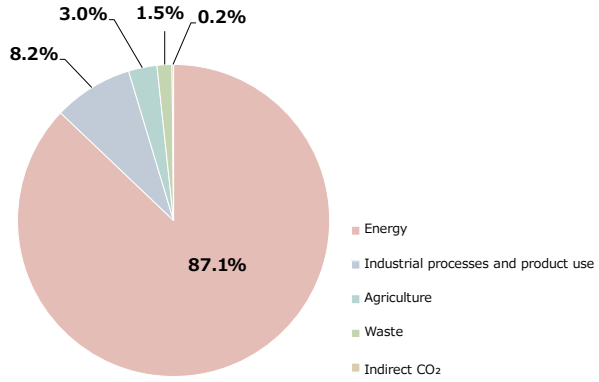


Figure I-13 Share of GHG emissions by sector (FY 2022, excluding LULUCF)

Table I-11 Trends in GHG emissions and removals by sector

GHGs	Emissions [Mt CO_2 eq.]										Changes in emissions	
	1990	1995	2000	2005	2010	2013	2015	2020	2021	2022	1990-2022	2013-2022
1 Energy	1,091.6	1,166.7	1,196.9	1,227.8	1,162.2	1,260.8	1,171.3	993.4	1,012.9	989.2	-9.4%	-21.5%
1.A Fuel combustion	1,085.6	1,163.0	1,194.1	1,226.1	1,160.6	1,259.3	1,169.8	992.2	1,011.7	988.0	-9.0%	-21.5%
1.A.1 Energy industries	369.5	380.1	396.8	451.3	475.4	585.3	529.2	438.0	444.6	436.9	+18.3%	-25.4%
1.A.2 Manufacturing industries and construction	351.3	359.6	348.9	336.6	303.2	307.0	290.1	235.0	252.3	236.3	-32.7%	-23.0%
1.A.3 Transport	205.9	246.9	257.1	240.9	224.0	216.9	210.6	178.0	179.3	186.5	-9.4%	-14.0%
1.A.4 Other sectors	159.1	176.4	191.4	197.2	157.9	150.1	139.9	141.2	135.5	128.3	-19.3%	-14.5%
1.B Fugitive emissions from fuels	6.0	3.7	2.8	1.8	1.6	1.5	1.4	1.3	1.2	1.2	-80.5%	-22.4%
2 Industrial processes and product use	107.4	131.8	105.0	86.5	79.6	87.9	91.3	95.2	97.0	93.4	-13.0%	+6.3%
3 Agriculture	39.3	39.0	37.0	36.3	35.4	34.5	33.9	33.8	33.9	33.5	-14.7%	-2.8%
4 LULUCF	-72.7	-85.0	-87.6	-90.8	-78.7	-73.3	-63.8	-58.3	-58.3	-53.2	-26.9%	-27.5%
5 Waste	31.1	33.8	32.4	27.4	23.0	21.9	20.6	18.0	18.3	17.5	-43.6%	-19.9%
Indirect CO_2	5.5	4.7	4.2	3.3	2.4	2.3	2.2	1.9	1.8	1.8	-66.8%	-20.5%
Gross Total (including LULUCF, including Indirect CO_2)	1,274.9	1,376.1	1,375.6	1,381.3	1,302.6	1,407.3	1,319.3	1,142.3	1,164.0	1,135.5	-10.9%	-19.3%
Gross Total (excluding LULUCF, including Indirect CO_2)	1,202.2	1,291.1	1,287.9	1,290.4	1,223.9	1,334.0	1,255.4	1,084.1	1,105.8	1,082.3	-10.0%	-18.9%

[16] As indicated in the 2006 IPCC Guidelines and the Common Reporting Tables (CRT).

4.1 Energy

Emissions from the energy sector in FY 2022 were 989 Mt CO_2 eq. They decreased by 9.4% since FY 1990 and decreased by 21.5% compared to FY 2013. The breakdown of the FY 2022 emissions from fuel combustion accounted for 99.9%. The largest source within fuel combustion was energy industries, which accounted for 44.0%, and was then followed by manufacturing industries and construction (23.7%) and transport (18.7%).

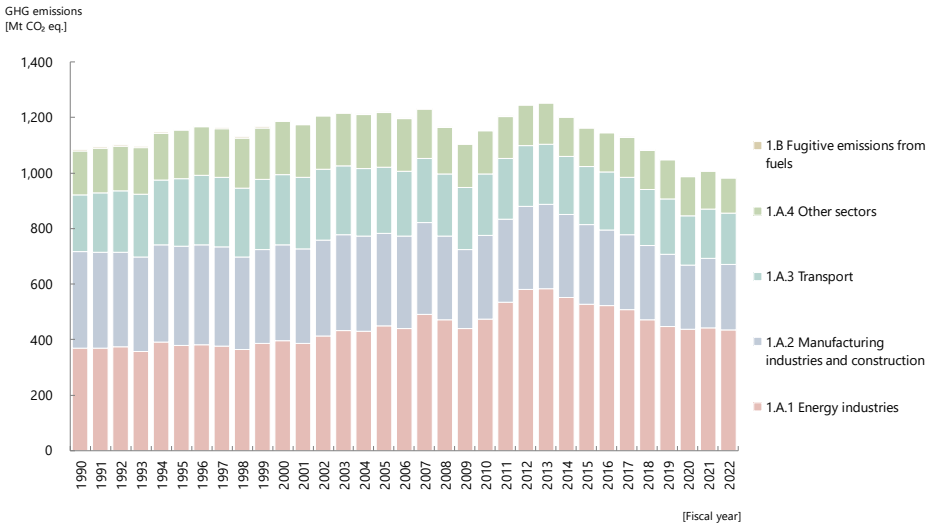


Figure I-14 Trends in GHG emissions from the energy sector

Table I-12 Trends in GHG emissions from the energy sector

GHGs	Emissions [Mt CO_2 eq.]										Changes in emissions	
	1990	1995	2000	2005	2010	2013	2015	2020	2021	2022	1990-2022	2013-2022
1.A Fuel Combustion	1,085.6	1,163.0	1,194.1	1,226.1	1,160.6	1,259.3	1,169.8	992.2	1,011.7	988.0	-9.0%	-21.5%
1.A.1 Energy industries	369.5	380.1	396.8	451.3	475.4	585.3	529.2	438.0	444.6	436.9	+18.3%	-25.4%
1.A.2 Manufacturing industries and cons	351.3	359.6	348.9	336.6	303.2	307.0	290.1	235.0	252.3	236.3	-32.7%	-23.0%
1.A.3 Transport	205.9	246.9	257.1	240.9	224.0	216.9	210.6	178.0	179.3	186.5	-9.4%	-14.0%
1.A.4 Other sectors	159.1	176.4	191.4	197.2	157.9	150.1	139.9	141.2	135.5	128.3	-19.3%	-14.5%
1.B Fugitive emissions from fuels	6.0	3.7	2.8	1.8	1.6	1.5	1.4	1.3	1.2	1.2	-80.5%	-22.4%
1.C CO_2 transport and storage	NE,NO	NO	NO	NE,NO	NO	NO	NO	NO	NO	NO	–	–
Total	1,091.6	1,166.7	1,196.9	1,227.8	1,162.2	1,260.8	1,171.3	993.4	1,012.9	989.2	-9.4%	-21.5%

4.2 Industrial Processes and Product Use

Emissions from the industrial processes and product use sector in FY 2022 were 93.4 Mt CO_2 eq. They decreased by 13.0% since FY 1990 and increased by 6.2% compared to FY 2013. The breakdown of GHG emissions from this sector in FY 2022 showed that the largest source was GHG emissions from product uses as ODS substitutes, accounting for 50.7%. It was followed by the mineral industry emissions such as GHG emissions from cement production (31.0%) and GHG emissions from the metal industry (5.9%).

Despite the increase in HFC emissions from product uses as substitutes for ODS compared to 1990, emissions from the industrial processes and product use sector decreased in the same period. The main driving factors for the decrease in emissions since FY 1990 were the decrease in CO_2 emissions from cement production (mineral industry) as clinker production declined, the decrease in emissions of HFC-23 produced as a by-product of HCFC-22 production (chemical industry) due to regulation under the Act on the Protection of the Ozone Layer Through the Control of Specified Substances and Other Measures, and the decrease in N_2O emissions from adipic acid production (chemical industry) as the N_2O abatement equipment came on stream.

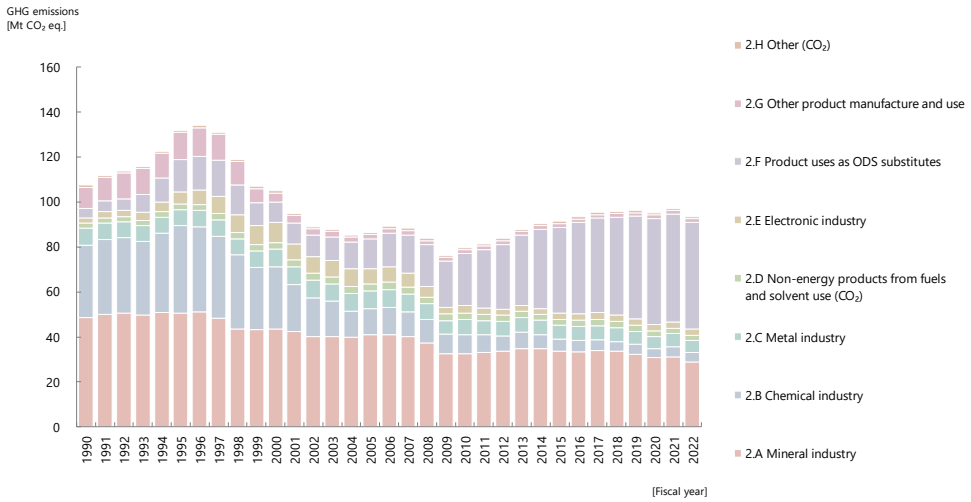


Figure I-15 Trends in GHG emissions from the industrial processes sector

Table I-13 Trends in GHG emissions from the industrial processes sector

GHGs	Emissions [Mt CO_2 eq.]										Changes in emissions	
	1990	1995	2000	2005	2010	2013	2015	2020	2021	2022	1990-2022	2013-2022
2.A Mineral industry	48.7	50.7	43.5	41.1	32.7	34.9	33.5	30.7	31.1	29.0	**-40.5%**	**-17.0%**
2.B Chemical industry	31.9	38.7	27.6	11.5	8.3	7.1	5.4	4.0	4.6	4.0	**-87.6%**	**-44.0%**
2.C Metal industry	7.8	7.2	7.9	7.9	6.7	6.6	6.4	5.4	5.8	5.5	**-29.1%**	**-16.4%**
2.D Non-energy products from fuels and solvent use (CO_2)	2.2	2.6	2.8	3.0	2.9	2.8	2.6	2.5	2.5	2.3	**+5.5%**	**-17.4%**
2.E Electronic industry	2.4	5.3	9.2	6.8	3.3	2.5	2.6	3.0	2.8	2.8	**+18.2%**	**+12.0%**
2.F Product uses as ODS substitutes	4.2	14.3	8.8	13.2	23.1	31.5	38.3	47.1	47.8	47.4	**+1020.0%**	**+50.6%**
2.G Other product manufacture and use	9.3	12.0	4.1	2.1	1.6	1.6	1.6	1.5	1.6	1.6	**-83.3%**	**-4.6%**
2.H Other (CO_2)	0.9	1.0	0.9	0.9	0.9	0.9	1.0	0.9	0.9	0.9	**+1.3%**	**-2.1%**
Total	107.4	131.8	105.0	86.5	79.6	87.9	91.3	95.2	97.0	93.4	**-13.0%**	**+6.2%**

4.3 Agriculture

Emissions from the agriculture sector in FY 2022 were 33.5 Mt CO_2 eq. They decreased by 14.7% since FY 1990 and decreased by 2.8% compared to FY 2013. The breakdown of the FY 2022 emissions from this sector showed that the largest source was rice cultivation, accounting for 39.0%. It was followed by enteric fermentation (25.8%) and agricultural soils (15.5%) as a result of the nitrogen-based fertilizer applications.

The main driving factor for the decrease in emissions since FY 1990 was the decrease in CH_4 emissions from enteric fermentation due to the decrease in the number of cattle, and the decrease in N_2O emissions from agricultural soils due to the decrease in the amount of inorganic nitrogen fertilizers applied and organic fertilizers from livestock manure applied.

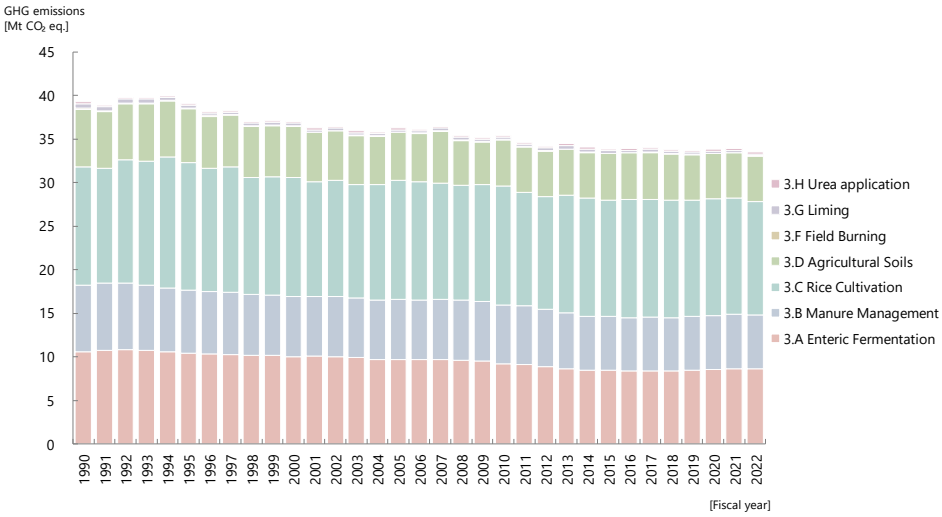


Figure I-16 Trends in GHG emissions from the agriculture sector

Table I-14 Trends in GHG emissions from the agriculture sector

GHGs	Emissions [Mt CO_2 eq.]										Changes in emissions	
	1990	1995	2000	2005	2010	2013	2015	2020	2021	2022	1990-2022	2013-2022
3.A Enteric Fermentation	10.6	10.4	10.0	9.7	9.2	8.7	8.4	8.5	8.6	8.7	-17.9%	-0.1%
3.B Manure Management	7.7	7.2	6.9	6.9	6.8	6.4	6.2	6.2	6.2	6.1	-19.9%	-3.9%
3.C Rice Cultivation	13.6	14.7	13.6	13.7	13.6	13.5	13.4	13.4	13.4	13.1	-3.8%	-3.4%
3.D Agricultural Soils	6.7	6.1	5.9	5.5	5.3	5.3	5.3	5.2	5.2	5.2	-21.9%	-1.4%
3.F Field Burning	0.1	0.1	0.1	0.1	0.04	0.05	0.04	0.04	0.04	0.04	-61.6%	-16.3%
3.G Liming	0.6	0.3	0.3	0.2	0.2	0.4	0.3	0.2	0.2	0.2	-63.1%	-46.5%
3.H Urea application	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	+14.5%	-2.9%
Total	39.3	39.0	37.0	36.3	35.4	34.5	33.9	33.8	33.9	33.5	-14.7%	-2.8%

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

Net removals (including CO_2, CH_4, and N_2O emissions) from the LULUCF sector in FY 2022 was 53.2 Mt CO_2 eq. They decreased by 26.9% since FY 1990 and decreased by 27.5% compared to FY 2013. The long-term declining trend in removals from 2004 was largely due to the maturity of Japanese forests. The breakdown of the FY 2022 emissions and removals from this sector showed that the largest was GHG removals from forest land of 59.6 Mt CO_2 eq., accounting for 112.2% of this sector's net total emissions / removals.

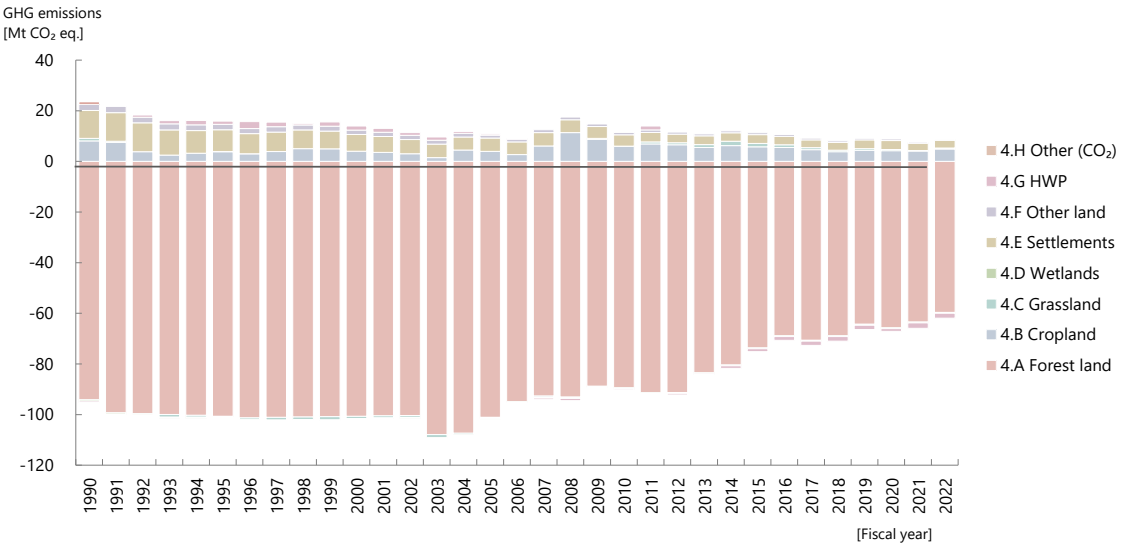


Figure I-17 Trends in GHG emissions and removals from the LULUCF sector

Table I-15 Trends in GHG emissions and removals from the LULUCF sector

GHGs	Emissions [Mt CO_2 eq.]										Changes in emissions	
	1990	1995	2000	2005	2010	2013	2015	2020	2021	2022	1990-2022	2013-2022
4.A Forest land	-94.2	-100.7	-100.7	-101.1	-89.4	-83.5	-73.7	-65.7	-63.5	-59.6	**-36.7%**	**-28.6%**
4.B Cropland	8.1	3.9	4.1	4.0	5.9	5.5	5.8	4.3	4.1	4.9	**-39.9%**	**-11.7%**
4.C Grassland	1.0	0.1	-0.9	-0.3	0.2	1.1	1.4	0.4	0.2	0.4	**-55.4%**	**-59.6%**
4.D Wetlands	-0.5	-0.2	-0.1	-0.4	-0.3	-0.4	-0.3	-0.3	-0.3	-0.3	**-35.8%**	**-6.5%**
4.E Settlements	11.0	8.6	6.6	5.2	4.4	3.5	3.4	3.5	2.9	3.0	**-73.0%**	**-14.3%**
4.F Other land	2.4	2.1	1.7	1.2	0.9	0.8	0.7	0.6	0.5	0.4	**-82.0%**	**-43.4%**
4.G HWP	-0.5	1.3	1.6	0.5	-0.5	-0.4	-1.2	-1.1	-2.1	-1.9	**+272.8%**	**+443.2%**
4.H Other (CO_2)	NO	NO	NO	NO	NO	NO	NO	NO	NO	-0.00001	—	—
Total	-72.7	-85.0	-87.7	-90.9	-78.7	-73.4	-63.9	-58.3	-58.3	-53.2	**-26.9%**	**-27.5%**

4.5 Waste

Emissions from the waste sector in FY 2022 were 17.5 Mt CO_2 eq. They decreased by 43.6% since FY 1990 and by 19.9% compared to FY 2013. The breakdown of the FY 2022 emissions from this sector showed that the largest source was waste incineration, etc., associated with waste derived from fossil fuels such as waste plastic and waste oil, accounting for 65.2%. It was followed by wastewater treatment and discharge (20.0%) and solid waste disposal (9.3%).

The main driving factor for the decrease in emissions since FY 1990 was the decrease in CH_4 emissions from solid waste disposal on land as a result of the decrease in the amount of disposal of biodegradable waste due to improvement in the volume reduction ratio by intermediate treatment under the Waste Management and Public Cleansing Act (Act No.137, 1970) and the Basic Act on Establishing a Sound Material-Cycle Society (Act No.110, 2000), and other recycling laws.

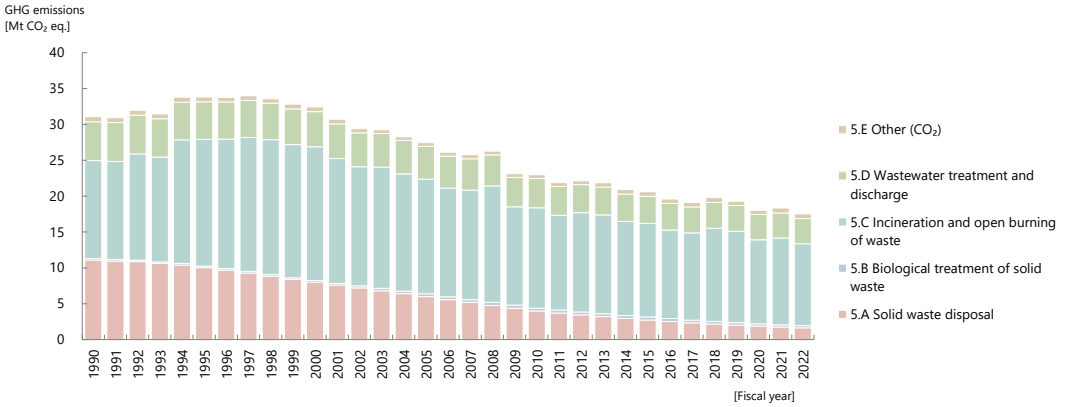


Figure I-18 Trends in GHG emissions from the waste sector

Table I-16 Trends in GHG emissions from the waste sector

GHGs	Emissions [Mt CO_2 eq.]										Changes in emissions	
	1990	1995	2000	2005	2010	2013	2015	2020	2021	2022	1990-2022	2013-2022
5.A Solid waste disposal	11.1	10.0	8.0	6.0	4.0	3.2	2.7	1.9	1.8	1.6	**-85.2%**	**-48.9%**
5.B Biological treatment of solid waste	0.2	0.2	0.2	0.4	0.4	0.4	0.4	0.3	0.3	0.3	**+41.1%**	**-23.9%**
5.C Incineration and open burning of waste	13.6	17.7	18.6	16.0	14.0	13.8	13.1	11.7	12.1	11.4	**-16.2%**	**-17.0%**
5.D Wastewater treatment and discharge	5.4	5.2	4.9	4.6	4.1	3.9	3.8	3.5	3.5	3.5	**-35.4%**	**-9.8%**
5.E Other（CO_2）	0.7	0.7	0.7	0.5	0.5	0.6	0.6	0.6	0.7	0.7	**-6.9%**	**+8.2%**
Total	31.1	33.8	32.4	27.4	23.0	21.9	20.6	18.0	18.3	17.5	**-43.6%**	**-19.9%**

Chapter II

Information necessary to track progress made in implementing and achieving nationally determined contributions under Article 4 of the Paris Agreement

Overview

(National circumstances and institutional arrangements)

- The population of Japan as of October 1, 2020, is approximately 126 million. It is predicted that the population of Japan will decline rapidly and reach around 101 to 108 million by 2050.
- As of fiscal year (FY) 2022, Japan's land area equaled 37.80 million hectares, or 0.3% of the total global land area, of which nearly 80% was accounted for as 24.97 million hectares (66.1%) of forests and 3.99 million hectares (10.5%) of agricultural land.
- Japan's GDP for FY 2022 was approximately 558 trillion yen, and GDP per capita was approximately 4.49 million yen.
- The final energy consumption by different sectors in Japan in FY 2022 was 45% for the industrial sector, including non-energy use, 31% for the commercial and residential sector, and 24% for the transport sector. The energy mix in electricity generation in FY 2010 was 29.0% for LNG thermal, 25.1% for nuclear, and 27.8% for coal thermal. However, because of the Great East Japan Earthquake in 2011, the nuclear power plants in Japan stopped, and the energy mix in electricity generation has significantly changed after FY 2011. In FY 2022, the energy mix in electricity generation was 33.8% for LNG thermal and 30.8% for coal thermal.
- Japan is one of the most forested countries in the world, and its forested area remains about 25 million hectares, or two-thirds of the country's total land area. Of this, 10 million hectares are planted forests. More than half of them are over 50 years old, and the amount of CO_2 removals is declining because of the maturation of the forests.
- Regarding the promotion of global warming countermeasures, there is specific legislation, the Act on the Promotion of Global Warming Countermeasures. Article 2, paragraph 2 of the Act states that global warming countermeasures must be promoted through close cooperation among citizens, the national government, local governments, businesses, and private organizations to realize a decarbonized society by 2050 while integrally promoting environmental conservation and economic and social development. Furthermore, the government established the *Plan for Global Warming Countermeasures* based on Article 8, paragraph 1, of the Act to promote global warming countermeasures towards the achievement of the Nationally Determined Contribution (NDC) comprehensively and systematically. The *Plan for Global Warming Countermeasures* is the only general plan regarding global warming in Japan. This plan sets targets for reducing GHG emissions and removals, basic matters concerning measures that businesses and citizens should implement, and basic matters concerning measures that the national government and local governments should implement in order to achieve the target.
- In the government, the Global Warming Prevention Headquarters, which is headed by the Prime Minister and includes all cabinet ministers as members, and the Executive Committee of the Global Warming Prevention Headquarters, which is a committee of the director-general level of each ministry and agency, play a central role in close coordination with the relevant ministries and agencies.
- In order to constantly monitor and ensure the effectiveness of the *Plan for Global Warming Countermeasures*, Japan strictly checks progress with respect to the measures implemented by the government for each countermeasure each year by assessing the emission reductions, the evaluation indicators for countermeasures, and other relevant indicators for greenhouse gas and category, and flexibly review the plan as required.

(Description of a Party's NDC under Article 4 of the Paris Agreement)

- Japan's GHG emission reduction target under the Paris Agreement is a reduction of 46% in national total greenhouse gas emissions in fiscal year (FY) 2030 from its FY 2013 levels, setting an ambitious target that is aligned with the long-term goal of achieving net zero by 2050. Furthermore, Japan will continue strenuous efforts in its challenge to meet the lofty goal of cutting its emissions by 50%. This target was submitted to the UNFCCC on October 22, 2021, as the update of Japan's NDC.
- Japan's long-term goal is to reduce greenhouse gas emissions to net zero, that is, to realize carbon neutrality.

(Information necessary to track progress made in implementing and achieving NDCs under Article 4 of the Paris Agreement)

- The total GHG emissions selected as an indicator to track progress made in implementing and achieving NDCs are the economy-wide national total GHG emissions, including indirect CO_2 and excluding LULUCF. In tracking and evaluating the progress of implementing and achieving the NDC, the total GHG emissions, the contribution from the LULUCF sector based on an activity-based approach, and the internationally transferred mitigation outcomes (ITMOs) consistent with Article 6 of the Paris Agreement will be considered.
- Total greenhouse gas emissions (excluding LULUCF) in FY 2022 were approximately 1,135 Mt CO_2 equivalent, a 19.3% reduction from the base year of FY 2013. Considering the contribution from LULUCF activities (approximately 50.2 Mt CO_2), the total greenhouse gas emissions in FY 2022 were approximately 1,085 Mt CO_2 eq., which is a 22.9% decrease from the base year. The net total GHG emissions in FY 2022 are the lowest since FY 1990, and Japan is making steady progress toward its 2030 emission reduction target and 2050 net-zero goal.

(Mitigation policies and measures, actions and plans, related to implementing and achieving a NDC under Article 4 of the Paris Agreement)

- For the energy conversion sector under the energy sector, initiatives such as the reduction of CO_2 emission intensity in power sectors, the maximum introduction of renewable energy, and the promotion of the introduction of facilities and equipment with high energy-saving performance in the petroleum product manufacturing sector will be promoted.
- For the industry sector, initiatives such as the promotion of voluntary effort by industry, the promotion of the introduction of facilities and equipment with high energy-saving performance, the implementation of thorough energy management, and the promotion of emissions reduction measures for small and medium businesses will be promoted.
- For the commercial sector, initiatives such as the improvement of the energy efficiency of buildings, the promotion of the introduction of facilities and equipment with high energy-saving performance, the greening of digital equipment and industry, and the implementation of thorough energy management will be promoted.
- For the residential sector, initiatives such as the improvement of energy efficiency of housing, the promotion of the introduction of facilities and equipment with high energy-saving performance, and the implementation of thorough energy management will be promoted.
- For the transport sector, initiatives such as the diffusion of next-generation vehicles and improvement of fuel efficiency, the measures for road traffic flow, the promotion of the use of public transportation and bicycles, the measures for railways, ships, and aviation, and the promotion of decarbonized logistic systems

will be promoted.

- For the industrial processes and product use (IPPU) sector, reduction of fluorinated gas emissions such as the promotion of non-fluorocarbons and low GWP products, the preventing leakage of fluorocarbons from the use of refrigeration and air-conditioning equipment for business use, and the recovery and proper disposal of fluorocarbons from refrigeration and air-conditioning equipment, and the reduction of CO_2 emissions from cement production by an expansion of the use of blended cement will be promoted.
- For the agriculture sector, measures for CH_4 emission reduction from rice cultivation and N_2O emission reduction associated with fertilization will be promoted.
- Regarding the forest carbon sinks measures in the land use, land use change and forestry (LULUCF) sector, initiatives to be implemented will include the maintenance of healthy forests, the promotion of appropriate management and conservation of protection forests, natural parks, and other areas, the fostering efficient and stable forest management, the promotion of people's participation in forest management, and the promotion of the use of wood and woody biomass. For measures to increase carbon removals in agricultural soils, carbon sequestration in cropland and grassland soils will be promoted through the continuous application of organic matter, such as compost and green manure to the soil. Also, urban greening and initiatives related to blue carbon will be promoted.
- For the waste sector, initiatives such as the diffusion of biomass plastics, the reduction of waste incineration, and the advancement of incineration at sewage sludge incineration facilities will be implemented.
- As cross-cutting measures, Green Transformation (GX) to fulfill Japan’s international commitments and simultaneously enhancement of Japan's industrial competitiveness and economic growth, the dissemination of DECOKASTU, which is a national movement to create new and affluent lifestyles towards decarbonization, the activation of the J-Credit scheme, the promotion of the Joint Crediting Mechanism (JCM), the creation of urban/regional structures and socioeconomic systems contributing to decarbonization, the realization of a hydrogen society, the promotion of sustainable finance will be promoted.

(Summary of greenhouse gas emissions and removals)

- An overview of GHG emissions and removals is outlined in Chapter I and is therefore omitted here.

(Projections of greenhouse gas emissions and removals)

- The future projections of GHG emissions and removals of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3) for FY 2030 are estimated by gas and sector.
- The projected total GHG emissions (excluding the net GHG removal contribution of the LULUCF sector) in FY 2030 under a with measures scenario is approximately 813 Mt CO_2 eq., which is a decrease of 42% from FY 2013. Considering the projections for the GHG removals contribution of LULUCF (removals by forest carbon sinks [approximately 38 Mt CO_2], carbon sinks in agricultural soils [approximately 8.5 Mt CO_2], and urban greening [approximately 1.2 Mt CO_2]) and the Joint Crediting Mechanism (JCM) in FY 2030, the projected total GHG emissions for FY 2030 will be a reduction of 46% from FY 2013.

A. National circumstances and institutional arrangements

(paras. 59–63 of the MPGs)

1 National circumstances

(paras. 59 and 60 of the MPGs)

1.1 Government structure

(1) Administrative organization

The administrative organization of Japan is shown in Figure II-1. It consists of one office and thirteen ministries and agencies as of July 2023. The roles of each major ministry are as described below.

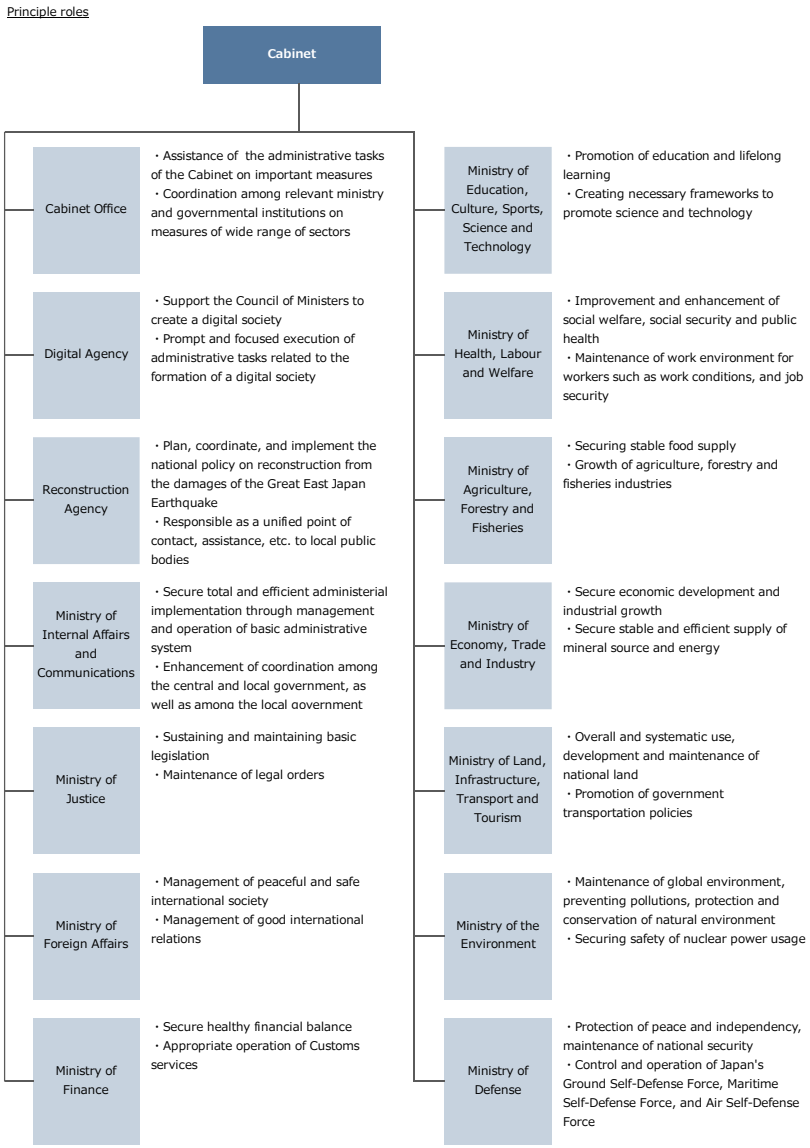


Figure II-1 Administrative organization of Japan (as of July 2023)

Reference: Based on Cabinet Office, *Figure of Administrative organization (as of July 2023)* and the Act for Establishment of each ministry

(2) Global Warming Prevention Headquarters

The climate change countermeasures in Japan are being promoted by various ministries and agencies under the Global Warming Prevention Headquarters established in the Cabinet. The headquarters was established in 2005 under the Act on Promotion of Global Warming Countermeasures (Act No. 117 of 1998). It is headed by the Prime Minister with the Chief Cabinet Secretary, the Minister of the Environment, and the Minister of Economy, Trade and Industry as vice chairmen and all other ministers as members.

(3) Budget for Global Warming Countermeasures

The plan for global warming countermeasures has been promoted as a plan for the comprehensive and strategic implementation of Japan's global warming countermeasures to build a mid and long-term decarbonized society. In order to assess the overall government initiatives from a budget perspective and to enhance linkage among ministries, the plans for the budget amount related to the global warming countermeasure are collected.

The plan for the budget related to the global warming countermeasures per each measure for FY 2023 is 391.1 billion yen (56%) for "A. Those effective for GHG reduction by 2030," 43.0 billion yen (6%) for "B. Those effective for GHG reduction after 2030," 191.1 billion yen (27%) for "C. Those contributing to GHG reduction as a result," and 75.3 billion yen (11%) for "D. Basic measures etc." (Table II-1).

Table II-1 Budget plan related to Global Warming Countermeasures in FY 2023

(Unit : million yen)

	A	B	C	D
	Measures effective for GHG reduction by 2030	Measures effective for GHG reduction after 2030	Measures contributing to GHG reduction as a result	Basic measures, etc.
Ministry of Economy, Trade and Industry	83,705	34,289	99,041	6,077
Ministry of the Environment	152,511	5,611	39,267	34,336
Ministry of Agriculture, Forestry and Fisheries	126,477	696	38,477	1,453
Ministry of Land, Infrastructure, Transport and Tourism	14,237	56	12,021	19,929
Ministry of Education, Culture, Sports, Science and Technology		2,327		8,236
Others	14,156		2,260	5,251
All ministries and offices	**391,087**	**42,978**	**191,068**	**75,282**

Note1: It does not include those that cannot be identified by global warming countermeasures.

Note2: Numbers may not add up due to rounding.

Reference: Ministry of the Environment, *Budget plan for Global Warming Countermeasures related matters for FY 2023*

1.2 Population profile

(1) Population structure

The population of Japan just after World War II was approximately 72 million, and it had consistently been on an increasing trend during the 20th century, reaching over 100 million in 1967. However, the rate of increase in the population slowed down after the 1980s. After reaching 128 million in 2008, the population has fallen into a decreasing trend. The population of Japan as of October 2020 is approximately 126 million. The population of Japan is expected to decline rapidly in the future, and it is predicted to decrease to approximately 101 million to 109 million by 2050.

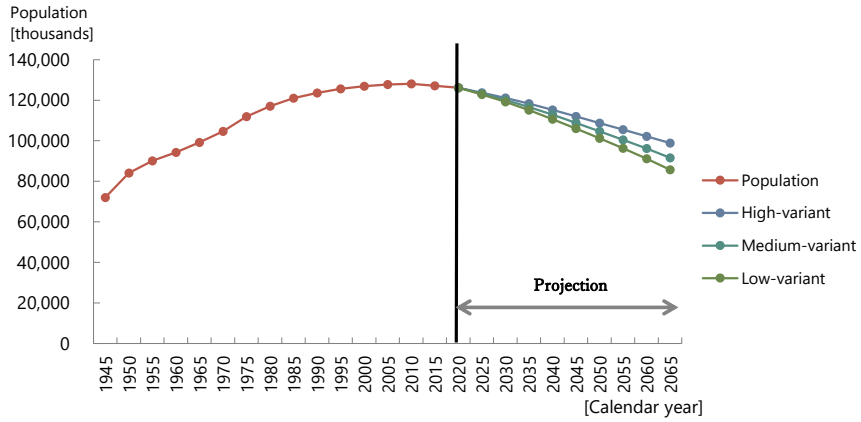


Figure II-2 Long-term trend in Japan's population
(As of November 1st for 1945, and as of October 1st every year from 1950 onwards.)

Reference: Statistics Bureau, Ministry of Internal Affairs and Communications, *Population Census* (1945-2020)
National Institute of Population and Social Security Research, *Population Projections for Japan: (medium-mortality)* (after 2021)

Changes in Japan's population structure are shown in Figure II-3 and Figure II-4. Japan's population structure is characterized by the peaks seen in the first baby boomer period brought about by the increase in marriages immediately after World War II, by the second baby boomer period, which was brought about by the birth of the children of the first baby boomers, and by the bottom of the pyramid narrowing after that.

When comparing the population structure of 2020 to that of 1990, the population from the ages of 0-64 in 1990 was approximately 90% of the total population with a relatively high portion of the younger generation. On the other hand, in 2020, the population from the ages of 0-64 was approximately 70% of the population, nearly 20 points less compared to that of 1990. It shows the population is aging.

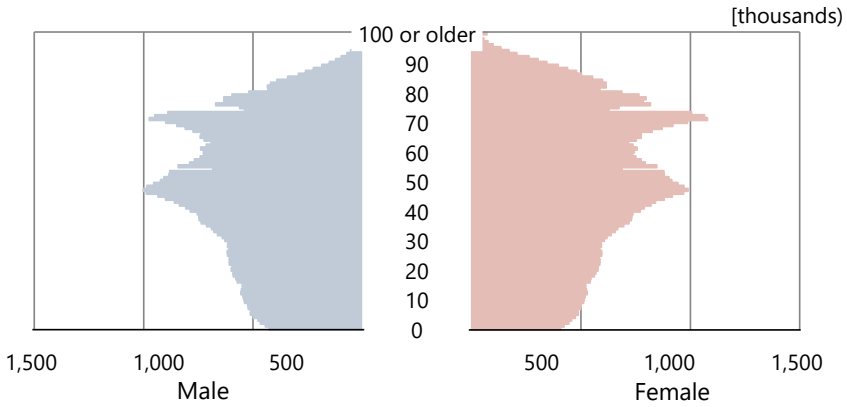


Figure II-3 Japan's population pyramid (as of October 1, 2020)

Reference: Ministry of Internal Affairs and Communications, *2020 Population Census*

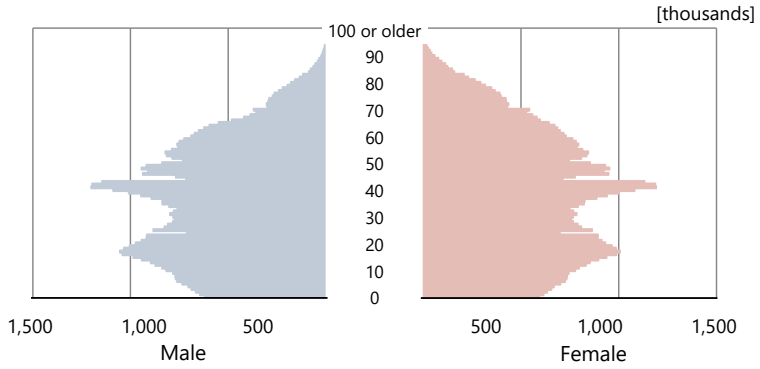
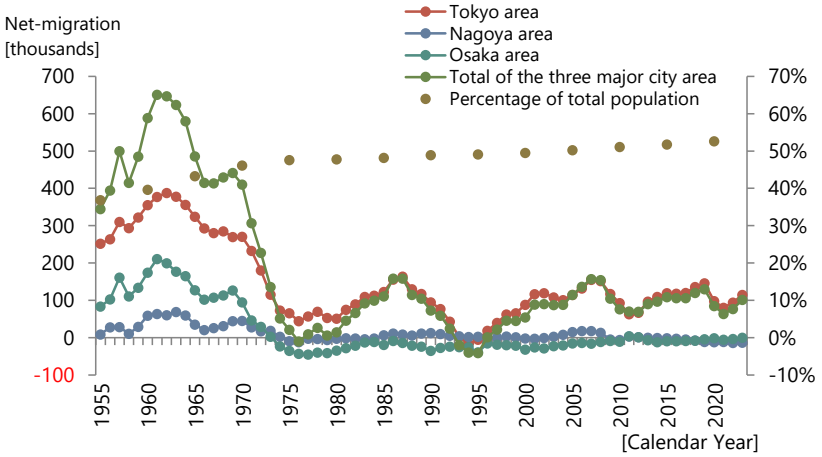


Figure II-4 Japan's population pyramid (as of October 1, 1990)

Reference: Ministry of Internal Affairs and Communications, *1990 Population Census*

(2) Population distribution

Trends in positive and negative net migration to the three metropolitan areas (Tokyo, Nagoya, and Osaka) are shown in Figure II-5. During the 1950s and the 1970s, positive migration to the three metropolitan areas greatly exceeded negative migration as many of those born in the suburban areas moved out for employment and further education. Soon after, in the mid-1970s and onwards, when the Japanese economy entered a period of stable growth, the number of positive migrations to the three metropolitan areas slowed down. When looking at each metropolitan area, for the Nagoya and Osaka areas, the excess of positive net migration is close to zero in the long term, with almost no positive migration of the population. On the other hand, the excess of positive migration has slowed down, and the migration results in excess throughout time are accelerating the centralization of the population to Tokyo.



Note 1: Tokyo area includes Saitama, Chiba, and Kanagawa prefectures and the Tokyo metropolitan area.
Note 2: Nagoya area includes Gifu, Aichi, and Mie prefectures.
Note 3: Osaka area includes Kyoto, Osaka, Hyogo, and Nara prefectures.
Note 4: The number of migrants, including foreigners, is only available from 2014 onwards, so the graph shows only Japanese migrants.

Figure II-5 Area with centralized population

Reference: Ministry of Internal Affairs and Communications, *Population census* and *Report on Internal Migration in Japan*

When looking at the portion of the population of the three metropolitan areas against the total population, it was 36.9% in 1955 and increased to 52.6% in 2020. From this data, the population had centralized to metropolitan areas throughout the post-war era.

(3) Number of households

The number of households in Japan in 2020 was approximately 56 million, an increase of 4.4% compared to 2015. The number of persons per household in 2020 decreased to 2.21 compared to 2.33 in 2015. After 1970, the number of households continued to grow, and the number of persons per household continued to decrease. These changes were due to the changes in the household structure, such as the shift from big families to nuclear families and the increase of one-person households, as well as a decrease in the number of children due to the decrease in the fertility rate.

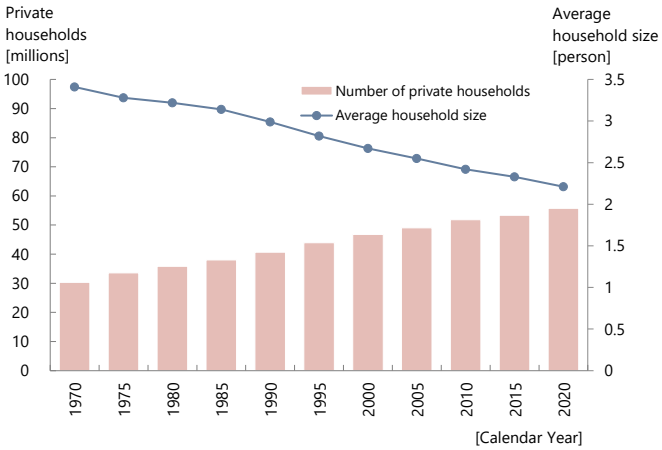


Figure II-6 Number of households and number of people per household (as of October 1 of each year)

Reference: Ministry of Internal Affairs and Communications *Population Census*

As for the change in the number of households with the number of people per household, the number of single and two-people households is increasing with the increasing rate of households of single people being particularly significant. The households of three people had increased by 2010 but in 2015 turned into a downward trend. Households with more than four people have consistently decreased after 1990.

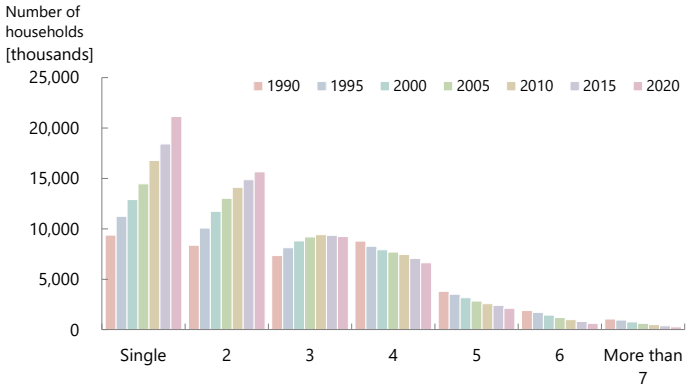


Figure II-7 Number of households by the number of people per household (as of October 1 of each year)

Reference: Ministry of Internal Affairs and Communications *Population Census*

(4) Impact on greenhouse gases

As described above, since Japan's population is expected to decrease in the future, it is predicted that Japan's energy consumption will decrease as a whole, and energy-related CO_2 emissions will decrease accordingly. On the other hand, since the number of households is increasing because of the increase in the number of single-person households, CO_2 emissions from the residential sector may not trend downward.

In addition, the concentration of the population in the three metropolitan areas may contribute to a decrease in CO_2 emissions from the transport and residential sectors since urban areas have better public transportation systems and a smaller residential area per household than rural areas.

1.3 Geographical profile

Japan, located on the east side of Eurasia, is a long, thin archipelago that lies approximately between latitudes 20 and 46 north and consists of four major islands - (from north to south) Hokkaido, Honshu, Shikoku, and Kyushu - as well as more than 6,800 other islands.

As of FY 2022, Japan’s land area equaled 37.80 million hectares, or 0.3% of the total global land area, of which nearly 80% was accounted for as 24.97 million hectares (66.1%) of forests and 3.99 million hectares (10.5%) of agricultural land.

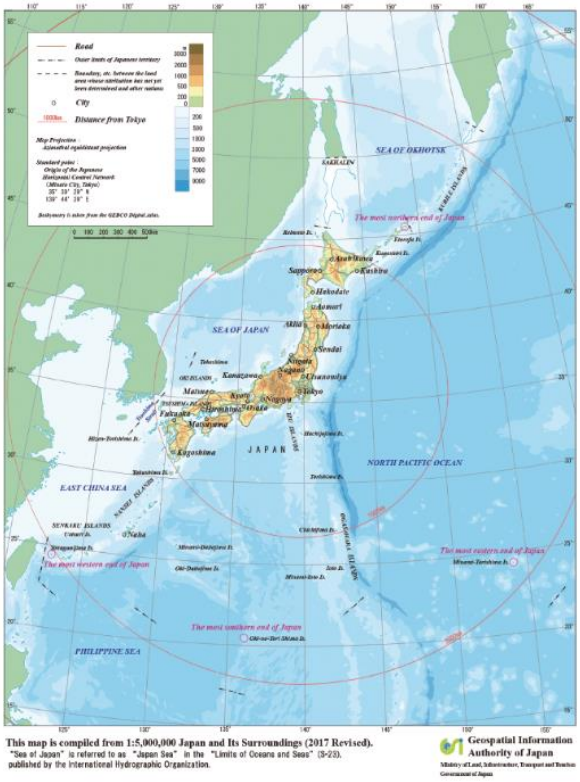


Figure II-8 Map of Japan

Reference: Ministry of Land, Infrastructure, Transport and Tourism *Map of Japan*

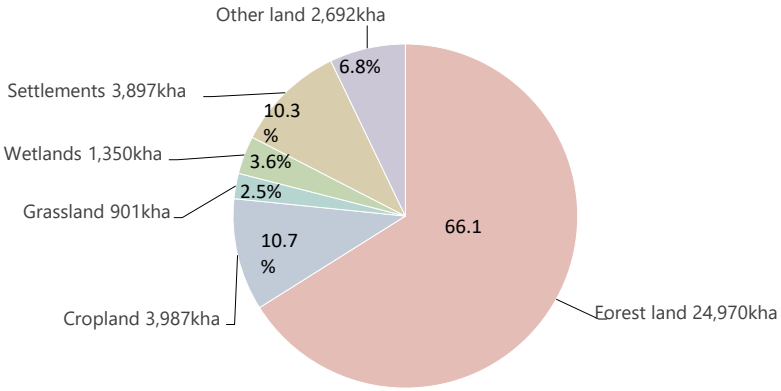


Figure II-9 Current land use in Japan[17] in FY 2022

Reference: National Institute for Environmental Studies *National Greenhouse Gas Inventory Report of Japan*

[17] "Settlements" are urban regions that do not correspond to forests, agricultural land, grasslands, or marshes. Figures are from the National Institute for Environmental Studies and consist of those directly assessed using existing statistics and those estimated for a portion of lands that could not be directly assessed.

1.4 Climate profile

Japan stretches over a great distance from north to south, with its southernmost point of land, including remote islands, located at 20 degrees north latitude and the northernmost point at 46 degrees north latitude. With such a structure, various climate zones exist on the islands of Japan, such as subarctic, extratropical, and subtropical zones. The difference in climate, when compared to the latitudes, and the difference in temperature is about 10 degrees Celsius or so between the Hokkaido area and the Okinawa area during summer. However, as the seasonal rain front or typhoons often hit the southern part of the country, the precipitation in the southern part of Japan compared to the northern part is remarkably higher. On the other hand, the average temperature in Okinawa during winter is above 15 degrees Celsius most of the time, whereas in Hokkaido, it often falls below zero. Therefore, the temperature gap within the country during winter is significant at more than 20 degrees Celsius. Sixty-one percent of the land of Japan is mountains, and in many areas, the mountain ranges divide the islands of Japan into the coastal areas facing the Pacific Ocean or the Sea of Japan. By orographic rainfall, the climates on the Pacific Ocean side and the Sea of Japan side are significantly different. In winter, seasonal cold winds from Siberia onto the coastal areas facing the Sea of Japan result in more days of snowfall, and in areas near the mountains, a large amount of snowfall piles up more than three meters high. In the coastal area facing the Pacific Ocean, dry winds blow down along the mountains, bringing more clear days.

The details of temperature and precipitation are described in Chapter III.B "Impacts, risks and vulnerabilities."

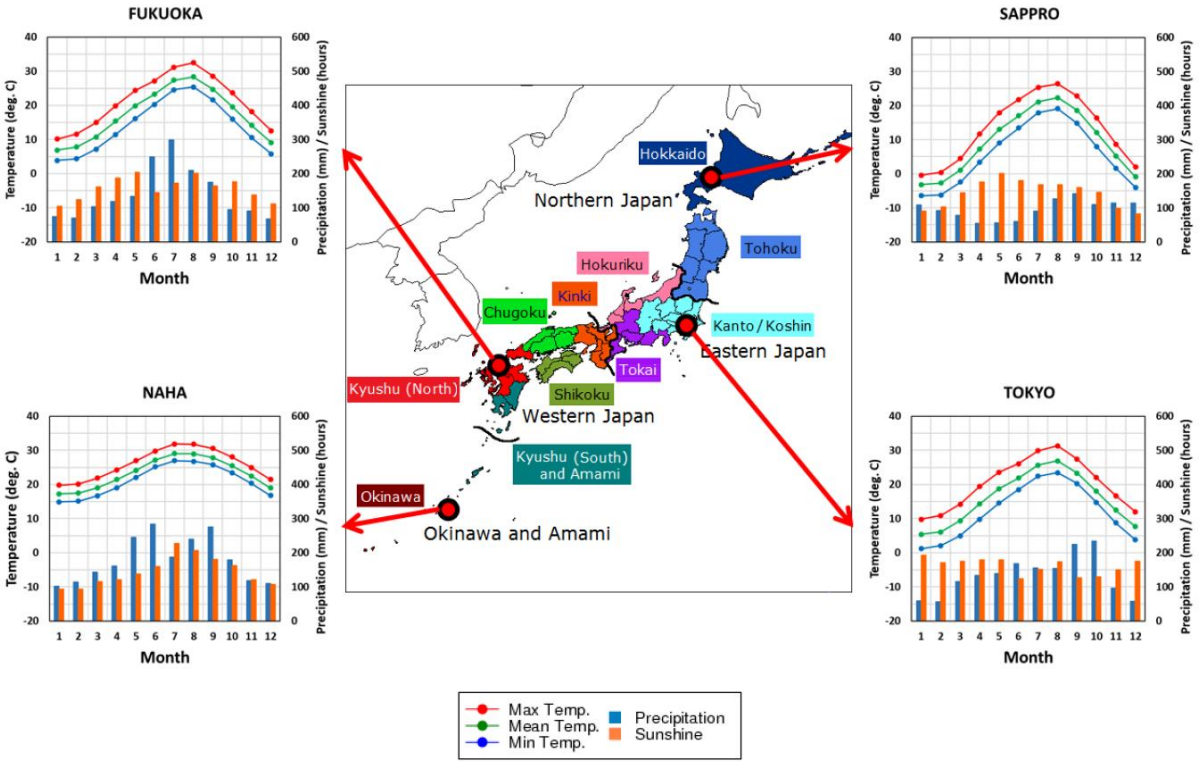


Figure II-10 Seasonal variation of meteorological elements in Sapporo, Tokyo, Fukuoka, and Naha

Reference: Website for Japan Meteorological Agency: (as of June 4, 2024)"

1.5 Economy

(1) Gross domestic production

Japan's economy grew extremely rapidly in the 1960s, resulting in the significant development of heavy industry and producing essential material products such as steel and petrochemical materials. In the 1970s, the oil shock induced the shift of the industrial structure from basic materials to manufacturing and assembly. In the latter half of the 1980s, the so-called Bubble Economy[18] started and was triggered by the domestic demand expansion attributed to the increased number of public projects supported by fiscal measures or to the increased money supply by the expansionary monetary policy. In the 1990s, land prices and stock values crashed, and so did the Bubble Economy. Since then, Japan's economy has entered a long period of a low growth rate. Japan's economy in the 1990s continued to stagnate from the lingering impact of the crash of the Bubble Economy, including the negative growth rate of the real gross domestic product (GDP)[19] to the previous year in FY 1993. In FY 1995, the growth rate of the real GDP reached over 3%, and again, in FY 1997, it turned negative due to the influence of the financial crisis in 1997 and 1998.

In the 2000s, the economy gradually recovered as exports grew from the depreciation of the yen and the global economic recovery. The length of the economic expansion marked the longest in the post-war era, exceeding the Izanagi boom.[20] In FY 2007, the financial insecurity and economic slowdown in the United States with the inflation of petroleum and materials gradually slowed Japan's economy. The growth rate of the real GDP turned negative compared to the previous year for two consecutive periods after the global financial crisis in 2008.

With the financial crisis remaining, the Great East Japan Earthquake made the economic situation difficult in the early 2010s. After the economy hit a trough in November 2012, the gradual recovery continued through 2018 as a steadily positive economic cycle started with increased corporate earnings leading to higher wages and employment growth, which in turn led to further corporate earnings growth through increased consumption and investment. However, with the global outbreak of COVID-19 from 2020 onward, the declaration of a state of emergency and other factors put downward pressure on consumer spending and external demand. The real GDP growth in FY 2020 marked a 3.9% decline from the previous year, the largest drop since 1980 when comparable figures were available. After COVID-19 was moved to a category five infection in May 2023, the economy's self-sustaining recovery mechanism began to work, and although the economy was on a gradual recovery path, domestic demand, such as consumer spending and capital investment, was lacking in strength.

Japan's real GDP in FY 2023 was approximately 558 trillion yen, and GDP per capita was approximately 4.49 million yen.

[18] Asset price movement away from the theory of price. It indicates Japan's 11th business cycle.

[19] GDP by chain-linked method (Benchmark year = 2015). GDP for 1980-1993 are reference values based on a simplified retrospective method.

[20] It indicates Japan's 6th business cycle.

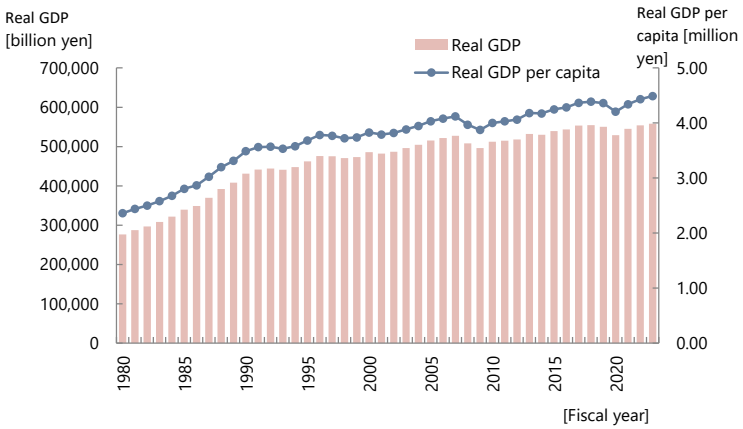


Figure II-11 Trend of Real GDP[21,]

Reference: Cabinet Office "Provisional estimates of GDP (Benchmark year = 2015)" (FY 1980 to FY 1993)
Cabinet Office "Quarterly Estimates of GDP for Apr. to Jun. 2024 (The Second Preliminary) (Benchmark year=2015)"(FY 1994 to FY 2023)
Ministry of Internal Affairs and Communications, *Monthly Report on Population Estimates*

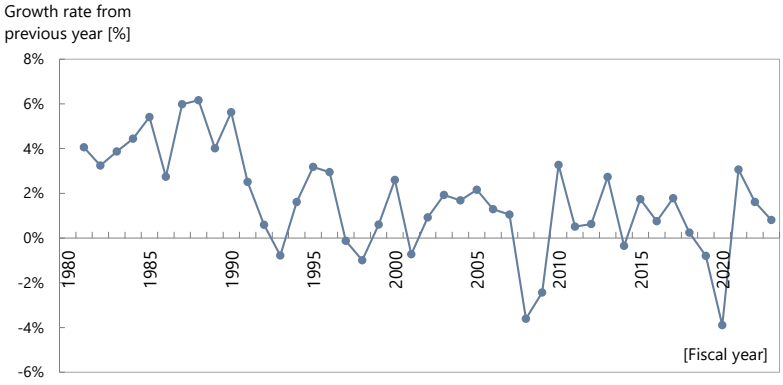


Figure II-12 Trend in Real GDP growth rate from the previous year

Reference: Cabinet Office *Provisional estimates of GDP* (Benchmark year = 2015) (FY 1981 to FY 1994)
Cabinet Office, *Quarterly Estimates of GDP for Apr. to Jun. 2024* (The Second Preliminary) (Benchmark year = 2015) (FY 1995 to FY 2023)

(2) Trade structure

Japan's trade balance was at a surplus from the 1990s to 2010 but turned into a deficit in 2011 because of the influences of the Great East Japan Earthquake, a major flood in Thailand, the yen appreciation, and the European debt problem. The trade surplus has decreased since then, marking the highest record for a trade deficit in 2014 by 10.4653 trillion yen. The balance turned into a surplus in 2016, not due to the increase in the export amount but the decrease in import amounts. In 2018, the trade balance turned into a deficit again, affected by the slowdown of the Chinese economy. In 2022, the trade balance was the largest in history due to the combination of surging resource prices and the record depreciation of the yen.

[21] Real GDP per capita is obtained by dividing the country's gross domestic product by the total population computed by averaging the population figures for each month.

Looking at Japan's imports by major commodity in 2023, mineral fuels accounted for the largest share, followed by electrical equipment. On the other hand, exports are dominated by machinery, transportation equipment, and electrical machinery. Compared to 1990, the value of imports increased by about 3.3 times, and the value of exports increased by about 2.4 times, indicating that globalization has increased trade with other countries

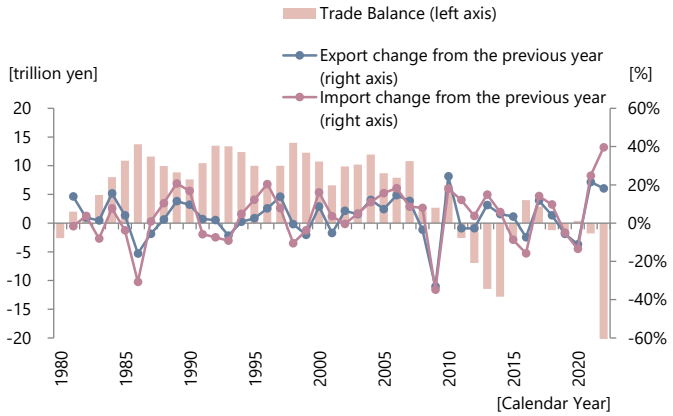


Figure II-13 Japan's Trade Trend (Calendar year)

Reference: Ministry of Finance *Trade Statistics*

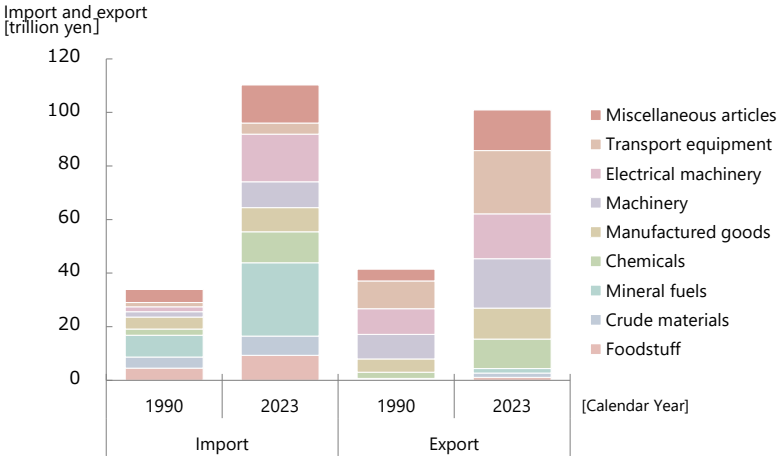


Figure II-14 Japan's imports and exports by main goods (Calendar year)

Reference: Ministry of Finance *Trade Statistics*

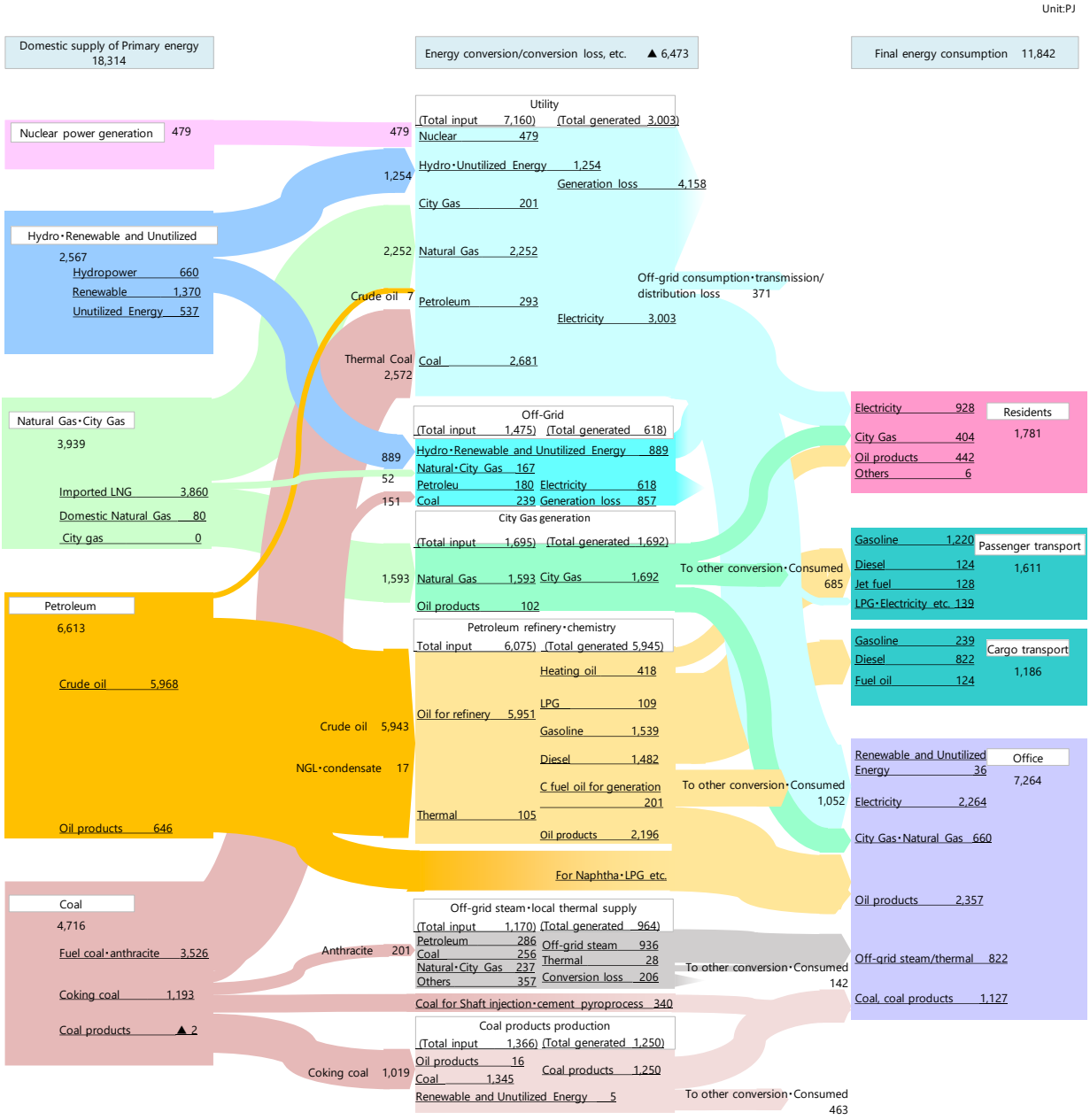
1.6 Energy

(1) Energy balance flow

The energy balance flow of Japan in FY 2022 is shown in Figure II-15. The primary energy supply in Japan was 18,314 PJ in FY 2022. The loss in energy conversion or during transport and consumption in the energy conversion sector was 6,473 PJ. Deducting the energy conversion/conversion loss from the primary energy supply, the final energy consumption of Japan in FY 2022 was 11,842 PJ.

The flow of each primary energy indicates that most nuclear and renewable energy is converted and consumed for electricity. On the other hand, natural gas is converted to electricity, and a large portion is converted to city gas by adjusting the calorific value. A relatively small portion of petroleum is converted to electricity; instead,

a majority is consumed as a transport fuel, such as gasoline and diesel, oil products, such as kerosene and heavy oil, and as a petrochemical raw material, such as naphtha. A majority of the uses of coal are converted to electricity and as a raw material for coke for steel manufacturing.



(1) This flow diagram shows overview of Japan's energy flow and does not cover details.
(2) "Petroleum" includes oil products as well as crude oil and NGL/condensates.
(3) "Coal" includes coal products as well as anthracite, coking coal and fuel coal.
Reference: "Total energy statistics", Agency for Natural Resources and Energy

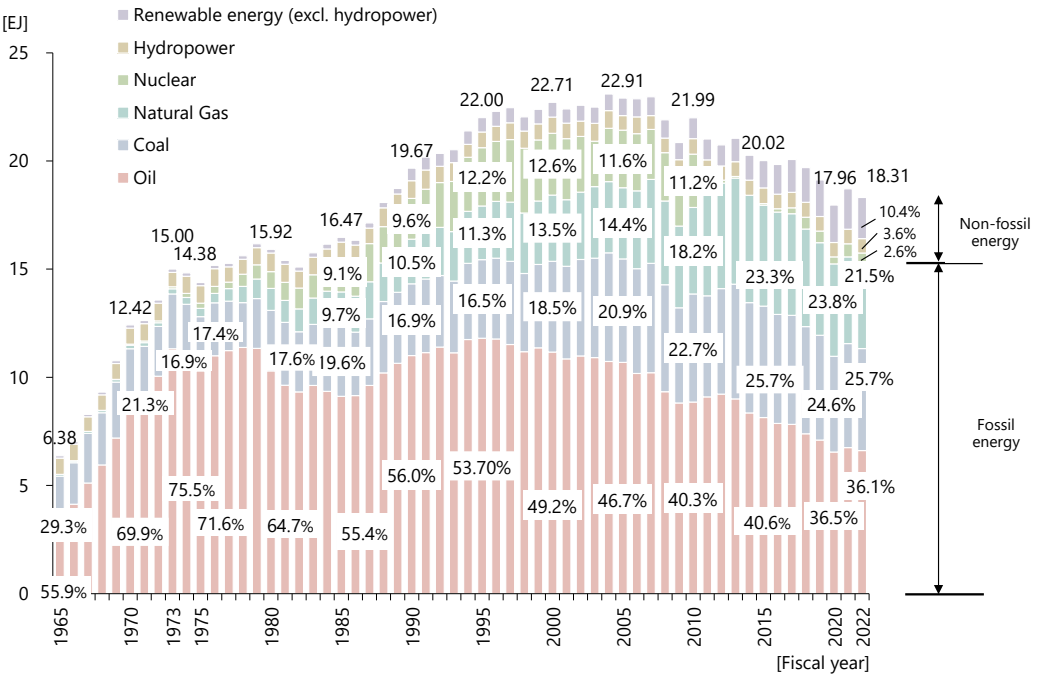
Figure II-15 Overview of Japan's Energy Balance Flow (FY 2022)[22]

Reference: Agency for Natural Resource and Energy, *Energy White Paper 2024*

[22] "Unutilized energy" refers to energy sources such as waste-to-energy and waste-to-energy recovery that make effective use of parts of energy sources that are normally discarded or dissipated after they have been used.

(2) Primary energy supply

The volume of the primary energy supply by fuel is shown in Figure II-16. Before the 1960s, domestic coal was Japan's main primary energy supply. Soon after, domestic coal lost price competitiveness. Therefore, Japan started to rely heavily on cheaper oil from the Middle East. However, when the second oil crisis hit in the 1970s, the oil-dependent policy and measures were replaced with the promoted introduction of nuclear power, natural gas, and coal, accelerating the development of new energy. Consequently, the portion of oil in the domestic primary supply, which was 75.5% in 1973 when the oil crisis occurred, had declined to 36.1% by FY 2022.



Note1: The calculation method has been changed after FY1990.

Note2: Renewable energy (excl. hydropower) includes solar power, wind power, biomass, geothermal etc.

Figure II-16 Primary Energy Supply

Reference: Agency for Natural Resource and Energy, *Energy White Paper 2024*

The energy self-sufficiency of Japan based on gross calorific value (Figure II-17) in FY 1960 was 58.1%, mainly using plenty of domestic natural resources, such as coal or hydropower. Entering the high economic growth period, self-sufficiency dropped to approximately 10% as energy demand in Japan increased and as energy supply efficiency decreased significantly as influenced by the change of fuels from coal to oil. After that, supply efficiency increased with the operation of nuclear power plants; however, because of the Great East Japan Earthquake in 2011, the nuclear power plants in Japan stopped operating. Consequently, the energy self-sufficiency had dropped to 9.4%. Since then, the introduction of new energy sources has been expanding, nuclear power plants have been restarted, and energy self-sufficiency has recovered to 16.6% by FY 2022.

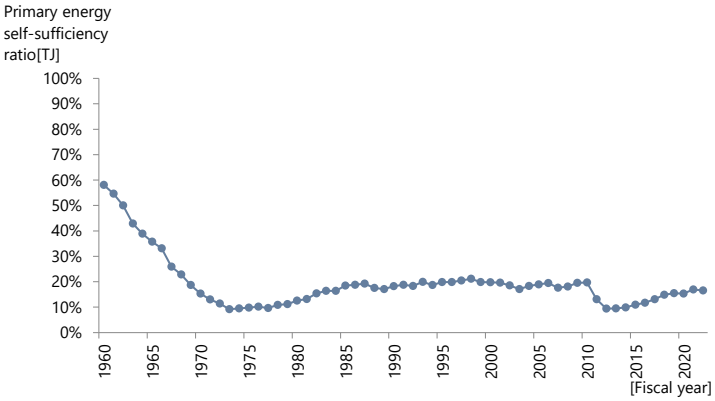


Figure II-17 Primary Self-Sufficiency ratio (based on gross calorific value)

Reference: IEA, Agency for Natural Resource and Energy, *Energy White Paper 2024*, Agency for Natural Resources and Energy, *General Energy Statistics*

(3) Energy mix

For the energy mix of power generation in FY 1990, oil-fired thermal power accounted for the largest share of Japan's total power supply at 28.7%, followed by nuclear power at 27.3%. Since then, the share of oil thermal has decreased while the share of coal-fired and nuclear power has increased, mainly due to the breakaway from the dependence on oil from the Middle East. In FY 2010, LNG-fired power accounted for 29.0%, nuclear power 25.1%, and coal-fired power 27.8%, and these three power sources accounted for more than 80% of total power generation. However, because of the shutdown of nuclear power plants in Japan after the Great East Japan Earthquake in 2011, the share of these three power sources in total power generation changed significantly since FY 2011. In FY 2022, LNG-fired and coal-fired power accounted for 33.8% and 30.8%, respectively.

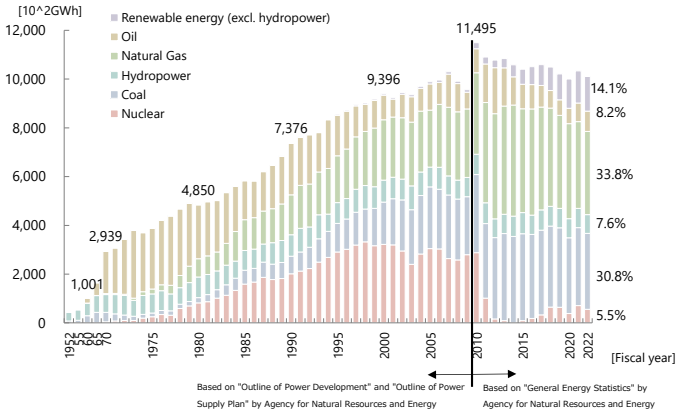


Figure II-18 Power generation by energy source[23]

Reference: Agency for Natural Resources and Energy, *Outline of Power Development* and *Outline of Power Supply Plan* (FY 1990 to FY 2009)
Agency for Natural Resources and Energy, *General Energy Statistics* (FY 2010-)

[23] Since electricity retailing was fully deregulated in FY 2016, *General Energy Statistics* is used, which covers all power generation, including auto producer generation. However, the data in *General Energy Statistics* are available only for FY 2010 and later. Thus, the figures for FY 2009 and earlier are based on *Outline of Power Development* and *Outline of Power Supply Plan*. The figures are excluding Okinawa Electric Power until FY 1971.

With the shutdown of nuclear power plants in Japan due to the Great East Japan Earthquake in 2011, the ratio of fossil power sources, mainly coal-fired thermal power, increased, leading to an increase in energy-related CO_2 emissions from the power generation sector. On the other hand, the share of new energy sources has gradually been increasing because of measures to introduce solar power and wind power generation, contributing to a decrease in energy-related CO_2 emissions.

(4) Energy consumption

Final energy consumption in Japan continued to increase significantly with the Japanese economy's rapid growth until the 1970s. It then levelled off following the two oil shocks of the 1970s, followed by a period represented by a downward trend. In the late 1980s, it began to increase again amid a strong economy and relatively lower crude oil prices. However, final energy consumption has been on a downward trend since peaking in FY 2005, partly due to the rise in crude oil prices after mid-FY 2000.

These trends can be summarized for different consumption sectors as follows. Until the first oil shock in 1973, energy consumption in the industrial, commercial and residential, and transport sectors grew rapidly. From FY 1973 until FY 1986, energy consumption in the commercial and residential sector and the transport sector continued to grow, but industrial energy consumption began to decrease because of the efforts for energy saving from the viewpoint of reducing production costs. From FY 1986 until FY 2000, the strong economy and drop in crude oil prices in the latter half of the 1980s boosted energy consumption in all four sectors. From FY 2001 onward, energy consumption in the industrial and transport sectors has decreased overall as a result of raising environmental awareness, but energy consumption in the commercial and residential sector has continued to increase. However, after the Great East Japan Earthquake in 2011, energy consumption in the industrial, commercial, and residential sectors decreased because of the further implementation of energy-saving efforts. In FY 2020, final energy consumption decreased significantly because of the impact of the suppression of human flows and the decline in production activities caused by the COVID-19 pandemic, and the decreasing trend continues in FY 2022.

By sector in FY 2022, the proportion of final energy consumption was 45% for the industrial sector, including non-energy use, 31% for the commercial and residential sector, and 24% for the transport sector.

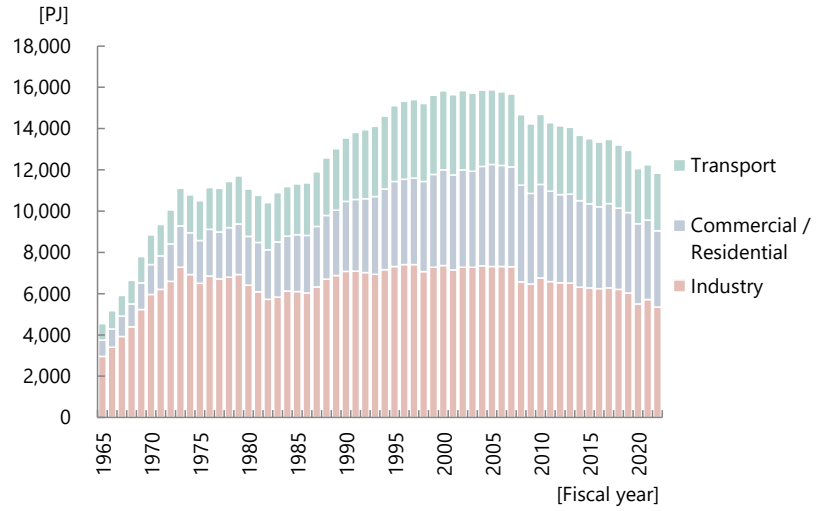


Figure II-19 Trends in final energy consumption

Reference: Agency for Natural Resource and Energy, *General Energy Statistics*

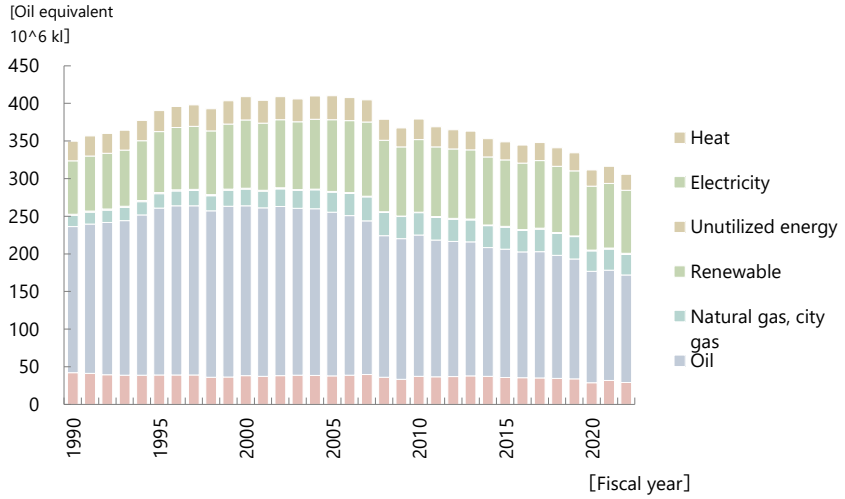
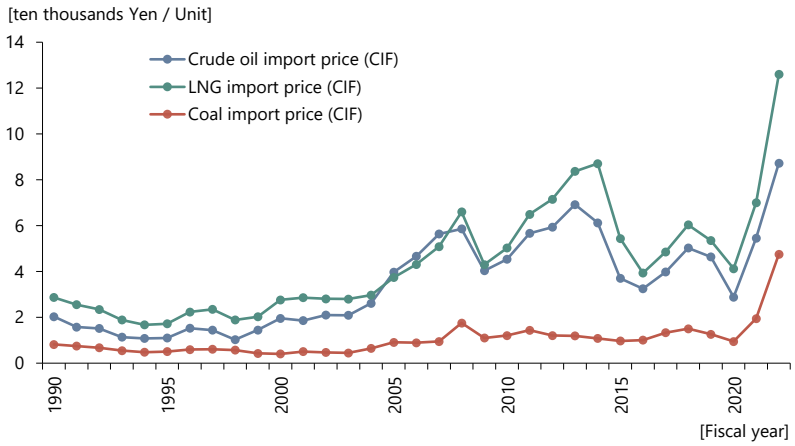


Figure II-20 Trends in final energy consumption by energy source

Reference: Agency for Natural Resource and Energy, *General Energy Statistics*

(5) Energy prices

Crude oil import prices (CIF) shifted to being stable in the 1990s, but the prices skyrocketed in the 2000s because of the strong growth in oil demand in developing countries and the increasing geopolitical risks in the Middle East. Soon after, the prices continued to rise until 2013, temporarily falling because of the slowdown in oil demand from the worldwide financial crisis in 2009. In 2014, crude oil prices fell dramatically from the excess supply caused by the slowdown in oil demand in developing countries, increased oil production by oil countries motivated by the high oil price, and steady growth of shale oil production. After oil countries decided to reduce production in 2016, oil prices began to rise again and remained on an upward trend until 2018. However, the oil supply-demand balance loosened because of increased shale oil production and other factors, and they turned downward again. Furthermore, the impact of the COVID-19 pandemic in 2020 led to a significant decline in oil demand and a sharp drop in oil prices. Oil prices soared in response to Russia's invasion of Ukraine, which began in February 2022. Japan’s LNG import prices (CIF) are linked to crude oil prices; therefore, the trend resembles that of crude oil prices. In FY 2022, LNG import prices (CIF) also rose significantly in line with the surge in crude oil prices and spot LNG prices due to Russia's invasion of Ukraine. The coal import prices (CIF) had been on a gradual increasing trend since the 2000s, but in 2022, coal prices soared due to Russia’s invasion of Ukraine, and the EU and Japan’s announcement of a ban on Russian coal imports.

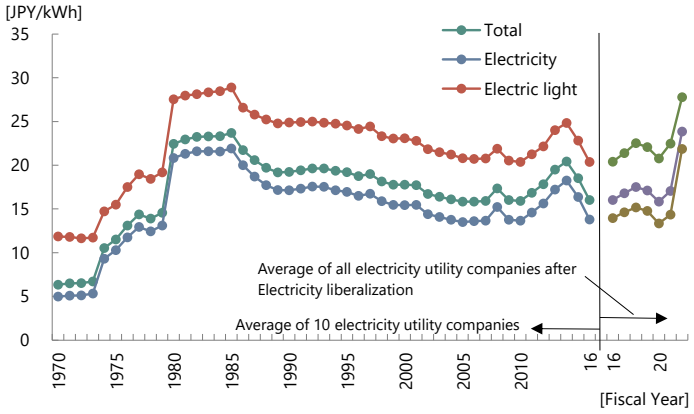


Note: A unit of crude oil is ten thousand yen/kl and units of LNG and coal are ten thousand yen/kt.

Figure II-21 Fuel import price (CIF)

Reference: Agency for Natural Resource and Energy, *Energy White Paper 2024*

Electricity prices rose sharply after the oil crisis partly because oil-fired thermal power was the mainstream power source at the time but subsequently began to decline. Since FY 2011, electricity prices have been linked to fluctuations in the cost of thermal power generation due to the rise and fall of fuel prices. Since FY 2015, electricity prices have repeatedly declined and risen in conjunction with changes in thermal power generation costs associated with higher and lower fuel prices. Electricity prices increased significantly in FY 2022 due to the sharp rise in fuel prices.



Note: Prior to FY 2016, 10 former electric utilities were covered; after FY 2016, all electric utilities were covered.

Figure II-22 Electricity price

Reference: Agency for Natural Resource and Energy, *Energy White Paper 2024*

1.7 Industry

Japan's GDP in 2022 consisted of approximately 1% of the primary industry, 25% of the secondary industry, and 74% of the tertiary industry. The tertiary industry, which includes wholesale and retail trade, real estate, professional, scientific, and technical activities, is a major industry. In the early 1990s, secondary industries accounted for about 40% of the total, but the appreciation of the Japanese yen from the spring of 1990 to the spring of 1995 affected the processing and assembly-type manufacturing industry, leading to the overseas

expansion of the manufacturing industry. The share of the primary industry, which includes agriculture, forestry, and fisheries, had been on a decreasing trend until 2004, but since then, it has remained at around 1.0%.

Improvement of energy efficiency in the secondary industry, which accounts for about 40% of total final energy consumption, can contribute significantly to the reduction of greenhouse gas emissions. In addition, since the tertiary industry accounts for about 70% of the industrial structure, energy efficiency improvements in companies and offices, such as promotion of energy conservation, improvement of heating and cooling efficiency, and more efficient lighting equipment, are also important for reducing greenhouse gas emissions.

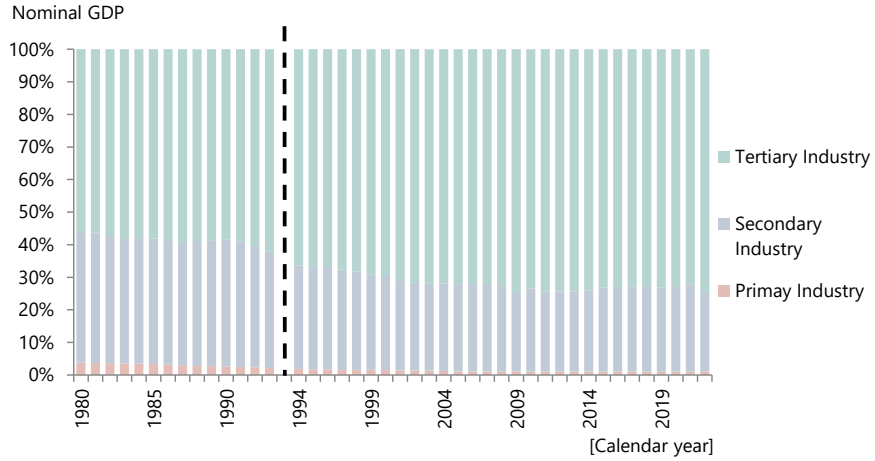


Figure II-23 Trend in nominal GDP composition by industry[24]

Reference: Cabinet Office *National Accounts for 2009* (Benchmark year = 2000)" (CY 1980 to CY 1993)
Cabinet Office *National Accounts for 2022* (Benchmark year = 2015)" (CY 1994 to CY 2022)

1.8 Transport

(1) Passenger transport

Domestic passenger traffic in Japan grew significantly throughout the period of rapid economic growth as a result of the popularization of cars, improvements in the transport system, and network expansion. Growth during the Bubble Economy was prominent, recording a 42.4% increase in FY 1989 against FY 1980.

Passenger traffic, mainly buses, railways, and passenger ships, declined or remained steady during the 1990s after the Bubble Economy crashed. On the other hand, passenger cars and aircraft constantly grew at a slower rate, contributing to the overall growth of domestic passenger traffic.

In the 2000s, passenger traffic growth flattened as passenger cars became popular for short-distance activities such as shopping and other daily activities. After FY 2006, passenger traffic continued to decline for four consecutive fiscal years as a consequence of the global financial crisis in 2008 and the Great East Japan Earthquake in 2011. However, it stopped declining and had been gradually increasing after FY 2012 as aircraft traffic grew with the introduction of low-cost carrier (LCC) services.

Passenger traffic, which declined significantly in FY 2020 because of the impact of COVID-19 pandemic, was in an increasing trend in FY 2022 due to the easing of behavioral restrictions and the recovery of economic activities. Passenger cars and railways accounted for 60.8% and 28.0% of the total passenger traffic in FY 2022,

[24] Nominal GDP up to CY 1993 and on and after CY 1994 cannot be connected because the benchmark year of the calculation is different.

respectively, with these two transportation modes accounting for more than 90% of the total.

CO_2 emissions per unit of transportation differ by transportation mode. In FY 2022, buses emitted about 3.6 times more CO_2, airplanes emitted about 5.1 times more CO_2, and private passenger cars emitted about 6.4 times more CO_2 than railways. Shifting from passenger cars to public transportation, such as railways and buses, enabled a reduction in CO_2 emissions.

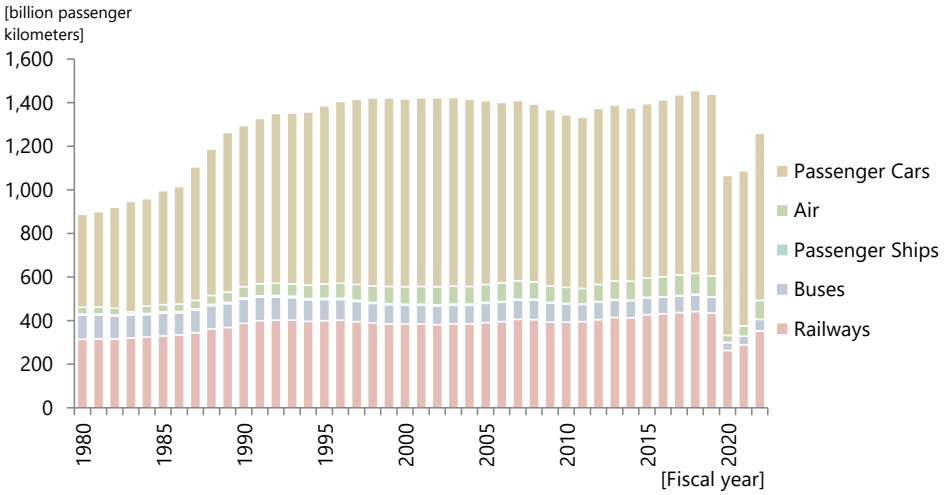


Figure II-24 Trend in Passenger Traffic

Reference: Ministry of Land, Infrastructure, Transport and Tourism, *Motor Vehicle Transport Statistics, Statistical Yearbook of Railway Statistics, Annual Statistical Report on Air Transport, and Annual Statistical Report on Shipping*

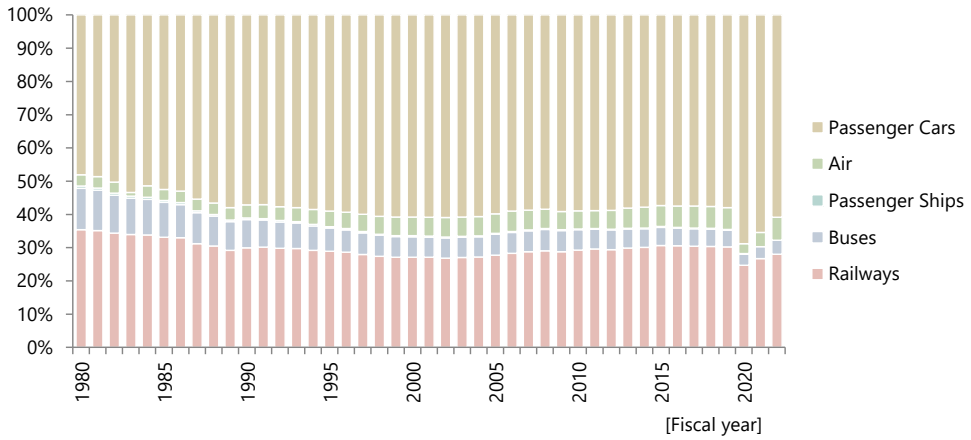


Figure II-25 Modal shares of domestic passenger traffic

Reference: Ministry of Land, Infrastructure, Transport and Tourism, *Motor Vehicle Transport Statistics, Statistical Yearbook Railway Statistics, Annual Statistical Report on Air Transport, and Annual Report on Shipping*

(2) Freight transport

Since the prewar time, domestic freight traffic in Japan depended on railways and shipping. In 1980 or so, roads developed to increase the dependency on motor vehicles. During the former part of the 1980s, industrial structures shifted from massive and heavy to small and light, moving on to a service-oriented economy and reducing domestic freight traffic. In the latter half of the 1980s, freight traffic shot up as the economy grew

during the bubble period.

In the 1990s, after the Bubble Economy crashed, domestic freight traffic, mainly railways, coastal shipping, and air, turned generally flat or declined. In total, freight traffic growth remained steady with the contribution of an increase in car traffic.

In the first half of the 2000s, the trend in growth did not change dramatically, however, in FY 2008, the growth dropped significantly for two consecutive fiscal years as a consequence of the global financial crisis. In FY 2010, freight traffic increased as the economy recovered temporarily, and from FY 2011 to FY 2012, car freight traffic was reduced by the Great East Japan Earthquake, along with a lack of truck drivers. Freight traffic continued to decrease until FY 2012, hitting the lowest level ever, and continues to remain so since then.

In FY 2022, freight traffic increased and is recovering from the impact of the COVID-19 pandemic. The share of freight traffic in FY 2022 was 55.7% for cars, 39.7% for coastal shipping, 4.4% for railways, and 0.2% for air. Cars and coastal shipping accounted for more than 95% of total freight traffic.

CO_2 emissions per tonne-km transported in FY 2022 were 208 g for commercial freight vehicles, compared to 20 g for railways and 43 g for ships.

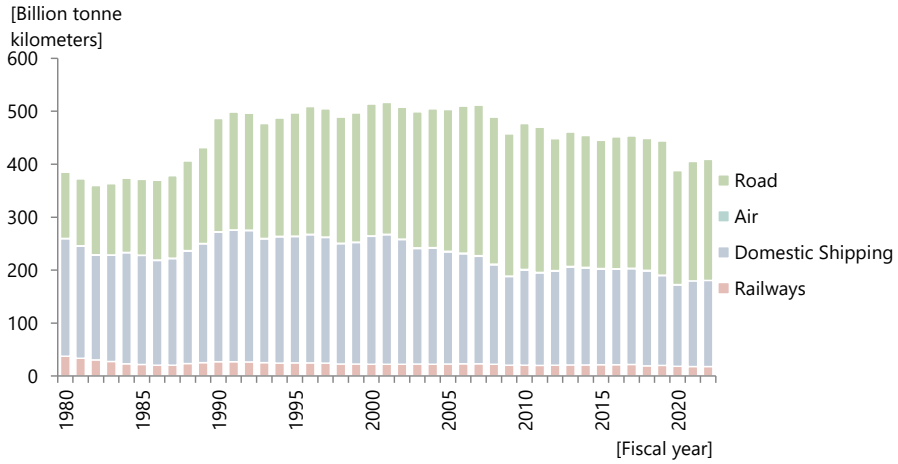


Figure II-26 Trend in domestic freight traffic

Reference: Ministry of Land, Infrastructure, Transport and Tourism, *Motor Vehicle Transport Statistics, Statistical Yearbook Railway Statistics, Annual Statistical Report on Air Transport, and Annual Report on Shipping*

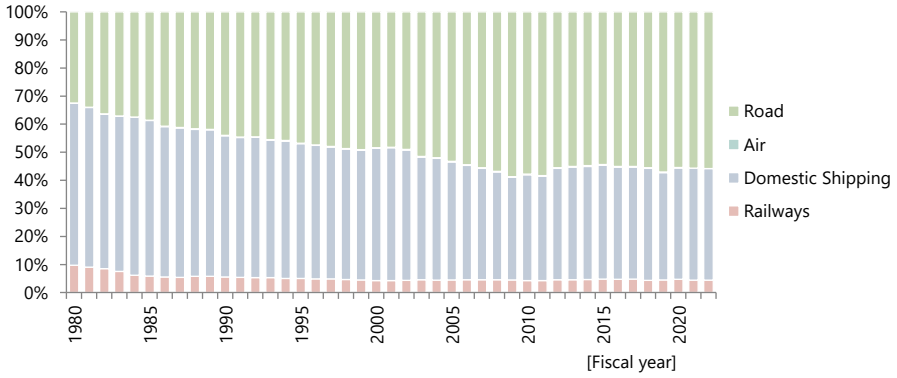


Figure II-27 Trend in domestic freight modal share

Reference: Ministry of Land, Infrastructure, Transport and Tourism, *Motor Vehicle Transport Statistics, Statistical Yearbook Railway Statistics, Annual Statistical Report on Air Transport, and Annual Report on Shipping*

(3) Car traffic

This section focuses on the trend in the number of cars, car traffic, and fuel consumption because cars account for a significant share of passenger and freight traffic.

The number of cars increased as a total during the 1990s, specifically with passenger cars as motorization advanced. The number of small trucks owned, on the other hand, turned into a declining trend upon the abolishment of the preferential taxation against freight vehicles in 1989 when the consumption tax was introduced. In the 2000s, the growth in the number of passenger cars slowed down and remained steady because of the increased population of seniors and as a consequence of the migration of the population to urban areas where passenger cars were relatively low. However, since 2010, the number of cars, mainly passenger cars, has shown a gradual upward trend due to the impact of eco-car tax reductions and subsidies.

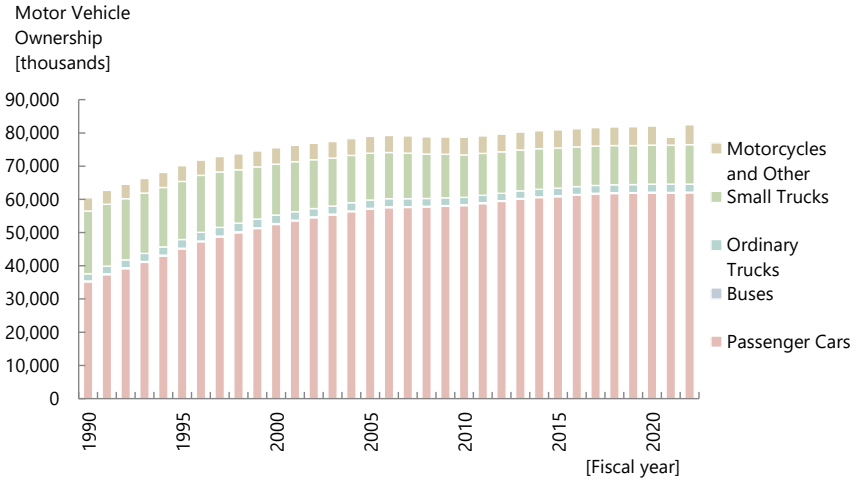


Figure II-28 Trend in the number of cars[25]

Reference: Ministry of Land, Infrastructure, Transport and Tourism, *Motor Vehicle Transport Statistics,* Automobile Inspection & Registration Information Association, *Statistical Data for Motor Vehicle Ownership*

Car traffic constantly increased until FY 2003 but turned into a declining trend as of FY 2004 as freight traffic declined, and around the same period, the traffic of private cars started to decline. Since FY 2014, car traffic has again shown an increasing trend, but in FY 2020 and FY 2021, it decreased significantly from the impact of the COVID-19 pandemic. In FY 2022, car traffic increased because of the economic recovery after the COVID-19 pandemic and the easing of behavioral restrictions.

[25] "Passenger cars" include lightweight cars. "Small trucks" include lightweight trucks. Special categories of small-size vehicles, Type I motorcycles (up to 50 cc), and Type II motorcycles (up to 125 cc) are not included.

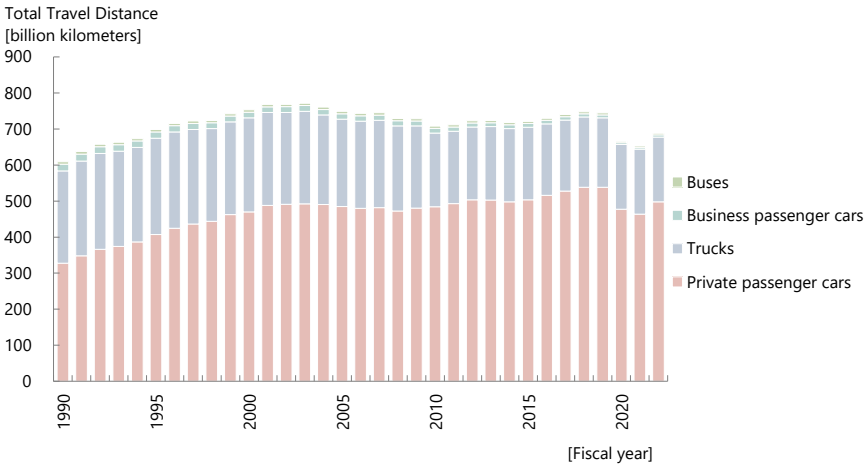


Figure II-29 Trend in cars total travel distance

※1: Since the survey and counting methods used in the *Annual Statistical Report on Automobile Transport* changed in October 2010, the data up to FY 2009 has a gap compared to the data after FY 2010. Therefore, the data after FY 2010 uses figures from the *Annual Report on Fuel Consumption of Automobiles*. It must be noted that the continuity of the data is not necessarily ensured.
※2: "Other" is the total of "other LPG automobiles" and "CNG automobiles" in the *Annual Report on Fuel Consumption of Automobiles*"
Reference: Ministry of Land, Infrastructure and Transportation, *Annual Statistical Report on Automobile Transport* and *Annual Report on Fuel Consumption of Automobiles*

The trend of private cars that account for a major share among the number of cars, almost no growth, or even declines are observed, except for minicars. The number of minicars is rapidly growing, indicating the miniaturization of the size of cars caused by the growing demand for low-priced and cost-effective cars.

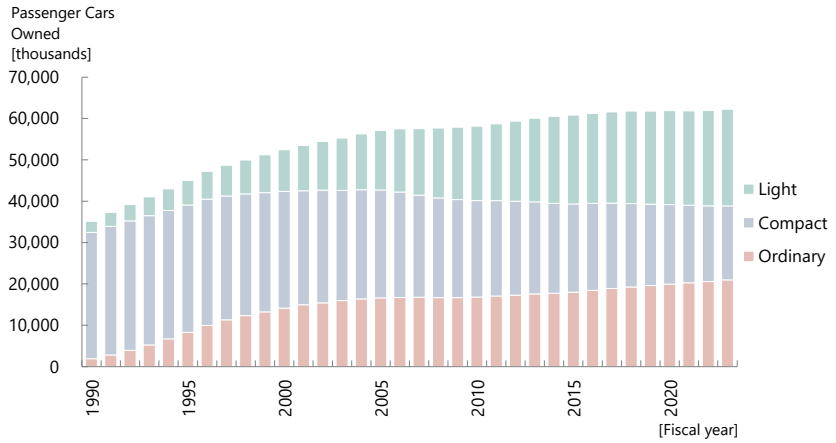


Figure II-30 The number of passenger cars (Ordinary, Compact, and Light Cars)

Reference: Automobile Inspection and Registration Association, *Car ownership by type of vehicle (in detail)*

1.9 Houses and commercial facilities

(1) Houses

As of October 1, 2018, the total number of houses had reached 62.41 million (53.62 million residing) for a total of 54.00 million households. The number of houses per household continued to rise, but the trend has slowed

in recent years with the number of houses per household in 2018 at 1.16, the same level as in 2013. When houses are counted by age, the housing stock built before the 1980s is 12.01 million, accounting for approximately 25% of the total.[26] The housing stock built after 2001 is 16.99 million and is approximately 35% of the total. By type of construction and ownership, for houses built before 1970, houses, including row houses, (owned) account for 75.8%, and apartments (rented) account for 13.2%. For houses built after 2011, the ratio of houses, including row houses, (owned) decreased to 48.9%, and apartment (rented) increased to 36.4%.

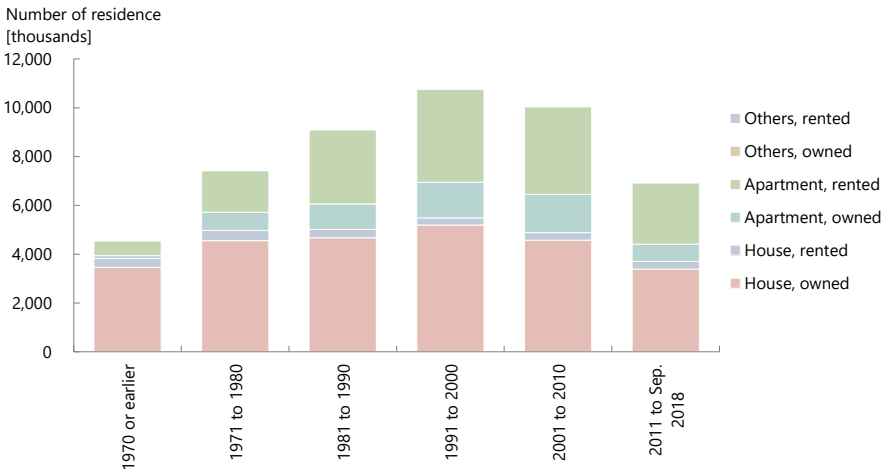


Figure II-31 Housing stock per age as of FY 2018

Reference: Ministry of Internal Affairs and Communications, *2018 Housing and Land Survey*

The average floor space per household demonstrates a steady improvement overall to 93.04 m^2 in 2018 compared to that of 77.14 m^2 in 1973. But when the details are analyzed, though the floor space per household increased compared to 1973 for both owned and rented, a stark contrast can be seen between owned houses (119.91 m^2) and rented houses (46.79 m^2), illustrating the prominence of small, rented houses.

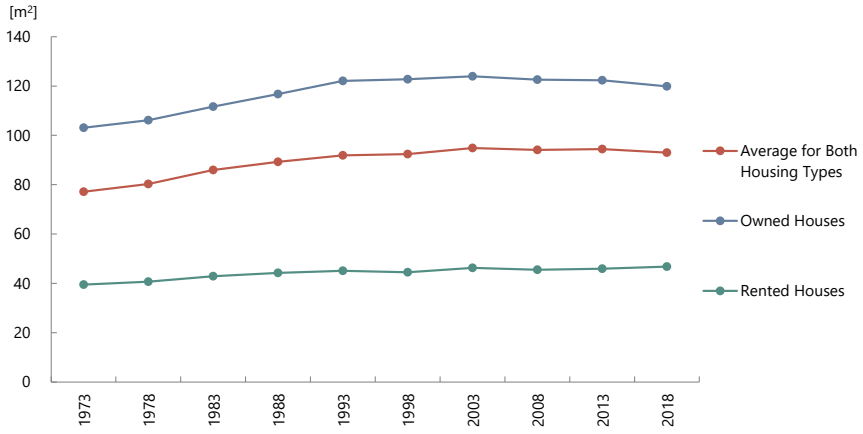


Figure II-32 Floor Space per Household in Japan

Reference: Ministry of Internal Affairs and Communications, *2018 Housing and Land Survey of Japan*

Energy consumption by use in the residential sector in recent years has been dominated by lighting and home appliances (including general home appliances other than air conditioners, such as refrigerators and televisions), followed by hot water supply and heating.

[26] "Total" refers to the number of houses, excluding those of unknown construction age.

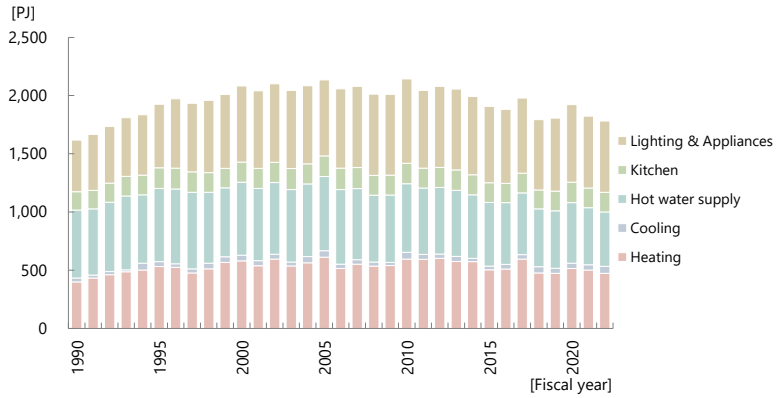


Figure II-33 Energy consumption by use in the residential sector

Reference: Agency for Natural Resources and Energy, *General energy statistics*, The Institute of Energy Economics, Japan, *Handbook of Energy & Economic Statistics in Japan*

(2) Commercial facilities

Since the period of rapid economic growth, the ratio of tertiary industries in Japan has increased in terms of the industrial structure, particularly with regard to the employment structure. The importance of "soft" work, including technology, information, planning, and design, has also increased in each industry, and the weight of indirect sectors has increased. In line with this shift towards service and other tertiary industries, the amount of floor space devoted to the commercial sector has steadily increased. Since FY 1965, it has increased at an average of 4.1% annually until FY 1999. However, between FY 2000 and FY 2022, the annual rate of increase has been in decline, with an annual mean of 0.7%.

An increase in total floor space in the commercial sector can lead to an increase in air conditioning, lighting, and other equipment, as well as an increase in energy consumption, which can lead to an increase in greenhouse gas emissions.

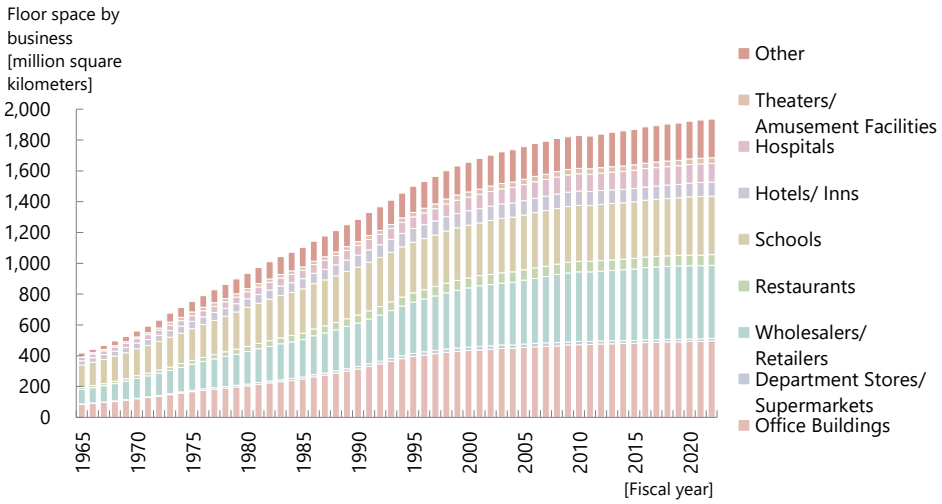


Figure II-34 Change in the amount of floor space in the commercial sector by business type

Reference: The Institute of Energy Economics, Japan, *Handbook of Energy & Economic Statistics in Japan*

1.10 Waste

(1) Waste management flow

From the 1960s to around 1990, Japan faced many issues, such as the increasing amount of waste along with increased income and pollution from rapid industrialization. Despite such measures as building basic systems for waste processing or an emission control strategy for hazardous substances that took place, the amount of waste continued to increase even after 1990. The land of Japan is small, and the insufficiency of landfill space has become a major issue. As a solution, the Revision of the Waste Management Act in 1991 included waste generation controls and waste separation/recycling, and the Act on the Promotion of Effective Utilization of Resources defined consideration for the environment in the product design and production process, the voluntary collection of waste by business operators, and the building of the recycling process. In the 2000s, the Basic Act on Establishing a Sound Material-Cycle Society (Act No.110 of 2000, hereinafter referred to as the "Basic Framework Act") was formulated to develop a sound material-cycle society with the firm realization of the 3Rs (Reduce, Reuse, Recycle) and proper waste processing.

In FY 2022, the final disposal volume accounted for 8.7% and 2.3% of Japan's general waste treatments and industrial waste emissions, respectively.

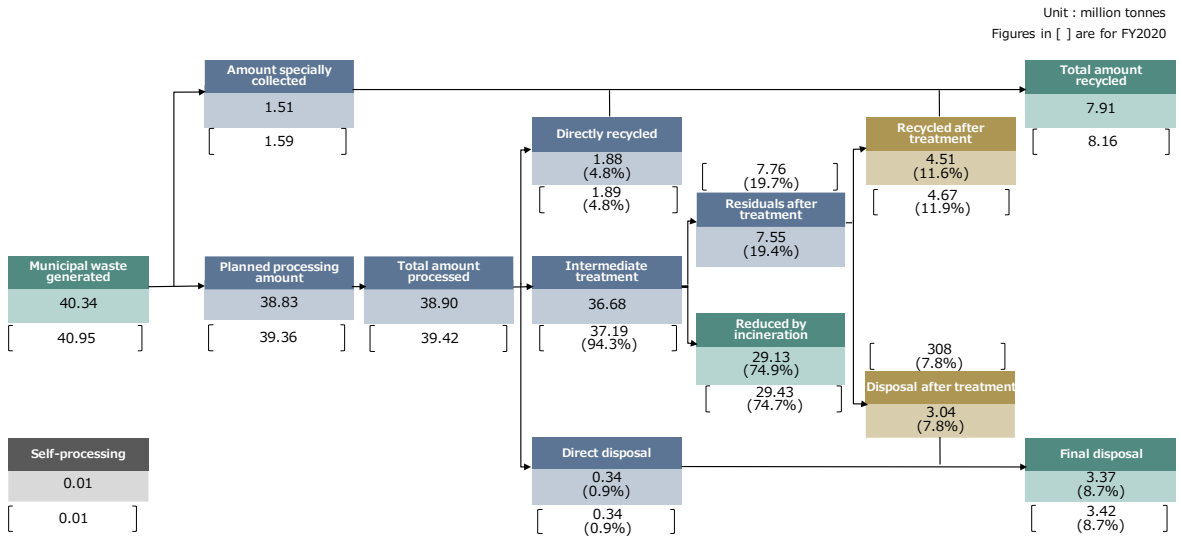


Figure II-35 Flow of Municipal Waste Management in Japan

Reference: Ministry of the Environment, *Annual Report on the environment in Japan 2024*

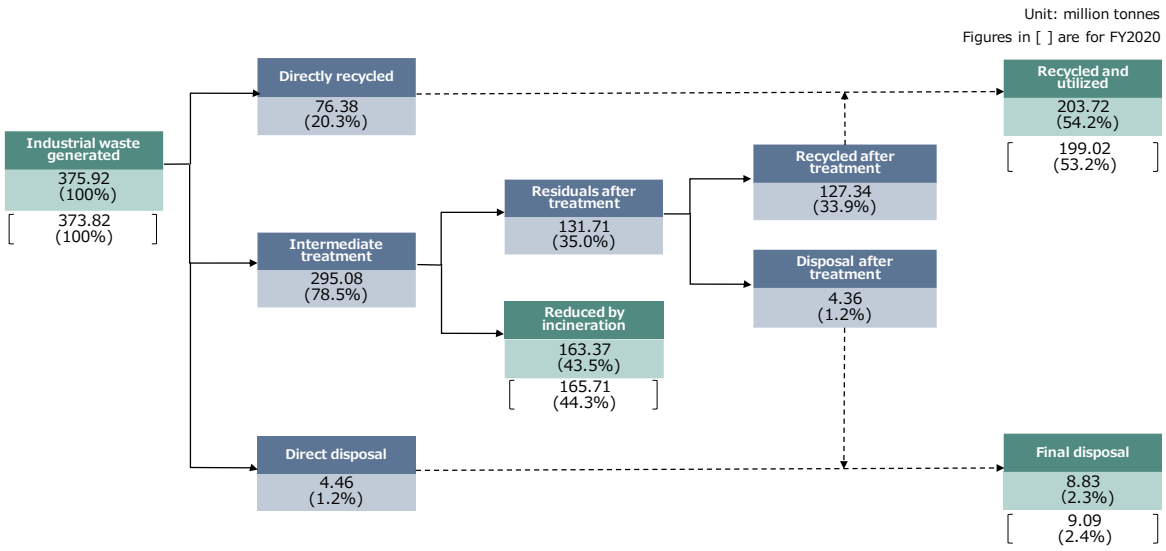


Figure II-36 Flow of Industrial Waste Management in Japan

Reference: Ministry of the Environment, *Annual Report on the environment in Japan 2024*

(2) Municipal solid waste

The volume of total and per person per day rapidly increased from around 1985 along with the economic rise during the bubble period. In the 1990s, after the Bubble Economy crashed, the increase continued mildly and turned into a downward trend after 2001 as the sound material-cycle society with the separated collection and varied recycling saturated socially, as well as by the influences from changes in the industrial structure and economic fluctuations. Waste volume per person per day in FY 2022 was 880 g/person/day.

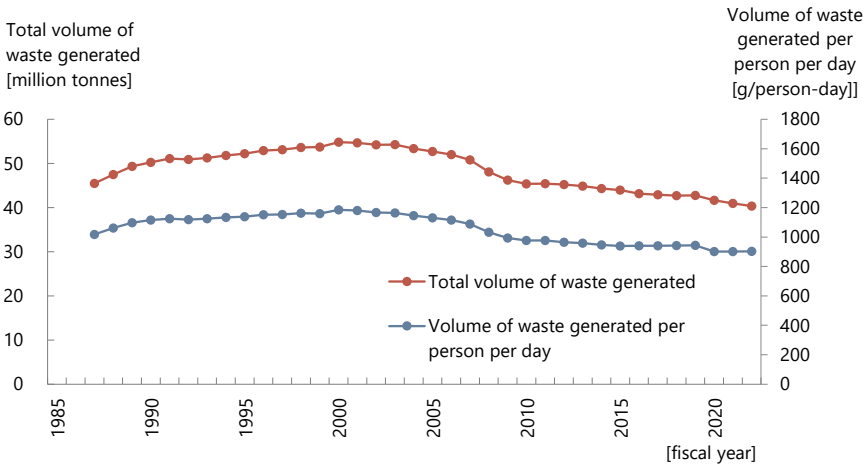


Figure II-37 Final disposal amount and final disposal amount per person per day

Reference: Ministry of the Environment, *Current status of municipal waste treatment*

Japan has promoted emission control and recycling, volume reduction, and acting against increasing waste. After 2000, the reduction of disposals is promoted systematically and effectively. As a result, the disposal amount of municipal solid waste is significantly decreasing. In FY 2022, the amount of disposal was 3.27 million tonnes.

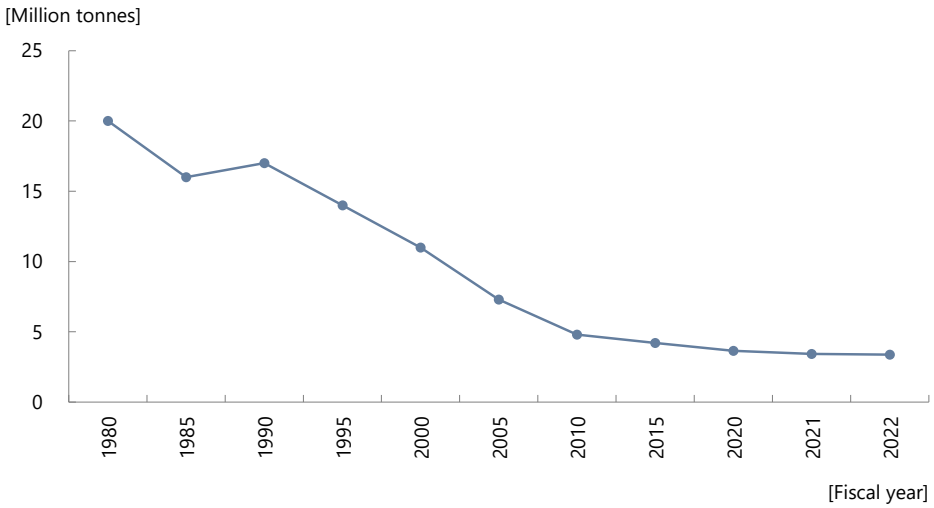


Figure II-38 Disposal of municipal waste

Reference: Ministry of the Environment, *Current status of municipal waste treatment*

(3) Industrial Waste

The volume of Industrial waste in Japan is shown in Figure II-39. Since 1990, the volume of Japan's industrial waste has not shown any major changes and has remained at the same level. Total industrial waste in FY 2020 was 370 million tonnes, a decrease of 5.7 million tonnes compared to FY 2021.

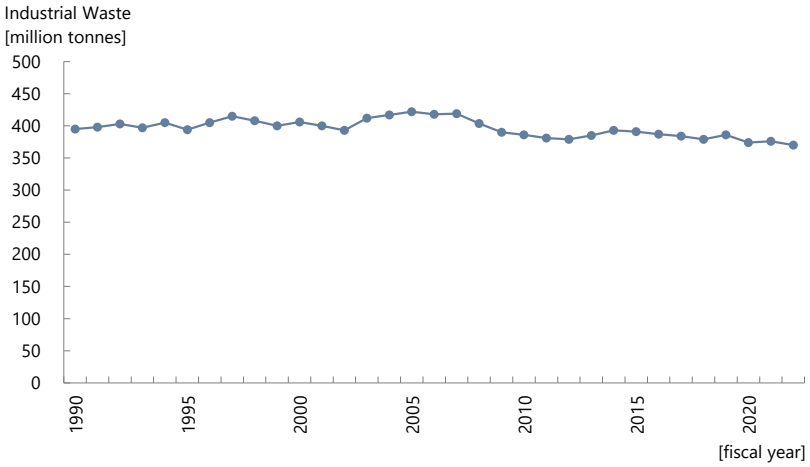


Figure II-39 Volume of industrial waste

Reference: Ministry of the Environment, *Current status of industrial waste treatment*

Similar to the trend of municipal solid waste, disposal of industrial waste has been significantly reduced as the volume of waste reduction increased (Figure II-40). Disposal of industrial waste in FY 2022 was 9 million tonnes, achieving an 87% reduction compared to FY 1980.

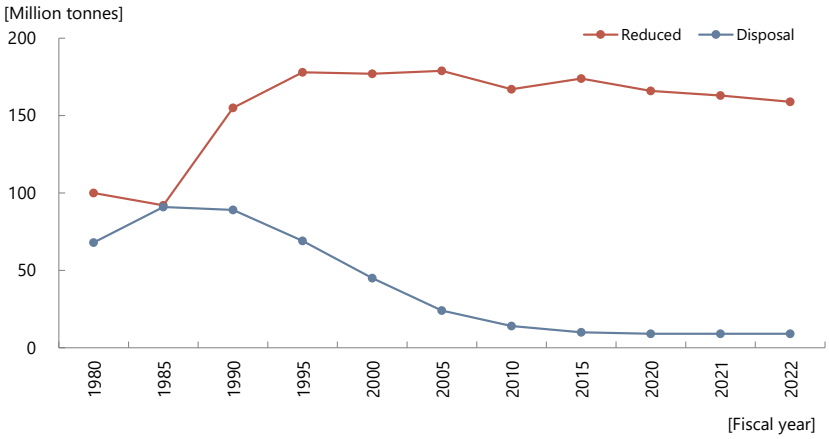


Figure II-40 Industrial waste disposal and reduction

Reference: Ministry of the Environment, *Current status of industrial waste treatment*

1.11 Agriculture

In Japan, which falls within the Asian monsoon region, rice cultivation in paddy fields has long formed part of the agricultural system suited to the humid and rainy summer conditions. In order to develop paddy field cultivation, measures to improve irrigation have been implemented, and as a result, the ratio of irrigated paddy fields out of the total agricultural area in Japan (54.3%) is quite high compared to other countries.

However, since Japan is mountainous and does not have much flat land (mountainous areas account for 61% of the national land area), there is intense competition over land use. The ratio of the national land area used for agriculture is about 12%, and the cultivated fields per agriculture management entity are small (approximately 3.4 hectares). Furthermore, the cultivated area has been decreasing each year, and in 2022, it had fallen about 18% from the 1990 level to 4.30 million hectares. Aging of farmers and the lack of a labor force resulted in uncultivated lands. This trend remains current.

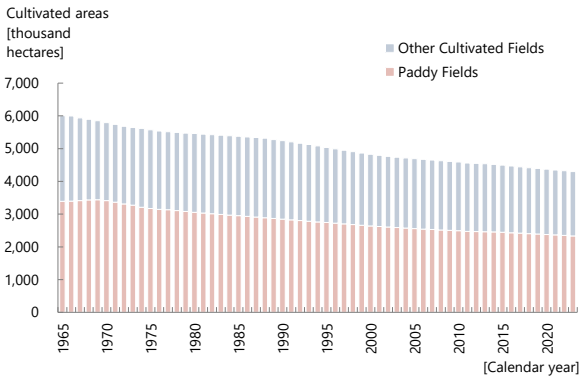


Figure II-41 Changes in cultivated areas

Reference: Ministry of Agriculture, Forestry and Fisheries of Japan, *Statistics on Cultivated Land and Planted Areas, 2022*

Livestock production in Japan accounts for about 39% of total agricultural output (in 2022), and the main livestock species are cattle (dairy cattle, beef cattle), swine, and chickens. Although a certain number of dairy and livestock farmers are leaving the industry every year because of the aging of the workforce and the lack of successors, the number of livestock per farmer has been increasing, and the trend toward large-scale production has been progressing. In recent years, the number of cattle kept has been on a gradual upward

trend.

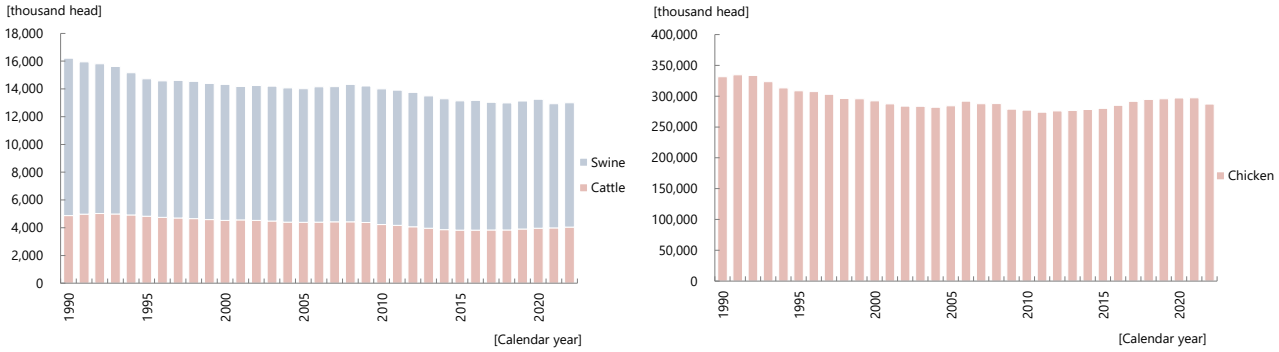


Figure II-42 Changes in livestock population

Reference: Cattle: Ministry of Agriculture, Forestry and Fisheries of Japan, *Livestock Statistics*
Swine: *Livestock Statistics* (Estimates for 2004, 2009, and 2014 due to missing data.)
Broiler: 1990-2008, Ministry of Agriculture, Forestry and Fisheries of Japan, *Livestock Products Distribution Statistics*, Number of young chickens for meat
2009-2022, Estimated based on the number of broilers shipped from *Livestock Products Distribution Statistics*
Hen: *Livestock Statistics* (Estimates for 2004, 2009, 2014, and 2019 due to missing data.)
Note: The number of chickens is the total number of broilers and hens.

1.12 Forestry

Forestry plays an important role in Japan in maintaining and fulfilling multiple functions of forests. This includes national land conservation through forestry activities, including thinning and tending, as well as providing products such as timber.

Forest cover remains about 25 million hectares, or about 70%, of Japan's national land area for years. It comprises national forests (approximately 30%) and non-national forests (approximately 70%). In Japan, trees were planted on over 300,000 hectares of land each year between the 1950s and the early 1970s, and at the peak of these efforts, over 400,000 hectares were planted in a single year. This active effort contributed to establishing over 10 million hectares of planted forests. As a result of the growth of these planted forests, the growing stock of Japan's forests[27] amounted to approximately 5.5 billion cubic meters in 2022, which is approximately three times greater compared to the level in 1966. More than half of the planted forest area is over 50 years old and has matured enough to be used as timber. The growth rate of planted forests declines after peaking at around the 4-5 age classes. The CO_2 removals of Japan's planted forests as a whole are also declining because of the maturation of the forests.

The demand for wood in Japan has been on a long-term downward trend but has been on a gradual upward trend since 2010, with the exception of 2020, when it declined because of the pandemic of COVID-19. Meanwhile, the supply of domestic wood is on an increasing trend, representing approximately 41% of the total wood demand in 2022.

[27] Total Volume of the trunk.

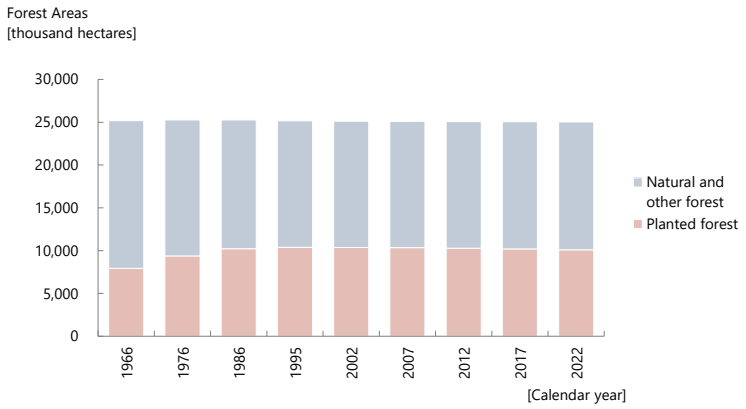


Figure II-43 Trends in forested area

Reference: Forestry Agency, *State of Forest Resources*

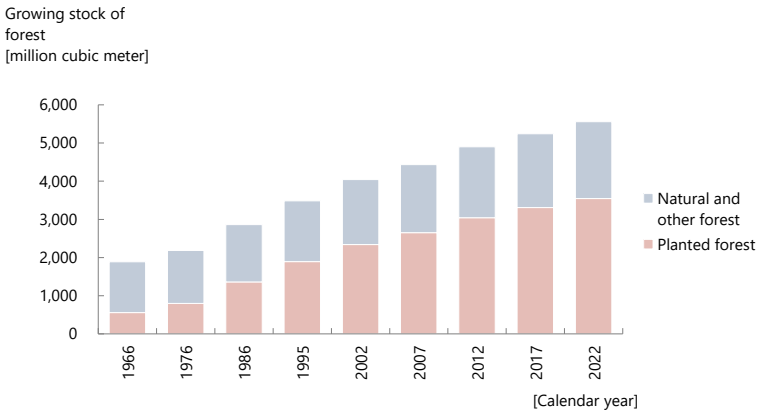


Figure II-44 Trends in growing stock of forest

Reference: Forestry Agency, *State of Forest Resources*

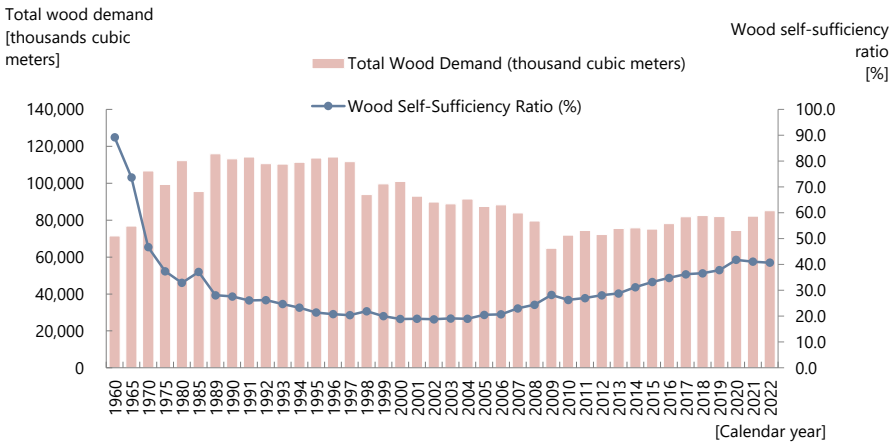


Figure II-45 Trends in wood demand and wood self-sufficiency ratio

Reference: Forestry Agency, *Demand and Supply of Woods*

2 Institutional arrangements in place to track progress made in implementing and achieving the NDC under Article 4

(paras. 61 and 62 of the MPGs)

2.1 Overall framework of promotion of global warming countermeasures

In the Basic Environment Law (November 19, 1993, Act No. 91) that defines the basic principles regarding environmental conservation in Japan and outlines the basic direction of national policy, proactive promotion of global environmental conservation is regulated. The government formulates the *Basic Environmental Plan* [28] based on Article 15, paragraph 1, of the Law to comprehensively and strategically promote measures related to environmental conservation. The global warming countermeasure is an important component of the plan.

Additionally, regarding the promotion of global warming countermeasures, there is specific legislation, the Act on the Promotion of Global Warming Countermeasures (1998, Act No. 117). Article 2, paragraph 2 of the Act states that global warming countermeasures must be promoted through close cooperation among citizens, the national government, local governments, businesses, and private organizations to realize a decarbonized society by 2050 while integrally promoting environmental conservation and economic and social development. Furthermore, the government established the *Plan for Global Warming Countermeasures* (Cabinet Decision on October 22, 2021) [29] based on Article 8, paragraph 1, of the Act in order to promote global warming countermeasures towards the achievement of the NDC comprehensively and systematically. The *Plan for Global Warming Countermeasures* is the only general plan regarding global warming in Japan. This plan sets targets for reducing GHG emissions and removals, basic matters concerning measures that businesses and citizens should implement, and basic matters concerning measures that the national government and local governments should implement in order to achieve the target.

2.2 Direction of global warming countermeasures in Japan

Japan will take the initiative in implementing global warming countermeasures under an international collaboration and based on scientific knowledge.

(1) Mid- and long-term strategic initiatives for achieving carbon neutrality by 2050

The Paris Agreement aims to hold the increase in the global average temperature to well below 2℃ and pursue efforts to limit the global average temperature to 1.5℃. Also, the Paris Agreement aims to have global emissions reach their peak as early as possible in order to realize early reductions in accordance with the latest science in order to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century.

As indicated in the *IPCC Special Report on Global Warming of 1.5°C*, it is globally urgent that we recognize that there are meaningful differences in the impact that might occur between a 1.5°C increase and a 2°C increase in temperature and that we pursue efforts to limit the increases in the global average temperature to 1.5°C above preindustrial levels.

Japan aims to reduce national total GHG emissions to zero by 2050, in other words, to realize carbon neutrality by 2050 in accordance with the notion that industrial structures and economic society can be transformed by proactively implementing global warming countermeasures that no longer act as a

[28] Currently, the *Sixth Basic Environment Plan*, approved by the Cabinet on May 21, 2024, is the latest.

[29] https://www.env.go.jp/content/000249337.pdf

constraint on economic growth and that can instead lead to significant growth. *The Act to Partially Amend the* Act on the Promotion of Global Warming Countermeasures (Act no. 54 of 2021; the amended Act on the Promotion of Global Warming Countermeasures shall hereinafter be referred to as the "Amended Global Warming Countermeasures Promotion Act"), which was passed by the 204th session of the Diet, enshrined the goal of carbon neutrality by 2050 into law. Accordingly, Japan will not just attain our medium-term emission reduction targets but also work to enhance the continuity and predictability of policies for realizing a decarbonized society and accelerate initiatives, investments, and innovations for the sake of decarbonization.

In addition, Japan aims to reduce its GHG emissions by 46% in fiscal year (FY) 2030 from its FY 2013 level, setting an ambitious target that is aligned with the long-term goal of achieving net zero by 2050 and continue strenuous efforts in its challenge to meet the lofty goal of cutting its emission by 50%. In order to give rise to a virtuous cycle for the economy and the environment and achieve strong growth towards our ambitious target for FY 2030, Japan will promote as many initiatives as possible in all areas, such as thorough energy conservation, the introduction of renewable energy sources to the maximum extent possible, and decarbonization of the public sector and regions. In the food, agriculture, forestry, and fisheries sectors, Japan aims to achieve both increased productivity and sustainability through innovations in accordance with the *Green Food System Strategy* (as determined by the Ministry of Agriculture, Forestry and Fisheries on May 12, 2021). Moreover, Japan steadily implements cross-sectoral decarbonization and other such initiatives on national land and in our urban and regional spaces in accordance with the *Green Challenge for Land, Infrastructure, Transport, and Tourism* (as determined by the Ministry of Land, Infrastructure, Transport and Tourism on July 6, 2021). Japan also creates new industries and jobs by promoting a strategic shift to a circular economy, which is needed for decarbonization, and nature-based solutions (NbS[30]).

Japan will continue to take on challenges towards 2030 and 2050. The realization of carbon neutrality by 2050 and a 46% reduction target by FY 2030 will certainly not be easy, but the decarbonization of all socioeconomic activities is positioned as a key challenge, and the pursuit of a shift to a sustainable and strong socioeconomic system is crucial. Japan will promote growth-contributing policies centered around decarbonization in order to realize our targets.

(2) Initiatives for reducing global GHG emissions

Japan will demonstrate global leadership in terms of spearheading global decarbonization. Japan will continue to expand cooperation based on ties of collaboration with partner countries on the basis of relationships of trust that have been established to date and promote the business-led international development of technologies and products that offer high levels of environmental performance by leveraging our technological strengths and making further improvements to the environment, such as by creating markets, developing human resources, and building systems in order to make maximum contributions to the efforts to reduce global emissions.

2.3 Basic concept of global warming countermeasures

(1) Integrated improvement of the environment, economy, and society

In promoting global warming countermeasures, Japan will promote policies that will help improve the

[30] Nature-based Solutions. Initiatives to solve social issues by taking advantage of the functions of healthy natural ecosystems.

environment, economy, and society on an integrated basis by harnessing local resources, technological innovations, and ingenuity and utilizing AI, the IoT, and other digital technologies in order to stimulate the Japanese economy, create jobs, solve issues plaguing local communities, and enable the achievement of SDGs.

Specifically, in order to promote economic development, the realization of high standards of living for citizens, the revitalization of communities, and reductions in GHG emissions, and while Japan strives to live in a state of harmony with nature, Japan will boldly shift to a nature-symbiotic society through the thorough promotion of energy conservation, the introduction of renewable energy to the maximum extent possible, the further acceleration of technological development, the reformation of social implementation and approaches to living and work, the promotion of a circular economy built around the 3Rs (reduce the generation of waste and reuse and recycle recyclable resources)+ Renewable (biomass and the use of recyclable materials), and the long-term demonstration of ecosystem services consisting of carbon removals and storage by natural ecosystems, as well as facilitate the aggressive transformation of business towards decarbonization and support labor movements caused by this transformation without allowing for unemployment to result. The Paris Agreement stipulates that the just transition of the workforce is imperative, such that it is important to proceed while working to ensure the creation of decent, rewarding jobs and improve labor productivity. In addition, the existence of many companies rooted in local communities in Japan means that Japan will need to study, in addition to the workforce, matters concerning transitions affecting local economies and local companies in an integrated manner.

It is exceedingly important that all entities, including citizens, the national government, local governments, and business enterprises, are aligned when it comes to improving the environment, the economy, and society on an integrated basis and that Japan cooperates in taking actual action towards making concrete progress in this regard.

(2) Green recovery from COVID-19

It is said that COVID-19 and other emerging infectious diseases are deeply connected to global environmental changes, such as the loss of biodiversity and climate change[31] and are forcing us to rethink the future of human activities and the way we coexist with nature. At the G7 Cornwall Summit, attendees shared the view that "the unprecedented and interdependent crises of climate change and biodiversity loss pose an existential threat to people, prosperity, security, and nature." Urgent and specific actions are needed to move towards global sustainability, further mitigate and adapt to climate change, and halt and restore the loss of biodiversity and environmental degradation.

Around the globe, green recovery efforts are underway to increase the ambition with respect to climate change countermeasures and achieve a sustainable economy and society as these matters relate to economic recovery in the wake of COVID-19. The new crisis brought about by COVID-19 has substantially altered the global socioeconomic framework, such that climate change countermeasures will also need to be promoted as an integral part of the way we will respond to these changes. In recognizing that we stand at a significant crossroads at this time in history, it is necessary to achieve a transformation of the social system into one that is sustainable and resilient rather than return to the society that existed before the

[31] In the *Workshop Report on Biodiversity and Pandemics of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (2020)* The underlying causes of the pandemic are the same global environmental changes that cause biodiversity loss and climate change, including land use change, agricultural expansion and intensification, wildlife trade and consumption, etc. The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBE) was established in April 2012 as an intergovernmental organization to make policy recommendations based on research findings on biodiversity and ecosystem services worldwide. It was established in April 2012.

emergence of COVID-19. Based on the 2050 declaration of carbon neutrality, Japan will accelerate the three pillars of transition to a decarbonized society, circular economy, and decentralized society, and then redesign the economy and society to be sustainable and resilient in a forceful manner.

(3) Transforming the awareness of all actors, changing their behavior, and strengthening their coordination

The issue of global warming is strongly linked to socioeconomic activities, local communities, and the lives of people in general and will have a major impact on future generations, which means that the people, the national government, local governments, business enterprises, and other actors will all need to address this issue in a participatory and coordinated way.

To this end, knowledge concerning the issue of global warming, which is becoming increasingly more serious, and information on what each individual should do and on the state of progress with respect to the implementation of global warming countermeasures should be proactively provided and shared as visibly as possible. Japan will train human resources and develop activities to communicate these ideas and put them into action so as to induce changes in awareness and behavior across all sectors and levels of the nation.

(4) Contribution to reducing global GHG emissions by strengthening research and development and spreading superior decarbonization technologies

In order to confront the global challenge of climate change and realize a decarbonized society, we must carry out innovations that do not constitute a mere extrapolation of the conventional path on which we are currently treading. The realization of a decarbonized society requires that we correct the singular understanding that innovation means just innovation of technology and that we promote innovation for practical applications and dissemination with a view to promoting the social implementation of technologies, including by way of spreading existing superior technologies along with innovation entailing the creation of innovative technologies. From this perspective, performance and efficiency are also important, but so is innovation conceived through a consideration of needs and a conception of what our future society should look like since performance, no matter how advanced, cannot be demonstrated if a technology is not selected by users.

Japan will strengthen research and development work on innovative technologies that pertain to promising fields based on the *Sixth Basic Plan for Science, Technology, and Innovation* (Cabinet Decision made on March 26, 2021) and the *Environment Innovation Strategy* (decision made by the Integrated Innovation Strategy Promotion Council on January 21, 2020). In addition, Japan will promote the diffusion of leading decarbonization technologies and the implementation of global warming mitigation activities through the Joint Crediting Mechanism (JCM) and other means.

(5) Implementation of the Paris Agreement

In order to achieve the goals of the Paris Agreement, Japan will steadily implement the five-year cycle of the submission and updating of targets under the Paris Agreement as well as the reporting and reviewing of tracking progress made in implementing and achieving targets. Furthermore, Japan will also proactively contribute to the establishment of detailed international rules of the Paris Agreement. We will also steadily respond to reports and reviews with respect to the state of initiatives as made by each country under the

Paris Agreement.

(6) Emphasizing the evaluation and review process (PDCA)

In order to constantly monitor and ensure the effectiveness of the Plan, Japan will strictly check progress with respect to measures implemented by the government for each countermeasure each year by assessing the emission reductions, the evaluation indicators for countermeasures, and other relevant indicators (hereinafter referred to as "measure evaluation indicators") for greenhouse gas and category, and flexibly review the Plan as required.

2.4 Promotion system of the *Plan for Global Warming Countermeasures* towards the achievement of the NDC

In order for each actor to continuously promote policies and measures and build a sustainable, decarbonized society, it is important to establish a systematic promotion system.

In the government, the Global Warming Prevention Headquarters, which is headed by the Prime Minister and includes all cabinet ministers as members, and the Executive Committee of the Global Warming Prevention Headquarters, which is a committee of the director-general level of each ministry and agency, play a central role in close coordination with the relevant ministries and agencies.

The *Plan for Global Warming Countermeasures*, which is a comprehensive implementation plan for achieving Japan's NDC, was discussed in public under a joint meeting of the Mid- and Long-term Climate Change Countermeasures Subcommittee of the Global Environment Committee under the Central Environment Council and the Working Group for Consideration of Global Warming Countermeasures of the Global Environment Subcommittee of the Committee on Industrial Science and Technology Policy and Environment under the Industrial Structural Council, with hearings being held with future generations and related ministries and agencies. The energy policy and energy mix were discussed under the Advisory Committee for Natural Resources and Energy. After the above process, the government's draft was compiled and decided on by the Global Warming Prevention Headquarters.

In addition, towards the achievement of a sustainable society, Japan is proactively working to expand the participation of women in the policy and decision-making process, and to ensure that gender perspectives, including gender equality, are reflected in specific initiatives, based on international trends in addressing environmental issues such as climate change.

For example, Japan is promoting the participation of women in councils and other bodies. One initiative ensures that half of the members of the meeting - a joint meeting of the Climate Change Countermeasures towards net-zero by 2050 Subcommittee of the Global Environment Committee under the Central Environment Council and the Working Group for Consideration of Global Warming Countermeasures of the Global Environment Subcommittee of the Committee on Innovation and Environment under the Industrial Structural Council- that is considering revisions to Japan's next NDC and the *Plan for Global Warming Countermeasures*, which is a comprehensive implementation plan for achieving the NDC, are women. In addition, in the regions, Regional Energy and Global Warming Prevention Promotion Councils established in each regional block are used in cooperation with local governments and regional councils for global warming countermeasures to back up regional efforts for global warming prevention in collaboration with relevant ministries and agencies.

2.5 Progress management of the *Plan for Global Warming Countermeasures* towards the achievement of the NDC

The Global Warming Prevention Headquarters strictly reviews the achievement status of targets by types of GHGs and other categories, relevant indicators, the progress of each policy and measure etc. every year, considering the periodic reviews and examinations by the relevant councils. Since it is necessary to grasp the latest status for an accurate review, the relevant government ministries and agencies strive to quickly calculate the actual figures required for reviewing measure evaluation indicators.

Specifically, the Global Warming Prevention Headquarters or the Executive Committee of the Global Warming Prevention Headquarters clarifies the actual figures of all the measure evaluation indicators for the fiscal year before the review (or actual figures for two fiscal years prior if it is difficult to provide actual figures for the previous fiscal year), as well as the outlooks of each measure evaluation indicator from the fiscal year of the progress review through to FY 2030 (the outlook in each fiscal year if the data is available) once every year. In addition, they clarify the implementation status of policies and measures in the previous fiscal year that supports the outlooks of the measure evaluation indicators and the contents of ongoing policies and measures in the current fiscal year, along with policies and measures that are going to be implemented in the next fiscal year or later, including budget proposals, tax reform plans, and bills that will be implemented as well.

Based on the above, each policy and measure will be evaluated to identify those that are slow to progress, and consideration will be made for the enhancement and strengthening of those policies and measures. In doing so, not only the enhancement of policies and measures that have already been included in the *Plan* but also new policies and measures will be explored. In reviewing the progress, an examination of the relationship between the evaluation indicators of each policy and measure and the emission reductions as the effects of implementing the corresponding policies and measures, as well as cost performance, are implemented when necessary. For the areas where evaluation methodology, like measures evaluation indicators, has not been fully established at this point, such as policies and measures that lead to the transformation of a socioeconomic system, proper evaluation methodology will be quickly established.

Furthermore, the evidence of the estimated emission reductions by each policy and measure and the results of progress reviews will be made public via the Internet so that the public can access the details of policies and measures and their progress appropriately.

In addition to such annual progress reviews, the targets, policies and measures set in the Plan are examined at least every three years based on the annual GHG emissions and removals and other circumstances, taking account of the reports submitted by the Japanese government to the secretariat of the United Nations Framework Convention on Climate Change, including the annual GHG inventory, the biennial transparency report, and the national communication. Then, the Plan shall be revised as necessary based on the results of the examination, and the revision shall be decided by the Cabinet.

2.6 Information on changes in domestic institutional arrangements

Since December 2022, when the 8th National Communication (NC8) and 5th Biennial Report (BR5) under the UNFCCC were submitted, there have been no changes regarding domestic institutional arrangements for promoting global warming countermeasures and reporting to the UNFCCC.

B. Description of a Party's nationally determined contribution under Article 4 of the Paris Agreement, including updates

(para. 64 of the MPGs)

1 Emission reduction target for 2030

Japan's GHG emission reduction target under the Paris Agreement is a reduction of 46% in national total greenhouse gas emissions in fiscal year (FY) 2030 from its FY 2013 levels, which sets an ambitious target that is aligned with the long-term goal of achieving net zero by 2050. Furthermore, Japan will continue strenuous efforts in its challenge to meet the lofty goal of cutting its emissions by 50%. This target was submitted to the UNFCCC on October 22, 2021, as the update of Japan's Nationally Determined Contribution (NDC).[32]

Japan's NDC includes not only a target for total national greenhouse gas emissions in FY 2030 but also an estimate of emissions by gas and category (Table II-2).

Information on the description of Japan's NDC under Article 4 of the Paris Agreement in accordance with Decision 5/CMA.3 is shown in Table II-3.

Table II-2 Targets and estimates by greenhouse gases and other classifications*1

(Unit：Mt CO_2 eq.)

	Targets and estimates in FY 2030*2	FY 2013
Greenhouse gas emissions and removals	760	1,407
Energy-related CO_2	677	1,235
Industry	289	463
Commercial and others	115	235
Residential	71	209
Transport	146	224
Energy conversion*3	56	106
Non-energy-related CO_2	70.0	82.2
Methane (CH_4)	29.1	32.7
Nitrous oxide (N_2O)	16.5	19.9
Four gases incl. alternative CFC*4	20.9	37.2
Hydrofluorocarbons（HFCs）	13.7	30.3
Perfluorocarbons（PFCs）	3.8	3.0
Sulfur hexafluoride（SF_6）	23.0	2.3
Nitrogen trifluoride（NF_3）	0.4	1.5
Greenhouse gas removals	-47.7	–
Joint Crediting Mechanism (JCM)	Japan aims to contribute to international emission reductions and removals at the level of a cumulative total of approximately 100 Mt CO_2 by FY 2030 through public-private collaborations. Japan will appropriately count the acquired credits to achieve its NDC.	

*1: The values are set based on the greenhouse gas inventory submitted to the UNFCCC in April 2024.

*2: Figures of target (or estimates in the case of energy-related CO_2).

*3: Excluding statistical discrepancy from power and heat allocation. For that reason, the total sum of the actual results by each sector is not equal to the emissions of energy-related CO_2.

*4: Figures for the four kinds of greenhouse gases of HFCs, PFCs, SF_6, and NF_3 are calendar year values.

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[32] Japan's Nationally Determined Contribution (NDC)
<https://unfccc.int/sites/default/files/NDC/2022-06/JAPAN_FIRST%20NDC%20%28UPDATED%20SUBMISSION%29.pdf>

Table II-3 CTF Appendix Description of a Party's nationally determined contribution under Article 4 of the Paris Agreement, including updates

Target(s) and description, including target type(s)	Economy-wide absolute greenhouse gas emission reduction target (A reduction of 46% in economy-wide national total greenhouse gas emissions by FY 2030 compared to FY 2013 level)
Target year(s) or period(s), and whether they are single-year or multi-year target(s)	Target year: FY 2030 Single-year target
Reference point(s), level(s), baseline(s), base year(s) or starting point(s), and their respective value(s)	Base year: FY 2013 National total GHG emissions in the base year: 1,407 Mt CO_2 eq.（based on greenhouse gas inventory submitted to the UNFCCC in April 2024）
Time frame(s) and/or periods for implementation	From April 1, 2021, to March 31, 2031
Scope and coverage, including, as relevant, sectors, categories, activities, sources and sinks, pools and gases	Sectors: All sectors and categories encompassing the following: (a) Energy - Fuel Combustion (Energy industries, Manufacturing industries and Construction, Transport, Commercial/Institutional, Residential, Agriculture/Forestry/Fishing, and Others) - Fugitive emissions from fuels - CO_2 transport and storage (b) Industrial processes and product use (c) Agriculture (d) Land Use, Land-Use Change and Forestry (LULUCF) Activities related to contributions from the LULUCF sector: afforestation and reforestation (AR), deforestation (D), forest management (FM), cropland management (CM), grazing land management (GM), and urban greening (UG) Carbon Pools for the LULUCF sector: Above ground biomass, below ground biomass, dead wood, litter, soils, and harvested wood products (HWP) (e) Waste Gases: CO_2, CH_4, N_2O, HFCs, PFCs, SF_6, NF_3
Intention to use cooperative approaches that involve the use of ITMOs under Article 6 towards NDCs under Article 4 of the Paris Agreement	Japan will establish and implement the Joint Crediting Mechanism (JCM) in order to quantitatively evaluate contributions of Japan to greenhouse gas emission reductions and removals which are achieved through the diffusion of, among others, leading decarbonizing technologies, products, systems, services, and infrastructures as well as through the implementation of measures in developing countries and others, and in order to use such contributions to achieve Japan's NDC. By doing so, through public-private collaborations, Japan aims to secure accumulated emission reductions and removals at the level of

	approximately 100 million t CO_2 by FY 2030. Japan will appropriately count the acquired credits to achieve its NDC. With regards to the JCM that Japan has initiated to establish, Japan secures environmental integrity and the avoidance of double counting in line with the international rules, including the Paris Agreement. Also, based on its experience in the JCM, Japan intends to lead international discussions, thereby contributing to the development of appropriate international rules for the use of market mechanisms. Furthermore, Japan will also make proactive efforts in the area of international cooperation to promote decarbonization and to improve resilience in developing countries and others, including from developing policies and institutional platforms to promoting sector- and city-level efforts as well as facilitating technology diffusion.
Any updates or clarifications of previously reported information	Not applicable

2 Long-term goal for 2050

On October 26, 2020, then Prime Minister Suga Yoshihide declared in his policy speech at the Diet that "Japan will aim to reduce greenhouse gas emissions to net zero by 2050, that is, to realize a carbon-neutral, decarbonized society." Subsequently, on October 22, 2021, the Cabinet decided on the *Long-Term Strategy as a Growth Strategy Based on the Paris Agreement*, which outlines the basic approach toward net zero by 2050 and submitted it to the UNFCCC secretariat as a long-term low greenhouse gas emission development strategy under Article 4.19 of the Paris Agreement.[33]

This 2050 carbon neutrality was newly positioned as a basic principle of the Act on Promotion of the Global Warming Countermeasures, which was amended in May 2021.

[33] https://unfccc.int/sites/default/files/resource/Japan_LTS2021.pdf

C. Information necessary to track progress made in implementing and achieving nationally determined contributions under Article 4 of the Paris Agreement

(paras. 65-79 of the MPGs)

1 Description of selected indicators

(paras. 65, 66, 67, 73, 76(a) of the MPGs)

Japan will select total greenhouse gas emissions as an indicator to track progress in implementing and achieving the NDC with a target year of FY 2030 submitted to the secretariat of the UNFCCC under the Paris Agreement.

Details of the selected indicator are shown in the tables below.

Table II-4 CTF Table 1 Structured Summary: Description of selected indicators

Indicator(s) selected to track progress	Description
Total greenhouse gas emissions	The economy-wide national total GHG emissions, including indirect CO_2 and excluding LULUCF
Information for the reference point(s), level(s), baseline(s), base year(s) or starting point(s)	Base year: FY 2013 (April 1, 2013 - March 31, 2014) Reference point (base year emissions): 1,407 Mt CO_2 eq. (*Note: This base year emissions are the total national greenhouse gas emissions, including indirect CO_2 and excluding LULUCF, in the 2024 national greenhouse gas inventory submission)
Updates in accordance with any recalculation of the GHG inventory	Base year emissions will be recalculated in future national GHG inventories.
Relation to NDC	Japan's NDC is an economy-wide absolute emission reduction target. Therefore, the total GHG emissions are the most appropriate indicator for this type of NDC.

Table II-5 CTF Table 2 Structured Summary: Definitions needed to understand NDC

Definitions	
Definition needed to understand each indicator:	
Total GHG emissions	The total GHG emissions selected as an indicator are the economy-wide national total GHG emissions, including indirect CO_2 and excluding LULUCF. The national total GHG emissions correspond to total GHG emissions in units of CO_2-equivalent as reported in the most recent national GHG inventory. In tracking and evaluating the progress of implementing and achieving the NDC, the total GHG emissions, the contribution from the LULUCF sector based on an activity-based approach, and the internationally transferred mitigation outcomes (ITMOs) consistent with Article 6 of the Paris Agreement will be considered.
Any sector or category defined differently than in the national inventory report:	

Sector	Not applicable
Category	LULUCF While the GHG emissions and removals of the LULUCF sector reported in the National Inventory Report are land-based values, the contributions from the LULUCF used to track progress in implementing and achieving the NDC are activity-based values covering the following activities. Activities covered: afforestation and reforestation (AR), deforestation (D), forest management (FM), cropland management (CM), grazing land management (GM), and urban greening (UG)
Definition needed to understand mitigation co-benefits of adaptation actions and/or economic diversification plans:	Not applicable
Any other relevant definitions	Not applicable

2 Methodologies and accounting approaches for tracking progress toward implementing and achieving the NDC

(paras. 71, 74, 75, 76, 77(d) of the MPGs)

Details of the methodologies and accounting approaches to be used to track progress in implementing and achieving the NDC are provided in the table below.

2.1 Overview of methodologies and accounting approaches

Table II-6 CTF Table 3 Structured Summary: Structured summary: Methodologies and accounting approaches – consistency with Article 4, paragraphs 13 and 14, of the Paris Agreement and with decision 4/CMA.1

Reporting requirement	Description
Accounting approaches	
Information on the accounting approach used is consistent with paragraphs 13–17 and annex II of decision 4/CMA.1 (para. 72 of the MPGs)	✓ Japan voluntarily applies the guidance for accounting for NDCs (4/CMA.1, annex II) in accordance with paragraph 14 of Decision 4/CMA.1 on the methodologies and accounting approaches for its first NDC and reports the relevant information.
Explain how the accounting for anthropogenic emissions and removals is in accordance with methodologies and common metrics assessed by the IPCC and in accordance with decision 18/CMA.1 (para. 1(a) of annex II to decision 4/CMA.1)	✓ The selected indicator, national total GHG emissions, is calculated based on the *2006 IPCC Guidelines*, the *2013 Supplement to the 2006 IPCC Guidelines: Wetlands* and the *2019 Refinements to the 2006 IPCC Guidelines*. ✓ The global warming potentials (GWPs) presented in the *IPCC Fifth Assessment Report* (AR5) are used to calculate the national total GHG emissions in CO_2 equivalent in accordance with the relevant provisions of the MPGs (18/CMA.1, Annex).

Reporting requirement	Description
	✓ Estimation of GHG emissions and removals from the LULUCF sector is calculated based on the same IPCC guidelines mentioned above. Accounting of the contribution from the LULUCF is calculated based on the activity-based approach described in the *2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol*. ✓ These methods of estimation are subject to change depending on the progress of future international negotiations on estimating and accounting rules.
Explain how consistency has been maintained between any GHG data and estimation methodologies used for accounting and the Party's GHG inventory, pursuant to Article 13, paragraph 7(a), of the Paris Agreement, if applicable (para. 2(b) of annex II to decision 4/CMA.1)	✓ The national total GHG emissions used to account for NDC are the values reported in the National Inventory Report. Thus, the two are fully consistent.
Explain how overestimation or underestimation has been avoided for any projected emissions and removals used for accounting (para. 2(c) of annex II to decision 4/CMA.1)	✓ The national total GHG emissions and contributions from the LULUCF used to account for the NDC are estimated based on the latest scientific knowledge in consideration of the principle of accuracy as stated in the IPCC Guidelines, to avoid estimates being overestimated or underestimated to the extent possible.
For each NDC under Article 4:	
Accounting for anthropogenic emissions and removals in accordance with methodologies and common metrics assessed by the IPCC and adopted by the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement:	
Each methodology and/or accounting approach used to assess the implementation and achievement of the target(s), as applicable (para. 74(a) of the MPGs)	✓ The implementation and achievement of the target in Japan's NDC will be done by comparing the base year emissions (FY 2013) of total economy-wide GHG emissions including indirect CO_2 and excluding LULUCF selected as an indicator, with the net national total GHG emissions in FY 2030, considering the contribution from the LULUCF sector based on an activity-based approach, and the internationally transferred mitigation benefits (ITMOs) under Article 6 of the Paris Agreement.
Each methodology and/or accounting approach used for the construction of any baseline, to the extent possible (para. 74(b) of the MPGs)	✓ Since the GHG emission reduction target in Japan's NDC is set as a reduction rate compared to the base year level, there is no baseline.
If the methodology or accounting approach used for the indicator(s) in Table 1 differ from those used to assess the implementation and achievement the target, describe each methodology or accounting approach used to generate the information generated for each indicator in Table 4 (para. 74(c) of the MPGs)	✓ Methodologies and accounting approaches used to develop the information on each indicator in CTF Table 4 are identical to those used for each indicator in CTF Table 1.
Any conditions and assumptions relevant to the achievement of the NDC under Article 4, as applicable and available (para. 75(i) of the MPGs)	✓ No conditions and assumptions have been set regarding the achievement of Japan's NDC under Article 4 of the Paris Agreement.

Reporting requirement	Description
Key parameters, assumptions, definitions, data sources and models used, as applicable and available (para. 75(a) of the MPGs)	✓ Information on methodologies, data sources, etc. on national total GHG emissions and contributions from the LULUCF sector used to track and evaluate the implementation and achievement of the NDC is explained in detail in the National Inventory Report.
IPCC Guidelines used, as applicable and available (para. 75(b) of the MPGs)	✓ 2006 IPCC Guidelines for National Greenhouse Gas Inventories ✓ 2019 Refinements to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories ✓ 2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands ✓ 2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol These methods of estimation are subject to change depending on the progress of future international negotiations on estimating and accounting rules.
Report the metrics used, as applicable and available (para. 75(c) of the MPGs)	✓ GWPs of a 100-year time horizon presented in *IPCC Fifth Assessment Report* (AR5)
For Parties whose NDC cannot be accounted for using methodologies covered by IPCC guidelines, provide information on their own methodology used, including for NDCs, pursuant to Article 4, paragraph 6, of the Paris Agreement, if applicable (para. 1(b) of annex II to decision 4/CMA.1)	✓ Not applicable
Provide information on methodologies used to track progress arising from the implementation of policies and measures, as appropriate (para. 1(d) of annex II to decision 4/CMA.1)	✓ Not applicable
Where applicable to its NDC, any sector-, category or activity-specific assumptions, methodologies and approaches consistent with IPCC guidance, taking into account any relevant decision under the Convention, as applicable (para. 75(d) of the MPGs)	✓ Estimation of GHG emissions and removals from the LULUCF sector is calculated based on the same IPCC guidelines mentioned above. Accounting of the contribution from the LULUCF is calculated based on the activity-based approach described in the *2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol*.
For Parties that address emissions and subsequent removals from natural disturbances on managed lands, provide detailed information on the approach used and how it is consistent with relevant IPCC guidance, as appropriate, or indicate the relevant section of the national GHG inventory report containing that information (para. 1(e) of annex II to decision 4/CMA.1, para. 75(d)(i) of the MPGs)	✓ Methodologies to exclude emissions and subsequent removals from natural disturbances on managed land are not applied
For Parties that account for emissions and removals from harvested wood products, provide detailed information	✓ Emissions and removals from annual carbon stock changes of harvested wood products are estimated based on the production approach.

Reporting requirement	Description
on which IPCC approach has been used to estimate emissions and removals (para. 1(f) of annex II to decision 4/CMA.1, para. 75(d)(ii) of the MPGs)	
For Parties that address the effects of age-class structure in forests, provide detailed information on the approach used and how this is consistent with relevant IPCC guidance, as appropriate (para. 1(g) of annex II to decision 4/CMA.1, para. 75(d)(iii) of the MPGs)	✓ Removals by forests are estimated with consideration given to the difference in amounts of carbon accumulation due to age-class structure.
How the Party has drawn on existing methods and guidance established under the Convention and its related legal instruments, as appropriate, if applicable (para. 1(c) of annex II to decision 4/CMA.1)	✓ The metrics used for the total GHG emissions and removals (CO_2 equivalent) are the GWPs of a 100-year time horizon presented in the *IPCC Fifth Assessment Report*. These methods of estimation are subject to change depending on the progress of future international negotiations on estimating and accounting rules. ✓ The existing methods and guidance in the *2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol* are applied for the contribution of the LULUCF mutatis mutandis.
Any methodologies used to account for mitigation co-benefits of adaptation actions and/or economic diversification plans (para. 75(e) of the MPGs)	✓ Not applicable
Describe how double counting of net GHG emission reductions has been avoided, including in accordance with guidance developed related to Article 6 if relevant (para. 76(d) of the MPGs)	✓ Refer to "Provide information on how each cooperative approach applies robust accounting to ensure, inter alia, the avoidance of double counting, consistent with decisions adopted by the CMA on Article 6"
Any other methodologies related to the NDC under Article 4 (para. 75(h) of the MPGs)	✓ Not applicable
Ensuring methodological consistency, including on baselines, between the communication and implementation of NDCs (para. 12(b) of the decision 4/CMA.1):	
Explain how consistency has been maintained in scope and coverage, definitions, data sources, metrics, assumptions and methodological approaches including on baselines, between the communication and implementation of NDCs (para. 2(a) of annex II to decision 4/CMA.1)	✓ At the time of communication of the 1st NDC, the 100-year GWPs in the *IPCC Fourth Assessment Report* (AR4 GWP) were to be used for metrics, but the 100-year GWPs in the *IPCC Fifth Assessment Report* (AR5 GWP) will be used for tracking and evaluating progress toward implementing and achieving the NDC, in accordance with MPGs. ✓ There is no methodological inconsistency with respect to matters other than metrics between the communication and implementation of the NDC.
Explain how consistency has been maintained between any GHG data and estimation methodologies used for accounting and the Party's GHG inventory, pursuant to Article 13, paragraph 7(a), of the Paris Agreement, if applicable (para. 2(b) of annex II to decision 4/CMA.1) and explain	✓ The methodologies used to estimate GHG emissions and removals for accounting NDC and the methodologies used in the GHG inventory are identical and consistent. ✓ There are no methodological inconsistencies between the most recent national inventory report and the NDC accounting.

Reporting requirement	Description
methodological inconsistencies with the Party's most recent national inventory report, if applicable (para. 76(c) of the MPGs)	
Explain how consistency has been maintained between any GHG data and estimation methodologies used for accounting and the Party's GHG inventory, pursuant to Article 13, paragraph 7(a), of the Paris Agreement, if applicable (para. 2(b) of annex II to decision 4/CMA.1) and explain methodological inconsistencies with the Party's most recent national inventory report, if applicable (para. 76(c) of the MPGs)	
Technical changes related to technical corrections to the Party's inventory (para. 2(d)(i) of annex II to decision 4/CMA.1)	✓ In the GHG inventory, if the methodology or data used for GHG emissions in a category is revised, GHG emissions for all years are recalculated in a manner that ensures time-series consistency, including base year emissions.
Technical changes related to improvements in accuracy that maintain methodological consistency (para. 2(d)(ii) of annex II to decision 4/CMA.1)	✓ Same as above
Explain how any methodological changes and technical updates made during the implementation of their NDC were transparently reported (para. 2(e) of annex II to decision 4/CMA.1)	✓ The presence or absence of recalculation of GHG emissions for all years, including base year emissions, the amount of change, and the reasons for such recalculation are reported transparently in the national inventory report.
Striving to include all categories of anthropogenic emissions or removals in the NDC and, once a source, sink or activity is included, continuing to include it (para. 3 of annex II to decision 4/CMA.1):	
Explain how all categories of anthropogenic emissions and removals corresponding to their NDC were accounted for (para. 3(a) of annex II to decision 4/CMA.1)	✓ The 2030 GHG emission reduction target in Japan's NDC covers GHG emissions from all IPCC categories. The methodologies for GHG emissions from all categories and the contribution from the LULUCF are reported in detail in the National Inventory Report.
Explain how Party is striving to include all categories of anthropogenic emissions and removals in its NDC, and, once a source, sink or activity is included, continue to include it (para. 3(b) of annex II to decision 4/CMA.1)	✓ Japan's 2030 GHG emission reduction target in its NDC covers GHG emissions from all IPCC categories. In addition, once a category has reported emissions in its GHG inventory, it has continued to report emissions in subsequent inventories and has not discontinued reporting of categories for which it had previously reported GHG emissions from a category in subsequent GHG inventories.
Provide an explanation of why any categories of anthropogenic emissions or removals are excluded (para. 4 of annex II to decision 4/CMA.1)	✓ There are no categories of emissions or removals excluded in the GHG inventory. ✓ For the LULUCF sector, emissions and removals not covered in the activities mentioned above are excluded from the NDC accounting due to application of activity-based approach for the contribution of the LULUCF.
Each Party that participates in cooperative approaches that involve the use of ITMOs towards an NDC under Article 4, or authorizes the use of mitigation outcomes for international mitigation purposes other than achievement of its NDC	
Provide information on any methodologies associated with any cooperative approaches that involve the use of ITMOs towards an NDC under Article 4 (para. 75(f) of the MPGs)	✓ Japan establishes and implements the Joint Crediting Mechanism (JCM) in order to quantitatively evaluate contributions of Japan to greenhouse gas emission reductions and removals which are achieved through the diffusion of, among others, leading decarbonizing technologies, products, systems, services, and infrastructures as well as through the

Reporting requirement	Description
	implementation of measures in developing countries and others, and in order to use such contributions to achieve Japan's NDC. ✓ There are 29 JCM partner countries as of 13 September 2024, and stage of progress of the JCM in each country is diverse. All the information related to the JCM are uploaded at the JCM web site (https://www.jcm.go.jp/), ✓ There are 126 approved methodologies for calculating emission reductions to be credited in all JCM partner countries in total as of 13 September 2024, and those methodologies are uploaded in the JCM web site (https://www.jcm.go.jp/methodologies/all).
Provide information on how each cooperative approach promotes sustainable development, consistent with decisions adopted by the CMA on Article 6 (para. 77(d)(iv) of the MPGs)	✓ With several JCM partner countries, the *Guidelines for Developing Sustainable Development Contribution Plan and Report* are adapted (in the case of Mongolia, see the document uploaded at https://www.jcm.go.jp/opt/mn-jp/rules_and_guidelines/download/JCM_MN_GL_SDCP_CR_ver01.0.pdf). ✓ Project participants are required to conduct not only an ex-ante analysis of the contribution to sustainable development but also an ex-post evaluation of the contribution to sustainable development, using forms specific to each JCM partner country. Those plans and reports are submitted at the time of request for registration of JCM projects and request for issuance of JCM credits and evaluated by the Joint Committee or each government for relevant decisions. ✓ There are several JCM partner countries with which the *Guidelines for Developing Sustainable Development Implementation Plan and Report* have not been adapted but the government of Japan intends to adapt those guidelines with all JCM partner countries.
Provide information on how each cooperative approach ensures environmental integrity consistent with decisions adopted by the CMA on Article 6 (para. 77(d)(iv) of the MPGs)	✓ With several JCM partner countries, the *Guidelines for Developing Proposed Methodology* are adapted, which explains how emission reductions should be calculated, as follows, In the JCM, emission reductions to be credited are defined as the difference between reference emissions and project emissions. The reference emissions are calculated to be below business-as-usual (BaU) emissions which represent plausible emissions in providing the same outputs or service level of a proposed JCM project in the partner country. The reference emissions are established in a manner that the proposed project contributes to the achievement of the latest nationally determined contributions of the partner country under the Paris Agreement. ✓ As per the paragraph above, the proposed project will contribute to achieve the latest nationally determined contributions of the JCM partner country, even after that country applies corresponding adjustments for the amount of JCM credits which are internationally transferred. Thus, there will be no net increase in global emissions within NDC implementation periods, ✓ There are several JCM partner countries with which *Guidelines for Developing Proposed Methodology* does not include the third paragraph above, but the government of Japan intends to include the third paragraph in the Guidelines with all JCM partner countries.

Reporting requirement	Description
	✓ With several JCM partner countries which intend to implement a JCM project for REDD+, *Guidelines for Developing Proposed Methodology for REDD+* is adapted, which includes how to deal with the risk of reversals by using a discount factor (in the case of Cambodia, see paragraph 40-43 in the document uploaded at https://www.jcm.go.jp/opt/kh-jp/rules_and_guidelines/download/reddplus/file_22/JCM_KH_GL_PM_REDD+_ver01.0.pdf).
Provide information on how each cooperative approach ensures transparency, including in governance, consistent with decisions adopted by the CMA on Article 6 (para. 77(d)(iv) of the MPGs)	✓ Japan and each JCM partner country establish the Joint Committee consisting of representatives from each government respectively to implement the JCM. ✓ In most of the JCM partner countries, the Joint Committee develops rules and guidelines necessary for the implementation of the JCM, relating to project cycle procedures, methodologies, project design documents, monitoring, designation of third-party entities, validation and verification and other related matters of the JCM. ✓ All rules, guidelines and decisions made by each Joint Committee, including approval of methodologies, registration of projects, notification to issue JCM credits and issuance of JCM credits by each government, and members of each Joint Committee, are made publicly available on the JCM website (https://www.jcm.go.jp/). In addition, all calls for public input on proposed methodologies and proposed projects are informed on the same website.
Provide information on how each cooperative approach applies robust accounting to ensure, inter alia, the avoidance of double counting, consistent with decisions adopted by the CMA on Article 6 (para. 77(d)(iv) of the MPGs)	✓ With several JCM partner countries, the Rules of Implementation are adapted, which contains the avoidance of double counting, as follows, JCM credits issued from emission reductions and removals may be used towards the achievement of Japan's nationally determined contribution, and the rest of the said JCM credits may contribute to the achievement of the JCM partner country's nationally determined contribution, while ensuring that double counting is avoided on the basis of corresponding adjustments. Each government authorizes the JCM credits issued in the JCM registry of Japan for the use toward the achievement of Japan's nationally determined contribution as internationally transferred mitigation outcomes consistent with the guidance on cooperative approaches, referred to in Article 6, paragraph 2 of the Paris Agreement (hereinafter referred to as "the guidance"). ✓ The JCM partner country applies a corresponding adjustment to the JCM credits issued in the JCM registry of the Japan as well as the JCM credits issued in the JCM registry of the JCM partner country and authorized for the use toward other international mitigation purposes, consistent with the guidance. ✓ Japan will apply corresponding adjustments (CA) to its target using the averaging method in consistent with paragraph. 7(a)(ii) of the annex to decision 2/CMA.3. The detailed method is described in the Procedures for Corresponding Adjustments regarding the JCM adopted by the JCM Promotion and Utilization Council in Japan (https://www.env.go.jp/content/000060562.pdf). ✓ In order to avoid double registration of projects, the validation by a third-party entities (TPE) at the time of JCM project registration should verify

Reporting requirement	Description
	that the proposed project is not registered under other international climate mitigation mechanisms.
Any other information consistent with decisions adopted by the CMA on reporting under Article 6 (para. 77(d)(iii) of the MPGs)	✓ The government of Japan maintains and operates the JCM Registry of Japan for the management and tracking of JCM credits consistent with Article 6 of the Paris Agreement, based on Act Partially Amending the Act on Promotion of Global Warming Countermeasures (Act No. 56 of 2024). ✓ Japan uses the JCM Registry for Japan for tracking JCM credits as ITMOs, which is provided for in the Act. ✓ The registry operated consistent with relevant decisions of the CMA in relation to cooperative approaches referred to in Article 6, paragraph 2, of the Paris Agreement. ✓ In the Japanese JCM registry, unique identifiers are assigned to JCM credits acquired to record authorization, first transfer, transfer, acquisition, use towards NDCs, authorization for use towards other international mitigation purposes, and voluntary cancellation.

2.2 Supplementary information on methodologies and accounting approaches

(1) Methodological details of the LULUCF sector accounting in the NDC

The following is a summary of the methodological approaches for the contributions from the LULUCF sector in the NDC. For details, refer to Annex 9 of the *National Inventory Report*.

(a) Activities subject to GHG emissions and removals estimation and their scope in the LULUCF sector in the NDC

This section, based on Decision 4/CMA.1, describes the activities subject to the estimation of GHG emissions by sources and removals by sinks and their scope in the LULUCF sector in Japan's NDC.

GHG emissions and removals in the LULUCF sector in Japan's NDC are calculated based on removals by measures for forest and other carbon sinks by adopting activity-based accounting. The scope is basically the same as the LULUCF activities under the second commitment period of the Kyoto Protocol: afforestation and reforestation (AR), deforestation (D), forest management (FM), cropland management (CM) and grazing management (GM), as well as urban greening (UG) in which scope has been expanded from revegetation (RV). These activities are collectively referred to as NDC-LULUCF activities. Table II-7 shows the status of estimations of carbon pools and gases reported for each activity.

Table II-7 Reporting status of each carbon pool and gas for NDC-LULUCF activities

NDC-LULUCF Activity	Change in carbon pool reported						Greenhouse gas sources reported						
	Living biomass	Litter	Dead wood	Soil		HWP	Fertili-zation	Drainage of organic soils		N mineralization in mineral soils	Biomass burning		
				Mineral	Organic		N_2O	CH_4	N_2O	N_2O	CO_2	CH_4	N_2O
Afforestation and reforestation	R	R	R	R	NO	IE	IE	NO	NO	NA	IE	IE	IE
Deforestation	R	R	R	R	NO	IO	NO	NO	NO	R	NO	NO	NO
Forest management	R	R	R	R	NO	R	R	NO	NO	R	IE	R	R
Cropland management	R	NA	NA	R	R			R		R	R	R	R
Grazing land management	R	NA	NA	R	R			R		R	NO	NO	NO
Urban greening	R	R	IE	R	NO		IE	NO	NO	NA	NO	NO	NO

R: Reported, NA: Not Applicable, NO: Not Occurring, IE: Included Elsewhere, IO: Instantaneous Oxidation

(b) Accounting approach for each NDC-LULUCF activity

The accounting approach used for each NDC-LULUCF activity is established consistent with Article 4.14 of the Paris Agreement by taking into account the existing methodology and guidance based on the 2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol (hereinafter referred to as KP Supplement), which was applied to each LULUCF activity in the second commitment period of the Kyoto Protocol. The gross-net approach was applied to afforestation and reforestation (AR) and deforestation (D) activities, which covered only lands with activities since 1990, as in the second commitment period of the Kyoto Protocol. The reference level approach was applied for forest management (FM). The reference level was set as zero for the forest carbon pools under FM, as in the second commitment period of the Kyoto Protocol by only accounting for lands where additional anthropogenic activities (e.g., thinning) have been reliably conducted since 1990, while future projections were applied to the reference level for the Harvested Wood Products (HWP) pool. Then, the sum of the reference levels for the forest carbon pools and HWP pool was used as the reference level for the entire FM. For CM and GM activities, as in the second commitment period of the Kyoto Protocol, the net-net approach was applied, using 1990 as the base year. In UG activities, the area of urban green space that have been established, serviced, or conserved is subject to calculation. In such net sink activities, it is important to maintain and enhance removals as an absolute amount in each year, so the net removals for the relevant fiscal year from the UG activity were directly accounted for as the amount of removals. This is equivalent to the gross-net accounting approach.

(c) Scope of estimations for each NDC-LULUCF activity

1) Afforestation/Reforestation (AR)

For AR activity, annual GHG emissions and removals associated with growth and forest management practices were estimated for land that was not forested at the end of 1989 but was converted to forest through afforestation or other human activities after 1990. This activity is similar to "land converted to forest land (4.A.2.)" in the inventory, but the starting point for counting the area covered is different (1990 for AR activity). The loss of carbon stocks of living biomass from lands prior to conversion to forest land is to be accounted for under the activities before the conversions. The carbon stock changes in HWP from AR activity are difficult to distinguish from HWP from FM activity, therefore, the entire amount is collectively estimated under FM activity.

2) Deforestation (D)

For D activity, annual GHG emissions from deforestation and site preparation were estimated for the

land that was anthropogenically converted from forest to non-forest land use after 1990. The increase in carbon stocks due to growth on the converted land is to be accounted for under the post-conversion activities.

3) Forest Management (FM)

For FM activity, GHG emissions and removals from the following activities (excluding AR activities) of forests with standing trees in "forest land remaining forest land (4.A.1.)" in the inventory were estimated.

- Ikusei-rin forests: Forestry practices conducted since 1990 to maintain forests in appropriate conditions, including regeneration (land preparation, soil scarification, planting, etc.), tending (weeding, pre-commercial cutting, etc.), thinning and harvesting.
- Tennensei-rin forests: Protection or conservation of forests, including regulating logging activities and restrictions on land-use changes, which have been carried out by law Carbon stock changes in HWP from the above-mentioned forests are also included in the estimation of this activity.

The amount of carbon stock change in HWP from FM activity is also included in this activity.

4) Cropland Management (CM)

For CM activity, GHG emissions and removals resulting from the practices of cultivating and other activities in rice fields, upland fields, and orchards in cropland (4.B.) in the inventory were estimated. Dilapidated farmland which is included in the inventory is not included in CM because the land is not being properly managed.

5) Grazing land Management (GM)

For GM activity, GHG emissions and removals resulting from grazing in pasture land under grassland (4.C.) in the inventory were estimated.

"Grazed Meadow land," which has no change in management practices and "wild land" which is not land dedicated for grazing, are not included in GM, although they are reported under grassland in the inventory.

6) Urban Greening (UG)

For UG activity, GHG emissions and removals from urban green areas under settlements (4.E.) of the inventory were included. The scope of activities includes urban green areas with an area of less than 0.05 ha as well as those that were established or serviced before 1990, which were not subject to reporting and estimation under the Revegetation (RV) activity of the Kyoto Protocol, and green spaces conserved by zoning.

(2) Methodological details of ITMOs under Article 6 of the Paris Agreement

Refer to Annex III (Initial report referred to in decision 2/CMA.3, annex, chapter IV.A).

3 Information to track progress made in implementing and achieving its NDC under Article 4

(para. 77 of the MPGs)

Information on Japan's progress toward achieving its 2030 emission reduction target in Japan's NDC is as follows.

Total greenhouse gas emissions (excluding LULUCF) in FY 2022 were approximately 1,135 Mt CO_2 equivalent, a 19.3% reduction from the base year of FY 2013. In consideration of the contribution from LULUCF activities (approximately 50.2 Mt CO_2), the total greenhouse gas emissions in FY 2022 were approximately 1,085 Mt CO_2e, which is a 22.9% decrease from the base year. The net total GHG emissions in FY 2022 are the lowest since FY1990, and Japan is making steady progress toward its 2030 emission reduction target and 2050 net-zero goal.

In assessing the achievement of the 2030 emission reduction target, Japan will use JCM credits issued through the Joint Crediting Mechanism (JCM) consistent with Article 6 of the Paris Agreement, but there are no JCM credits used during FY 2021 and FY 2022.

Figure II-46 Progress towards 2030 emission reduction target and 2050 net zero goal

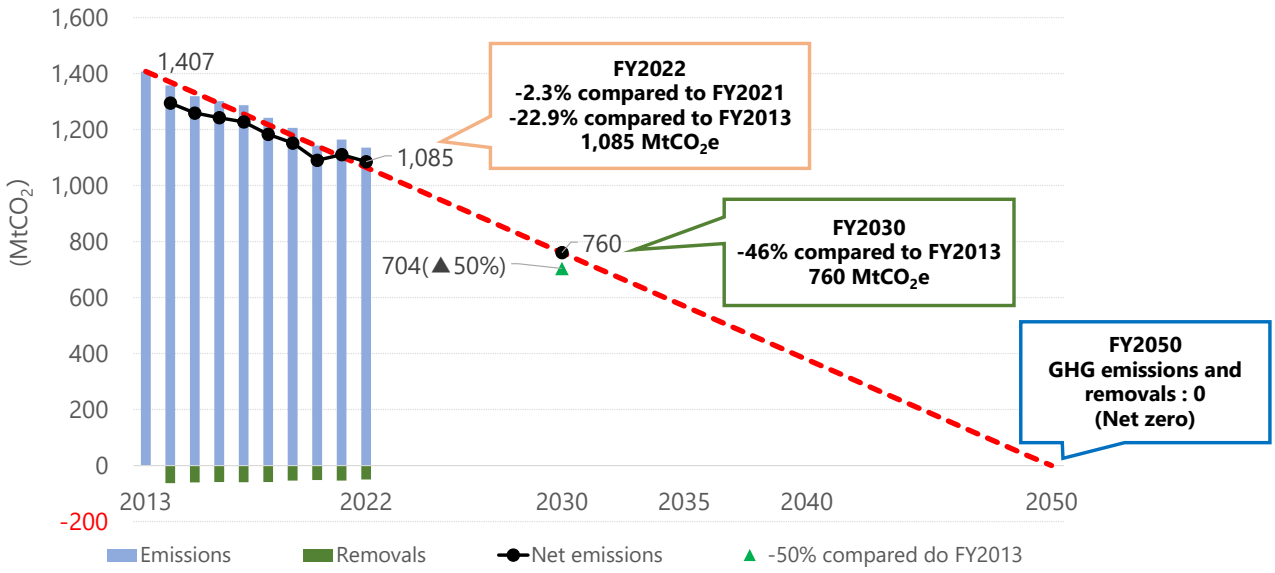

Table II-8 CTF Table II Structured summary: Tracking progress made in implementing and achieving the NDC under Article 4 of the Paris Agreement

	Unit, as applicable	*Reference point(s), level(s), baseline(s), base year(s) or starting point(s) (paras 67 and 77(a)(i) of the MPGs)*	*Implementation period of the NDC covering information for previous reporting years and the most recent year, including the end year or end of period (paras 68 and 77(a)(ii–iii) of the MPGs)*		*Target level*[b]	*Target year or period*	*Progress made towards the NDC, as determined by comparing the most recent information for each selected indicator, including for the end year or end of period, with the reference point(s), level(s), baseline(s), base year(s) or starting point(s) (paras. 69–70 of the MPGs)*
			2021	2022			
Indicator(s) selected to track progress towards the implementation and/or achievement of the NDC under Article 4 of the Paris Agreement: (paras 65 and 77(a) of the MPGs)							
GHG emissions	kt CO_2e	1,407,337.90	1,164,039.66	1,135,458.33	760,000.00	FY 2030	*-22.9%*
Where applicable, total GHG emissions and removals consistent with the coverage of the NDC (para. *77(b) of the MPGs)*	kt CO_2e		1,164,039.66	1,135,458.33			
Contribution from the LULUCF sector for each year of the target period or target year, if not included in the inventory time series of total net GHG emissions and removals, as applicable (para.*77(c) of the MPGs)*	kt CO_2e		-53,627.10	-50,180.97			
Each Party that participates in cooperative approaches that involve the use of ITMOs towards an NDC under Article 4 of the Paris Agreement, or authorizes the use of mitigation outcomes for international mitigation purposes other than achievement of the NDC, shall provide: (*para. 77(d) of the MPGs)*							
If applicable, an indicative multi-year emissions trajectory, trajectories or budget for its NDC implementation period (para. 7(a)(i), annex to decision 2/CMA.3)	NA	NA	NA	NA			
If applicable, multi-year emissions trajectory, trajectories or budget for its NDC implementation period that is consistent with the NDC (para. 7(b), annex to decision 2/CMA.3)	NA	NA	NA	NA			
Annual anthropogenic emissions by sources and removals by sinks covered by its NDC or, where applicable, from the emission or sink categories as identified by the host Party pursuant to paragraph 10 of annex to decision 2/CMA.3 (para. 23(a), annex to decision 2/CMA.3) (as part of para. 77 (d)(i) of the MPGs)	kt CO_2e	NA	1,110,412.56	1,085,277.35			
Annual anthropogenic emissions by sources and removals by sinks covered by its NDC or, where applicable, from the portion of its NDC in accordance with paragraph 10, annex to decision 2/CMA.3 (para. 23(b), annex to decision 2/CMA.3)	NA	NA	NA	NA			

	Unit, as applicable	*Reference point(s), level(s), baseline(s), base year(s) or starting point(s) (paras 67 and 77(a)(i) of the MPGs)*	*Implementation period of the NDC covering information for previous reporting years and the most recent year, including the end year or end of period (paras 68 and 77(a)(ii–iii) of the MPGs)*		*Target level*[b]	*Target year or period*	*Progress made towards the NDC, as determined by comparing the most recent information for each selected indicator, including for the end year or end of period, with the reference point(s), level(s), baseline(s), base year(s) or starting point(s) (paras. 69–70 of the MPGs)*
			2021	2022			
If applicable, annual level of the relevant non-GHG indicator that is being used by the Party to track progress towards the implementation and achievement of its NDC and was selected pursuant to paragraph 65, annex to decision 18/CMA.1 (para. 23(i), annex, decision 2/CMA.3)	NA	NA	NA	NA			
Annual quantity of ITMOs first transferred (para. 23(c), annex to decision 2/CMA.3) (para. 77(d)(ii) of the MPGs)	kt CO_2e	FY 2021	0	0			
Annual quantity of mitigation outcomes authorized for use for other international mitigation purposes and entities authorized to use such mitigation outcomes, as appropriate (para 23(d), annex to decision 2/CMA.3) (para. 77(d)(ii) of the MPGs)	kt CO_2e	FY 2021	0	0			
Annual quantity of ITMOs used towards achievement of the NDC (para. 23(e), annex to decision 2/CMA.3) (para. 77(d)(ii) of the MPGs)	kt CO_2e	FY 2021	0	0			
Net annual quantity of ITMOs resulting from paras. 23(c)-(e), annex to decision 2/CMA.3 (para. 23(f), annex to decision 2/CMA.3)	kt CO_2e	FY 2021	0	0			
If applicable, the cumulative amount of ITMOs, divided by the number of elapsed years in the NDC implementation period (para. 7(a)(ii), annex to decision 2/CMA.3)	kt CO_2e	FY 2021	0	0			
Total quantitative corresponding adjustments used to calculate the emissions balance referred to in para. 23(k)(i), annex to decision 2/CMA.3, in accordance with the Party's method for applying corresponding adjustments consistent with section III.B (Application of corresponding adjustments) (para. 23(g), annex to decision 2/CMA.3)	kt CO_2e	FY 2021	0	0			
The cumulative information in respect of the annual information in para. 23(f), annex to decision 2/CMA.3, as applicable (para. 23(h), annex to decision 2/CMA.3)	kt CO_2e	FY 2021	0	0			
For metrics in tonnes of CO2 eq. or non-GHG, an annual emissions balance consistent with chapter III.B (Application of corresponding adjustment), annex, decision 2/CMA.3 (para. 23(k)(i), annex to decision 2/CMA.3) (as part of para. 77 (d)(ii) of the MPGs)	kt CO_2e	FY 2021	0	0			
For metrics in non-GHG, for each non-GHG metric determined by participating Parties, annual adjustments resulting in an annual adjusted indicator, consistent with para. 9 of chapter III.B (Corresponding adjustments), annex to decision 2/CMA.3, and future guidance to be adopted by the CMA (para. 23(k)(ii), annex to decision 2/CMA.3)	NA						
Any other information consistent with decisions adopted by the CMA on reporting under Article 6 (para. 77(d)(iii) of the MPGs)	NA						

	Unit, as applicable	*Reference point(s), level(s), baseline(s), base year(s) or starting point(s) (paras 67 and 77(a)(i) of the MPGs)*	*Implementation period of the NDC covering information for previous reporting years and the most recent year, including the end year or end of period (paras 68 and 77(a)(ii–iii) of the MPGs)*		*Target level*[b]	*Target year or period*	*Progress made towards the NDC, as determined by comparing the most recent information for each selected indicator, including for the end year or end of period, with the reference point(s), level(s), baseline(s), base year(s) or starting point(s) (paras. 69–70 of the MPGs)*
			2021	2022			
Assessment of the achievement of the Party's NDC under Article 4 of the Paris Agreement (para. 70 of the MPGs):							
Restate the target of the Party's NDC:	NA						
Information for reference point(s), level(s), baseline(s), base year(s), or starting point(s):	NA						
Final information for the indicator for the target year/period, including the application of the necessary corresponding adjustments consistent with chapter III, annex, decision 2/CMA.3 (Corresponding adjustments) and consistent with future decisions from the CMA (para. 23(l), annex to decision 2/CMA.3):	NA						
Comparison:	NA						
Achievement of NDC: {yes/no, explanation}	NA						

Notes: (1) Pursuant to para. 79 of the MPGs, each Party shall report the information referred to in paras. 65–78 of the MPGs in a narrative and common tabular format, as applicable. (2) A Party may amend the reporting format (e.g. Excel file) to remove specific rows in this table if the information to be provided in those rows is not applicable to the Party's NDC under Article 4 of the Paris Agreement, in accordance with the MPGs. (3) The Party could add rows for each additional selected indicator.

[a] This table could be used for each NDC target in case Party's NDC has multiple targets.

[b] Parties may provide information on conditional targets in a documentation box with references to the relevant page in their biennial transparency report.

D. Mitigation policies and measures, actions and plans, related to implementing and achieving a nationally determined contribution under Article 4 of the Paris Agreement

(paras. 80–90 of the MPGs)

1 Introduction

An overview of the specific policies and measures to achieve the emission reduction target for FY 2030 in Japan's NDC stipulated in the *Plan for Global Warming Countermeasures*. This section outlines specific policies and measures by sector.

The *Plan for Global Warming Countermeasures* stipulates a mechanism for an annual review of the progress of each policy and measure, as explained in Chapter II.2. The results of the progress evaluation of the policies and measures in the progress review are also reported[34]. The progress of emission reductions is evaluated on a five-point scale from A to E below, based on the estimates and outlooks of the measure evaluation indicators up to FY 2030 and based on the actual values up to FY 2022.

1. Steady Implementation, evaluation, and verification of Industry's Action Plans for a Low-Carbon Society (Number of industries: 114)

A : Performance in FY 2022 already exceeded the FY 2030 target level

B : Performance in FY 2022 exceeded the level of reference year/BAU (Business As Usual), but fell below the FY 2030 target level

C : Performance in FY 2022 fell below the FY 2030 target level and increased compared to the reference year/BAU

D : Data not compiled (newly established / change in target levels / revisions to calculation methodology / etc.)

E : Target not set

2. Policies and measures other than 1 (Number of policies and measures: 115)

A: Measure evaluation indicator is expected to exceed the target level in FY 2030 if efforts are continued, and performance in FY 2022 already exceeded the FY2030 target (Projected to exceed FY 2030 target level and already exceeded FY 2030 target level in FY2022)

B: Measure evaluation indicator is expected to exceed the target level in FY 2030 if efforts are continued, (excluding A) (Projected to exceed FY 2030 target level)

C: Measure evaluation indicator is expected to reach the same level as the target in FY 2030 if efforts are continued (Projected to meet FY 2030 target level)

D: Measure evaluation indicator is expected to fall below the target level in FY 2030 if efforts remain unchanged (Projected to fall below FY 2030 target level)

E: Quantitative data are not available, etc.

[34] The progress status of all policies and measures can be found in *Progress of the Plan for Global Warming Countermeasures in FY 2022* (June 20, 2024) (Global Warming Prevention Headquarters) https://www.env.go.jp/content/900447451.pdf

Evaluation results on the progress of policies and measures implemented in FY 2022 are shown in Table II-9.

In order to achieve the targets of the Plan, the policies and measures set forth in the Plan will be further promoted, considering annual GHG emissions and evaluation results.

In particular, for those industries (39 industries) rated as "A. Performance already exceeded the target level" in "1. A. Steady Implementation, evaluation, and verification of Industry's Action Plans for a Low-Carbon Society," the government will encourage constant review and promotion of further measures, including consideration of raising the target. B. For those industries (70 industries) rated as "B. Performance exceeded the level of reference year/BAU, but fell below the target level," "C. Performance fell below the target level and increased compared to the reference year/BAU" (2 industries), and "E. Target not set" (2 industries), the government will encourage them to enhance and strengthen their efforts and set the target level. Furthermore, for those industries that have not yet formulated a low-carbon society action plan, the government will focus on encouraging them to consider formulating their action plans.

For the policies and measures rated as "D. Measure evaluation indicator is expected to fall below the target level if efforts remain unchanged" (19 cases) in "Policies and measures other than 1," the government will proceed to consider enhancement and reinforcement them, and if necessary, consider new policies and measures as well. In addition, policies and measures other than "D." will also be considered for further emission reductions.

Table II-9 Results of progress evaluation of policies and measures implemented in FY 2022

Category	Evaluation	Number of industries/policies and measures
Steady Implementation, evaluation, and verification of Industry's Action Plans for a Low-Carbon Society	A	39
	B	70
	C	2
	D	1
	E	2
Policies and measures other than the above	A	8
	B	19
	C	62
	D	19
	E	7

A summary of each mitigation policy and measure and details of emission reductions (achieved and expected) based on CTF Table 5 are shown in Table II-11 (p.145). Note that for some policies and measures, expected emission reductions (estimated mitigation impacts) are not reported because quantitative data and necessary statistical information are not available.

2 Energy sector

2.1 Energy conversion

(1) Reduction of CO_2 emission intensity in power sectors

(Decarbonization of the electric power sector)

Under the energy policy principle of S+3E (Safety, Energy security, Economic efficiency, and Environment), to decarbonize the electric power sector, the use of renewable energy as the main source of power will be thoroughly promoted while working on renewable energies as the highest priority, aiming to realize their maximum utilization while reducing the burden on citizens and coexisting with local communities. Review of siting regulations, overcoming grid constraints, ensuring flexibility in the power system through the use of storage batteries and demand response, including EVs etc., and drastic reform of the electricity market system will be promoted.

Steady investment in the necessary power transmission and distribution networks and power sources as well as the improvement of cost efficiency and true local production for local consumption, such as distributed energy systems, will also be encouraged.

With regard to nuclear energy, based on the Strategic Energy Plan, nuclear power plants will be restarted with the highest priority on safety. We will also work on the development and construction of next-generation innovative reactors that incorporate new safety mechanisms. At the same time, the establishment of a nuclear emergency preparedness system, including effective nuclear regulations and the securing of evacuation routes through road construction and other measures, will be steadily promoted. Also, research and development and human resource development for the future will be conducted, including the pursuit of reactors with superior safety features.

For thermal power, CO_2 emissions from thermal power generation will be reduced in a consistent manner with the long-term goals of the Paris Agreement in order to achieve a decarbonized society. Therefore, by fading out inefficient coal-fired thermal power generation etc., dependence on thermal power generation will be reduced as much as possible on the basic premise of ensuring a stable supply. Furthermore, efforts will be accelerated to replace thermal power generation with decarbonized power generation using hydrogen, ammonia, CCUS,[35] and other technologies, aiming towards 2050.

(a) Reduction of CO_2 emission intensity in power sectors

In July 2015, a voluntary framework for the electric power sector and the *Industry's Action Plans Toward a Low-Carbon Society* involving major business operators (the target is to achieve about 0.37 kg-CO_2 kWh, which is consistent with the national energy mix and CO_2 reduction target at the time) was announced. In February 2016, the Electric Power Council for a Low-Carbon Society was established and announced mechanisms and rules for individual companies to develop their own reduction plans and implement PDCA cycles as a whole industry.

Subsequently, in April 2021, an ambitious target consistent with carbon neutrality in 2050 was set to reduce greenhouse gas emissions by 46% from the FY 2013 level by FY 2030 and continuing strenuous efforts in its challenge to meet the lofty goal of cutting its emission by 50%. In October of the same year, *The 6th Strategic Energy Plan* and the *Plan for Global Warming Countermeasures* were adopted by the Cabinet,

[35] Abbreviation for Carbon dioxide capture, utilization, and storage. A technology for separating and recovering CO_2 contained in exhaust gases from thermal power plants, factories etc., and in the atmosphere, and effectively utilizing it as a resource in the manufacture of minerals, chemicals, and fuels, or storing it in stable underground formations.

which presented the outlook for energy and electricity supply and demand to achieve Japan's GHG reduction target for FY 2030.

In response, the Electric Power Council for a Low-Carbon Society (ELCS) revised its target for FY 2030 based on the *Energy Demand and Supply Outlook for FY 2030* in June 2022, to aim for achieving an emission factor of 0.25 kg-CO_2/kWh as a whole of Japan. This target is based on the premise of safety and priority on a stable energy supply, and maximum efforts to realize "S+3E," which includes economic efficiency, and environmental compatibility at the same time.

To reach the goal set by the voluntary framework, , by implementing policies in accordance with the Act on the Rationalization of Energy Use and Shift to Non-fossil Energy (Act No. 49 of 1979, hereinafter referred to as the "Energy Conservation Act") and Energy Supply Structure Advancement Act (2009, Act No. 72, hereinafter referred to as the "the Advancement Act"), the effectiveness of the efforts of the entire power sector will be ensured under electricity deregulation.

Specifically, the effective measures, including the following items, will be implemented to be consistent with Japan's CO_2 emission reduction target and energy mix,[36] and the future global warming countermeasures in the electric power sector will be considered continuously.

<Voluntary framework>

- The review of emission factor targets consistent with national CO_2 emissions reduction targets and the energy mix and the improvement of the effectiveness and transparency of efforts by the electric power sector as a whole will be promoted. Also, sincere commitment to achieving the stated targets will be encouraged.
- The national council (Resources and Energy Working Group of Industrial Science and Technology Policy and Environment Meeting of Industrial Structure Council and Global Environment Subcommittee) will also follow up on initiatives under the voluntary framework of the electric power sector.

<Policy responses>

- In accordance with the Energy Conservation Act, power generators are required to meet power generation efficiency standards for newly constructed power generation facilities on a per facility basis. In addition, power generators are also required to meet the power generation efficiency standards for existing power generation facilities on a per generator basis.
- Furthermore, in order to steadily fade out inefficient coal-fired thermal power generation towards 2030, the benchmark target for power generators with coal-fired power generation facilities requires power generation efficiency (on a per generator basis) that is at the same level as state-of-the-art USC (ultra-supercritical) plants. In doing so, the introduction of technologies for decarbonization will be promoted by allowing the subtraction of co-firing hydrogen, ammonia, etc. in the calculation of power generation efficiency.
- Based on the Advancement Act, retail electric utilities are required to ensure that the percentage of non-fossil power sources in the electricity they sell is above the standard.

[36] The energy mix for FY 2030 is expected to be about 11% for hydro, about 14% to 16% for solar, about 5% for wind, about 1% for geothermal, and about 5% for biomass.

- With a view to 2030 and beyond, CCS[37] will be addressed based on the Strategic Energy Plan and the Long-Term Strategy as a Growth Strategy Based on the Paris Agreement (Cabinet decision on October 22, 2021).

In introducing power generation facilities through competition, Japan believes that constant promotion of the advancement of power generation technologies that contribute to the realization of decarbonization as well as maintenance and improvement of Japan's technological superiority in the power generation business will lead to increased international competitiveness and the decarbonization of the world. Based on this concept and considering future trends in the development of power generation technology, the adoption of BAT will be encouraged.

The effectiveness and transparency of the efforts made by the entire electric power industry will be ensured by addressing the above. In addition, the implementation status, including an assessment of whether these initiatives continue to be effective, will be evaluated to ensure that the emission factor targets consistent with national CO_2 emissions reduction targets for FY 2030 and the *6th Strategic Energy Plan* are met.

If it is determined that the emission factor target cannot be achieved based on the assessment of emissions from the power generation sector and the status of the emission factor, the enhancement of measures will be considered with a stable supply as a major premise.

(2) Maximum introduction of renewable energy

(a) Maximum introduction of renewable energy

1) Renewable electricity generation

Renewable energy does not emit greenhouse gases in its generation, so its increased introduction is essential for mitigating global warming in the energy conversion sector. It is also a promising, diverse, and important domestic energy source that can contribute to energy security because it can be produced domestically. Under the concept of S+3E, the highest priority will be placed on renewable energy, and its maximum introduction will be encouraged while reducing the burden on the citizens and coexisting with local communities. Specific initiatives include the following:

- Appropriate operation and revision of the Feed-in Tariff (FIT) scheme

The FIT scheme, based on the Act on Special Measures Concerning Procurement of Electricity from Renewable Energy Sources by Electricity Utilities (Act No. 108 of 2011), is a measure to reduce the cost of renewable energies by allowing the purchase of renewable energy at a fixed price over a long period of time, increasing investment incentives, and promoting the spread of renewable energy. In the future, efforts to reduce costs by power generation companies will be promoted through the use of a bidding system and the setting of mid- to long-term price targets. From FY 2022 onwards, the FIP scheme was introduced under which power producers sell electricity on the wholesale electricity trading market or in relative transactions, as with other power sources, and receive a certain premium calculated on the basis of the market price. This would encourage the trading of electricity according to supply and demand conditions and market prices and promote the integration of renewable energy into the electricity market.

In order to continue to promote the maximum use of renewable energy while reducing the burden on

[37] Abbreviation for Carbon dioxide Capture and Storage.

the citizens, the FIT and FIP[38] schemes will be appropriately operated, and the systems will be appropriately revised as necessary.

- Expansion of use and development of a business environment for long-term stable power generation

  In order to maximize the use of renewable electricity and achieve long-term stable use with the understanding of local communities and society, the business environment will be improved through the following initiatives: the development of rules for grid maintenance and grid operation, the development of technologies for higher efficiency and lower cost of power generation facilities and advanced grid operation, rationalization of related regulations as necessary, and establishment of a business discipline for coexistence with the local community.

- Expansion of renewable energy in consumers and communities

  The use of solar power generation at factories, offices, housing, and buildings will be promoted while facilitating proactive initiatives in the public sector, such as the installation of solar power generation systems in public buildings. For houses and buildings, the target is to have 60% of newly built houses equipped with photovoltaic power generation systems by 2030. In addition, efforts will be made to publicize and disseminate the PPA model[39] and other information to facilitate a smooth introduction to such customers. Also, the Act on Promotion of Global Warming Countermeasures and other relevant measures will be utilized to promote the introduction of renewable energy with proper environmental consideration and benefits to local communities.

  Furthermore, it is important to work to maximize the introduction of wind power generation with managing appropriate consideration to the environment and living in harmony with local communities while preventing the introduction of wind power generation in a way that hinders the conservation of the natural environment, and to this end, the optimal environmental impact assessment system will be examined.

  At the same time, continued efforts will be made to accelerate the development of geothermal power generation through the implementation of scientific studies in coexistence with local communities.. Unused hydroelectric energy will be utilized, such as by installing power generation facilities in existing dams that are not being used for power generation and by examining the feasibility of improving dam operations using the latest weather forecasting technology.

2) Renewable heat energy

Focusing on renewable heat energy (solar heat, geothermal heat, snow and ice heat, hot spring heat, seawater heat, river heat, sewage heat, etc.), which is a highly local energy source, the use of biomass heat from sewage sludge, waste wood, and unused materials, and the use of unused heat, such as waste heat from waste treatment, will be promoted according to economic efficiency and regional

[38] Feed-in Premium: A scheme in which a certain amount of subsidy is added to the sales price of electricity generated from renewable energy sources when the electricity is sold.

[39] PPA (Power Purchase Agreement) model: A contract method in which a power generation business supplies electricity generated by the business to specific consumers, etc. This model assumes a business model in which a business operator installs and operates a solar power generation system etc. on a customer's roof or site free of charge, the customer purchases the electricity generated by the system from the business operator who installed it and pays the PPA business operator for its use. This model has advantages in terms of reducing the burden on consumers, such as the fact that the initial cost of installing solar power generation equipment may be zero, but it should be noted that this does not mean that consumers do not bear the cost of the equipment since the cost is paid through electricity usage fees.

characteristics. Meanwhile, the use of biofuels, hydrogen and other decarbonized fuels that can partially replace petroleum products as fuels in the transport sector is also important. The aim is to expand the use of renewable energy and heat by supporting the introduction of facilities that supply renewable energy and heat and by demonstrating and building models for the effective use of a variety of different types of heat energy in the region.

(3) Promotion of energy-saving measures in the petroleum product manufacturing sector

(a) Promotion of the introduction of facilities and equipment with high energy-saving performance (petroleum product manufacturing sector)

Efforts to achieve energy reductions equivalent to 1 million kl in crude oil equivalent from BAU by (1) effective use of heat, (2) introduction of advanced control and high-efficiency equipment, (3) improvement of power system operations, and (4) large-scale improvements and upgrade of processes based on the Industry's Action Plans for a Low-Carbon Society in the petroleum product manufacturing sector by petroleum refiners.

2.2 Industry sector

(1) Promotion of voluntary effort by industry

(a) Steady Implementation, evaluation, and verification of Industry's Action Plans for a Low-Carbon Society

The Keidanren and industries have been working to reduce emissions by formulating voluntary action plans and have achieved good results so far. Based on the fact that *Industry's Action Plans for a Low-Carbon Society* have led to steady reductions in GHG emissions while maintaining economic competitiveness in many industries, Japan will continue to promote voluntary efforts by the industry as a central part of the measures implemented by the industry sector to steadily implement emission reductions toward achieving the reduction targets in the Plan.

Such a voluntary approach requires a certain level of government involvement in terms of transparency, reliability, and probability of achieving the target. Meanwhile, it has the advantages of allowing each entity to select superior measures based on its originality and ingenuity and of providing incentives to work toward higher targets. It is thus extremely important that industries continue to employ these advantages and promote efforts to reduce GHG emissions. For this reason, while considering the advantages of leaving the targets and contents of the Industry's Action Plans for a Low-Carbon Society to the autonomy of the industry, in order to respond to social demands, the industry formulates and implements the plan while paying attention to the following points and review it from time to time based on periodic evaluations and verifications:

(i) For industries that have not yet formulated the Industry's Action Plans for a Low-Carbon Society, the number of industries that have formulated targets increased from 87 in FY 2013 to 114 in FY 2018 as a result of active encouragement of the formulation of new voluntary action plans not only for industries that have been participating in the Kyoto Protocol Target Achievement Plan but also for those have not been participating in that plan. Continued efforts will be made to increase the coverage rate within the industry, including SMEs.

(ii) In setting targets in the Industry's Action Plans for a Low-Carbon Society, from the perspective of reducing GHG emissions, CO_2 reduction targets are established based on the maximum introduction

of the best available technology (BAT: Best Available Technology) and proactive energy saving efforts. The targets are explained to the public as being the maximum target level that can be achieved. It is important to collect data that will enable a comparison of energy efficiency and CO_2 emissions between Japan and other countries so that the severity of the target level set and the degree of effort made by the industry can be evaluated. In addition, by clearly indicating BAT and best practices in advance, it will be possible to evaluate not only the achievement of the target level but also the efforts made by each industry. Furthermore, while respecting the voluntary targets, the committee will also consider the consistency with the government's 2030 target, the setting of the 2030 target with a view to the ideal state in 2050, and a unified presentation of the CO_2 emission reduction rate compared to the FY 2013 level as a common indicator. In the event that technological developments enable the diffusion of new BAT, the targets will be flexibly raised on a constant basis.

※For the target indicators, each industry makes an independent judgment and mainly selects either energy consumption intensity, energy consumption, CO_2 emission intensity, CO_2 emission, or reduction from Business As Usual (BAU).[40] It is important to continue to examine the nature of the target setting, including consistency with the government's 2030 target.

(iii) Under the *Industry's Action Plans for a Low-Carbon Society*, the PDCA cycle will be promoted as before to ensure effectiveness, transparency, and reliability. In doing so, in consideration of the fact that the plan for 2030 is a long-term initiative, various factors, such as changes in the structure of society and industry and progress in technological innovation, will be considered while clarifying the preconditions and ensuring transparency so that the 2030 target can be easily compared among industries.

(iv) In addition to the emission reduction targets (commitments) set out in (ii) above, the reduction of CO_2 emissions throughout the supply chain by supplying decarbonized products and services in cooperation with related industries. Efforts will also be made to raise public awareness and improve the knowledge of global warming prevention.

(v) From the perspective of contributing to global warming countermeasures on a global scale, each industry will actively work on reducing emissions globally through the overseas deployment of decarbonized products and services etc., transferring technology and know-how based on international rules to developing countries that are willing to improvement measures to prevent global warming, and strengthening the private sector based international collaborative activities. At the same time, contributions to reducing emissions through specific initiatives of the business fields of each industry will be presented.

(vi) Each industry will actively work on the development and practical application of innovative technologies to achieve carbon neutrality in 2050 from a medium- to long-term perspective that looks beyond 2030.

(vii) In addition, in order to disseminate easy-to-understand information on initiatives based on the *Industry's Action Plans for a Low-Carbon Society* to foreign countries and consumers, each industry will make international comparisons based on reliable data and actively disseminate such information to the outside world.

(viii) The effectiveness of the plan will be examined in light of progress on the 2050 carbon neutrality and FY 2030 emission reduction targets, and the survey design will be simplified to make it easier for the industry to participate.

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[40] "Reduction from BAU" refers to the targeted reduction in CO_2 emissions etc. achieved through maximum introduction of BAT etc. based on the assumed emissions (BAU emissions) in the target year when no additional measures are taken, in other words, when the technology level (intensity) is fixed in a given year.

Based on the perspectives of (i) to (viii) above, the government will conduct rigorous and periodic evaluation and verification by relevant councils of the *Industry's Action Plans for a Low-Carbon Society* formulated by each industry sector and the initiatives to be implemented based on the action plans, as well as the review of how to proceed with the *Industry's Action Plans for a Low-Carbon Society*.

In addition, the industry will contribute to CO_2 reductions in the commercial and institution sector and transport sector by making materials and other products lighter and more functional, developing and providing energy-efficient decarbonized products and services, improving the efficiency of logistics through modal shifts and other means, and promoting the use of next-generation vehicles and public transportation.

<Progress assessment of policies and measures>

The progress assessment results against the targets for FY 2030 of each industry in the *Industry's Action Plans for a Low-Carbon Society* are shown in Table II-10.

Table II-10 Target indicators, target levels, and progress evaluation results for each industry in the Low Carbon Society Action Plan

Type of industry	Upper row：CO_2 emissions Middle and lower rows：Target indicators	Base year/BAU	Actual performance										Target Level	Progress in the emission reductions
			2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2030	
Industry sector														
Industry under Ministry of Finance														
Brewers Association of Japan	CO_2 emissions	kt CO_2	546	528	512	499	488	466	450	402	394	407		B
	CO_2 emissions	FY2013	—	-16%	-17%	-18%	-19%	-21%	-23%	-31%	-31%	-29%	-46%	
Japan Tobacco Inc.	CO_2 emissions	kt CO_2	950	920	900	835	791	770	711	650	645	615		B
	CO_2 emissions	FY2019	—	—	—	—	—	—	—	-11%	-12%	-16%	-47%	
Industry under Ministry of Health, Labour and Welfare														
The Federation of Pharmaceutical Manufacturers' Associations of Japan	CO_2 emissions	kt CO_2	2,565	2,469	2,409	2,431	2,348	2,197	2,133	2,062	2,165	2,184		B
	CO_2 emissions	FY2013	—	-5%	-8%	-7%	-10%	-16%	-18%	-21%	-17%	-16%	-46%	
Industry under Ministry of Fisheries, Forestry and Agriculture														
Japan Starch & Sweeteners Industry Association	CO_2 emissions	Kt CO_2	1,148	1,180	1,255	1,139	1,122	1,078	1,081	984	959	943		B
	CO_2 emissions	FY2013	—	+3%	+9%	-1%	-2%	-6%	-6%	-14%	-16%	-18%	-30.3%	
Japan Dairy Industry Association	CO_2 emissions	kt CO_2	1,195	1,155	1,160	1,117	1,035	977	958	942	1,262	1,254		B
	CO_2 emission intensity	FY2013	—	-3%	-10%	-13%	-19%	-22%	-24%	-23%	-31%	-32%	-38%	
Japan Soft Drink Association	CO_2 emissions	kt CO_2	1,220	1,156	1,150	1,140	1,106	1,178	1,161	1,093	1,135	1,130		A
	CO_2 emission intensity	FY2012	+2%	-3%	-7%	-10%	-15%	-12%	-19%	-15%	-18%	-20%	-18%	
Japan Baking Industry Association	CO_2 emissions	kt CO_2	1,085	1,091	1,070	1,047	1,020	995	979	930	890	854		A
	CO_2 emission intensity	FY2013	—	-6%	-8%	-11%	-15%	-16%	-18%	-20%	-24%	-31%	-13%	
Japan Canners Association	CO_2 emissions	kt CO_2	755	679	634	788	1,062	616	628	640	585	729		A
	Energy consumption intensity	FY2009	-5%	-15%	-9%	-13%	-7%	-29%	-26%	-15%	-19%	-35%	-19%	
Japan Beet Sugar Association	CO_2 emissions	kt CO_2	638	653	704	601	661	648	692	666	696	616		A
	Energy consumption intensity	FY2010	-15%	-19%	-21%	-12%	-17%	-25%	-17%	-18%	-17%	-17%	-15%	
Japan Oilseed Processors Association	CO_2 emissions	kt CO_2	610	607	612	624	635	616	593	585	573	551		A
	CO_2 emissions	FY2013	—	-0%	+0%	+2%	+4%	+1%	-3%	-4%	-6%	-10%	-6.5%	

Type of industry	Upper row：CO_2 emissions Middle and lower rows：Target indicators	Base year/BAU	Actual performance										Target Level	Progress in the emission reductions
			2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2030	
	CO_2 emission intensity	FY2013	—	+0%	-2%	-2%	-2%	-0%	-4%	-7%	-7%	-9%	-6.5%	
All Nippon Kashi Association	CO_2 emissions	kt CO_2	974	973	960	916	943	863	830	860	875	850		A
	CO_2 emissions	FY2013	—	-0%	-1%	-6%	-3%	-11%	-15%	-12%	-10%	-13%	-17%	
	CO_2 emission intensity	FY2013	—	-7%	-18%	-25%	-25%	-32%	-35%	-33%	-30%	-26%	-17%	
Japan Sugar Refiners' Association	CO_2 emissions	kt CO_2	390	376	365	358	345	324	303	278	289	289		A
	CO_2 emissions	FY2013	—	-4%	-6%	-8%	-12%	-17%	-22%	-29%	-26%	-26%	-22.0%	
Japan Frozen Food Association	CO_2 emissions	kt CO_2	437	403	419	514	499	528	662	656	591	587		B
	Energy consumption intensity	FY2013	—	-3%	-5%	-6%	-9%	-8%	-4%	-6%	-7%	-7%	-15.7%	
Japan Ham & Sausage Processors Cooperative Association	CO_2 emissions	kt CO_2	569	569	561	550	547	514	511	483	482	443		B
	Energy consumption intensity	FY2011	-6%	-4%	-6%	-6%	-8%	-4%	-3%	-7%	-7%	-0%	-17%	
Flour Millers Association	CO_2 emissions	kt CO_2	305	303	286	275	268	242	232	227	222	219		B
	CO_2 emission intensity	FY2013	—	-1%	-7%	-11%	-14%	-21%	-24%	-24%	-25%	-26%	-32.1%	
All Japan Coffee Association	CO_2 emissions	kt CO_2	118	116	120	136	126	127	127	127	123	112		A
	CO_2 emission intensity	FY2005	-33%	-38%	-41%	-44%	-49%	-52%	-53%	-49%	-51%	-57%	-25%	
Japan Soy-sauce Association	CO_2 emissions	kt CO_2	198	182	174	170	166	161	154	145	145	135		A
	CO_2 emissions	FY2013	—	-8%	-12%	-14%	-16%	-19%	-22%	-27%	-27%	-32%	-30%	
Japan Convenience Foods Industry Association	CO_2 emissions	kt CO_2	247	254	258	259	264	263	265	270	274	255		A
	CO_2 emission intensity	FY2013	—	-2%	-3%	-1%	-3%	-5%	-5%	-7%	-5%	-11%	-10%	
Japan Association of Mayonnaise ＆ Dressings	CO_2 emissions	kt CO_2	62	60	58	57	55	53	50	44	44	44		A
	CO_2 emissions	FY2012	+1%	-1%	-6%	-7%	-11%	-14%	-19%	-28%	-29%	-29%	-21.7%	
	CO_2 emission intensity	FY2012	-1%	-3%	-9%	-11%	-15%	-18%	-24%	-29%	-32%	-31%	-17.9%	
Japan Rice Millers Association	CO_2 emissions	kt CO_2	70	70	70	86	87	77	71	72	76	75		B
	Energy consumption intensity	FY2005	-3%	-7%	-3%	-10%	-9%	-6%	-12%	-13%	-11%	-12%	-12%	
Industry under Ministry of Economy, Trade and Industry														

Type of industry	Upper row：CO_2 emissions Middle and lower rows：Target indicators	Base year/BAU	Actual performance										Target Level	Progress in the emission reductions
			2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2030	
The Japan Iron and Steel Federation	CO_2 emissions	kt CO_2	194,408	191,803	184,085	182,643	181,200	177,385	172,613	145,932	163,086	150,231		B
	CO_2 emissions	FY2013	—	-1%	-5%	-6%	-7%	-9%	-11%	-25%	-16%	-23%	-30%	
Japan Chemical Industry Association	CO_2 emissions	kt CO_2	63,651	62,656	61,524	59,921	60,486	58,480	57,697	55,181	57,413	54,681		B
	CO_2 emissions	FY2013	—	-2%	-3%	-6%	-5%	-8%	-9%	-13%	-10%	-14%	-32%	
Japan Paper Association	CO_2 emissions	kt CO_2	18,828	18,159	17,934	17,798	17,860	17,519	16,613	15,649	15,835	14,343		B
	CO_2 emissions	FY2013	—	-4%	-5%	-5%	-5%	-7%	-12%	-17%	-16%	-24%	-38%	
Japan Cement Association	CO_2 emissions	kt CO_2	18,065	17,744	17,177	16,957	17,319	16,857	16,138	15,513	15,291	13,960		A
	Energy consumption intensity	FY2013	—	+1%	+1%	-1%	+0%	-1%	-2%	-3%	-6%	-7%	-9.7%	
	CO_2 emissions	FY2013	—	-2%	-5%	-6%	-4%	-7%	-11%	-14%	-15%	-23%	-15%	
Liaison Group of Japanese Electrical and Electronics Industries for Global Warming Prevention	CO_2 emissions	kt CO_2	12,966	13,340	13,440	14,005	14,414	13,401	12,993	11,804	12,337	12,509		B
	Energy intensity improvement rate	FY2020	—	—	—	—	—	—	—	—	-5%	-0%	-9.56%	
Japan Auto Parts Industries Association	CO_2 emissions	kt CO_2	7,707	7,444	6,863	6,980	6,986	6,503	6,188	5,710	5,711	5,700		B
	CO_2 emissions	FY2013	—	-16%	-21%	-18%	-15%	-17%	-19%	-24%	-26%	-26%	-46.0%	
Japan Automobile Manufacturers Association / Japan Auto-Body Industries Association	CO_2 emissions	kt CO_2	7,473	7,150	6,633	6,694	6,606	6,242	5,827	5,229	5,204	5,184		B
	CO_2 emissions	FY2013	—	-4%	-11%	-10%	-11%	-17%	-22%	-30%	-31%	-31%	-38%	
Japan Mining Industry Association	CO_2 emissions	kt CO_2	4,489	4,407	4,040	3,684	3,614	3,410	3,306	3,200	3,140	3,094		B
	CO_2 emissions	FY2013	—	-7%	-8%	-14%	-20%	-20%	-21%	-22%	-30%	-31%	-38%	
Lime Manufacture Association	CO_2 emissions	kt CO_2	2,463	2,460	2,226	2,246	2,267	2,230	2,099	1,762	1,887	1,751		A
	CO_2 emissions	FY2013	—	-0%	-10%	-9%	-8%	-10%	-15%	-29%	-24%	-29%	-29%	
The Japan Rubber Manufacturers Association	CO_2 emissions	kt CO_2	2,103	2,033	1,899	1,817	1,739	1,615	1,462	1,378	1,516	1,473		B
	CO_2 emissions	FY2013	—	-22%	-25%	-26%	-27%	-29%	-34%	-37%	-32%	-37%	-46%	
Japan Textile Finishers' Association	CO_2 emissions	kt CO_2	1,165	1,154	1,123	1,097	1,039	982	879	788	749	710		A
	CO_2 emissions	FY2013	—	-1%	-4%	-6%	-11%	-16%	-25%	-32%	-36%	-39%	-38%	
Japan Aluminum Association	CO_2 emissions	kt CO_2	1,462	1,490	1,442	1,449	1,419	1,344	1,260	1,173	1,222	1,188		B
	CO_2 emissions	FY2013	—	+2%	-1%	-1%	-3%	-8%	-13%	-20%	-16%	-19%	-31%	

Type of industry	Upper row：CO_2 emissions Middle and lower rows：Target indicators	Base year/BAU	Actual performance										Target Level	Progress in the emission reductions
			2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2030	
Japan Federation of Printing Industries	CO_2 emissions	kt CO_2	1,437	1,371	1,357	1,316	1,192	1,094	1,006	945	901	867		A
	CO_2 emissions	FY2010	-12%	-14%	-12%	-13%	-19%	-22%	-26%	-30%	-33%	-36%	-30.1%	
	CO_2 emissions	FY2013	—	-5%	-6%	-8%	-17%	-24%	-30%	-34%	-37%	-40%	-54.8%	
Flat Glass Manufacturers Association of Japan	CO_2 emissions	kt CO_2	1,171	1,102	1,062	1,060	1,088	1,098	1,114	941	917	762		A
	CO_2 emissions	FY2013	—	-6%	-9%	-9%	-7%	-6%	-5%	-20%	-22%	-35%	-25.8%	
Japan Glass Bottle Association	CO_2 emissions	kt CO_2	894	848	852	838	809	768	731	686	685	677		B
	CO_2 emissions	FY2013	—	-5%	-5%	-6%	-10%	-14%	-18%	-23%	-23%	-24%	-27.1%	
The Japanese Electric Wire & Cable Makers' Association	CO_2 emissions	kt CO_2	961	914	881	853	825	786	717	657	670	643		B
	CO_2 emissions	FY2013	—	-5%	-8%	-11%	-14%	-18%	-25%	-32%	-30%	-33%	-37.4%	
The Japan Bearing Industry Association	CO_2 emissions	kt CO_2	846	836	788	781	784	744	677	595	666	649		B
	CO_2 emission intensity	FY2013	—	-1%	-7%	-8%	-7%	-12%	-20%	-30%	-21%	-23%	-38%	
The Japan Society of Industrial Machinery Manufacturers	CO_2 emissions	kt CO_2	573	573	545	535	526	489	468	446	445	451		B
	Energy consumption intensity	FY2013	—	+0%	-5%	-7%	-8%	-15%	-18%	-22%	-22%	-21%	-38%	
Japan Copper and Brass Association	CO_2 emissions	kt CO_2	476	457	423	451	400	377	352	331	364	563		B
	CO_2 emissions	FY2013	—	-32%	-37%	-32%	-40%	-43%	-47%	-50%	-45%	-16%	-33%	
Japan Construction Equipment Manufacturers Association	CO_2 emissions	kt CO_2	501	475	410	411	448	411	359	340	383	398		A
	Energy consumption intensity	Average of FY2020-FY2022	+31%	+16%	+13%	+25%	+10%	-1%	-1%	+9%	-1%	-8%	-8%	
Limestone Association of Japan	CO_2 emissions	kt CO_2	284	280	273	266	264	260	256	244	247	240		B
	CO_2 emissions	BAU	-1%	-1%	-1%	-2%	-3%	-3%	-4%	-6%	-6%	-7%	-17 ktCO_2	
Japan Sanitary Equipment Industry Association	CO_2 emissions	kt CO_2	257	232	199	196	197	203	198	183	182	171		B
	CO_2 emissions	FY2013	—	-10%	-22%	-24%	-23%	-21%	-23%	-29%	-29%	-34%	-40%	
Japan Machine Tool Builders' Association	CO_2 emissions	kt CO_2	363	370	354	334	337	329	294	256	288	312		B
	CO_2 emissions	FY2013	—	+2%	-3%	-8%	-7%	-9%	-19%	-29%	-21%	-14%	-38%	
Japan Energy Resources Development Association	CO_2 emissions	kt CO_2	254	221	215	211	203	231	212	211	354	353		B

Type of industry	Upper row：CO_2 emissions Middle and lower rows：Target indicators	Base year/BAU	Actual performance										Target Level	Progress in the emission reductions
			2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2030	
(Former Japan Petroleum Development Association)	CO_2 emissions	FY2013	—	-52%	-53%	-54%	-56%	-50%	-54%	-54%	-23%	-23%	-40%	
Japan Prefabricated Construction Suppliers & Manufacturers Association	CO_2 emissions	kt CO_2	163	138	137	137	134	123	114	101	111	109		B
	CO_2 emissions	FY2013	—	-16%	-16%	-16%	-18%	-25%	-30%	-38%	-51%	-63%	-65%	
Japan Industrial Vehicles Association	CO_2 emissions	kt CO_2	48	47	44	43	42	40	37	37	41	41		B
	CO_2 emissions	FY2013	—	+0%	-4%	-4%	-2%	-4%	-19%	-8%	-15%	-15%	-38%	
Japan Carbon Association	CO_2 emissions	kt CO_2	451	445	393	319	385	390	334	257	304	333		B
	CO_2 emissions	FY2013	—	-1%	-13%	-29%	-15%	-14%	-26%	-43%	-32%	-26%	-46%	
Industry under Ministry of Land, Infrastructure, Transport and Tourism														
The Shipbuilders' Association of Japan/The Cooperative Association of Japan	CO_2 emissions	kt CO_2	650	694	693	705	650	595	535	533	422	380		A
	CO_2 emissions	FY2013	—	+7%	+7%	+8%	+0%	-8%	-18%	-18%	-35%	-42%	-28%	
Japan Ship Machinery and Equipment Association	CO_2 emissions	kt CO_2	85	85	80	83	70	66	70	65	53	73		B
	Energy consumption intensity	FY1990	-30%	-29%	-27%	-23%	-33%	-37%	-33%	-24%	-33%	-27%	-30%	
Japan Marine Industry Association	CO_2 emissions	kt CO_2	26	27	26	26	26	27	26	20	27	28		B
	CO_2 emissions	FY2010	-14%	-11%	-13%	-14%	-13%	-9%	-14%	-34%	-11%	-5%	-14%	
Japan Association of Rolling Stock Industries	CO_2 emissions	kt CO_2	36	36	34	34	35	32	31	29	27	25		A
	CO_2 emissions	FY1990	-22%	-22%	-26%	-26%	-24%	-30%	-33%	-39%	-41%	-47%	-35%	
Japan Federation of Construction Contractors	CO_2 emissions	kt CO_2	4,113	4,382	4,313	4,237	4,119	4,291	4,448	3,949	3,542	2,970		A
	CO_2 emission intensity	FY1990	-18%	-18%	-19%	-19%	-21%	-21%	-22%	-26%	-32%	-40%	-25%	
Japan Federation of Housing Organizations	CO_2 emissions (over life cycle of housing)	kt CO_2	2,600 (221,830)	2,400 (208,910)	2,390 (199,430)	2,410 (199,650)	2,280 (207,900)	2,110 (207,560)	2,060 (188,470)	1,980 (185,640)	2,085 (155,642)	2,040 (148,800)		D
	Environmental performance of new houses	—	—	—	—	—	—	—	—	—	—	—	Realization of ZEH on average for new construction	
Commercial and Other Sector														
Industry under Financial Services Agency														

Type of industry	Upper row：CO_2 emissions Middle and lower rows：Target indicators	Base year/BAU	Actual performance										Target Level	Progress in the emission reductions
			2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2030	
Japanese Bankers Association	CO_2 emissions	kt CO_2	1,390	1,340	1,270	1,200	1,120	1,000	920	890	830	890		B
	CO_2 emissions	FY2013	—	-18%	-22%	-27%	-31%	-39%	-44%	-45%	—	-45%	-51%	
The Life Insurance Association of Japan	CO_2 emissions	kt CO_2	1,107	1,019	956	851	796	727	667	630	623	605		B
	Energy consumption intensity	FY2009	—	—	—	—	—	—	—	—	-33%	-36%	-51%	
The General Insurance Association of Japan	CO_2 emissions	kt CO_2	270	256	235	223	200	188	170	165	154	144		B
	CO_2 emission intensity	FY2013	—	—	—	—	—	—	—	—	-39%	-39%	-51%	
The National Association of Shinkin Banks	CO_2 emissions	kt CO_2	321	302	281	272	258	232	216	216	206	200		A
	Energy consumption	FY2009	-11%	-14%	-17%	-17%	-18%	-21%	-24%	-23%	-26%	-28%	-19%	
Community Bank Shinyo Kumiai	CO_2 emissions	kt CO_2	—	—	—	—	—	—	—	—	—	—		A
	Energy consumption	FY2009	—	—	—	—	—	—	—	—	-22%	-24%	-18%	
Japan Securities Dealers Association	CO_2 emissions	kt CO_2	194	180	168	160	147	136	122	113	108	115		B
	CO_2 emission intensity	FY2013	—	—	—	—	—	—	—	—	-38%	-33%	-51%	
Industry under Ministry of Internal Affairs and Communications														
Telecommunications Carriers Association	CO_2 emissions	kt CO_2	5,706	5,652	5,520	5,204	5,010	4,806	4,630	4,680	4,220	4,289		B
	Energy consumption intensity	FY2013	—	-24%	-48%	-65%	-70%	-76%	-79%	-86%	-87%	-90%	-90%	
Telecom Services Association	CO_2 emissions	kt CO_2	1,021	963	895	894	811	772	812	801	797	812		A
	Energy consumption intensity	FY2013	—	-3%	-6%	-4%	-9%	-9%	-7%	-0%	-8%	-9%	-2%	
The Japan Commercial Broadcasters Association	CO_2 emissions	kt CO_2	245	226	223	222	220	202	213	216	202	192		A
	CO_2 emission intensity	FY2012	-6%	-6%	-6%	-7%	-13%	-19%	-26%	-24%	-24%	-26%	-10%	
Japan Broadcasting Corporation	CO_2 emissions	kt CO_2	211	199	188	185	171	159	158	157	153	152		E
	CO_2 emissions	FY2018	—	—	—	—	—	—	—	—	—	—	—	
Japan Cable and Telecommunications Association	CO_2 emissions	kt CO_2	—	—	—	109	113	110	93	89	82	79		B
	Energy consumption intensity	FY2020	—	—	—	—	—	—	—	—	+3%	+0%	-1%	
Japan Satellite Broadcasting Association	CO_2 emissions	kt CO_2	10	9	8	7	6	23	10	12	14	13		B

Type of industry	Upper row：CO_2 emissions Middle and lower rows：Target indicators	Base year/BAU	Actual performance										Target Level	Progress in the emission reductions
			2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2030	
	Energy consumption intensity	FY2010	-4%	-10%	-11%	-12%	-12%	-12%	-14%	-14%	-15%	-15%	-15%	
Japan Internet Providers Association	CO_2 emissions	kt CO_2	—	—	—	—	—	—	—	—	49	28		A
	Energy consumption intensity	FY2015	—	—	—	-17%	+14%	-24%	-26%	-36%	-53%	-67%	-1%	
Industry under Ministry of Education, Culture, Sports, Science and Technology														
The Federation of All Japan Private Schools' Associations	CO_2 emissions	kt CO_2	—	—	3,651	3,821	3,638	3,520	—	3,122	—	3,230		B
	CO_2 emission intensity	FY2012	—	—	—	—	—	—	—	—	—	-14%	-40%	
Industry under Ministry of Health, Labour and Welfare														
Japan Medical Association / Council of 4 Hospitals	CO_2 emissions	kt CO_2	9,170	8,776	8,515	8,705	8,638	8,129	7,568	7,581	7,876	7,765		B
	CO_2 emission intensity	FY2006	-18%	-21%	-22%	-21%	-20%	-23%	-25%	-25%	-24%	-25%	-25%	
Japanese Consumers Co-operative Union	CO_2 emissions	kt CO_2	—	—	—	—	—	—	—	—	—	0		B
	CO_2 emissions	FY2013	—	-28%	-28%	-32%	-33%	-33%	-31%	-40%	-34%	-32%	-40%	
Industry under Ministry of Fisheries, Forestry and Agriculture														
Japan Processed Foods Wholesalers Association	CO_2 emissions	kt CO_2	291	326	322	289	272	269	277	268	262	270		A
	Energy consumption intensity	FY2011	+2%	-2%	-9%	-5%	-7%	-8%	-16%	-15%	-20%	-11%	-5%	
Japan Foodservice Association	CO_2 emissions	kt CO_2	7,209	6,824	6,794	6,722	6,472	6,057	5,894	5,266	5,031	5,106		A
	Energy consumption intensity	FY2013	—	-4%	-5%	-8%	-10%	-14%	-15%	-10%	-15%	-23%	-15.7%	
Industry under Ministry of Economy, Trade and Industry														
Japan Chain Stores Association	CO_2 emissions	kt CO_2	5,400	4,950	3,929	2,832	2,198	2,094	2,060	2,099	1,913	1,883		B
	Energy consumption intensity	FY2013	—	+1%	-11%	-12%	-14%	-1%	-2%	-2%	-2%	-5%	-5.1%	
Japan Franchise Association	CO_2 emissions	kt CO_2	4,379	4,578	4,488	4,472	4,301	4,014	3,756	3,587	3,572	3,543		B
	CO_2 emission intensity	FY2013	—	—	—	—	—	—	—	—	-30%	-30%	-46%	
Japan Council of Shopping Centers	CO_2 emissions	kt CO_2	3,317	2,755	2,688	2,585	2,554	2,308	2,207	1,992	1,828	1,709		A
	Energy consumption intensity	FY2005	-30%	-32%	-34%	-35%	-37%	-37%	-37%	-41%	-42%	-44%	-23.0%	

Type of industry	Upper row：CO_2 emissions Middle and lower rows：Target indicators	Base year/BAU	Actual performance										Target Level	Progress in the emission reductions
			2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2030	
Japan Department Stores Association	CO_2 emissions	kt CO_2	1,905	1,726	1,594	1,513	1,339	1,196	1,132	875	895	878		B
	Energy consumption intensity	FY2013	—	-6%	-11%	-12%	-14%	-17%	-19%	-24%	-24%	-23%	-26.5%	
	CO_2 emissions	FY2013	—	-9%	-16%	-21%	-30%	-37%	-41%	-54%	-53%	-54%	-50%	
Major Home Appliances Distributors Association	CO_2 emissions	kt CO_2	811	777	713	704	671	605	603	561	543	532		A
	CO_2 emissions	FY2013	—	-4%	-12%	-13%	-17%	-25%	-26%	-31%	-33%	-34%	-26.8%	
Japan DIY HC Association	CO_2 emissions	kt CO_2	487	463	463	466	349	282	333	227	452	264		A
	Energy consumption intensity	FY2013	—	-16%	-13%	-14%	-11%	-21%	-10%	-13%	-10%	-25%	-25%	
Japan Information Technology Services Industry Association	CO_2 emissions	kt CO_2	206	166	134	115	105	96	90	100	95	95		B
	(Office) Energy consumption intensity	FY2020	—	—	—	—	—	—	—	—	-4%	-3%	-9.56%	
	CO_2 emissions	kt CO_2	643	617	553	522	440	408	477	471	445	436		
	(Data center) Energy consumption intensity	FY2020	—	—	—	—	—	—	—	—	-5%	-6%	-9.56%	
Japan Association of Chain Drug Stores	CO_2 emissions	kt CO_2	1,325	1,505	1,559	1,594	1,691	1,676	1,547	1,596	1,656	1,684		B
	Energy consumption intensity	FY2013	—	-7%	-16%	-19%	-21%	-23%	-27%	-29%	-33%	-33%	-34.0%	
Japan Foreign Trade Council, Inc.	CO_2 emissions	kt CO_2	54	51	45	41	37	34	32	28	29	21		A
	Energy consumption intensity	FY2013	—	-3%	-6%	-10%	-11%	-13%	-13%	-26%	-23%	-44%	-15.7%	
Japan LP Gas Association	CO_2 emissions	kt CO_2	31	30	28	28	27	25	24	24	24	20		B
	Energy consumption	FY1990	-5%	-7%	-8%	-7%	-6%	-7%	-7%	-7%	-6%	-6%	-10%	
Japan Leasing Association	CO_2 emissions	kt CO_2	9	18	17	16	15	14	14	14	8	7		B
	Energy consumption intensity	FY2013	—	+8%	+3%	-4%	-4%	-5%	-5%	-4%	-28%	-32%	-46%	
Industry under Ministry of Land, Infrastructure, Transport and Tourism														
The Japan Warehousing Association Inc.	CO_2 emissions	kt CO_2	1,190	1,060	1,210	1,220	1,290	1,250	1,250	1,250	1,210	1,250		A

Type of industry	Upper row：CO_2 emissions Middle and lower rows：Target indicators	Base year/BAU	Actual performance										Target Level	Progress in the emission reductions
			2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2030	
	Energy consumption intensity	FY1990	-15%	-18%	-19%	-19%	-19%	-20%	-22%	-24%	-30%	-31%	-20%	
Japan Association of Refrigerated Warehouses	CO_2 emissions	kt CO_2	1,064	1,031	976	956	901	855	827	824	840	829		B
	CO_2 emission intensity	FY2013	—	-4%	-9%	-12%	-17%	-24%	-26%	-31%	-29%	-31%	-51%	
Japan Hotel Association	CO_2 emissions	kt CO_2	696	682	658	644	632	607	569	435	470	519		A
	Energy consumption intensity	FY2010	-7%	-9%	-11%	-11%	-10%	-13%	-15%	-15%	-17%	-18%	-15%	
Japan Ryokan & Hotel Association	CO_2 emissions	kt CO_2	—	—	—	50	57	24	72	38	17	44		A
	Energy consumption intensity	FY2016	—	—	—	—	-10%	-10%	-7%	-37%	-49%	-18%	-10%	
Japan Automobile Service Promotion Association	CO_2 emissions	kt CO_2	4,155	4,165	4,185	4,191	4,133	4,161	3,999	4,196	4,275	4,247		B
	CO_2 emissions	FY2007	-8%	-8%	-7%	-7%	-9%	-8%	-12%	-7%	-5%	-6%	-15%	
The Real Estate Companies Association of Japan	CO_2 emissions	kt CO_2	—	—	—	—	—	—	—	—	—	2,597		B
	CO_2 emissions	FY2013	—	—	—	—	—	—	—	—	—	-6%	-51%	
	CO_2 emission intensity	FY2013	—	—	—	—	—	—	—	—	-35%	-41%	-64%	
Japan Building Owners and Managers Association	CO_2 emissions	kt CO_2	—	—	—	—	—	—	—	—	3,173	2,890		B
	CO_2 emission intensity	FY2013	—	—	—	—	—	—	—	—	-38%	-44%	-64%	
Industry under Ministry of the Environment														
Japan Federation of Industrial Waste Management and Recycling Associations	CO_2 emissions	kt CO_2	4,475	4,565	4,706	4,727	4,765	4,976	4,809	4,818	4,659	4,190		B
	CO_2 emissions	FY2010	+3%	+5%	+8%	+8%	+9%	+14%	+10%	+10%	+7%	-4%	-10%	
The Japan Newspaper Publishers & Editors Association	CO_2 emissions	kt CO_2	537	500	467	453	420	374	349	325	313	297		A
	Energy consumption intensity	FY2013	—	Annual average -5.8%	Annual average -5.0%	Annual average -4.4%	Annual average -4.4%	Annual average -4.6%	Annual average -4.6%	Annual average -4.5%	Annual average -4.2%	Annual average -4.2%	Annual average -1%	
Zenkoku Pet Kyoukai (pet retail)	CO_2 emissions	kt CO_2	5	5	6	5	5	5	5	5	6	6		C
	CO_2 emission intensity	FY2012	+28%	+35%	+4%	-18%	+0%	-4%	-6%	-9%	-0%	+2%	0%	
Industry under National Police Agency														
All Japan Pachinko Association	CO_2 emissions	kt CO_2	5,020	4,470	4,260	4,010	3,830	3,290	3,110	2,660	2,600	2,350		A

Type of industry	Upper row：CO_2 emissions Middle and lower rows：Target indicators	Base year/BAU	Actual performance										Target Level	Progress in the emission reductions
			2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2030	
	CO_2 emissions	FY2007	-15%	-22%	-23%	-25%	-26%	-32%	-33%	-42%	-43%	-48%	-22%	
Japan Amusement Industry Association	CO_2 emissions	kt CO_2	253	237	238	233	225	190	187	188	188	188		A
	CO_2 emissions	FY2012	-7%	-11%	-11%	-15%	-15%	-30%	-30%	-30%	-30%	-30%	-16.6%	
Transport Sector														
Industry under Ministry of Land, Infrastructure, Transport and Tourism														
The Japanese Shipowners' Association	CO_2 emissions	kt CO_2	55,388	54,172	52,145	52,582	54,025	32,662	45,635	40,237	37,010	36,851		A
	CO_2 emission intensity	FY1990	-38%	-43%	-41%	-39%	-48%	-37%	-31%	-35%	-38%	-31%	-30%	
Japan Trucking Association	CO_2 emissions	kt CO_2	40,790	41,000	40,910	40,680	40,870	41,040	40,440	38,742	41,150	40,004		B
	CO_2 emission intensity	FY2005	-9%	-7%	-4%	-7%	-7%	-7%	-10%	+3%	+4%	-0%	-31%	
The Scheduled Airlines Association of Japan	CO_2 emissions	kt CO_2	21,522	22,476	23,199	24,376	25,362	24,871	25,394	12,602	16,991	21,122		B
	CO_2 emission intensity	FY2013	—	-6%	-6%	-8%	-11%	-8%	-8%	+6%	+3%	-4%	-22%	
	CO_2 emission intensity	FY2019	—	—	—	—	—	—	—	—	—	+4%	-15.4%	
Japan Federation of Coastal Shipping Associations	CO_2 emissions	kt CO_2	7,221	7,257	7,039	7,131	7,026	7,067	6,999	6,657	6,986	7,125		B
	CO_2 emissions	FY1990	-16%	-15%	-18%	-17%	-18%	-18%	-18%	-22%	-19%	-17%	-34%	
Japan Passengerboat Association	CO_2 emissions	kt CO_2	3,613	3,656	3,509	3,479	3,424	3,356	3,377	3,215	3,363	3,433		E
	CO_2 emission intensity	FY2012	-1%	-2%	-6%	-6%	-10%	-9%	-11%	-19%	-19%	-14%	—	
Japan Federation of Hire-Taxi Associations	CO_2 emissions	kt CO_2	3,383	3,254	3,100	2,861	2,729	2,527	2,270	1,280	1,263	1,426		A
	CO_2 emissions	FY2010	-12%	-15%	-19%	-25%	-29%	-34%	-41%	-67%	-67%	-63%	-25%	
Nihon Bus Association	CO_2 emissions	kt CO_2	3,757	3,732	3,664	3,590	3,480	3,410	3,640	2,460	2,388	2,780		C
	CO_2 emission intensity	FY2015	—	—	—	-0%	-4%	-0%	-0%	+16%	+9%	+9%	-6%	
Japan Private Railway Association	CO_2 emissions	kt CO_2	2,860	2,740	2,610	2,560	2,460	2,280	2,160	2,050	1,816	1,800		B
	CO_2 emissions	FY2013	—	+6%	+0%	-1%	-5%	-12%	-17%	-21%	-30%	-31%	-46%	
East Japan Railway Company	CO_2 emissions	kt CO_2	2,150	2,230	2,160	2,180	2,120	2,060	1,990	1,940	1,826	1,840		B
	CO_2 emissions	FY2013	—	+4%	+0%	+1%	-1%	-4%	-7%	-10%	-15%	-14%	-50%	
West Japan Railway Company	CO_2 emissions	kt CO_2	1,855	1,817	1,772	1,717	1,640	1,602	1,518	1,388	1,525	1,492		B
	CO_2 emissions	FY2013	—	-15%	-18%	-20%	-24%	-25%	-29%	-35%	-29%	-31%	-50%	

Type of industry	Upper row：CO_2 emissions Middle and lower rows：Target indicators	Base year/BAU	Actual performance										Target Level	Progress in the emission reductions
			2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2030	
Central Japan Railway Company	CO_2 emissions	kt CO_2	1,192	1,169	1,150	1,137	1,095	1,035	1,019	933	1,241	1,285		B
	CO_2 emissions	FY2013	—	-29%	-30%	-31%	-32%	-35%	-38%	-39%	-26%	-23%	-46%	
The Japan Harbor Transportation Association	CO_2 emissions	kt CO_2	390	384	377	378	377	373	365	332	347	336		B
	CO_2 emission intensity	FY2005	-10%	-11%	-10%	-11%	-14%	-15%	-15%	-15%	-15%	-18%	-20%	
Japan Freight Railway Company	CO_2 emissions	kt CO_2	649	623	601	563	551	455	490	471	453	449		B
	Energy consumption intensity	FY2013	—	-2%	-4%	-7%	-8%	-11%	-4%	+1%	-0%	-1%	-15%	
Kyushu Railway Company	CO_2 emissions	kt CO_2	442	430	410	394	379	343	327	303	252	293		B
	CO_2 emissions	FY2013	—	-0%	-6%	-18%	-25%	-30%	-47%	-49%	-47%	-38%	-50%	
Hokkaido Railway Company	CO_2 emissions	kt CO_2	321	314	305	308	305	310	321	315	306	311		B
	Energy consumption intensity	FY2013	—	-0%	-1%	-4%	-6%	-6%	-7%	-8%	-6%	-6%	-7%	
All Japan Freight Forwarders Association	CO_2 emissions	kt CO_2	129	129	127	125	123	123	120	110	109	109		B
	CO_2 emissions	FY2009	-3%	-3%	-5%	-6%	-8%	-8%	-10%	-18%	-18%	-18%	-20%	
Shikoku Railway Company	CO_2 emissions	kt CO_2	80	77	77	76	74	69	69	66	64	68		B
	CO_2 emissions	FY2013	—	-4%	-4%	-5%	-7%	-14%	-14%	-18%	-20%	-15%	-30%	
Energy Conversion Sector														
Industry under Ministry of Economy, Trade and Industry														
The Electric Power Council for a Low Carbon Society	CO_2 emissions	kt CO_2	493,000	469,000	441,000	430,000	411,000	372,000	345,000	329,000	326,000	327,000		B
	CO_2 emissions	BAU	—	-38%	-41%	-56%	-61%	-77%	-85%	-96%	-88%	-104%	-11 $MtCO_2$	
	CO_2 emission intensity	—	—	+121%	+112%	+106%	+98%	+85%	+78%	+76%	+74%	+75%	About 0.25kg-CO_2/kWh	
Petroleum Association of Japan	CO_2 emissions	kt CO_2	40,326	38,233	38,335	38,443	38,083	36,824	34,463	30,392	31,743	32,323		B
	CO_2 emissions	FY2013	—	-5%	-5%	-5%	-6%	-9%	-15%	-25%	-21%	-20%	-28%	
The Japan Gas Association	CO_2 emissions	kt CO_2	456	476	445	459	454	426	398	400	401	387		B
	CO_2 emission intensity	FY2013	—	+2%	-3%	-6%	-6%	-7%	-10%	-9%	-10%	-11%	-28%	

Type of industry	Upper row：CO_2 emissions Middle and lower rows：Target indicators	Base year/BAU	Actual performance										Target Level	Progress in the emission reductions
			2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2030	

<Assessment of Progress towards target level for FY 2030>
The meanings of A through E of the “Progress in the emission reductions“ section are as follows:
A: Performance in FY 2022 already exceeded the FY2030 target level
B: Performance in FY 2022 exceeded the level of reference year/BAU, but fell below the FY 2030 target level
C: Performance in FY 2022 fell below the FY 2030 target level and increased compared to the reference year/BAU
D: Data not compiled (newly established / change in target levels / revisions to calculation methodology / etc.)
E: Target not set

(2) Promotion of decarbonization in corporate management

Since the adoption of the Paris Agreement and along with the expansion of ESG finance, the number of Japanese companies which have recognize climate change as a management issue and are engaging in decarbonization management to decarbonize their businesses is increasing. For example, the number of Japanese companies that support the Task Force on Climate-related Financial Disclosures (TCFD) and those that set medium- and long-term targets, such as Science Based Targets (SBT[41]) and RE100, is among the highest in the world.

The government will provide technical advice to companies on information disclosure, setting of emission reduction targets and planning, etc. in order to further promote decarbonization management while considering trends in the financial aspects, including ESG finance. In calculating and reducing emissions, the calculation and reduction of emissions throughout the supply chain are promoted. The regional support system for the decarbonization of small and medium enterprises will also be strengthened. Furthermore, promoting the visualization of GHG emissions during the life cycle of products and services will establish an enabling environment in which consumers can evaluate decarbonization management.

(3) Promotion of the introduction of facilities and equipment with high energy-saving performance

In accordance with the Energy Conservation Act, thorough energy management and the introduction of energy-efficient facilities and equipment will be promoted in order to improve energy intensity.

In addition, based on the periodic reports submitted in accordance with the Energy Conservation Act, the energy-saving status of businesses will be assessed, and stagnant businesses will be given intensive guidance and advice, while excellent businesses will be publicized and praised.

In addition, the benchmarking system, which sets high-energy conservation targets by industry and area and requires the achievement of those targets, will be expanded to cover more areas, and the target values will be revised to encourage further energy conservation efforts by the business.

(a) Promotion of the introduction of facilities and equipment with high energy-saving performance (across industries)

In the industry sector, the introduction of energy-efficient facilities and equipment will be promoted for major energy-consuming equipment used in a wide range of industries, including air conditioning, lighting, hot water supply, industrial furnaces, boilers, and cogeneration equipment.

(b) Promotion of the introduction of facilities and equipment with high energy-saving performance (iron and steel industry)

As part of the introduction of the latest technologies, the efficiency of power-consuming equipment, waste heat recovery equipment, power generation equipment, and coke ovens will be further improved, and the use of waste plastics and other materials that can be used as a substitute for coal in coke ovens

[41] An initiative that requires companies to set greenhouse gas emission reduction targets consistent with the levels required by the Paris Agreement (which aims to limit global temperature increase to well below 2°C above pre-industrial levels and 1.5°C below preindustrial levels).

will be expanded.

In addition to the existing technologies, innovative technologies will be developed for significant energy conservation and low carbon emission in the steelmaking process with the aim of putting these technologies into practical use by around 2030.

(c) Promotion of the introduction of facilities and equipment with high energy-saving performance (chemical industry)

CO_2 emissions will be reduced by promoting the development and introduction of new innovative energy-saving technologies, as well as promoting the recovery of an emitted energy and the rationalization of processes according to the characteristics of each process.

(d) Promotion of the introduction of facilities and equipment with high energy-saving performance (cement and ceramic industry)

Energy consumption in the cement manufacturing process by introducing equipment that can use thermal and electrical energy with high efficiency and by promoting the use of waste as a substitute for thermal energy. In addition, through the practical application and introduction of advanced process technology, energy conservation will be achieved in the cement and glass manufacturing processes while ensuring the same quality as conventional products.

(e) Promotion of the introduction of facilities and equipment with high energy-saving performance (pulp, paper, and paper product industry)

In the used paper pulping process, the introduction of pulpers that can more efficiently mix used paper and water and dissociate the used paper than conventional types will be supported with the aim of reducing operational energy consumption.

(f) Promotion of the introduction of facilities and equipment with high energy-saving performance (construction work and use of special vehicles)

In the short term, the goal is to reduce CO_2 emissions by promoting the use of construction equipment with excellent fuel efficiency. In the long term, a certification system for innovative construction machinery (electric, hydrogen, biomass, etc.) based on a radical conversion from the light oil-fueled power source will be established, and its introduction and widespread use will be promoted in order to achieve carbon neutrality. In addition, by promoting i-Construction and other such measures as the spread of construction using the information and communication technology (ICT) among small and medium-sized construction companies that carry out construction work for local governments, efficiency and labor saving in construction and maintenance will be further improved to cope with the declining number of skilled workers.

(g) Promotion of the introduction of facilities and equipment with high energy-saving performance (greenhouse horticulture, agricultural machinery, and fisheries)

As a measure to reduce GHG emissions from greenhouse horticulture, the development and dissemination of efficient and low-cost energy utilization technologies (heat pumps, woody biomass

heating equipment, etc.) in horticulture will be promoted. In addition, low CO_2 emissions in agricultural machinery and energy conservation on fishing vessels will be promoted, such as efficiency improvement through the introduction of LED fishing lights and energy-saving outboard engines. Another target is to establish technologies related to the electrification and hydrogenation of agricultural and forestry machinery and fishing vessels by 2040.

(4) Promotion of energy conservation initiatives through inter-industry collaboration

Further energy conservation can be achieved through cooperation between multiple factories and businesses, such as energy sharing among multiple factories and businesses, including the use of unused heat disposed of at factories without being used. Thus, through the use of the coordinated energy efficiency and conservation planning system based on the Energy Conservation Act and other support measures, energy efficiency and conservation initiatives through such cooperation between multiple operators will be promoted.

(5) Electrification and Fuel Conversion

(a) Promotion of fuel conversion

In conjunction with efforts to decarbonize power sources, electrification in final energy consumption has the potential to reduce fossil fuel consumption in such industrial processes as heating and drying processes, although it is more difficult to apply in some sectors and processes. By increasing the controllability of the process, it is expected to not only reduce energy consumption but also provide added value to the production process, such as low-volume, high-mix production, and automation. In addition, the implementation of the demand response will be promoted to shift demand by operating electricity-intensive production processes in a flexible manner. Initiatives toward electrification will be deepened with a focus on medium- to low-temperature heat.

Examples of fuel conversion include boilers with excellent environmental compatibility, industrial furnaces with excellent energy efficiency, natural gas cogeneration that achieves high-energy savings through combined heat and power supply, fuel cells, and gas air conditioning that mitigates peaks in grid power supply and demand. Fuel conversion in high-temperature industrial heat, which is difficult to electrify and hydrogenate, will be promoted.

(6) Implementation of thorough energy management

(a) Implementation of thorough energy management using FEMS

In the industry sector, energy management is already advanced to some extent due to energy management obligations under the Energy Conservation Act. Further energy and CO_2 reductions can be achieved by visualizing energy consumption and promoting energy-saving efforts based on objective data through the promotion of the introduction of factory energy management systems (FEMS) using the IoT.

(7) Promotion of emissions reductions measures for small and medium businesses

To strengthen energy conservation and emission reduction measures in small- and medium-scale businesses,

measures will be implemented, such as publicity to raise awareness toward energy efficiency and conservation, reduction of energy consumption through energy efficiency diagnoses, implementation of detailed training courses for those in charge of energy management in companies, horizontal development of best practices for energy efficiency and conservation measures, etc. Support will be provided to introduce emission reduction equipment to small and medium-sized businesses with a focus on reducing emission intensity.

In addition, a platform to provide detailed support for energy conservation efforts by small and medium-sized businesses in a given region will be established through collaboration among regional organizations, financial institutions, chambers of commerce and industry, local governments, etc. This platform will cover a wide range of activities, from identifying small and medium-sized businesses engaged in energy conservation to following up on their efforts, including operational improvements and capital investment.

(8) Creation of role models in factories and offices

The packaged support covers the formulation of ambitious CO_2 reduction plans for factories and offices based on their CO_2 reduction potentials and the installation of advanced equipment, electrification, fuel conversion, and operational improvements under the plans. Excellent examples will be published to be implemented horizontally.

2.3 Commercial sector

(1) Improvement of the energy efficiency of buildings

Looking at achieving carbon neutrality in 2050, the goal for buildings in 2030 is to ensure that new buildings have energy-saving performance at the level of the ZEB[42] standard[43] by making maximum use of currently available technical and economical technologies.

In order to strengthen energy efficiency and conservation measures in buildings, the Act on the Improvement of Energy Consumption Performance of Buildings (Law No. 53 of 2015, hereinafter referred to as the "Building Energy Efficiency Act") was revised in 2022 to make it mandatory, by FY 2025, for small buildings to conform to the Energy Efficiency Standard to which they are currently not obligated to conform. In addition, with the aim of securing ZEB standard level energy efficiency for new buildings built in FY 2030 and later, guiding standards will be raised in a consistent manner, and Energy Efficiency Standard levels will be raised in stages by no later than FY 2030.

At the same time, the Top Runner Program for equipment and building materials will be strengthened to improve the performance of equipment and building materials installed in buildings and to promote their widespread use. In doing so, from the perspective of ensuring resilience, the energy-saving performance of water heaters and other equipment will be improved, keeping in mind that equipment that uses diverse energy sources is necessary.

In addition, not only regulations but also proactive initiatives at public buildings will be strengthened, and

[42] ZEB (Net Zero Energy Building): A building in which energy consumption is further reduced through the introduction of renewable energy etc. after achieving energy conservation of 50% or more. In addition, buildings that are expected to save 30% to 40% or more of energy and introduce technologies that are not currently evaluated in energy conservation calculation programs based on the Building Energy Conservation Law, although the energy conservation effects are expected to be achieved, are defined as "ZEB" (reduction of 75% to 100%), 3) ZEB Ready (no introduction of renewable energy), and (4) ZEB Oriented is defined as a building of 10,000 m^2 or more.

[43] Reduction of primary energy consumption, excluding renewable energy, by 30% or 40% (20% for small buildings) from the current energy conservation standard value, depending on the use.

support for ZEB demonstrations and further expansion will be provided. Furthermore, energy conservation measures, including support for renovation and reconstruction of existing buildings and energy conservation performance labeling, will be promoted.

(2) Promotion of the introduction of facilities and equipment with high energy-saving performance

(a) Promotion of high-efficiency energy-saving equipment

The development of energy conservation technologies is further accelerated while further promoting the spread of high-efficiency energy conservation devices in order to further improve the efficiency of individual devices and systems.

In order to achieve 100% diffusion of high-efficiency lighting, such as LEDs in stock by 2030, the Top Runner Program for lighting fixtures and bulbs was revised in FY 2019, and incandescent bulbs were newly added to the Top Runner Program. Further diffusion of high-efficient lighting will be promoted by requiring businesses to comply with the Top Runner Standard. In addition, the installation of energy-efficient commercial water heaters, such as heat pump water heaters and latent heat recovery water heaters, will be promoted.

Furthermore, the energy efficiency of refrigeration and air-conditioning equipment will be improved by improving refrigerant management technology etc.

Also, information will be disseminated through leading decarbonization technologies (LD-Tech) and other Instruments.

(b) Improvement of energy efficiency of equipment through Top Runner Programs

The Top Runner Program based on the Energy Conservation Act was established in FY 1998, and the number of target equipment has been gradually expanded, covering 29 energy consumption equipment types as of FY 2020. In order to further improve the efficiency of individual equipment in the future, studies will be conducted to review the standards for target equipment for which the target year has been reached.

(3) Greening of digital equipment and industry

Regarding the utilization of power semiconductors and next-generation semiconductors, research and development will be promoted for the commercialization of ultra-efficient next-generation power semiconductors (GaN, SiC, Ga_2O_3, etc.). Also, capital investment support will be provided for the necessary parts of the semiconductor supply chain in order to promote their introduction, thereby accelerating the commercialization and expansion of next-generation power semiconductors with energy savings of 50% or more by 2030. In addition, research, development, and demonstrations will be carried out to improve the energy efficiency of data centers and to improve the energy efficiency of the entire system by improving the efficiency of software development and processing. In the meantime, the energy efficiency of all new data centers will be improved by 30% or more, and part of the electricity used at data centers in Japan will be switched to renewable energies by 2030 by supporting capital investment to expand the manufacturing of energy-saving semiconductors and switching the electricity used at data centers in Japan to renewable energy. In addition to steadily implementing these initiatives, the necessary systems to realize carbon neutrality will be examined, such as the system to promote energy conservation and CO_2 emission

reductions that cover electrical machinery and information and telecommunications industries where electricity consumption is increasing.

(4) Implementation of thorough energy management

(a) Implementation of thorough energy management through the use of BEMS and Energy Conservation diagnosis

In order to promote thorough energy saving and CO_2 reductions throughout buildings, a building energy management system (BEMS) that displays the energy usage status and supports the optimal operation of lighting, air conditioning, and other equipment and facilities will be installed in about half of all buildings by 2030. In addition, more efficient energy management in buildings will be promoted by utilizing energy use data obtained from BEMS.

In addition, GHG emissions will be reduced by promoting eco-tuning, which involves appropriate operational improvements to equipment and systems while ensuring comfort and productivity in buildings.

Based on the results of visualization of energy consumption and energy conservation diagnosis, comprehensive services related to energy conservation will be provided. Also, the introduction of energy-saving equipment and facilities using businesses that warrant energy conservation effects (ESCO: Energy Service Company) and downsizing (optimization of equipment and facilities) will be promoted.

(5) Promotion of sector coupling of electricity, heat, and mobility

Considering that solar power generation systems generate electricity intensively during a certain time period, EVs, heat pump water heaters, fuel cells, cogeneration, etc. that provide demand-side flexibility will be introduced depending on the local characteristics. Also, the use of energy management systems (HEMS and BEMS) and ICT in homes and buildings will be promoted to adjust supply and demand in line with the amount of solar power generated (sector coupling of electricity, heat, and mobility).

In addition, while utilizing local renewable energy, the use of EV car sharing and the installation of EV/battery stations with replaceable batteries will be promoted to improve the demand/supply adjustment function at the local level and decarbonize local transportation.

(6) Promotion of local production for local consumption and areal use of energy

(a) Promotion of local production for local consumption and areal use of energy

Local energy production for local consumption and energy use of energy is desirable from the perspective of climate change x disaster prevention, which effectively links climate change measures with disaster prevention and mitigation measures since such as measures lead to efficient energy use, regional revitalization, and reduced risk of power outages etc. in the event of a disaster. In order to utilize a combination of renewable energy and distributed energy resources, such as storage batteries and cogeneration in a region, the expectation is to construct a regional micro-grid using existing grid lines and a self-supporting and distributed energy system using self-owned lines and heat pipes etc. Seizing opportunities for urban development etc., the formulation of plans and the introduction of equipment and systems for the construction of such a system will be supported, and the facilitation of

coordination among local governments and other related parties will be promoted. In addition, to promote true local production for local consumption, which contributes to strengthening regional resilience and revitalizing regional economies, honor will be given to outstanding businesses that coexist with the region and contribute to the construction of regional industrial infrastructure to encourage such activities.

(7) Other policies and measures

(a) Decarbonization of urban areas through the improvement of the thermal environment by heat island control

Utilizing the knowledge gained from observations, surveys, and research on the heat island phenomenon, especially in urban areas, heat island-related measures will be comprehensively developed, such as the reduction of artificial heat emissions, improvement of ground surface cover, improvement of urban structures, improvement of lifestyles, and adaptation measures to reduce the impact on human health, including heat stroke, thereby promoting urban decarbonization through thermal environment improvements.

Urban CO_2 emissions will be reduced by decreasing anthropogenic heat emissions, such as air-conditioning equipment systems and vehicles, through the promotion of the use of higher efficiency energy-consuming equipment, low-carbon buildings and facilities, technological development and the spread of next-generation vehicles, promotion of measures on traffic flows, and promotion of the use of unused energy.

In addition, from the perspective of reducing evapotranspiration and preventing/improving high temperatures on the ground surface by an artificial ground surface cover, the ground surface cover of the entire region will be improved by securing green spaces through the development of urban parks, greening of public spaces and government facilities, greening of building sites through the use of greening area systems, and preservation of privately owned green areas and agricultural land.

Furthermore, while preserving green spaces in cities, the urban structure will be improved through the formation of water and green networks and the promotion of multiple nature-type river creations from the perspective of securing green spaces and wind paths from the water surface.

In addition, the promotion of national movement called Decokatsu, including Cool Biz, will encourage people to modify their lifestyles and achieve appropriate air-conditioning temperatures. Also, local governments and businesses are encouraged to implement heat stroke countermeasures and other adaptive measures according to the characteristics of their regions, city blocks, and businesses.

(b) Introduction of energy conservation and renewable energy in water supply and sewage (promotion of energy conservation and renewable energy measures in waterworks)

(c) Introduction of energy conservation and renewable energy in water supply and sewage systems (promotion of energy conservation and energy creation measures in sewage systems)

In waterworks, energy conservation will be promoted through the introduction of energy-saving and high-efficiency equipment, the introduction of energy-conservation facilities, such as inverter-controlled pumps, and the wide-area expansion, consolidation, and reallocation of facilities, as well as the introduction of renewable energy power generation facilities, such as small-scale hydroelectric and solar power generation.

In addition, as a long-term initiative, the potential for water supply facilities to contribute to the adjustment of electricity supply and demand will be pursued.

In sewage systems, the sophistication and efficiency of facility management will be promoted through digital transformation (DX), as well as the introduction of energy-saving equipment and renewable energy sources, such as solar power and sewage heat. Also, energy creation initiatives that effectively use sewage biomass, such as power generation from sewage sludge-derived solid fuel and digestion gas, will be promoted.

(d) Initiatives in waste treatment

While promoting the 3Rs + Renewable, which contributes to the reduction of GHG emissions, the 5th Fundamental Plan for Establishing a Sound Material-Cycle Society (hereinafter referred to as "the 5th Fundamental Plan") was formulated in August 2024 based on the Basic Framework Act for energy recovery, such as waste power generation and production of waste fuels at waste treatment facilities, will be further promoted. GHG emissions generated by vehicles during waste collection and transportation will be reduced through the introduction of energy conservation measures at waste treatment and recycling facilities and EV waste collection vehicles.

(e) Systematic promotion of measures for inter-ministerial cooperation

In order to more reliably achieve the FY 2030 reduction targets in the commercial and other sectors, such as thorough promotion of energy conservation, the introduction of renewable energy, and energy conservation in buildings, the cooperation of relevant government agencies will be systematically promoted to more effectively and efficiently implement efforts in all areas.

2.4 Residential sector

(1) Improvement of energy efficiency of housing

Looking at achieving carbon neutrality in 2050, the goal for housing in 2030 is to ensure[44] that new housing has energy-saving performance at the level of the ZEH[45] standard by making maximum use of currently available technological and economical technologies.

In order to strengthen energy efficiency and conservation measures in housing, the Building Energy Efficiency Act was revised in 2022 to make it mandatory, by FY 2025, for homes to conform to the Energy Efficiency Standard to which they are currently not obligated to conform. In addition, with the aim of securing ZEH standard level energy efficiency for new homes built in FY 2030 and later, guiding standards and Residential Housing Top Runner standards will be raised in a consistent manner, and Energy Efficiency Standard levels will be raised in stages by no later than FY 2030.

At the same time, the Top Runner Program for equipment and building materials will be strengthened in order to improve the performance of equipment and building materials installed in homes and to promote

[44] Compliance with enhanced envelope standards and a 20% reduction in primary energy consumption, excluding renewable energy, from the current energy conservation standard values.

[45] ZEH (Net Zero Energy House): A house that has achieved energy conservation of 20% or more and further reduced energy consumption by introducing renewable energy etc. is defined as (1) ZEH (reduction of 100% or more), (2) Nearly ZEH (reduction of 75% to less than 100%), or (3) ZEH Oriented (no introduction of renewable energy), depending on the reduction amount (75% to less than 100% reduction), and (3) ZEH Oriented (no introduction of renewable energy), depending on the amount of reduction.

their widespread use. In doing so, from the viewpoint of ensuring resilience, the energy-saving performance of water heaters and other equipment will be improved, keeping in mind that equipment that uses diverse energy sources is necessary. Moreover, in order to promote the spread of window products with high thermal insulation performance, the ideal performance labeling system that can communicate the thermal insulation performance of window products to consumers in an easy-to-understand manner will be considered.

In addition, not only regulations will be strengthened but also support will be provided for the demonstration of ZEH and further expansion of its use. Furthermore, comprehensive energy conservation measures will be promoted, including support for renovation and reconstruction of existing houses, development and dissemination of building materials and construction methods that are easily applicable to renovation with excellent energy conservation performance, and promoting energy conservation performance labeling when houses are sold or leased.

(2) Promotion of the introduction of facilities and equipment with high energy-saving performance

(a) Diffusion of high-efficiency energy-saving equipment (household sector)

(b) Diffusion of high-efficiency energy-saving equipment (household sector) (energy-saving septic tanks)

To further promote the development of energy-saving technologies to further improve the efficiency of individual devices and systems, as well as to promote the spread of high-efficiency energy-saving equipment.

In order to achieve 100% diffusion of high-efficiency lighting, such as LEDs in the stock by 2030, the Top Runner Program for lighting fixtures and light bulbs was revised in FY 2019, making incandescent light bulbs newly subject to the Top Runner Program, in addition to fluorescent lamps and LED lamps. The Top Runner standards for water heaters, including heat-pump water heaters and latent heat recovery water heaters, were also revised, and the target level was raised, among others. Japan will continue to encourage the further spread of high-efficiency lighting and energy-efficient water heaters by requiring businesses to comply with the Top Runner standards.

Fuel cells for residential use are a distributed energy source that can achieve a total energy efficiency of up to 90% or more by producing hydrogen from city gas or LP gas, generating electricity through a chemical reaction with oxygen in the air, and effectively using the heat generated during power generation. Japan aims to further introduce hydrogen fuel cells, including pure hydrogen fuel cells, in the future.

With regard to septic tanks, the spread of advanced energy-saving household septic tanks and the introduction of medium- and large-sized septic tanks with high energy-saving performance by guiding energy-saving measures will be promoted in support of the installation of septic tanks.

The related information will be disseminated through LD-Tech and other Instruments.

(c) Improvement of energy efficiency performance of equipment through Top Runner Programs (household sector)

(3) Implementation of thorough energy management

(a) Implementation of thorough energy management through the use of HEMS, smart meters, and smart home devices and the provision of energy-saving information

In order to promote energy saving and CO_2 reductions in the entire house, home energy management systems (HEMS) and smart home devices that display energy usage status and support optimal operation of air conditioning, lighting, and other equipment will be spread almost widely by 2030. In addition, the introduction of smart meters that can measure electricity consumption at home in more detail than before and promote the visualization of electricity consumption through linkage with HEMS and other means will be promoted. Furthermore, by utilizing energy consumption data obtained from HEMS, more efficient energy management in homes will be promoted. Also, based on the Energy Conservation Act, energy retailers will be asked to provide information that contributes to energy conservation by general consumers, thereby encouraging further energy conservation efforts in the home.

Based on the results of visualization of energy consumption through these efforts, the introduction of energy-saving equipment and facilities using ESCOs will be promoted.

(4) Other policies and measures

(a) Systematic promotion of inter-ministerial cooperation

In order to more reliably achieve the emission reduction targets for FY 2030 in the household sector, such as thorough promotion of energy conservation, the introduction of renewable energy, and improvement of energy efficiency in housing, the cooperation of relevant government agencies will be systematically promoted to more effectively and efficiently implement efforts in all areas.

2.5 Transport sector

(1) Measures concerning vehicles

(a) Diffusion of next-generation vehicles, improvement of fuel efficiency, etc.

The spread and expansion of next-generation vehicles (electric vehicles [EVs], fuel cell vehicles [FCVs], plug-in hybrid electric vehicles [PHEVs], hybrid vehicles [HVs], etc.) that excel in energy efficiency will be promoted. To this end, comprehensive measures will be taken to expand the introduction of electric vehicles and infrastructure and to strengthen technologies, supply chains, and value chains related to electric vehicles, such as batteries. For those vehicles that are currently in the early stages of introduction and face such issues as high costs, support measures that include subsidy programs and preferential tax treatment will be provided. Through these efforts, Japan aims to increase the share of next-generation vehicles in new passenger car sales from 50% to 70% by 2030 and to increase the share of electric vehicles (EVs, FCVs, PHEVs, and HVs) in new passenger car sales to 100% by 2035.

In addition, Japan aims to spread of electric vehicles by studying the placement of EV charging facilities on roads by supporting research on in-transit power supply technology and promoting the development of information signs on trunk roads in areas with few EV charging facilities.

To further expand the introduction of FCVs, support will be provided for the strategic development of hydrogen stations and the development and introduction of stations with large-scale filling capacity. In addition, technologies to reduce station-related costs will be developed.

In March 2020, new fuel efficiency standards for passenger cars were established for the target fiscal year of FY 2030, including EVs and PHEVs, based on the Well to Wheel evaluation. Toward achieving carbon neutrality in the future, both regulatory methods and incentive measures are necessary to be used, and technology-neutral fuel efficiency regulations and a combination of all technologies will be used to effectively reduce CO_2 emissions.

To this end, the government will encourage automobile manufacturers etc. to improve the fuel efficiency of new vehicles through the achievement of new fuel efficiency standards. In doing so, enforcement for compliance with fuel efficiency standards by reviewing the operation of recommendations and announcements will be strengthened. Furthermore, taxation measures etc. will be reviewed as necessary to further promote fuel efficiency improvement. Technological development and social implementation of cellulose nanofibers, modified lignin, etc., which are expected to improve fuel efficiency by reducing the weight of automobile components, will be promoted.

Biofuels[46] are carbon-neutral fuels made from plants, waste, and other materials, and efforts for their appropriate supply will be promoted.

(2) Measures for road traffic flow

(a) Implementation of measures for road traffic flow

(b) Promotion of the installation of LED road lighting

(c) Promotion of intelligent transport system (ITS) (centralized control of traffic lights)

(d) Maintenance of traffic safety facilities (improvement and profile (hybrid) of traffic lights)

(e) Maintenance of traffic safety facilities (promotion of the use of LED lights in signal lights))

(f) Promotion of automated driving

While recognizing the possibility that so-called induced and diverted traffic may occur as a result of road construction, the following measures will be implemented: the strengthening of arterial road networks, including ring roads that will contribute to reducing CO_2 emissions; specific countermeasures on bottlenecks of traffic congestion using big data such as ETC2.0; study of the introduction of a planar congestion management system using ICT, AI, etc.; further energy savings and upgrading of road lighting; and installation of LED road lighting. In addition, studies will be conducted to promote the use of renewable energy sources, such as solar power generation, for the electricity required for road management, with the aim of nationwide deployment.

Other measures include the following: promotion of intelligent transport systems (ITS), such as centralized control of traffic lights; improvement of traffic lights, such as profiling; improvement of traffic safety facilities, etc. that promote sustainable and green traffic, such as LED traffic signal lights; promotion of autonomous driving; and measures for road traffic flow that contribute to reductions in CO_2 emissions.

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[46] There are generally three types of biofuels.
(1) Bioethanol: Biofuels as an alternative to gasoline. The main raw materials are agricultural crops such as corn and sugarcane, woody cellulose, waste, etc.
(2) Biodiesel: Biofuels as an alternative to diesel. The main raw materials are palm oil, waste cooking oil, rapeseed oil, etc.
(3) Biojet: Biofuel as an alternative to jet fuel (kerosene). The main raw materials are woody cellulose, microalgae, waste cooking oil, etc.

(3) Greening of vehicle transportation business by promoting the use of environmentally friendly vehicles etc.

(a) Greening of the vehicle transportation business by promoting the use of environmentally friendly vehicles etc.

To promote eco-driving of commercial vehicles, such as trucks, buses, and cabs, the Eco-Drive Management System (EMS) will be disseminated and promoted among transportation companies etc. In addition, publicity centered on the Eco-driving Promotion Liaison Committee of the four relevant ministries and agencies will be used to promote the spread of eco-driving.

Also, the spread of the Green Management Certification System, which certifies transportation companies that implement excellent environmental initiatives, such as improved fuel efficiency, will be promoted.

(4) Promotion of the use of public transportation and bicycles

(a) Promotion of the use of public transportation

(b) Promotion of the use of bicycles

In order to decarbonize the public transportation sector and create an environment that facilitates mobility without relying solely on private cars, the use of public transportation services will be promoted in cooperation with community development while further improving their convenience through the following measures: promotion of the development of light rail transit (LRT[47]), bus rapid transit (BRT[48]), and other low-carbon transportation systems; support for the construction of regional public transportation plans by local governments; support for the social implementation of Mobility as a Service (MaaS[49]), promotion of compact plus networks; reorganization of regional transportation networks; promotion of barrier-free transportation; and strengthening of connections between various transport modes (modal connections) through public-private partnerships, such as through the development of transport nodes, including station squares and bus stations.

In addition, in order to promote the use of bicycles, in coordination with safety assurance measures, the environment that encourages the use of bicycles will be created, including support for the formulation of bicycle utilization promotion plans by local governments, development of bicycle traffic space networks, development of bicycle parking facilities, and promotion of shared bicycle use.

In addition, the environmental load will be reduced through reductions in automobile traffic and other measures by promoting proactive efforts by businesses, including commuter traffic management, and by promoting efforts to encourage behavioral changes in the public, including how they use their cars on daily life. The government will continue to promote the use of public transportation and the active use of bicycles in government activities.

An environment that facilitates mobility without relying solely on private cars will also be created in order to realize environmentally sustainable transport (EST).

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[47] A next-generation tram system that is friendly to people and the environment and has excellent features in terms of ease of boarding and alighting, punctuality, speed, transportation capacity, comfort, etc. by improving the running space, vehicle performance, etc.

[48] Bus rapid transit system utilizing dedicated lanes, etc.

[49] A service that uses a smartphone application etc., to provide an optimal combination of multiple public transportation and other transportation services to meet the trip-by-trip transportation needs of each local resident or traveler, including search, reservation, payment, etc., all at one time.

(5) Measures for railways, ships, and aviation

(a) Decarbonization of the railways

In the railways sector, energy-efficient railway vehicles and advanced energy-saving equipment, such as lightweight railway vehicles and railway vehicles equipped with variable voltage variable frequency control (VVVF) equipment,[50] have been introduced and will continuously be promoted further introduction. The development of fuel-cell railway vehicles fueled by hydrogen will also be promoted. At the same time, photovoltaic power generation using rail and track facilities will also be introduced.

(b) Decarbonization of the shipping sector

In the shipping sector, Japan accelerates demonstration and introduction of methanol-fueled ships, LNG-fueled ships, hydrogen-fueled ships, and battery propulsion ships in addition to promoting spread of energy-saving and low CO_2 emission ships through Coastal Ship Energy Efficiency Rating System etc. Furthermore, Japan also aims to start commercial operation of ammonia- and hydrogen-fueled ships early.

(c) Decarbonization of the aviation sector

In order to decarbonize the aviation sector, the following initiatives will be promoted: (1) promotion of the introduction of sustainable aviation fuel (SAF), (2) improvement of flight operation by renovating air navigation service, (3) the introduction of new technologies in aircraft and equipment, and (4) reduction of CO_2 emissions from airport facilities and airport vehicles. Also, measures to turn airports into renewable energy hubs will be examined and initiated, and public-private partnerships will be promoted.

(6) Promotion of decarbonized logistics systems

(a) Efficiency improvement of truck transportation and the promotion of joint transportation and delivery (Efficiency improvement of truck transportation)

(b) Efficiency improvement of truck transportation and the promotion of joint transportation and delivery (Promotion of joint transportation and delivery)

Initiatives, such as consolidated collection and delivery, will be promoted through cooperation between shippers requesting deliveries and logistics operators undertaking deliveries. Initiatives to mitigate global warming will also be promoted by improving transport and loading efficiency while greening the entire logistics system.

Therefore, energy management will continuously be promoted by shippers and carriers in accordance with the Energy Conservation Act. Also, based on the Act on the Advancement of Integration and Streamlining of Distribution Business (Act No. 85 of 2005), measures will be implemented to streamline transport, such as the establishment of truck sales offices at distribution facilities for storage, cargo handling, and distribution processing, and the introduction of truck reservation reception systems to consolidate and rationalize delivery networks. At the same time, the decarbonization of logistics will be promoted by providing support for operations that provide truck transport with no waiting time, further promotion of modal shifts, and the promotion of consolidated transport and delivery initiatives in

[50] A vehicle equipped with a mechanism that efficiently controls the speed of the motor without using electrical resistance.

depopulated areas and cities. Furthermore, the Green Logistics Partnership Conference[51] will carry out the following activities in cooperation with shippers, logistics companies, and other related parties: modal shifts, efficient truck transportation, and other initiatives to reduce the environmental impact of the logistics sector, improve logistics productivity, and create a sustainable logistics system. Awards will be given to companies that have made outstanding achievements in the construction of green logistics to motivate them to take independent initiatives and to promote the spread and expansion of green logistics. Responding to the growing needs of shippers, consumers, and others for the decarbonization of logistics services, initiatives will be promoted to utilize electric vehicles, such as for the electrification of intra-regional transportation and delivery and the development and dissemination of fuel cell trucks for long-distance transportation. In addition, in order to facilitate cooperation between shippers, logistics companies, and other related parties, the effectiveness of each initiative will be objectively evaluated using a unified method (guidelines) for calculating CO_2 emissions in the logistics sector that can be commonly used by both parties.

In addition, the rapid development of electronic commerce (EC) in recent years has led to an annual increase in the number of parcel deliveries handled, while the redelivery rate has just decreased to about 10% partly because of an increase in the home delivery rate caused by the COVID-19 pandemic. The redelivery rate needs to be reduced continuously. Still, besides the perspective of increasing CO_2 emissions and the growing shortage of drivers, it is also necessary to promote noncontact and non-face-to-face methods of delivery to avoid the spread of COVID-19. Thus, efforts to reduce redelivery will be promoted, such as the use of delivery boxes, diversification of parcel receiving methods, such as receiving at stations and convenience stores, and the spread and improved operation of left-behind delivery systems. Delivery efficiency will also be improved using tools, such as drones and automatic delivery robots. Especially in depopulated areas, demonstration projects will be conducted for the social implementation of drone delivery. The possibility of using a delivery method with less environmental impact will be verified through the dissemination of the *Guidelines for Delivery of Packages by Drones Ver. 3.0* (March 31, 2022, formulated by the Cabinet Secretariat, and the Ministry of Land, Infrastructure, Transport and Tourism) to ensure its implementation in society in the near future.

In addition, the efficiency of logistics will be improved by promoting the spread of double-articulated trucks and other measures. Efficiency will also be enhanced by strengthening access to expressways, including direct connections to private facilities, supporting operation management using ETC2.0, and speeding up administrative procedures for passage of oversize and overweight vehicles through promoting the use of a new passage system.

(c) Promotion of a modal shift to marine transportation and rail freight transportation (Promotion of a modal shift to marine transportation)

(d) Promotion of a modal shift to marine transportation and rail freight transportation (Promotion of a modal shift to rail freight transportation)

In order to promote the greening of the entire logistics system, the shift from automobile transportation to transportation by coastal shipping or rail, which emit less CO_2, will be promoted.

As part of this initiative, in order to increase the competitiveness of coastal shipping that takes on

[51] The organization is composed of member companies and organizations from shipper companies, logistics companies, government, and other related fields, and is operated with the cooperation of the Ministry of Economy, Trade and Industry, the Ministry of Land, Infrastructure, Transport and Tourism, and related organizations in order to promote voluntary efforts by the industry toward green logistics.

transport, transportation cost reduction, and service improvement will be promoted through the development of domestic trade terminals for intermodal transportation while spreading and promoting energy-efficient coastal vessels. Furthermore, a modal shift to coastal shipping will be promoted through the introduction of trailers that can be detached from truck cabs and the use of the Eco-Ship Mark.

Similarly, in order to increase the competitiveness of freight transportation by rail, transportation capacity will be increased, and transportation quality will be improved by devising new timetable settings and by enhancing transportation equipment, such as block trains and temperature-controlled freight trains. In addition, modal shifts will be promoted by introducing new technologies that contribute to better efficiency and labor savings and safety improvement at freight stations, enhancing BCP for container platform expansion in preparation for alternative transportation in preparation for disasters etc., and improving the convenience of freight railway by promoting the Eco Rail Mark etc.

The introduction of automated equipment and systems that utilize AI, IoT, and other digital technologies through collaboration among related businesses will also be promoted to improve transportation efficiency and energy conservation throughout the supply chain.

In addition, further efficiency improvements will be promoted in truck transportation. In doing so, the conversion from private trucks to commercial trucks and the use of larger vehicles and trailers, such as large CNG[52] trucks, will be promoted. Loading efficiency will also be improved by eliminating congestion and securing return cargo.

(e) Promotion of decarbonization of logistics facilities

The spread of zero-energy models for warehouses will be promoted by supporting projects that simultaneously introduce renewable energy equipment, such as solar power generation facilities, and equipment that contributes to unmanned and laborsaving operations, such as unmanned forklifts and carriers, in facilities, such as sales warehouses, which are the core of logistics operations. The decarbonization of logistics facilities will also be promoted by converting to energy-efficient natural refrigerant equipment in refrigerated and frozen warehouses.

(f) Initiatives at ports and harbors (Reduction of the distance of land transportation of cargo through optimal selection of ports and harbors)

(g) Initiatives at ports and harbors (comprehensive decarbonization of ports and harbors)

Ports and harbors are international logistics hubs through which 99.6% of Japan's imports and exports are routed. They are also industrial centers where many of Japan's industries, including power generation, steel, and chemicals, which account for about 60%[53] of the country's CO_2 emissions, are located. In such ports and harbors, Carbon Neutral Port (CNP) initiative, which includes upgrading port functions for decarbonization and improving the receiving environment for hydrogen, etc. is established to contribute to achieve 2050 carbon neutral.

Specific initiatives include the following: alleviation of traffic congestion in front of container gates through the establishment of a digital logistics system; promotion of the introduction of onshore power

[52] Compressed Natural Gas

[53] Energy conversion sector (power plants, refineries, etc.), steel and chemical industries (including petroleum and coal products) The ratio of total energy-derived CO_2 emissions (before electricity and heat allocation) from the energy conversion sector (including oil and coal products) to Japan's CO_2 emissions (FY 2019 results).

supply facilities for ships at berth; introduction of low-carbon and zero-carbon cargo-handling equipment etc.; introduction of stand-alone hydrogen power generation, including from the perspective of maintaining the necessary functions during disasters and responding to power shortages; development of fuel supply systems for hydrogen, ammonia, and other fuels for fuel vessels; promotion of the introduction of renewable energy sources, such as offshore wind and solar power; conservation, restoration, and creation of the Blue Infrastructure (seaweed beds, tidal flats, etc. and bio-symbiotic port structures) and the promotion of Blue Carbon-derived carbon credit system in order to promote the use of Blue Carbon.

Also, by promoting the development of international marine container terminals, international logistics terminals, and domestic logistics bases that can handle intermodal transportation, marine transportation to the nearest port will be enabled, reducing the travel distance for truck transportation.

Other initiatives include the following: promotion of modal shift and transportation efficiency improvement by utilizing marine transportation related to venous logistics, creation of port green areas that contribute to CO_2 removals, and examination of the development of technologies to reduce CO_2 emissions at ports and harbors.

(7) Other policies and measures

(a) Systematic promotion of measures for inter-ministerial cooperation

(b) Utilization of the Special Zones for Structural Reform system related to global warming countermeasures

In order to more reliably achieve the 2030 emission reduction targets in the transport sector, including the decarbonization of each transport mode and the promotion of modal shifts, the relevant ministries and agencies will systematically promote cooperation and implement initiatives in all areas in a more effective and efficient manner. In addition, initiatives that take advantage of special regulatory measures under the Special Zones for Structural Reform system etc., will be promoted.

3 Industrial processes and product use (IPPU) sector

3.1 Expansion of the use of blended cement (CO_2)

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

In addition, the use of mixed cement will be promoted by taking the lead in the use of mixed cement in public works projects conducted by the government through the proactive use of mixed cement based on the Act on the Promotion of Procurement of Eco-Friendly Goods and Services by the State and Other Entities (2000, Act No. 100, hereinafter referred to as "Act on Green Purchasing").

3.2 Fluorinated gases: (HFCs, PFCs, SF_6, NF_3)

(1) Promotion of non-fluorocarbons and low GWP products

In order to reduce the environmental burden caused by fluorocarbons, gas manufacturers etc. (manufacturers and importers of fluorocarbons) are encouraged to implement such measures as the

substitution of fluorocarbons with non-fluorocarbons alternatives and recycling, including lowering the GWP of fluorocarbons that they handle and reducing their production volume etc.

In response to the Kigali Amendment, gas manufacturers are requested to systematically reduce the amount of fluorocarbons they manufacture based on the outlook for the use of fluorocarbons established by the government in accordance with the Act on Rational Use and Proper Management of Fluorocarbons.

The following measures are implemented to promote the accelerated and steady shift to non-fluorocarbons and low-GWP refrigeration and air-conditioning equipment and other fluorocarbons-using products, taking into consideration that the equipment to be introduced will continue to be used for a certain period of time and considering future technological development and market trends in Japan and overseas.

- In accordance with the Act on Rational Use and Proper Management of Fluorocarbons, the designated product system, which requires manufacturers and importers to achieve a certain standard value in a certain target year for each appropriate product category, was developed. Regarding the system, the use of non-fluorocarbons and low GWP products will be promoted as early as possible by an active operation of the system by adding new products and revising target values.
- To raise awareness of the global warming potential effect of fluorocarbons and to educate users and consumers about the introduction of non-fluorocarbons and low GWP products, the labeling of products that use fluorocarbons will be improved in a way that is easy for them to understand.
- In addition to institutional measures, measures will be implemented to encourage product technology development by manufacturers and new technology introduction by users to promote the penetration of energy-saving equipment using natural refrigerants, to train technicians to install and maintain equipment compatible with new alternative refrigerants, to ensure the quality of these service providers, and to raise public awareness.

(2) Preventing leakage of fluorocarbons from the use of refrigeration and air-conditioning equipment for business use waste

Based on the Act on Rational Use and Proper Management of Fluorocarbons, the prevention of leakage of fluorocarbons from commercial refrigeration and air conditioning equipment during use will be achieved through the promotion of the equipment management standard compliance including equipment inspections, implementation of the accounting and reporting system for fluorocarbons leakage, and promotion of compliance with proper filling of refrigerants in cooperation with prefectures. In addition, applicable IoT and digital technologies due to the technological advancement will be considered for introduction into regulations and standards, such as equipment inspections.

To prevent refrigerant leakage of refrigeration and air-conditioning equipment during use, not only product manufacturers and equipment users but also equipment service technicians should be the policy targets. The efforts to improve the technical level of equipment maintenance and management for early leakage detection and to secure and train personnel with expertise in the practical management of refrigeration and air-conditioning equipment will be promoted.

(3) Recovery of fluorocarbons from commercial refrigeration and air-conditioning equipment waste

The recovery and proper disposal of fluorocarbons from refrigeration and air-conditioning equipment have been promoted through robust enforcement of the Act on Rational Use and Proper Management of

Fluorocarbons, the Act on Recycling of End-of-Life Automobiles, and the Act on Recycling of Specified Kinds of Home Appliances.

In particular, HFC emissions from the commercial refrigeration and air-conditioning equipment (excluding car air conditioners) account for approximately 70% of HFC emissions from the from refrigeration and air-conditioning equipment in total. Aiming the fluorocarbons recovery rate to be improved continuously, an institutionalized system that enables equipment disposers, dismantlers, waste management and recycling operators, fluorocarbons filling and recovery operators, and others to check each other has been thoroughly implemented in cooperation with prefectures under the Act on Rational Use and Proper Management of Fluorocarbons.

In addition, technical experiment on the refrigerant recovery from the equipment is conducted to increase the recovery rate per unit and further improve the recovery rate in total.

(4) Recovery and proper disposal of fluorocarbons from waste household air conditioners

With regard to fluorocarbons contained in waste household air conditioners, the recovery rate of waste household air conditioners will be improved, thereby promoting the collection and proper disposal of fluorocarbons by steadily enforcing the Act on Recycling of Specified Kinds of Home Appliances and spreading awareness of the Act.

(5) Promotion of voluntary initiatives by industry

The industry's voluntary action plans related to fluorocarbons are evaluated and verified. Also, measures will be implemented to support businesses' efforts to reduce emissions, such as subsidies for the introduction of equipment that contributes to emission reductions.

4 Agriculture sector

4.1 Reduction of methane emissions in paddy fields

CH_4 emissions generated from rice cultivation (paddy fields) will be reduced by promoting the prolonged mid-season drainage period, which reduces CH_4 emissions as part of rice paddy water management based on the actual conditions of the region.

4.2 Reduction of nitrous oxide associated with fertilization

N_2O emissions generated by fertilizer application will be reduced by reducing the amount of fertilizer applied, using a divided application, and using slow-release fertilizers.

5 Land use, land use change and forestry (LULUCF) sector

5.1 Policies and measures for forest carbon sinks

Forests, which cover about 70% of Japan's land, play multiple roles in land and watershed conservation while simultaneously sequestering CO_2 from the atmosphere, contributing to the prevention of global warming as a

sink for greenhouse gases. Wood also contributes to the reduction of CO_2 emissions not only by storing carbon sequestered by forests but also as a material that consumes relatively little energy during manufacturing and other processes and as an energy source by replacing fossil fuels.

In order to achieve the goals of the *Basic Plan for Forests and Forestry* (approved by the Cabinet on June 15, 2021) regarding the fulfillment of the multifunctional role of forests and the supply and use of forest products, appropriate management and conservation of forests, and the utilization of wood will be promoted. Through these efforts, Japan aims to secure and enhance removals in forests over the mid to long term, and thereby contribute to achieving the GHG emissions reduction target for FY 2030 (the target for removals by forest is approximately 38 million t CO_2 [approximately 2.7% of total GHG emissions in FY 2013]), and further to achieving net zero by 2050. To this end, in addition to efforts such as appropriate thinning, sustainable and cyclic use of planted forests –a cycle of harvesting, utilizing, re-planting and tending– will be established to increase wood use and ensure the creation of young, fast-growing forests including by planting elite trees. The following measures, including cross-sectoral ones, will be comprehensively implemented with the cooperation of all actors, including local authorities, forest owners, private enterprises, and the public.

(1) Maintenance of healthy forests

- Promotion of diverse forest management, including by appropriate thinning, reforestation after harvesting, development of multi-layered forests, and long rotation forest management.
- Promotion of additional thinning and reforestation, including through further promotion of municipal efforts based on the Act on Special Measures concerning the Promotion of Forest Thinning (Act No. 32 of 2008).
- Promotion of forest management by public entities, utilizing the private forest management entrustment system and the Forest Environment Transfer Tax based on the Private Forest Management Entrustment Act (Act No. 35 of 2018).
- Development of forestry road systems by appropriately combining forest roads and forestry operation roads while also taking into consideration the preservation of the natural environment.
- Promotion of the development of mixed conifer-broadleaf forests through harvesting and introducing broadleaf trees depending on natural conditions.
- Promotion of reforestation through labor-saving and low-cost silviculture practices, including by using drones and forestry machinery to transport saplings, leveraging integrated harvesting and reforestation operations, low-density planting, and the use of elite trees and large saplings to reduce the frequency of weeding.
- Efficient development and expansion of seed and seedling production of elite trees with excellent growth, and promotion of countermeasures against damage by wild birds and animals.
- Securing reforestation through proper implementation of regulations, such as the logging and reforestation notification system.
- Restocking of unforested and unplanted areas in upstream watersheds. and rehabilitation of devastated satoyama forests.

(2) Promotion of appropriate management and conservation of protection forests, natural parks, and other areas.

- Appropriate operation of regulations under the protection forest system, planned designation of protection forests, appropriate conservation and management under the forest protection system in

national forests, and promotion of measures to conserve and restore natural vegetation collaboratively including with NPOs.

- Systematic implementation of forest conservation projects in areas vulnerable to mountain disasters and in devastated forests.
- Prevention of forest pests and diseases, as well as the damage caused by animals and implementation of forest fire prevention measures.
- Expansion of nature parks and nature conservation areas and proper operation of regulations and strengthening of conservation management within these areas.

(3) Fostering efficient and stable forestry management

- Securing long-term sustainable forestry management by clarifying forest ownership and boundaries, consolidating forest operations, promoting long-term outsourcing of operations, establishing management rights under the private forest management entrustment system, promotion of forest management projects by forest owners' cooperatives, and formulation of forest management plans.
- Promotion of new forestry initiatives through the reduction of silviculture cost as well as the labor saving and lightening of forestry work through the development and diffusion of remotely and automatically operated machinery.
- Development of forest resource information using laser scanning surveys, sharing and advanced use of forest-related information, including those on forest owners, and streamlining of timber production, distribution, and management using ICT.
- Introduction and efficient use of operation systems that properly combines forest road network development and high-performance forestry machinery, and implementation of initiatives based on the Forestry Innovation Program for On-site Implementation (formulated by the Ministry of Agriculture, Forestry and Fisheries in December 2019, and updated in July 2022).
- Promotion of initiatives to train and secure forestry workers.

(4) Promotion of peoples' participation in forest management

- Promotion of public participation in forest management activities through nationwide greening events such as the National Tree-Planting Festival.
- Support for forest management and conservation activities, such as tree planting by a wide range of entities, including companies and NPOs, and support for forest creation activities by companies etc., and promotion of green fundraising activities
- Improvement of skills of and safety systems for forest volunteers and others.
- Promotion of forest environment education
- Promotion of forest conservation and management and use of forest resources through cooperation among local residents, forest owners, and others
- Creation and promotion of forest service industries that comprehensively utilize forest spaces.
- Promotion of ecosystem maintenance and restoration projects related to deer and other animals and green worker projects for the conservation of forest ecosystems in national parks and other areas.
- Cultivation of public awareness of the fact that people's lives are supported by the rich forests, countryside, rivers, and oceans

(5) Promotion of the use of wood and woody biomass

- Promotion of the use of locally distributed wood for housing and construction.
- Further promotion of wood use in urban areas through the construction of wooden public buildings and medium- and large-scale buildings as well as the development and dissemination of products and technologies, such as cross-laminated timber (CLT) and fire-resistant wood materials under the Act for the Promotion of the Use of Wood in Buildings to Contribute to the Realization of a Decarbonized Society. (Act No. 36 of 2010, hereinafter referred to as "Wood Use Promotion Act")
- Development, practical application, and dissemination of new wood-based materials such as glycol lignin that can replace fossil-based plastics, and cellulose nanofibers.
- Establishment of a stable supply system for domestic wood to meet demand, including the development of efficient wood processing and distribution facilities
- Promotion of power generation and heat utilization through the establishment of efficient and low-cost collection and transportation systems for woody biomass in a manner that guarantees the sustainable use of forest resources.
- Promotion of initiatives, to foster public understanding toward wood use and lead to ESG investment in companies that engage in sustainable use of woods that include the announcement of the meaning and benefits of wood use, wood promotion campaigns and wood education to encourage the use of wood.

5.2 Policies and measures to increase carbon removals in agricultural soils

It has been confirmed that carbon sequestration in cropland and grassland soils in Japan can be increased through the continuous application of organic matter, such as compost and green manure to the soil as part of soil preparation and the application of biochar. Thus, promoting these contributes to carbon sequestration in cropland and grassland soils.

5.3 Promotion of urban greening

Urban greening is the most familiar sink measure for people in their daily lives. Its promotion is not only effective as an actual sink measure but also has a great effect on spreading awareness of the concept of global warming countermeasures.

Therefore, in accordance with the *Green Policy Guidelines* (decided by the Ministry of Construction on July 28, 1994), the *Green Basic Plan* formulated by municipalities and other comprehensive plans for the conservation and creation of greenery by the national and local governments, the following initiatives will be actively promoted: the development of urban parks; greening of roads, rivers and erosion control structures, ports and harbors, sewage treatment facilities, public rental housing, and government facilities; and creation of new green spaces on the rooftops of buildings.

As part of this initiative, the meaning and benefits of urban greening will be widely publicized to all sectors of the public. At the same time, support will be actively provided to create new green areas, such as in urban areas using a variety of different means, and entities, such as urban greening, through the participation of a variety of entities, including citizens, businesses, and NPOs, and the use of a citizen greening certification system and multistory urban park system.

In addition, the development of a system for reporting and verifying the removals by urban greening etc., will

continue to be systematically promoted.

5.4 Initiatives related to blue carbon and other sinks

Blue carbon refers to CO_2-derived carbon that is absorbed and fixed by coastal and marine ecosystems, and its sinks include seaweed beds and tidal flats in shallow waters. The calculation method of greenhouse gas removals and fixation by blue carbon has not been finalized, except for some parts. Thus, relevant research will be carried out so that these calculation methods can be established, and they can be added to the IPCC guidelines for national greenhouse gas inventories. At the same time, effective seaweed bed and tidal flat conservation, creation, and restoration will be promoted. In addition, the creation of new industries based on marine resources will be promoted through the development and innovation of new materials, such as functional foods and biomass plastics made from aquatic plants.

Research and development related to technology to increase CO_2 removal efficiency and accelerate the growth of algae (algae production process technology) and technology for breeding to increase the tolerance of algae will be promoted. Through this, a large-scale demonstration will be conducted, and the cost will be reduced from the current range of 1,600 yen per liter to 100 yen per liter, which is equivalent to the cost of existing products, by around 2030 ahead of other countries to achieve practical application.

The capacity of healthy ecosystems will be increased to absorb CO_2 by promoting the conservation and restoration of forests, grasslands, peatlands, and other wetlands, soils, coastal areas, and other ecosystems that fix a substantial amount of carbon. Appropriate bird and animal management will be promoted, including damage control and population management, in order to reduce damage caused by birds and animals that have a significant impact on forests and other ecosystems and to help ensure removals by healthy ecosystems. Furthermore, to increase the adaptive capacity of ecosystems to climate change, stresses other than climate change (e.g., development, environmental pollution, overuse, and invasion of non-native species) will be reduced in conjunction with the formation of ecosystem networks, which are pathways for organisms to move and disperse.

In addition, green infrastructure that utilizes the diverse functions of the natural environment and ecosystem-based approaches, such as forests (EbA[54] and Eco-DRR[55]), can be used for disaster prevention and mitigation. A variety of benefits can also be expected, including mitigation of climate change through carbon storage; effective use of aboveground resources in satochi-satoyama; creation of diverse social, economic, and cultural reciprocity in local communities; and contribution to biodiversity conservation and sustainable use. These efforts, more comprehensively referred to as nature-based solutions (NbS), will be promoted in conjunction with the establishment of protected areas and other areas conducive to biodiversity conservation, as needed.

For CO_2-absorbing concrete, the aim is to achieve the same price as existing concrete (30 yen per kg) in 2030 as a cost target by expanding sales channels through public procurement. Thus, CO_2-absorbing concrete will be registered in the Ministry of Land, Infrastructure, Transport and Tourism's database on new technologies (NETIS) and will be widely publicized to local governments. Another aim is to expand public procurement by national and local governments by introducing the system at the 2025 Japan International Expo and other events.

[54] Ecosystem-based Adaptation

[55] Ecosystem-based Disaster Risk Reduction

6 Waste sector

6.1 Diffusion of biomass plastics

CO_2 emissions from incineration of waste plastics (CO_2 derived from petroleum-based carbon in waste plastics) will be reduced by replacing petroleum-based plastics through the promotion of the use of plastics made from biomass.

6.2 Reduction of waste incineration

The 3R + Renewable activities will be promoted to achieve the target set forth in the *Fifth Fundamental Plan for Establishing a Sound Material-Cycle Society* under the Basic Act on Establishing a Sound Material-Cycle Society and the waste reduction target based on the Waste Management and Public Cleansing Act. Also, the incineration of petroleum-based waste, such as waste plastic and waste oil, will be reduced under the *Fifth Fundamental Plan for Establishing a Sound Material-Cycle Society*. Specific actions to reduce CO_2 emissions from waste incineration include the enforcement of separate collection at municipalities and introduction of a charge for refuse, implementation of measures in accordance with the *Act on the Promotion of Resource Circulation related to Plastics* (Act No. 60 of 2021) and individual recycling acts, reduction of the generation of waste through such measures as the recycling of waste oil, and promotion of recycling and reuse.

6.3 Reduction of final waste disposal

The 3R + Renewable activities will be promoted to achieve the target set forth in the *Fifth Fundamental Plan for Establishing a Sound Material-Cycle Society* under the Basic Framework Act and the waste reduction target based on the Waste Management and Public Cleansing Act. Also, specific studies will be conducted under the *Fifth Fundamental Plan*. Specific measures to reduce CH_4 emissions from landfilling waste include reevaluation of the disposal method by municipalities, thorough waste sorting, and strengthening the disposal system, which will directly reduce the landfilling of organic waste, such as food waste.

6.4 Adoption of semi-aerobic landfill structures in final waste disposal sites

A semi-aerobic landfill structure will be adopted when installing a final waste disposal site. This will reduce CH_4 emissions from the biological decomposition of organic waste, such as landfilled food waste, compared to an anaerobic landfill structure.

6.5 Advancement of incineration at sewage sludge incineration facilities

N_2O emissions from the incineration of sewage sludge will be reduced by advancing combustion at sewage sludge incineration facilities and promoting incinerators and sewage sludge solid fuel conversion facilities that emit less N_2O.

6.6 Reduction in the amount of municipal waste incineration

The 3R + Renewable activities will be promoted to achieve the target set forth in the *Fifth Fundamental Plan*

under the Basic Framework Act and the waste reduction target based on the Waste Management Act. Also, under the *Fifth Fundamental Plan*, the amount of waste incinerated at general waste incineration plants will be reduced. Also, N_2O emissions from waste incineration will be reduced by increasing the upgraded combustion at general waste incineration plants through the conversion to full continuous feed incinerators due to the wide-area waste disposal and by increasing the proportion of waste treated by continuous operation at general waste incineration plants.

7 Cross-cutting measures

7.1 Cross-cutting measures to achieve the target

(1) Realization of Green Transformation (GX)

In order to fulfill our international commitments and simultaneously enhance Japan's industrial competitiveness and economic growth, Japan will realize and implement the *Pro-Growth Carbon Pricing Concept* to achieve a Green Transformation (GX) investment of more than 150 trillion yen over the next 10 years through public-private partnership (Please refer to the website for *The Basic Policy for the Realization of GX,* https://www.cas.go.jp/jp/seisaku/gx_jikkou_kaigi/pdf/kihon_en.pdf).

Since it is necessary for the government to enhance the predictability in the private sector by providing public support over a long period of time and multiple fiscal years, the government establishes and utilizes a new GX Economic Transition Bonds, delivering bold upfront investment support on the scale of 20 trillion yen. The investment promotion measures will be implemented in tandem with regulatory and institutional measures to effectively create new markets and demand. In this regard, the bond targets investments in areas where it is truly difficult for the private sector alone to make investment decisions and where investments will contribute to the enhancement of industrial competitiveness, economic growth, and emission reductions.

In addition, carbon pricing will not be introduced immediately but rather after providing businesses with enough time to focus on GX. Together with a deferral of implementation of carbon pricing, announcing in advance the policy to set low initial prices and gradually raising them can attract more early-stage GX investment. By taking these measures, the government aims to harness the feature of carbon pricing and provide incentives for businesses to start investing in GX at an early stage.

These methods, combined with early-stage investment of 20 trillion yen by the government and the utilization of new financial instruments, will target over 150 trillion yen of GX investment through public-private partnerships.

(2) Dissemination of DECOKATSU (a national movement to create new and affluent lifestyles towards decarbonization)

To achieve the 2050 carbon neutrality and 2030 reduction goals, a new national movement called Decokatsu[56] has been launched to encourage a transformation in the behavior and lifestyle of citizens and consumers. It proposes a vision of citizens' future lives covering all aspects of daily life, such as clothing,

[56] Decokatsu is an acronym for the national movement to create a new enriched lifestyle leading to decarbonization, combining the words "Decarbonization" (DE) for reducing carbon dioxide (CO_2) , "Eco" for environmentally friendly activities and living, and "-Katsu", the Japanese word for activity and lifestyle.

food, housing, transportation, and shopping, aiming for Newly Prosperous Lifestyles toward Decarbonized Society in 10 years. This initiative is being carried out in collaboration with businesses, local governments, and organizations to create a carbon-neutral and enriched lifestyle for citizens.

Decokatsu proposes a vision of citizens' future lives covering all aspects of daily life, such as clothing, food, housing, transportation, and shopping, aiming for Newly Prosperous Lifestyles toward Decarbonized Society in 10 years. Collaborating with local governments, businesses, and organizations that have joined the public-private partnership council (Decokatsu Support Team) established simultaneously with the start of Decokatsu, efforts are being made to support citizens in creating enriched lives. This will promote lifestyle changes, stimulate new consumption and behaviors both domestically and internationally, and generate demand for products and services.

Another specific initiative of Decokatsu is to disseminate information registered by businesses, local governments, and through a newly launched website（https://ondankataisaku.env.go.jp/decokatsu/en/）to support citizens in the following four aspects:

1. Support diverse and comfortable ways of working and living using digital tools (telework, regional relocation, workation, etc.).
2. Provide and propose products and services that lead to decarbonization and a new enriched lifestyle.
3. Support behavior change through incentives and effective information dissemination (awareness raising, reinforcement, and consumer input).
4. Propose and support region-specific ways of living (based on climate, culture, etc.).

Additionally, efforts to enrich and improve the citizens' lives have been determined through a total of 13 actions:

1. "Start Here": four actions in line with De-Co-Ka-Tsu
2. Three actions for "CO_2 reduction on your own"
3. Six actions for "Everyone's in this together"

Encouraging and supporting individual Deco-katsu practices in daily life, the government will promote these actions.

Furthermore, to promote Decokatsu, the government calls on organizations (including businesses and local governments) and individuals to make a Decokatsu Declaration. The government also requests that daily Decokatsu efforts be shared on social media using the hashtag #Decokatsu (in Japanese) to spread the movement.

In this way, various opportunities are being seized to promote Decokatsu as a demand-side measure toward achieving the 2050 carbon neutrality and 2030 reduction goals.

(3) Activation of the J-Credit scheme

(a) Activation of the J-Credit scheme

The J-credit scheme,[57] recognized as a reliable and high-quality credit system, is necessary for achieving net zero by 2050. In 2023, the carbon credit market was opened, and trading started on the

[57] https://japancredit.go.jp/english/

Tokyo Stock Exchange, credit transactions are expected to expand. While ensuring its continuity as a system even after FY 2030, in order to continue to actively promote measures to reduce emissions by introducing energy-saving equipment and utilizing renewable energy by various domestic actors, as well as removal measures through appropriate forest management, the J-credit scheme will be further activated to certify credits that can be used for carbon offsets and for increasing the added value of goods and services.

Specifically, in order to promote the generation of carbon removal credits that is increasingly important to achieve GHG net zero, Japan intends to scale up the generation of forest-based credits through forest management activities by encouraging forest owners and managers to use the system and by reviewing to streamline the monitoring process which is also supported by digital MRV systems.

Additionally, in order to promote the conversion to the credit of the environmental value generated by the introduction of energy-saving and renewable energy devices for individuals and small and medium-sized enterprises, the use of subsidized projects will be further promoted by the national government, as well as the integration of different small and medium-sized enterprises adopting energy-saving equipment and individual greenhouse gas reduction activities into large projects led by manufacturers of energy-saving equipment, leasing companies, and trading companies will also be promoted. Furthermore, its supply will be increased while at the same time ensuring quality by considering the creation of credits using new technologies like hydrogen, ammonia, and CCUS/carbon recycling. In addition to expanding the supply side this way, demand will also be expanded through the use of offsets by companies and central and local governments. Specifically, Japan will consider the utilization of the J-Credit for Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) and will expand demand for the credit in collaboration with local governments aiming to realize Zero Carbon Cities and a Circular and Ecological Economy. At the same time, while promoting the revision of certification targets within a range that ensures the reliability of the system, including methodology and new formulations, in consideration of technological development and the business environment, improvement of the system's environment will be considered by promoting digitalization to ensure convenience, cooperating with similar systems like non-fossil certificates and increasing activities to publicize the system. Furthermore, a framework for encouraging market-based voluntary transactions aimed at reducing carbon values will be considered.

(4) Joint Crediting Mechanism (JCM)

(a) Promotion of the Joint Crediting Mechanism (JCM)

Reducing emissions and increasing removals through the diffusion of leading decarbonization technologies with a deep understanding of the needs of partner countries can help the transition to a decarbonized society and contribute to the creation of a virtuous cycle of the economy and the environment not only for partner countries but also for Japan.

For this reason, Japan establishes and implements the Joint Crediting Mechanism (JCM) in order to quantitatively evaluate contributions of Japan to greenhouse gas emission reductions and removals that are achieved through the diffusion of, among others, leading decarbonizing technologies, products, systems, services, and infrastructures as well as through the implementation of measures in developing countries and others, and in order to use such contributions to achieve Japan's NDC. By doing so, through public-private collaborations, Japan aims to secure accumulated emission reductions and removals at the level of approximately 100 Mt CO_2 by FY 2030. Japan will appropriately count the acquired credits to achieve its NDC.

Japan continues to properly operate the measurement, reporting, and verification (MRV) of the registration and credit issuance of JCM projects and promotes the system by improving intercity and regional cooperation, strengthening business-led international expansion with funding from different sources, including the private sector, and diversifying and scaling-up projects to contribute to decarbonization in a multisided approach. Additionally, Japan also supports the creation of projects and offers technical verification support, including in cooperation with related Japanese and international organizations like the New Energy and Industrial Technology Development Organization (NEDO), Japan International Cooperation Agency (JICA), Japan Bank for International Cooperation (JBIC), Nippon Export and Investment Insurance (NEXI), Asian Development Bank (ADB), World Bank (WB), United Nations Industrial Development Organization (UNIDO), the Japan International Research Center for Agriculture, Forestry and Fisheries (JIRCAS), and others. Furthermore, in order to implement the JCM in Japan consistent with the Paris Agreement and related decisions, JCM-related bilateral documents and the rules and guidelines adopted by the Joint Committee established and based on the above documents, Japan established a JCM Promotion and Utilization Council at the Ministry in charge of JCM implementation. The JCM Promotion and Utilization Council carries out duties relating to the authorization of JCM credits as a Party to the Paris Agreement, the determination of a method to apply a corresponding adjustment to prevent double counting, and the revision of the Guidelines for the Implementation of the JCM.

(5) Creation of urban/regional structures and socioeconomic systems contributing to decarbonization

Since urban and regional structures and transportation systems will continue to affect CO_2 emissions over the medium to long term through variations in traffic volume and work floor area, it will become necessary to move away from conventional diffusion-type urban development and promote urban and regional development that contributes to decarbonization by compacting cities and rebuilding public transportation networks (compact plus network), creating people-centered downtowns, and improving the efficiency of the city's energy system.

In order to do this, Japan will promote measures and projects based on the Comprehensive Urban and Regional Transportation Strategy and create spaces that are comfortable and walkable by combining pleasant stay enhancement zones with the Improved Pedestrian Convenience Road System (*Hokomichi*) and urban compacting based on location optimization planning and low carbon city planning. With regard to the decarbonization of each area in the city, Japan will also strongly promote smart-city type social development, as well as comprehensive efforts, including privately funded ones, like urban regeneration efforts through regional energy use, the conservation and creation of green spaces, as well as the upkeep of city parks that remove greenhouse gases, the utilization of digital technology, and support for environmentally conscious and high-quality private sector urban development projects. Japan will also promote the introduction of renewable energy in city parks.

As for local government action plans and regional climate change adaptation plans, Japan will proceed with such efforts in coordination with location optimization planning, low-carbon city planning, agricultural promotion area development plans, and other policies. Additionally, Japan will enhance systems for enabling the development of facilities that contribute to the local production and local consumption of renewable energy utilizing land of unknown owners. Japan will also promote the use of public transportation in coordination with land usage policies and consider optimizing the floor area of stores and commercial premises. As for existing infrastructure like public facilities, including water and sewage treatment facilities, waste processing facilities, transportation infrastructure, and energy

infrastructure, Japan will enhance their energy-saving efficiency while turning them into regional energy centers and, at the same time, expanding and consolidating them, extending their life cycle, and improving their disaster prevention features. On top of that, Japan will promote the social implementation of green infrastructure that makes the best use of the diverse characteristics of the natural environment through public-private partnerships and cross-sectoral collaboration.

Moreover, Japan will promote the development of leading-edge, low-carbon cities and regions, including initiatives to build cities that can serve as models for the environmentally conscious cities of the future, as well as cross-expand the knowledge and know-how gained through them, which will lead to nationwide expansion.

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(a) Decarbonization initiatives in national parks

In national parks and hot spring areas with full respect for the natural environment, Japan will create a virtuous cycle of nature conservation and usage by enhancing the attractiveness and resilience of the region through the creation of sustainable tourist destinations that aim to decarbonize the demand side, such as the generation of heat and power using hot springs, the decarbonization of mobility, the introduction of renewable energy equipment, and the introduction of energy-saving equipment for self-consumption to be used in accommodation and visitor facilities.

(b) Initiatives for the effective utilization of distributed energy resources

To promote the use of distributed energy resources, it is necessary to further facilitate the activities of aggregators who can bundle a variety of distributed resources like storage batteries, renewable energies, fuel cells, and cogeneration and appropriately trade them in the market. In addition to reducing demand (negative demand response) from large consumers like factories, which currently represent the main business of aggregators, Japan will improve the market environment so that distributed energy resources can be prized as adjustment power and supply power in the supply and demand adjustment market and the wholesale electricity market. Additionally, with an eye on the FIP system, Japan will promote verification of renewable energy aggregation businesses, avoid output control, and promote efforts to alleviate grid congestion by shifting power demand (positive demand response) using distributed resources.

Additionally, storage batteries, which play a particularly important role among distributed energy resources, present the problem that the cost of the power storage system remains high compared to other countries. In order to further reduce costs, measures like setting a target price of 70,000 yen/kWh for household power storage systems and 60,000 yen/kWh for commercial and industrial power storage systems for FY 2030, a price at which investments can be recovered from profits obtained from power storage systems and using it as a price target for the introduction support provided by the government in consideration of the fact that the number of used in-vehicle storage batteries is expected to increase in the future, as well as promoting the reuse of stationary storage batteries with high safety and performance reliability in order to reduce the burden on the environment, are expected to stimulate price reductions and promote widespread use.

(c) Promotion of regional decarbonization

Based on the *Plan for Global Warming Countermeasures* and the *Regional Decarbonization Roadmap*, the relevant ministries and agencies work together in all sectors to mobilize all decarbonization-based measures in order for a decarbonization domino effect of implementation to occur in which regional decarbonization spreads from areas with high willingness and feasibility to other areas. To this end, the government actively supports regional initiatives in terms of human resources, information and technology, and finance. For example, at least 100 "Decarbonization Leading Areas" are to be selected by FY 2025 and realized by FY 2030, which will achieve net zero CO_2 emissions from electricity consumption in the residential sector and commercial sector, and a sufficient reduction in other GHG emissions relative to Japan's FY 2030 emission reduction target. As of the end of August 2024, 73 proposals have been selected and implemented. In addition, 148 local governments were selected as of the end of August 2024 for the Priority Measures Acceleration Project in which local governments will implement a combined effort over multiple years to promote roof top solar power generation, ZEB/ZEH, EVs, and other priority measures throughout Japan. The Regional Decarbonization Transition/Renewable Energy Promotion Subsidy was established to provide continuous and comprehensive support over multiple years to local governments and businesses implementing such ambitious initiatives. Moreover, Japan Green Investment Corporation for Carbon Neutrality was established under the Act on the Promotion of Global Warming Countermeasures to attract more private investment by providing funds (risk money) for various decarbonization projects. As of the end of August 2024, 27 support projects have been decided and announced. (For details, please see the website (Japanese only), https://policies.env.go.jp/policy/roadmap/)

7.2 Other relevant cross-sectoral measures

(1) Realization of a hydrogen society

With an eye to future carbon neutrality, hydrogen can be expected to make many important contributions, like reducing to zero the emissions of power sources, decarbonizing the transportation and industrial sectors, helping in the production of synthetic fuels and synthetic methane, and stimulating a more efficient use of renewable energies. Its role is expected to expand even further in the future.

In order to achieve a hydrogen society in which hydrogen is universally used in daily life and in industrial activities, it is necessary to reduce the supply cost of hydrogen and create demand across different fields in an integrated manner. To this end, we aim to reduce the hydrogen supply cost to 30 yen/Nm^3 (CIF price[58]) by 2030 and to 20 yen/Nm^3 or less by 2050.

In order to reliably guarantee a vast and inexpensive hydrogen supply over the long term, it is important to simultaneously promote the use of hydrogen produced overseas and establish a hydrogen production base that uses domestic resources. Therefore, with the aim of commercializing hydrogen production by 2030, thanks to an international hydrogen supply chain and water electrolysis equipment using surplus renewable energies and other energies, Japan will support increases in the size of transportation and supply facilities, including hydrogen carriers, as well as developing technology for the upsizing and modularization of water electrolysis equipment.

In order to increase hydrogen demand, it will be necessary to accelerate initiatives in each area where hydrogen is expected to play a role. In the transportation sector, in addition to supporting the introduction

[58] CIF (Cost, Insurance and Freight) price: the sum of the freight cost, freight charges and freight insurance premiums

of FCVs and enhancing the strategic development of hydrogen stations, Japan will support the expansion of the possible uses for trucks and ships, as well as the development of infrastructure to support large-scale stations. In the power generation sector, Japan will support the technological development of combustors for exclusive combustion and the verification of actual power generation capabilities of large-scale combustors, as well as set up systems for the appropriate evaluation of the non-fossil fuel energy values. In the industrial sector, Japan will promote the development of innovative technologies for the large-scale conversion of manufacturing processes like hydrogen-reduced iron making and will develop and verify technologies for building large boilers suited to the combustion characteristics of hydrogen.

Additionally, Japan will establish a model for an ideal hydrogen society that makes the best use of existing infrastructure and the supply and demand characteristics of nearby geographical regions, as well as verify self-sustaining and distributed energy systems that utilize local resources like renewable energies and other energies with the aim of expanding them nationwide.

As for hydrogen regulatory reforms, Japan has steadily implemented those aimed at introducing fuel cell vehicles and hydrogen stations. In sync with the progress of the social implementation of hydrogen in each area, in addition to the transportation sector, Japan will expand the scope of consideration and consider streamlining regulations with the goal of ensuring safety.

(2) Initiatives based on guidelines for controlling GHG emissions

As for guidelines for emission reductions based on the Act on Promotion of Global Warming Countermeasures, Japan will expand the countermeasure menu to include initiatives like making decisions on the decarbonization of energy based on technological trends like BAT, and Japan will formulate and announce as soon as possible initiatives in fields that are as of yet undeveloped. Furthermore, with the goal of contributing to the decarbonization of individual lifestyles, Japan will further expand the measures that must be implemented by businesses when manufacturing and providing products and services that people use in their daily lives. Japan will also promote voluntary and proactive efforts on the part of business operators to engage in environmentally conscious business activities by offering a variety of different forms of assistance and information to encourage the implementation of the measures included in the guidelines.

(3) GHG emissions accounting, reporting, and disclosure program

From the standpoint of establishing the foundation of voluntary emission reduction initiatives by having the emitters themselves calculate emissions and by promoting voluntary efforts by the general public and businesses through the increased visualization of emission data as outlined in the Act on Promotion of Global Warming Countermeasures, businesses that emit more than a certain amount of greenhouse gases are obliged to calculate their own emissions and report them every year to the national government that compiles them and publishes them as a report. Based on the Amended Global Warming Countermeasures Promotion Act, Japan will build an electronic reporting system that facilitates the task of reporting parties, and by setting as the standard the information reported through this system, Japan will speed up the collection and publication of information. When disclosing the reported information, Japan will provide the information in a highly convenient form using the relevant systems and include the information for each business establishment in order to make it easy to consult. When doing so, Japan will also provide information on the precautions needed to interpret the information, such as reporting that simple comparisons between businesses may not be significant.

Additionally, calculation rules will be reviewed based on the latest information, like the IPCC guidelines, and factors like forest removals due to forest management and handling of CCS and CCU may be taken into consideration. Moreover, to improve the ease of using the reported information, Japan will actively encourage the reporting of information on initiatives for reducing emissions, in addition to emission data, and will stimulate the reduction of GHG emissions by business operators by listening to the opinions of businesses actively engaged in decarbonization.

(4) Promotion of environmental considerations in business activities

In order to reduce GHG emissions, Japan will appropriately incorporate the standpoint of environmental consideration into economic activities and promote investment and technological development in business activities.

More specifically, Japan will promote a cycle whereby businesses that are implementing environmental considerations can reap benefits by implementing a series of initiatives based on the following model: (1) the value of environmental consideration in products, services, and financial markets is widely appreciated and the public demands environmental consideration from businesses; (2) suppliers carry out environmentally conscious business activities and inform consumers about them in easy-to-understand terms; and (3) the accurate delivery of such information to consumers allows consumers to reward environmentally conscious businesses, as well as their products and services, by choosing and evaluating them.

To this end, Japan will encourage business operators to voluntarily and proactively engage in environmentally conscious business activities based on guidelines like those for reducing emissions.

Furthermore, based on the Law Concerning the Promotion of Business Activities with Environmental Consideration by Specified Corporations etc. and by Facilitating Access to Environmental Information and Other Measures (Law No. 77 of 2004), Japan will establish the conditions for environmentally conscious business activities and environmentally conscious products to be held in high regard by society and the market by promoting the use of environmental information by businesses and the public through the disclosure of environmental data by businesses. To that end, Japan will promote efforts to improve the reliability and comparability of disclosed information throughout the supply chain.

Moreover, Japan will enhance the effectiveness of environmental management by promoting the deployment of environmental management systems incorporating a PDCA cycle, like ISO 14001 and Eco Action 21 for small and medium-sized enterprises, and environmental due diligence, and at the same time, promote further environmental consideration in Japanese business activities by fostering the appropriate training of employees.

(5) Greening of the tax system and effective use of tax for global warming mitigation

Greening the tax system is one of the important policies for achieving net-zero by 2050. We will investigate and analyze comprehensively and systematically the environmental effects of environment-related tax systems, including the situation in other countries. By doing so, we will address global warming countermeasures.

By using the revenue from the special tax measure of the Petroleum and Coal Tax for climate change mitigation enforced since October 2012, we will steadily implement a wide range of policies to reduce energy-related CO_2 emissions, such as energy-saving, deploying renewable energy, and making fossil fuels cleaner and more efficient. Under the close cooperation between relevant ministries, we promote wise

spending by focusing on cost-effective policies given the characteristics of each business.

(6) Promotion of sustainable finance

In order to realize the society envisioned in the Paris Agreement, it is necessary to further encourage private investment for companies working on climate change measures and innovation; therefore, the role of finance is becoming more important. Across the world, sustainable finance, in particular ESG finance, which incorporates environmental, social, and governance factors into investment and loan decisions from the standpoint of reducing investment risk and improving returns over the medium to long term, is becoming widespread. Furthermore, including climate change risk in investment decisions is becoming the standard in the international financial markets. In Japan, the scale of ESG investment has expanded significantly in recent years.

At the same time, demand is increasing for information disclosure of climate-related financial information, with Japan having the largest number of organizations supporting TCFD in the world. On the other hand, a movement is gaining ground, mostly in Europe, to introduce regulations on the labeling of financial products and to make sustainability disclosures mandatory. Additionally, it is becoming necessary for financial institutions to calculate the greenhouse gas emission levels of their investments (financed emissions) and consider measures to reduce them as they respond to climate change throughout their entire portfolios.

In order to attract domestic and foreign environment-related investment in businesses that contribute to global warming countermeasures for the realization of a decarbonized society, Japan will promote sustainable finance like ESG finance in consideration of international trends.

More specifically, based on the Climate Innovation Finance Strategy 2020 (established by the Ministry of Economy, Trade and Industry on September 16, 2020), in collaboration with related ministries and agencies and in addition to renewable energies and other energies (green), Japan will integrally promote the transition to decarbonization (transition), including steady efforts to reduce CO_2 emissions by energy saving and more, as well as finance innovative technology (innovation) towards decarbonization. As for the green aspects, Japan will promote green finance, starting with green bonds, by establishing a system for issuing them and developing the market for them. Furthermore, with an eye toward the realization of a decarbonized society and with regard to transitional finance, for example, financing efforts to reduce GHG emissions according to a long-term strategy as outlined in the Basic Guidelines for Climate Transition Finance (set forth on May 7, 2021, by the Financial Services Agency, the Ministry of Economy, Trade and Industry, and the Ministry of the Environment), Japan will promote investment in companies that are engaged in transitioning to decarbonization and in innovation by formulating a sectoral roadmap for high-emission industries that cannot be decarbonized in a single step, and Japan will also support Asia's transition toward the realization of global carbon neutrality. In order to promote innovation, in September 2020, companies that have challenged themselves to boldly pursue innovation toward the realization of a decarbonized society have been hailed as Zero Emission Challenge Companies, and their efforts have been highlighted both in Japan and abroad.

Additionally, the active disclosure of information by companies and the constructive dialogue based on such disclosures constitute the foundation of encouraging financing for initiatives to improve corporate value through the decarbonization of companies. Based on the Sustainability Disclosure Standards finalized by the International Sustainability Standards Board (ISSB) in June 2023, the Sustainability Standards Board of Japan (SSBJ) released drafts in March 2024. Japan will actively participate in international discussions to develop a framework for sustainability-related disclosure at the ISSB, etc. In

addition, Japan will also consider the application of domestic standards and the nature of the assurance for sustainability information that are functionally equivalent to the ISSB standards for all or some of the companies listed on the Tokyo Stock Exchange Prime Market. Moreover, Japan will promote disclosure and debate and improve their quality by supporting scenario analysis by companies and financial institutions, as well as by supporting the formulation, revision, and diffusion of scenario analysis guides and domestic guidelines for green finance and TCFD.

From the standpoint of promoting regional decarbonization, the role of regional financing is extremely important. In order to link the decarbonization of a region to a virtuous cycle of economic and environmental progress in the same region, besides offering a clear nationwide vision, Japan will promote ESG regional financial efforts with a significant impact on the environment, economy, and society by advancing the creation of models for solving regional issues and the establishment of business using regional resources by forward-looking regional financial institutions in cooperation with local governments.

Furthermore, Japan will promote initiatives to steer private investment towards initiatives for reducing greenhouse gases by supporting investment in decarbonization projects where private funds are insufficient and by promoting investment in innovative equipment through leasing methods.

Moreover, Japan will turn the spotlight on ESG finances by holding the ESG Financial High-Level Panel, a gathering of top executives from the financial and investment fields, and Japan will promote discussions to create a positive impact on the environment and society through finance.

8 International aviation and shipping (International bunker fuels)

The international transportation sector (international aviation and shipping), which operates across national borders, is covered in the national GHG inventories because of the difficulty of assigning emissions to individual countries, and the International Civil Aviation Organization (ICAO) and International Maritime Organization (IMO) are considering measures to reduce CO_2 emissions.

8.1 Policies and measures for international aviation

(1) Overview

For international aviation, ICAO has set a global emission reduction target that the global emissions will not increase after 2020, and the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) was launched in 2021 among the voluntary participating countries as a CO_2 emission reduction framework for international aviation. Japan has also voluntarily joined the scheme.

Under these circumstances, in order to accelerate the decarbonization of the aviation sector, Japan has established committees on CO_2 reduction in aircraft operations and airports and has been holding discussions. The committee on aircraft operations has been discussing the direction of medium- and long-term initiatives to reduce CO_2 emissions through the following three approaches: (1) promotion of the introduction of sustainable aviation fuel (SAF), (2) improvement of flight operation by renovating air navigation service, and (3) introduction of new technologies for aircraft and equipment The committee for the airport has been discussing initiatives to reduce CO_2 emissions from airport facilities and airport vehicles by promoting the introduction of energy-saving systems, such as LEDs at airport facilities,

promotion of the introduction of clean energy airport vehicles, such as EVs and FCVs; promotion of the introduction of power and air conditioning supply facilities from airports to aircraft (ground power unit: GPU); and airport's transformation into a renewable energy hub by promoting the introduction of solar power generation. Based on the discussions at the respective committees, Japan has developed a roadmap of CO_2 reductions for aircraft operations and the airport, respectively.

For aircraft operations, a public-private council has been established for each approach to accelerate initiatives. For the airport, public-private partnership platform has been established under the study group to accelerate initiatives.

In addition, based on the *Basic Policy for the Promotion of Decarbonization of Aviation* by the government, it is important to encourage proactive and systematic decarbonization efforts by airlines and airports to decarbonize aviation, and we have been promoting the certification of the *Plan for the Promotion of Decarbonization in Air Transport* and the *Airport Decarbonization Promotion Plan* under the Civil Aeronautics Law, and in 2023, the first certification was granted in 2023.

(2) Initiative for aircraft operations

(Sustainable Aviation Fuel [SAF])

Sustainable Aviation Fuel (SAF), including bio-jet fuel, has a significant CO_2 reduction effect compared to conventional fossil-origin jet fuel, and its use is essential to achieve the ICAO global reduction target, which is no increase in total emissions from international aviation after 2020. Therefore, the introduction of SAF is an urgent issue in Japan. The government, airlines, fuel suppliers, and others are cooperating to consider promotion measures for the introduction of SAF. In addition, since Japan believes that it is important to set a target of SAF as a direction for steady progress and as a milestone for the initiatives, Japan has set a target of replacing 10% of fuel consumption by Japanese airlines with SAF for SAF consumption in 2030.

Based on this target, Japan will work with related ministries and agencies, airlines, fuel suppliers, and others to promote the development of domestically produced SAF, the establishment of a supply chain that includes imported mixed SAF, and the development of international standards toward the introduction of SAF.

(Improvement of flight operations by renovating air navigation service)

In response to the increase in air traffic, Japan is working to reduce fuel consumption and CO_2 emissions while ensuring safety through the introduction of new technologies and approaches to advance air traffic control.

While taking into account future developments in air traffic systems and trends in technological development, Japan will work to optimize air traffic as a whole and promote improvement measures for each situation, such as air routes, departures and arrivals, and airports.

(Introduction of new technologies into aircraft and equipment)

The development of low-carbon aircraft and equipment technologies is expected worldwide in the future. It is necessary to promote the spread of new technologies into aircraft and equipment, such as electrification, hydrogen-powered aircraft, weight reduction, and efficiency improvement, towards decarbonization with a view to strengthening the international competitiveness of Japan's manufacturers.

Based on the background, NEDO will continue working on development, such as the development of new technologies with a view to applying them to next-generation aircraft, including high-rate lightweight

structures and ultra-high efficiency (airframe, propulsion, and equipment), hybrid electric (propulsion and equipment), hydrogen combustion propulsion systems, and hydrogen fuel cell electric propulsion systems.

It is necessary for industry and government to work together to consider safety standards in parallel with the development of technologies in order to achieve the early commercialization of new technologies for which standards are currently being developed. Japan will work on the development of globally harmonized safety standards with manufacturers, airlines, airports, research institutes, academia, and relevant ministries and agencies.

(3) Initiative for airport

Regarding airports, in June 2022, the Civil Aeronautics Act and Airport Act. were amended to establish a system under which airport administrators, in cooperation with airport-related parties, develop airport decarbonization promotion plans that set specific goals and initiatives.

As for promotion plans, starting with certification of plans for four airports (Narita International Airport, Chubu Centrair International Airport, Kansai International Airport and Osaka International Airport) in December 2023, as at the end of August 2024, plans for a total of 34 airports had been developed and certified.

We will promote further decarbonization of government-managed airports by maximizing the use of high-efficiency air-conditioning equipment, LED lighting and aviation lights, EV vehicles, and the introduction of renewable energy sources such as solar power generation equipment.

8.2 Policies and measures for international shipping

Regarding international shipping, discussions to review the GHG reduction strategy adopted in 2018 at the IMO began in 2021, and “2023 IMO Strategy on reduction of GHG emissions from ships” aiming for reaching net-zero GHG emissions by or around 2050 was adopted at the 80th session of the IMO Marine Environment Protection Committee held in July 2023. Also, the EEXI (Energy efficiency regulations for existing ships) and CII (Rating of fuel efficiency performance) systems adopted at the 76th meeting of the IMO Marine Environment Protection Committee in June 2021 came into effect in Japan in January 2023. This accelerates efforts to decarbonize international shipping. Hereafter, based on the strategy that sets a common global goal of achieving carbon neutrality of emissions from international shipping by or around 2050, Japan will contribute to discussions on the introduction of concrete measures to achieve the goal (mid-term measures).

In addition, since it is essential to convert fuels to hydrogen and ammonia, etc., which do not emit GHGs to achieve carbon neutrality in international shipping, Japan started the "Development of Next-Generation Ships" project using the Green Innovation Fund in October 2021 and is supporting the development and demonstration of engines, fuel tanks, fuel supply systems, and other core technologies for zero-emission ships using hydrogen and ammonia. The ammonia-fueled ships are expected to start experimental operation in 2026 and commercial operation as early as possible up to 2028. The hydrogen-fueled ships are expected to start experimental operation in 2027 and commercial operation in 2030 or later.

Table II-11 Information on mitigation policies and measures (CTF Table 5)

Name	Description	Objectives	Type of instrument	Status	Sector(s) affected	Sub-sector(s) affected	Gases affected	Start year of implementation	Implementing entity or entities	Estimates of GHG emission reductions ($kt\ CO_2\ eq$)											
										2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2025	2030
Reduction of CO_2 emission intensity in power sectors	Promotion of efforts by the electric power industry under a voluntary framework and follow-up of efforts under a voluntary framework by the government. Under the Energy Conservation Act, require power generation companies to meet power generation efficiency standards for newly constructed power generation facilities on a facility-by-facility basis. Also, require power generation companies that own coal-fired thermal power generation facilities to meet benchmark targets for power generation efficiency (on a per-unit basis) on par with state-of-the-art ultra-supercritical (USC) power generation facilities. Require retail electric utilities to increase the ratio of non-fossil power sources in the electricity they sell to more than the standard, in accordance with the Advanced Electricity Utilization Law. CCS initiatives based on the Strategic Energy Plan and the Long-Term Strategy as a Growth Strategy Based on the Paris Agreement. Promotion of the adoption of BAT, considering future trends in the development of power generation technologies.	Improving efficiency of thermal power generation	Law / Standard, Technology Development, Other	Implemented	Energy	Energy conversion	CO_2	2016	METI	NE	4,200	4,500	6,200	6,700	8,500	9,300	10,600	9,700	11,400	NE	11,000

Name	Description	Objectives	Type of instrument	Status	Sector(s) affected	Sub-sector(s) affected	Gases affected	Start year of implementation	Implementing entity or entities	Estimates of GHG emission reductions ($kt CO_2 eq$)											
										2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2025	2030
	Promotion of efforts by the electric power industry under a voluntary framework and follow-up of efforts under a voluntary framework by the government. Under the Energy Conservation Act, require power generation companies to meet power generation efficiency standards for newly constructed power generation facilities on a facility-by-facility basis. Also, require power generation companies that own coal-fired thermal power generation facilities to meet benchmark targets for power generation efficiency (on a per-unit basis) on par with state-of-the-art ultra-supercritical (USC) power generation facilities. Require retail electric utilities to increase the ratio of non-fossil power sources in the electricity they sell to more than the standard, in accordance with the Advanced Electricity Utilization Law. CCS initiatives based on the Strategic Energy Plan and the Long-Term Strategy as a Growth Strategy Based on the Paris Agreement. Promotion of the adoption of BAT, considering future trends in the development of power generation technologies.	Improving efficiency of thermal power generation, utilization of nuclear power generation that has been confirmed safe, maximum introduction of renewable energy	Law / Standard, Technology Development, Other	Implemented	Energy	Energy conversion	CO_2	2016	METI	NE	4,000	29,000	41,000	54,000	88,000	112,000	116,000	112,000	128,000	NE	329,000
Maximum introduction of renewable energy	Reduce CO_2 emissions from fossil fuel combustion by expanding the use of renewable energy as an energy source for power generation use and replacing fossil fuels	Expansion of use of renewable electricity	Law / Standard, Taxation, Subsidy, Financing, Technology Development, Other	Implemented	Energy	Energy conversion	CO_2	2012	METI	76,620	86,160	96,600	99,840	110,260	115,240	120,640	128,890	136,620	142,240	NE	206,700
	Reduce CO_2 emissions from fossil fuel combustion by expanding the use of renewable energy as an energy source for heat utilization and replacing fossil fuels	Expansion of use of renewable heat	Law / Standard, Taxation, Subsidy, Financing, Technology Development, Other	Implemented	Energy	Energy conversion	CO_2	2012	METI	29,800	30,350	30,390	30,370	31,310	30,840	31,320	31,870	28,921	29,520	NE	36,180

Name	Description	Objectives	Type of instrument	Status	Sector(s) affected	Sub-sector(s) affected	Gases affected	Start year of implementation	Implementing entity or entities	Estimates of GHG emission reductions ($kt CO_2 eq$)											
										2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2025	2030
Promotion of the introduction of facilities and equipment with high energy-saving performance (petroleum product manufacturing sector)	Promote efforts to achieve energy reductions equivalent to 1 million kL in crude oil equivalent from BAU by (1) effective use of heat, (2) introduction of advanced control and high-efficiency equipment, (3) improvement of power system operations, and (4) large-scale improvements and upgrade of processes, based on the Industry's Action Plans for a Low-Carbon Society in the petroleum product manufacturing sector by petroleum refiners.	Effective use of heat, introduction of advanced control and high-efficiency equipment, improvement of power system operations, and large-scale improvements and upgrades of processes	Subsidy	Implemented	Energy	Energy conversion	CO_2	2013	METI	86	319	556	748	1,007	1,137	1,164	1,127	1,273	1,416	1,412	2,047
Steady Implementation, evaluation, and verification of Industry's Action Plans for a Low-Carbon Society	Each industry sets emission reduction targets and works to reduce GHG emissions by improving energy efficiency, developing, and promoting low-carbon products, and making international contributions through technology transfers, etc.	Steady Implementation, evaluation, and verification of Industry's Action Plans for a Low-Carbon Society	Voluntary Agreement	Implemented	Energy	Cross-Cutting	CO_2	1997	METI, MOE, FSA, NPA, MIC, MOF, MEXT, MHLW, MAFF, MLIT	-	-	-	-	-	-	-	-	-	-	-	-
Promotion of the introduction of facilities and equipment with high energy-saving performance (across industries)	Introduction of high-efficiency air conditioning	Introduction of high-efficiency air conditioning	Law / Standard, Taxation, Subsidy, Technology Development	Implemented	Energy	Industry	CO_2	2008	METI	46	93	147	205	260	306	398	447	504	548	860	690
	Introduction of industrial HP (heat pump)	Introduction of industrial Heat pump	Law / Standard, Taxation, Subsidy, Technology Development	Implemented	Energy	Industry	CO_2	2008	METI	2	19	36	51	71	92	108	117	137	155	660	1,610
	Introduction of industrial high-efficiency lighting	Introduction of industrial lighting	Law / Standard, Taxation, Subsidy, Technology Development	Implemented	Energy	Industry	CO_2	2008	METI	670	1,259	1,881	2,552	3,252	3,902	4,532	5,102	5,832	6,402	8,442	2,931

Name	Description	Objectives	Type of instrument	Status	Sector(s) affected	Sub-sector(s) affected	Gases affected	Start year of implementation	Implementing entity or entities	Estimates of GHG emission reductions ($kt CO_2 eq$)											
										2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2025	2030
	Introduction of low-carbon industrial furnaces	Introduction of low-carbon industrial furnaces	Law / Standard, Taxation, Subsidy, Technology Development	Implemented	Energy	Industry	CO_2	2008	METI	575	1,017	1,416	2,155	2,823	3,363	3,910	4,472	5,055	5,619	6,925	8,069
	Introduction of industrial motors and inverters	Introduction of industrial motors and inverters	Law / Standard, Taxation, Subsidy, Technology Development	Implemented	Energy	Industry	CO_2	2008	METI	338	673	1,141	1,695	2,075	2,370	2,654	2,924	3,224	3,543	10,820	7,608
	Introduction of high-performance boilers	Introduction of high-performance boilers	Law / Standard, Taxation, Subsidy, Technology Development	Implemented	Energy	Industry	CO_2	2008	METI	292	618	934	1,277	1,584	1,917	2,235	2,500	2,792	3,075	3,307	4,679
	Introduction of cogeneration	Introduction of cogeneration	Law / Standard, Taxation, Subsidy, Technology Development	Implemented	Energy	Industry	CO_2	2008	METI	410	630	970	1,273	1,490	2,006	2,542	3,324	3,804	4,169	6,942	10,610
Promotion of the introduction of facilities and equipment with high energy-saving performance (iron and steel industry)	Replace the main facilities that consume electricity in steel mills with higher efficiency equipment (oxygen plant with higher efficiency, blowers, compressed air plant with higher efficiency)	Improvement of efficiency of main electricity demand facilities	Subsidy, Technology Development	Implemented	Energy	Industry	CO_2	2008	METI	-4	34	26	-24	3	43	90	87	96	164	NE	100
	Reduce the use of coal by effectively utilizing waste plastics, etc. collected based on the Law Concerning the Promotion of Sorted Collection and Recycling of Containers and Packaging by pyrolyzing them in a coke oven, etc.	Expansion of chemical recycle of waste plastics at steel mills	Subsidy, Technology Development	Implemented	Energy	Industry	CO_2	2008	METI	-70	110	70	110	180	-40	20	-180	-40	-180	NE	2,120
	Reduce the energy consumption for coke production by upgrading the coke ovens in the coke production process.	Efficiency improvement of Coke Oven	Subsidy, Technology Development	Implemented	Energy	Industry	CO_2	2008	METI	-100	-322	-192	-287	-339	-200	-77	-178	-170	-270	NE	480

Name	Description	Objectives	Type of instrument	Status	Sector(s) affected	Sub-sector(s) affected	Gases affected	Start year of implementation	Implementing entity or entities	Estimates of GHG emission reductions (kt CO_2 eq)											
										2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2025	2030
	Replace power generation equipment in joint thermal power generation with high-efficiency equipment.	Improvement of power generation efficiency (Joint thermal power generation facilities)	Subsidy, Technology Development	Implemented	Energy	Industry	CO_2	2008	METI	194	232	286	286	286	286	286	398	400	400	NE	440
	Replace power generation equipment in in-house power generation with high-efficiency equipment	Improvement of power generation efficiency (In-house power generation facilities)	Subsidy, Technology Development	Implemented	Energy	Industry	CO_2	2008	METI	112	112	234	330	384	384	494	494	490	470	NE	700
	Expand energy-saving facilities such as the Top pressure Recovery Turbine (TRT) for blast furnace top pressure and utilization of waste heat such as Coke Dry Quenching (CDQ) in coke ovens	Enhancement of energy-saving facilities	Subsidy, Technology Development	Implemented	Energy	Industry	CO_2	2008	METI	9	31	55	41	44	44	46	65	30	60	NE	650
	Reduce energy consumption by about 10% in the operating process of the blast furnace by using ferro coke, an innovative alternative coke reduction material made from low-grade coal and low-grade iron ore, to speed up and lower the temperature of the reduction reactions in the blast furnace.	Introduction of innovative pig iron making process (ferro coke)	Subsidy, Technology Development	Implemented	Energy	Industry	CO_2	2013	METI	0	0	0	0	0	0	0	0	0	0	NE	820
	Introduce innovative steelmaking processes that reduce CO_2 emissions by integrating technologies such as CO_2 capture from blast furnace gas, unused medium- and low-temperature heat recovery, coke modification, water amplification, and iron ore hydrogen reduction	Introduction of environmentally harmonious ironmaking processes	Subsidy, Technology Development	Implemented	Energy	Industry	CO_2	2008	METI	0	0	0	0	0	0	0	0	0	0	NE	110
Promotion of the introduction of facilities and equipment with high energy-saving performance (chemical industry)	Work on energy-saving by recovery of energy and rationalization of processes, etc.	Introduction of energy-saving process technologies in chemistry	Subsidy, Technology Development	Implemented	Energy	Industry	CO_2	2008	METI	456	898	1,370	1,730	2,361	2,750	3,200	3,781	4,289	4,834	NE	3,891

Name	Description	Objectives	Type of instrument	Status	Sector(s) affected	Sub-sector(s) affected	Gases affected	Start year of implementation	Implementing entity or entities	Estimates of GHG emission reductions ($kt CO_2 eq$)											
										2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2025	2030
	Promote the development and introduction of new and innovative energy-saving technologies	Introduction of carbon dioxide utilization technologies	Subsidy, Technology Development	Implemented	Energy	Industry	CO_2	2013	METI	NE	0	0	0	0	0	0	0	0	0	2	173
Promotion of the introduction of facilities and equipment with high energy-saving performance (cement and ceramic industry)	Promote energy-saving in the cement manufacturing process by introducing equipment that can use thermal and electrical energy at high efficiency.	Conventional energy-saving technology	Subsidy	Implemented	Energy	Industry	CO_2	2008	METI	5	11	19	21	24	27	43	40	40	40	NE	64
	Promote energy-saving in the cement manufacturing process by promoting the use of waste as an alternative to thermal energy.	Technology to use waste as a substitute for thermal energy	Subsidy	Implemented	Energy	Industry	CO_2	2008	METI	-82	-60	121	260	260	243	328	424	429	594	127	192
	Achieve energy-saving in the cement manufacturing processes while ensuring the same quality as conventional products through practical application and introduction of advanced process technology	Innovative cement production process	Subsidy	Implemented	Energy	Industry	CO_2	2010	METI	0	0	0	0	0	0	0	0	0	0	122	408
	Achieve energy-saving in the glass manufacturing processes while ensuring the same quality as conventional products through practical application and introduction of advanced process technology	Glass melting process technology	Subsidy	Implemented	Energy	Industry	CO_2	2008	METI	0	0	0	0	0	0	0	0	0	0	41	81
Promotion of the introduction of facilities and equipment with high energy-saving performance (pulp, paper, and paper product industry)	Reduce operational energy consumption by supporting the introduction of pulpers that can more efficiently mix used paper and water and dissociate the used paper than conventional types in the used paper pulping process	Introduction of high-efficiency used paper pulping process technology	Subsidy	Implemented	Energy	Industry	CO_2	2008	METI	5	19	43	46	54	57	76	84	87	91	92	105

Name	Description	Objectives	Type of instrument	Status	Sector(s) affected	Sub-sector(s) affected	Gases affected	Start year of implementation	Implementing entity or entities	Estimates of GHG emission reductions ($kt CO_2 eq$)											
										2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2025	2030
Promotion of the introduction of facilities and equipment with high energy-saving performance (construction work and use of special vehicles)	In the short term, the goal is to reduce CO_2 emissions by promoting the use of construction equipment with high fuel efficiency. In the long term, a certification system for innovative construction machinery (electric, hydrogen, biomass, etc.) based on a radical conversion from the light oil-fueled power source will be established, and its introduction and widespread use will be promoted in order to achieve carbon neutrality. In addition, by promoting i-Construction and other such measures as the spread of construction using the information and communication technology (ICT) among small and medium-sized construction companies that carry out construction work for local governments, efficiency and labor saving in construction and maintenance will be further improved to cope with the declining number of skilled workers.	Introduction of hybrid construction equipment, etc.	Law / Standard, Subsidy, Financing, Technology Development, Awareness Raising	Implemented	Energy	Industry	CO_2	2010	METI	NE	NE	NE	NE	40	56	77	101	124	NE	290	480
Promotion of the introduction of facilities and equipment with high energy-saving performance (greenhouse horticulture, agricultural machinery, and fisheries)	Reduce the fuel oil consumption by installing energy-saving heating equipment in horticulture facilities, etc., and reduce CO_2 emissions from fuel oil (mainly heavy oil A) combustion in heating equipment	Introduction of energy-saving equipment in horticulture facilities	Subsidy, Awareness Raising	Implemented	Energy	Industry	CO_2	2007	MAFF	NE	180	290	390	480	580	680	760	850	950	1,150	1,550
	Reduction of fuel oil consumption in agricultural machinery	Introduction of energy-saving agricultural machinery	Subsidy, Awareness Raising	Implemented	Energy	Industry	CO_2	2007	MAFF	0	0	0	0	0	0	0	1	1	1	3	8
	Conversion to energy-saving fishing vessels	Energy-saving on fishing vessels	Subsidy, Awareness Raising	Implemented	Energy	Industry	CO_2	2007	MAFF	NE	10	21	31	41	50	60	71	80	90	132	194

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										2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2025	2030
Promotion of energy conservation initiatives through inter-industry collaboration	Promote energy conservation initiatives through cooperation among multiple operators	Promotion of energy conservation initiatives through inter-industry collaboration	Law / Standard, Taxation, Subsidy	Implemented	Energy	Industry	CO_2	2013	METI	0	0	53	92	194	220	336	447	463	537	710	780
Promotion of fuel conversion	Reduction of CO_2 emissions at factories and business sites through fuel conversion from coal, heavy oil, etc., to gas, etc., which is a highly effective CO_2 reduction measure and can be steadily implemented.	Promotion of fuel conversion	Subsidy	Implemented	Energy	Industry	CO_2	2014	MOE	NE	204	260	420	449	582	760	869	1,104	1,189	1,510	2,110
Implementation of thorough energy management using FEMS	Reduce energy consumption through the introduction of factory energy management systems (FEMS) and energy management based on these systems.	Implementation of thorough energy management using FEMS	Law / Standard, Taxation, Subsidy, Technology Development	Implemented	Energy	Industry	CO_2	2013	METI	150	213	274	318	319	420	680	509	236	298	2,380	2,000
Improvement of the energy efficiency of buildings	Reduce CO_2 emissions from energy consumed in buildings by increasing the proportion of energy-efficient building stock.	Improvement of the energy efficiency of buildings (new buildings)	Law / Standard, Taxation, Subsidy, Technology Development, Awareness Raising, Other	Implemented	Energy	Commercial	CO_2	2003	MLIT	125	540	960	1,611	2,031	2,521	2,725	2,921	3,147	3,325	NE	10,100
	Reduce CO_2 emissions from energy consumed in buildings by increasing the proportion of energy-efficient building stock.	Improvement of the energy efficiency of buildings (renovation and reconstruction of existing buildings)	Law / Standard, Taxation, Subsidy, Technology Development, Awareness Raising, Other	Implemented	Energy	Commercial	CO_2	2003	MLIT	91	179	325	438	794	896	1,321	1,485	1,603	1,759	NE	3,550
Promotion of high-efficiency energy-saving equipment	Reduction of energy consumption by establishing appropriate management methods in the installation of high-efficiency water heaters.	Installation of energy-efficient commercial water heaters	Law / Standard, Subsidy, Technology Development	Implemented	Energy	Commercial	CO_2	2008	METI	50	139	227	319	411	511	657	726	791	860	1,150	1,410
	Reduction of energy consumption by establishing appropriate management methods in the installation of high-efficiency lighting.	Introduction of high-efficiency lighting	Law / Standard, Subsidy, Technology Development	Implemented	Energy	Commercial	CO_2	2008	METI	980	2,389	3,877	5,115	6,594	8,028	9,377	10,567	12,112	13,302	12,570	6,720

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										2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2025	2030
	Reduction of energy consumption by establishing appropriate management methods in the installation of refrigeration and air conditioning equipment.	Introduction of refrigerant management technology	Law / Standard, Subsidy, Technology Development	Implemented	Energy	Commercial	CO_2	2014	METI	235	256	269	288	299	346	323	318	271	225	216	16
Improvement of energy efficiency of equipment through Top Runner Programs	Reduce the energy consumption of equipment in the commercial sector by promoting the improvement of energy consumption efficiency of top runner equipment.	Improvement of energy efficiency of equipment through Top Runner Programs	Law / Standard, Taxation, Subsidy, Technology Development, Awareness Raising	Implemented	Energy	Commercial	CO_2	1998	METI	520	820	1,122	1,439	1,753	2,534	3,027	3,816	4,745	6,227	13,000	9,200
Implementation of thorough energy management through the use of BEMS, and Energy Conservation diagnosis	Reduce energy consumption by installing BEMS and conducting energy efficiency audits to gain a detailed understanding of the energy usage status of commercial facilities (buildings, etc.) and control equipment based on this understanding.	Implementation of thorough energy management through the use of BEMS and Energy Conservation diagnosis	Law / Standard, Subsidy, Technology Development	Implemented	Energy	Commercial	CO_2	1998	METI	560	950	1,283	1,618	2,015	2,307	2,529	2,920	3,310	3,628	6,280	6,440
Promotion of local production for local consumption and areal use of energy	Promote local production for local consumption and areal use of energy	Promotion of local production for local consumption and areal use of energy	Subsidy, Other	Implemented	Energy	Commercial	CO_2	2008	METI	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Decarbonization of urban areas through the improvement of the thermal environment by heat island control	Promote low-carbon urbanization through the improvement of the thermal environment with rooftop greening and other heat-island countermeasures.	Decarbonization of urban areas through improvement of the thermal environment by heat island control	Law / Standard	Implemented	Energy	Commercial	CO_2	2008	MLIT	NE	8	13	20	25	26	30	34	37	40	36	33
Introduction of energy conservation and renewable energy in water supply and sewage (waterworks)	Reduce CO_2 emissions from electricity use through the implementation of energy conservation and renewable energy measures by waterworks operators and water supply companies nationwide.	Promotion of energy conservation and renewable energy measures in waterworks	Subsidy, Awareness Raising	Implemented	Energy	Commercial	CO_2	2016	MHLW	NE	31	18	6	-31	-8	-3	-2	-11	NE	320	216

Name	Description	Objectives	Type of instrument	Status	Sector(s) affected	Sub-sector(s) affected	Gases affected	Start year of implementation	Implementing entity or entities	Estimates of GHG emission reductions ($kt CO_2 eq$)											
										2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2025	2030
Introduction of energy conservation and renewable energy in water supply and sewage (sewage systems)	Promote through digital transformation (DX), the sophistication and efficiency of facility management as well as the introduction of energy-saving equipment and renewable energy sources, such as solar power and swage heat, also reduce CO_2 emissions through power generation using sewage sludge-derived solid fuel etc., and through substitution of fossil fuels by supplying solid fuel.	Promotion of energy conservation and energy creation measures in sewage systems	Law / Standard, Taxation, Subsidy, Technology Development, Awareness Raising	Implemented	Energy	Commercial	CO_2	2016	MLIT	NE	160	281	347	540	639	590	596	602	NE	1,380	1,300
Initiatives in waste treatment	Promote sorted collection and recycling (material recycling and chemical recycling) of plastic containers and packaging based on the Containers and Packaging Recycling Law.	Promotion of sorted collection and recycling of plastic containers and packaging	Law / Standard, Subsidy, Other	Implemented	Energy	Commercial	CO_2	2000	MOE	NE	62	62	61	59	-65	69	75	125	38	44	62
	Reduce energy-related CO_2 emissions associated with the use of electricity by installing high-efficiency power generation equipment at the time of new construction, renewal, or core improvement of waste incineration facilities, depending on the size of the facility.	Introduction of waste power generation at municipal waste incineration plants	Law / Standard, Subsidy, Other	Implemented	Energy	Commercial	CO_2	2016	MOE	NE	16	151	467	688	808	985	1,067	1,200	NE	2,001	1,242
	Reduce energy-related CO_2 emissions associated with the use of electricity by installing high-efficiency power generation equipment at the time of new construction, renewal, or core improvement of waste incineration facilities, depending on the size of the facility.	Introduction of waste power generation at industrial waste incineration plants	Law / Standard, Subsidy, Other	Implemented	Energy	Commercial	CO_2	2003	MOE	NE	256	188	180	195	288	445	121	100	NE	415	201
	Reduce energy-related CO_2 emissions from fuel combustion by manufacturing fuel from waste plastics and paper waste, replacing fossil fuels used in manufacturing and other industries.	Promotion of fuel production and energy conservation measures in the waste management industry	Law / Standard, Subsidy, Other	Implemented	Energy	Commercial	CO_2	2016	MOE	NE	-46	23	194	220	248	196	118	290	NE	888	1,345

Name	Description	Objectives	Type of instrument	Status	Sector(s) affected	Sub-sector(s) affected	Gases affected	Start year of implementation	Implementing entity or entities	Estimates of GHG emission reductions ($kt CO_2 eq$)											
										2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2025	2030
	Reduce CO_2 emissions from the waste collection vehicles by replacing the current internal combustion engine waste collection vehicles with EV waste collection vehicle, which is fully electric from driving to loading.	Introduction of electric waste collection vehicles	Law / Standard, Subsidy, Other	Implemented	Energy	Commercial	CO_2	2013	MOE	0	0	0	0	0	0	0	0	0	0	12	150
Improvement of energy efficiency of housing	Reduce CO_2 emissions from residential energy consumption by increasing the proportion of energy-efficient housing stock.	Improvement of energy efficiency of housing (new housing)	Law / Standard, Taxation, Subsidy, Financing, Technology Development, Awareness Raising, Other	Implemented	Energy	Residential	CO_2	2003	MLIT	0	207	337	601	895	1,290	1,112	1,415	1,733	2,264	NE	6,200
	Reduce CO_2 emissions from residential energy consumption by increasing the proportion of energy-efficient housing stock.	Improvement of energy efficiency of housing (renovation and reconstruction of existing housing)	Law / Standard, Taxation, Subsidy, Financing, Technology Development, Awareness Raising, Other	Implemented	Energy	Residential	CO_2	2003	MLIT	NE	39	112	178	243	303	691	834	946	1,150	NE	2,230
Diffusion of high-efficiency energy-saving equipment	Reduction of energy consumption by installing high-efficiency water heaters.	Installation of high-efficiency water heaters	Law / Standard, Subsidy, Technology Development	Implemented	Energy	Residential	CO_2	2013	METI	180	507	837	1,181	1,549	1,937	2,351	3,015	3,472	4,024	6,400	8,980
	Reduction of energy consumption by installing high-efficiency lighting.	Introduction of high-efficiency lighting	Law / Standard, Subsidy, Technology Development	Implemented	Energy	Residential	CO_2	2008	METI	730	2,052	3,312	4,990	6,516	7,950	9,320	10,540	12,190	13,460	12,570	6,510
Diffusion of high-efficiency energy-saving equipment (energy-saving septic tanks)	Reduce the electricity consumption and CO_2 emissions associated with the use of electricity by installing advanced energy-saving septic tanks that consume 26% less electricity than the current low-carbon society-compatible septic tanks when installing new septic tanks	Promotion of energy-efficient septic tank application (introduction of advanced energy-efficient household septic tanks)	Subsidy	Implemented	Energy	Residential	CO_2	2016	MOE	NE	NE	11	15	19	23	27	31	35	39	61	49

Name	Description	Objectives	Type of instrument	Status	Sector(s) affected	Sub-sector(s) affected	Gases affected	Start year of implementation	Implementing entity or entities	Estimates of GHG emission reductions ($kt CO_2 eq$)											
										2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2025	2030
	Reduce the electricity consumption and CO_2 emissions associated with the use of electricity by replacing existing medium- and large-sized septic tanks with new ones that have low energy efficiency when renewing septic tanks.	Promotion of energy-efficient septic tank application (replacement of low energy-efficient existing medium-and large-sized septic tanks)	Subsidy	Implemented	Energy	Residential	CO_2	2022	MOE	NE	NE	16	23	27	31	37	37	39	42	92	74
Improvement of energy efficiency of equipment through Top Runner Programs	Reduce the energy consumption of equipment in the residential sector by promoting the improvement of energy consumption efficiency of top-runner equipment	Improvement of energy efficiency of equipment through Top Runner Programs	Law / Standard, Subsidy, Technology Development, Awareness Raising	Implemented	Energy	Residential	CO_2	1998	METI	243	600	964	1,195	1,497	1,595	1,751	2,096	2,232	2,420	7,134	4,757
Implementation of thorough energy management through the use of HEMS, smart meter energy-saving information	Reduction of energy consumption through a detailed understanding of household energy consumption status and device control based on this understanding by introducing HEMS, smart meters, and smart home devices, and promotion of household energy-saving activities through the provision of information by energy retailers, etc.	Implementation of thorough energy management through the use of HEMS and smart meters	Subsidy, Technology Development, Awareness Raising	Implemented	Energy	Residential	CO_2	2010	METI	24	32	41	52	58	68	82	982	1,340	1,537	3,658	5,691
Diffusion of next-generation vehicles, improvement of fuel efficiency, etc.	Reduce energy consumption by diffusion of next-generation vehicles and improvement of fuel efficiency, as well as reduce CO_2 by developing a supply system for biofuels.	Diffusion of next-generation vehicles, improvement of fuel efficiency	Law / Standard, Taxation, Subsidy, Financing, Technology Development, Awareness Raising	Implemented	Energy	Transport	CO_2	1979	METI	533	1,315	2,275	2,398	3,430	4,408	5,463	6,401	7,889	9,553	NE	26,740
Promotion of road traffic flow measures	Promote traffic congestion countermeasures using ETC2.0 as well as connecting arterial road networks, including ring roads, in order to improve the driving speed	Implementation of measures for road traffic flow	Other	Implemented	Energy	Transport	CO_2	2012	MLIT	NE	NE	1,000	NE	NE	NE	NE	NE	1,970	NE	NE	2,000
Promotion of the maintenance of LED road lighting	Promote further energy-saving and advancement for road lighting and the use of LED road lighting.	Promotion of the installation of LED road lighting	Law / Standard, Technology Development, Other	Implemented	Energy	Transport	CO_2	2012	MLIT	NE	NE	NE	NE	NE	NE	NE	40	60	70	50	130

Name	Description	Objectives	Type of instrument	Status	Sector(s) affected	Sub-sector(s) affected	Gases affected	Start year of implementation	Implementing entity or entities	Estimates of GHG emission reductions ($kt CO_2 eq$)											
										2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2025	2030
Promotion of Intelligent Transport Systems (ITS) (centralized control of traffic lights)	Reduce CO_2 emissions from automobiles by smoothing traffic flow and improving fuel efficiency through centralized control of traffic signals.	Promotion of intelligent transport system (ITS) (centralized control of traffic lights)	Subsidy	Implemented	Energy	Transport	CO_2	2012	NPA	1,330	1,370	1,400	1,400	1,410	1,410	1,420	1,420	1,430	1,430	1,440	1,500
Maintenance of traffic safety facilities (improvement and profile (hybrid) of traffic lights)	Reduce CO_2 emissions from automobiles by improving traffic signals to facilitate traffic flow and improve fuel efficiency.	Installation of traffic safety facilities (improvement of traffic lights and profiling [hybrid])	Subsidy	Implemented	Energy	Transport	CO_2	2012	NPA	470	490	500	500	500	500	500	510	510	510	520	560
Maintenance of traffic safety facilities (promotion of the use of LED lights in signal lights)	Reduce energy consumption and CO_2 emissions by converting from bulb-type signal lights to LED-type signal lights	Installation of traffic safety facilities (promotion of the installation of LED traffic lights)	Subsidy	Implemented	Energy	Transport	CO_2	2012	NPA	65	98	103	110	114	113	117	126	135	143	122	110
Promotion of autonomous driving	Reduce energy consumption in transportation by utilizing auto-driving technology such as ACC/CACC technology	Promotion of automated driving	Technology Development	Implemented	Energy	Transport	CO_2	2012	METI	56	72	96	129	170	217	262	437	484	653	833	1,687
Greening of the vehicle transportation business by promoting the use of environmentally friendly vehicles etc.	Reduction of CO_2 emissions by promoting the use of environmentally friendly automobiles, etc.	Greening of vehicle transportation business by promoting the use of environmentally friendly vehicles etc.	Subsidy, Awareness Raising	Implemented	Energy	Transport	CO_2	2012	MLIT	0	8	42	249	492	670	710	690	690	890	752	1,012
Promotion of the use of public transportation	Reduce CO_2 emissions from the use of private automobiles by promoting the use of existing railway (e.g., by improving the convenience of railway stations), subsidies and tax incentives to promote the use of buses (e.g., by introducing bus location systems), and the spread of eco-commuting to encourage people to change their behavior, including the way they use their cars in their daily lives.	Promotion of the use of public transportation	Taxation, Subsidy, Awareness Raising	Implemented	Energy	Transport	CO_2	1992	MLIT	NE	235	1,037	796	559	403	98	-689	NE	NE	1,310	1,620

Name	Description	Objectives	Type of instrument	Status	Sector(s) affected	Sub-sector(s) affected	Gases affected	Start year of implementation	Implementing entity or entities	Estimates of GHG emission reductions ($kt CO_2 eq$)											
										2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2025	2030
	Ensure means of transportation with reduced environmental impact by enhancing and improving the convenience of regional public transportation utilizing the Regional Public Transportation Revitalization Act, promote the spread of MaaS that can meet various needs, and develop public transportation systems such as new railway lines, LRT, and BRT to encourage people to change their behavior, including how they use cars in their daily lives, and reduce CO_2 emissions associated with private vehicle use.	Improving route efficiency through regional public transportation convenience improvement projects	Taxation, Subsidy, Awareness Raising	Implemented	Energy	Transport	CO_2	2020	MLIT	NE	NE	NE	NE	NE	NE	NE	9	11	14	16	23
Promotion of the use of bicycles	Reduce CO_2 emissions associated with the use of private cars by promoting a shift from the use of private cars to bicycles by creating a safe and comfortable bicycle use environment	Promotion of the use of bicycles	Law / Standard, Other	Implemented	Energy	Transport	CO_2	2017	MLIT	NE	NE	0	NE	NE	NE	NE	NE	NE	NE	140	280
Decarbonization of the railways	Promote the introduction of energy-efficient vehicles, such as VVVF-equipped vehicles, storage battery vehicles and hybrid vehicles, and the installation of energy-saving equipment in railway facilities.	Promotion of decarbonization of the railways	Law / Standard, Taxation, Subsidy, Technology Development	Implemented	Energy	Transport	CO_2	2005	MLIT	NE	172	387	670	1,007	1,583	2,428	2,860	3,127	3,504	1,835	2,600
Decarbonization of the shipping sector	Promote energy-saving and CO_2 emission-saving vessels through the Domestic Vessel Energy Saving Rating System etc. and also promote technological development, demonstration, and introduction of vessels, including LNG-fueled vessels, hydrogen-fueled vessels, and EV vessels that also contribute to the modernization and better operational efficiency in coastal shipping using innovative energy-saving technologies and digital technologies etc.	Promotion of energy-saving and CO_2 emission-saving vessels	Taxation, Subsidy, Financing, Technology Development, Other	Implemented	Energy	Transport	CO_2	2005	MLIT	NE	-79	286	224	384	411	458	962	464	271	1,180	1,810

Name	Description	Objectives	Type of instrument	Status	Sector(s) affected	Sub-sector(s) affected	Gases affected	Start year of implementation	Implementing entity or entities	Estimates of GHG emission reductions ($kt CO_2 eq$)											
										2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2025	2030
Decarbonization of the aviation sector	Promote the introduction of new technologies in aircraft and equipment, improvement of flight operation methods by upgrading air traffic control, promotion of the introduction of sustainable aviation fuel (SAF), and reduction of CO_2 emissions from airport facilities and airport vehicles and promote public-private partnerships by examining measures to turn airports into renewable energy hubs	Promotion of decarbonization of aviation	Technology Development, Law / Standard, Subsidy, Other	Implemented	Energy	Transport	CO_2	2005	MLIT	NE	468	880	807	816	871	970	6,261	4,837	2,159	1,410	2,024
Improvement of efficiency of truck transportation	Reduce CO_2 emissions by promoting efficiency improvement of truck transportation	Efficiency improvement of truck transportation	Law / Standard, Taxation, Subsidy, Awareness Raising	Implemented	Energy	Transport	CO_2	2001	MLIT	NE	348	573	900	2,619	3,730	5,364	6,597	7,124	7,458	8,580	11,800
Promotion of joint transportation and delivery	Promote reduction of redelivery of parcels through joint transportation and delivery by carriers, etc.	Promotion of joint transportation and delivery	Law / Standard, Subsidy, Awareness Raising	Implemented	Energy	Transport	CO_2	2001	MLIT	NE	12	13	15	19	19	19	26	-34	-7	44	50
	Reduce CO_2 emissions by promoting the social implementation of drone logistics	Social implementation of drone logistics	Law / Standard, Subsidy, Awareness Raising	Implemented	Energy	Transport	CO_2	2020	MLIT	NE	NE	NE	NE	NE	NE	NE	0	0	0	5	65
Promotion of a modal shift to marine transportation	Promote the modal shift from truck transportation to coastal shipping through the introduction of vessels that contribute to reducing energy and CO_2 emissions, new vessels and equipment, and the application of the Energy Conservation Act.	Promotion of a modal shift to marine transportation	Law / Standard, Taxation, Subsidy, Financing, Awareness Raising	Implemented	Energy	Transport	CO_2	2001	MLIT	NE	33	225	615	481	510	622	576	1,112	NE	1,369	1,879
Promotion of a modal shift to rail freight transportation	Promote the modal shift from truck transportation to freight rail transportation because the CO_2 emission intensity of freight rail is 1/13 compared to that of trucks for business use.	Promotion of a modal shift to rail freight transportation	Law / Standard, Taxation, Subsidy, Awareness Raising	Implemented	Energy	Transport	CO_2	2001	MLIT	NE	28	141	96	168	-314	-151	-435	-492	0	424	1,466

Name	Description	Objectives	Type of instrument	Status	Sector(s) affected	Sub-sector(s) affected	Gases affected	Start year of implementation	Implementing entity or entities	Estimates of GHG emission reductions ($kt\ CO_2\ eq$)											
										2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2025	2030
Promotion of decarbonization of logistics facilities	Reduce electricity consumption through the use of lighting and air-conditioning equipment by introducing energy-saving, man-free equipment, such as forklift trucks and AGVs, to create man-free zones. At the same time, achieve decarbonization of warehouses and other logistics facilities by installing photovoltaic power generation and other renewable energy facilities.	Promotion of decarbonization of logistics facilities	Subsidy	Implemented	Energy	Transport	CO_2	2020	MLIT	NE	NE	NE	NE	NE	NE	NE	1	1	4	NE	110
Reduction of the distance of land transportation of cargo through optimal selection of ports and harbors	Reduce the travel distance for truck transportation by developing ports where vessels can call at ports will enable marine transportation to the nearest port	Reduction of the distance of land transportation of cargo through optimal selection of ports and harbors	Subsidy	Implemented	Energy	Transport	CO_2	2016	MLIT	NE	168	192	249	301	301	301	301	301	1,245	960	960
Comprehensive decarbonization of ports and harbors	Promote the introduction of energy-efficient cargo handling machinery	Comprehensive decarbonization of ports and harbors [promotion of introduction of energy-efficient cargo handling machinery, etc.]	Subsidy	Implemented	Energy	Transport	CO_2	2016	MLIT,MOE	NE	3	4	6	7	10	13	13	13	13	20	27
	Promote modal shift and transportation efficiency related to venous logistics	Comprehensive decarbonization of ports and harbors [promotion of modal shift and transportation efficiency improvement related to venous logistics]	Subsidy	Implemented	Energy	Transport	CO_2	2016	MLIT,MOE	NE	6	12	15	22	31	36	47	52	62	133	145

Name	Description	Objectives	Type of instrument	Status	Sector(s) affected	Sub-sector(s) affected	Gases affected	Start year of implementation	Implementing entity or entities	Estimates of GHG emission reductions (kt CO_2 eq)											
										2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2025	2030
Utilization of the Special Zones for Structural Reform system related to global warming countermeasures	Reduce CO_2 emissions by reducing the number of carriages transporting steel products to public wharves by using special exception measures (projects to improve port logistics efficiency using special large-size transportation vehicles). Also, reduce CO_2 emissions by using special measures (special measures for the use of pipelines for the transport of specially controlled industrial waste).	Utilization of the Special Zones for Structural Reform system related to global warming countermeasures	Law / Standard	Implemented	Energy	Transport	CO_2	2016	CAO	53	53	53	53	53	53	53	53	NE	NE	53	53
Expansion of the use of blended cement	Reduce the amount of clinker, an intermediate product of cement, by expanding the use of blended cement, and reducing the amount of CO_2 produced by chemical reactions in the clinker manufacturing process from the raw material (black ash).	Expansion of the use of blended cement	Law / Standard, Awareness Raising, Other	Implemented	Industry/Industrial Processes		CO_2	2001	METI,MLIT,MOE	NE	0	0	0	0	0	0	0	0	0	NE	388
Fluorinated Gases: (HFCs, PFCs, SF_6, NF_3)	Promote non-fluorocarbons and low-GWP products to gas and equipment manufacturers in accordance with the Act on Rational Use and Appropriate Management of Fluorocarbons.	Promotion of non-fluorocarbons and low GWP products in gas and manufacturing sector	Law / Standard, Subsidy, Technology Development, Awareness Raising, Other	Implemented	Industry/Industrial Processes		HFCs,PFCs,SF_6,NF_3	2015	MOE,METI	NE	148	141	547	551	1,317	1,755	3,059	4,548	6,073	8,910	14,630
	Request equipment users to implement measures against leakage during use through inspections	Preventing leakage of fluorocarbons from the use of refrigeration and air-conditioning equipment for business use	Law / Standard, Subsidy, Technology Development, Awareness Raising, Other	Implemented	Industry/Industrial Processes		HFCs,PFCs,SF_6,NF_3	2015	MOE,METI	NE	NE	NE	820	1,540	2,160	2,770	3,270	3,770	4,540	13,300	21,500
	Promote the recovery of fluorocarbons, for which measures were strengthened by the 2022 amendment of the law and promote measures throughout the entire life cycle of fluorocarbons	Recovery of fluorocarbons from refrigeration and air-conditioning equipment for business use waste	Law / Standard, Subsidy, Technology Development, Awareness Raising, Other	Implemented	Industry/Industrial Processes		HFCs,PFCs,SF_6,NF_3	2001	MOE,METI	NE	-19	-327	-288	12	32	-54	-208	-395	-256	13,500	16,900

Name	Description	Objectives	Type of instrument	Status	Sector(s) affected	Sub-sector(s) affected	Gases affected	Start year of implementation	Implementing entity or entities	Estimates of GHG emission reductions ($kt\ CO_2\ eq$)											
										2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2025	2030
	Promote collection of waste household air conditioners based on the Act on Recycling of Specified Kinds of Home Appliances and increase the amount of HFCs recovered contained as a refrigerant.	Recovery and proper processing of fluorocarbons from the disposal of household air conditioners	Law / Standard, Subsidy, Technology Development, Awareness Raising, Other	Implemented	Industry/Industrial Processes		HFCs,PFCs,SF_6,NF_3	2021	MOE,METI	NE	NE	NE	NE	NE	NE	0	-150	30	NE	620	1,130
	Require comprehensive measures through emission controls based on the industry's voluntary action plans.	Promotion of voluntary initiatives by industry	Law / Standard, Subsidy, Technology Development, Awareness Raising, Other	Implemented	Industry/Industrial Processes		HFCs,PFCs,SF_6,NF_3	1998	MOE,METI	NE	244	179	193	221	223	221	206	236	183	880	1,220
Reduction of methane emissions in paddy fields	Promote reduction of CH_4 emissions from rice cultivation by prolonging the mid-season drainage period, which reduces CH_4 generation as water management for rice cultivation	Measure to reduce GHG emissions in agricultural soils [CH4 emission reduction from rice cultivation]	Law / Standard, Subsidy, Awareness Raising, Other	Implemented	Agriculture		CH_4	2007	MAFF	NE	-30	150	-60	0	90	180	150	170	460	NE	1,040
Reduction of nitrous oxide associated with fertilization	Reduce N_2O emissions generated by fertilizer application by reducing the amount of fertilizer applied, using a divided application, and using slow-release fertilizers.	N_2O emission reduction associated with fertilizer application	Subsidy, Awareness Raising	Implemented	Agriculture		N_2O	2007	MAFF	NE	51	123	93	-92	-95	-4	10	-83	64	156	244
Policies and measures for forest carbon sinks	Based on the Basic Plan for Forests and Forestry and utilizing a variety of policies and measures, the government will secure CO_2 removals of forests by promoting forest sink measures such as the development of healthy forests through appropriate thinning and reforestation, promoting appropriate management and conservation of protection forests, fostering efficient and stable forest management, promoting public participation in forest management, and promoting the use of wood and woody biomass.	Policies and measures for forest carbon sinks	Law / Standard, Taxation, Subsidy, Financing, Technology Development, Awareness Raising	Implemented	LULUCF		CO_2	2007	MAFF	51,720	61,050	57,360	55,560	55,270	53,850	49,470	47,150	48,080	45,680	NE	38,000

Name	Description	Objectives	Type of instrument	Status	Sector(s) affected	Sub-sector(s) affected	Gases affected	Start year of implementation	Implementing entity or entities	Estimates of GHG emission reductions ($kt CO_2 eq$)											
										2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2025	2030
Policies and measures to increase carbon removals in agricultural soils	Promote carbon sequestration in cropland and grassland soils by promoting soil preparation through the application of organic matter such as compost and green manure.	Measures to increase carbon removals in agricultural soils	Law / Standard, Subsidy, Awareness Raising, Other	Implemented	LULUCF		CO_2	2008	MAFF	1,450	130	950	1,490	2,460	3,530	2,970	3,330	3,990	3,000	NE	8,500
Promotion of urban greening	Promote greening in urban parks, roads, ports, etc.	Promotion of urban greening	Law / Standard, Subsidy	Implemented	LULUCF		CO_2	2006	MLIT	1,150	1,170	1,190	1,210	1,230	1,240	1,270	1,279	1,550	1,470	1,220	1,240
Diffusion of biomass plastics	Promote the use of carbon-neutral biomass plastics to replace petroleum-based plastics used in products, thereby reducing non-energy related CO_2 dioxide emissions from the incineration of plastics, both general and industrial waste. Present policies and measures to expand the introduction of biomass plastics in the Biomass Plastics Road Map (formulated in January 2021). Develop guidelines for environmentally friendly design by the Act on the Promotion of Resource Circulation related to Plastics, and the government certify designs that comply with the guidelines, leading to increased use of plastic.	Diffusion of biomass plastics	Law / Standard, Subsidy, Technology Development, Other	Implemented	Waste management/Waste		CO_2	2016	MOE	0	-8	-7	2	9	6	11	50	80	NE	1,410	2,090
Reduction of waste incineration	Reduce non-energy-related CO_2 emissions associated with the incineration of plastics by reducing incineration of municipal waste plastics by controlling their discharge and promoting recycling through sorted collection and recycling of plastic resources. Reduce non-energy-related CO_2 emissions associated with the incineration of plastics by reducing incineration of industrial waste plastics by promoting the 3Rs.	Promotion of recycling of waste plastics	Law / Standard, Technology Development, Awareness Raising	Implemented	Waste management/Waste		CO_2	2013	MOE	0	1,190	1,430	2,030	2,210	3,020	3,240	3,870	4,150	4,040	4,980	6,400
	Reduce non-energy-related CO_2 emissions from incineration by reducing the amount of industrial waste oil incinerated by promoting the 3Rs and other measures	Promotion of recycling of waste oil	Law / Standard, Technology Development, Awareness Raising	Implemented	Waste management/Waste		CO_2	2013	MOE	0	74	74	0	74	99	49	-10	143	130	398	699

Name	Description	Objectives	Type of instrument	Status	Sector(s) affected	Sub-sector(s) affected	Gases affected	Start year of implementation	Implementing entity or entities	Estimates of GHG emission reductions (kt CO_2 eq)											
										2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2025	2030
Reduction of final waste disposal	Reduce the amount of direct landfilled organic solid waste by banning direct landfill of organic solid waste. Reduce CH_4 emissions from the decomposition of organic municipal waste in landfill sites. Continue to reduce the volume of final disposal of industrial waste by promoting the 3Rs.	Reduction of final waste disposal	Law / Standard, Awareness Raising	Implemented	Waste management/Waste		CH_4	2016	MOE	NE	6	28	58	91	127	155	192	226	NE	390	520
Adoption of semi-aerobic landfill structures in final waste disposal sites	Reduce CH_4 generation from the decomposition of organic waste by adopting a semi-aerobic landfill structure and open outflow port of leachate collection system when a new municipal waste landfill site is constructed, compared to an anaerobic landfill structure.	Adoption of semi-aerobic landfill structures in municipal waste disposal sites	Law / Standard	Implemented	Waste management/Waste		CH_4	2016	MOE	NE	0	3	5	6	6	7	7	8	NE	39	54
	Reduce CH_4 generation from the decomposition of organic waste by adopting a semi-aerobic landfill structure and open outflow port of leachate collection system when a new industrial waste landfill site is constructed, compared to an anaerobic landfill structure.	Adoption of semi-aerobic landfill structures in industrial waste disposal sites	Law / Standard	Implemented	Waste management/Waste		CH_4	2016	MOE	NE	0	-1	-3	-3	-3	-1	1	2	NE	2	4
Advancement of incineration at sewage sludge incineration facilities	Reduce N_2O emissions from sludge incineration, which are generated during wastewater treatment, by advancing combustion efficiency	Advancement of incineration at sewage sludge incineration facilities	Law / Standard, Taxation, Subsidy, Technology Development, Awareness Raising	Implemented	Waste management/Waste		N_2O	2001	MLIT	NE	100	40	145	35	20	250	330	195	NE	630	780
Activation of the J-Credit Scheme	Further revitalize the J-Credit scheme, which certifies the GHG emission reductions and removals achieved through emission reduction measures by installing energy-saving equipment and utilizing renewable energy, and through sink measures by appropriate forest management, as credits that can be used to achieve the targets of the Industry's Action Plans for a Low-Carbon Society, carbon offsets, and other measures.	Activation of the J-Credit Scheme	Law / Standard, Awareness Raising, Other	Implemented	Cross-Cutting		CO_2, CH_4, N_2O, HFCs,PFCs ,SF_6,NF_3	2013	MOE,METI,MAFF	30	630	1,030	2,420	3,420	4,710	5,850	6,970	8,060	8,890	11,000	15,000

Name	Description	Objectives	Type of instrument	Status	Sector(s) affected	Sub-sector(s) affected	Gases affected	Start year of implementation	Implementing entity or entities	Estimates of GHG emission reductions (kt CO_2 eq)											
										2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2025	2030
Promotion of the Joint Crediting Mechanism (JCM)	Quantitatively evaluate Japan's contribution to the reduction of emissions and increase in removals through the deployment of decarbonization technologies, products, systems, services, and infrastructure, as well as the implementation of countermeasures, and implement the JCM to use it to achieve Japan's NDCs. By doing this, Japan aims to achieve international emission reductions and removals for a total of about 100 Mt-CO_2 by 2030 through public-private partnerships.	Promotion of the Joint Crediting Mechanism (JCM)	Law / Standard, Subsidy	Implemented	Cross-Cutting		CO_2, CH_4, N_2O, HFCs,PFCs ,SF_6,NF_3	2013	MOE, METI	0	2	15	52	553	2,827	5,124	7,902	11,582	14,978	NE	100,000
Decarbonization initiatives in national parks	Register areas in national parks that are taking prior actions to decarbonize through the use of electric vehicles, renewable energy, etc., as "Zero Carbon Parks" and promote such efforts.	Promotion of decarbonization efforts in national parks [Zero Carbon Park]	Subsidy	Implemented	Cross-Cutting		CO_2, CH_4, N_2O, HFCs,PFCs ,SF_6,NF_3	2021	MOE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Proactive actions by the national government	Implementation and inspection of government action plans. Implementation and inspection of action plans of each ministry and agency	Proactive actions by the national government	Law / Standard, Subsidy, Education, Other	Implemented	Cross-Cutting		CO_2, CH_4, N_2O, HFCs,PFCs ,SF_6,NF_3	2001	MOE	NE	NE	NE	108	164	213	294	348	381	458	NE	1,196
Proactive actions by local governments and promotion by the national government	Reduce GHG emissions by establishing the local government's action plans for municipal operations and implementing their measures.	Initiatives led by local government's and promotion by the national government	Law / Standard, Subsidy	Implemented	Cross-Cutting		CO_2, CH_4, N_2O, HFCs,PFCs ,SF_6,NF_3	2001	MOE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Promotion of initiatives based on the local government's action plans for entire municipal jurisdictions	Reduce GHG emissions by establishing the local government's action plans for entire municipal jurisdictions and implementing their measures.	Promotion of efforts local government's action plans for entire municipal jurisdictions	Law / Standard, Subsidy	Implemented	Cross-Cutting		CO_2, CH_4, N_2O, HFCs,PFCs ,SF_6,NF_3	2008	MOE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Transition to a decarbonized lifestyle	Promote understanding of the critical situation of global warming and its adverse effects on society and promote Cool Biz and Warm Biz.	Promotion of thorough implementation of Cool Biz and Warm Biz	Law / Standard, Subsidy, Awareness Raising	Implemented	Cross-Cutting		CO_2	2005	MOE	-37	-233	-203	-254	-446	-616	-435	-239	137	265	742	553

Name	Description	Objectives	Type of instrument	Status	Sector(s) affected	Sub-sector(s) affected	Gases affected	Start year of implementation	Implementing entity or entities	Estimates of GHG emission reductions ($kt CO_2 eq$)											
										2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2025	2030
	Promote understanding of the critical situation of global warming and its adverse effects on society and promote home eco-diagnosis.	Home Eco-Diagnosis	Law / Standard, Subsidy, Awareness Raising	Implemented	Cross-Cutting		CO_2	2005	MOE	1	1	2	2	3	3	3	3	3	4	26	49
	Implement eco-driving with consideration for reduction of environmental impact	Eco-driving	Law / Standard, Subsidy, Awareness Raising	Implemented	Cross-Cutting		CO_2	2006	MOE	260	NE	NE	NE	NE	NE	4,680	5,884	5,882	5,875	5,800	6,570
	Implement car sharing with consideration for reduction of environmental impact	Car sharing	Law / Standard, Subsidy, Awareness Raising	Implemented	Cross-Cutting		CO_2	2005	MOE	70	167	292	388	529	674	853	726	806	962	1,170	1,920
	Promote measures to reduce food loss to achieve a decarbonized society.	Reduction of food loss and waste in households	Law / Standard, Subsidy, Awareness Raising	Implemented	Cross-Cutting		CO_2	2018	MOE	0	92	60	51	83	120	189	253	267	NE	281	396

Note
1: ”NE” means "Not Estimated"
2: Negative values mean that the measures were not as advanced as expected and the actual results of emission reductions did not reach the expected emission reductions.
3: The full names of the abbreviations for the implementing entity are as follows.
CAO: Cabinet Office
FSA: Financial Services Agency
MAFF: Ministry of Agriculture, Forestry and Fisheries
METI: Ministry of Economy, Trade and Industry
MEXT: Ministry of Education, Culture, Sports, Science and Technology
MHLW: Ministry of Health, Labour and Welfare
MIC: Ministry of Internal Affairs and Communications
MLIT: Ministry of Land, Infrastructure, Transport and Tourism
MOE: Ministry of the Environment
MOF: Ministry of Finance
NPA: National Police Agency

9 Methodologies and assumptions used to estimate the GHG emission reductions or removals due to each action, policy and measure

9.1 Overview

The achieved emission reductions for FY 2013-2022 and the expected emission reductions for FY 2025 and FY 2030 reported in Table II-11 Information on mitigation policies and measures (CTF Table 5) are estimated based on the methodologies developed in the *Plan for Global Warming Countermeasures* defining the details of each policy and measure. The assumptions used in the estimation of the emission reductions from each policy and measure in the *Plan for Global Warming Countermeasures* are listed in the appended table of the plan[59]. For more detailed information, please refer to that document.

The appended table of the *Plan for Global Warming Countermeasures* includes specific details, evaluation indicators, expected emission reductions, and an overview of the methodology for the expected emission reductions of each policy and measure. The expected emission reductions are estimated by multiplying the amount of energy saved or GHG reductions by the implementation of policy and measure (emission reduction intensity) by the implementation status of the policy and measure (for example, the number of energy-saving devices installed, the implementation rate of the measure, etc.), after setting appropriate comparable such as base year and BAU for each policy and measure. The achieved emission reductions in previous years due to each policy and measure are estimated based on the actual introduction of the policies and measures, using the same methodologies as for the expected emission reductions. Details of the progress of each policy and measure up to the latest year (FY 2022) are published by the Global Warming Prevention Headquarters in a document titled *Progress of the Plan for Global Warming Countermeasures in FY 2022*[60].

Below are the methodologies and assumptions for estimating emission reductions for representative policies and measures in each sector.

9.2 Assumptions and methodologies for estimating emission reductions in each sector

(1) Energy Sector

(a) Maximum introduction of renewable energy (expansion of renewable electricity use)

[Measure Evaluation Indicator]

Electricity generated from renewable energy sources (100 million kWh)

[Methodologies]

Expected emission reductions (kt CO_2) = measure evaluation indicator (100 million kWh) x average emission factor of thermal power electricity generation

The average emission factor of thermal power electricity generation for FY 2013 and FY 2030 are set from the *Environmental Action Plan by the Japanese Electric Utility Industry* (The Federation of Electric Power Companies of Japan) and the *Outlook for Long-Term Energy Supply and Demand* (July 2015,

[59] *Plan for Global Warming Countermeasures* <https://www.env.go.jp/content/000249336.pdf>

[60] *Progress of the Plan for Global Warming Countermeasures in FY 2022* <https://www.env.go.jp/content/900447451.pdf>

Agency for Natural Resources and Energy), respectively.

The assumption of electricity generation in FY 2030 is based on the *Outlook for Long-Term Energy Supply and Demand* (July 2015, Agency for Natural Resources and Energy).

(b) Diffusion of next-generation vehicles, improvement of fuel efficiency

[Measure Evaluation Indicators]

Share of next-generation vehicles to new vehicle sales (%)

Average fuel efficiency of vehicles owned (km/L)

[Methodologies]

The amount of energy saved is calculated using the following formula because the fuel efficiency of vehicles improves due to the diffusion of next-generation vehicles and the improvement of fuel efficiency.

Energy consumption [L] = Total running mileage [km] / Average fuel efficiency of vehicles owned [km/L]

The average fuel efficiency of vehicles owned is a stock-based value calculated by multiplying the average fuel efficiency of new vehicles sold in each fiscal year by the number of remaining vehicles owned in each fiscal year and dividing by the total number of vehicles owned.

The emission reductions are calculated by estimating energy consumption based on the average fuel efficiency owned by each vehicle type and multiplying by emission factors for each energy source.

The share of next-generation vehicles to new vehicle sales in FY 2030 is based on the *Japan Revitalization Strategy 2015* (decided in June 2015).

(2) Industrial Processes and Product Areas of Use

(a) Expansion of the use of blended cement

[Measure Evaluation Indicator]

Share of blended cement production in total cement production (%)

[Methodologies]

The expected emission reductions are calculated by subtracting CO_2 emissions under the with measures scenario from CO_2 emissions under the without measures scenario, based on the estimated production for the relevant fiscal year.

Expected emission reductions = (CO_2 emissions under the without measures scenario) - (CO_2 emissions under the with measures scenario) for the relevant year

CO_2 emissions = Portland cement production × CO_2 emission factor of limestone calcination originated Portland cement + blended cement production × CO_2 emission factor of limestone calcination originated blended cement

Without measures scenario: The share of blended cement production to total cement production is the same as that of the base year, FY 2013.

With measures scenario: The share of blended cement production to total cement production would

be the same level as the forecast in the measure evaluation indicator.

Production volume forecast: The values shown in the *Low-Carbon Society Action Plan* and the *Outlook for Long-Term Energy Supply and Demand (*July 2015*)* in the cement industry.

(b) Preventing leakage of fluorocarbons from the use of commercial refrigeration and air-conditioning equipment

[Measure Evaluation Indicator]

Leakage rate of reduction rate in use for equipment of 7.5 kW and above (%)

Leakage rate of reduction rate in use for equipment less than 7.5 kW (separately installed SC) (%)

Leakage rate of reduction rate in use for equipment less than 7.5 kW (other than separately installed SC) (%)

[Methodologies]

Assuming that periodic inspections and simple inspections based on the Act on Rational Use and Proper Management of Fluorocarbons will reduce the leakage rate in use.

Emissions are calculated as follows:

(Emissions at production) = (Number of units produced) x (Emissions at production per unit)

(Leakage in use) = (Number of units stocked in the market) x (Maximum amount of refrigerant) x (Emission factor) - (Recovered amount during maintenance)

(Emissions at disposal) = (Number of units disposed of) x (Amount of refrigerant remaining per unit) - (Amount recovered at disposal)

Estimated emission reductions are calculated from the difference between BAU emissions and emissions based on assumptions.

(3) Agriculture Sector

(a) Reduction of paddy methane emissions

[Measure Evaluation Indicator]

Implementation rate of the prolonged mid-season drainage period (%) (* Since the implementation rate of the prolonged mid-season drainage period is not the only variable that affects methane emissions, it is positioned as a reference indicator)

[Methodologies]

Based on data such as the rice paddies planted area, drainage of rice paddies, the amount of organic matter applied to rice paddy soil, and the ratio of intermittently irrigated rice fields, methane emissions for each year are estimated using the calculation model (DNDC-Rice model) developed by the National Institute for Agro-Environmental Sciences, and the differences between the actual methane emissions in FY 2013 and those for each year are considered as the expected emission reductions.

The implementation rate of the prolonged mid-season drainage period is calculated by dividing the area where the long-term mid-season drainage is implemented taken from the direct payment subsidy

for environmentally friendly agriculture by the rice cultivated area in the *Statistics of Cultivated and Planted Area*.

(b) Reduction of nitrous oxide due to fertilizer application

[Measure Evaluation Indicator]

Chemical fertilizer demand (kt N)

[Methodologies]

Since N_2O from agricultural land is generated in proportion to the amount of fertilizer applied, the N_2O emissions are estimated based on the demand for chemical fertilizer and emission factors. The difference between the actual emissions and the BAU in each fiscal year is considered as the emission reductions.

The demand for chemical fertilizers was estimated based on the assumption that the production effort target (FY 2025) based on the new *Basic Plan for Food, Agriculture, and Rural Areas* (approved by the Cabinet on March 31, 2015) will be achieved.

(4) LULUCF Sector

(a) Policies and measures for forest sinks

[Measure Evaluation Indicator]

Forest management area (10,000 ha)

[Methodologies]

Forest removals are calculated as the sum of the amount of forest removals expected to be secured if forest sink measures, including forest management, are implemented as targeted, and the effect of HWP (harvested wood products) expected if efforts are made to expand supply and use of forest products

Forests included in the calculation of forest removals

- Ikusei-rin forests: Forestry practices conducted since 1990 to maintain forests in appropriate conditions, including regeneration (land preparation, soil scarification, planting, etc.), tending (weeding, pre-commercial cutting, etc.), thinning and harvesting.
- Tennensei-rin forests: Protection or conservation of forests, including regulating logging activities and restrictions on land-use changes, which have been carried out by law. Carbon stock changes in HWP from the above-mentioned forests are also included in the estimation of this activity.

(b) Measures to increase carbon sinks in agricultural soils

[Measure Evaluation Indicator]

Carbon storage in soil (mineral soil) (10,000 t CO_2)

[Methodologies]

Based on the amount of organic matter applied to the soil, the amount of crop residues returned to

the soil, and meteorological data on temperature and precipitation, a calculation model developed by the National Institute for Agro-Environmental Sciences (improved Roth-C model) was used to estimate the annual change in soil carbon content (stock) in mineral soil nationwide in each year. The amount of soil carbon sequestration (removals) was estimated based on the accounting rules in the Kyoto Protocol which is the net-net approach that the base year is 1990, as stipulated in the IPCC guidelines.

Assumed that the forecast of crop area for FY 2025 in the *Basic Plan for Food, Agriculture and Rural Areas* (approved by the Cabinet on March 31, 2015) will be achieved or nearly achieved and that the target value will be maintained after FY 2025.

(5) Waste

(a) Reduction in the amount of waste incineration

[Measure Evaluation Indicator]

Amount of municipal waste plastics incinerated (kt) (dry basis)

[Methodologies]

Assuming that the curbing of municipal waste generation and the sorted collection of plastic containers and packaging based on the Act on the Promotion of Resource Circulation related to Plastics will progress from FY 2013 onward. The emission reductions are estimated by multiplying the reduction in the amount of municipal waste plastics incinerated from the BAU scenario (kt [dry basis]/year) by the CO_2 emission factor associated with the incineration of municipal waste plastics.

(b) Reduction of final waste disposal

[Measure Evaluation Indicator]

Final disposal volume of organic municipal waste (kt) (dry weight basis)

[Methodologies]

Assuming that the final disposal volume of organic municipal waste will be reduced after FY 2013. The expected emission reduction is calculated by multiplying the difference between the BAU and the actual value of waste decomposition in each year, which is calculated based on the final disposal volume of organic municipal waste, and the methane emission factor for each waste type and various parameters set in the GHG inventory.

10 Policies and measures no longer in place

There are no policies and measures reported in the *Eighth National Communication* (NC8) and *Fifth Biennial Report* (BR5) submitted in December 2022 that have not been implemented.

11 Modifying longer-term trends in greenhouse gas emissions

Japan aims to achieve net zero greenhouse gas emissions by 2050, based on the idea that addressing climate change is no longer a constraint on economic growth and that proactive climate change measures bring the

transformation of industrial structures as well as its economy and society, leading to dynamic economic growth. By the Amended Global Warming Countermeasures Promotion Act in the 204th session of the Diet (Act No. 54 of 2021), which was enacted in the 204 sessions of the Diet, net zero by 2050 became a Basic Principle of the Act. The legislative amendment will enhance the continuity and predictability of policies and accelerate efforts and investments as well as innovation for decarbonization towards not only the achievement of the midterm target but also the realization of a decarbonized society.

The *Long-Term Strategy as a Growth Strategy Based on the Paris Agreement*, which was approved by the Cabinet on October 22, 2021, and submitted to the UNFCCC secretariat, presents long-term sector-by-sector visions as ideal future models toward the realization of net zero by 2050. These visions will provide directions for all stakeholders to pursue possibilities toward the realization of the target. Together with policy directions, they will improve the predictability of investment and serve as the basis for expanding investment in Japan. At the same time, it identifies areas that need disruptive innovation to promote corporate research and development (R&D) and investment. Furthermore, by setting forth these visions, Japan will take the lead in future international discussions, including the formulation of frameworks and standards in the area of climate change.

Japan aims to reduce its GHG emissions by 46% in FY 2030 from its FY 2013 levels, setting an ambitious target that is aligned with the long-term goal of achieving net zero by 2050. Furthermore, Japan will continue strenuous efforts in its challenge to meet the lofty goal of cutting its emissions by 50%. From now on and towards 2030, Japan will work on a variety of measures, including technology development, all of which will be in line with the goal of net zero by 2050. On the way to FY 2030, Japan will make the best use of the existing technologies to achieve this ambitious goal. On this basis, towards net zero by 2050, Japan will strive to develop and diffuse decarbonization technologies that are yet to be widely deployed by further expanding and deepening the efforts for the FY 2030 target. Meanwhile, it is difficult at this stage to accurately estimate the outcome of the technology development or innovation to fulfill the 2050 goal. Thus, it is necessary to determine and update priorities in climate measures and technology development by constantly reflecting up-to-date information while keeping the ambition of the 2050 net-zero target. Also important is to keep our minds open to all possibilities and to strive to utilize every available technology, aiming at achieving the updated emission reduction target for FY 2030 as well as the ambitious goal of net zero by 2050.

E. Summary of greenhouse gas emissions and removals

(para. 91 of the MPGs)

CTF Table 6: Summary of greenhouse gas emissions and removals in accordance with the common reporting table 10 emission trends – summary is as follows.

For more information on the summary and details of greenhouse gas emissions and removals, please refer to the *National Greenhouse Gas Inventory Document of JAPAN (2024)* and Chapter I.

Table II-12 Summary of greenhouse gas emissions and removals in accordance with the common reporting table 10 emission trends – summary (CTF Table 6)

GREENHOUSE GAS EMISSIONS AND REMOVALS	Reference year/period for NDC	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
	CO_2 equivalents (kt)												
CO_2 emissions without net CO_2 from LULUCF			1,157,373.66	1,169,070.54	1,178,852.02	1,171,862.38	1,226,887.10	1,239,225.93	1,251,737.66	1,244,449.39	1,204,602.52	1,241,233.83	1,263,950.96
CO_2 emissions with net CO_2 from LULUCF			1,083,678.16	1,089,827.85	1,095,825.83	1,085,608.38	1,140,728.19	1,153,351.14	1,164,688.89	1,156,595.75	1,116,649.45	1,153,827.50	1,175,482.31
CH_4 emissions without CH_4 from LULUCF			49,814.96	49,086.61	49,015.92	48,013.99	48,055.43	46,726.22	45,309.02	44,782.24	42,889.68	42,461.73	41,738.66
CH_4 emissions with CH_4 from LULUCF			49,931.67	49,198.50	49,123.28	48,145.22	48,175.83	46,832.94	45,441.01	44,920.52	42,994.91	42,558.67	41,837.81
N_2O emissions without N_2O from LULUCF			28,877.65	28,579.41	28,677.07	28,613.18	29,630.15	29,892.30	30,738.96	31,418.12	30,134.75	24,631.37	26,875.45
N_2O emissions with N_2O from LULUCF			29,748.53	29,431.46	29,509.57	29,425.68	30,417.35	30,659.03	31,492.62	32,161.37	30,866.20	25,352.05	27,582.56
HFCs			13,409.95	14,605.14	14,969.87	15,388.11	17,954.07	21,561.36	21,123.34	21,057.58	20,506.98	21,054.41	19,841.27
PFCs			6,162.69	7,030.77	7,112.98	10,133.72	12,408.13	16,209.87	16,721.20	18,239.37	15,045.09	11,796.00	10,483.24
Unspecified mix of HFCs and PFCs			NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
SF_6			13,763.76	15,222.44	16,757.19	16,825.37	16,091.88	17,624.35	18,257.77	15,807.56	14,479.71	10,321.25	8,190.95
NF_3			27.97	27.97	27.97	37.29	65.26	172.48	164.43	148.49	164.99	275.30	258.18
Total (without LULUCF)			1,269,430.63	1,283,622.88	1,295,413.03	1,290,874.05	1,351,092.02	1,371,412.53	1,384,052.36	1,375,902.73	1,327,823.73	1,351,773.89	1,371,338.70
Total (with LULUCF)			1,196,722.72	1,205,344.13	1,213,326.69	1,205,563.77	1,265,840.72	1,286,411.19	1,297,889.25	1,288,930.62	1,240,707.34	1,265,185.18	1,283,676.32
Total (without LULUCF, with indirect)			1,274,920.52	1,288,934.05	1,300,447.19	1,295,675.01	1,355,883.58	1,376,105.67	1,388,779.85	1,380,459.17	1,331,999.97	1,355,944.68	1,375,580.83
Total (with LULUCF, with indirect)			1,202,212.62	1,210,655.30	1,218,360.86	1,210,364.73	1,270,632.28	1,291,104.32	1,302,616.74	1,293,487.06	1,244,883.58	1,269,355.98	1,287,918.44

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Reference year/period for NDC	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
	CO_2 equivalents (kt)												
1. Energy			1,091,637.39	1,101,948.51	1,109,893.61	1,103,867.12	1,154,767.89	1,166,710.06	1,178,085.35	1,172,559.87	1,138,410.42	1,174,953.12	1,196,891.92
2. Industrial processes and product use			107,441.66	111,844.18	113,778.73	115,769.47	122,574.62	131,844.92	134,027.68	131,078.50	118,810.64	106,912.52	104,964.85
3. Agriculture			39,280.61	38,896.72	39,766.03	39,780.42	39,961.06	39,034.27	38,171.95	38,270.04	37,034.56	37,089.51	37,048.49
4. Land use, land-use change and forestry			-72,707.91	-78,278.75	-82,086.33	-85,310.28	-85,251.30	-85,001.34	-86,163.11	-86,972.11	-87,116.39	-86,588.70	-87,662.39
5. Waste			31,070.98	30,933.47	31,974.65	31,457.04	33,788.47	33,823.28	33,767.40	33,994.32	33,568.11	32,818.73	32,433.44
6. Other			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (with LULUCF)			1,196,722.72	1,205,344.13	1,213,326.69	1,205,563.77	1,265,840.72	1,286,411.19	1,297,889.25	1,288,930.62	1,240,707.34	1,265,185.18	1,283,676.32

GREENHOUSE GAS EMISSIONS AND REMOVALS	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	CO_2 equivalents (kt)									
CO_2 emissions without net CO_2 from LULUCF	1,249,355.11	1,278,980.99	1,287,481.55	1,282,872.03	1,290,333.45	1,267,269.01	1,302,996.43	1,232,180.57	1,163,365.75	1,214,785.38
CO_2 emissions with net CO_2 from LULUCF	1,160,175.61	1,188,163.11	1,186,910.83	1,185,659.38	1,198,740.60	1,180,280.02	1,220,701.91	1,154,523.02	1,088,317.56	1,135,460.71
CH_4 emissions without CH_4 from LULUCF	40,428.86	39,510.11	38,501.19	38,158.53	38,150.96	37,518.53	36,834.90	35,943.76	35,336.94	34,830.53
CH_4 emissions with CH_4 from LULUCF	40,532.82	39,624.16	38,592.73	38,260.55	38,248.65	37,606.55	36,922.15	36,056.50	35,432.13	34,918.43
N_2O emissions without N_2O from LULUCF	23,669.31	23,006.49	23,150.43	22,995.86	22,706.29	22,691.81	22,334.93	21,463.75	20,898.67	20,572.85
N_2O emissions with N_2O from LULUCF	24,362.25	23,685.87	23,814.60	23,647.45	23,337.58	23,300.77	22,924.60	22,033.57	21,441.07	21,093.38
HFCs	16,998.64	14,371.36	14,488.20	11,441.37	11,848.46	13,588.84	15,642.52	18,037.47	19,668.96	21,964.07
PFCs	8,711.17	8,213.50	7,958.20	8,326.05	7,801.85	8,177.37	7,182.08	5,198.60	3,667.46	3,842.80
Unspecified mix of HFCs and PFCs	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
SF_6	6,933.64	6,591.86	6,236.47	6,153.43	5,827.95	5,919.49	5,355.99	4,705.35	2,759.75	2,779.09
NF_3	264.99	332.14	377.29	437.96	1,362.55	1,293.61	1,462.37	1,365.05	1,250.50	1,423.42
Total (without LULUCF)	1,346,361.71	1,371,006.44	1,378,193.33	1,370,385.24	1,378,031.53	1,356,458.66	1,391,809.22	1,318,894.55	1,246,948.03	1,300,198.15
Total (with LULUCF)	1,257,979.12	1,280,981.98	1,278,378.32	1,273,926.20	1,287,167.65	1,270,166.65	1,310,191.61	1,241,919.56	1,172,537.43	1,221,481.90
Total (without LULUCF, with indirect)	1,350,165.28	1,374,568.63	1,381,615.59	1,373,731.43	1,381,282.34	1,359,631.78	1,394,831.28	1,321,618.24	1,249,461.54	1,302,639.68
Total (with LULUCF, with indirect)	1,261,782.69	1,284,544.17	1,281,800.58	1,277,272.39	1,290,418.47	1,273,339.77	1,313,213.67	1,244,643.25	1,175,050.94	1,223,923.44

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	CO_2 equivalents (kt)									
1. Energy	1,184,584.95	1,216,210.69	1,225,086.24	1,220,918.08	1,227,839.54	1,205,115.14	1,241,309.24	1,173,529.25	1,112,282.16	1,162,225.22
2. Industrial processes and product use	94,815.83	88,956.33	87,924.36	85,367.50	86,473.82	89,118.38	88,249.63	83,730.82	76,384.39	79,599.45
3. Agriculture	36,260.35	36,443.27	35,945.98	35,823.28	36,271.13	36,111.74	36,481.54	35,358.48	35,158.92	35,394.54
4. Land use, land-use change and forestry	-88,382.59	-90,024.45	-99,815.01	-96,459.05	-90,863.87	-86,292.00	-81,617.61	-76,974.99	-74,410.60	-78,716.24
5. Waste	30,700.59	29,396.14	29,236.76	28,276.39	27,447.04	26,113.40	25,768.81	26,275.99	23,122.56	22,978.93
6. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (with LULUCF)	1,257,979.12	1,280,981.98	1,278,378.32	1,273,926.20	1,287,167.65	1,270,166.65	1,310,191.61	1,241,919.56	1,172,537.43	1,221,481.90

GREENHOUSE GAS EMISSIONS AND REMOVALS	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Change from 1990 to latest reported year
	CO_2 equivalents (kt)												(%)
CO_2 emissions without net CO_2 from LULUCF	1,264,803.16	1,305,969.51	1,315,319.81	1,263,765.97	1,223,194.82	1,203,177.55	1,187,523.91	1,142,499.29	1,105,461.58	1,040,475.86	1,061,855.50	1,034,861.07	-10.59
CO_2 emissions with net CO_2 from LULUCF	1,186,529.21	1,224,805.23	1,241,424.94	1,193,509.74	1,158,831.27	1,142,676.61	1,123,503.68	1,079,185.32	1,047,718.85	981,690.47	1,003,093.58	981,200.92	-9.46
CH_4 emissions without CH_4 from LULUCF	33,469.48	32,732.27	32,660.55	32,097.90	31,682.52	31,638.88	31,433.68	30,926.28	30,639.08	30,404.00	30,377.58	29,866.97	-40.04
CH_4 emissions with CH_4 from LULUCF	33,558.01	32,814.44	32,744.27	32,202.44	31,767.84	31,717.50	31,536.56	31,005.71	30,721.36	30,483.32	30,464.58	29,947.06	-40.02
N_2O emissions without N_2O from LULUCF	20,201.81	19,890.17	19,896.96	19,453.75	19,170.91	18,712.55	18,954.79	18,490.15	18,032.29	17,692.36	17,592.00	17,252.26	-40.26
N_2O emissions with N_2O from LULUCF	20,697.51	20,359.73	20,348.61	19,891.99	19,594.70	19,125.21	19,359.03	18,889.65	18,431.68	18,092.07	17,994.90	17,657.52	-40.64
HFCs	24,624.99	27,730.25	30,336.63	33,843.98	37,122.08	39,485.14	40,952.93	42,336.01	44,466.60	46,143.64	46,896.17	46,136.61	244.05
PFCs	3,400.36	3,123.69	2,984.67	3,065.58	3,016.56	3,075.81	3,191.88	3,200.20	3,156.35	3,214.18	2,904.84	3,048.52	-50.53
Unspecified mix of HFCs and PFCs	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	–
SF_6	2,531.75	2,482.71	2,345.91	2,288.02	2,365.79	2,407.26	2,323.84	2,272.12	2,202.05	2,246.19	2,238.15	2,135.95	-84.48
NF_3	1,668.88	1,398.59	1,504.29	1,041.80	524.43	581.53	406.85	276.06	256.83	292.79	331.53	336.30	1,102.37
Total (without LULUCF)	1,350,700.43	1,393,327.20	1,405,048.80	1,355,557.01	1,317,077.12	1,299,078.72	1,284,787.89	1,240,000.11	1,204,214.78	1,140,469.02	1,162,195.77	1,133,637.69	-10.70
Total (with LULUCF)	1,273,010.70	1,312,714.64	1,331,689.31	1,285,843.55	1,253,222.67	1,239,069.06	1,221,274.77	1,177,165.07	1,146,953.72	1,082,162.66	1,103,923.75	1,080,462.89	-9.71
Total (without LULUCF, with indirect)	1,353,054.54	1,395,610.65	1,407,337.90	1,357,774.54	1,319,271.59	1,301,235.54	1,286,909.29	1,242,072.63	1,206,230.11	1,142,344.12	1,164,039.66	1,135,458.33	-10.94
Total (with LULUCF, with indirect)	1,275,364.81	1,314,998.09	1,333,978.41	1,288,061.08	1,255,417.15	1,241,225.87	1,223,396.18	1,179,237.59	1,148,969.05	1,084,037.75	1,105,767.65	1,082,283.52	-9.98

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Change from 1990 to latest reported year
	CO_2 equivalents (kt)												(%)
1. Energy	1,212,953.68	1,253,260.96	1,260,769.02	1,210,165.94	1,171,257.55	1,152,195.82	1,136,279.74	1,090,695.95	1,055,067.29	993,441.95	1,012,903.61	989,178.82	-9.39
2. Industrial processes and product use	81,260.59	83,733.55	87,928.88	90,392.59	91,347.53	93,370.21	95,362.89	95,732.04	96,151.92	95,161.70	97,044.96	93,425.77	-13.05
3. Agriculture	34,605.97	34,199.40	34,485.62	34,090.71	33,871.72	33,907.76	34,023.60	33,780.82	33,704.30	33,830.98	33,906.15	33,509.53	-14.69
4. Land use, land-use change and forestry	-77,689.73	-80,612.56	-73,359.49	-69,713.46	-63,854.44	-60,009.67	-63,513.12	-62,835.04	-57,261.06	-58,306.37	-58,272.01	-53,174.81	-26.87
5. Waste	21,880.19	22,133.30	21,865.29	20,907.76	20,600.32	19,604.93	19,121.65	19,791.30	19,291.26	18,034.40	18,341.05	17,523.57	-43.60
6. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	–
Total (with LULUCF)	1,273,010.70	1,312,714.64	1,331,689.31	1,285,843.55	1,253,222.67	1,239,069.06	1,221,274.77	1,177,165.07	1,146,953.72	1,082,162.66	1,103,923.75	1,080,462.89	-9.71

F. Projections of greenhouse gas emissions and removals

(paras. 92-102 of the MPGs)

1 Overview

(General)

- The future projections of greenhouse gas (GHG) emissions and removals of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3) for FY 2030 are estimated by gas and sector.
- The projected total GHG emissions (excluding the net GHG removal contribution of the LULUCF sector) in FY 2030 under a with measures scenario is approximately 813 Mt CO_2 eq., which is a decrease of 42% from FY 2013. Considering the projections for the GHG removals contribution of LULUCF (removals by forest carbon sinks [approximately 38 Mt CO_2], carbon sinks in agricultural soils [approximately 8.5 Mt CO_2] and urban greening [approximately 1.2 Mt CO_2]) and the Joint Crediting Mechanism (JCM) in FY 2030, the projected total GHG emissions for FY 2030 will be a reduction of 46% from FY 2013.
- Japan has not yet estimated the future projections of GHG emissions and removals in FY 2035. Therefore, only the future projections in FY 2030 are reported.

(Projections by gas)

- The projected emissions of energy-related CO_2 in FY 2030 decrease by 45% compared to the emissions in FY 2013 (approximately 677 Mt CO_2). A significant reduction is expected in all sectors, and the reduction rate is particularly large in the residential and commercial sectors.
- The projected emissions of non-energy-related CO_2 (Fugitive emissions from fuels, Industrial Processes and Product Use (IPPU), Agriculture, Waste, and Indirect CO_2) in FY 2030 decrease by 15% compared to FY 2013 (approximately 70.0 Mt CO_2).
- The estimated CH_4 emissions in FY 2030 decrease by 11% compared to FY 2013 (approximately 29.1 Mt CO_2 eq.). The largest reduction rate from FY 2013 is in the waste sector, followed by fugitive emissions from fuels.
- The N_2O projected emissions in FY 2030 decrease by 17% compared to FY 2013 (approximately 16.5 Mt CO_2 eq.). The largest reduction rate from FY 2013 is in the fuel combustion sector, followed by the IPPU sector.
- The projected emissions of fluorinated gases (HFCs, PFCs, SF_6, and NF_3) in CY 2030 decrease by 44% from CY 2013 (approximately 20.9 Mt CO_2 eq.).

(Projections by sector)

- The projected emissions of the energy sector in FY 2030 are a decrease of 45% compared to FY 2013 (approximately 682.8 Mt CO_2 eq.).
- The projected emissions of the IPPU sector in FY 2030 are a decrease of 27% compared to FY 2013 (approximately 64.3 Mt CO_2 eq.). The emission decrease in FY 2030 is based on an emission reduction in the refrigerants sector by leakage prevention of fluorocarbons from the use of refrigerators and air conditioners, promotion of the recovery of fluorocarbons in disposal and promotion of eliminating fluorocarbons, and the lowering of the GWP.

- The projected emissions from the agriculture sector in FY 2030 are a decrease of 1% compared to FY 2013 (approximately 34.0 Mt CO_2 eq.). The emission decrease in FY 2030 is based on the reduction of emissions from rice cultivation through the implementation of emission reduction measures.
- The estimated net removals of the LULUCF sector in FY 2030 (based on the scope of the national GHG inventory) are approximately 37.6 Mt CO_2.
- The projected emissions from the waste sector in FY 2030 are a decrease of 24% compared to FY 2013 (approximately 30.1 Mt CO_2 eq.). The emission decrease in FY 2030 is based on a decrease in the amount of waste incineration, final disposal, and treated wastewater by the promotion of 3R and CO_2 emission reduction in plastics incineration by the introduction of biomass plastics.
- The estimated indirect CO_2 emissions in FY 2030 are a decrease of 11% compared to FY 2013 (approximately 2.0 Mt CO_2 eq.). The emission based on decrease in FY 2030 are a decrease in the amount of use of solvents such as paint.

2 Projections

(paras. 92-95，97-101 of the MPGs)

2.1 Projected scenarios

The future projections of the emissions and removals of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3) for FY 2030 are estimated by gas and by sector as follows.

In accordance with paragraph 95 of the MPGs, the future projections must begin from the most recent year in the national inventory report and extend at least 15 years beyond the next year ending in zero or five (i.e., FY 2040). However, as the future projections are under consideration together with the next NDC to be submitted in February 2025, only the projections for FY 2030 are to be reported in the BTR1.

Paragraph 97 of the MPGs also requests that projections of key indicators to determine progress towards its NDC be provided. Since Japan's NDC is an economy-wide absolute greenhouse gas emission reduction target, as explained in Chapter II B and C, the key indicators to determine progress towards NDC are total greenhouse gas emissions. Therefore, the projections of greenhouse gas emissions reported in this section correspond to the projections of key indicators.

Based on the outlook of the macro frame shown in Chapter II.F.3.2, the projections for FY 2030 are estimated under a with measures scenario in consideration of future emission reductions by each policy and measure described in Chapter II.D. This with measures scenario considers the policies and measures that have already been implemented at the time of FY 2013 and those adopted and will be implemented by FY 2030 in the future.

A without measures scenario is not estimated. According to the UNFCCC reporting guidelines, a 'without measures' projection should exclude all policies and measures implemented, adopted, or planned after the year chosen as the starting point for that projection. However, it is impossible to estimate the emission figures accurately before the PaMs are implemented because each indicator used for the projection has already reflected the reduction effects of PaMs and it is difficult to exclude the effects of interconnected PaMs. Moreover, an additional measures scenario is not estimated as well because Japan first believes that it is most important to steadily implement the *Plan for Global Warming Countermeasures* to achieve the emission reduction target for FY 2030 with certainty, and any policies and measures that are not included in the *Plan for Global Warming Countermeasures* are not planned at present.

There are two types of projections reported for the forestry/LULUCF sector. One represents annual net

emissions and removals from the LULUCF sector consistent with the scope of the national GHG inventory covering all categories, carbon pools and gases. The other is the projection consistent with the scope of the contribution from the LULUCF sector (GHG removals contribution) to be accounted for the achievement of the emission reduction target of NDC, which is described as part of Japan's NDC in Chapter II.B and C. The GHG removals contribution to be accounted for tracking progress made in implementing and achieving its NDC is equivalent to the emission reductions and removals achieved through the implementation of policies and measures for the specific mitigation activities in the LULUCF sector, which is accounted for in accordance with the activity-based accounting in consideration of the existing methods and guidance of the LULUCF in the *IPCC 2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol*, which is different from the projected annual emissions and removals of the land-based national GHG inventory. Although the implications of the two projections are different, consistent estimates are used for these two projections where target categories, carbon pools and gases were consistent. See Chapter II.F.3.6 for further details.

2.2 Overall projections of GHG emissions

The projected total GHG emissions (excluding the net GHG removals by the LULUCF sector) in FY 2030 under a *with measures* scenario is approximately 813 Mt CO_2 eq., which is a decrease of 42% from FY 2013. Considering the projections for the GHG removals contribution of the LULUCF sector (removals by forest carbon sinks [approximately 38 Mt CO_2], carbon sinks in agricultural soils [approximately 8.5 Mt CO_2] and urban greening [approximately 1.2 Mt CO_2]) and the JCM in FY 2030, the projected total GHG emissions for FY 2030 will be a reduction of 46% from FY 2013.

The net total GHG emissions including the LULUCF sector (based on the scope of the national GHG inventory) is estimated at 774 Mt CO_2 eq. in FY 2030.

Table II-13 Information on greenhouse gas projections under a with measures scenario (CTF Table 7)

									GHG emission projections (kt CO_2 eq)			
	1990	1995	2000	2005	2010	2015	2020	2022	2025	2030	2035	2040
Sectors												
Energy	886,167.53	920,247.59	940,341.73	987,382.17	938,521.01	960,935.20	815,684.81	802,840.94	NE	550,800.00	NE	NE
Transport	205,469.86	246,462.48	256,550.20	240,457.36	223,704.21	210,322.35	177,757.14	186,337.88	NE	146,200.00	NE	NE
Industrial processes and product use	107,441.66	131,844.92	104,964.85	86,473.82	79,599.45	91,347.53	95,161.70	93,425.77	NE	65,800.00	NE	NE
Agriculture	39,280.61	39,034.27	37,048.49	36,271.13	35,394.54	33,871.72	33,830.98	33,509.53	NE	34,000.00	NE	NE
LULUCF	-72,707.91	-85,001.34	-87,662.39	-90,863.87	-78,716.24	-63,854.44	-58,306.37	-53,174.81	NE	-37,600.00	NE	NE
Waste	31,070.98	33,823.28	32,433.44	27,447.04	22,978.93	20,600.32	18,034.40	17,523.57	NE	15,400.00	NE	NE
Indirect CO2	5,489.89	4,693.13	4,242.13	3,250.81	2,441.53	2,194.48	1,875.10	1,820.63	NE	2,000.00	NE	NE
Gases												
CO_2 emissions including net CO_2 from LULUCF	1,083,678.16	1,153,351.14	1,175,482.31	1,198,740.60	1,135,460.71	1,158,831.27	981,690.47	981,200.92	NE	706,400.00	NE	NE
CO_2 emissions excluding net CO_2 from LULUCF	1,157,373.66	1,239,225.93	1,263,950.96	1,290,333.45	1,214,785.38	1,223,194.82	1,040,475.86	1,034,861.07	NE	744,400.00	NE	NE
CH_4 emissions including CH_4 from LULUCF	49,931.67	46,832.94	41,837.81	38,248.65	34,918.43	31,767.84	30,483.32	29,947.06	NE	29,500.00	NE	NE
CH_4 emissions excluding CH_4 from LULUCF	49,814.96	46,726.22	41,738.66	38,150.96	34,830.53	31,682.52	30,404.00	29,866.97	NE	29,400.00	NE	NE
N_2O emissions including N_2O from LULUCF	29,748.53	30,659.03	27,582.56	23,337.58	21,093.38	19,594.70	18,092.07	17,657.52	NE	17,000.00	NE	NE
N_2O emissions excluding N_2O from LULUCF	28,877.65	29,892.30	26,875.45	22,706.29	20,572.85	19,170.91	17,692.36	17,252.26	NE	16,600.00	NE	NE
HFCs	13,409.95	21,561.36	19,841.27	11,848.46	21,964.07	37,122.08	46,143.64	46,136.61	NE	13,700.00	NE	NE
PFCs	6,162.69	16,209.87	10,483.24	7,801.85	3,842.80	3,016.56	3,214.18	3,048.52	NE	3,800.00	NE	NE
SF_6	13,763.76	17,624.35	8,190.95	5,827.95	2,779.09	2,365.79	2,246.19	2,135.95	NE	3,000.00	NE	NE
NF_3	27.97	172.48	258.18	1,362.55	1,423.42	524.43	292.79	336.30	NE	400.00	NE	NE
Indirect CO_2	5,489.89	4,693.13	4,242.13	3,250.81	2,441.53	2,194.48	1,875.10	1,820.63	NE	2,000.00	NE	NE
Total with LULUCF	1,202,212.62	1,291,104.32	1,287,918.44	1,290,418.47	1,223,923.44	1,255,417.15	1,084,037.75	1,082,283.52	NE	776,000.00	NE	NE
Total without LULUCF	1,274,920.52	1,376,105.67	1,375,580.83	1,381,282.34	1,302,639.68	1,319,271.59	1,142,344.12	1,135,458.33	NE	813,000.00	NE	NE

- Projected emissions of the transport sector for FY 2030 include CO_2 emissions from electricity consumption in railways that should be included in the energy sector in the national GHG inventory under the UNFCCC. This is because the CO_2 emissions from electricity consumption by railways in FY 2030 are based on non-public data and, therefore, cannot be used in this table.
- For FY 2030, the total does not match the sum of each sector because of rounding.
- The projection in FY 2030 for the LULUCF sector in this table represents the annual net removals based on the scope of the national GHG inventory, however, a part of the estimation scope is slightly different from the current national GHG inventory. This projection is different from the GHG removal target (approximately 47.7 Mt CO_2) set out in the NDC. See section 2.7.3(6) for details.
- CO_2 emissions from energy use of waste are counted in the energy sector in this table, but they are counted in the waste sector in the following sections in accordance with the emission categories for the projections.

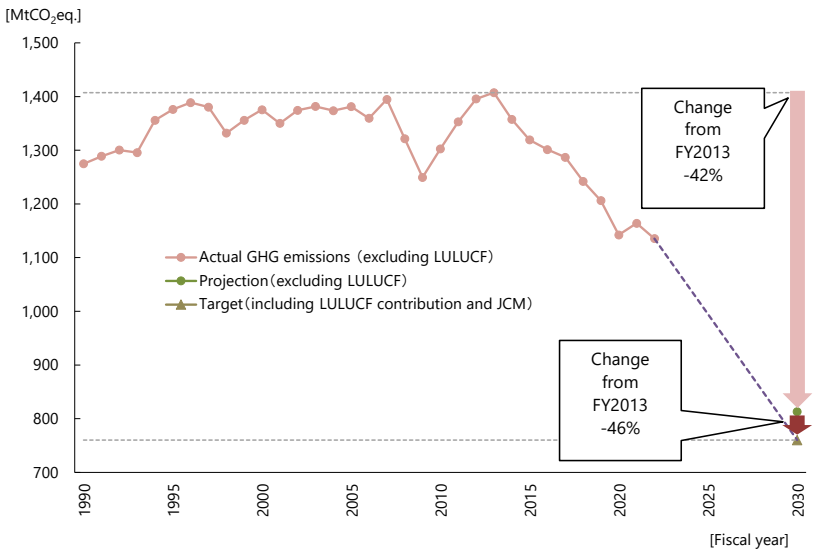


Figure II-47 GHG emission and removal projections under a with measures scenario

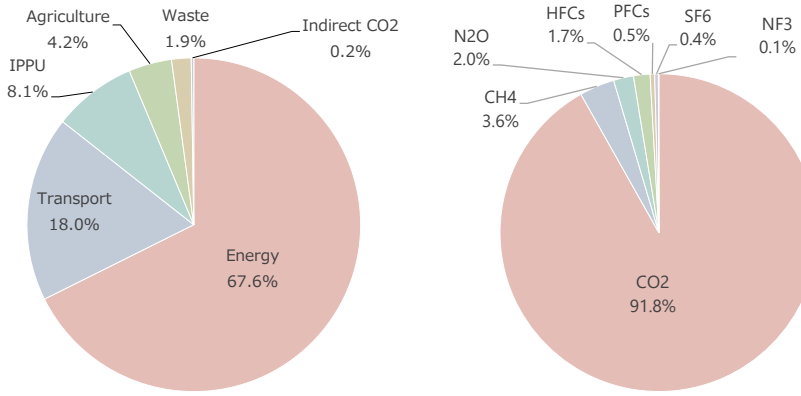


Figure II-48 GHG emissions projections by sector (left) and by gas (right) under a with measures scenario (excluding LULUCF)

2.3 Projections by gas

(1) CO_2

Energy-related CO_2 covers approximately 90% of Japan's GHG emissions. Based on the energy statistics of Japan, it can be broken down into the following five sectors: industry, commercial and other, residential, transport, and energy conversion. The emission reductions of policies and measures can be observed by each sector as well. Table II-14 shows projections of emissions for each sector. The projection for energy-related CO_2 emissions by each sector is estimated on the basis of the CO_2 emissions with electricity generation and heat production allocated to the demand sectors, considering national circumstances for the planning and implementation of domestic policies and measures. In addition, CO_2 emissions from the energy use of waste are not included.

The projected emissions in FY 2030 decrease by 45% compared to the emissions in FY 2013 (approximately 677 Mt CO_2). A significant reduction is expected in all sectors, and the reduction rate is particularly large in the residential sector and the commercial and other sector. The actual emissions in FY 2020 show a reduction of 22.0% (approximately 964 Mt CO_2) compared to the emissions in FY 2013. The contribution of the reduction in the industry sector is especially significant.

The projected emissions of non-energy-related CO_2 (Fugitive emissions from fuels, IPPU, Agriculture, Waste, and Indirect CO_2) in FY 2030 decrease by 15% compared to FY 2013 (approximately 70.0 Mt CO_2). In the projection for non-energy-related CO_2 emissions by sector, CO_2 emissions from the waste sector include CO_2 emissions from the energy use of waste, considering the national circumstances for the planning and implementation of domestic policies and measures.

The main emission sources in FY 2013 (the base year) of non-energy-related CO_2 are cement production (IPPU sector) and waste incineration (waste sector). The emission reductions in FY 2030 from FY 2013 are expected to be mainly reductions in the IPPU and waste sector.

Table II-14 Projected emissions of CO_2 by sector

[Mt-CO_2]

	Actual emissions								Estimated emissions	
									FY2030	
	FY1990	FY1995	FY2000	FY2005	FY2013	FY2015	FY2020	FY2022	Emissions	(Changes from FY2013)
Energy-related CO_2	**1,068**	**1,142**	**1,170**	**1,201**	**1,235**	**1,146**	**968**	**964**	**677**	**-45%**
Industry	505	492	479	470	463	431	355	352	289	-38%
Commercial and Other	131	164	190	222	235	217	181	179	115	-51%
Residential	126	145	152	165	209	187	168	158	71	-66%
Transport	208	249	259	244	224	217	183	192	146	-35%
Energy conversion	96	93	95	102	106	97	82	85	56	-47%
Non-energy-related CO_2	**95.3**	**101.8**	**97.9**	**93.1**	**82.2**	**79.6**	**74.5**	**72.6**	**70.0**	**-15%**
Fugitive emissions from fuels	0.2	0.5	0.5	0.5	0.5	0.4	0.4	0.3	0.8	+80%
Industrial Processes and Product Use	65.2	67.2	60.2	57.0	49.3	47.2	42.3	40.9	43.1	-13%
Agriculture	0.7	0.5	0.5	0.4	0.6	0.5	0.4	0.4	0.5	-9%
Waste	23.7	29.0	32.5	32.1	29.9	29.6	29.8	29.6	23.8	-20%
Other	-0.1	-0.1	-0.0	-0.2	-0.3	-0.3	-0.3	-0.4	-0.2	-34%
Indirect CO_2	5.5	4.7	4.2	3.3	2.3	2.2	1.9	1.8	2.0	-11%

- The estimated emissions for FY 2030 are calculated by the reduction rate from FY 2013 when the emission reduction target was decided and emissions for FY 2013 of the latest national GHG inventory.
- CO_2 emissions from the energy use of waste are included in the waste sector in accordance with the classifications for the projections in Japan.

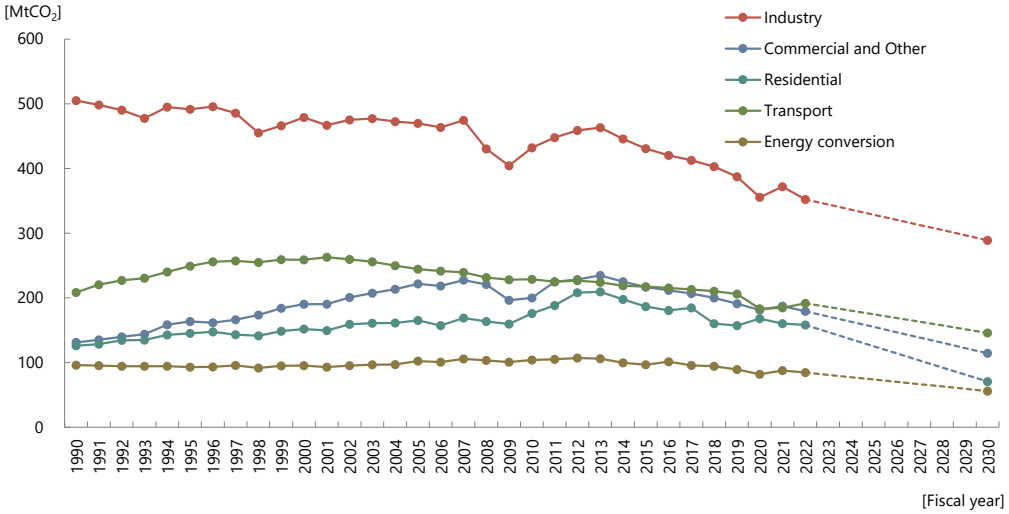


Figure II-49 Projected emissions of energy-related CO_2 by sector

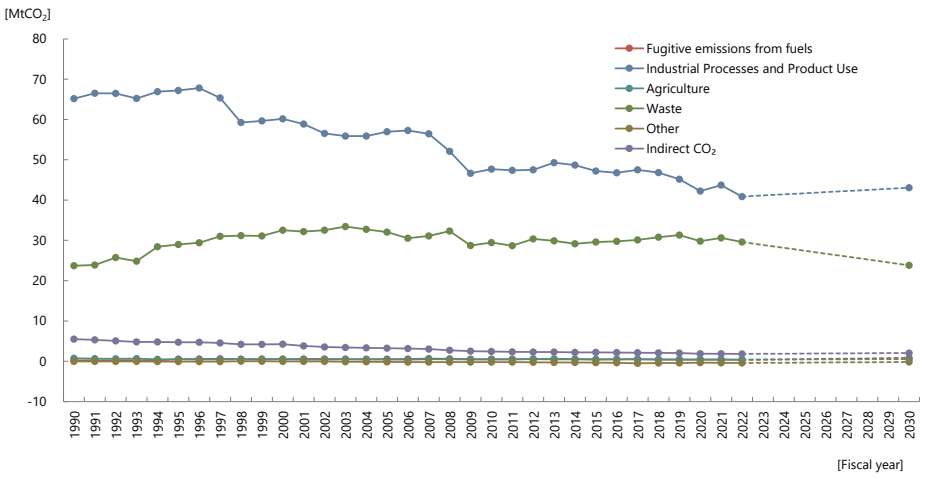


Figure II-50 Projected emissions of non-energy-related CO_2 by sector

(2) Methane

The projected CH_4 emissions in FY 2030 decrease by 11% compared to FY 2013 (approximately 29.1 Mt CO_2 eq.). In the projection for CH_4 emissions by sector, CH_4 emissions from the waste sector include emissions from the energy use of waste, considering the national circumstances for the planning and implementation of domestic policies and measures.

The main emission sources in FY 2013 (the base year) are rice cultivation, enteric fermentation of livestock (agriculture sector), and landfill of waste (waste sector). The largest reduction rate in FY 2030 from FY 2013 is the waste sector, followed by the fugitive emissions from fuels sector.

Table II-15 Projected CH_4 emissions by sector

[Mt-CO_2]

	Actual emissions								Estimated emissions	
									FY2030	
	FY1990	FY1995	FY2000	FY2005	FY2013	FY2015	FY2020	FY2022	Emissions	(Changes from FY2013)
Fuel combustion	1.4	1.4	1.3	1.5	1.1	1.1	1.0	0.9	0.9	-14%
Fugitive emissions from fuels	5.8	3.2	2.2	1.2	1.0	1.0	0.9	0.8	0.8	-21%
Industrial Processes and Product Use	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	-19%
Agriculture	28.0	28.8	27.1	26.6	25.0	24.6	24.7	24.5	24.3	-3%
Waste	14.5	13.3	11.0	8.8	5.5	5.0	3.9	3.6	3.3	-40%
Total	**49.8**	**46.7**	**41.7**	**38.2**	**32.7**	**31.7**	**30.4**	**29.9**	**29.1**	**-11%**

- The estimated emissions for FY 2030 are calculated by the reduction rate from FY 2013 when the emission reduction target was decided and emissions for FY 2013 of the latest national GHG inventory.
- Since the emissions in FY 2030 for each sector are estimated separately, their sums do not equal the total shown in this table.
- CH_4 emissions from the energy use of waste are included in the waste sector in accordance with the classifications for the projections in Japan.

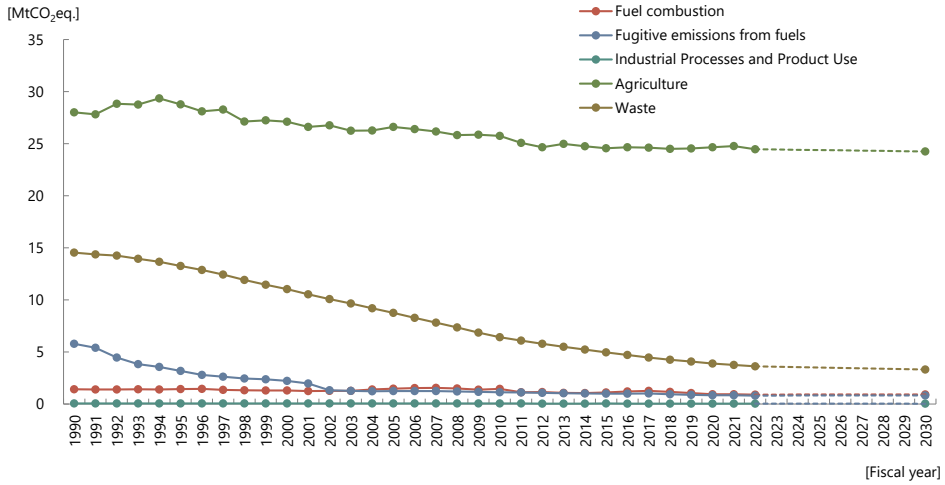


Figure II-51 Estimated CH_4 emissions by sector

(3) Nitrous oxide

The projected N_2O emissions in FY 2030 decrease by 17% compared to FY 2013 (approximately 16.5 Mt CO_2 eq.). In the projection for N_2O emissions by sector, N_2O emissions from the waste sector include emissions from the energy use of waste, considering the national circumstances for the planning and implementation of domestic policies and measures.

The main emission sources in FY 2013 (the base year) are agricultural soils and manure management (agriculture sector) and the fuel combustion sector. The largest reduction rate in FY 2030 from FY 2013 is the fuel combustion sector, followed by the IPPU sector.

Table II-16 Projected N_2O emissions by sector

[Mt-CO_2]

	Actual emissions								Estimated emissions	
									FY2030	
	FY1990	FY1995	FY2000	FY2005	FY2013	FY2015	FY2020	FY2022	Emissions	(Changes from FY2013)
Fuel combustion	5.6	6.8	7.1	6.5	5.6	5.5	4.4	4.3	3.5	-38%
Fugitive emissions from fuels	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-26%
Industrial Processes and Product Use	8.8	9.0	6.0	2.6	1.4	1.1	1.0	0.8	0.9	-37%
Agriculture	10.5	9.8	9.4	9.2	8.9	8.8	8.7	8.6	9.2	+3%
Waste	3.9	4.3	4.4	4.4	4.0	3.8	3.6	3.5	3.1	-23%
Total	**28.9**	**29.9**	**26.9**	**22.7**	**19.9**	**19.2**	**17.7**	**17.3**	**16.5**	**-17%**

- The estimated emissions for FY 2030 are calculated by the reduction rate from FY 2013 when the emission reduction target was decided and emissions for FY 2013 of the latest national GHG inventory.
- Since the emissions in FY 2030 for each sector are estimated separately, their sums do not equal the total shown in this table.
- N_2O emissions from the energy use of waste are included in the waste sector in accordance with the classifications for projections in Japan.

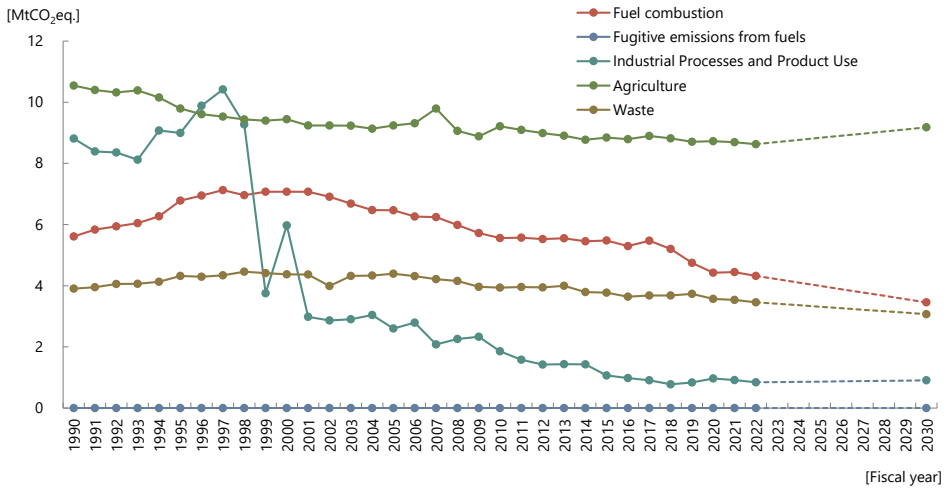


Figure II-52 Projected emissions of N_2O by sector

(4) Fluorinated gases

The projected emissions of fluorinated gases (HFCs, PFCs, SF_6, and NF_3) in CY 2030 decrease by 44% from CY 2013 (approximately 20.9 Mt CO_2 eq.).

The main emission sources in CY 2013 (the base year) are fugitive emissions during the production, use and disposal of HFCs used as refrigerants in refrigerators and air conditioners. The actual HFC emissions in CY 2022 increased by 52.1% compared to the emissions in CY 2013, but the estimated HFC emissions in CY 2030 are expected to decrease by 55% compared to CY 2013 by the measures of eliminating fluorocarbons, lowering the GWP, and leakage prevention.

Table II-17 Projected emissions of fluorinated gases by gas

[Mt-CO_2]

	Actual emissions								Estimated emissions	
									CY2030	
	CY1990	CY1995	CY2000	CY2005	CY2013	CY2015	CY2020	CY2022	Emissions	(Changes from CY2013)
HFCs	13.4	21.6	19.8	11.8	30.3	37.1	46.1	46.1	13.7	-55%
PFCs	6.2	16.2	10.5	7.8	3.0	3.0	3.2	3.0	3.8	+26%
SF_6	13.8	17.6	8.2	5.8	2.3	2.4	2.2	2.1	3.0	+27%
NF_3	0.0	0.2	0.3	1.4	1.5	0.5	0.3	0.3	0.4	-70%
Total	**33.4**	**55.6**	**38.8**	**26.8**	**37.2**	**43.0**	**51.9**	**51.7**	**20.9**	**-44%**

- The estimated emissions for FY 2030 are calculated by reduction rate from FY 2013 when the emission reduction target was decided and emissions for FY 2013 of the latest national GHG inventory.

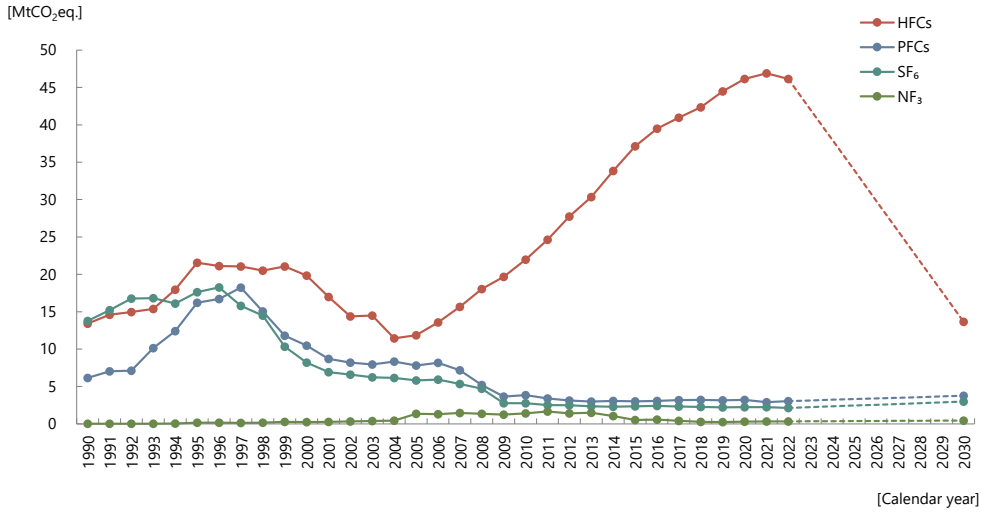


Figure II-53 Projected emissions of fluorinated gases by gas

(5) Precursors

The projected NO_X emissions in FY 2030 decrease by 25% from FY 2013 (approximately 1,071 kt). The projected SOx emissions in FY 2030 decrease by 25% from FY 2013 (approximately 537 kt). The projected CO emissions in FY 2030 decrease by 2% from FY 2013 (approximately 2,646 kt). The projected NMVOC emissions in FY 2030 decrease by 12% from FY 2013 (approximately 861 kt).

In FY 2013 (the base year), more than 90% of NOx, SOx, and CO emissions are from fuel combustion, and more than 70% of NMVOC emissions are from the IPPU sector. The sectors with large reductions in FY 2030 compared to FY 2013 are the same as the largest emissions sectors in FY 2013.

Table II-18 Projected emissions of precursors by gas

(kt)

	Actual emissions								Estimated emissions	
									FY2030	
	FY1990	FY1995	FY2000	FY2005	FY2013	FY2015	FY2020	FY2022	Emissions	(Changes from FY2013)
NOx	1,961	2,061	2,036	1,960	1,421	1,312	1,055	1,043	1,071	-25%
SOx	1,252	1,203	1,130	1,012	720	673	338	330	537	-25%
CO	4,353	4,039	3,753	2,948	2,710	2,711	2,332	2,231	2,646	-2%
NMVOC	2,186	1,981	1,779	1,395	977	933	816	788	861	-12%

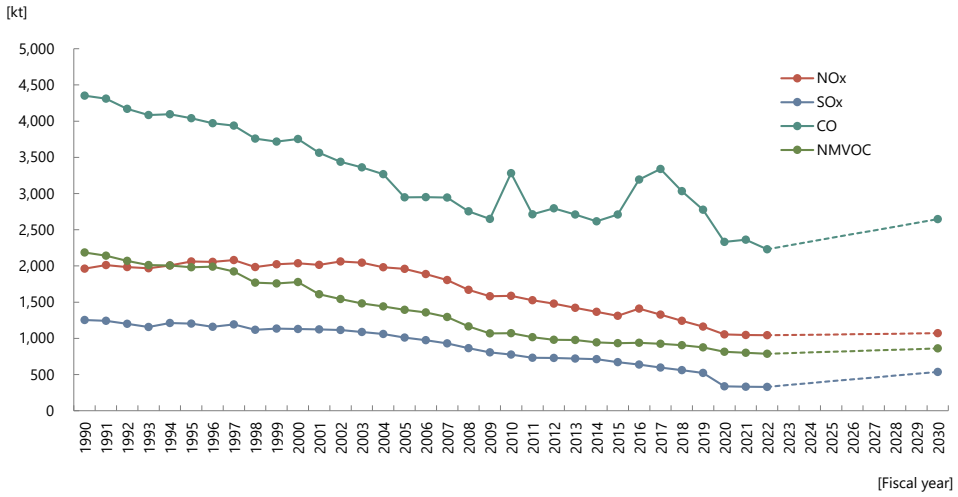


Figure II-54 Projected emissions of fluorinated gases and each gas

2.4 Projections by sector

(1) Energy

The projected emissions of the energy sector in FY 2030 are a decrease of approximately 45% compared to FY 2013 (approximately 682.8 Mt CO_2 eq.). Emissions from the energy use of waste are included in the waste sector in accordance with the classifications for projections in Japan.

Most emissions in the energy sector are CO_2 from fuel combustion (Energy-related CO_2). See the section of "CO_2" for the trend of future estimated energy-related CO_2 emissions.

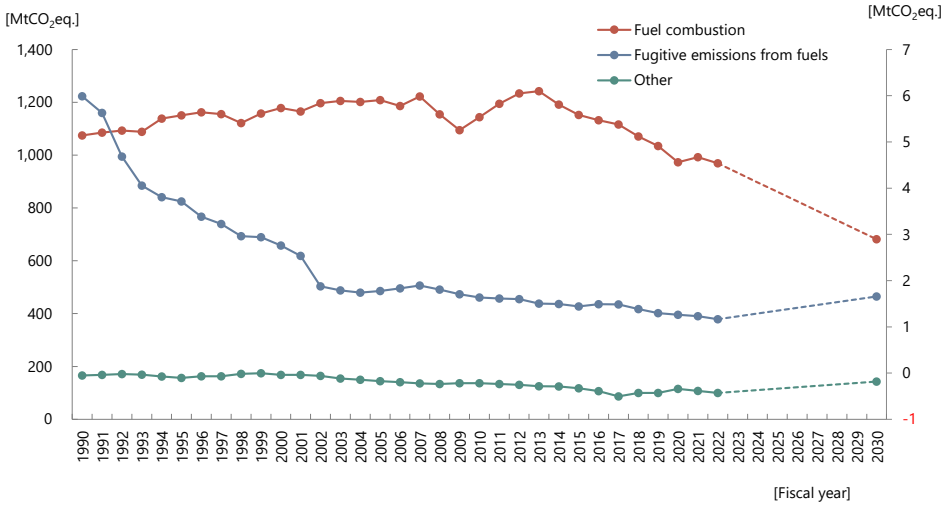
The projected emissions from fugitive emissions from fuels in FY 2030 increase compared to FY 2013. The reason for this increase is that it is assumed that CO_2 emissions in the steam produced by the steam production wells of geothermal power plants increase with the increase in geothermal power generation.

Table II-19 Projected emissions of the energy sector

[Mt-CO_2]

	Actual emissions								Estimated emissions	
									FY2030	
	FY1990	FY1995	FY2000	FY2005	FY2013	FY2015	FY2020	FY2022	Emissions	(Changes from FY2013)
CO_2	**1,067.7**	**1,142.6**	**1,170.8**	**1,200.9**	**1,235.6**	**1,145.9**	**968.0**	**964.0**	**677.6**	**-45%**
Fuel combustion	1,067.6	1,142.1	1,170.3	1,200.5	1,235.4	1,145.8	967.9	964.1	677.0	-45%
Fugitive emissions from fuels	0.2	0.5	0.5	0.5	0.5	0.4	0.4	0.3	0.8	+80%
Other	-0.1	-0.1	-0.0	-0.2	-0.3	-0.3	-0.3	-0.4	-0.2	-34%
CH_4	**7.2**	**4.6**	**3.5**	**2.7**	**2.1**	**2.1**	**1.8**	**1.7**	**1.8**	**-17%**
Fuel combustion	1.4	1.4	1.3	1.5	1.1	1.1	1.0	0.9	0.9	-14%
Fugitive emissions from fuels	5.8	3.2	2.2	1.2	1.0	1.0	0.9	0.8	0.8	-21%
N_2O	**5.6**	**6.8**	**7.1**	**6.5**	**5.6**	**5.5**	**4.4**	**4.3**	**3.5**	**-38%**
Fuel combustion	5.6	6.8	7.1	6.5	5.6	5.5	4.4	4.3	3.5	-38%
Fugitive emissions from fuels	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-26%
Total	**1,080.5**	**1,154.0**	**1,181.4**	**1,210.1**	**1,243.2**	**1,153.5**	**974.2**	**970.0**	**682.8**	**-45%**

- The estimated emissions for FY 2030 are calculated by the reduction rate from FY 2013 when the emission reduction target was decided and emissions for FY 2013 of the latest national GHG inventory.
- Emissions from the energy use of waste are included in the waste sector in accordance with the classifications for projections in Japan.



(※Fugitive emissions from fuels and others are on the right axis)

Figure II-55 Projected emissions of the energy sector

(2) Industrial Processes and Product Use (IPPU)

The projected emissions of the IPPU sector in FY 2030 decrease by approximately 27% compared to FY 2013 (approximately 64.3 Mt CO_2 eq.).

The main emission sources in FY 2013 are the mineral industry (CO_2), refrigerants (HFCs), chemical industry (CO_2, CH_4, and N_2O), and metal production (CO_2, CH_4). The emission decrease in FY 2030 is based on an emission reduction in the refrigerants sector by leakage prevention of fluorocarbons from the use of refrigerators and air conditioners, promotion of recovery of fluorocarbons in disposal and promotion of eliminating fluorocarbons, and the lowering of the GWP.

Table II-20 Projected emissions of the IPPU sector

[Mt-CO_2]

	Actual emissions								Estimated emissions	
									FY2030	
	FY1990	FY1995	FY2000	FY2005	FY2013	FY2015	FY2020	FY2022	Emissions	(Changes from FY2013)
CO_2・CH_4・N_2O	**74.1**	**76.3**	**66.2**	**59.6**	**50.8**	**48.3**	**43.3**	**41.8**	**44.1**	**-13%**
Mineral industry	48.7	50.7	43.5	41.1	34.9	33.5	30.7	29.0	30.7	-12%
Chemical industry	14.7	14.7	11.7	7.5	5.4	4.8	3.7	3.8	3.9	-27%
Metal industry	7.3	7.0	6.9	6.7	6.4	6.1	5.1	5.2	5.2	-18%
Non-energy products from fuels and solvent use	2.2	2.6	2.8	3.0	2.8	2.6	2.5	2.3	3.0	+6%
Electronics Industry	0.0	0.0	0.0	0.1	0.3	0.3	0.3	0.4	-	-
Other product manufacture and use	0.2	0.4	0.3	0.2	0.1	0.1	0.1	0.1	0.1	+5%
Other	0.9	1.0	0.9	0.9	0.9	1.0	0.9	0.9	1.2	+27%
Fgas	**33.4**	**55.6**	**38.8**	**26.8**	**37.2**	**43.0**	**51.9**	**51.7**	**20.9**	**-44%**
HFCs	13.4	21.6	19.8	11.8	30.3	37.1	46.1	46.1	13.7	-55%
PFCs	6.2	16.2	10.5	7.8	3.0	3.0	3.2	3.0	3.8	+26%
SF_6	13.8	17.6	8.2	5.8	2.3	2.4	2.2	2.1	3.0	+27%
NF_3	0.0	0.2	0.3	1.4	1.5	0.5	0.3	0.3	0.4	-70%
Total	**107.4**	**131.8**	**105.0**	**86.5**	**87.9**	**91.3**	**95.2**	**93.4**	**64.3**	**-27%**

- The estimated emissions for FY 2030 are calculated by the reduction rate from FY 2013 when the emission reduction target was decided and emissions for FY 2013 of the latest national GHG inventory.
- Since the emissions in FY 2030 for each sector are estimated separately, their sums do not equal the total shown in this table.
- The electronics industry is a newly added emission source. Therefore, the electronics industry does not yet have FY 2030 targets.

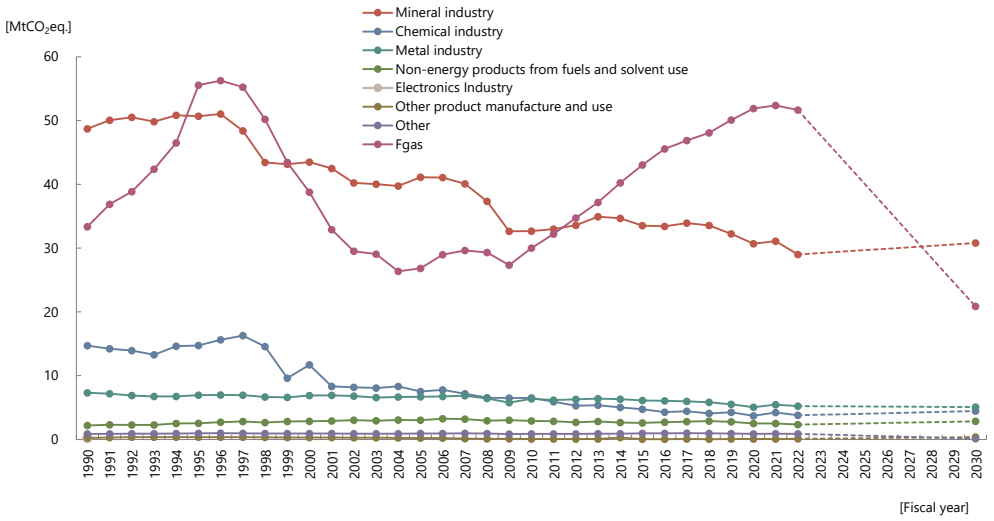


Figure II-56 Projected emissions of the IPPU sector

(3) Agriculture

The projected emissions from the agriculture sector in FY 2030 are a decrease of approximately 1% compared to FY 2013 (approximately 34.0 Mt CO_2 eq.).

The main emission sources in FY 2013 are rice cultivation (CH_4), enteric fermentation (CH_4), manure management (CH_4 and N_2O), and agricultural soils (N_2O). The emission decrease in FY 2030 is based on an emission reduction from rice cultivation through the implementation of emission reduction measures.

Table II-21 Projected emissions of the agriculture sector

[Mt-CO_2]

	Actual emissions								Estimated emissions	
									FY2030	
	FY1990	FY1995	FY2000	FY2005	FY2013	FY2015	FY2020	FY2022	Emissions	(Changes from FY2013)
Enteric fermentation	10.6	10.4	10.0	9.7	8.7	8.4	8.5	8.7	9.2	+6%
Manure management	7.7	7.2	6.9	6.9	6.4	6.2	6.2	6.1	6.3	-2%
Rice cultivation	13.6	14.7	13.6	13.7	13.5	13.4	13.4	13.1	12.4	-9%
Agricultural soils	6.7	6.1	5.9	5.5	5.3	5.3	5.2	5.2	5.6	+6%
Field burning of agricultural residues	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	-4%
Liming and Urea application	0.7	0.5	0.5	0.4	0.6	0.5	0.4	0.4	0.5	-9%
Total	**39.3**	**39.0**	**37.0**	**36.3**	**34.5**	**33.9**	**33.8**	**33.5**	**34.0**	**-1%**

- The estimated emissions for FY 2030 are calculated by the reduction rate from FY 2013 when the emission reduction target was decided and emissions for FY 2013 of the latest national GHG inventory.

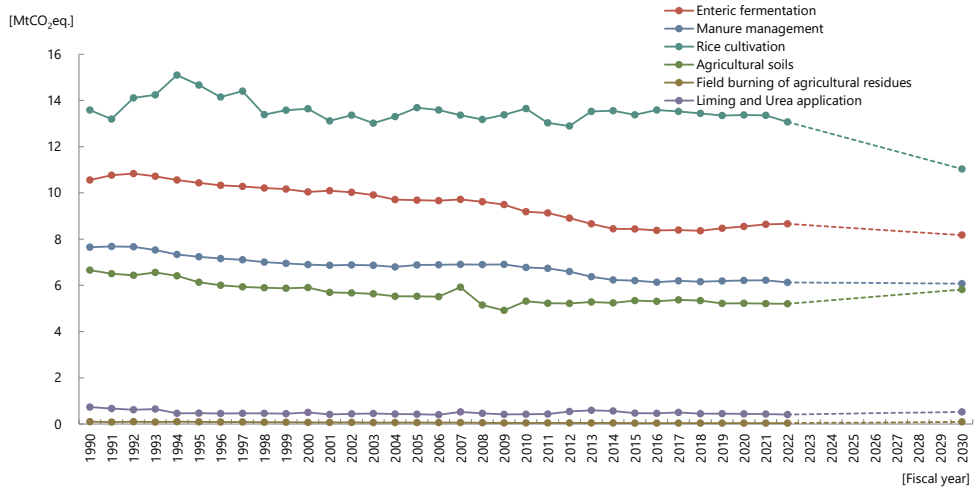


Figure II-57 Projected emissions of the agriculture sector

(4) LULUCF

The projected net removals of the LULUCF sector in FY 2030 (based on the scope of the national GHG inventory[61]) are approximately 37.6 Mt CO_2.

The LULUCF sector covers CO_2 emissions and removals resulting from carbon stock changes and non-CO_2 emissions in forest lands, croplands, grasslands, wetlands, settlements, and other land. Major parts of removals are attributed to forest land sinks.

[61] Projections for forest land and HWP categories, which are relevant to the forest carbon sink measures, are consistent with the scope of the contribution from the LULUCF sector.

Table II-22 Projected emissions and removals from the LULUCF sector

[Mt-CO_2]

	Actual emissions								Projected emissions	
									FY2030	
	FY1990	FY1995	FY2000	FY2005	FY2013	FY2015	FY2020	FY2022	Emissions and Removals	(Changes from FY2013)
Forest land	-94.3	-100.8	-100.8	-101.2	-83.6	-73.8	-65.9	-59.8	-31.2	-63%
Cropland	8.0	3.8	4.0	3.9	5.5	5.7	4.2	4.8	-0.9	-116%
Grassland	1.0	0.1	-0.9	-0.3	1.1	1.3	0.4	0.4	-0.2	-115%
Wetlands	-0.5	-0.2	-0.1	-0.4	-0.4	-0.3	-0.3	-0.3	-0.4	+1%
Settlements	10.4	8.0	6.1	4.8	3.2	3.2	3.3	2.7	1.1	-66%
Other land	2.3	2.0	1.6	1.1	0.7	0.7	0.5	0.4	0.3	-62%
HWP	-0.5	1.3	1.6	0.5	-0.4	-1.2	-1.1	-1.9	-6.8	+1,826%
Non CO_2 gases	1.0	0.9	0.8	0.7	0.5	0.5	0.5	0.5	0.5	-9%
Total	**-72.7**	**-85.0**	**-87.7**	**-90.9**	**-73.4**	**-63.9**	**-58.3**	**-53.2**	**-37.6**	**-49%**

* based on the GHG inventory when the reduction target was decided.

- In the projected number of FY 2030, emissions associated with land use conversion from forest land to non-forest land uses are included under the category in forest land. Thus, the emissions and removals in each land use category level are slightly different between historical values and projected values.
- The GHG emissions or removals in 2030 formed the basis for the removals contribution of the LULUCF sector indicated in Table II-11 is used for the projected number in the corresponding categories in 2030.

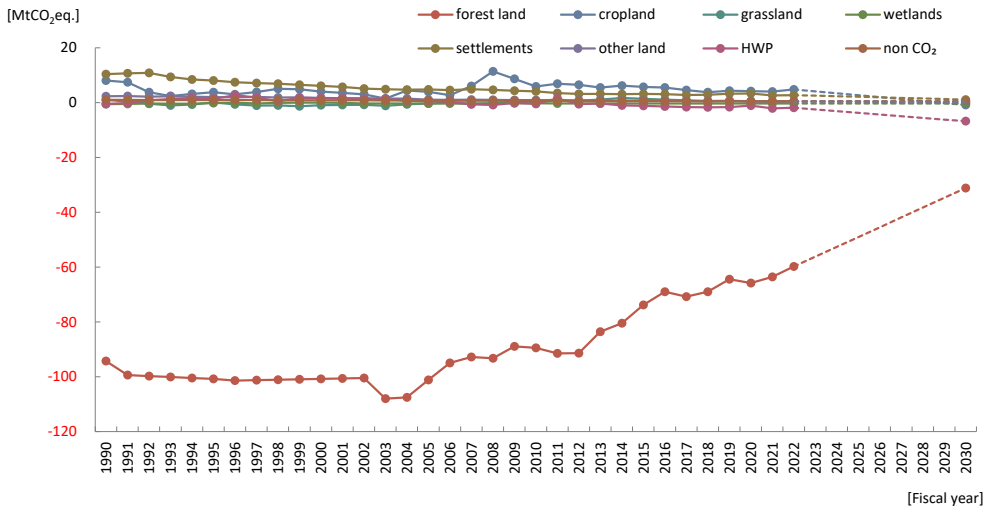


Figure II-58 Projected emissions and removals from the LULUCF sector

As a reference, Table II-23 below shows the details about the historical GHG removals contribution accounted for the emission reduction target and the projected GHG removals contribution in FY 2030. The GHG removals contribution is equivalent to the emission reductions and removals achieved through the implementation of policies and measures for the specific mitigation activities in the LULUCF sector, which is accounted for in accordance with the activity-based accounting in consideration of the existing methods and guidance of the LULUCF in the *IPCC 2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol*.

Table II-23 Historical and projected GHG removal contribution accounted for the emission reduction target

[Mt-CO_2]

LULUCF categories	LULUCF contribution										Accounting Approach
	Historical Values							NDC period		Projection	
	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022	FY2030	
Forest Carbon Sink	**-61.0**	**-57.4**	**-55.6**	**-55.3**	**-53.8**	**-49.5**	**-47.2**	**-48.1**	**-45.7**	**-38.0**	
forest management	-62.3	-58.9	-57.3	-56.7	-55.4	-51.1	-48.9	-49.3	-47.0		reference level
afforestation/reforestation	-1.9	-1.9	-1.6	-1.5	-1.4	-1.7	-1.6	-1.5	-1.5		gross-net
deforestation	3.2	3.4	3.3	2.9	2.9	3.3	3.3	2.8	2.8		gross-net
Carbon Sinks in agricultiral soils	**-0.3**	**-1.0**	**-1.6**	**-2.6**	**-3.5**	**-3.0**	**-3.3**	**-4.0**	**-3.0**	**-8.5**	
cropland management	-1.5	-2.0	-2.2	-3.1	-3.8	-3.4	-3.5	-3.9	-3.1		net-net
cgrazing land management	1.3	1.0	0.7	0.5	0.3	0.4	0.2	-0.1	0.0		net-net
Urban greening	**-1.8**	**-1.7**	**-1.7**	**-1.7**	**-1.7**	**-1.6**	**-1.6**	**-1.6**	**-1.5**	**-1.2**	
urban greening	-1.8	-1.7	-1.7	-1.7	-1.7	-1.6	-1.6	-1.6	-1.5		net-net
Total	**-63.1**	**-60.1**	**-58.8**	**-59.5**	**-59.0**	**-54.1**	**-52.1**	**-53.6**	**-50.2**	**-47.7**	

Note: Historical values of the LULUCF contribution are the accounted numbers calculated by "annual estimated emissions/removals" minus "baseline" of each activities.

(5) Waste

The projected emissions from the waste sector in FY 2030 are a decrease of approximately 24% compared to FY 2013 (approximately 30.1 Mt CO_2 eq.).

The main emission sources are waste incineration and incineration with energy recovery (CO_2, CH_4, and N_2O), wastewater treatment (CH_4 and N_2O), and final disposal (CH_4). The emission decrease in FY 2030 is based on a decrease in the amount of waste incineration, final disposal, and treated wastewater by the promotion of 3R and CO_2 emission reduction in plastics incineration by the introduction of biomass plastics.

Table II-24 Projected emissions of the waste sector

[Mt-CO_2]

	Actual emissions								Estimated emissions	
									FY2030	
	FY1990	FY1995	FY2000	FY2005	FY2013	FY2015	FY2020	FY2022	Emissions	(Changes from FY2013)
Solid waste disposal	11.1	10.0	8.0	6.0	3.2	2.7	1.9	1.6	1.5	-54%
Biological treatment of solid waste	0.2	0.2	0.2	0.4	0.4	0.4	0.3	0.3	0.4	-9%
Incineration and open burning of waste	24.8	30.4	34.1	33.7	31.3	30.8	31.0	30.6	24.6	-21%
Wastewater treatment and discharge	5.4	5.2	4.9	4.6	3.9	3.8	3.5	3.5	3.3	-14%
Other	0.7	0.7	0.7	0.5	0.6	0.6	0.6	0.7	0.5	-9%
Total	**42.2**	**46.6**	**47.9**	**45.2**	**39.4**	**38.3**	**37.3**	**36.7**	**30.1**	**-24%**

- The estimated emissions for FY 2030 are calculated by the reduction rate from FY 2013 when the emission reduction target was decided and emissions for FY 2013 of the latest national GHG inventory.
- Since the emissions in FY 2030 for each sector are estimated separately, their sums do not equal the total shown in this table.
- Emissions from the energy use of waste are included in the waste sector in accordance with the classifications for projections in Japan.

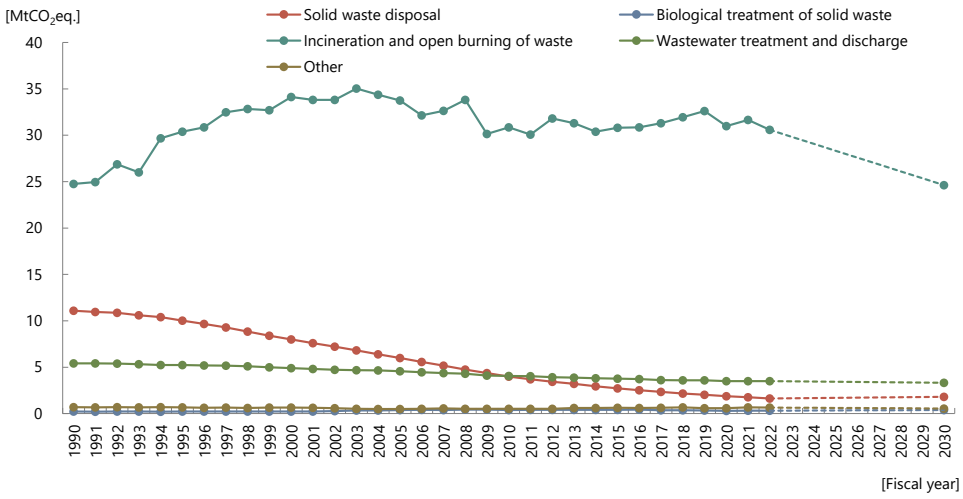


Figure II-59 Projected emissions of the waste sector

(6) Indirect CO_2

The projected indirect CO_2 emissions in FY 2030 are a decrease of approximately 11% compared to FY 2013 (approximately 2.0 Mt CO_2 eq.).

The main emission sources in FY 2013 are the incineration of NMVOC emitted from solvents such as paint. The emission decrease in FY 2030 is a decrease in the amount of use of solvents such as paint.

Table II-25 Projected indirect CO_2 emissions

[Mt-CO_2]

	Actual emissions								Estimated emissions	
									FY2030	
	FY1990	FY1995	FY2000	FY2005	FY2013	FY2015	FY2020	FY2022	Emissions	(Changes from FY2013)
Fugitive emissions from fuels (Derived from CH_4)	0.6	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	-23%
Fugitive emissions from fuels (Derived from NMVOC)	0.5	0.5	0.6	0.5	0.5	0.4	0.4	0.4	0.4	-18%
Industrial Processes and Product Use (Derived from CH_4)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-19%
Industrial Processes and Product Use (Derived from NMVOC)	4.4	3.8	3.4	2.6	1.7	1.6	1.4	1.4	1.6	-8%
Total	**5.5**	**4.7**	**4.2**	**3.3**	**2.3**	**2.2**	**1.9**	**1.8**	**2.0**	**-11%**

- The estimated emissions for FY 2030 are calculated by reduction rate from FY 2013 when the emission reduction target was decided and emissions for FY 2013 of the latest national GHG inventory.

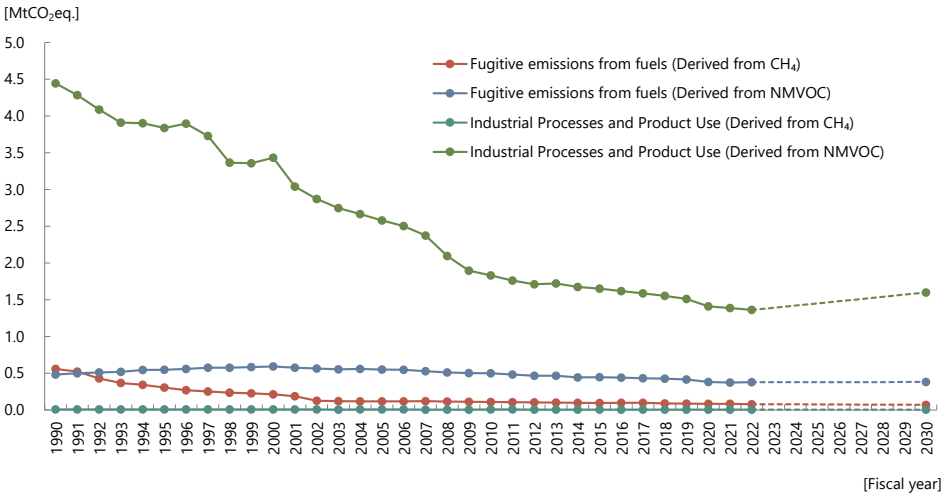


Figure II-60 Projected indirect CO_2 emissions

Table II-26 Projected emissions in FY 2030 by sector (excluding LULUCF)

[Mt-CO_2]

	Actual emissions								Estimated emissions	
									FY2030	
	FY1990	FY1995	FY2000	FY2005	FY2013	FY2015	FY2020	FY2022	Emissions	(Changes from FY2013)
Energy	1,080.6	1,154.1	1,181.4	1,210.3	1,243.5	1,153.8	974.5	970.5	683.0	-45%
Industrial Processes and Product Use	107.4	131.8	105.0	86.5	87.9	91.3	95.2	93.4	64.3	-27%
Agriculture	39.3	39.0	37.0	36.3	34.5	33.9	33.8	33.5	34.0	-1%
Waste	42.2	46.6	47.9	45.2	39.4	38.3	37.3	36.7	30.1	-24%
Other	-0.1	-0.1	-0.0	-0.2	-0.3	-0.3	-0.3	-0.4	-0.2	-34%
Indirect CO_2	5.5	4.7	4.2	3.3	2.3	2.2	1.9	1.8	2.0	-11%
Total	**1,274.9**	**1,376.1**	**1,375.6**	**1,381.3**	**1,407.3**	**1,319.3**	**1,142.3**	**1,135.5**	**813.3**	**-42%**

- The estimated emissions for FY 2030 are calculated by the reduction rate from FY 2013 when the emission reduction target was decided and emissions for FY 2013 of the latest national GHG inventory.

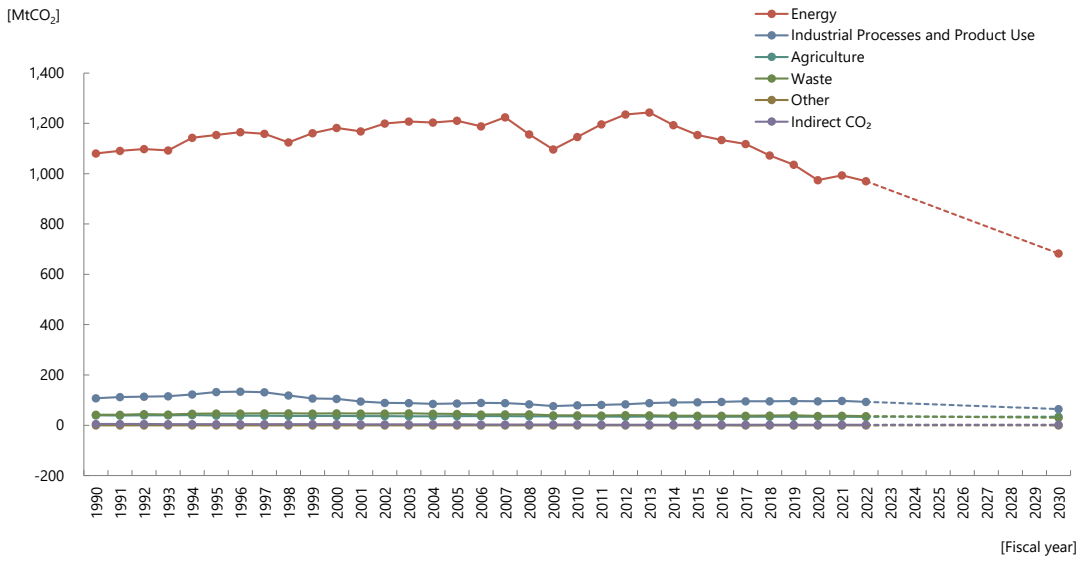


Figure II-61 Projected emissions in FY 2030 by sector (excluding LULUCF)

(7) International aviation and shipping

Japan has neither conducted emissions projections related to fuel sold to ships and aircraft engaged in international transport nor included them in the national total projected emissions. This is due to the lack of data on the projected demand for international transportation and the related projected future energy consumption and future fuel mix.

3 Methodology

(para. 96(a), (c) of the MPGs)

3.1 Overview

The projections of GHG emissions are conducted by sectors, and the basic methodology is different between fuel combustion (CO_2) in the energy sector and other sectors.

The projections in fuel combustion (CO_2) are conducted using the energy supply and demand model. The energy supply and demand model is composed of some sub-models and calculates the energy consumption and CO_2 emissions by inputting exogenous values, such as the macro frame. (The reduction measures in the model are set to avoid overlapping as much as possible, and the amount of expected energy savings [CO_2 reductions] is calculated by reduction measures.) With regard to the avoidance of the overlapping of reduction effects, for example, consideration is given to ensuring that there is no overlapping of emission reductions between measures (electricity and heat) on the energy consumption side and measures on the energy supply side. The strength of the energy supply and demand model is to be able to consider a variety of factors affecting energy consumption and CO_2 emissions comprehensively in one model. On the other hand, the weakness is that the more complex the model, the more difficult it is to understand the calculation process.

The projections in sectors other than fuel combustion (CO_2) are conducted by the bottom-up model by using spreadsheets. This model is the same framework as the calculation methods and models of the national GHG inventory, and the calculation years are extended for the future. Emissions and removals are calculated by multiplying the emission and removal factors by activity data. The future emissions and removals are calculated by using the assumed future emission and removal factors and the assumed future activity data. These future emission and removal factors and future activity data are set to avoid double counting of the reduction measures. When there are some reduction measures at one emission source, the synergistic reduction effect of measures is also taken into consideration. The strength of the bottom-up model is that it is highly consistent with the national GHG inventory because it uses the same calculation methods as the national GHG inventory, and it is highly transparent because of the simple calculation methods. On the other hand, the weakness is that the interrelationship between parameters is not sufficiently reflected because the parameters used in each emission source and removal sink are set independently.

3.2 Key parameters and assumptions

The outlook on the macro frame used for the projections is shown in Table II-27. These assumptions are set based on the prospects of the economic growth rate, population, etc.

Table II-27 Key assumptions on the macro frame (key parameters and assumptions) (CTF Table 11)

item	unit	Actual values								estimated values			
		FY1990	FY1995	FY2000	FY2005	FY2010	FY2015	FY2020	FY2022	FY2025	FY2030	FY2035	FY2040
Real GDP	trillion(2015)yen	430.86	462.18	485.62	515.13	512.06	539.41	528.80	551.92	NE	660.00	NE	NE
Population	10^3 people	123,611	125,570	126,926	127,768	128,057	127,095	126,146	124,947	NE	119,125	NE	NE
Household	10^3 households	41,797	44,831	48,015	51,102	53,783	56,951	59,497	60,266	NE	58,120	NE	NE
Crude steel production	10^6t	112	100	107	113	111	104	83	88	NE	90	NE	NE
Cement production	10^6t	87	92	80	70	51	54	50	48	NE	56	NE	NE
Ethylene production	10^6t	5.8	7	7.6	7.5	7.0	6.8	6.0	5.5	NE	5.7	NE	NE
Paper and paperboard production	10^6t	28	30	32	31	27	26	23	23	NE	22	NE	NE
Commercial floor area	10^6m^2	1,286	1,500	1,657	1,758	1,829	1,871	1,923	1,937	NE	1,965	NE	NE
Passenger transport volume	10^9 passenger-km	1,295	1,385	1,417	1,409	1,348	1,394	1,066	1,262	NE	1,360	NE	NE
Freight transport volume	10^9 ton-km	486	497	513	503	492	445	388	410	NE	420	NE	NE

- The actual values compiled from *National Accounts of Japan* (Oct.-Dec. 2023 [The 2nd preliminary]) (Cabinet Office) (GDP for FY 1990 is a reference value based on a simplified retrospective method.), *Population Estimates* (Ministry of Internal Affairs and Communications) (The data for the years the census was conducted are based on the census population.), *Counts of population, vital events and households derived from Basic Resident Registration* (Ministry of Internal Affairs and Communications), *Current Survey of Production* (Ministry of Economy, Trade and Industry), *Survey on Motor Vehicle Transport* (Ministry of Land, Infrastructure, Transport and Tourism), *Handbook of Japan's & World Energy & Economic Statistics* (The Institute of Energy Economics, Japan), and other sources. Note that the actual values of real GDP are those at the time of the projection estimated and differ from the latest real GDP values at the time of the preparation of BTR1, shown in Figure II-11 in Chapter II. A.1.5.
- Projections compiled from *Economic and Fiscal Projections for Medium to Long Term Analysis* (July 2021) (Cabinet Office), *Medium projection* (National Institute of Population and Social Security Research), *Outlook for energy supply and demand in FY 2030 relevant material* (November 2021) (Agency for Natural Resources and Energy), and other sources.
- "NE" (Not Estimated) means that emissions are not estimated, and the macro frame is not set.

3.3 Energy

(1) Fuel combustion (CO_2)

The projected values for energy consumption and CO_2 emissions are calculated on the basis of the energy supply and demand model as described above. The overall structure of the energy supply and demand model is shown in Figure II-62. Table II-28shows a description of the primary sub-models included in the energy supply and demand model.

Table II-28 Primary sub-models included in the energy supply and demand model

Sub-models	Details
Macroeconomic model	Calculates a consistent and balanced macro frame, including income distribution, production markets, labor markets, and general prices, and estimate economic activity indicators that directly and indirectly influence energy demand based on the macro frame.
Secondary energy price model	Estimates energy purchase prices that influence energy demand and selection behavior based on energy import prices, such as crude oil and LNG, and domestic general price index.
Optimum generation planning model	For the electricity demand estimated by the energy supply and demand model, the economic and optimum generation mix (electric power generation and installed capacity) is estimated by dynamically minimizing the total system cost (equipment cost and fuel cost) after conversion into a discounted current value during the target period. The optimum method uses dynamic programming.
Elements bottom-up model	Estimates energy-saving indicators, such as the efficiency of home appliances and vehicle fuel efficiency, to explicitly incorporate the effects of the Top-Runner Standard, which is difficult to deal with in the regression-type macroeconomic model.
Energy supply and demand model	Estimates energy demand in each final demand sector using economic activity indicators, price indicators, and energy-saving indicators, which are calculated from the above-mentioned models. Second, the primary energy supply is estimated through energy

Sub-models	Details
	conversion in the power generation sector. Finally, CO_2 emissions are calculated on the basis of consumption by energy sources.

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

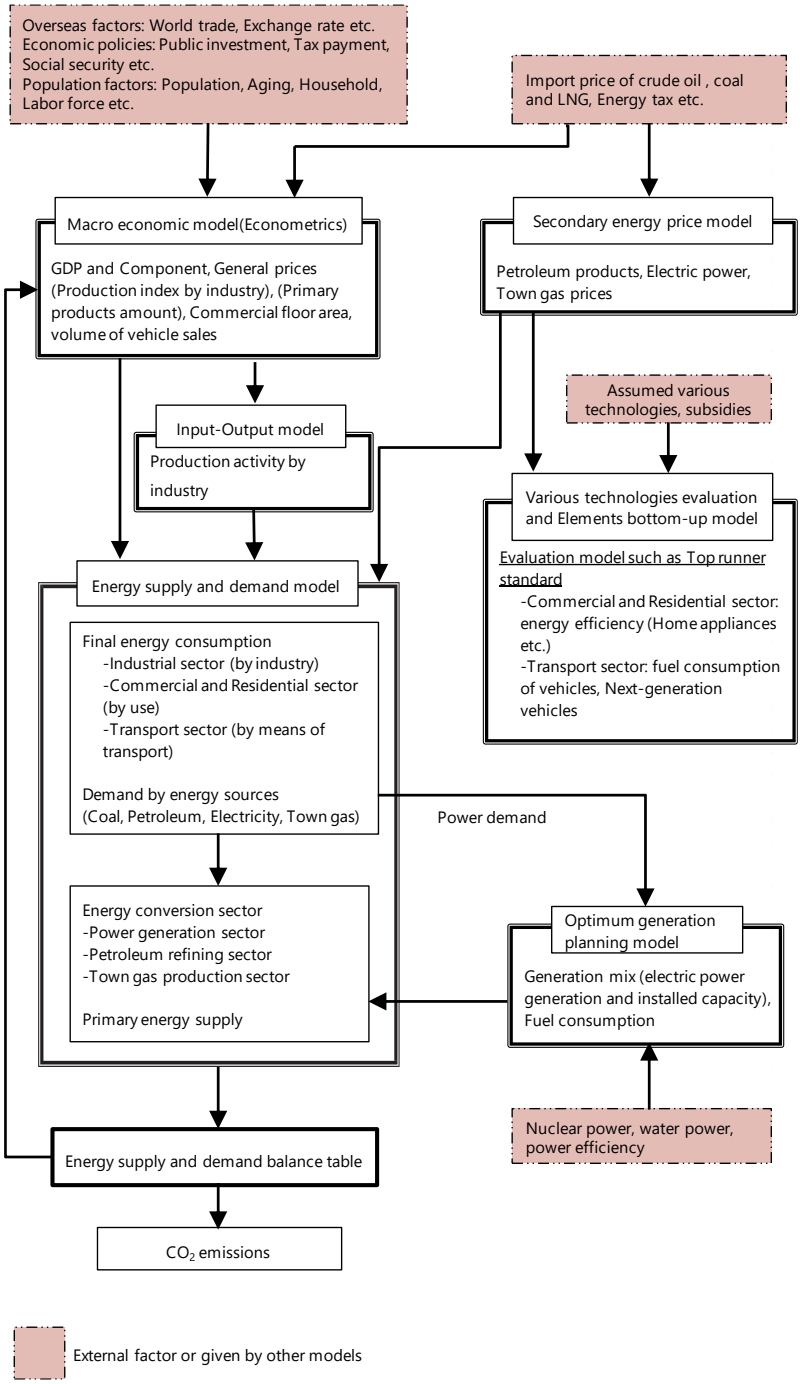


Figure II-62 Overall structure for energy supply and demand model

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

Primary parameters used in the energy supply and demand models are shown in Table II-27. The structure of power generation (Energy Mix) in the future is shown in Table II-29. These data are entered as exogenous

values. In the model, the energy consumption and CO_2 emissions in the future are calculated on the basis of policies, measures, and technologies that are supported by sufficient consideration of technical constraints and cost-related issues in order to maintain consistency with the energy mix. (The reduction measures in the model are set to avoid overlapping as much as possible and expected energy savings (CO_2 reductions) are calculated by reduction measures.)

Table II-29 Energy mix used for FY 2030 emission projections

	FY 2030
●Final energy consumption	280 10^6kl
（Reduction of energy saving）	70 10^6kl
●Total electric power generation	approximately 934 TWh
Renewable energy	approximately 36%～38%
Nuclear	approximately 20%～22%
LNG	approximately 20%
Coal	approximately 19%
Oil	approximately 2%
Hydrogen/Ammonia	approximately 1%
（Breakdown of Renewable energy）	
Solar	approximately 14%～16%
Wind	approximately 5%
Geothermal	approximately 1%
Hydropower	approximately 11%
Biomass	approximately 5%

(2) Fuel combustion (CH_4 and N_2O)

Based on the national GHG inventory, projections of CH_4 and N_2O emissions from fuel combustion cover five sectors: industry, commercial and other, residential, transport, and energy conversion.

The projected emissions are based on calculations multiplying the projected fuel consumption for each sector by the projected emission factors in accordance with the estimation method of the national GHG inventory. The projected fuel consumption is the same as the fuel consumption used in the estimation of fuel combustion (CO_2).

The projected emission factors are the same as those used as current (FY 2019) emission factors under the assumption that the present emission level is supposed to continue into the future.

(3) Fugitive emissions from fuels

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

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

The projected future activity data is established based on the future estimated domestic energy supply

and demand in the fuel combustion sector. Activity data associated with the domestic production of fossil fuels, such as coal, crude oil, and natural gas production, is established under the assumption that the current activity level is supposed to continue into the future.

The projected emission factors are the same as those used as current (FY 2019) emission factors under the assumption that the present emission level is supposed to continue into the future.

(4) CO_2 transport and storage

The future CO_2 emissions and removals from this sector are the same as current (FY 2019) emissions and removals under the assumption that the present emissions and removals are supposed to continue into the future.

3.4 IPPU

(1) CO_2, CH_4, and N_2O

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

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

The projected future activity data is established based on the future production of various industrial products and the projected future Indices of Industrial Production. As for the cement production sector, where the reduction measure of increasing the use of blended cement is implemented, the activity data varies in accordance with the level of the measure by reflecting the reduction in the amount of clinker used because of the spread of blended cement to clinker production.

The projected emission factors are the same as those used as current (FY 2019) emission factors under the assumption that the present emission process is supposed to continue into the future.

(2) Fluorinated gases

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

The projected future emissions are based on calculations multiplying the projected activity data (for example, the amount of charged refrigerant by type of refrigerant) by the projected emission factor for each emission source in accordance with the estimation method of the national GHG inventory. The activity data and emission factors for emission sources where the reduction measures, such as preventing leakage of fluorocarbons from the use of refrigeration and air-conditioning equipment for business use, are implemented and vary in accordance with the level of the measures.

3.5 Agriculture

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

The projected future emissions are based on calculations multiplying the projected activity data (for example, livestock population and crop area) by the projected emission factor for each emission source in accordance with the estimation method of the national GHG inventory.

The projected future activity data is established based on the future livestock population and crop area in the *Basic Plan for Food, Agriculture and Rural Areas* (Ministry of Agriculture, Forestry and Fisheries, Cabinet decision on March 31, 2020). As for the agricultural soils where the reduction measure of "Emissions reduction of nitrous oxide associated with the application of inorganic fertilizers" is implemented, the activity data of the applied inorganic fertilizer is set to decrease in accordance with the reduction in the amount of inorganic fertilizer applied per unit area.

The projected emission factors are the same as those used as current (FY 2019) emission factors under the assumption that the present emission level is supposed to continue into the future. As for rice cultivation where the measure for the reduction of methane emissions associated with rice cultivation is implemented, a 30% lower emission factor than normal paddy fields is applied to the paddy fields where the mid-season drainage period is prolonged as the reduction measure (30% of the total area in FY 2030).

3.6 LULUCF

The projection of the LULUCF sector contains two types of calculations: 1) projection of annual emissions and removals from the LULUCF sector in FY 2030 consistent with the scope of the national GHG inventory (Table II-22), and 2) projection consistent with the scope of the LULUCF contribution to be accounted for the emission reduction target (Table II-23). The number for FY 2030 in the CTF Table 7 is the projection based on the scope of the national GHG inventory.

In the projection based on the scope of the national GHG inventory, projected emissions and removals from the LULUCF sector cover CO_2 emissions and removals resulting from carbon stock changes and non-CO_2 emissions in forest lands, croplands, grasslands, wetlands, settlements, and other land in line with the land-use classification indicated in the IPCC guidelines. The emission and removal projections by the following three activities, 1) measures for forest carbon sinks, 2) measures to increase carbon sinks in agricultural soils, and 3) urban greening, all of which are described in Chapter II.B and C, are estimated on the basis of the GHG removals contribution to be accounted for the emission reduction target. The projections of other emissions and removals that are not covered in 1) to 3) are separately implemented.

1) The projections of forest land and HWP categories in FY 2030 are consistent with the target value of the forest carbon sink measures. They are estimated as net CO_2 removals resulting from carbon stock changes in land area subject to the activities of afforestation/reforestation, deforestation and forest management, which are basically equivalent to activities specified in the *IPCC 2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol*, assuming that forest management and conservation will be implemented in accordance with the *Basic Plan of Forests and Forestry* in Japan. The projected net CO_2 removals are estimated in consideration of the existing methods and guidance for the LULUCF accounting rules provided in the *IPCC 2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol*, which consist of the contribution of carbon sinks in forests and the contribution of harvested wood products

(HWP). The former covers the national GHG inventory categories of 4.A.1 forest land remaining forest land (covering only those forests meeting the definition of forest management), 4.A.2 land converted to forest land and 4.B.2.1 – 4.F.2.1 land converted from forest land, while the latter covers carbon stock changes in 4.G. HWP category. Since the forest management reference level for forest carbon pools is set as zero, this projected CO_2 removal contribution in FY 2030 is directly used as the annual emission and removal estimation for FY 2030. The carbon stock changes in forests that are outside the scope of forest management activities are excluded from the estimation.

2) The contribution of carbon sinks in agricultural soils is the accounted net emission reduction value in consideration of the existing methods and guidance of the LULUCF about cropland management and grazing land management activities in the *IPCC 2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol* (= based on net-net accounting against the base year of 1990). The values of mineral soils carbon stock change, which is the main component of this category, are estimated based on a mathematical model (revised Rothamsted Carbon (Roth-C) Model), taking into account future temperature and cultivated areas provided in the *Basic Plan for Food, Agriculture and Rural Areas*, and corresponding to the carbon stock change in mineral soil of the national GHG inventory categories of croplands, grasslands, and croplands/grasslands converted to other land uses (forest land, wetlands, settlements, and other land). The future projections of net emissions in FY 2030 are calculated by subtracting the emissions in FY 1990 from the contribution of carbon sinks in agricultural soils.

3) The net removals by urban greening in settlements are shown as the contribution for carbon sinks due to the promotion of urban greening, including but not limited to revegetation implemented under LULUCF activity in the *IPCC 2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol*. These are calculated by estimating the activity data as the cumulative area of urban green spaces under 30 years since its establishment in FY 2030 and using the estimation method of the national GHG inventory. It corresponds to the removals in all carbon pools in the settlements category of the national GHG inventory. The net removals shown in the contribution are the accounted values, which are equivalent to annual removals without subtracting the base year value. Therefore, the estimated value of the contribution in FY 2030 is used directly as the net removals in future projections in FY 2030.

The details of definitions and accounting approach are described in section Chapter II.C.2.2.

4) The emissions and removals not contained in 1) to 3) are estimated in each of the most detailed categories and pool levels. Estimations related to cropland and grassland (not covered in 2) above) are calculated by using future cultivated area based on the value provided in the *Basic Plan for Food, Agriculture and Rural Areas*, in accordance with the estimation method of the national GHG inventory. Other small sources of emissions are estimated by simple extrapolation without the assumption of scenarios because the contribution of these emissions and removals is not large.

3.7 Waste

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

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

The future projected activity data is established based on the future population and industrial activity. For the diffusion of biomass plastics, which is the main reduction measure of the waste sector, the introduction amount of biomass plastics for the future is set based on the target for the diffusion of biomass plastics listed in the *Plastics Material Cycle Strategy*.

The projected emission factors are the same as those used as current (FY 2019) emission factors under the assumption that the present emission level is supposed to continue into the future.

3.8 Indirect CO_2

Based on estimations in the national GHG inventory, projected future emissions of indirect CO_2 emissions cover two sectors: fugitive emissions from fuels (derived from CH_4 and NMVOC) and the IPPU (derived from CH_4 and NMVOC).

The projected future emissions derived from CH_4 are the same as CH_4 emissions estimated in the fugitive emissions from fuels sector and the IPPU sector (see the section of "Fugitive emissions from fuels" and "IPPU" for the estimation method). The projected future emissions derived from NMVOC are based on calculations multiplying the projected activity data (for example, population and transport volume) by the projected emission factor and the carbon content of NMVOC for each emission source in accordance with the estimation method of the national GHG inventory. The emissions from small emission sources are the same as current (FY 2019) emissions.

The projected emission factors are the same as those used as current (FY 2019) emission factors under the assumption that the present emission level is supposed to continue into the future.

4 Sensitivity analysis

(para. 96(d) of the MPGs)

The current methodologies for the projections of emissions and removals have been used since the NC8 and BR5, however, sensitivity analysis for the projections is not performed. This is because the appropriate methodology for sensitivity analysis has not been considered.

5 Differences from the projections reported in the NC8/BR5

(para. 96(b) of the MPGs)

5.1 Changes in projection methodologies

From the NC8/BR5 submitted in December 2022 to the BTR1, historical emissions, which are the basis for future projections, were changed from emissions in the national GHG inventory submitted in 2021 to emissions in the national GHG inventory submitted in 2024.

In accordance with the above change, the GWP for estimating the CO_2 equivalent of each GHG was changed from the 100-year GWP of the *IPCC Fourth Assessment Report* to the GWP of the *IPCC Fifth Assessment Report*.

5.2 Comparison of projections

The information below is a comparison of the future emissions reported between the BTR1 and the NC8/BR5.

The total GHG emission projections (excluding LULUCF) in FY 2030 are unchanged from the BR5, which is approximately 1,079 Mt CO_2 eq. The total GHG emission projections (including LULUCF, on the national inventory basis) have increased from approximately 774 Mt CO_2 eq. in NC8/BR5 to approximately 776 Mt CO_2 eq.

Table II-30 Comparison of projections in the BR5 and BTR1

$ktCO_2$	NC8/BR5			BTR1		
	2013	2030	Changes from FY2013	2013	2030	Changes from FY2013
Sectors						
Energy	1,044,606	552,000	-47%	1,044,122	550,800	-47%
Transport	217,069	146,200	-33%	216,647	146,200	-33%
Industry/industrial processes	89,522	65,500	-27%	87,929	65,800	-25%
Agriculture	32,138	31,700	-1%	34,486	34,000	-1%
Forestry/LULUCF	-63,060	-39,800	-37%	-73,399	-37,600	-49%
Waste management/waste	22,554	15,800	-30%	21,865	15,400	-30%
Indirect CO_2	2,303	2,100	-9%	2,289	2,000	-13%
Gases						
CO_2 emissions excluding net CO_2 from LULUCF	1,315,343	744,900	-43%	1,315,320	744,400	-43%
CH_4 emissions excluding CH_4 from LULUCF	30,041	26,700	-11%	32,661	29,400	-10%
N_2O emissions excluding N_2O from LULUCF	21,406	17,800	-17%	19,897	16,600	-17%
HFCs	32,121	14,500	-55%	30,337	13,700	-55%
PFCs	3,286	4,200	28%	2,985	3,800	27%
SF_6	2,075	2,700	30%	2,346	3,000	28%
NF_3	1,617	500	-69%	1,504	400	-73%
Indirect CO_2	2,303	2,100	-9%	2,289	2,000	-13%
Total with LULUCF	1,345,131	774,000	-42%	1,333,938	776,000	-42%
Total without LULUCF	1,408,191	813,000	-42%	1,407,338	813,000	-42%

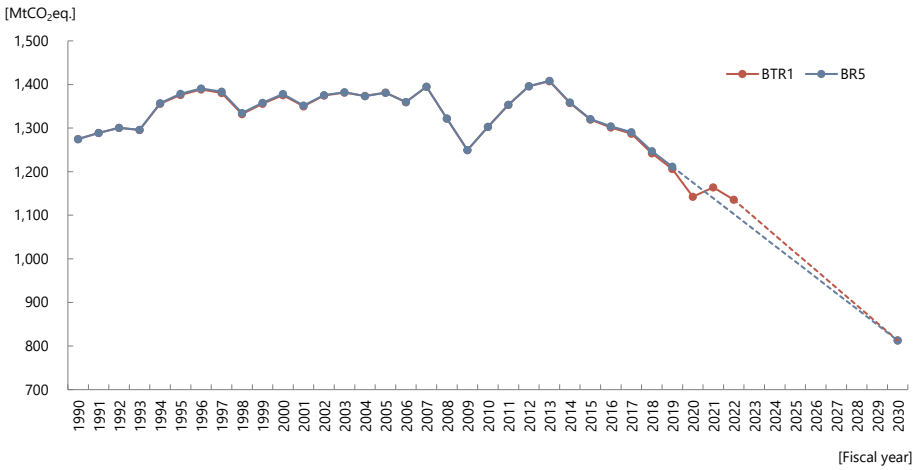


Figure II-63 Comparison of projections in the BR5 and BTR1（excluding LULUCF）

Chapter III

Information related to climate change impacts and adaptation under Article 7 of the Paris Agreement

Japan's First Biennial Transparency Report

under the Paris Agreement

Overview

(Institutional and legal framework for climate change adaptation measures)

- In Japan, the *National Plan for Adaptation to the Impacts of Climate Change* was formulated and approved by the Cabinet in November 2015. Subsequently, in order to define the legal position of climate change adaptation and to promote climate change adaptation more strongly in collaboration with a variety of stakeholders, including the national government, local governments, business operators, and citizens, the *Climate Change Adaptation Act* was promulgated in June 2018 and has been in force since December 2018. This was followed by the formulation of the *Climate Change Adaptation Plan* in November of the same year based on the *Climate Change Adaptation Act*. After that, the *Climate Change Adaptation Plan* was revised in October 2021 based on the *Assessment Report on Climate Change Impacts in Japan,* published in December 2020, etc. Thereafter, the *Climate Change Adaptation Act* was also revised in April 2023 to promote government-wide heat illness countermeasures, followed by formulation of the *Heat Illness Prevention Action Plan* and partial revision of the *Climate Change Adaptation Plan* (adding basic matters of the Heat Illness Prevention Action Plan) in May of the same year.

(Objectives and progress management)

- The objective of Japan's adaptation measures is to comprehensively and systematically promote climate change adaptation policies based on scientific findings. This aims to prevent and mitigate damage from the impact of climate change; to promote the stable life of citizens, sound development of society and the economy, conservation of the natural environment, and achievement of resilient national land; and to build a safe, comfortable, and sustainable society.
- The progress of adaptation measures is to be periodically checked under the Climate Change Adaptation Promotion Council, which is chaired by the Minister of the Environment and composed of the relevant ministries and agencies.

(Major climate change impacts assessments and adaptation measures on individual sectors)

- In the *Assessment Report on Climate Change Impacts in Japan* that was published in December 2020, the impact that climate change could have on Japan is assessed for 71 categories covering seven sectors (agriculture, forestry, and fisheries; water environment and water resources; natural ecosystems; natural disasters and coastal areas; human health; industrial and economic activities; and life of the citizenry and urban life) from three perspectives, including the degree and possibility of the impact (significance), the expression time of the impact, the time when adaptation efforts need to be started, and when an important decision needs to be made (urgency) and the certainty of evidence (confidence). The result of the assessment indicates that the impacts of climate change are significant and urgent.
- The *Climate Change Adaptation Plan*, which was revised in October 2021 (and also revised partially in May 2023), sorted the climate change impacts for each category and the basic concept of adaptation measures in consideration of the climate change impacts assessment in the aforementioned report.

(Adaptation efforts by local governments)

- In local governments as of March 2024, 315 local governments have formulated *Local Climate Change Adaptation Plans* and are implementing adaptation measures based on local circumstances in a planned manner. As of March 2024, 63 local governments established Local Climate Change Adaptation Centers that serve as the bases to collect, organize, analyze, and provide information related to local climate

change impacts and climate change adaptation and to provide technical advice.

(Cross-sectoral efforts and international cooperation)

- Regarding cross-sectoral efforts, the *Climate Change Adaptation Plan* stipulates the fundamental measures for the enhancement and utilization of scientific knowledge on climate change and other related issues; fundamental measures related to ensuring the system for collection, organization, analysis, and provision of information related to climate change; fundamental measures related to the promotion of measures related to climate change adaptation with local governments; fundamental measures related to the promotion of climate change adaptation by business operators and business activities contributing to climate change adaptation; and fundamental measures for securing international collaboration and promoting international cooperation related to climate change.
- Concerning international cooperation, the *Climate Change Adaptation Plan* positions the "contribution to increasing the adaptive capacity of developing countries" as one of its basic strategies. For this reason, Japan built the Asia-Pacific Climate Change Adaptation Information Platform (AP-PLAT), which was established to support decision-making in consideration of climate change risks and highly effective climate change adaptation in the Asia-Pacific region and promotes, through cooperation with relevant institutions and others, the enhancement of scientific findings related to climate change risks, development and provision of publicly available tools to assist in the formulation of climate change adaptation plans, and development of capacities related to the climate change impact assessment and climate change adaptations.

A. National circumstances, institutional arrangements, and legal frameworks related to climate change impacts and adaptation

(para. 106 of the MPGs)

1 National circumstances relevant to its adaptation actions

In Japan, climate change and its impacts have been observed in many parts of the country in recent years, including rising temperatures, increased frequency of heavy rainfall, deterioration of crop quality, changes in the distribution areas of plants and animals, and increased risk of heat stroke, etc. Japan suffered from the Heavy Rain Event of July 2018, Typhoon No. 21, and a record-breaking heat wave in 2018; Typhoons No. 15 and No. 19 (Typhoon Hagibis, known as Reiwa 1st year East Japan Typhoon) in 2019; and the Heavy Rain Event of July, Reiwa 2 in 2020, which resulted in a series of disasters caused by heavy rain and typhoons. These disasters resulted in many victims and inflicted tremendous damage on the lives of the people, society, and the economy. In addition, in 2023, Japan experienced continued high temperatures from spring to autumn, and the annual average temperature was the highest since 1898. In the future, the risk of such extreme heat and heavy rainfall is expected to increase further as global warming progresses.

In Japan, the *National Plan for Adaptation to the Impacts of Climate Change* was formulated and approved by the Cabinet in November 2015 in order to systematically and comprehensively promote coordinated government-wide efforts to address the various impacts of climate change. Subsequently, in order to define the legal position of climate change adaptation and to promote climate change adaptation more strongly in collaboration with a variety of stakeholders, including the national government, local governments, business operators, and citizens, the *Climate Change Adaptation Act* was promulgated in June 2018 and has been in force since December 2018. This was followed by the formulation of the *Climate Change Adaptation Plan* in November of the same year based on the *Climate Change Adaptation Act*. After that, the *Climate Change Adaptation Plan* was revised in October 2021 based on the *Assessment Report on Climate Change Impacts in Japan*, published in December 2020, etc. Thereafter, the *Climate Change Adaptation Act* was also revised in April 2023 to promote government-wide heat illness countermeasures, followed by formulation of the *Heat Illness Prevention Action Plan* and partial revision of the *Climate Change Adaptation Plan* (adding basic items to the Heat Illness Prevention Action Plan) in May of the same year.

2 Institutional and legal framework for climate change adaptation measures

Japan’s efforts related to climate change adaptation have advanced step by step, including investigation and research on climate change impacts and adaptation, making and publicizing the *Assessment Report on Climate Change Impacts in Japan* (2015), and the establishment and implementation of the *National Plan for Adaptation to the Impacts of Climate Change* (2015). In the course of this, the *Climate Change Adaptation Act* was promulgated and came into force in 2018 to define the legal position of climate change adaptation and to promote climate change adaptation more strongly. In the same year, the *Climate Change Adaptation Plan* was formulated in accordance with the provisions of that law. In December 2020, the government compiled and published the *Assessment Report on Climate Change Impacts in Japan* based on the latest scientific findings related to climate change impacts, while the *Climate Change Adaptation Plan* has been revised, taking into consideration the latest scientific findings provided in the *Assessment Report on Climate Change Impacts in*

Japan. Moreover, the *Climate Change Adaptation Act* was amended in 2023 to strengthen measures against heat illness. For the tracking of progress, the Climate Change Adaptation Promotion Council, which consists of the relevant ministries and agencies, keeps track of the short-term progress of measures identified in the *Climate Change Adaptation Plan*, confirms the status of efforts and KPI figures for sectoral and fundamental measures, and publishes them annually as a follow-up report to the *Climate Change Adaptation Plan*.

2.1 Establishment of the Climate Change Adaptation Act

In 2018, Japan established a single law for the promotion of adaptation measures, the Climate Change Adaptation Act (hereinafter referred to as the "Adaptation Act"), which is rare[62] in global terms, and under the Adaptation Act, stakeholders are accelerating efforts for adaptation together. The Adaptation Act consists roughly of the following four pillars:

(1) Integrated promotion of adaptation

- Defining the roles of the national government, local governments, business operators, and citizens in promoting adaptation to climate change.
- The national government shall establish a *Climate Change Adaptation Plan*.
- The Minister of the Environment shall receive the opinions of the Central Environment Council approximately once every five years and assess the impact of climate change.
- The national government shall consider a comprehensive assessment, etc., of the latest impact of climate change, examine the *Climate Change Adaptation Plan*, and, if deemed necessary, promptly revise the plan.

(2) Developing information infrastructure

- The National Institute for Environmental Studies collects, organizes, analyzes, and provides information on the impact and adaptation of climate change and engages in operations related to technical support etc. for local governments and Local Climate Change Adaptation Centers.

(3) Enhancing local adaptation

- Prefectures and municipalities strive to formulate *Local Climate Change Adaptation Plans* in consideration of the *National Climate Change Adaptation Plan*.
- Prefectures and municipalities strive to establish a system that functions as bases to collect, organize, analyze, and provide information related to local climate change impacts and climate change adaptation and to provide technical advice (Local Climate Change Adaptation Centers).
- Regional environment offices and other local administrative organs of the national government, prefectures, municipalities, and other entities may organize Regional Councils on Climate Change Adaptation in order to adapt to climate change through widescale cooperation.

[62] In a range that could be identified by a survey conducted before enforcement of the *Adaptation Act* (November 2018), Japan was the only country in the world that legislated for adaptation alone.

(4) Promoting international cooperation in adaptation and other issues

- The national government promotes international cooperation related to climate change adaptation and develops rules related to the promotion of business activities that contribute to climate change adaptation by business operators.

Moreover, after the revision of the Adaptation Act in 2023, measures, such as establishing a system to strengthen the prevention of heat illness, have been implemented, and further promotion of countermeasures against heat illness is being carried out. The revised Adaptation Act stipulates the formulation of the Heat Illness Prevention Action Plan that indicates the government's measures against heat illness, the legalization of Heat Stroke Alert, and the establishment of a higher-level Special Heat Stroke Alert, as well as the system for designating Cooling Shelters, etc.

2.2 Implementation of climate change impacts assessment

The Ministry of the Environment assessed the impact of climate change on 71 categories covering seven sectors,[63] such as natural disasters and coastal areas, human health, etc., based on scientific findings from three perspectives—significance, urgency, and confidence—and published the *Assessment Report on Climate Change Impacts in Japan* in December 2020 (hereinafter referred to the "2020 Impact Assessment Report"). A total of 1,261 reference documents were used as the basis for the report, which is approximately 2.5 times more than the previous assessment (2015) in number, and confidence increased for 31 categories. As a result, confidence was at a medium or higher degree in 55 categories (77%). Concerning significance and urgency, compared with the assessment conducted in 2015, three categories were newly assessed as recognized as having particularly significant impacts, and eight categories were assessed as having high urgency of response. This Impact Assessment Report will be updated approximately every five years in consideration of the latest scientific findings based on the Adaptation Act.

2.3 Establishment and revision of the Climate Change Adaptation Plan by the national government

The national government organized the basic idea and concrete measures for climate change adaptation measures concerning 71 categories covering seven sectors in consideration of the *2020 Impact Assessment Report* published in December 2020, and the *Climate Change Adaptation Plan* (hereinafter referred to as the "Adaptation Plan") was approved by the Cabinet in October 2021. The Adaptation Plan stipulates the basic roles of the national government, local governments, business operators, citizens, etc., seven basic strategies, management and assessment of the progress of the Adaptation Plan, and sectoral and fundamental measures for climate change adaptation, whereas in accordance with the revision of the Adaptation Act in April 2023, the "basic matters related to the Heat Illness Prevention Action Plan were added to the Adaptation Plan in May 2023.

Based on a comprehensive assessment of climate change impacts, it is important to review climate change adaptation plans by considering measures related to climate change adaptation in each sector so that they can respond to the latest scientifically confirmed climate change impacts. It is also important to give priority to sectors rated high in significance and urgency in climate change impact assessments, evaluate the content of

[63] The seven categories are agriculture, forest/forestry, and fisheries; water environment and water resources; natural ecosystems; natural disasters and coastal areas; human health; industrial /economic activities; and life of citizenry and urban life.

measures, and prioritize them as necessary. In addition, in the implementation of adaptation, the time needed for implementing adaptation measures, limits to implementation, vulnerability, and other factors will be considered in determining the content, implementation time frame, and priorities of the measures. It should be noted that the Adaptation Plan is to be revised under the Adaptation Act in consideration of the revision of the climate change impacts assessment.

2.4 Coordination of relevant stakeholders and addressing cross-cutting issues (Organization of the Climate Change Adaptation Promotion Council by relevant ministries and agencies)

The Adaptation Act clearly states the importance of coordination among relevant stakeholders and addressing cross-cutting issues (Article 15: Cooperation in Related Policies; Article 29: Cooperation by Relevant Administrative Authorities). In addition, the basic strategies of the Adaptation Plan also incorporate the promotion of coordination among the relevant stakeholders and response to cross-sectoral issues (Basic strategy [i]: "Embed climate change adaptation in every relevant policy"; Basic strategy [vii]: "Ensure a system of close collaboration among relevant administrative agencies") and promote coordination among relevant parties and the response to cross-sectoral issues.

In addition, the Climate Change Adaptation Promotion Council, which consists of the Minister of the Environment as chairperson and the relevant ministries and agencies (the Cabinet Secretariat and 12 ministries and agencies), has been established to ensure the appropriate implementation of the Adaptation Plan. The Climate Change Adaptation Promotion Council makes the necessary coordination between relevant ministries and agencies, promotes measures related to climate change adaptation by taking a whole-of-government approach while engaging in mutual collaboration, and checks on progress periodically.

2.5 Monitoring and evaluation of the progress of adaptation actions

The Adaptation Plan sets Key Performance Indicators (KPI) for the sectoral and fundamental measures. Changes to the indicators are checked every fiscal year, etc., and in this way, the progress of each measure based on the plan is identified. For the establishment of KPIs for sectoral measures, priority is typically given to the sectors rated high in significance and urgency in the comprehensive assessments of climate change impacts (18 major items and 32 subitems). Indicator data will be broadly collected, and the progress of medium- and long-term climate change adaptation will be checked every five years. Moreover, PDCA methods are revised as necessary, and the methods to identify and assess the impact of adaptation measures are examined.

The progress of measures related to climate change adaptation based on the Adaptation Plan is checked every year at the Climate Change Adaptation Promotion Council. A follow-up is conducted every year to check the progress of measures based on the Adaptation Plan, and the follow-up report to the Adaptation Plan is published on the website after each meeting every year (Japanese only: https://www.env.go.jp/earth/earth/tekiou/page_00004.html). Follow-up reports are prepared and published every fiscal year, from the results of FY 2016 to the results of FY 2022.

2.6 Data Governance

Based on the Adaptation Plan, the National Institute for Environmental Studies (NIES) is developing an information platform related to the impacts of climate change and climate change adaptation. The NIES

manages and operates the Climate Change Adaptation Information Platform (A-PLAT), an information platform on climate change adaptation, and combines it with the Data Integration and Analysis System (DIAS) to collect, organize, analyze, and provide information on climate change impacts and adaptation.

B. Impacts, risks, and vulnerabilities

(para. 107 of the MPGs)

1 Current and projected climate trends and extreme events

1.1 Approaches and methodologies to assess climate trends and extreme events

Observations have been conducted by the Japan Meteorological Agency, Ministry of Education, Culture, Sports, Science and Technology, Ministry of the Environment, and other bodies via ground-based and ship-based observations, the use of Argo floats, and in recent years by satellite as well. Continuous monitoring of climate change is being done in a variety of ways, such as satellite monitoring of vapor, sea surface temperatures, soil moisture, snow, and ice, etc., using GCOM-W (Global Change Observing Mission - Water "SHIZUKU"), and physical parameters (vegetation, clouds, aerosols, etc.) using GCOM-C (Global Change Observing Mission - Climate "SHIKISAI").

For the projection, the Ministry of Education, Culture, Sports, Science and Technology and the Japan Meteorological Agency published *Climate Change in Japan(2020) – Report on Assessment of Observed/Projected Climate Change Relating to the Atmosphere, Land and Oceans* - in December 2020, which covers the latest expertise on observed changes and projections on climate change in Japan. This report is used as the basis for the national Climate Change Adaptation Plan and local government's regional plans. Furthermore, the Ministry of Education, Culture, Sports, Science and Technology and the Japan Meteorological Agency compiled 16 sets of climate projection data developed by various organizations along with its guidebook. These data sets are used as basic data for adaptation measures to climate change etc., such as analysis and assessment of the impact of climate change by various research institutions and companies.

1.2 Current and projected climate trends

Current and projected climate trends in Japan are presented below, based on Climate Change Monitoring Report 2023[64] and Climate Change in Japan (2020) – Report on Assessment of Observed/Projected Climate Change Relating to the Atmosphere, Land and Oceans -,[65] Please note that the confidence levels in this section were assessed in Climate Change in Japan (2020) and differ from those in other sections.

Please refer to the Japan Meteorological Agency website for the latest information.

(1) Surface Temperature

The annual average surface temperature in Japan has increased from 1898 to 2023 with fluctuations at a rate of 1.35°C per century (statistically significant at a confidence level of 99%) (Figure III-1)

[64] https://www.jma.go.jp/jma/en/NMHS/indexe_ccmr.html

[65] https://www.data.jma.go.jp/cpdinfo/ccj/index.html (Japanese), https://www.data.jma.go.jp/cpdinfo/ccj/2020/pdf/cc2020_gaiyo_en.pdf (English summary)

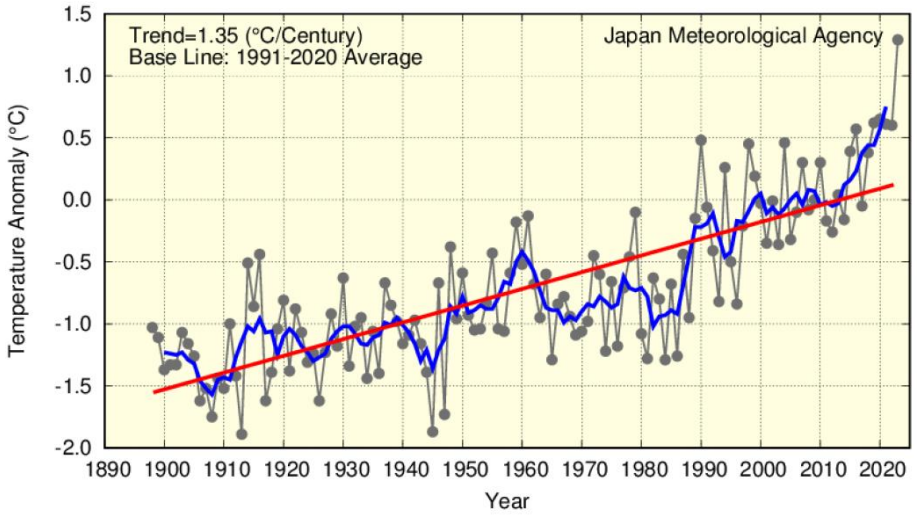


Figure III-1 Annual surface temperature anomalies from 1898 to 2023 in Japan

Anomalies are deviations from the baseline (i.e., the 1991 − 2020 average). The thin black line indicates the surface temperature anomaly for each year. The blue line indicates the five-year running mean, and the red line indicates the long-term linear trend.

The annual mean temperature in Japan at the end of the 21st century is expected to be significantly higher nationwide relative to the end of the 20th century (high confidence). The national mean temperature increase is 4.5°C under the RCP8.5 scenario and 1.4°C under the RCP2.6 scenario.

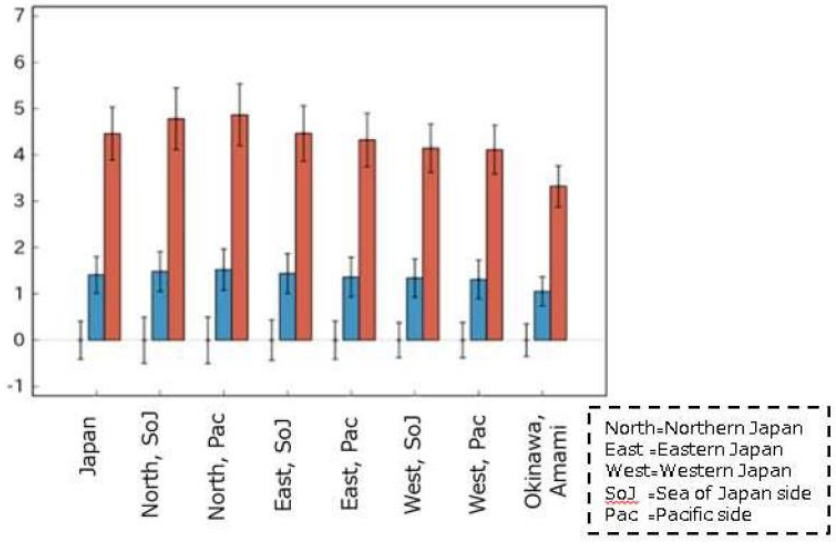


Figure III-2 Future trends in annual mean temperatures as projected by the Japan Meteorological Agency (°C)

The bar graph shows the future changes at the end of the 21st century (average for 2076−2095) relative to the end of the 20th century (average for 1980−1999), with the thin vertical lines indicating the range of interannual variability. For the color of the bars, red corresponds to the RCP8.5 scenario and blue to the RCP2.6 scenario. The thin vertical lines where there is no bar represent the range of interannual variability at the end of the 20th century. (Projection results for the RCP8.5 scenario are from the Japan Meteorological Agency (2017)).

(2) Precipitation

No statistically significant long-term trend is evident during the period 1898 to 2023 in terms of annual precipitation (Figure III-3) calculated from precipitation data observed nationwide at 51 observation stations of the Japan Meteorological Agency.

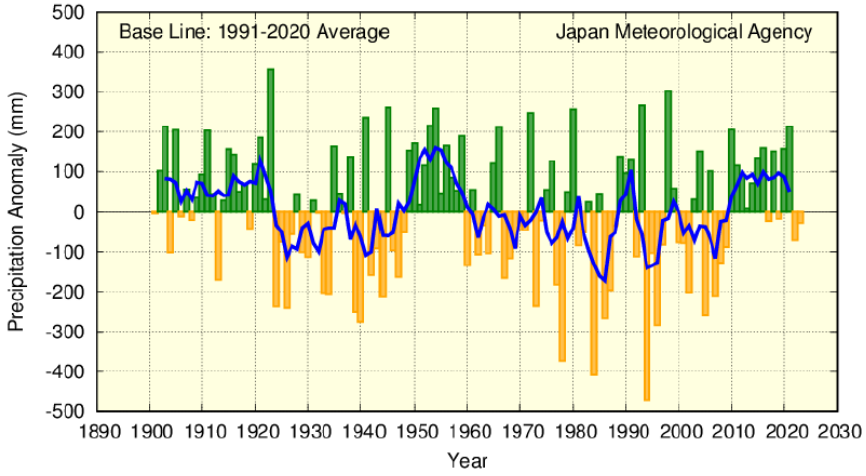


Figure III-3 Annual anomalies in precipitation from 1898 to 2023 in Japan

Anomalies are deviations from the baseline (i.e., the 1991–2020 average). The bars indicate the precipitation anomaly for each year, and the blue line indicates the five-year running mean.

Under the RCP8.5 scenario, no significant trend is evident in national annual average precipitation from the end of the 20th century (average of 1980-1999) to the end of the 21st century (average of 2076–2095). The fact that no significant trend is evident from nationally averaged future projections of annual precipitation is consistent with actual observations. Still, the level of confidence is medium as the range that can be assessed for precipitation over Japan with the resolution of global models is limited. Analyzed by region and season, there is an increase in summer on the Sea of Japan side of northern Japan, a decrease in the annual average, and in winter on the Sea of Japan side of eastern Japan, a decrease in winter on the Sea of Japan side of western Japan, and a decrease in spring on the Pacific side of eastern Japan, and each change is statistically significant. However, there is a large difference in the projection results among the members, and not enough research has been done, so there is a high level of uncertainty in the projections of precipitation at the regional level.

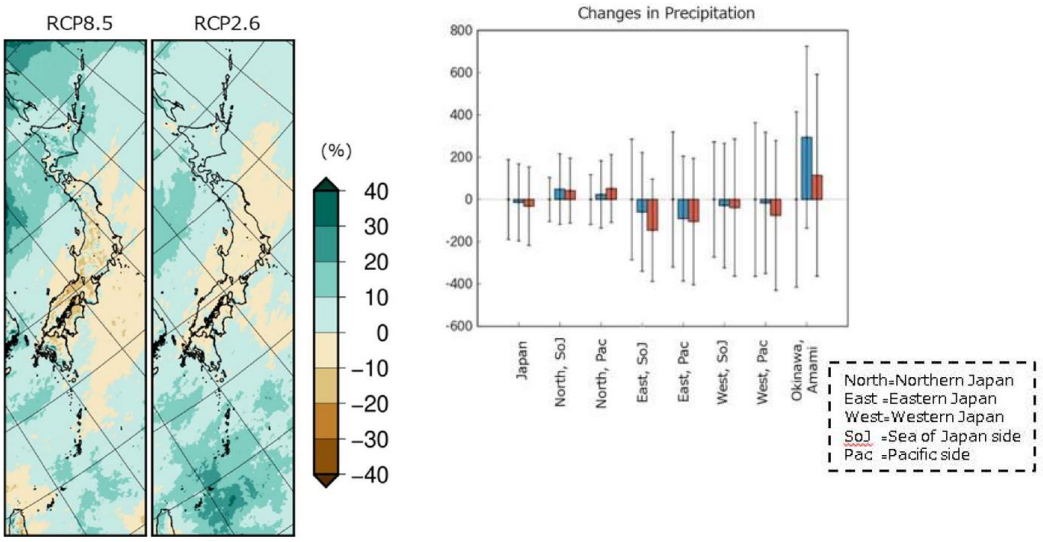


Figure III-4 Future changes in annual precipitation based on Japan Meteorological Agency projections

Figure to the left: Projections for the RCP8.5 scenario are on the left and RCP2.6 on the right. The figures indicate the percent of change from the end of the 20th century (average of 1980–1999) relative to the end of the 21st century (average of 2076–2095).

Figure to the right: The bar graph shows the future change at the end of the 21st century (average for 2076–2095) relative to the end of the 20th century (average for 1980-1999), with the thin vertical lines indicating the range of interannual variability. Red bars correspond to the RCP8.5 scenario, and blue bars correspond to RCP2.6, each indicating projected future changes. Thin vertical lines where there is no bar represent the range of interannual variability at the end of the 20th century.

1.3 Current and projected extreme events

Current and projected extreme events in Japan are presented below, based on Climate Change Monitoring Report 2023[66] and Climate Change in Japan (2020) – Report on Assessment of Observed/Projected Climate Change Relating to the Atmosphere, Land and Oceans -.[67] Please note that the confidence levels in this section were assessed in Climate Change in Japan (2020) and differ from those in other sections.

Please refer to the Japan Meteorological Agency website for the latest information.

(1) Extreme temperature

Analysis of observed values at 13 Japan Meteorological Agency sites where the effects of urbanization are considered to be relatively small shows that during the statistical period from 1910 to 2023, the number of days with a daily maximum temperature of 35°C or above has increased (statistically significant at a confidence level of 99%). Meanwhile, the number of days with a daily minimum temperature below 0°C decreased during the same period, and the number of days with a daily minimum temperature of 25°C or above increased (both statistically significant at a confidence level of 99%).

[66] https://www.jma.go.jp/jma/en/NMHS/indexe_ccmr.html

[67] https://www.data.jma.go.jp/cpdinfo/ccj/index.html (Japanese), https://www.data.jma.go.jp/cpdinfo/ccj/2020/pdf/cc2020_gaiyo_en.pdf (English summary)

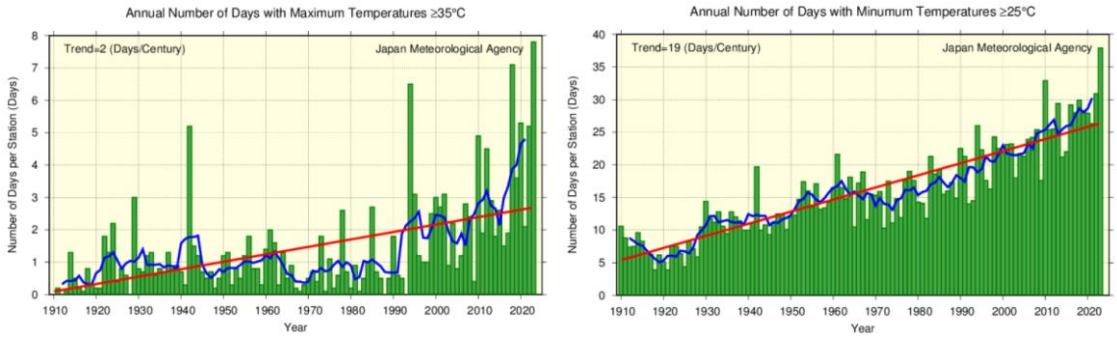


Figure III-5 Annual number of days with maximum temperatures of ≥ 35°C (left figure) and with minimum temperatures of ≥ 25°C (right figure) from 1910 to 2023

The green bars indicate the annual number of days per station for each year. The blue line indicates the five-year running mean, and the straight red line indicates the long-term linear trend.

Under the RCP8.5 scenario, the annual number of days with a maximum temperature of 35°C or above is projected to increase significantly nationwide at the end of the 21st century (average for 2076–2095) relative to the end of the 20th century (average for 1980–1999). This can be interpreted as accompanying the significant temperature increases being projected, and since it is consistent with the global-level projections by the IPCC as well as actual observations, the level of confidence is high. The annual number of days with a minimum temperature of 25°C or above is also projected to increase significantly nationwide. They are projected to become more frequent in coastal and other low-lying areas, which is a similar projected trend to the number of days with a maximum temperature of 35°C or above (high confidence, for reasons similar to the number of days with a maximum temperature of 35°C or above).

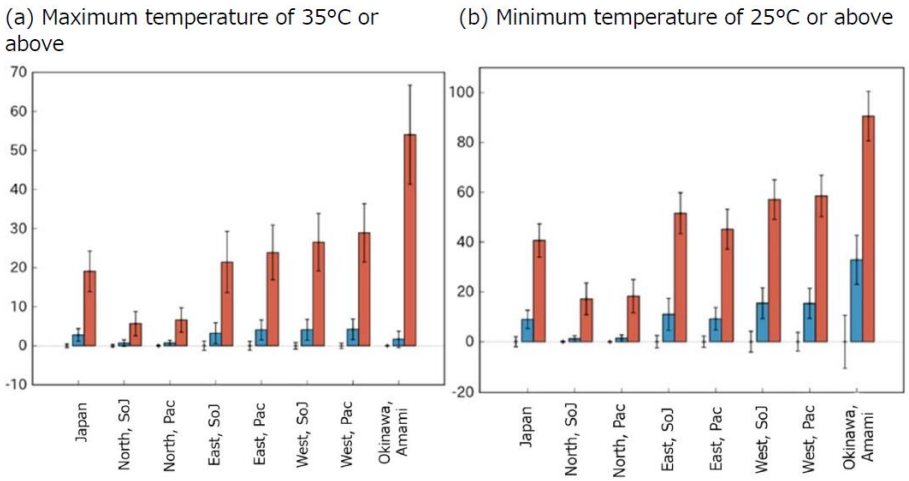


Figure III-6 Future trends in the annual number of days with an extreme maximum or minimum temperature as projected by the Japan Meteorological Agency (days)

The bar graph shows the future change at the end of the 21st century (average for 2076–2095) relative to the end of the 20th century (average for 1980–1999), with the thin vertical lines indicating the range of interannual variability. For the color of the bars, red corresponds to the RCP8.5 scenario and blue to the RCP2.6 scenario. Thin vertical lines where there is no bar represent the range of interannual variability at the end of the 20th century. (Projection results for the RCP8.5 scenario are from the Japan Meteorological Agency (2017)).

(2) Extreme precipitation

There is an increasing number of days with heavy rainfall of 100 mm or more per day and 200 mm or more per day calculated from precipitation data as observed at 51 Japan Meteorological Agency observation stations nationwide for the period 1901 to 2023 (statistically significant at a confidence level of 99%). The annual frequency of rainfall events with precipitation of 50 mm or more per hour is also increasing, calculated from precipitation data from about 1,300 Japan Meteorological Agency AMeDAS stations nationwide for the period 1976 to 2023 (statistically significant at a confidence level of 99%).

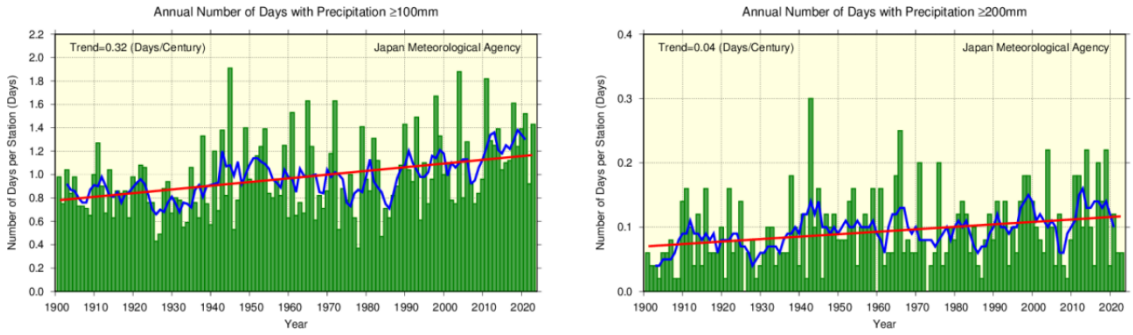


Figure III-7 Annual number of days with precipitation ≥ 100 mm (left figure) and ≥ 200 mm (right figure) from 1901 to 2023

The green bars indicate the annual number of days per station for each year. The blue line indicates the five-year running mean, and the straight red line indicates the long-term linear trend.

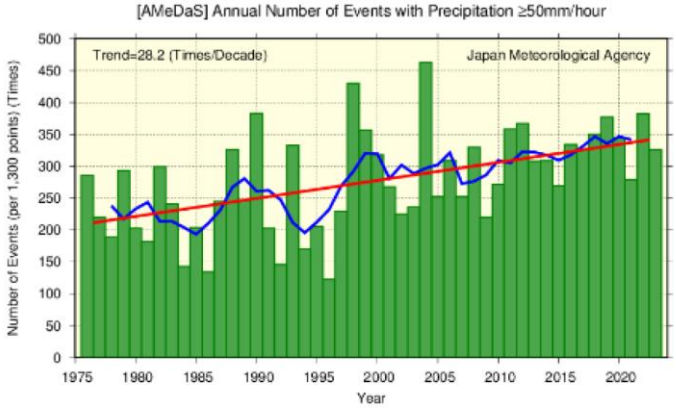


Figure III-8 Annual numbers of heavy rainfall events with precipitation ≥ 50 mm/hour [AMeDAS data] from 1976 to 2023

The green bars indicate the annual number of events per 1,300 AMeDAS stations for each year. The blue line indicates the five-year running mean, and the straight red line indicates the long-term linear trend.

Under the RCP8.5 scenario, the number of days with heavy rainfall of 100 mm or more and 200 mm or more is projected to increase significantly nationwide at the end of the 21st century (average of 2076–2095) relative to the end of the 20th century (average of 1980–1999). This is consistent with CMIP5 projections and the long-term increase observed to date, so the level of confidence is high. Under the RCP2.6 scenario, the averages of nation-wide and many regions are projected to have a significant increase (high confidence).

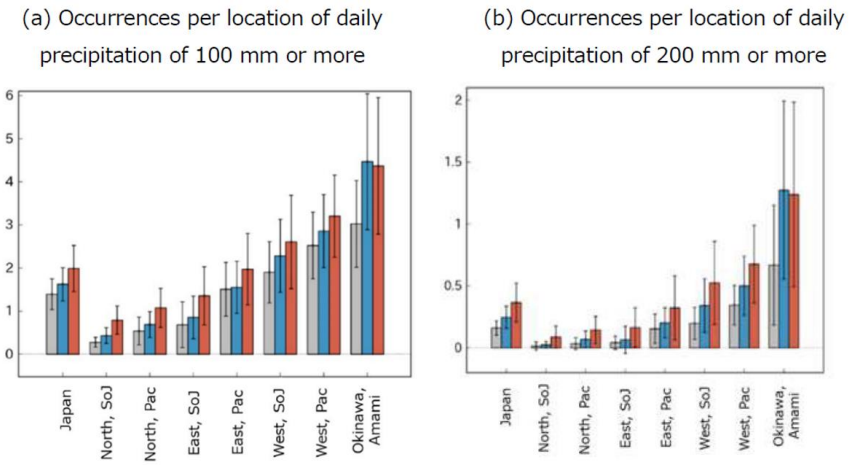


Figure III-9 Occurrences per location of daily precipitation of 100 mm or more and 200 mm or more, nationwide and by region (days/year)

(a) is the annual occurrence of precipitation of 100 mm or more per day, and (b) is 200 mm or more per day. Both graphs are based on projections by the Japan Meteorological Agency. The bars indicate the frequency of occurrence of heavy rainfall for each, and the thin vertical lines indicate the range of interannual variability. For the color of the bars, gray corresponds to the end of the 20th century (1980–1999), red to the RCP8.5 scenario, and blue to the RCP2.6 scenario at the end of the 21st century (2076–2095). However, it is important to note that although bias correction has been done for the values for the end of the 20th century, the bias has not been completely removed, and values are different from the observed values.

According to projections by the Japan Meteorological Agency, under the RCP8.5 scenario, the amount of rainfall of 50 mm or more per hour is projected to increase significantly nationwide at the end of the 21st century (average of 2076–2095) relative to the end of the 20th century (average of 1980–1999). As with heavy rainfall, this is consistent with CMIP5 projections for East Asia and with the observed long-term trends, so the level of confidence is high. Under the RCP2.6 scenario, a significant increase is also projected nationwide (high confidence).

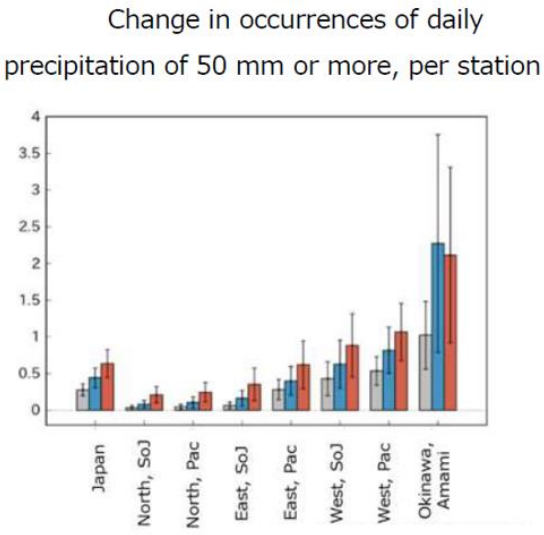


Figure III-10 Occurrences per location of precipitation of 50 mm or more per hour, nationwide and by region (days/year)

The graph is based on projections by the Japan Meteorological Agency. The interpretation of this figure is the same as with the previous figure.

2 Observed and potential impacts of climate change

2.1 Approaches and methodologies to assess climate change impacts

In the *Assessment Report on Climate Change Impacts in Japan* that was published in December 2020, the impact that climate change could have on Japan is assessed for 71 categories covering seven sectors based on scientific knowledge from three perspectives, including the degree and possibility of the impact (significance), the expression time of the impact, the time when adaptation efforts need to be started and when an important decision needs to be made (urgency), and the certainty of evidence (confidence).

The assessment of the significance of impacts is based on three criteria (social, economic, and environmental) and with reference to criteria used in the IPCC Fifth Assessment Report as a basis to identify key risks, as well as the UK-CCRA approach. For the assessment of significance, the designation as "Recognized as having particularly significant impacts" or "Recognized as having impacts" is, in principle, determined based on science, including the findings described in research papers and other literature, as well as expert judgment, following the approach shown in the table below. The term "N/A (currently cannot be assessed)" is used to indicate cases where assessment is currently difficult.

Table III-1 Approach for assessment of significance

Criteria for Assessment	Metrics for Assessment (Approach)		Means of Indicating Final Assessment
	Recognized as having particularly significant impacts	Recognized as having impacts	
	Assess significance in terms of social, economic, environmental impacts based on the following criteria: ● Magnitude of impacts (area, duration) ● Likelihood of occurrence of impacts ● Irreversibility of impacts (difficulty of restoring original conditions) ● Persistent vulnerability or exposure contributing to the impacts of concern		Indicate the degree of significance, and where "recognized as having particularly significant impacts," indicate the criteria.
1. Social	At least one of the following applies: ● Involves the loss of human life, or on the health dimension, the extent of impacts and likelihood of occurrence are particularly high (abbreviated as "extent" below). e.g.: Hazards (disasters) could result in the loss of human life Health impacts for large numbers of people ● Magnitude of impacts on local society and community is particularly high e.g.: Impacts are nationwide Impacts are not nationwide, but are serious locally ● Magnitude of impacts on cultural assets and community services is particularly high E.g., Irreversible impacts on cultural assets Serious impacts on citizens' livelihoods	An assessment of "Recognized as having particularly significant impacts" does not apply	
2. Economic	The following applies: ● Magnitude of economic losses is particularly high e.g., Large-scale losses occur to assets and infrastructure Loss of employment opportunities for a large number of citizens Large-scale disruptions of transportation networks over a large area	An assessment of "Recognized as having particularly significant impacts" does not apply	
3. Environment	The following applies: ● Magnitude of losses to environmental and ecosystem functions is particularly high e.g., Large-scale loss of important species, habitats, and landscapes For ecosystems, significant deterioration in quality of places that are important internationally and nationally Significant decline in land/water/atmospheric/ecological functions over a broad area	An assessment of "recognized as having particularly significant impacts" does not apply	

For criteria corresponding to urgency, the assessment is conducted with reference to the IPCC Fifth Assessment Report "timing of impacts" and the U.K. CCRA "urgency with which adaptation decisions need to be taken." It should be noted that because adaptation includes measures that need to be implemented in the long term and on an ongoing basis, for the timing of impacts and urgency with which adaptation decisions need to be taken, it is necessary to consider the amount of time required to implement measures. The term "N/A (cannot currently be assessed)" is indicated in cases where assessment is currently difficult.

Table III-2 Approach for assessment of urgency

Criteria for Assessment	Assessment Measure			Means of Indicating Final Assessment
	High urgency	Medium urgency	Low urgency	
1. Timing of impacts	Impacts are already evident	High likelihood that impacts will occur by mid-21st century	High likelihood that impacts will occur after mid-21st century or level of uncertainty is extremely high	The level of urgency is to be indicated for each sub-category as one of three levels, with both 1 and 2 considered
1. Timing needed to initiate adaptation measures and make critical decisions.	High urgency	Medium urgency	Low urgency	
	Decisions need to be made as soon as possible.	Major decisions need to be made within about 10 years (by about 2030)	The need is low to make major decisions within about 10 years (by about 2030)	

The assessment of confidence is conducted, in principle, based on the "type, amount, quality, and consistency of evidence" and "degree of agreement" in the IPCC Fifth Assessment Report. Regarding the "type, amount, quality, and consistency of evidence," integrated judgment is to be used, but because in some cases, the quantity of available research and reports containing projections of future impacts in Japan is less than in IPCC discussions, one of the key metrics for determining the approach is whether or not research and reports with quantitative analysis are available.

Regarding the assessment levels for confidence, three options were used: high, medium, and low. When assessing confidence, the assessment was also based on the degree of certainty of the projections, such as the amount of precipitation obtained from climate projection models being used. Also, the term "N/A (cannot currently be assessed)" is used in cases where assessment is currently difficult.

Table III-3 Approach for assessment of confidence

Considerations for assessment	Levels of assessment (approach)			Means of Indicating Final Assessment
	High Confidence	Medium Confidence	Low Confidence	
IPCC Assessment of Confidence ○ Type, amount, quality, and consistency of research/reports ○ Agreement of opinion among research/reports	Corresponds to IPCC confidence rating of "high" and above	Corresponds to IPCC confidence rating of "medium"	Corresponds to IPCC confidence rating of "low" and below	Using the IPCC's confidence level, indicate the confidence level for each sub-category using one of three levels

When referring to this report and considering the current situation as well as projected impacts, it is important to keep the following points in mind:

- For the climate change impacts in each sector, the assessments might be conducted with expert judgment where necessary. Also, the impacts that cannot be fully assessed based on existing literature may appear in the future.

- Climate change projections (e.g., temperature increases and changes in precipitation) vary in the range of magnitudes of projected changes and involve some uncertainty because of differences in the greenhouse gas emission scenarios and climate models utilized. In addition, extreme events, such as short-term intense rainfall, have a high degree of spatial uncertainty in terms of the location of their occurrence.
- Impacts in each sector are not necessarily caused only by climate change. Almost all phenomena are affected by a variety of factors other than climate change.

2.2 Summary of observed and potential impacts of climate change

A summary of the results of the assessment of the impacts of climate change is as follows (Table III-4).

Table III-4 Results of climate change impact assessments (Summary)

List of climate change impact assessment result

Sector	Category	Sub-category	Significance (RCP2.6/8.5)	Urgency	Confidence
Agriculture Forest/, Forestry, Fisheries	Agriculture	Paddy field rice	●/●	●	●
		Vegetables, etc.	◆	●	▲
		Fruit trees	●/●	●	●
		Barley/wheat, soybean, feed crops, other crops	●	▲	▲
		Livestock farming	●	●	▲
		Plant pests, weeds, etc.	●	●	●
		Water, land and agricultural infrastructure	●	●	●
		Food supply and demand	◆	▲	●
	Forest/Forestry	Timber production (e.g., planted forests)	●	●	▲
		Non-timber forest products (e.g., mushrooms)	●	●	▲
	Fisheries	Migratory fish stocks (ecology of fishes)	●	●	▲
		Propagation and aquaculture	●	●	▲
		Fishery environments in coastal areas and inland waters, etc.	●/●	●	▲
Water Environment, Water Resources	Water environment	Lakes, marshes, dams (reservoirs)	◆/●	▲	▲
		Rivers	◆	▲	■
		Coastal zones and closed sea areas	◆	▲	▲
	Water resources	Water supply (surface water)	●/●	●	●
		Water supply (groundwater)	●	▲	▲
		Water demand	◆	▲	▲
Natural ecosystems	Terrestrial ecosystems	Alpine/subalpine zone	●	●	▲
		Natural forests, secondary forests	◆/●	●	●
		Countryside -landscape ("satochi-satoyama")	◆	●	■
		Planted forests	●	●	▲
		Damage from wildlife	●	●	■
		Material balance	●	▲	▲
	Freshwater ecosystems	Lakes, marshes	●	▲	■
		Rivers	●	▲	■
		Marshlands	●	▲	■
	Coastal ecosystems	Subtropics	●/●	●	●
		Temperate, subarctic	●	●	▲
	Marine ecosystems		●	▲	■
Natural ecosystems	Others	Phenology	◆	●	●
		Shifts in distribution and populations (Endemic)	●	●	●
		Shifts in distribution and populations (Exotic)	●	●	▲
	Ecosystem services		●	—	—
		Nutrient and turbid material retention functions in watersheds	●	▲	■
		Supply of fisheries resources by coastal seagrass ecosystems	●	●	▲
		Eco-DRR functions of coral reefs	●	●	●
		Recreational functions related to natural ecosystems	●	▲	■

Sector	Category	Sub-category	Significance (RCP2.6/8.5)	Urgency	Confidence
Natural Disasters, Coastal Areas	Rivers	Floods	●/●	●	●
		Inland waters	●	●	●
	Coastal areas	Sea-level rise	●	▲	●
		Storm surges, high waves	●	●	●
		Coastal erosion	●/●	▲	●
	Mountain areas	Debris flows, landslides, and other disasters	●	●	●
	Others	Strong winds, etc.	●	●	▲
Human health	Impacts of complex disasters				
	Winter warming	Mortality in winter season	◆	▲	▲
	Heat stress	Risk of mortality, etc.	●	●	●
		Heat illness, etc.	●	●	●
	Infectious diseases	Water- and food-borne diseases	◆	▲	▲
		Vector-borne infectious diseases	●	●	▲
		Other infectious diseases	◆	■	■
	Others	Complex impacts of warming and air pollution	◆	▲	▲
		Impacts on vulnerable populations (elderly, children, persons with underlying health conditions, etc.)	●	●	▲
		Other health impacts	◆	▲	▲
Industrial / Economic Activities	Manufacture	—	◆	■	■
		Food manufacturing industry	●	▲	▲
	Energy	Energy supply and demand	◆	■	▲
	Commerce		◆	■	■
		Retail industry	◆	▲	▲
	Finance, insurance		●	▲	▲
	Tourism	Leisure	◆	▲	●
		Leisure industry based on natural resources	●	▲	●
	Construction		●	●	■
	Medical		◆	▲	■
	Others	Others (overseas impacts)	◆	■	▲
		Others	—	—	—
Life of Citizenry, Urban Life	Urban infrastructure, critical services, etc.	Water supply, transportation, and others	●	●	●
	Life with sense of culture and history	Phenology, traditional events/ local industry (Phenology)	◆	●	●
		Phenology, traditional events/ local industry (Local industry)	—	●	▲
	Others	Impacts on life due to heat stress, etc.	●	●	●
Inter-sectoral Impact Linkages	Impacts of disruptions of urban infrastructure and critical services				

Legend

Significance
- ● : Recognized as having particularly significant impacts
- ◆ : Recognized as having impacts
- — : N/A (cannot currently be assessed)

Urgency and Confidence
- ● : High
- ◆ : Medium
- ■ : Low
- — : N/A (cannot currently be assessed)

Indicates that changes and/or updates have been made in categories and/or assessment results since the first impact assessm
Assessment of significance and/or urgency has been revised upwards
New category added for this assessment

Note: For some categories, urgency has been assessed separately for RCP2.6/ RCP8.5 senarios.

The *Assessment Report on Climate Change Impacts in Japan* compiles the observed and potential impacts of climate change for each sector. For details on the assessment of the impact of climate change and the methods and scenarios used for projections on individual sectors, please refer to the latest *Assessment Report on Climate Change Impacts in Japan*.

(https://www.env.go.jp/content/000047546.pdf)

C. Adaptation priorities and barriers

(para. 108 of the MPGs)

1 Domestic priorities and progress towards those priorities

As stated in A.2, under the Adaptation Plan, Key Performance Indicators (KPI) are established for the fields with high significance and urgency (18 major items and 32 subitems), and the progress of each measure on the plan is identified. The time needed for implementing adaptation measures, limits to implementation, vulnerability, and other factors are to be considered in determining the content, implementation time frame, and priorities of the measures.

The results of KPIs are monitored through the follow-up to the Adaptation Plan each year and are published on the website as part of the follow-up report (Japanese only:

https://www.env.go.jp/earth/earth/tekiou/page_00004.html).

2 Adaptation challenges and gaps and barriers to adaptation

For the effective implementation of the Adaptation Plan, it is crucial to quantitatively ascertain and assess the effectiveness of climate change adaptation measures, such as how much each measure has contributed to the avoidance and reduction of damage from climate change impacts. However, there have been no established methods of ascertaining and assessing the effectiveness of climate change adaptation measures in Japan or elsewhere in the world for such reasons as the difficulty of setting adequate indicators and the long period needed to assess the effectiveness.

To address this, the Japanese government will develop methods to more accurately ascertain and assess the progress of climate change adaptation resulting from the implementation of the Adaptation Plan. Specifically, this will involve organizing the latest findings from investigations and research on indicators and methods related to the assessment of how adaptation measures have contributed to the reduction of climate change impacts and collecting information on international trends, initiatives by other countries, and efforts by local governments on this topic to push forward with studies on a more appropriate PDCA approach to the Adaptation Plan.

D. Adaptation strategies, policies, plans, goals and actions to integrate adaptation into national policies and strategies

(para. 109 of the MPGs)

In implementing climate change adaptation measures, it is essential to coordinate them with other relevant measures, such as those for DRR (Disaster Risk Reduction), agriculture/forestry/fisheries, and biodiversity conservation, and thus it is important that the government, through collaboration among relevant ministries and agencies, incorporates climate change adaptation into all relevant measures, such as those for DRR, agriculture/forestry/fisheries, and biodiversity conservation to effectively and efficiently implement climate change adaptation measures and seeks to mainstream adaptation in its policies. Therefore, incorporating climate change adaptation into every relevant policy is set as one of the basic strategies in the Adaptation Plan. This basic strategy also mentions that the government, in implementing its policies, shares findings and information across society through inclusive risk communication and develops decision-making and consensus-building processes that consider gender equality and vulnerable groups and regions so that every actor and every stakeholder in every sector can work together and act responsibly.

1 Promotion of adaptation actions through the Climate Change Adaptation Plan

The Adaptation Plan stipulates the objectives, basic roles of stakeholders, basic strategies, and progress management of Japan's adaptation measures as follows.

1.1 Objectives

The objectives are to prevent and mitigate damage from the impact of climate change; to promote the stable life of citizens, sound development of society and the economy, conservation of the natural environment, and achievement of resilient national land by promoting measures related to climate change adaptation integrally and systematically based on scientific findings; and to build a safe, comfortable, and sustainable society. In addition to the socioeconomic perspective, such as the reduction of the population and post-COVID-19, other new perspectives, including Adaptive Recovery and NbS (Nature-based Solutions), will be considered.

1.2 Basic strategies

In order to promote measures related to climate change adaptation integrally and systematically based on scientific findings and to achieve the goals of the Adaptation Plan, basic strategies are defined as stated below. The national government and relevant ministries and agencies collaborate closely and promote sectoral and basic measures effectively under these basic strategies.

- Basic strategy [i] Embed climate change adaptation in every relevant policy.
- Basic strategy [ii] Promote climate change adaptation based on scientific knowledge.
- Basic strategy [iii] Consolidate the knowledge of research institutions in Japan and develop the information infrastructures.
- Basic strategy [iv] Promote climate change adaptation according to local backgrounds.

- Basic strategy [v] Deepen the understanding of citizens and promote climate change adaptation corresponding to business activities.
- Basic strategy [vi] Contribute to enhancing the adaptive capacity of developing countries.
- Basic strategy [vii] Ensure a system of close collaboration among relevant administrative agencies.

1.3 Integration of the best available science into adaptation measures

(1) Basic measures for the enhancement and utilization of scientific knowledge on climate change and other related issues,

- The government promotes the observation, monitoring, prediction, assessment, and development of historical datasets related to climate change and climate change impacts in various sectors and their investigation and research. In particular, there is a lack of monitoring data in the Arctic. To improve the precision of climate change predictions, the government will enhance monitoring data by operation of the Arctic research vessel.
- The government promotes DRR, water resource management, farming support, biodiversity conservation, and other technical developments related to climate change adaptation, and it promotes the proactive use of technologies related to climate change adaptation.
- In addition, in order to ensure a continuous meteorological satellite observation system for purposes such as monitoring typhoons, heavy rainfall, and other global environment issues, the government will steadily develop the next-generation geostationary meteorological satellite, Himawari-10, which incorporates the latest technology, such as 3D observation functions, with the aim of starting operations in FY 2029.

(2) Basic measures related to ensuring the system for collection, organization, analysis, and provision of information related to climate change, etc.

- The government consolidates the research results, data, information, etc., of various research and study institutions, etc., thereby enhancing and strengthening A-PLAT and the Data Integration and Analysis System (DIAS). In addition, in collaboration with the National Institute for Environmental Studies, the government consolidates and shares data related to climate change, etc., and information on activities related to climate change adaptation as well as scientific knowledge and tools that are possessed by the relevant ministries and agencies, local governments, business operators, private organizations, citizens, etc. in A-PLAT.

1.4 Implementation of adaptation actions

Initiatives and projects have been implemented based on sectoral and fundamental measures set out in the Adaptation Plan. See the follow-up report to the Adaptation Plan for further details on the initiatives and projects (Japanese only)：

Follow-up report on FY 2022 measures to the Climate Change Adaptation Plan

https://www.env.go.jp/content/000167609.pdf

<Appendix 1> Follow-up Individual Sheet for measures implemented in FY 2022

https://www.env.go.jp/content/000167596.pdf

<Appendix 2> Actual values for FY 2022 of the KPIs for the sectoral and fundamental measures set out in the Climate Change Adaptation Plan.

https://www.env.go.jp/content/000167597.pdf

Also, see section C.1 for details on the progress of sectoral measures identified as a high priority.

2 Adaptation efforts by local governments and business operators

2.1 Efforts by local governments

Under the *Adaptation Act*, it is stipulated that local governments strive to promote measures related to climate change adaptation based on natural, economic, and social circumstances in the local areas and strive to provide information related to adaptation measures while taking other measures in order to promote the climate change adaptation of business operators and others and business activities contributing to climate change adaptation in the local areas.

In addition, under the *Adaptation Plan*, the basic role of local governments is defined as promoting climate change adaptation based on local natural, economic, and social circumstances, the local promotion of climate change adaptation with stakeholders, and the local enhancement and use of scientific findings. Also, there are relevant provisions in the section on basic measures.

As of March 2024, 47 prefectures, 20 ordinance-designated cities, and 248 municipalities have formulated *Local Climate Change Adaptation Plans* and are implementing adaptation measures based on local circumstances in a planned manner. The Ministry of the Environment created and published the *Manual for Formulating Local Climate Change Adaptation Plans* to support local governments in formulating local climate change adaptation plans.

In addition, as of March 2024, 44 prefectures, 3 ordinance-designated cities, and 16 municipalities established Local Climate Change Adaptation Centers that serve as the bases to collect, organize, analyze, and provide information related to local climate change impacts and climate change adaptation and to provide technical advice.

In order to further strengthen the collaboration among stakeholders in the local areas and to promote climate change adaptation in collaboration with wide-ranging stakeholders at the local level, based on the provisions of the *Adaptation Act*, the Regional Councils on Climate Change Adaptation in which regional environment offices and other local administrative organs of the national government, prefectural governments, municipal governments, Local Climate Change Adaptation Centers, business operators, and other entities participated were established in seven regions in Japan.

The National Institute for Environmental Studies Climate Change Adaptation Center manages and operates the Climate Change Adaptation Information Platform (A-PLAT) to consolidate and provide climate change risk information to local governments, etc., based on the provisions of the *Adaptation Act*. It supports local governments in formulating *local climate change adaptation plans* and provides technical support to Local Climate Change Adaptation Centers by offering learning opportunities through training and seminars, organizing opinion exchange meetings, and dispatching experts.

2.2 Activities by business operators

Under the *Adaptation Act*, it is stipulated for business operators to engage in climate change adaptation based

on the details of their business activities in order to implement their business activities smoothly and to strive to cooperate with the measures of the national government and local governments related to climate change adaptation.

In addition, the promotion of climate change adaptation based on the characteristics of business details and the development of adaptation businesses are defined as the basic roles of business operators under the *Adaptation Plan*. Furthermore, it developed basic measures for adaptation related to industrial and economic activities and has relevant provisions in the section on basic measures.

In the *Assessment Report on Climate Change Impacts in Japan* that was published in December 2020, concerning industrial and economic activities, 11 subitems (manufacture, food manufacture, energy, commerce, retail, finance/insurance, tourism, leisure industry using natural resources, construction, medical, and others) were assessed. The outline is as stated in the following table.

Table III-5 Outline of the Assessment Report on Climate Change Impacts in Japan (industrial and economic activities)

Industrial and economic activities
(Manufacture) - Stopping operation plants, etc. due to heavy rainfall, tropical cyclones, etc.* **(Energy)** - Changes in energy demand in association with increased air temperature** - Changes in power generation of recyclable energy (hydroelectric power plants, etc.)** **(Commerce)** - Temporary closure of department stores, supermarkets, etc. due to heavy rainfall, tropical cyclones, etc.** - Growing difficulty in predicting demand for seasonal goods (beverages, clothing, etc.)** **(Finance/insurance)** - Increases in insurance payments due to large-scale natural disasters** - Increases in demand for insurance, increases in business opportunities, such as the development of new goods** **(Tourism)** - Loss or decreases in leisure sites and resources using natural resources (forests, snowy mountains, sandy beaches, tidal flats, etc.)*** **(Construction)** - Revision of design conditions, standards, etc. related to wind load, air-conditioning load, etc.* **(Medicine)** - Increases in damage from inundation of medical institutions due to flooding* **(Other (overseas impacts, etc.))** - Impacts on the economy in Japan through the global supply chain* - Impacts of climate change on national security -

Underlined: Newly added impacts in this climate change impacts assessment. Asterisks and codes at the end of each sentence indicate the assessment results related to confidence for the corresponding sub-items and detailed items.
***: High confidence **: Medium confidence *: Low confidence -: Cannot be assessed at current status.

There are no subitems where the significance, urgency, and confidence are all high; however, in many industries,

climate change impacts are predicted, and the necessity of preparing for these impacts and engagement in climate risk management is increasing.

Concerning climate risk management, the Ministry of the Environment revised the *Climate Change Adaptation Guide for Private Sector -Preparing for Climate Risk and Surviving-* in March 2022, established in March 2019, and enhanced the description of the latest climate risk information and the concepts and methods to address adaptation measures. In addition, in September 2021, the relevant ministries and agencies established the Public-Private-Academic Networking Meeting on Climate-related Risks in Japan with the aim of improving issues in promoting climate change adaptation through the regular exchange of views and collaboration among industry, government, and academia. In addition to supporting the efforts of businesses through these initiatives, examples of climate risk management and adaptation businesses by domestic and foreign operators are introduced, and a portal website, the Climate Change Risk Analysis Information Site, is available for business operators working on physical risk analysis to obtain information in a centralized manner on the Climate Change Adaptation Information Platform (A-PLAT) managed and operated by the National Institute for Environmental Studies.

At the same time, concerning activities for adaptation businesses, the Ministry of Economy, Trade and Industry investigated the information disclosed by Japanese companies and analyzed activities that were analogized to contributing to overseas adaptation measures. As a result, seven major fields were indicated where Japanese companies could contribute internationally to adaptation businesses: Resilient Infrastructure against Natural Disasters; Sustainable Energy Supply; Food Security, Agriculture/Strengthening Food Production Base; Health and Sanitation; Weather Observation, Monitoring, and Early Warning; Securing Resources/Stable Water Supply; and Finance Related to Climate Change Risks. The Ministry of Economy, Trade and Industry created the Climate Change Adaptation Good Practices by the Japanese Private Sector (56 practices listed as of March 2024) based on these fields, introduced adaptation business cases of Japanese companies at seminars inside and outside Japan, and thereby has been supporting adaptation business activities. In addition, at COP27, the Ministry of Economy, Trade and Industry, together with the UN-Habitat regional office for Asia and the pacific, announced the SUBARU (SUstainable Business of Adaptation for Resilient Urban future) Initiative, which aims to promote climate-resilient cities in developing countries. Under this initiative, they are working to match local governments in Asia-Pacific countries that need adaptation measures with Japanese companies using adaptation technology. Moreover, the Climate Change Adaptation Information Platform (A-PLAT) compiled adaptation business cases in each sector, including agriculture, forestry and fisheries, water environment and water resources, natural ecosystems, natural disasters, and coastal areas, human health, industrial and economic activities, and life of the citizenry and urban life, and adaptation business activities in and outside Japan are gradually being activated.

In addition, relevant ministries and agencies, local governments, research institutions, universities, private sectors, etc., are holding symposiums and seminars, creating and publishing guidebooks, etc., and business operators are promoting climate change adaptation based on business characteristics by business operators and supporting the development of the adaptation business.

Towards the acceleration of activities for climate risk management and the adaptation business, behavioral changes are encouraged, and the need to expand adaptation financing is becoming recognized from the perspective of promoting the transfer and dispersion of increasing risks. Under these circumstances, the Ministry of the Environment published *Guide for Adaptation Finance* (March 2021). Furthermore, in 2017, the Ministry of the Environment formulated domestic guidelines for green bonds and loans and others based on the International Capital Market Association (ICMA)'s international principles with the aim of stimulating the potential demand of financiers and developing the market. The 2022 revision of these guidelines includes organizing specific examples of green projects in Annex 1 (Green List), including adaptation businesses based on the Adaptation Plan, and there are also efforts underway to encourage initiatives by private companies,

including financial institutions.

3 Nature-based solutions to climate change adaptation

The Adaptation Plan highlights the importance of the integration of the concept of NbS and clarifies the necessity of adaptation measures focusing on Ecosystem-based Disaster Risk Reduction (Eco-DRR) and Ecosystem-based Adaptation (EbA).

Also, the National Biodiversity Strategy and Action Plan of Japan 2023−2030 (NBSAP), formulated in March 2023, positions NbS as one of its five basic strategies, and it states that the government will maximize synergies, minimize trade-offs between biodiversity and measures for such various issues as climate change, and thereby maximize the efforts of NbS while maintaining biodiversity. In addition, the 30 by 30 target, effectively conserving at least 30% of the land and 30% of the sea by 2030, has been set as a national target in the NBSAP, wherein the achievement would contribute to better functioned NbS, including for climate change mitigation and adaptation.

In 2023, the Ministry of the Environment published guidance for the development and use of a Potential Map of Ecosystem Conservation/Restoration that shows the locations with potential for Eco-DRR (English summary: https://www.env.go.jp/content/000124850.pdf) and a nationwide base map on Eco-DRR and is promoting Eco-DRR that contributes to both the establishment of resilient communities against natural disasters and the conservation of biodiversity, as well as to the social and economic development of the communities.

In 2023, the Ministry of Land, Infrastructure, Transport and Tourism formulated the Green Infrastructure Promotion Strategy 2023, which sets out the vision for a green infrastructure and the perspectives for initiatives and aims to promote and build a green infrastructure in all fields and situations with both the public and private sectors working together. The strategy comprehensively and systematically positions the initiatives of the Ministry of Land, Infrastructure, Transport and Tourism. In order to promote the initiatives set out in the strategy, the Ministry of Land, Infrastructure, Transport and Tourism is making use of the Green Infrastructure Public-Private Partnership Platform and is also creating and publishing the *Green Infrastructure Implementation Guide*.

E. Progress on implementation of adaptation

(paras. 110−111 of the MPGs)

1 Progress of adaptation actions

As stated in A.2, the progress of measures related to climate change adaptation is checked every year at the Climate Change Adaptation Promotion Council. In the follow-up of the measures for FY2022, the status of implementation of the 614 items related to the measures specified in the Adaptation Plan (basic approaches to measures are listed in the Eighth Japan's National Communication / the second adaptation communication of Japan to be submitted to the UNFCCC Secretariat in light of Article 7, paragraph 10 and 11. of the Paris Agreement) as well as the actual values of the KPIs were confirmed and compiled into a report. The method for confirming the progress of each measure in the follow-up of measures is as follows: the measures and projects are listed on the follow-up individual sheets in a way that corresponds to the content of the measures indicated in the Adaptation Plan, and the ministries and agencies in charge describe the implementation status of each measure and project, the budget amount, the content of the measures and projects, future plans, indicators that show progress, and the relationship with the SDGs, etc. For more details, please refer to the following websites (Japanese only).

Follow-up report on FY 2022 measures to the Climate Change Adaptation Plan

https://www.env.go.jp/content/000167609.pdf

<Appendix 1> Follow-up Individual Sheet for measures implemented in FY 2022

https://www.env.go.jp/content/000167596.pdf

<Appendix 2> Actual values for FY 2022 of the KPIs for the sectoral and fundamental measures set out in the Climate Change Adaptation Plan.

https://www.env.go.jp/content/000167597.pdf

Also, see section C.1 for details on the progress of sectoral measures identified as a high priority.

2 Steps taken to formulate, implement, and update the Climate Change Adaptation Plan

The Climate Change Adaptation Act, enacted in 2018, stipulates that the Minister of the Environment shall make and publicize a report on the comprehensive assessment of the Climate Change Impact approximately every five years, that the government shall establish a plan for Climate Change Adaptation, that the government shall consider the most recent comprehensive assessment of the Climate Change Impact and other situations and, if deemed necessary, shall promptly change the plan, and that the government shall endeavor to understand the progress of Climate Change Adaptation in detail through utilizing the Climate Change Adaptation Plan and to develop a method of evaluation.

After the promulgation of the Adaptation Act in 2018, a climate change adaptation plan was formulated in the same year based on the provisions of the Adaptation Act. After the publication of the *Assessment Report on Climate Change Impacts in 2020*, the Adaptation Plan was revised in 2021 based on the content of the report (the Adaptation Plan was partially revised again in May 2023), etc. In addition, follow-up on the measures set out in the Adaptation Plan has been carried out regularly since FY 2018.

In FY 2025, the plan is to monitor and evaluate progress in medium- to long-term climate change adaptation

and to prepare the next assessment report on climate change impacts. Based on these contents, the plan is to revise the Adaptation Plan in FY 2026 and beyond.

F. Monitoring and evaluation of adaptation actions and processes

(paras. 112–114 of the MPGs)

1 Monitoring and evaluation of adaptation actions and processes

1.1 National systems for monitoring and evaluation of adaptation actions

See section A.2 for national systems for monitoring and evaluation of adaptation actions.

In order to monitor and evaluate progress in medium- to long-term climate change adaptation, a PDCA Method Review Committee for Climate Change Adaptation Measures has been established, consisting of experts in various fields, and is currently working on developing methods for accurately monitoring and evaluating the effectiveness of sectoral and fundamental measures related to adaptation. The compilation of the evaluation methods under review is scheduled to be carried out in FY 2025.

Based on the content of the evaluation of progress in medium- to long-term climate change adaptation, the content of the next *Assessment Report on Climate Change Impact*, which is scheduled to be formulated in FY 2025 and other information, if it is determined that the current adaptation plan's adaptation actions are not sufficient to avoid impacts, new adaptation measures will be considered in the Adaptation Plan, which is scheduled to be revised in 2026 or later.

1.2 Approaches and results of the monitoring and evaluation

See section E.1 for the progress of adaptation actions and its approach. Also, see section C.1 for details on the monitoring and evaluation of sectoral measures identified as high priority.

Moreover, KPIs related to fundamental measures have also been set in line with each basic strategy set out in the Adaptation Plan (including KPIs to contribute to improving the adaptive capacity of developing countries). See the website for further details. (Japanese only: https://www.env.go.jp/earth/earth/tekiou/page_00004.html)

2 Effectiveness and sustainability of adaptation actions

Regarding ownership and stakeholder engagement in adaptation, the Adaptation Act and the Adaptation Plan specify the roles of each actor. See section A.2 for more details.

Also, see section D.2 for information on the alignment of adaptation actions with national and subnational policies and replicability. For the effectiveness and sustainability of adaptation actions, see section C.1.

G. Information related to averting, minimizing and addressing loss and damage associated with climate change impacts

(para. 115 of the MPGs)

In Japan, measures related to averting, minimizing, and addressing loss and damage associated with climate change impacts are being implemented as part of climate change adaptation measures.

H. Cooperation, good practices, experience and lessons learned

(para. 116 of the MPGs)

1 International cooperation

Concerning international cooperation, the *Climate Change Adaptation Plan* positions the contribution to increasing the adaptive capacity of developing countries as one of its basic strategies and lists the following strategies.

Many developing countries lack the capacity to adapt to the impact of climate change. Their vulnerability to current and future climate change is significant, and the impact may become more severe. From the perspective of ensuring security, actions on the impact of climate change in developing countries are important.

For this reason, the government of Japan built the Asia-Pacific Climate Change Adaptation Information Platform (AP-PLAT), which was established to support decision-making in consideration of climate change risks and highly effective climate change adaptation for the Asia-Pacific countries and promotes, through cooperation with relevant institutions, enhancement of scientific knowledge related to climate change risks, development and provision of publicly available tools to assist in the formulation of climate change adaptation plans and development of capacities related to the climate change impact assessment and climate change adaptations.

*In addition, various international cooperation frameworks, such as meteorological satellites, are used to promote technical cooperation in the observation, monitoring, projection, and assessment of climate change and its impacts, as well as DRR, climate change adaptation in the fields of agriculture, water and sanitation, and public health, etc. Especially based on regional circumstances, cooperation with international organizations is to be promoted so that the results of their research and technology development can be used to establish projects in advance to respond to future climate change impacts.

Also, the government of Japan assists in consultations through public-private partnerships to promote the international development of Japanese adaptation businesses. Furthermore, Japan utilizes the observation, monitoring, projection, and assessment of climate change and its impacts, disaster prevention experiences in Japan, technologies related to disaster prevention, climate change adaptation of agriculture, and other knowledge to promote overseas development and international cooperation by both the public and private sectors.

Japan has provided a wide range of support, from disaster preparedness, such as capacity development and early warning systems, to disaster risk management.

At COP28, the government of Japan announced its "Assistance Package to Promote Investments for Global Actions Toward the Achievement of the Paris Agreement Goals" (https://www.env.go.jp/en/press/press_02190.html). This assistance package to promote investments aims to resolve the three gaps, namely the ambition gap, adaptation gap, and implementation gap, by establishing a foundation to promote investments for decarbonization and adaptation.

In addition, at the G7 Ministers' Meeting on Climate, Energy, and Environment held in Sapporo on April 15-16, 2023, the G7 announced the G7 Inventory on Climate Disaster Risk Reduction, Response and Recovery as a list of support measures for climate disaster risks. Japan's initiatives are also included in the G7 Inventory on Climate Disaster Risk Reduction, Response and Recovery.

2 Strengthening scientific research and knowledge

2.1 Promotion of scientific research

The Plan for Global Warming Countermeasures stipulates that Japan promotes research on climate change and strengthens the observation and monitoring system as a fundamental measure for global warming policies and measures. In addition, the Adaptation Plan stipulates that Japan promotes observation, monitoring, projection, and assessment, as well as research and studies of climate change and its impacts in various fields and develops scientific knowledge on climate change projection based on the latest research results as a basic strategy.

Regarding the development of climate projection models and related research, which are crucial for future hazard projections in natural disasters, efforts have been made to enhance model sophistication, reduce uncertainties, and understand hazards in natural disasters under the "MEXT-program for the advanced studies for climate change projection (SENTAN)". Furthermore, in the predecessor program, the "Integrated Research Program for Advancing Climate Models (TOUGOU)," the Ministry of Education, Culture, Sports, Science and Technology promoted the development and research of numerous climate models by utilizing the Earth Simulator supercomputer. This program also conducted the CMIP6 experiments, which were essential for the creation of the *IPCC Sixth Assessment Report*, thereby contributing to the report through the generation of scientific knowledge.

Research into the impacts of climate change is also treated as part of the strategic research of the Environmental Research Promotion Fund. For example, the Strategic Research on Environment Research and Technology Development Fund S-8 (Comprehensive Study on Impact Assessment and Adaptation for Climate Change) conducted research related to the examination of the effects of impact projection and adaptation measures based on climate projection on the national and regional level, scientific support for the promotion of municipalities adaptation measures, and contributions to the planning and implementation of adaptation measures in the Asia-Pacific region with a view to supporting regional adaptation measures for the impacts of climate change.

Moreover, through the Asia-Pacific Network for Global Change Research (APN), Japan enhances activities related to global change research in the Asia-Pacific region by cooperating with researchers and governmental officers throughout the region. There are six research areas targeted: (1) Climate; (2) Biodiversity and ecosystems; (3) Air, land, coasts, and oceans; (4) Food, water, and energy; (5) Risk and resilience; and (6) Human dimensions. Within them, high-demanded research themes are prioritized through discussions in the subregional committees.

2.2 Promoting the introduction of the early warning system

At COP27, the Japanese government expressed support for the UN's initiatives and announced the launch of a new initiative by the Ministry of the Environment called the "Initiative to Promote the Development of Early Warning Systems through Public-Private Partnerships in the Asia-Pacific Region" (hereinafter referred to as the "EWS Public-Private Partnership Initiative"). The EWS Public-Private Partnership Initiative aims to establish a system for public-private partnerships to promote the deployment of early warning systems for the business sector (e.g., installation of observation devices, analysis and projection based on observation data, and delivery of climate information services) by Japanese private companies in the ASEAN region and other parts of the Asia-Pacific region, as well as the development of businesses that utilize early warning systems and aims to first build a prototype of an early warning system for the business sector in the Asian region to pave the way for further development. In June 2023, the Consultation of the Early Warning System through Public Private

Partnership on International Contribution to the Promotion of Early Warning System was established to hold the necessary discussions between the relevant stakeholders and promote the deployment of early warning systems. （https://www.ewsi.green/en）

Chapter IV

Information on financial, technology development and transfer and capacity-building support provided and mobilized under Articles 9–11 of the Paris Agreement

Japan's First Biennial Transparency Report

under the Paris Agreement

Overview

（Finance）

- Japan has provided a variety of climate change support through multilateral and bilateral frameworks to support the implementation of the Paris Agreement by developing countries.
- Japan's climate change support to developing countries during the two-year period from 2021 to 2022 (both calendar years) reached approximately 26.9 billion USD (public financing amounted to approximately 22.4 billion USD and private financing amounted to approximately 4.5 billion USD). Regarding the Green Climate Fund (GCF), Japan, in addition to its contributions of 1.5 billion USD to the GCF for initial resource mobilization (2015–2018) and 1.5 billion USD for the First Replenishment (2020–2023), has committed to making contributions of up to 165 billion JPY for the Second Replenishment (2024–2027) of the GCF.
- Moreover, based on the decision at COP27, related to the decision on operationalization of the new funding arrangements, including a fund, for responding to loss and damage, which was adopted at COP28, Japan announced that it was ready to contribute 10 million USD to commence the operationalization of the fund and became the first country in the world to disburse the fund in March 2024.
- In addition, in November 2022, Japan contributed to the launch of the Just Energy Transition Partnership (JETP) Indonesia as one of the co-lead countries with the United States and participated in JETP Vietnam as one of the partner countries.
- Based on these achievements, a new climate finance commitment from 2021 was announced by former Prime Minister Suga at the G7 Cornwall Summit in June 2021 to provide climate-related assistance to developing countries totaling 6.5 trillion JPY in both public and private sectors over the five years from 2021 to 2025. In addition, at COP26 in November 2021, Prime Minister Kishida announced up to 10 billion USD in the five years starting from 2021 to 2025 on top of the 6.5 trillion JPY announced at the G7 Cornwall Summit in order to take the initiative in fulfilling the financial gap in the annual 100 billion USD joint mobilization goal of climate finance by developed countries. Furthermore, as part of these financial commitments, Japan announced at COP26 that it would double its assistance for adaptation, totaling approximately 1.6 trillion yen from both public and private financing for adaptation in the five years starting from 2021 to 2025. These commitments were on track in 2022.
- As a major developed country, Japan will continue to support actions to address climate change in developing countries by steadily implementing its financial commitments.

（Technology Development and Transfer）

- Based on the Plan for Global Warming Countermeasures, Japan expanded cooperation based on collaboration with partner countries and promoted international deployment of environmentally friendly technologies and products by leveraging Japan's strengths in technology to make the greatest possible contribution to global emission reductions.
- For technology transfer, Japan is contributing by deepening discussions on innovation creation through international platforms and other means to promote discussion. In addition, Japan promotes demonstration projects to create innovations for radically restructuring excellent decarbonizing technologies to meet the characteristics of developing countries while also creating opportunities for new innovations through the dissemination of innovative technologies and sharing the effects of such technologies with developing countries.
- Japan also promotes the Joint Crediting Mechanism (JCM), which facilitates the diffusion of advanced

decarbonizing technologies, products, systems, services, and infrastructure through investments by Japanese entities, as well as the City-to-City Partnership (C2C), which supports the introduction of superior decarbonizing technologies, including systems and know-how, based on the experience of local governments in Japan.

- As a cross-sectoral effort, technical development assistance to various developing countries is also provided for agriculture, forestry, and fisheries.
- In the field of adaptation, we are working with domestic and international organizations to diversify funding and provide support for adaptation projects based on the priority areas and the needs of each country.

（Capacity building）

- Based on the global warming countermeasures plan, Japan is expanding cooperation based on collaboration with partner countries and further improving the environment by creating markets, fostering human resources, and building institutions.
- In the field of mitigation, Japan supports the formulation of a long-term strategy and the update of NDCs by assessing policy options and quantifying the various future scenarios using the Asia-Pacific Integrated Model (AIM). In the field of adaptation, Japan supports climate change impact assessment and capacity building on climate change adaptation, including the development of early warning systems by the private sector. Additionally, various seminars are provided to enhance adaptation capacity by sharing information and knowledge. As capacity-building support for transparency, Japan contributes to capacity building and the institutional development of a measurement and reporting system, especially in Asia, by hosting the Workshop on Greenhouse Gas Inventories in Asia and the Partnership to Strengthen Transparency for Co-Innovation (PaSTI).

A. National circumstances and institutional arrangements

(paras. 119–120 of the MPGs)

Japan has announced a number of climate finance commitments since 2013 and achieved all of them. Also, Japan developed the Proactive Diplomatic Strategy for Countering Global Warming (ACE: Actions for Cool Earth) in November 2013 and announced the provision of a total 1.6 trillion yen (approx. USD 16 billion) for developing countries during the three-year period from 2013 through 2015. This commitment was achieved in approximately one and one-half years. In November 2015, at COP21, Japan announced its new climate finance commitment under the Actions for Cool Earth (ACE) 2.0 and committed to providing approximately 1.3 trillion yen from both the public and private sectors to developing countries in 2020. This commitment was also achieved in 2020. Based on these achievements, a new climate finance commitment from 2021 was announced by former Prime Minister Suga at the G7 Cornwall Summit in June 2021 to provide climate assistance for developing countries totaling 6.5 trillion yen in public and private financing over the five years from 2021 to 2025. In addition, at COP26 in November 2021, Prime Minister Kishida announced up to 10 billion USD for the five years starting from 2021 to 2025 on top of the 6.5 trillion yen announced at the G7 Cornwall Summit in order to take the initiative in fulfilling the financial gap in the joint mobilization goal of an annual 100 billion USD in climate finance by developed countries. As part of these financial commitments, Japan also announced at COP26 that it would double the assistance for adaptation, totaling approximately 1.6 trillion yen in both public and private financial resources over the five years from 2021 to 2025. This commitment of doubling the adaptation financing by Japan was the precursor to the Glasgow Climate Pact, which urged developed countries to at least double their provision of climate finance for adaptation to developing countries from 2019 levels by 2025. These commitments are on track in 2022.

Japan, as a major developed country, continues to steadily implement its announced financial commitments and strongly supports climate actions by developing countries.

Financial support from Japan in the two years from 2021 to 2022 reached approximately 26.1 billion USD (public financing amounted to approximately 22.4 billion USD, and private financing amounted to approximately 4.5 billion USD).

Japan, in addition to its contributions of 1.5 billion USD to the Green Climate Fund (GCF) for initial resource mobilization (2015–2018) and 1.5 billion USD for the First Replenishment (2020–2023), has committed to making contributions of up to 165 billion JPY for the Second Replenishment (2024–2027) of the GCF. As a major donor, Japan has seats as a board member and an alternate member on the GCF Board and has actively contributed to the operation of the GCF. Among Japanese entities, the Japan International Cooperation Agency (JICA), MUFG Bank, Ltd, (MUFG), and Sumitomo Mitsui Banking Corporation (SMBC) have been approved as accredited entities of the GCF. So far, two funding proposals from JICA (enhancing climate resilience and reduction of deforestation in Timor-Leste and a climate resilience enhancement project in the Maldives) and three from MUFG Bank (sustainable forestry funds in seven countries in Sub-Saharan Africa and Latin America; green bond issuance support projects in eight countries in Asia, Latin America, and Africa; and the establishment of a blended finance platform for 19 vulnerable countries) were approved by the GCF Board. These are supports for climate actions of developing countries through the GCF. Also, Japan regularly holds annual policy dialogues with GCF. In November 2023, Mr. HORII Iwao, state minister for Foreign Affairs, received a courtesy call from Ms. Mafalda DUARTE, the executive director of the GCF, during her visit to Japan.

On another note, in November 2022, Japan contributed to the launch of the Just Energy Transition Partnership (JETP) Indonesia as one of the co-lead countries with the United States and participated in JETP Vietnam as one of the partner countries. In JETP Indonesia, Japan supported the preparation of the Comprehensive

Investment and Policy Plan (CIPP) as the JETP investment plan announced by the Indonesian government in November 2023, and in JETP Vietnam, Japan supported the preparation of the Resource Mobilisation Plan (RMP) as the JETP investment plan announced by the Vietnamese government in December 2023. In these ways, Japan is actively contributing to the decarbonization of Asia in particular.

The main types of climate finance from Japan are as follows: (1) grant aid, (2) concessional loans, (3) technical cooperation, (4) contributions to international organizations, (5) Other Official Flows (OOF), and (6) private financing. The implementing agencies of types (1)-(3) above include the Ministry of Foreign Affairs; Ministry of Finance; Ministry of Agriculture, Forestry and Fisheries; Ministry of Economy, Trade and Industry; Ministry of the Environment; and the Japan International Cooperation Agency (JICA). Type (4) is contributions to environment-related funds and development cooperation organizations, such as the Global Environment Facility (GEF), Green Climate Fund (GCF), the World Bank, and the United Nations Development Programme (UNDP), which act as implementing agencies for this type of assistance. Regarding type (5), Japan's relevant ministries and the Japan Bank for International Cooperation (JBIC) are the main implementing agencies, and type (6) is private finance mobilized by co-financing with the JBIC and trade insurance from Nippon Export and Investment Insurance (NEXI).

The Ministry of Foreign Affairs gathers the data related to support for developing countries provided by the above-mentioned institutions from the relevant ministries and institutions and compiles the information on financial, technology development and transfer and capacity-building support in the field of climate change.

Many ministries and agencies of the Japanese government are involved in climate change action support, and it requires many processes and time to compile and verify the data. In addition, while the support provided and mobilized through public financing can be captured through the above methods, there is currently no way for government agencies to capture purely private financing, particularly investments in private funds. In order to grasp the overall picture of support for climate change measures, it is necessary to consider a method to capture the flow of private financing. However, the private sector is not necessarily incentivized to disclose the amount of money and the areas and purposes in and for which each company invested since it may fall under the category of business confidentiality.

As a part of the efforts to encourage the private sector to provide climate finance and invest in relevant projects, the Japan Bank for International Cooperation (JBIC), a public financial institution, co-finances climate change projects financed by private sector financial institutions, and the government subsidizes a portion of the initial investment costs of projects to reduce greenhouse gas emissions by utilizing the advanced decarbonization technologies of Japanese companies.

In gathering the assistance data, Japan counts projects that contribute to climate change mitigation and adaptation in developing countries using the OECD Rio markers. For bilateral, regional, and other channels since 2020, Japan further promotes its climate change assistance to developing countries. By doing so, Japan introduces the coefficient method by applying a certain coefficient to some projects, depending on the degree of climate change objective embedded in each project. As of the coefficient, in light of the OECD Rio markers, Japan counts 100% for projects whose climate change objective is principal, and 50% for projects whose climate change objective is significant. For multilateral channels, Japan counts climate-specific amounts of Japan's contributions to multilateral climate funds, MDBs, and climate-related international organizations calculated on the basis of the imputed share set by OECD DAC or based on the attribution percentage calculated by a given international organization based on its budget allocation percentage for climate actions.

In addition, based on the idea that it is extremely important for all actions to solve climate change issues to be effectively and efficiently carried out not only by one country but also through international cooperation, Japan is also actively promoting initiatives that will lead to emission reductions throughout the world. For example, based on its global warming countermeasures plan, Japan is promoting initiatives related to technology

development and transfer and capacity building support, expanding cooperation based on collaboration with partner countries, and promoting the international deployment of technologies and products with high environmental performance, as well as the further environmental improvements of market creation, human resource development, institution building, and financing promotion. Specifically, Japan is promoting the Support for Infrastructure Export Guided by Decarbonization Transition Policies in which, based on a deep understanding of the needs of partner countries, Japan proposes all options for reducing carbon dioxide emissions and supports the formulation of policies for decarbonization, including a long-term strategy to achieve the goals of the Paris Agreement. In this case, based on the Ministry of the Environment's Decarbonization Infrastructure Initiative (formulated by the Ministry of the Environment on June 15, 2021), in addition to the public-private partnership to realize the Joint Crediting Mechanism (JCM) project's assumed cumulative greenhouse gas emission reduction of about 100 million t CO_2, the government is promoting the introduction of decarbonization technologies in the energy sector through such public-private partnerships as Cleaner Energy Future Initiative for ASEAN (CEFIA) established in the ASEAN+3 Energy Ministerial process in 2019, as well as transition finance etc. Through joint development and demonstration projects with overseas companies, opportunities for new innovations are also being created through the formation of *co-innovation* that will also contribute to emission reductions in Japan and promote carbon neutrality around the world.

B. Underlying assumptions, definitions and methodologies

(paras. 121–122 of the MPGs)

The main types of climate finance from Japan are as follows: (1) grant aid, (2) concessional loans, (3) technical cooperation, (4) contributions to international organizations, (5) Other Official Flows (OOF), and (6) private financing. The implementing agencies of types (1)-(3) above include the Ministry of Foreign Affairs; Ministry of Finance; Ministry of Agriculture, Forestry and Fisheries; Ministry of Economy, Trade and Industry; Ministry of the Environment; and the Japan International Cooperation Agency (JICA). Type (4) is contributions to environment-related funds and development cooperation organizations, such as the Global Environment Facility (GEF), Green Climate Fund (GCF), the World Bank, and the United Nations Development Programme (UNDP), which act as implementing agencies for this type of assistance. Regarding type (5), Japan's relevant ministries and the Japan Bank for International Cooperation (JBIC) are the main implementing agencies, and type (6) is private finance mobilized by co-financing with the JBIC and trade insurance from Nippon Export and Investment Insurance (NEXI).

The Ministry of Foreign Affairs gathers the data related to support for developing countries provided by the above-mentioned institutions from the relevant ministries and institutions and compiles the information on financial, technology development and transfer and capacity-building support for climate change. Public financing for international cooperation activities by governments and government-related organizations whose primary purpose is development in developing countries and regions is the ODA, and the above-mentioned items (1), (2), (3), and (4) fall under this category. For concessional loans, the grant element is calculated on the basis of such factors as interest rates and reimbursement period and is considered to be concessional accordingly. Public financing is from central and local governments and government agencies (ODA and OOF), while private finance mobilized is from other financial sources that are subject to co-financing, guarantees, or insurance by government agencies.

In gathering the assistance data, Japan counts projects that contribute to climate change mitigation and adaptation in developing countries using the OECD Rio marker. For bilateral (assistance to a single beneficiary country), regional (assistance to several countries in the same region), and multi-bilateral (bilateral cooperation project implemented by international organization) channels, since 2020, Japan further promotes its climate change assistance to developing countries. For doing so, Japan introduces the coefficient method by applying predefined coefficients to projects, depending on the degree of the climate change objective embedded in each project. As of the coefficient, based on the OECD DAC Rio markers, Japan counts 100% for projects whose climate change objective is principal, and 50% for projects whose climate change objective is significant.

For multilateral channels, Japan counts the climate-specific amounts of Japan's contributions to multilateral climate funds, MDBs, and climate-related international organizations calculated on the basis of the imputed share set by OECD DAC. The contributions through multilateral channels are observed as inflows to multilateral institutions and include core (general) contributions that include but are not limited to climate change measures and a climate-specific portion that is intended to address climate change. Based on the percentages calculated by budget allocations for climate change action projects, Japan counts the climate-specific share of its contributions to multilateral climate funds, multilateral development finance institutions, and climate change-related international organizations. In all cases through multilateral channels, contributions by relevant Japanese government ministries and agencies are reported.

Note that the assistances registered by Japan in this report are targeted to non-Annex I Parties of the UNFCCC.

In this report, Japan's climate financing is newly committed or contributed during the reporting period in 2021 and 2022 (both calendar years); therefore, it is *new and additional*, and the increase from the 2019 and 2020

levels is reported in a common tabular format. The conversion between Japanese yen and United States dollars is based on the OECD exchange rate of 109.754 JPY to 1 USD for 2021 and 131.428 JPY to 1 USD for 2022. However, for contributions to international organizations that are determined in foreign currencies, the exchange rate determined prior to the start of the budget year is used in accordance with the Japanese government internal rules. In addition, for the amounts financed by government-affiliated financial institutions, the exchange rate close to the transaction date is applied for practical purposes as a financial institution.

Japan positions new and additional climate financing as newly committed or disbursed financing that contributes to addressing climate change in developing countries. For this purpose, the Japanese government gains new funding with the approval of the Diet on an annual basis and does not include financing committed or disbursed climate financing reported in previous biennial reports. Funds reported as committed are those that have been approved by the Diet or by cabinet decisions or committed through international agreements but have not yet been completely disbursed during the reporting period. Funds reported as disbursed are those that have actually been transferred to the project or the referenced international organization.

In 2021 and 2022, Japan implemented cooperation projects for about 150 countries. In implementing ODA projects, Japanese embassies and JICA offices in various developing countries formulate projects through consultations based on the requests and needs of the partner countries. Other projects are planned and implemented in collaboration with international organizations. Japan provides assistance by selecting the appropriate financial instrument from grant aid, technical cooperation, and other forms of assistance in consideration of the economic situation of the recipient country and the nature of the project. In cooperation with private sector projects through JICA's overseas investments and loans and JBIC co-financing, the relevant agencies and companies coordinate with each other to ensure that the support is effective in responding to the needs and priority policies of developing countries, and the relevant government agencies adopt projects with such effective content.

In particular, Japan also focused its assistance to island countries that are considered vulnerable to the effects of climate change, providing approximately US$852 million in assistance during the years 2021 and 2022.

Details of the aggregation methodology are as follows. Regarding the classification of sectors, each individual case is classified into one of the following sectors: energy, transportation, industry, agriculture, forestry, water and sanitation, cross-sectoral, and other (see the CTF for details). Those projects that were selected as Other in the sector section are specifically described in the subsector section. In addition, whether or not the project falls under capacity building or technology development and transfer is determined based on the form of support implementation, purpose code, SDG, and content of support.

Capacity building and technology development and transfer are essential for climate action, and Japan provides this assistance along with financial assistance. Depending on the content and implementation format of the project, financial assistance may be accompanied by capacity building or technology development and transfer, financial assistance may have aspects of capacity building as its main objective as in the case of ODA technical cooperation, or cooperation may be provided for capacity building or technology development and transfer without the objective of financial assistance. Japan determines whether Japanese assistance projects fall under these categories, referring also to the methodology that has been formulated by the OECD/DAC. See the CTF (Table III. 4 and 5) for specific cases. Regarding the avoidance of double counting, there are no budgets or projects that overlap with those of other countries. There is no mobilization of private funds involving multiple countries. Funds provided by Japan for the purpose of obtaining credits to be used for achieving the NDC are not reported as financial assistance in order to avoid double counting. Cooperation projects benefiting multiple countries are recorded as projects for multiple recipient countries, which are distinguished from pure bilateral cooperation projects, and the amount of assistance for these projects is not added to the amount of pure bilateral cooperation projects for each country. Regarding projects for technology development and transfer and capacity building that do not involve financial contributions, the Ministry of the Environment

makes inquiries of the relevant ministries and agencies to collect information on technology development and transfer and capacity-building projects implemented in the reporting years.

All climate change assistance is intended to contribute to the achievement of the Paris Agreement's long-term temperature goals, emission reduction or abatement goals, and climate change adaptation goals. In order to ensure that each assistance project is implemented in accordance with its objectives, Japan evaluates the effectiveness of the project in accordance with the project implementation procedures.

C. Information on financial support provided and mobilized under Article 9 of the Paris Agreement

(paras. 123–125 of the MPGs)

1 Overview

The summary of Japan's public support, which amounted to 22.4 billion USD during 2021 and 2022, is as follows. The total amount of public financial support in 2021 was approximately 1,133.7 billion JPY (10.3 billion USD) with approximately 150.8 billion JPY (1.37 billion USD) through multilateral channels and approximately 982.9 billion JPY (8.96 billion USD) through bilateral and regional channels. The total amount of public financial support in 2022 was approximately 1,587.9 billion JPY (12.1 billion USD) with approximately 115.5 billion JPY (900 million USD) through multilateral channels and approximately 1472.3 billion JPY (11.2 billion USD) through bilateral and regional channels.

Note that Japan's support for developing countries accords importance to establishing a mechanism that not only ensures the effective use of public financing but also facilitates the mobilization of private financing. Large-scale projects on infrastructure, such as the installation of facilities with high energy efficiency and for renewable energy, as well as the construction of electric power transmission facilities, require massive investments, and thus leveraging private financing is crucially important (more than 4.5 billion USD in private financing was mobilized during 2021 and 2022). Japan also provides support in capacity building to improve access to funds, such as the Green Climate Fund (GCF) and Global Environment Facility (GEF), by providing study and training sessions.

2 Contribution by type of support

2.1 Mitigation 17.1. billion USD

Assisting developing countries in such areas as the promotion of renewable energy, including solar energy, wind energy, and geothermal, and the introduction of facilities with high-energy efficiency to contribute to reducing GHG emissions.

（Examples）

- The Project for Improving Efficiency of the National Electric Power System（Paraguay: 85 million USD）
- Project Financing for Onshore Wind Farm Project in Egypt（3.17 trillion USD）
- Metro Manila Subway Project (Phase 1) (Ⅱ)（Philippines: 1.93 billion USD）

2.2 Adaptation 6.8 billion USD

The purpose of this financing is to strengthen the developing countries' capability to cope with natural disasters caused by climate change and to provide the necessary equipment and facilities to implement precautionary measures against and for recovery from natural disasters, including floods and droughts.

（Examples）

- The Project for Irrigated Rice Production in the Senegal River Valley（Senegal: 65.32 million USD）
- The Project for the Expansion of Phum Prek Water Supply System（Cambodia: 12.79 million USD）

- The Project for the Reconstruction of Tamavua-i-wai Bridge（Fiji: 11.15 million USD）
- The Project for the Rehabilitation of the Irrigation System in Eastern Terai Area（Nepal: 8.58 million USD）
- The Project for the Installation of Weather Surveillance Radar in Sukkur City（Pakistan: 18.10 million USD）
- The Project for the Development of Digital Topographic Map（Bhutan: 7.25 million USD）

2.3 Mitigation and Adaptation 3 billion USD

Multifaceted support was realized to assist developing countries in tackling climate change issues (both mitigation and adaptation).

3 Contribution by channels

3.1 Bilateral and regional channels

Public financial support through bilateral and regional channels in 2021 was approximately 982.9 billion JPY (9 billion USD) of which approximately 564.8 billion JPY (5.1 billion USD) was for mitigation, approximately 402.1 billion JPY (3.66 billion USD) for adaptation, and approximately 16 billion JPY (146 million USD) for cross-cutting.

Public financial support through bilateral and regional channels in 2022 was approximately 1.47 trillion JPY (11.2 billion USD) of which approximately 988 billion JPY (7.5 billion USD) was for mitigation, approximately 406.6 billion JPY (3.1 billion USD) for adaptation, and approximately 77.7 billion JPY (590 million USD) for cross-cutting.

[Grant aid in bilateral cooperation (examples)]

- Prevention of Disasters (adaptation)

  In addition to providing relief and emergency aid in a disaster, Japan has provided facilities and equipment that contributed to the prevention and mitigation of disaster and transferred the knowledge and technologies necessary for maintaining and managing the equipment and facilities. For example, in the Kingdom of Tonga, dealing with such natural disasters as cyclones and earthquakes is an immediate priority. Japan has provided equipment and facilities for a disaster prevention radio system, an acoustic warning system, and a broadcasting station for the Tongan Broadcasting Commission to facilitate rapid transmission of emergency warnings and safety information, as well as training to strengthen Tonga's disaster prevention capacity.

- Water Supply (mitigation/adaptation)

  Japan supports constructing and repairing energy-efficient water supply facilities in areas that have been experiencing droughts caused by climate change. For example, in Jordan, where the amount of water resources is even lower than the standard for absolute water scarcity, Japan is improving the energy efficiency of the water supply system that supports life in the Amman metropolitan area, the capital of Jordan, and contributing to the stabilization of the water supply.

- Support for Agriculture (adaptation)

  Japan is providing assistance to agriculture in regions where climate change is affecting food production. For example, in order to solve the problem of the tight water supply in Iran, Japan is supporting the development of desalination systems and the introduction of irrigation systems for water-efficient agriculture.

[Loan support in bilateral cooperation (examples)]

- Improvement of Energy Efficiency and Energy Access (mitigation)

  Japan contributes to sustainable development through energy efficiency and conservation to mitigate the effects of climate change by reducing the increase in energy consumption caused by economic development. For example, in Paraguay, Japan is contributing to sustainable economic development by constructing a backbone power transmission line to supply electricity to the metropolitan area of Paraguay through concessional yen loans, thereby ensuring a stable and efficient supply of electricity to the metropolitan area and promoting energy conservation by installing power efficient equipment in public facilities, thus improving the efficiency of the entire power system. The project contributes to sustainable economic development by improving the efficiency of the entire power system.

- Reducing traffic congestion and climate change mitigation through transportation conversion by improving public transportation systems（mitigation）

  By developing subways in urban areas and freight rail networks in rural areas, the project will contribute to the reduction of greenhouse gas emissions by promoting the shift from automobiles to rail transportation. In the Philippines, for example, the construction of a subway system in Metro Manila, where traffic congestion is severe, is helping to meet increasing transportation demand while encouraging a shift to public transportation, thereby contributing to air pollution mitigation and climate change mitigation.

[Technical assistance in bilateral cooperation (examples)]

- Prevention of Disaster and Rehabilitation (adaptation)

  Japan has aided with disaster risk reduction in line with the Sendai Framework for Disaster Risk Reduction 2015–2030 as adopted by UN Member States in 2015 and the Sendai Cooperation Initiative for Disaster Risk Reduction of the government of Japan, in addition to initiatives on climate change.

  Japan made policy recommendations to the Philippines, Chile, and other countries for sustainable regional economic development in light of the environment and climate change and contributed to the development and improvement of policies and plans related to climate change and disaster prevention.

  At the same time, Japan is formulating master plans and implementing feasibility studies on flood control and drainage and landslides that include climate change aspects in Indonesia and the Philippines. Moreover, Japan is providing support through projects for the prevention of disaster capacity enhancement in the Philippines, Vietnam, Bhutan, Mauritius, and other countries.

- Agriculture (adaptation)

  Japan promotes the technology transfer to popularize irrigation and water management skills that are essential for agriculture. Across Asia, Africa, and Central and South America, such as Timor-Leste, India, Nepal, Sudan, Zambia, Zimbabwe, and Paraguay, Japan has implemented technical cooperation in the field of irrigation and water management. Also, in more than 20 African countries, such as Ghana, Kenya, Senegal, and Madagascar, Japan supports the development and dissemination of technologies in order to improve the productivity of irrigated rice. Furthermore, in Indonesia and Ethiopia, Japan cooperates with farmers in agricultural insurance to enable them to continue their agricultural activities while coping with such risks as crop loss due to natural disasters associated with climate change.

- Introduction of Energy Savings and Renewable Energy (mitigation)

  Japan promotes decarbonization in developing countries by using Japan’s expertise in energy efficiency and

conservation (EE&C) and renewable energy. For example, Japan has been providing training programs related to EE&C policies and technologies for participants from the regions of Latin America, the Caribbean, and Central and South Asia and planning, constructing, and utilizing hydropower facilities, including visiting hydropower facilities for sub-Saharan countries. In Malaysia, Japan proposed a project for the development of advanced hybrid ocean thermal energy conversion (H-OTEC). Through joint research, the University of Technology of Malaysia and a Japanese research institution develop new hybrid-system OTEC technology, establish a method for multiple uses of deep-sea water, and implement human capital development in order to provide support for establishing a sustainable Malaysian model.

- Promotion of REDD+ Efforts (adaptation/mitigation)

  Japan implemented technical cooperation projects in Mozambique, the Democratic Republic of Congo, Laos, and Vietnam in order to strengthen policies and disseminate technology that can contribute to forest conservation, particularly through REDD+ (reducing emissions from deforestation and forest degradation, and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries). In addition, Japan implemented training courses for senior officials to develop the human resources responsible for policy formulation and implementation based on the international framework of REDD+. Furthermore, training courses were provided for nine countries in 2021 and eight countries in 2022 to acquire the knowledge and skills required for tropical forest conservation using the JICA-JAXA Forest Early Warning System in the Tropics (JJ-FAST).

3.2 Multilateral channels

Public financial support (climate change specific portion) through multilateral channels in 2021 is about 151 billion JPY (about 1.4 billion USD), and about 115.5 billion JPY (about 900 million USD) for 2022. In addition to international organizations and multilateral funds that specialize in climate change countermeasures, projects for climate change countermeasures are being implemented through many international organizations, including multilateral development finance institutions whose main purpose is development, and specialized organizations in such fields as meteorology, health, disaster risk reduction, and agriculture.

[Cooperation with international organizations(examples)]

- Contribution to GEF (mitigation/adaptation)

  Japan contributed to the Global Environment Facility (GEF), which is a multilateral financial mechanism to support developing countries' efforts to preserve and improve the global environment.

- Contribution to GCF (mitigation/adaptation)

  Japan contributed to the Global Climate Fund (GCF), which is a fund for supporting effort of reductions in greenhouse gases and addressing the impacts of climate change in developing countries.

- World Bank Partnership for Market Implementation Facility Multi-Donor Trust Fund (mitigation)

  Through the World Bank's Partnership for Market Implementation (PMI), Japan contributes to the decarbonization efforts of each country by supporting the development of carbon pricing policy instruments (emission trading system, carbon tax, and crediting mechanism, including Article 6 of the Paris Agreement) in emerging and developing countries while utilizing the experience of implementing the Joint Crediting Mechanism (JCM).

- Cooperation with UNDP (mitigation/adaptation)

  In collaboration with UNDP, Japan supports the implementation of greenhouse gas emission reduction efforts and adaptation measures in emerging and developing countries as well as the implementation of

Nationally Determined Contributions (NDC) by each country.

- Cooperation with UNEP (mitigation)

  Through contributions to the Trust Fund, Japan supports the activities of the Climate and Clean Air Coalition (CCAC), an international partnership launched under UNEP to reduce short-lived climate pollutants (SLCPs), such as hydrofluorocarbons (HFCs) and methane.

3.3 Mobilization of private financing

In order to further diversity on climate change, Japan has been working to establish a mechanism to leverage private investment by using public financing. Co-financing by JBIC with the private sector and trade insurance by NEXI are examples of the use of public financing that also leverages private financing. Private financing also plays an important role in tackling climate change as its total amount was 1.4 billion USD in 2021 and 3.1 billion USD in 2022.

JICA's financing of private sector projects through overseas investments and loans and JBIC cooperation with private financial institution projects through co-financing with the private sector provide public financing to enable participation in projects that would be difficult with the private sector alone. The mobilization of private financing is determined on the basis of the time when the decision to mobilize private financing is made and announced, such as when the co-financing agreement is signed. When public institutions support private financing through public financing, such as co-financing and trade insurance, and when projects, such as lending and borrowing, are realized, they are recognized as private finance mobilized by public financing.

In April 2010, JBIC started a new operation titled GREEN (Global action for Reconciling Economic growth and Environmental preservation), wherein the primary purpose was to support projects with favorable impacts on the preservation of the global environment, such as renewable energy projects and energy efficiency projects. Under the GREEN operation, JBIC implements support by using untied loans, guarantees, and equity investments while mobilizing private funds. In 2022, JBIC established the Global Investment Enhancement Facility (the Sustainability Window) to strengthen support for projects that contribute to global environmental protection, including climate change measures.

In addition, in July 2019, NEXI launched the Loan Insurance for Green Innovation with an increased commercial risk coverage rate compared with that of its usual loan insurance. This insurance can be applied for financing projects in the field of environmental protection and climate change prevention, such as projects using renewable energy, energy savings, and innovative technology. Furthermore, in December 2020, NEXI established the LEAD initiative to actively promote the underwriting of projects with Leading Features. The Leading Features include a contribution to global carbon neutrality and DX (digital transformation), alliances with international partners, a solution to social issues, and achievement of the SDGs. In July 2023, NEXI launched a new loan insurance arrangement in which NEXI provides the domestic financial institutions with loan insurance to cover the cases where domestic borrowers, who are running overseas businesses, such as decarbonization, request loans for those businesses.

D. Information on support for technology development and transfer provided under Article 10 of the Paris Agreement

(paras. 126−127 of the MPGs)

1 Overview

Based on the Plan for Global Warming Countermeasures, Japan expanded cooperation based on collaboration with partner countries and promoted international deployment of environmentally friendly technologies and products by leveraging Japan's strengths in technology, to make the greatest possible contribution to global emission reductions.

For technology transfer, Japan is contributing to deepening the discussions on innovation creation through international platforms, to implementing demonstration projects to create innovations, and to promoting the Joint Crediting Mechanism (JCM) and other measures that attract private investment and promote advanced decarbonization technologies, products, systems, services, and infrastructure.

As a cross-sectoral initiative, Japan provides technical development assistance to various developing countries in the area of agriculture, forestry, and fisheries.

In the field of adaptation, we are working with domestic and international organizations to diversify funding and provide support for adaptation projects based on the priority areas and needs of each country.

2 Technology development and transfer for mitigation

2.1 Cooperation with countries and international organizations around the world

- The 24th Tripartite Environment Ministers Meeting among Japan, Korea, and China

  The 24th Trilateral Environment Ministers Meeting among Japan, Korea, and China was held in Nagoya in November 2023. The 25th meeting was held in Jeju in September, 2024. Environment ministers of the three countries exchanged views on key environmental policies of each country, including climate change measures and contributions to the upcoming UNFCCC COP28, and they also reviewed progress in implementing the Tripartite Joint Action Plan.

- The ASEAN-Japan Cooperation Initiative

  Under the ASEAN-Japan Environmental Cooperation Initiative, Japan and ASEAN countries are strengthening cooperation for the decarbonization of ASEAN countries based on the Japan-ASEAN Climate Change Action Agenda 2.0 proposed at the ASEAN Summit in October 2021.

  We also continue to work on the Cleaner Energy Future Initiative for ASEAN (CEFIA), which is a public private initiative proposed by the government of Japan to advance the dissemination of decarbonizing technologies and the establishment of related policies and systems under the leadership of businesses with the aim of promoting energy transition and decarbonization in the ASEAN region.

  The basic policy of our activities is to contribute to the ASEAN Program for the Action Plan for Energy Cooperation (APAEC). In order to achieve the above objectives, Japan is promoting the following six

projects (Flagship Projects): optimal energy control of factory facilities and buildings using IoT (RENKEI), buildings that practically consume no energy (ZEB), energy savings of steel facilities by introducing Japan's excellent energy-saving technologies (SteelEcosol), air conditioning that realizes comfort and energy saving, biochar that stores the CO_2 generated from biomass, and micro-grids that utilize renewable energy and storage batteries on remote islands. In addition, in cooperation with the Association of Development Financing Institutions in Asia and the Pacific (ADFIAP), Japan is working to mobilize funds for decarbonization technologies by local banks in ASEAN countries. The 6th CEFIA Public and Private Forum was held on July 23, 2024, in Thailand with the participation of the ASEAN public and private sectors and shared the progress of the Flagship Projects and discussed cross-cutting initiatives, such as mobilizing funds for decarbonization technologies, visualizing greenhouse gas emission reductions, and entrepreneurship development.

- Asia Zero Emission Community (AZEC)

The Asia Zero Emission Community (AZEC) Leaders Meeting was held in December 2023. Prime Minister Kishida touched on Japan’s actions towards developing and introducing next-generation GX (Green Transformation) technologies and expressed his willingness to share Japan’s technologies and experiences through the AZEC platform. He proposed such actions as policy coordination through the Asia Zero Emission Center to be set up at the Economic Research Institute for ASEAN and East Asia (ERIA), establishment of green supply chains through cooperation projects that include development of zero emission industrial parks, collaboration among business entities by the AZEC Advocacy Group, and promotion of transition finance.

- Innovation for Cool Earth Forum (ICEF)

Since 2014, the ICEF Annual Meeting has been held by the government of Japan every year. The 10th ICEF Annual Meeting was held in a hybrid format on October 4–5 under the theme “Innovation for Just, Secure and Sustainable Global Green Transformation (GX).” The two-day meeting was attended by around 1,700 participants from 79 countries and regions, including government, industry, academia, and international organizations. Japan will continue to hold meetings with the participation of many opinion leaders from industry, academia, and governments from various countries to accelerate the promotion of innovation that contributes to solving the global warming problem.

2.2 Overseas development of decarbonizing technologies and energy infrastructure

- Joint Crediting Mechanism（JCM）

Japan has been implementing the JCM in order to quantitatively evaluate the contributions of Japan to greenhouse gas emission reductions and removals, which are achieved through the diffusion of, among others, leading decarbonizing technologies, products, systems, services, and infrastructures as well as through the implementation of measures in developing countries and others and in order to use such contributions to achieve Japan’s NDC. Since Japan and Mongolia signed a bilateral document in January 2013 for the first time to start the JCM, the number of partner countries has increased to 29. There are more than 250 GHG emission reduction projects being implemented so far. At this point, there are more than 80 registered projects with 41 projects issued JCM credits. Furthermore, more than 100 MRV methodologies (methods for calculating GHG emission reductions) have been approved as a step toward

project registration. Japan will continue to support the further formulation of JCM projects in collaboration with the relevant ministries and agencies.

- Support for overseas energy infrastructure

  In order to support the introduction of renewable energy that meets the needs of partner countries, we support the formulation of basic plans for specific development regions as a whole and promote the introduction of Japan's high-quality energy infrastructure technologies for energy conservation and renewable energy. At the same time, Japan supports feasibility studies of energy conservation and renewable energy infrastructure projects conducted by private companies and promotes the export of energy infrastructure overseas to contribute to global carbon dioxide emission reductions in line with the long-term objectives of the Paris Agreement.

- The innovation needed to decarbonize fossil fuels and for renewable energy as well as international cooperation

  Japan, through the New Energy and Industrial Technology Development Organization (NEDO), has been promoting the realization of innovation by supporting overseas demonstrations utilizing Japan's advanced energy technologies and systems. We have also contributed to the energy transition and decarbonization abroad as well as in Japan by promoting the diffusion of these demonstration technologies. For example, carbon recycling efforts, in which carbon dioxide is regarded as a resource and reused, are also important toward carbon neutrality. The Japanese government has formulated a Carbon Recycling Roadmap (June 2023) that outlines trends in technological development and the challenges for social implementation by promoting technological development and demonstration to reduce costs. In addition, the government has been deepening international collaboration by holding the International Conference on Carbon Recycling to share the significance of carbon recycling, the status of initiatives, and the future direction of carbon recycling.

- Dissemination of the results of innovations

  In order to disseminate the results of innovations obtained through such efforts mentioned above, Japan has been preparing for financial support, such as loans. Specifically, Nippon Export and Investment Insurance (NEXI) has increased the insurance coverage rate for projects related to renewable energy and those that incorporating new technologies that contribute to global environmental protection through the Loan Insurance for Green Innovation established in July 2019. Through the LEAD Initiative established in December 2020, we have strengthened financial support in important areas, such as improving industrial competitiveness in the field, such as carbon neutrality and digital fields, international collaboration with value co-creation partners, and contributions to solving social issues and achieving the SDGs. In addition, in July 2023, NEXI launched a new loan insurance arrangement in which NEXI provides the domestic financial institutions with loan insurance to cover the cases where domestic borrowers, who are running overseas businesses, such as decarbonization, request loans for those businesses. Through these efforts, we continue to strive to spread innovations by actively structuring projects that contribute to global environmental protection.

2.3 Fostering urban actions for decarbonization technology

- Promotion of city-to-city collaboration

Utilizing the experience and know-how of Japanese cities, in FY 2023, 25 cities in eight developing countries and 13 cities in Japan implemented the City-to-City Cooperation Project, which is a package of cooperative projects for finding and conducting surveys on projects related to the formation of a decarbonized society in developing countries, supporting institutional establishment, and assisting in human resource development. Five JCM model projects in FY 2022 and one in FY 2023 were created from these projects. Toward FY 2030, we will expand and deepen cooperative relationships with overseas cities and spread the decarbonization dominoes that we are creating in Japan based on the regional decarbonization roadmap to other countries.

- Zero Carbon City International Forum

In FY 2020, the first Zero Carbon City International Forum was held in cooperation with the UNFCCC. The forum confirmed the importance of urban decarbonization policies directly linked to communities and support for them by central governments and international organizations and confirmed that the advanced efforts of cities will be spread around the world to accelerate the *decarbonization domino effect* in the future. From FY 2021, the event has been co-hosted by Japan and the United States based on the Global Subnational Zero Carbon Promotion Initiative. In FY 2022, Zero Carbon City International Forum 2023 was held on March 1, 2023, to share advanced urban efforts. The importance of dialogues between G7 and U7 was recognized, and it was confirmed that the G7 and U7 discussions on the promotion of national and subnational cooperation will be connected to the G20 and U20 to enhance the momentum of global efforts toward COP28. We will lead a forum for sharing and discussing the efforts of domestic and foreign cities in cooperation with the relevant countries and organizations, such as the United States and ICLEI.

2.4 Development of activities related to fluorocarbons

- Initiative on Fluorocarbons Life Cycle Management

Japan launched the Initiative on Fluorocarbons Life Cycle Management (IFL) at the 25th Conference of the Parties (COP25) to the United Nations Framework Convention on Climate Change (UNFCCC) in Madrid, Spain, in December 2019, and the initiative is endorsed by 15 countries/international organizations and 16 domestic companies/organizations (as of January 2024).

In FY 2023, we held an official COP28 side event on CFC management together with the International Partnership for Climate and Air Quality (CCAC) and held meetings with domestic stakeholders. In FY 2024 and beyond, we will continue to hold side events to raise international awareness of the importance of CFC lifecycle management.

- F-gas recovery and destruction model projects

In the subsidized projects for the recovery and destruction of CFC substitutes using the Joint Crediting Mechanism (JCM), projects were implemented in Thailand and Vietnam from FY 2018 to FY 2020, and new projects were started in the Philippines and Vietnam from FY 2021, and we are working to identify new projects in addition to the continuation of existing projects in FY 2024 and beyond. In FY 2020, we started a project for supporting institutional development in developing countries. Specifically, we have conducted surveys on the status of legal developments in developing countries, especially in Southeast Asia, capacity building for government official users related to CFC treatment, and prepared a handbook for local engineers to improve CFC recovery technology. We will continue this project in the future and

contribute to the development of systems for the proper treatment of CFCs in developing countries.

- Measures to reduce short-lived climate pollutants (SLCPs)

  Japan launched the Initiative on Fluorocarbons Life Cycle Management (IFL) at the 25th Conference of the Parties (COP25) in Madrid, Spain, in December 2019. Since then, we have supported the establishment of CFC management systems and capacity building in developing countries and have held side events at the Meeting of the Parties (MOP) to the Montreal Protocol and the Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) to promote and raise awareness of CFC lifecycle management. In the CCAC 2030 Strategy, a new strategy for FY 2021 and beyond, Japan actively participated in the development of the strategy to strengthen the linkage between the Fluorocarbons Initiative (IFL) and CCAC activities. Japan will continue to contribute to the CCAC and help realize the co-benefits of climate change countermeasures and the prevention of air pollution by supporting CCAC activities, especially in the reduction of international SLCPs in the fields of refrigeration and waste management.

2.5 International development of climate actions in agriculture, forestry, and fisheries

In order to promote countermeasures for deforestation and forest degradation and afforestation activities, Japan developed measures for fostering private sectors participation in forestation activities in developing countries as well as technologies for disaster prevention and mitigation by forests, and then studied the implementation rules for REDD+ (reduction of emissions from deforestation and degradation in developing countries) and afforestation/reforestation under the Joint Crediting Mechanism (JCM) and developed technologies for afforestation. In addition, Japan, in collaboration with the Asian Development Bank, finalized and published a draft JCM methodology for Alternate Wetting and Drying (AWD) in the Philippines to support projects that combine JCM with AWD to reduce methane emissions from rice paddy fields. In order to promote REDD+ and afforestation activities by private Japanese companies in cooperation with the public and private sectors, we will continue to conduct surveys, research, technology development, and dissemination of information to private companies and improve the environment for the use of JCM in the agricultural sector based on the ASEAN-Japan MIDORI Cooperation Plan.

- Support for developing a toolkit

  Through a financial contribution to the Food and Agriculture Organization (FAO), the Foundation supported the international dissemination of Japanese knowledge and technology on disaster prevention and mitigation using Japan's forests, and the development of a toolkit for policymakers and others in African countries to learn effective methods to reduce deforestation in Africa, using the same forest area as a demonstration site when formulating their own policies.

- Seminars on technologies that promote carbon sequestration and GHG emission reductions from agricultural land and soils

  To increase capacity and awareness in developing countries, Japan collaborated with international organizations to conduct online seminars on technologies that promote carbon sequestration and GHG emission reductions from agricultural land and soils.

- Support for the development of sustainable agronomic technologies

  Through contributions to the International Agricultural Research Organization (International Center for Tropical Agriculture (CIAT) and International Maize and Wheat Improvement Center (CIMMYT), Japan supported the development of sustainable agronomic technologies that adapt to changes in the agricultural production environment.

- Promotion of sustainable wood use

  Through contributions to the International Tropical Timber Organization (ITTO), Japan supported sustainable wood use promotion projects launched in Thailand and Indonesia in 2023 and in Malaysia in 2024. In these projects, policy reviews on wood use, establishment of wood use promotion systems, market surveys, and consumer education are being conducted in each country.

2.6 Measures to reducing emissions from deforestation and forest degradation

- Ensuring emission reduction and sequestration in the forest sector

  Japan actively promotes the reduction of emissions from deforestation and forest degradation in developing countries, including forest conservation, sustainable forest management, and enhancement of forest carbon stocks (REDD+), through initiatives, such as the JCM-REDD+, and contributes to ensuring emission reduction and sequestration in the forest sector.

- Reduction of deforestation and support for sustainable forest management

  Japan supports sustainable forest management in developing countries and contributes to reducing deforestation through data services, such as the JICA-JAXA Forest Early Warning System in the Tropics (JJ-FAST). In addition, Japan promotes international cooperation on the distribution and utilization of legally harvested wood products according to the Act on Promoting the Distribution and Use of Legally Harvested Wood and Wood Products as well as support efforts to promote sustainable forest management.

3 Technology development and transfer for adaptation

The Asia-Pacific Climate Change Adaptation Information Platform (AP-PLAT) was established to support decision-making based on climate change risks and the promotion of effective climate change adaptation measures in the Asia-Pacific region. The AP-PLAT is being used to enhance scientific knowledge on climate change risks, provide tools to support stakeholders, and strengthen capacity building for climate change impact assessment and climate change adaptation in collaboration with countries and relevant organizations in the region while taking vulnerable groups and regions into consideration.

In addition, by utilizing various international cooperation schemes and technologies, such as meteorological satellites, the JICA and other organizations promote technical cooperation in developing countries in the areas of observation, monitoring, prediction, and assessment of climate change and its impacts and adaptation to climate change in the fields of disaster prevention, agriculture, and water resources.

Through collaboration with Japanese cooperation organizations or governmental financial institutions, including the JICA, JBIC, and NEXI, Japan will support adaptation projects based on the priorities and needs of each country while diversifying the financial resources, including mobilization of private financing. In order to

enhance resilience to climate change, Japan will support infrastructure development, including the fields of irrigation, waterworks, and disaster risk reduction. Japan will also support the development and dissemination of drought-resistant and short-duration rice varieties for a sustainable and stable food supply and provide support for agricultural insurance for smallholder farmers vulnerable to climate change. Japan's support extends to ecosystem-based adaptation for coastal protection by using the ecosystems of coral reefs and mangroves. Being mindful of the situation among Small Island Developing States (SIDS), which are particularly vulnerable to climate change, Japan will provide comprehensive support focused on disaster risk reduction by integrating the provision of necessary equipment, such as meteorological observation and disaster early warning equipment, and technical cooperation.

E. Information on capacity-building support provided under Article 11 of the Paris Agreement

(paras. 128–129 of the MPGs)

1 Overview

Based on the Global Warming Countermeasures Plan, Japan is expanding cooperation based on collaboration with partner countries and further improving the environment by creating markets, fostering human resources, and building institutions.

In December 2023, the Japan Assistance Package to Promote Investments for Global Actions Toward the Achievement of the Paris Agreement Goals was released. The said support package aims to close three gaps by establishing a foundation to promote investments in decarbonization and adaptation: the *target gap* where the 1.5°C goal is not reached even if reduction targets are accumulated, the *adaptation gap* where adaptation measures are not keeping pace with increasing climate risks, and the *implementation gap* where investments necessary to implement the plan are not available. The goal is to close these three gaps and bring the emission pathway on track.

In the field of mitigation, Japan supports the formulation of long-term strategy and revision of NDC updates by assessing policy options and quantifying various future scenarios using the Asia-Pacific Integrated Model (AIM). In the field of adaptation, Japan supports climate change impact assessment and capacity building on climate change adaptation, including the development of early warning systems by the private sector. Additionally, various seminars are provided to enhance adaptation capacity by sharing information and knowledge. As capacity-building support for transparency, Japan contributes capacity building and institutional development of a measurement and reporting system, especially in Asia, by hosting the Workshop on Greenhouse Gas Inventories in Asia and the Partnership to Strengthen Transparency for Co-Innovation (PaSTI).

2 Capacity-building support for mitigation

- Support for the formulation of long-term strategy and the revision of NDCs update through the Asia-Pacific Integrated Model (AIM)

  The Asia-Pacific Integrated Model (AIM), which is a large-scale computer simulation model developed by the National Institute for Environmental Studies in collaboration with Kyoto University and others, has been used to assess policy options and the quantification of various future scenarios for the revision of the NDCs and the development of a long-term strategy. The support through AIM has been provided to Vietnam, Thailand, Indonesia, Malaysia, and other countries.

  The government of Japan continues to provide support for the setting of scenarios analytics and the formulation of long-term strategies using AIM to more countries, aiming to achieve the Paris Agreement Goals, including the 1.5 degrees target.

- Support for emissions estimation technology

  The government launched the successor to GOSAT, GOSAT-2, in October 2018 to contribute to tackling climate change. It will support countries in making use of satellite data to verify their national GHG inventories and to decide on GHG reduction policies by refining the accuracy of estimations of GHGs at the national, mega-city, and/or major emission source levels. As an achievement to date, with support by

Japan, Mongolia has confirmed that CO_2 emissions estimated using observation data from GOSAT are highly accurate and consistent with the statistic-based estimation. Mongolia reported this achievement in *Mongolia's Second Biennial Update Report* (November 2023) submitted to the UN for the first time in the world. In parallel, this technology is being deployed in Central Asian countries. Uzbekistan, Kazakhstan, Tajikistan, and Kyrgyzstan concluded MOUs, and expert meetings have already been held. In addition, India presented the results of a comparison of methane emission estimates using GOSAT data with its own calculations in India's third National Communication (December 2023). Japan will steadily develop the GOSAT-GW, the successor to GOSAT-2. We will promote the satellite-based GHG emission estimation technology that Japan has pioneered and aim for international standardization of the technology.

- Workshops in collaboration with IRENA

  The Ministry of the Environment, Japan, and IRENA co-organize workshops and forums periodically for renewable energy deployment and capacity building at Small Island Developing States (SIDS).

- Promotion of mitigation actions taken by nonstate actors

  In order to enhance the actions and innovation by cities and private sectors, Japan has implemented cooperation projects and nurtured mutual learning among cities in developing countries and Japan as well as promoted private companies' investments in decarbonization technologies in developing countries.

  Japan has provided technical support to prepare GHG emission inventories at the city level, developed master plans, and supported institutions towards zero-carbon cities in developing countries by utilizing the experience and know-how of Japanese local governments and coordination among cities both in developing countries and Japan. To assist Japanese companies working on climate change programs, Japan has supported the development and implementation of corporate targets consistent with the Paris 2-degree target (Science-Based Target, SBT) as well as activities to contribute to global emission reductions based on the industry's action plans for a low-carbon society and to promote emission reductions in the global value chain of Japanese companies in addition to domestic emission reductions. Moreover, Japan has collaborated with the alliances of the private sector, including the Japan Climate Leaders Partnership (Japan-CLP), which reckons climate change measures as business opportunities and backup programs led by the private sector. Japan has also promoted REDD+ through public-private partnerships.

- Establishment and implementation of appropriate international rules to utilize market mechanisms

  In order to establish a carbon market mechanism, including the JCM consistent with the Paris Agreement, Article 6, the so-called high integrity carbon market, Japan initiated the launch of the Paris Agreement Article 6 Implementation Partnership (A6IP) at COP27 (partners were 75 countries and 135 organization as of March 31, 2023). A6IP promotes an understanding of Article 6 rules and conducts training for capacity building at the country level. As capacity building at the country level, A6IP provides hands-on training tailored to each country for authorization, reporting, and tracking consistent with the Paris Agreement, Article 6, in order to build institutional arrangements for authorization, reporting, and tracking.

3 Capacity-building support for adaptation

- Science-based development of adaptation plans and strategies

Risk evaluations based on scientific knowledge and their reflection upon the adaptation plans are essential for implementing adequate adaptation plans. Implementing adaptation measures also requires innovation of policy processes in both developed and developing countries. By providing the latest technology and expertise obtained by its industry-government-academia partnership, Japan supports the consolidation and dissemination of information on climate risk, the establishment of risk evaluation methods, and the development of national adaptation plans in developing countries. More specifically, Japan will support impact assessments of climate change and the development of national adaptation plans through bilateral collaboration. Based on the long-term risk evaluation on storm tides and waves caused by cyclones in small island developing states, which were implemented in the Republic of Fiji, Samoa, and other islands, Japan will propose the Nature-based Solution (NbS) focusing on the disaster prevention function of reef-building coral. Japan has supported the development of the system of Analysis and Mapping of Impacts under Climate Change for Adaptation and Food security (AMICAF). In addition, Japan will promote human resource development in the field of climate change by supporting the construction and institutional development of the Pacific Climate Change Center in cooperation with the Secretariat of the Pacific Regional Environment Programme (SPREP), as well as the strengthening of the Climate Change International Technical and Training Center (CITC) in Thailand. To accelerate the development of early warning systems by the private sector, the government of Japan established the Public Private Partnership for the Development of Early Warning Systems as a framework for public-private partnerships in 2023 and aims to establish the system in more than half of ASEAN countries by 2025 with prototypes of early warning systems being built first in the Asian region. In addition, the Asia-Pacific Climate Change Adaptation Information Platform (AP-PLAT) has been used to support climate change impact assessments and capacity building on climate change adaptation and other relevant themes to narrow the adaptation gap. Furthermore, the government of Japan contributes to enhancing the resilience of cities in the Asia-Pacific region through the SUBARU Initiative, in which local governments and other entities in Asia-Pacific countries with climate change adaptation needs are matched with Japanese companies that possess adaptation technologies.

- Cooperation on adaptation

The Global Adaptation Network (GAN) and the Asia-Pacific Adaptation Network (APAN) continued during fiscal year 2022 to provide various seminars and workshops and to share information on websites that provide knowledge and offer lessons for adaptation in developing countries. Japan largely contributes to the capacity building of researchers and policymakers, mainly in developing countries among the Asia-Pacific region by financially supporting GAN and APAN and by supporting the international joint research program and development program in the field of various cross-sectoral issues, such as climate change and biodiversity, through the Asia-Pacific Network for Global Change Research (APN). Japan uses the Asia-Pacific Climate Change Adaptation Information Platform (AP-PLAT), which was launched to support decision-making, to take the risks of climate change into consideration for highly effective climate change adaptation in the Asia-Pacific region in order to improve scientific knowledge related to the risks of climate change, to provide stakeholder support tools, and to strengthen capacity related to the assessment of climate change impacts and climate change adaptation in collaboration with countries and the relevant institutions in the region.

4 Capacity-building support for transparency

- Workshop on Greenhouse Gas Inventories in Asia (WGIA)

  As capacity-building support for the enhancement of transparency on greenhouse gas emissions, Japan convened the 21st Workshop on Greenhouse Gas (GHG) Inventories in Asia (WGIA21) in Malaysia, with 132 participants (including online participants), including government and research representatives from 16 member countries, including Japan. In this workshop, mutual learning sessions on GHG inventories were held. Also, various issues related to the latest inventories submitted by participating countries in their National Communications (NCs) and Biennial Update Reports (BURs), and new reporting formats under the Enhanced Transparency Framework (ETF) of the Paris Agreement were discussed. The workshop contributes to enhancing transparency-related capacity building in participating countries and further strengthens the network among countries through the WGIA.

- The Partnership to Strengthen Transparency for Co-Innovation (PaSTI)

  In order to promote the disclosure of greenhouse gas emissions from the private sectors in developing countries, the Partnership to Strengthen Transparency for Co-Innovation (PaSTI) launched in 2017 provided institutional establishment, human resource development, and capacity building for enhanced transparency. Japan continues to support institutional development to establish a greenhouse gas emissions measurement and reporting system for the private sector in Vietnam, the Philippines, and Thailand as part of bilateral cooperation.

- Support for the preparation of reports under the enhanced transparency

  Japan has provided, for government agencies and research institutions, various global conferences, workshops to further promote understating for Article 6, and mutual learning programs incorporating exercises on reporting mitigation measures.

  In order to contribute to the decarbonization of industries in the Asia Zero Emission Community (AZEC) partner countries, the AZEC International Conference to Promote the JCM and Develop Carbon Markets was held in 2023 and 2024. The conference brought together government officials from energy and environment-related ministries in AZEC partner countries. Participants held proactive discussions on the progress of the JCM, the status of carbon market development in each country, energy policies, etc.

  To support the preparation of reports referred to in Article 6 of the Paris Agreement, the Japanese government provides technical support to government officials of JCM partner countries on the preparation of draft initial reports and regular information on compliance with Article 6, up to submission to the Secretariat of the UNFCCC.

  The Mutual Learning (MLP) workshops are intended to allow multiple countries to learn from each other based on draft reports and to reflect the learning into practice. The MLP also aims to facilitate understanding of how to use this information to track the implementation and achievement of the NDCs; some of the CTF Tables 5 were produced through the MLP and would be used as the basis for biennial transparency reports (BTRs) under the Paris Agreement's Enhanced Transparency Framework (ETF). More than 10 countries attended the MLP and continue its activity, collaborating with the Capacity-building Initiative for Transparency – Global Support Programme (CBIT-GSP) from 2023.

- Support for International Standardization

  In order to promote disclosure of greenhouse gas emissions from the private sectors in ASEAN, the ASEAN Guidelines on Facility-level GHG Measurement and Reporting was developed in 2023 in addition to capacity-building support in the ASEAN region.

Annex

Japan's First Biennial Transparency Report

under the Paris Agreement

A. Annex I Common reporting tables for the electronic reporting of the national inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases

Please refer to the following URL for the common reporting tables of Japan's 1st BTR.

https://www.env.go.jp/earth/ondanka/ghg-mrv/unfccc/2024unfccc_00001.html

B. Annex II Common tabular formats for the electronic reporting of the information necessary to track progress in implementing and achieving the NDC and information on financial, technology development and transfer and capacity-building support provided and mobilized

Please refer to the following URL for the common tabular format of Japan's 1st BTR.

https://www.env.go.jp/earth/ondanka/ghg-mrv/unfccc/btr1_00001.html

C. Annex III Information in relation to the Party's participation in cooperative approaches

Initial report referred to in decision 2/CMA.3, annex, chapter IV.A (Initial report)

Party	Japan
NDC period	2021–2030
Report number for the NDC period[a]	1
Report type	Initial report ☒ Updated initial report ☐
Updated initial report number	1
Version[b]	1.0
Date	31/10/2024
Name(s) of cooperative approach(es) included in this report	Joint Crediting Mechanism between the government of Japan and the government of the Kingdom of Thailand

[a] Note: The number "1" means the initial report.
[b] Note: Decimal increase for minor revisions (typos, corrections) and digit increase for content changes.

I. Participation responsibilities (para. 18(a))

A. Information on how the Party ensures that it is a Party to the Paris Agreement (para. 18(a), para. 4(a), to be updated by para. 21(a))

Japan deposited the instrument of acceptance of the Paris Agreement with the Secretary-General of the United Nations at the UN Headquarters in New York on 8 November 2016.

Reference:

- United Nations Treaty Repository (Paris Agreement) https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-7-d&chapter=27&clang=_en

B. Information on how the Party ensures that it has prepared, communicated, and is maintaining an NDC in accordance with Article 4, paragraph 2 (para. 18(a), para. 4(b), to be updated by para. 21(a))

The government of Japan communicated the updated NDC on 22 October 2021. The government of Japan continues to implement the updated NDC.

Reference:

- NDC Registry – Japan's First NDC (Updated submission) (Submitted on Oct 22, 2021) https://unfccc.int/sites/default/files/NDC/2022-06/JAPAN_FIRST%20NDC%20%28UPDATED%20SUBMISSION%29.pdf

C. Information on how the Party ensures it has arrangements in place for authorizing the use of ITMOs towards achievement of NDCs pursuant to Article 6, paragraph 3 (para. 18(a), para. 4(c), to be updated by para. 21(a))

The government of Japan establishes and implements the Joint Crediting Mechanism (JCM) in order to quantitatively evaluate contributions of the government of Japan to greenhouse gas emission reductions and removals which are achieved through the diffusion of decarbonizing technologies, products, systems, services, and infrastructures as well as through the implementation of measures in developing countries and others, and in order to use such contributions to achieve Japan's NDC.

In order to implement the JCM in the government of Japan consistent with the Paris Agreement and other relevant decisions, five ministries, the Ministry of the Environment, the Ministry of Economy, Trade and Industry, the Ministry of Foreign Affairs, the Ministry of Agriculture, Forestry and Fisheries, and the Ministry of Land, Infrastructure, Transport and Tourism, which are the JCM implementing authorities, established the **JCM Promotion and Utilization Council** in January 2022[1] based on the *Plan for Global Warming Countermeasures* (approved by the Cabinet on October 22, 2021).

In summary, the Council's duties include the following:

- Authorization of JCM credits as a Party to the Paris Agreement
- Determination of a method to apply corresponding adjustments to prevent double counting.

Reference:

- Establishment of the JCM Promotion and Utilization Council (January 11, 2022) https://www.env.go.jp/content/000060591.pdf

D. Information on how the Party ensures it has arrangements in place that are consistent with the Article 6, paragraph 2, guidance and relevant decisions of the CMA for tracking ITMOs (para. 18(a), para. 4(d), to be updated by para. 21(a))

The government of Japan uses the **JCM Registry for Japan** for tracking JCM credits as ITMOs, which is provided for in the Act on Promotion of Global Warming Countermeasures (Act No. 56 of 2024).

The registry has been developed in line with the Common Specifications of the JCM Registry and will be implemented consistent with relevant decisions of the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement (CMA) in relation to cooperative approaches referred to in Article 6, paragraph 2, of the Paris Agreement.

In the Japanese JCM registry, unique identifiers are assigned to JCM credits to record authorization, first transfer, transfer, acquisition, use towards the NDCs, authorization for use towards other international mitigation purposes, and voluntary cancellation.

The Ministry of the Environment and the Ministry of Economy, Trade and Industry are the JCM registry management authorities, and the contact information of both ministries is available on the following registry page:
https://www.jcmregistry.go.jp/contents/JP/Contact/Contact.html

Reference:

- The JCM registry system for Japan
  https://www.jcmregistry.go.jp/

E. Information on whether the most recent national inventory report required in accordance with decision 18/CMA.1 has been provided (para. 18(a), para. 4I, to be updated by para. 21(a))

The government of Japan submitted its most recent national inventory report in line with decision 18/CMA.1 on April 12, 2024. It covers the inventory reporting years between 1990 and 2022.

Reference:

- Japan. National Inventory Document (NID)
  https://unfccc.int/documents/637879

F. Information on how the Party ensures participation contributes to the implementation of its NDC and long-term low-emission development strategy, if it has submitted one, and the long-term goals of the Paris Agreement (para. 18(a), para. 4(f), to be updated by para. 21(a))

The government of Japan aims to reduce its greenhouse gas emissions by 46 percent in fiscal year 2030 from its fiscal year 2013 levels, setting an ambitious target that is aligned with the long-term goal of achieving net zero by 2050. Furthermore, the government of Japan will continue strenuous efforts in its challenge to meet the lofty goal of cutting its emissions by 50 percent.

Furthermore, in its Long-Term Strategy under the Paris Agreement submitted in October 2021, Japan describes the JCM as a part of international cooperation with the goal of driving global greenhouse gas (GHG) emission reductions and removals, thereby contributing to the realization of carbon neutrality in the world.

Reference:

- Long-Term Strategy under the Paris Agreement (Cabinet decision, October 22, 2021)
  https://unfccc.int/sites/default/files/resource/Japan_LTS2021.pdf

II. Description of the Party's NDC, as referred to in decision 18/CMA.1, annex, paragraph 64, where a participating Party has not yet submitted a biennial transparency report (para. 18(b), to be updated by para. 21(b))

All the information in Section II is provided on the basis of the Japan First NDC (Updated submission) (Submitted on 22 October, 2021)

A. Target(s) and description, including target type(s) (decision 18/CMA.1, annex, para. 64(a))

Target(s) and description: Economy-wide absolute greenhouse gas emission reduction target (A reduction of 46% in economy-wide national total greenhouse gas emissions by FY 2030 compared to FY 2013 level)

Target type: Single-year target

B. Target year(s) or period(s), and whether they are single-year or multi-year target(s) (decision 18/CMA.1, annex, para. 64(b))

Target year: Fiscal year 2030 (from April 1, 2030, to March 31, 2031), single-year target

C. Reference point(s), level(s), baseline(s), base year(s) or starting point(s), and their respective value(s) (decision 18/CMA.1, annex, para. 64(c))

Base year: Fiscal year 2013 (from April 1, 2013, to March 31, 2014)

National total GHG emissions in the base year: 1,407 Mt CO2e（base on greenhouse gas inventory submitted to the UNFCCC in April 2024）

D. Time frame(s) and/or periods for implementation (decision 18/CMA.1, annex, para. 64(d))

From April 1, 2021, to March 31, 2031

E. Scope and coverage, including, as relevant, sectors, categories, activities, sources and sinks, pools and gases (decision 18/CMA.1, annex, para. 64(e))

Sectors of coverage:

All sectors and categories encompass the following:

(a) Energy

- Fuel Combustion (Energy industries, Manufacturing industries and Construction, Transport, Commercial/Institutional, Residential, Agriculture/Forestry/Fishing, and Other)
- Fugitive emissions from fuels
- CO_2 transport and storage

(b) Industrial processes and product use

(c) Agriculture

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

Activities related to contributions from the LULUCF sector:

afforestation and reforestation (AR), deforestation (D), forest management (FM), cropland management (CM) and grazing management (GM), and urban greening (UG)

Carbon Pools for the LULUCF sector:

Above ground biomass, below ground biomass, dead wood, litter, soils, and harvested wood products (HWP)

(e) Waste

Targeted gases:

Carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6) and nitrogen trifluoride (NF_3).

Percentage of coverage:

100 percent

F. Intention to use cooperative approaches that involve the use of internationally transferred mitigation outcomes under Article 6 towards NDCs under Article 4 of the Paris Agreement (decision 18/CMA.1, annex, para. 64(f))

The government of Japan establishes and implements the JCM in order to quantitatively evaluate the contributions of the Japanese government to greenhouse gas emission reductions and removals, which are achieved through the diffusion of decarbonizing technologies, products, systems, services, and infrastructures, as well as through the implementation of measures in developing countries and others, and in order to use such contributions to achieve Japan's NDC.

By doing so, through public-private collaborations, the government of Japan aims to contribute to accumulated emission reductions and removals at the level of approximately 100 million tonnes of CO_2 by fiscal year 2030.The government of Japan will appropriately count the acquired credits to achieve its NDC.

With regard to the JCM, the government of Japan secures environmental integrity and the avoidance of double-counting consistent with the guidance on cooperative approaches as referred to in Article 6, paragraph 2, of the Paris Agreement (hereinafter referred to as "the Article 6.2 guidance").

G. Any updates or clarifications of previously reported information (e.g., recalculation of previously reported inventory data or greater detail on methodologies or use of cooperative approaches) (decision 18/CMA.1, annex, para. 64(g))

Not applicable

III. Information on ITMO metrics, method for applying corresponding adjustments, and method for quantification of the NDC (para. 18(c–f))

A. ITMO metrics Ira. 18(c))

Methods of estimations are in line with the Guidelines for National Greenhouse Gas Inventories prepared by the IPCC and adopted by the COP.

The metrics used for the total GHG emissions and removals (CO_2 equivalent) are the Global Warming Potentials of a 100-year time horizon that were presented in the *IPCC Fifth Assessment Report*.

Reference: Japan First NDC (Updated submission) (2021), 2024 NID

B. Method for applying corresponding adjustments as per chapter III.B (Application of corresponding adjustment (para. 18(c))

1. Description of the method for applying corresponding adjustment for multi- or single year NDCs that will be applied consistently throughout the period of NDC implementation, if applicable (para. 18(c))

The government of Japan has a **single-year NDC target** to reduce its GHG emissions by 46 percent by FY2030 from its FY2013 level. The government of Japan will apply CA to its target using the **averaging method** in line with para. 7(a)(ii), annex to decision 2/CMA.3. The detailed method is described in the Procedures for Corresponding Adjustments regarding the Joint Crediting Mechanism.

(1) For each year from 2021 to 2029, the government of Japan applies indicative corresponding adjustments by subtracting the average annual amount of JCM credits as of the said year from the amount of Japan's total greenhouse gas emissions for the said year submitted to the Secretariat of the United Nations Framework Convention on Climate Change. The average amount of JCM credits as of the said year is calculated by dividing the cumulative amount of JCM credits, which have been confirmed that the government of the partner country, as a Party to the Paris Agreement, authorizes and applies corresponding adjustments by adding to the greenhouse gas emissions covered by its NDC and which have been transferred to the retirement account in the JCM registry of Japan from January 1, 2021 to December 31st of the said year by the number of years elapsed from 2021 to the said year.

(2) For 2030, the government of Japan applies corresponding adjustments by subtracting the average annual amount of JCM credits from the total amount of Japan's greenhouse gas emissions covered by the NDC. The average annual amount of JCM credits is calculated by dividing the cumulative amount of JCM credits issued for emission reductions and removals realized from January 1, 2021 to December 31, 2030, which have been confirmed that the government of the partner country, as a Party to the Paris Agreement, authorizes and applies corresponding adjustments and which have been transferred to the retirement account in the JCM registry of Japan by 10, which is the number of years of the NDC implementation period.

Reference:

- Procedures for Corresponding Adjustments regarding the Joint Crediting Mechanism (April 7, 2022)
  https://www.env.go.jp/content/000060562.pdf

2. Description of the method for applying corresponding adjustments where the method is a multiyear emissions trajectory, trajectories, or budget if applicable (para. 18(c)).

Not applicable

C. Quantification of the Party's mitigation information in its NDC in t CO_2 eq, including the sectors, sources, GHGs, and time periods covered by the NDC, the reference level of emissions and removals for the relevant year or period, and the target level for its NDC or, where this is not possible, the methodology for the quantification of the NDC in t CO_2 eq (para. 18(d))

Sectors and sources covered by the NDC	Energy, IPPU, Agriculture, LULUCF, and Waste
GHGs covered by the NDC	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6, and NF_3
Time period covered by the NDC	From April 1, 2021, to March 31, 2031
Reference level of emissions and removals for the relevant year or period	GHG emissions in FY 2013: 1,407 Mt CO_2 eq (based on NID submitted in 2024)
Target level for the NDC	760 Mt CO_2 eq in FY 2030 (46 percent of the reference level)

Reference: Japan First NDC (Updated submission) (2021)

D. Quantification of the Party's NDC, or the portion in the relevant non-GHG indicator, in a non-GHG metric determined by each participating Party, if applicable (para. 18(e))

Not applicable

E. For a first or first updated NDC consisting of policies and measures that is not quantified, information on quantification of the Party's emission level resulting from the policies and measures that are relevant to the implementation of the cooperative approach and its mitigation activities for the categories of anthropogenic emissions by sources and removals by sinks, as identified by the first transferring Party pursuant to paragraph 10, and the time periods covered by the NDC (para. 18(f))

Not applicable

IV. Information on each cooperative approach (para. 18(g–i), para. 19)

A. Copy of the authorization by the participating Party (para. 18(g))

The JCM Promotion and Utilization Council in the government of Japan authorizes JCM credits issued in the JCM registry for the government of Japan and promptly publishes the information on the authorization on the JCM website (https://www.jcm.go.jp), including the name of the relevant partner country, the name of the JCM project, the name of the legal entity acquiring JCM credits, the JCM credit identification number, and the status of authorization by the relevant partner country etc.

Procedures for Authorization as a Party to the Paris Agreement regarding the Joint Crediting Mechanism (April 7, 2022) can be found at https://www.env.go.jp/content/000060562.pdf

B. Description of the cooperative approach (para. 18(g))

The Joint Crediting Mechanism (JCM) is a bilateral crediting mechanism established in order to quantitatively evaluate the contributions of Japan to greenhouse gas emission reductions and removals, which are achieved through the diffusion of, among others, leading decarbonizing technologies, products, systems, services, and infrastructures, as well as through the implementation of measures in developing countries and others, and in order to use such contributions to achieve Japan's NDC consistent with the Article 6.2 guidance and relevant decisions of the CMA.

The JCM between the government of Japan and a partner country is implemented consistently with the Article 6.2 guidance, contributing to the achievement of both countries' NDCs while ensuring the avoidance of double counting through corresponding adjustments.

Both governments establish a Joint Committee (JC) consisting of representatives from both countries to make the necessary decisions.

The JCM between the government of Japan and the government of the Kingdom of Thailand is implemented in two tracks:

(1) Rules of Implementation for the JCM track under the Premium Thailand Voluntary Emission Reduction (Premium T-VER)
https://www.jcm.go.jp/opt/th-jp/rules_and_guidelines/download/ext/file_32/Attachment_1_JCM_TH_RoI.pdf

(2) Rules of Implementation for the JCM for Existing Projects
https://www.jcm.go.jp/opt/th-jp/rules_and_guidelines/download/ext/file_33/Attachment_2_JCM_TH_RoI.pdf

All the relevant rules, guidelines, and decisions made by the Joint Committee, including approval of methodologies, registration of projects, notification to issue JCM credits, and issuance of credits by each government are made publicly available on the JCM website https://www.jcm.go.jp/. In addition, all calls for public input on the proposed methodologies and proposed projects are announced on the same website.

C. Duration of the cooperative approach (para. 18(g))

The cooperation covers the period for the issuance of credits that covers GHG emission reductions or removals from JCM projects until December 31, 2030. Both governments may consider a possible extension of the above-mentioned period and reach a decision by 2030.

Reference:

- Rules of Implementation for Premium T-VER JCM Track, para. 5.
https://www.jcm.go.jp/opt/th-jp/rules_and_guidelines/download/ext/file_32/Attachment_1_JCM_TH_RoI.pdf
- Each bilateral document and rules of implementation are available on the JCM website:
https://www.jcm.go.jp/

D. Expected mitigation for each year of the duration of the cooperative approach (para. 18(g))

Estimated emission reductions in each year until 2030 of each JCM project are included in a Project Design Document (PDD), a document that includes monitoring methods and estimated emission reductions.

For those projects and their emission reductions or removals (average), see the website below:
https://www.jcm.go.jp/projects/registers

E. Participating Parties involved in the cooperative approach (para. 18(g))

The government of Japan and the government of the Kingdom of Thailand

F. Authorized entities (para. 18(g))

The JCM Promotion and Utilization Council in the government of Japan authorizes JCM credits issued in the JCM registry of Japan and publicizes, among others, legal entities acquiring those JCM credits on the JCM website (https://www.jcm.go.jp).

G. Description of how the cooperative approach ensures environmental integrity (para. 18(h), to be updated by para. 22(b))

1. Description of how the cooperative approach ensures that there is no net increase in global emissions within and between NDC implementation periods (para. 18(h)(i), to be updated by para. 22(b)(i))

Both governments mutually recognize that part of the credits issued from emission reductions and removals achieved by the JCM projects may be used towards the achievement of Japan's NDC while ensuring that double counting is avoided on the basis of corresponding adjustments consistent with the Article 6.2 guidance. The corresponding adjustments are applied to authorized credits.

2. Description of how the cooperative approach ensures environmental integrity through robust, transparent governance and the quality of mitigation outcomes, including through conservative reference levels and baselines set in a conservative way and below business as usual emission projections (including by taking into account all existing policies and addressing uncertainties in quantification and potential leakage) (para. 18 (h)(ii) to be updated by para. 22(b)(ii)).

The JCM is established by a Memorandum of Cooperation (MoC) signed between both governments and implemented in line with the relevant domestic laws and regulations. In line with the MoC, the JC is established, consisting of government officials from both governments.

(1) The JCM track under the Premium T-VER Program

The JCM projects under the Premium T-VER program track are implemented in line with the rules of implementation adopted between the government of Japan and the government of Thailand and the applicable rules and guidelines of the Premium T-VER program, which is governed by the Board of Directors of Thailand Greenhouse Gas Management Organization. Information relating to relevant rules and guidelines and the registered mitigation activities, including the mitigation activity design documents and the verified monitoring reports, are made publicly accessible.

The baseline applied by the projects under the Premium T-VER program is set in a conservative manner below business-as-usual emission projections.

(2) The JCM for existing projects

The JC adopted relevant rules and guidelines, which are made publicly available on the JCM website. In addition, all calls for public inputs on proposed methodologies and proposed projects are informed on the same website.

The methodologies are developed in line with JCM Guidelines for Developing Proposed Methodology, which explain the key concepts, such as reference emissions and eligibility criteria under the JCM. The JC assesses and considers the approval of the proposed methodologies. The list of approved JCM methodologies can be found on the JCM website (https://www.jcm.go.jp).

The JCM Guidelines for Developing Proposed Methodology stipulate that the reference emissions are calculated to be below business-as-usual (BaU) emissions, which represent plausible emissions in providing the same outputs or service level of the proposed JCM project. Therefore, the baselines are to be set in such a way that emission reductions would not overestimate mitigation from an activity.

3. Description of how the cooperative approach is minimizing the risk of non-permanence of mitigation across several NDC periods and how, when reversals of emission reductions or removals occur, the cooperative approach will ensure that these are addressed in full (para. 18(h)(iii), to be updated by para. 22(b)(iii))

If a project is susceptible to the risk of non-permanence, the relevant rules and procedures will be applied concerning buffer credits, which are withheld from issued credits of the project and may be released in line with the relevant decisions.

H. Additional description of the cooperative approach (para. 18(i))

1. Description of how the cooperative approach minimizes and, where possible, avoids negative environmental, economic, and social impacts (para. 18(i)(i), to be updated by para. 22(f))

The JCM is implemented taking the negative environmental, economic, and social impacts into consideration in consultation with the relevant stakeholders in line with the relevant domestic laws and regulations in force. Where negative impacts are found, the project participants are requested to propose and implement safeguard measures.

Reference:

(1) The JCM track under the Premium T-VER Program:
The Guidelines for Assessment and Monitoring the Sustainable Development & Safeguards of T-VER project
https://ghgreduction.tgo.or.th/en/premium-t-ver.html.

(2) The JCM for Existing Projects:
JCM Guidelines for Developing Sustainable Development and Safeguards Assessment Report and Monitoring Report
https://www.jcm.go.jp/th-jp/rules_and_guidelines

2. Description of how the cooperative approach reflects the eleventh preambular paragraph of the Paris Agreement, acknowledging that climate change is a common concern of humankind, Parties should, when taking action to address climate change, respect, promote and consider their respective obligations on human rights, the right to health, the rights of indigenous peoples, local communities, migrants, children, persons with disabilities and people in vulnerable situations and the right to development, as well as gender equality, empowerment of women and intergenerational equity (para. 18(i)(ii), to be updated by para. 22(g))

Each project's compliance with the domestic laws and regulations is monitored by both governments, ensuring that the eleventh preambular paragraph of the Paris Agreement is respected by the JCM projects.

Reference:

(1) The JCM track under the Premium T-VER Program:
Guidelines for Assessment and Monitoring the Sustainable Development & Safeguards of T-VER project
https://ghgreduction.tgo.or.th/en/premium-t-ver.html

(2) The JCM for Existing Projects:
JCM Guidelines for Developing Sustainable Development and Safeguards Assessment Report and Monitoring Report
https://www.jcm.go.jp/th-jp/rules_and_guidelines

In addition, project participants who receive financial support from the government of Japan should take the best possible measures in line with the National Action Plan on Business and Human Rights (2020-2025) and the Guidelines on Respecting Human Rights in Responsible Supply Chains.

3. Description of how the cooperative approach is consistent with the sustainable development objectives of the Participant, noting national prerogatives (para. 18(i)(iii), to be updated by para. 22(h))

The JCM is implemented to contribute to the SDGs in consultation with relevant stakeholders in a way that is consistent with their national objectives by adopting rules and guidelines for sustainable development.

Reference:

(1) The JCM track under the Premium T-VER Program:
Guidelines for Assessment and Monitoring the Sustainable Development & Safeguards of T-VER project
https://ghgreduction.tgo.or.th/en/premium-t-ver.html

(2) The JCM for Existing Projects:
JCM Guidelines for Developing Sustainable Development and Safeguards Assessment Report and Monitoring Report
https://www.jcm.go.jp/th-jp/rules_and_guidelines

4. Description of how the cooperative approach applies any safeguards and limits set out in further guidance from the CMA pursuant to chapter III.D (para. 18(i)(iv), to be updated by para. 22(i)).

Not applicable.

Necessary arrangements will be made in line with further guidance on safeguards and limits developed by the CMA.

5. Description of how the cooperative approach contributes resources for adaptation pursuant to chapter VII (Ambition in mitigation and adaptation actions), if applicable (para. 18(i)(v), to be updated by para. 22(j))

The government of Japan does not require adaptation contribution from mitigation activities under the JCM.

6. Description of how the cooperative approach delivers overall mitigation in global emissions pursuant to chapter VII (Ambition in mitigation and adaptation actions), if applicable (para. 18(i)(vi), to be updated by para. 22(k))

The government of Japan does not require the cancellation of a certain amount of JCM credits for delivering overall mitigation of global emissions.

D. Acronyms and Abbreviations

	Terms	Definition
A	ACC/CACC	Adaptive Cruise Control/Cooperative Adaptive Cruise Control
	ACE	Actions for Cool Earth
	ACE2.0	Actions for Cool Earth 2.0
	ADB	Asian Development Bank
	ADFIAP	Association of Development Financing Institutions in Asia and the Pacific
	AGV	Automated Guided Vehicle
	AI	Artificial Intelligence
	AIM	Asia pacific Integrated Model
	AMICAF	Analysis and Mapping of Impacts under Climate Change for Adaptation and Food Security
	APAEC	ASEAN Plan of Action for Energy Cooperation
	APAN	Asia Pacific Adaptation Network
	APN	Asia Pacific Network for Global Change Research
	AP-PLAT	Asia Pacific Climate Change Adaptation Information Platform
	ASEAN	Association of Southeast Asian Nations
	AZEC	Asia Zero Emission Community
B	BAT	Best Available Technology
	BAU	Business As Usual
	BEMS	Building and Energy Management System
	BR	Biennial Report
	BRT	Bus Rapid Transit
	BTR	Biennial Transparency Report
	BUR	Biennial Update Report
C	CBIT-GSP	Capacity-building Initiative for Transparency – Global Support Programme
	CAO	Cabinet Office
	CCAC	Climate and Clean Air Coalition to Reduce Short-lived Climate Pollutants
	CCS	Carbon dioxide Capture and Storage
	CCUS	Carbon dioxide Capture, Utilization and Storage
	CEFIA	Cleaner Energy Future Initiative for ASEAN
	CH_4	Methane
	CIAT	International Center for Tropical Agriculture
	CIF	Cost, Insurance and Freight
	CII	Carbon Intensity Indicator
	CIMMYT	International Maize and Wheat Improvement Center
	CIPP	Comprehensive Investment and Policy Plan
	CITC	Climate Change International Technical and Training Center
	CM	Cropland Management
	CMIP	Coupled Model Intercomparison Project
	CNG	Compressed Natural Gas
	CNP	Carbon Neutral Port
	CO	Carbon Monoxide

	Terms	Definition
	CO_2	carbon dioxide
	COP	Conference of the Parties
	CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
	CTF	Common Tabular Format
D	DAC	Development Assistance Committee
	DIAS	Data Integration and Analysis System
	DNDC	Denitrification-Decomposition
	DR	Demand Response
	DX	Digital Transformation
	DRR	Disaster Risk Reduction
E	EbA	Ecosystem-based Adaptation
	EC	Electronic Commerce
	Eco-DRR	Ecosystem-based Disaster Risk Reduction
	EDMC	Energy Data and Modelling Center
	EEXI	Energy Efficiency Existing Ship Index
	EMS	Eco-drive Management System
	ERIA	Economic Research Institute for ASEAN and East Asia
	ESCO	Energy Service Company
	ESG	Environment, Social, Governance
	EST	Environmentally Sustainable Transport
	ETC	Electronic Toll Collection System
	ETF	Enhanced Transparency Framework
	EV	Electric Vehicle
	EWS	Early Warning System
F	FAO	Food and Agriculture Organization of the United Nations
	FCV	Fuel Cell Vehicle
	FEMS	Factory Energy Management System
	FIP	Feed-in Premium
	FIT	Feed in Tariff
	FM	Forest Management
	FSA	Financial Services Agency
G	GAN	Global Adaptation Network
	GCF	Green Climate Fund
	GCOM-C	Global Change Observation Mission- Climate
	GCOM-W	Global Change Observation Mission- Water
	GDP	Gross Domestic Product
	GEF	Global Environment Facility
	GHG	Greenhouse Gas
	GM	Grazing land Management
	GOSAT	Greenhouse Gases Observing SATellite
	GPU	Ground Power Unit
	GREEN	Global action for Reconciling Economic growth and ENvironmental preservation
	GWP	Global Warming Potential

	Terms	Definition
	GX	Green Transformation
H	HCFC	Hydrochlorofluorocarbon
	HEMS	Home Energy Management System
	HFCs	Hydrofluorocarbons
	HV	Hybrid vehicle
	HWP	Harvested Wood Products
I	ICAO	International Civil Aviation Organization
	ICEF	Innovation for Cool Earth Forum
	ICMA	International Capital Market Association
	ICT	Information and Communication Technology
	IFL	Initiative on Fluorocarbons Life Cycle Management
	IMO	International Maritime Organization
	IoT	Internet of Things
	IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
	IPCC	Intergovernmental Panel on Climate Change
	IPPU	Industrial Processes and Product Use
	ISSB	International Sustainability Standards Board
	ITMOs	Internationally Transferred Mitigation Outcomes
	ITS	Intelligent Transport Systems
	ITTO	International Tropical Timber Organization
J	JBIC	Japan Bank for International Cooperation
	JCLP	Japan Climate Leaders' Partnership
	JCM	Joint Crediting Mechanism
	JETP	Just Energy Transition Partnership
	JICA	Japan International Cooperation Agency
	JIRCAS	Japan International Research Center for Agricultural Sciences
	JJ-FAST	JICA-JAXA Forest Early Warning System in the Tropics
K	KPI	Key Performance Indicator
L	LCC	Low Cost Carrier
	LD-Tech	Leading Decarbonization Technology
	LED	Light Emitting Diode
	LNG	Liquefied Natural Gas
	LPG	Liquefied Petroleum Gas
	LRT	Light Rail Transit
	LULUCF	Land Use, Land-Use Change and Forestry
M	MaaS	Mobility as a Service
	MAFF	Ministry of Agriculture, Forestry and Fisheries
	METI	Ministry of Economy, Trade and Industry
	MEXT	Ministry of Education, Culture, Sports, Science and Technology
	MHLW	Ministry of Health, Labour and Welfare
	MIC	Ministry of Internal Affairs and Communications
	MLIT	Ministry of Land, Infrastructure, Transport and Tourism
	MLP	Mutual Learning Program for Enhanced Transparency

	Terms	Definition
	MOE	Ministry of the Environment
	MOF	Ministry of Finance
	MOP	Meeting of Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer
	MOU	Memorandum of Understanding
	MPGs	Modalities, procedures and guidelines
	MRV	Measurement, Reporting, and Verification
	MUFG	Mitsubishi UFJ Financial Group
N	N_2O	Nitrous oxide
	NbS	Nature-based Solutions
	NC	National Communication
	NDC	Nationally Determined Contribution
	NE	not estimated
	NEDO	New Energy and Industrial Technology Development Organization
	NETIS	New Technology Information System
	NEXI	Nippon Export and Investment Insurance
	NF_3	Nitrogen Trifluoride
	NGL	Natural Gas Liquids
	NID	National Inventory Document
	NIR	National Inventory Report
	NMVOC	Non-Methane Volatile Organic Compounds
	NO_X	Nitrogen Oxides
	NPA	National Police Agency
O	ODA	Official Development Assistance
	ODS	Ozone-Depleting Substances
	OECD	Organization for Economic Co-operation and Development
	OOF	Other Official Flows
	OTEC	Ocean Thermal Energy Conversion
P	PaSTI	Partnership to Strengthen Transparency for co-Innovation
	PDCA	Plan Do Check Action
	PFCs	Perfluorocarbons
	PHEV	Plug-in Hybrid Electric Vehicle
	PMI	Partnership for Market Implementation
	PPA	Power Purchase Agreement
R	RE100	Renewable Energy 100%
	REDD+	Reducing Emissions from Deforestation and Forest Degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries
	RV	Revegetation
S	S+3E	Safety + Energy Security, Economic Efficiency, Environment
	SAF	Sustainable aviation fuel
	SBT	Science Based Targets
	SDGs	Sustainable Development Goals
	SF_6	Sulfur Hexafluoride

	Terms	Definition
	SiC	Silicon carbide
	SLCPs	Short-Lived Climate Pollutants
	SMBC	Sumitomo Mitsui Banking Corporation
	SO_X	Sulfur Oxide
	SPREP	South Pacific Regional Environment Programme
	SSBJ	Sustainability Standards Board of Japan
	SUBARU	SUstainable Business of Adaptation for Resilient Urban future
T	TCFD	Task Force on Climate-related Financial Disclosures
	TPE	Third Party Entity
U	UG	Urban Greening
	UNDP	United Nations Development Programme
	UNFCCC	United Nations Framework Convention on Climate Change
	UNIDO	United Nations Industrial Development Organization
	USC	Ultra Super Critical
V	VOC	Volatile Organic Compounds
	VVVF	Variable Voltage Variable Frequency
W	WB	World Bank
	WGIA	Workshop on Greenhouse Gas Inventories in Asia
Z	ZEB	Net Zero Energy Building
	ZEH	Net Zero Energy House

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