Tokyo Environmental Master Plan

September 2022

TOKYO
METROPOLITAN
GOVERNMENT

A Green and Resilient Global City Tokyo Opens up a Future - Create a Brighter Future for All -

The environmental situation is posing serious issues on a global scale, such as an even further aggravated climate crisis, biodiversity loss, and changes in the water environment and air quality, requiring us to act on it immediately. Natural disasters seem to be breaking records almost every year, and the impacts of climate change have extended to the daily lives of people. In addition, the unstable supply of crude oil and natural gas due to the energy crisis after February 2022 poses a threat to Japan, which depends on imports for most of its fossil fuels.

Facing two crises, the climate crisis and the energy crisis, the world is moving forward with structural transformations aimed at decarbonization and improved energy self-sufficiency. The Tokyo Metropolitan Government (TMG) also needs to refine its policies from the perspective of the HTT (Ⓗ Herasu (save), Ⓣ Tsukuru (generate), and Ⓣ Tameru (store) electricity) initiatives and realize decarbonization and energy security in an integrated manner. It is our mission for future generations to make the efficient use of energy and utilization of renewable energy common practice.

To help Tokyo move ahead with a sustainable recovery from the COVID-19 crisis and develop as a city that will still be attractive and prosperous 50 to 100 years from now, we must pursue efforts that lead the national government and rest of the world and take the lead in resolving environmental issues that are becoming increasingly diversified and aggravated.

Since the era of high economic growth, the TMG has been working on environmental issues, such as air and water pollution and waste. The air quality in Tokyo has dramatically improved thanks to programs such as diesel vehicle control implemented ahead of the national government's standards. The world's first urban cap-and-trade program, which was introduced in 2010 as a climate change measure, has achieved great results with the cooperation of businesses. In addition, we are accelerating efforts toward "Carbon Half," a plan to halve greenhouse gas (GHG) emissions by 2030, with an eye to the realization of a Zero Emission Tokyo that will contribute to achieving net zero CO_2 emissions worldwide by 2050.

The Tokyo Environmental Master Plan, which was revised recently, sets out specific targets and the shape of initiatives based on the recognition that actions in the period up to 2030 are extremely important to realize the visions for 2050.

We will comprehensively solve environmental issues in various fields through the 3+1 Strategies consisting of Strategy 0 to deal with the impending energy crisis promptly and accurately in addition to the three strategies: Energy Decarbonization and the Sustainable Use of Resources, Realization of an Environmentally Symbiotic, Prosperous Society, and Realization of a Better Urban Environment.

"TIME TO ACT"—Now is the time to accelerate actions. Based on the plan, we will work together with Tokyo residents, businesses, and other various entities to realize a green and resilient global city Tokyo opening up a future that is sustainable, safe, secure, and comfortable, balancing growth with maturity.

September 2022

KOIKE Yuriko
Governor of Tokyo

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Part 1: Formulation of the New Tokyo Environmental Master Plan

Formulation of the Environmental Master Plan

Background of the formulation

In accordance with the Environmental Master Plan formulated in March 2016, the Tokyo Metropolitan Government (TMG) has been working on a wide range of environmental initiatives with the aim of realizing Tokyo as a world-leading, environment-conscious city.

While interest in the realization of a sustainable society has increased worldwide in the six years since the formulation of the plan, the environmental situation is posing ever more serious issues on a global scale, such as further aggravated climate crisis, biodiversity loss, and changes in the water environment and air quality. The United Nations estimates that the world population will grow to 8.5 billion by 2030 and 9.7 billion by 2050, with almost all of the growth occurring in urban areas. In addition, we are in the midst of unprecedented crises, including the COVID-19 pandemic and the impact of the conflict between Ukraine and Russia on resources and energy.

In European and other countries, there is a movement aiming for a green recovery to "build back better" from the COVID-19 crisis while coping with the climate crisis. TMG is promoting sustainable recovery that expands the perspective to include the realization of sustainable lifestyles. Now is the time to act for TMG to realize a green and sustainable Zero Emission Tokyo and create a sustainable city full of abundance, which will provide environmental symbiosis and an excellent air quality 50 or 100 years from now.

As one of the major cities in the world, TMG determined to formulate a new Environmental Master Plan that will more boldly accelerate our environmental initiatives to open up the future of the world and Tokyo.

Perspectives needed for the formulation

In order for TMG to solve diversified and complicated environmental issues, it needs to work with Tokyo residents, businesses, and organizations to take action while ensuring their understanding.

As the climate crisis becomes even further aggravated and the trend toward decarbonization expands throughout the world, achieving net zero CO_2 emissions by 2050 and "Carbon Half*" by 2030 can no longer be relegated to the distant future and we have no time to lose. It is impossible to overcome the crisis facing us without daily efforts accumulated one by one by Tokyo residents and businesses, including the thermal-insulation of houses, the introduction of more energy efficient machinery equipment, and the active use of renewable energy.

In Edo, once the world's largest city, recycling and reuse were carried out in all aspects of food, clothing and shelter, nurturing the prosperous city in harmony with nature.

For the future, we will treat environmental issues as vital and harness all of Tokyo's strengths to accelerate our efforts.

* Halving greenhouse gas emissions in Tokyo by 2030 compared to 2000

Positioning of the plan

This plan has been formulated as that stipulated in Paragraph 1, Article 9 of the Tokyo Metropolitan Environmental Basic Ordinance (Tokyo Metropolitan Ordinance No. 92, 1994) and that stipulated in the Local Governments' Action Plans for Global Warming Countermeasures (Regional Policy Edition) stipulated in Paragraph 3, Article 21 of the Law Concerning the Promotion of the Measures to Cope with Global Warming (Law No. 117, 1998).

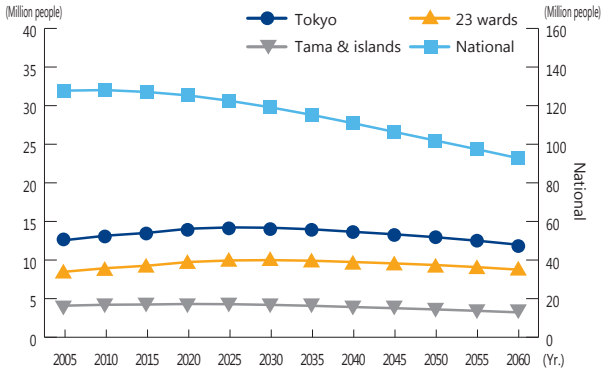
The initiatives described in this plan are intended to promote the Future Tokyo: Tokyo's Long-Term Strategy formulated in March 2021 as a guiding principle for TMG.

Socioeconomic Trends in Tokyo

Trends in population and households in Tokyo

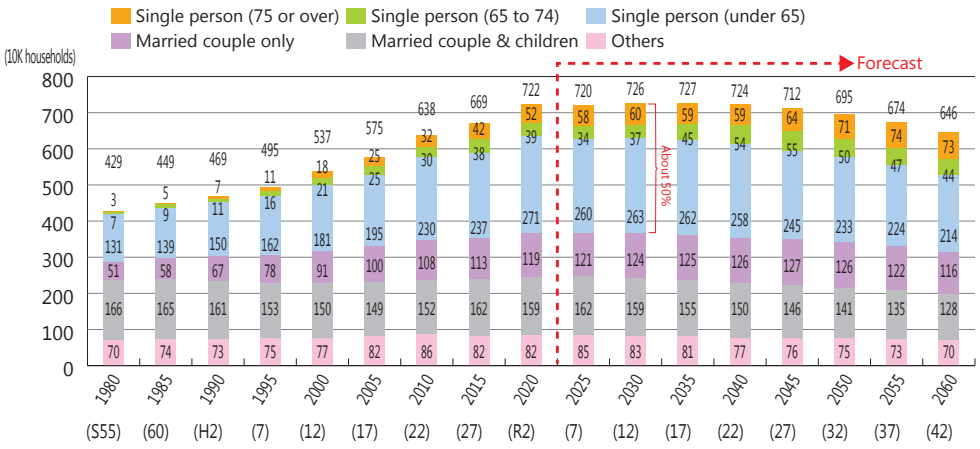
With the progress in a declining birthrate, aging and declining population, the total population of Tokyo is expected to peak in 2025 and continue to decrease thereafter. While the number of households is expected to start declining in 2035, the number of single-person households is increasing and expected to account for about 50% of all households by 2030.

Changes in population



Source: Attachment to the Future Tokyo: Tokyo's Long-Term Strategy in March 2021.

Changes in the number of households by family type in Tokyo



Source: Tokyo Metropolitan Housing Master Plan in March 2022.

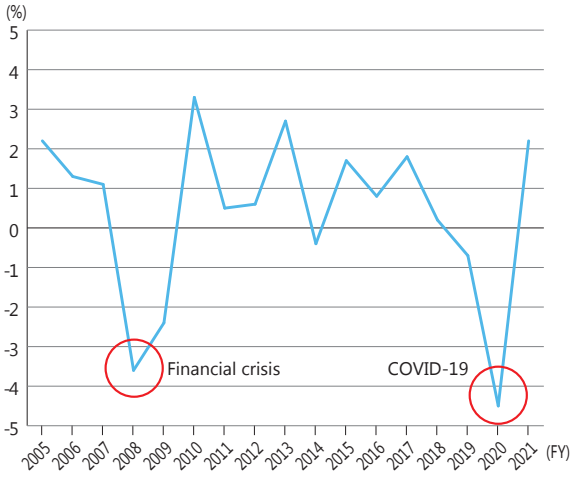
Impact of COVID-19 etc. on the economy and society, and lives and behaviors of residents

Impact on economy and society

The prolonged spread of the COVID-19 pandemic has had various impacts on people's lives and values. Some aspects of daily life and work, which hitherto had been taken for granted, have seen major changes, such as restrictions on socioeconomic activities, a lessening of social interactions, and a stressed medical system. The trend of digitalization called the fourth industrial revolution has caused big waves.

Hit by the COVID-19 crisis, Japan's real GDP growth rate in FY 2020 declined by 4.5% from the previous fiscal year, which was the largest post-war decline, surpassing the 3.6% decline in FY 2008 when the financial crisis hit, highlighting the magnitude of the impact of the COVID-19 crisis.

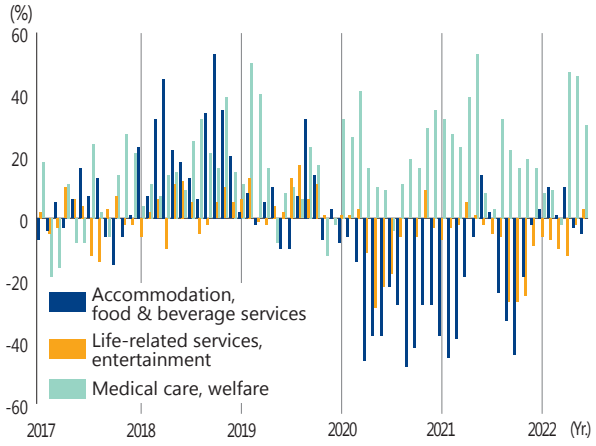
Changes in Japan's real GDP growth rate from FY 2005 to 2021



Source: Cabinet Office. National Accounts (GDP Statistics).

The reduction of outings caused by the COVID-19 pandemic has had a major impact on employment figures for associated industries. In particular, the accommodation, food and beverage service, and entertainment industries have not yet recovered to the levels before the COVID-19 crisis.

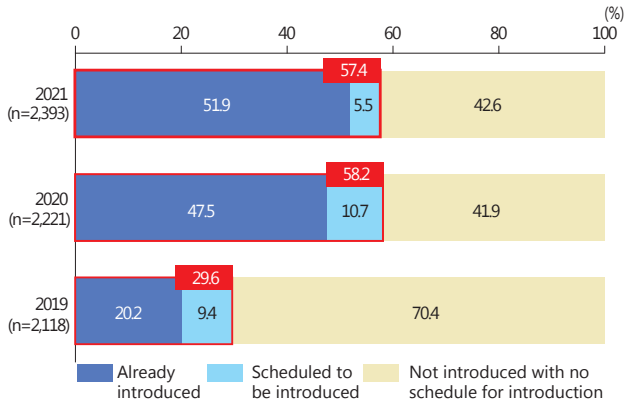
Number of employees by major industry
(raw numbers, year-on-year rate of change)



Source: Statistics Bureau, Ministry of Internal Affairs and Communications. Labor Force Survey (Basic Tabulation).

The COVID-19 crisis has also encouraged the introduction of remote work in businesses, and the percentage of businesses that have introduced working from home has reached nearly 60%, indicating that digitalization is developing rapidly.

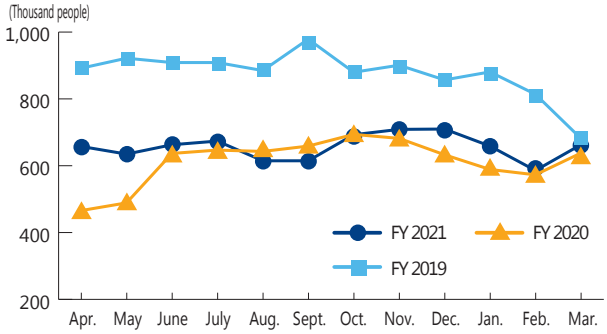
Introduction of remote work



Source: Ministry of Internal Affairs and Communications. Communications Usage Trend Survey 2021.

On the other hand, the development of flexible work styles, such as working from home, has significantly decreased the number of railway passengers since the beginning of the COVID-19 crisis. In January 2022, the number of the passengers was down by about 25% compared to the same month in 2020.

Changes in the number of passengers at major railroad companies



Source: Material of Japan Private Railway Association

Relationship with the natural environment

A United Nations report pointed out that COVID-19 may be a zoonotic disease derived from wildlife, and pandemics of such infectious diseases will increase in the future.

It also said that the background to this is the serious environmental destruction caused by humans, such as the development of roads, farmlands, and pastures, and the mining of resources that cause deforestation. According to the report, these actions have not only created new points of contact with wild animals that have viruses or bacteria, i.e., unknown pathogens existing in nature, but also increased opportunities to come into contact with them. The post-COVID-19 society is requiring us to reconsider such relationships between humans and nature.

Dealing with well-being

People's values have changed under the COVID-19 pandemic. The World Economic Forum Annual Meeting 2021 (Davos Forum) was held under the theme of a "Great Reset." With the focus on policies designed to renew all aspects of society and economy, it drew particular attention to a reconsideration of well-being for people. In addition to GDP and other indexes that measure economic wealth, a new index called GDW (gross domestic well-being) has been proposed while the concept of well-being, which focuses on the wealth of society, people's quality of life, and their level of satisfaction, has been disseminating.

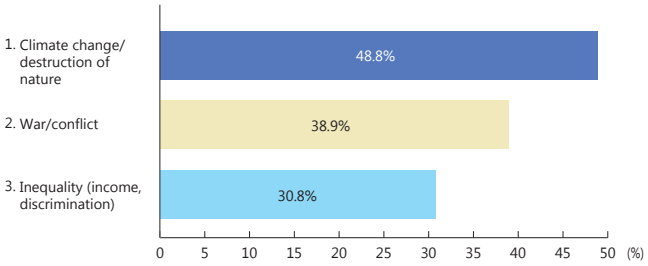
The World Health Organization (WHO) formulated a Towards Developing WHO's Agenda on Well-Being report in 2021 to recommend the creation of a public policy for the common good toward the realization of a well-being society. The World Happiness Report 2022 ranked Japan as low as 54th, implying that in Japan it may be difficult to feel happiness despite its economic wealth. Under these circumstances, a liaison meeting of ministries and agencies related to well-being has been established in Japan to share information,

strengthen cooperation, and disseminate best practices among different organizations for the promotion of efforts toward well-being. Efforts to create a society where people can feel happiness are underway, with key performance indicators (KPIs) related to well-being incorporated into various national basic plans.

Awareness of environmental issues among young people, including Millennials and Generation Z

There are changes in the way people, young people in particular, deal with environmental and social issues on a global scale. In a World Economic Forum survey of approximately 31,500 Millennials aged 18-35 in 186 countries, to the question "What are the most serious issues affecting the whole world?" about 49% (the majority) of respondents answered, "Climate change/destruction of nature."

Serious global issues focused on by Millennials



Source: World Economic Forum. Global Shapers Annual Survey 2017.

Young people take the severe impact of climate change and environmental destruction seriously as a real threat to their future. In particular, Generation Z, also known as digital natives, can quickly share their sense of crisis with young people around the world through online platforms and social media, causing a surge of activity around the world with their aggressive actions, such as carrying out climate strikes and giving speeches at the United Nations and the Conference of the Parties (COP) to the UN Framework Convention on Climate Change.

Green recovery from the COVID-19 crisis

A green recovery is spreading all over the world as an economic recovery measure from the COVID-19 crisis. In May 2020, the European Commission announced the establishment of a EUR 750 billion recovery fund, the Next Generation EU, to support EU member states hit by the COVID-19 pandemic. It includes targets raised in line with the Paris Agreement: Net zero greenhouse gas emissions by 2050 and a 50-55% reduction below 1990 levels by 2030.

In the United States, President Biden has made climate change measures one of his administration's flagship policies. On January 20, 2021, the day of his inauguration, he announced that the US would rejoin the Paris Agreement and his administration would work on measures to achieve carbon neutrality by 2050, marking a complete change from the previous administration's policy direction.

The Sustainable Recovery report of the International Energy Agency (IEA) pointed out that intensive investment in sustainability-focused initiatives will create 9 million new jobs and reduce greenhouse gas emissions by 4.5 billion tonne-CO_2, resulting in an average increase of 1.1% in the world GDP growth rate.

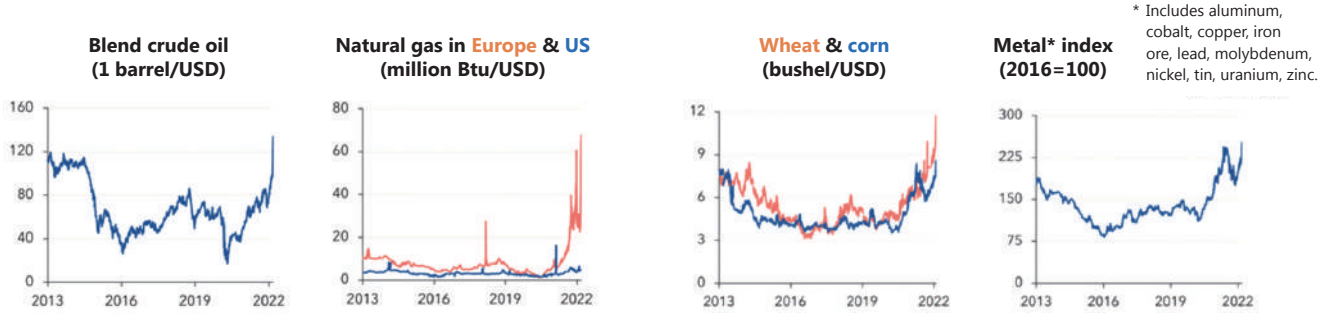
It is necessary to accelerate the movement toward the realization of a sustainable recovery that will achieve a sustainable society by accurately understanding these trends and utilizing emerging fields, such as green transformation and digital transformation.

Global situation of increasing uncertainty

Russia's invasion of Ukraine in February 2022 has had a huge impact on people's lives and economic activities.

Ukraine and Russia play an important role in the world economy as suppliers of energy, fossil fuels, mineral resources, and grains. The prices of fossil fuels, such as crude oil and natural gas, food, such as wheat and corn, and major metals, which had been on an upward trend, have risen sharply in the wake of Russia's invasion. There is a concern that rising prices of these primary commodities will decrease income value, restrict the lives of households, and have a great impact on business activities due to shortages and rising prices of raw materials for semiconductors etc.

Changes in prices of fossil fuels, grains, and major metals



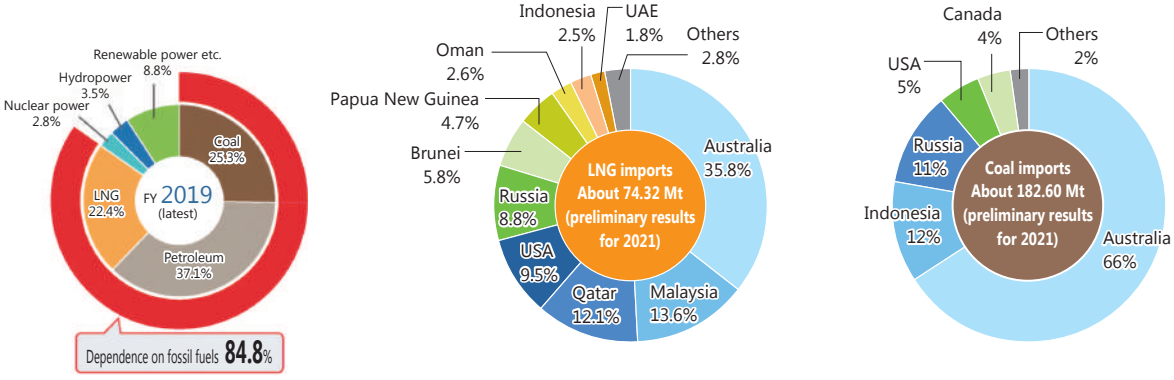
Source: International Monetary Fund. How War in Ukraine Is Reverberating Across World's Regions, March 15, 2022.

Impact on energy security

Japan is highly dependent on fossil fuels, such as oil, natural gas (LNG), and coal imported from overseas, and the level of dependence reached nearly 85% in FY 2019 according to Japan's Energy 2021 Edition of the Agency for Natural Resources and Energy. Its primary energy self-sufficiency rate is about 12% which is lower than that of other OECD countries. Its percentage of renewable power was about 18% in FY 2019, falling far behind major European countries, including Germany with about 35%, the UK with about 34%, Spain with about 38%, and Italy with about 40%.

In April 2022, Japan decided to phase out and eventually ban coal imports from Russia as an economic sanction against the country. However, this might lead to rising prices for electricity and steel products due to higher coal prices, and there is a concern that the supply of energy resources will be unstable for extended periods.

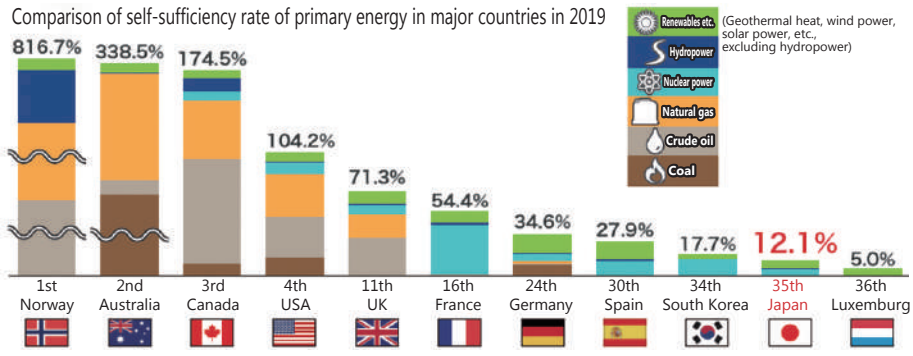
Primary energy supply mix of Japan and fossil fuel exporters to Japan



Source: Agency for Natural Resources and Energy. Japan's Energy 2021 Edition.

Source: FY 2021 Annual Report on Energy.

Comparison of self-sufficiency rate of primary energy in major countries in 2019



Source: Agency for Natural Resources and Energy. Japan's Energy 2021 Edition.

Environmental Issues Tokyo Faces Today

Impending crisis of unstable energy supply

As fossil fuel production areas are relatively unevenly distributed, supply has been affected by political factors in resource exporting countries and resource importing countries including Japan have had to take such measures as the diversification of procurement sources and market intervention. The impact of Russia's invasion of Ukraine is jeopardizing energy security and has resulted in soaring international prices of fossil fuels.

In response to the energy crisis, the European Commission announced on March 8, 2022, an REPowerEU policy aimed at eliminating the EU's dependence on Russian fossil fuels and ensuring a stable supply of less expensive and more sustainable energy. The policy aims to diversify natural gas sources and eliminate dependence on fossil fuels, further supporting the promotion of solar and wind power and heat pumps, the electrification of factories, and switching to renewable hydrogen.

In order to reduce dependence on fossil fuels from overseas and establish a stable energy supply, Japan as a whole and Tokyo in particular as a major energy consumer, should accelerate efforts to further pursue energy efficiency, make renewable energy a major energy source, and optimize supply and demand through energy management.

Aggravated global environmental crisis - Climate change and biodiversity loss -

The earth, the basis for our existence, is in serious danger. Risks are increasing throughout the world. Recent years have seen record natural disasters, such as heat waves, wildfires, floods, hurricanes, and heavy rains occurring with alarming frequency, as well as extinction of species, depletion of water resources, and destabilization of resources and food. In Japan, heavy rains and huge typhoons, which were once said to occur only rarely, striking decades apart, have been hitting various regions almost every year, causing tremendous damage, including river flooding and landslides. This situation poses a threat to socioeconomic activities in Tokyo, not only because it may potentially directly impact on the lives of Tokyo residents and business activities in Tokyo, but also because the city is dependent on the supply of energy, resources, and products from home and abroad.

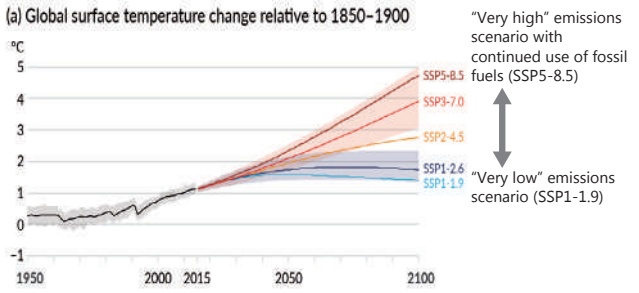
Climate change and biodiversity loss are considered to be major factors contributing to this dire situation.

Aggravated climate crisis

To avoid the climate crisis facing us, the Paris Agreement, which came into effect in 2016, set a common goal of holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels. According to the Special Report on Global Warming of 1.5°C publicized by UN IPCC (Intergovernmental Panel on Climate Change) in October 2018, limiting global average temperature rise to 1.5°C requires global greenhouse gas emissions to be approximately halved by 2030 and net zero by 2050. At COP26 held in Glasgow, UK in November 2021, it was agreed globally to pursue efforts to limit the temperature increase to 1.5°C, indicating that the trend toward decarbonization is significantly accelerated around the world.

However, the Working Group I Contribution to the Sixth Assessment Report released by IPCC in August 2021 stated that the temperature rise is very likely to exceed 1.5°C between 2021 and 2040.

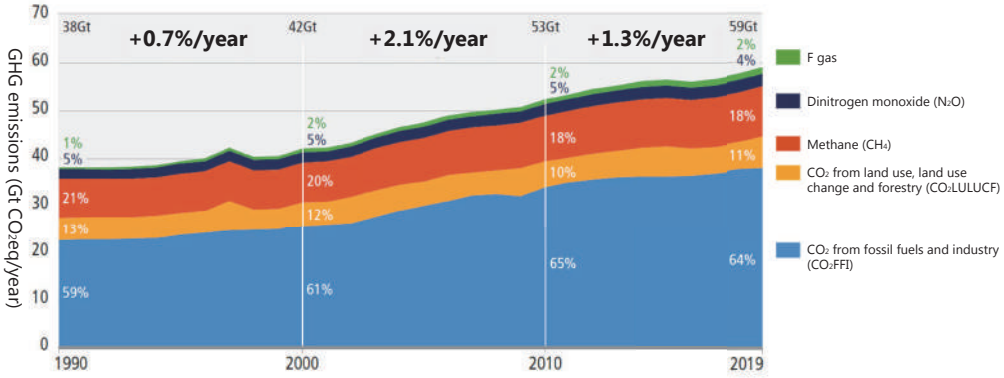
Changes in global average temperature relative to 1850 - 1900



Source: IPCC AR6 WG1.

The Working Group III Contribution to the Sixth Assessment Report released in April 2022 pointed out that the rate of increase in greenhouse gas emissions in the 2010s was lower than that in the 2000s, but that emissions were still increasing.

Trends in anthropogenic GHG emissions from 1990 to 2019

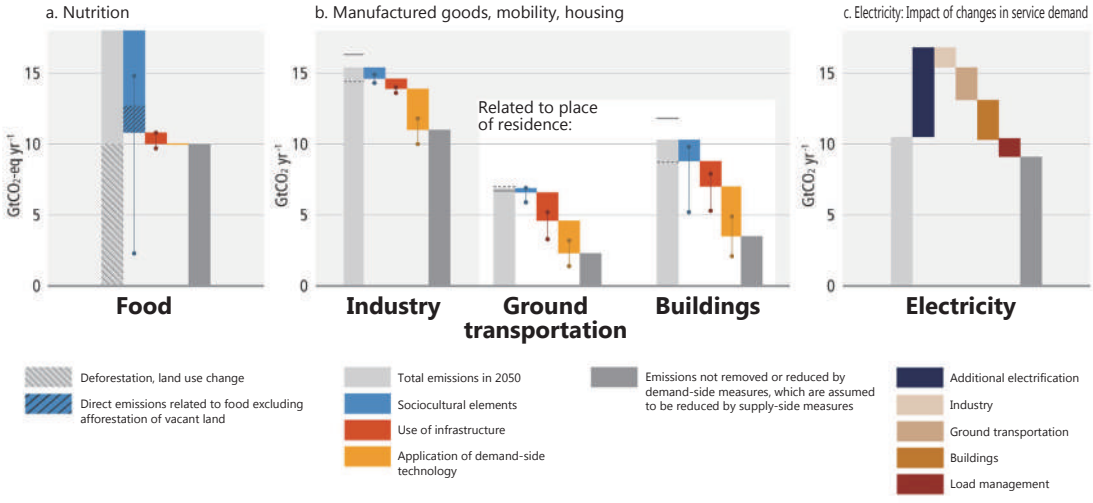


Source: IPCC Working Group III Contribution to the Sixth Assessment Report, Summary for Policymakers.

The report indicated that measures taken on the demand side will be able to reduce greenhouse gas emissions worldwide by 40-70% by 2050 compared to the baseline scenario. It also pointed out that in order to achieve the 1.5°C target, it is necessary to make greenhouse gas emissions start decreasing by 2025, with the road to achieving the target getting narrower each and every second. In addition to the thorough implementation of energy efficiency measures and the accelerated broader use of renewable energy, such as solar and wind power, whose introduction costs have been reduced, there is a need to encourage changes in society including lifestyles and promote behavior change for each and every individual.

The impact of global climate change has caused unprecedented extreme heat, heavy rains, stronger hurricanes, and the natural disasters that accompany them. In recent years, natural disasters due to typhoons and torrential rains have occurred frequently. A report by Aon, a US risk consulting firm, says that among natural disasters in the world in 2019 the 2019 East Japan Typhoon caused the greatest economic loss of USD 15 billion (about JPY 2 trillion), and the 2019 Boso Peninsula Typhoon came in at third place with USD 10 billion (about JPY 1.3 trillion). In addition to mitigation measures to reduce greenhouse gas emissions, we need to work on adaptation measures to avoid and alleviate damage from natural disasters due to the impact of climate change.

Demand-side reduction measures by sector



Source: IPCC Working Group III Contribution to the Sixth Assessment Report, Summary for Policymakers.

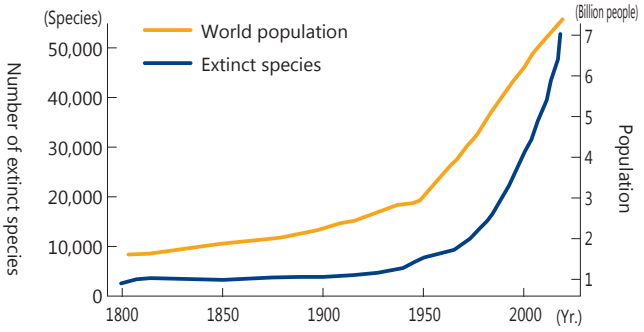
Biodiversity loss

The present age is called the era of the sixth mass extinction, in which living things are becoming extinct at the fastest rate since the beginning of life on earth primarily due to the impact of human activity. In addition to extinction of various species, there is a rapid progression of a deterioration of ecosystems that create biological resources.

These issues are caused by a complicated interaction between direct factors such as development and overexploitation by humans and climate change, with other factors that are intricately intertwined such as changes in the industrial structure, and the consumption and production trends that drive these changes, which are in turn affected by people's values and behaviors. As the world's population continues to grow, there is a concern that if we do not change our social systems and lifestyles, we will no longer be able to enjoy the blessings of biodiversity that support our lives.

At the 10th Conference of the Parties (COP10) to the Convention on Biological Diversity held in 2010, 20 targets for 2020 were set. They included raising public awareness of biodiversity, control of overfishing, securing protected areas, enhancement of ecosystem services, and ensuring human resources and funds. However, the Global Biodiversity Outlook 5, released in September 2020, shows that none of these targets have been fully achieved, with harsh consequences. International discussions are underway to adopt a new set of global targets, the Post-2020 Global Biodiversity Framework. At Part 1 of the 15th Conference of the Parties (COP15) held in Kunming, China in October 2021, the Kunming Declaration was adopted, emphasizing putting biodiversity on track to restoration by 2030.

World population growth and species extinction crisis



Source: Scott, J.M. Threats to Biological Diversity: Global, Continental, Local. U.S. Geological Survey. Idaho Cooperative Fish and Wildlife Research Unit, University of Idaho, 2008.

The Earth, home to all manner of lifeforms, human and otherwise, is already approaching its limit, and we have no time to lose. The whole of society needs to act for the realization of a sustainable global environment.

A need to continue pursuing a high-quality urban environment

By working with its residents, businesses, and organizations to promote various pioneering efforts, Tokyo has made great strides in tackling serious environmental issues, including the pollution of air, water, and soil caused by rapid industrialization and the widespread use of automobiles during the high economic growth period.

However, further efforts are needed to solve other environmental challenges, such as photochemical oxidants and PM2.5, with the possibility of ongoing research revealing new environmental risks. For air pollutants, particular attention should be given to transboundary movements, which cannot be solved by measures taken in a specific region.

To secure the health and safety of Tokyo residents and create a sustainable city, we should have a broad-based perspective and continue pursuing a high-quality urban environment.

Interconnections between fields and the need for integrated measures

Synergies, trade-offs, and other interconnections are seen in different fields of environmental initiatives.

Many efforts to reduce air pollutants also have the effect of reducing CO_2 emissions, further bolstering climate change measures. When considering measures against air pollutants, the reduction of ozone, the main components of photochemical oxidants, and soot (black carbon) in PM2.5, is said to be particularly effective for both ameliorating climate change and improving air quality, an approach that has attracted the attention of international organizations. The introduction of zero-emission vehicles (ZEVs[*1]), which do not emit carbon dioxide, and the conservation and creation of greenery will also improve air quality.

As photochemical oxidants may not only threaten the health and safety of Tokyo residents, but also adversely affect the growth of plants, and the release of chemical substances into nature can affect ecosystems, the realization of a high-quality urban environment by improving the air, water, and soil environment will also contribute to the recovery of biodiversity. This is what is meant by the synergy or interconnection of countermeasures in different fields.

*1 Electric vehicles (EVs), plug-in hybrid vehicles (PHVs) (in EV mode), and fuel cell vehicles (FCVs) that do not emit CO_2 or other exhaust gases during driving.

Most importantly, climate change and biodiversity are closely linked. Rising temperatures, droughts, and floods due to heavy rains have become causes of biodiversity loss. Biodiversity contributes to the mitigation of and adaptation to climate change by means of the absorption of carbon dioxide by plants and the alleviation of damage caused by heavy rains through drainage of rainwater.

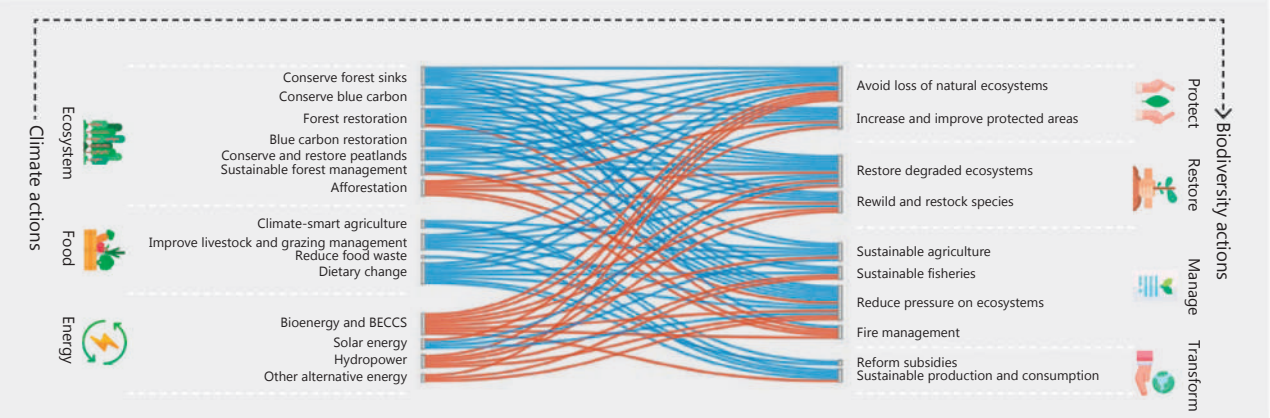
A report indicates the interconnections between climate change mitigation/adaptation measures and biodiversity conservation measures as shown in the figure below.

NbSs (Nature-based Solutions*2), efforts to solve various social issues through the sustainable use of the functions of nature, are also extremely important. Such efforts produce benefits for a wide range of aspects, including the wealth of life, health, and community development as well as climate change and natural disasters.

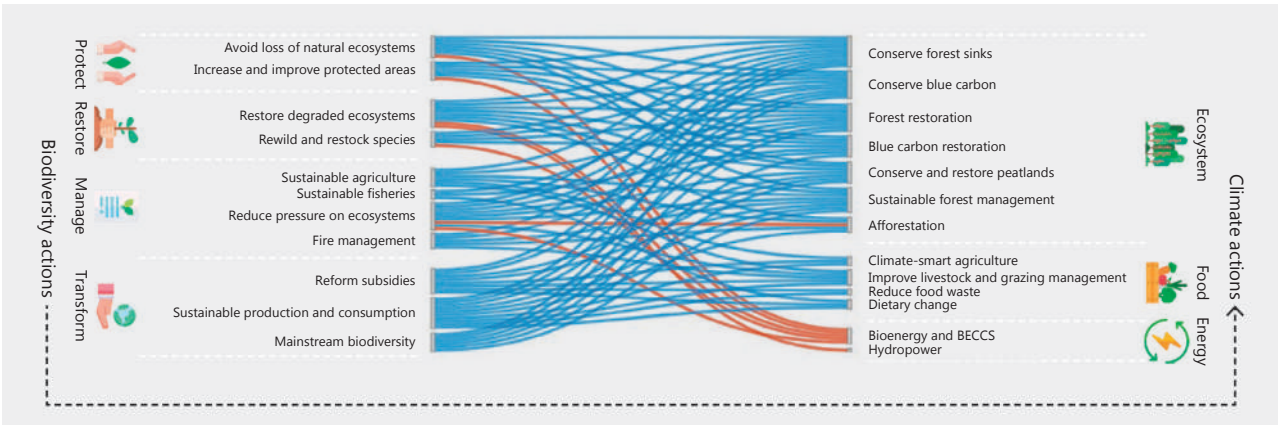
To solve impending environmental issues, we need to work in a comprehensive and integrated manner, taking these interconnections into account.

*2 Defined by IUCN (International Union for Conservation of Nature and Natural Resources) as "Actions to protect, sustainably manage and restore natural and modified ecosystems in ways that address societal challenges effectively and adaptively, to provide both human well-being and biodiversity benefits."

Impact of climate change mitigation measures on biodiversity conservation measures



Impact of biodiversity conservation measures on climate change mitigation measures



* Blue lines represent positive effects, while orange lines represent negative effects. This network of interaction is evolving as many of the solutions are still in the ideation phase or have not yet been deployed at any sizable scale. Likewise, the strength of interactions may shift over time as the scale of solutions moves beyond the threshold at which unforeseen interactions, positive or negative, may occur.

Source: IGES. IPBES-IPCC Co-Sponsored Workshop Report on Biodiversity and Climate Change, September 2021.

A need to change the status quo of consumption and production

A key to resolving environmental issues can be found in re-evaluating the status quo of consumption and production. In each process of consumption and production, the global environment may be burdened with emissions of greenhouse gases, overexploitation of resources, an increase in waste, and air pollution. Studies by the European Commission - Joint Research Centre show that the food system contributes up to 1/3 of greenhouse gas emissions, up to 80% of biodiversity loss, and up to 70% of freshwater use. The United Nations Food Systems Summit held in September 2021 pointed out the need to make the food system more sustainable and resilient.

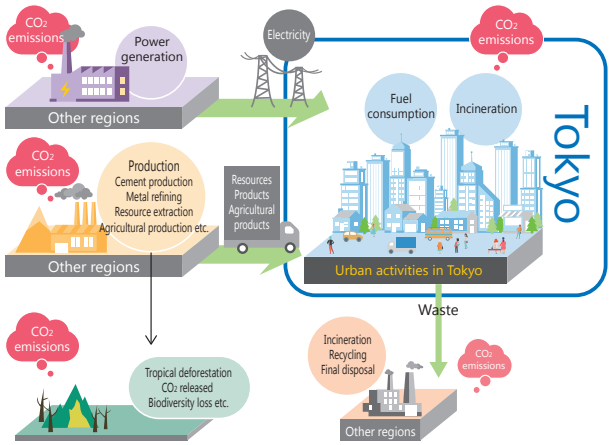
The Annual Report on the Environment, the Sound Material-Cycle Society and Biodiversity in Japan 2020 indicates that about 60% of greenhouse gas emissions in Japan on a consumption basis (relative to carbon footprint) are caused by households, of which 12% is caused by food.

Due to the globalization of the supply chain and other reasons, the impact of economic or consumption activity in a region on the land use and natural environment of a distant region (telecoupling) has reached a scale that cannot be overlooked. There is a need for a shift to a decarbonized lifestyle through the selection of consumption behavior that has a low environmental load.

In light of changes in socioeconomic conditions, the acceleration of computerization and globalization, and the COVID-19 crisis, consumer preferences for products and services have diversified and the mindset of prioritizing quality over quantity and emphasizing the social background and impact has become widespread as the environment surrounding consumption and production is undergoing major changes.

The metropolis of Tokyo relies on areas outside of Tokyo (other regions and countries) for a substantial amount of resources and natural capital. The amount of resources produced outside Tokyo to be then transported and consumed in Tokyo is enormous, estimated at around 100 million tonnes per year. All entities, including Tokyo residents and businesses, should transform any lifestyles or business activities that are premised on the mass consumption of energy and resources into more sustainable models, and contribute to the reduction of the environmental load generated outside Tokyo associated with activities in Tokyo as well as that generated inside Tokyo.

Environmental load caused by urban activities



Realization of a sustainable global environment: Absolute requirement for a bright future

The United Nations Sustainable Development Goals (SDGs) consist of 17 goals for the sustainable development of the world. In the SDGs Wedding Cake Model, which is a conceptual diagram showing the relationships between these goals, they are divided into three layers: Biosphere, Society, and Economy. It indicates that Biosphere is the basis of everything, Society and Economy are built on top of it, these goals are related, and one problem-solving action should aim to solve multiple problems. It also suggests that climate change and biodiversity degradation may hinder the achievement of goals in other fields.

In order to protect the basis that humans and all living things require for life itself and realize a sustainable and better society, we need to take drastic measures to overcome the crisis of the global environment and change the socioeconomic structure.

Source: Illustration by the Stockholm Resilience Centre.

Concept of the New Tokyo Environmental Master Plan

Tokyo's role to play and vision for a desirable city

As one of the world's leading metropolitan cities, Tokyo should boldly strengthen its efforts in all fields and demonstrate international leadership to realize zero emissions by 2050 and a 50% reduction in greenhouse gas emissions in Tokyo by 2030 ("Carbon Half"), which is key for zero emissions by 2050.

Tokyo also needs to change the status quo of consumption and production by restoring biodiversity, working to create a better urban environment, and realizing sustainable consumption and production.

As for environmental issues, Tokyo is required to work together with all entities, including its residents and businesses, to solve challenges, boldly accelerate actions with "Let's Start from Here" in mind, and take the lead in implementing reforms as a "large-scale business" that consumes a lot of energy and resources.

Tokyo will aim to be a green and resilient global city that opens up a future—a sustainable, safe, secure, comfortable, and hopeful Tokyo balancing growth with maturity, achieving sustainable growth even as a mature society with a highly developed economy.

Strategic development to realize a vision for a desirable city

3+1 Strategies

To avoid a crisis of the unstable supply of energy that threatens the basis of the metropolis of Tokyo, and drastically strengthen and thoroughly implement decarbonization initiatives that are essential from the perspective of energy security, TMG will work with Tokyo residents and businesses to make all-out efforts to deal with the crisis.

For the realization of Tokyo's vision for a desirable city, we will immediately develop Strategy 0 to deal with the impending energy crisis promptly and accurately in addition to the three strategies to realize a sustainable city, including decarbonization, biodiversity, and a better urban environment. We will comprehensively solve environmental issues in such fields as climate change/energy, nature, and air quality, by making efforts in Strategy 0 and deploying initiatives based on Strategies 1 to 3 in an integrated manner.

Strategy 0: Integrated Realization of Decarbonization and Energy Security Spurred on by the Crisis

Strategy 1: Realization of Zero Emissions through Energy Decarbonization and the Sustainable Use of Resources

Strategy 2: Realization of an Environmentally Symbiotic, Prosperous Society that Continues to Benefit from Biodiversity

Strategy 3: Realization of a Better Urban Environment that Ensures the Safety and Health of Tokyo Residents

Cross-sectional and comprehensive efforts

To build a future Tokyo, we need to cooperate with various actors, such as Tokyo residents, businesses, organizations, the national government, other local governments, and cities overseas, to confront the crises facing us together.

In order to accelerate environmentally friendly behavior in collaboration with these actors, TMG will leverage digital transformation to develop projects in cooperation with Tokyo residents, businesses, and organizations, provide information on best practices, retain and develop human resources, and promote behavior change.

We will further strengthen collaboration with municipalities that are familiar with local circumstances and provide cooperation and support for them according to their situation and needs.

In addition, Tokyo will exercise international leadership as one of the world's largest cities and actively work to solve environmental issues through cooperation with overseas cities and participation in international conferences.

Concept of target setting

Setting and clarifying targets is important to help the administration, businesses, and residents of Tokyo identify and share what goals they should work toward to realize Tokyo's vision for a desirable city.

We have set out the targets in this plan from the following perspectives and will ensure the PDCA cycle to steadily promote initiatives taking into account the latest technological trends and costs.

- Set out targets based on the recognition that actions in the period up to 2030 are extremely important to realize the visions for 2050
- Adopt highly feasible approaches to achieve 2030 targets, taking into account the latest technological trends and costs
- Look at the future from the perspective of backcasting
- Keep a sustainable recovery in perspective
- Accelerate TMG's own efforts to take the lead in society with "Let's Start from Here" in mind
- Promote policies in collaboration with a variety of actors

Part 2

Future Direction of Environmental Policy

017 Strategy 0: Integrated Realization of Decarbonization and Energy Security Spurred on by the Crisis

023 Strategy 1: Realization of Zero Emissions through Energy Decarbonization and the Sustainable Use of Resources

030 Making Renewable Energy a Major Energy Source

037 Expanding Zero Emission Buildings

049 Promoting Zero Emission Mobility

056 Expanding the Use of Hydrogen Energy

062 Realizing the Sustainable Use of Resources

070 Efforts toward Zero Hydrofluorocarbon Emissions

073 Promoting Climate Change Adaptation Measures

082 Bold Acceleration of TMG's Initiatives for Its Own Sustainability

087 Strategy 2: Realization of an Environmentally Symbiotic, Prosperous Society that Continues to Benefit from Biodiversity

093 Promoting the conservation and recovery of biodiversity, handing down the luxuriant nature of Tokyo to future generations

096 Using the blessings of biodiversity in a sustainable manner, utilizing the functions of nature to improve the lives of Tokyo residents

098 Recognizing the value of biodiversity, changing that idea into actions that address global issues as well as those in Tokyo

101 Strategy 3: Realization of a Better Urban Environment that Ensures the Safety and Health of Tokyo Residents

102 Further Improving Air Quality Etc.

109 Reducing Risks Caused by Chemical Substances Etc.

113 Further Promoting the Proper Treatment of Waste

Strategy 0

Part 2: Future Direction of Environmental Policy

Integrated Realization of Decarbonization and Energy Security Spurred on by the Crisis

Integrated Realization of Decarbonization and Energy Security Spurred on by the Crisis

Although we are becoming familiar with the effects of the climate crisis, the conflict between Ukraine and Russia has revealed anew the vulnerability of Japan's energy security. It has become even clearer that decarbonization through the more efficient use of energy and the use of renewable energy as a major energy source is closely tied with energy security, which is essential for the maintenance and development of socioeconomic activities.

As the capital of Japan and a major energy consumer, Tokyo will overcome these two crises, the climate crisis and the energy crisis, by means of all-out efforts together with Tokyo residents and businesses. TMG will realize decarbonization and energy security in an integrated manner by drastically strengthening and thoroughly implementing its climate change measures.

Trends in the Energy Crisis

Trends in the energy crisis

The risk of dependence on fossil fuels revealed again by the energy crisis

The conflict between Ukraine and Russia has once again revealed the vulnerability of Japan's socioeconomic system, which is dependent on fossil fuels imported from abroad.

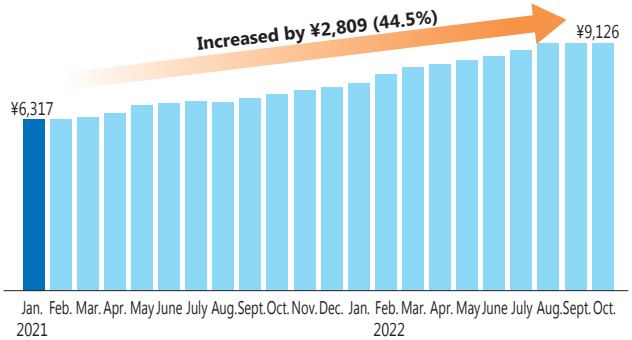
The temporary shutdown of large power plants due to earthquakes and other natural disasters has caused a situation of tight supply and demand of electricity.

In light of the outlook for the international situation, there is concern that the impact of the energy crisis will be prolonged.

Soaring energy prices and tight supply and demand

Electricity prices have risen due to soaring import prices caused by an increasing demand for fossil fuels. In October 2022, under the impact of growing tension in Ukraine, the electricity prices of 10 major electric power companies for standard households rose to their highest level over the past five years.

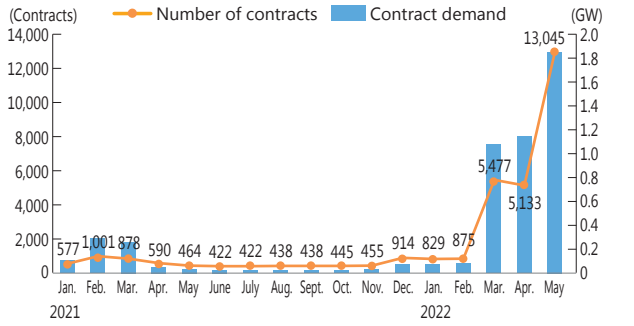
Electricity prices of Tokyo Electric Power Company (TEPCO)



Source: Data published by TEPCO.

Soaring electricity market prices triggered by higher fuel prices caused some power producers and suppliers to go bankrupt or suspend their operations, resulting in major electric power companies postponing concluding new contracts. As a result, the number of applications for last resort supply contracts by power transmission and distribution business operators has increased sharply, which has had a great impact on people's lives and economic activities. Furthermore, gas prices are rising as well.

Contract demand and number of contracts for last resort supply



Source: Electricity and Gas Market Surveillance Commission. Documents submitted to the Secretariat of the 73rd System Design Special Meeting.

On March 21, 2022, a power shortage warning was issued for the first time in the service area of Tokyo Electric Power Company. In the electricity supply and demand outlook for FY 2022, the national government announced that the reserve margin will barely exceed 3%, the minimum requirement for a stable supply of electricity, in the Tohoku, Tokyo, and Chubu power service areas in summer.

Course of events

Monday (holiday), March 21
- 20:00: Power shortage warning (1) ⇒ Warning issued for Tokyo service area

Tuesday, March 22
- 11:30: Power shortage warning (2) ⇒ Warning extended to Tohoku service area
- 14:45: METI Minister's emergency interview (request for further power saving)
- 21:00: Announcement of prospects for avoiding power outages
- 23:00: Power shortage warning (3) ⇒ Warning canceled for Tohoku service area

Wednesday, March 23
- 11:00: Power shortage warning (4) ⇒ Warning canceled for Tokyo service area

Source: Material of the Ministry of Economy, Trade and Industry.

On June 27, 2022, a power shortage advisory was issued. The tight situation continued for the four days through to June 30. Such a situation may occur again at any time though the reserve margin has improved due to the open recruitment for additional supply capacity and changes in the operation plans of power sources.

For the winter season, it is expected that a reserve margin of 3% can be maintained in nine areas from the Tohoku to Kyushu regions, but the supply and demand conditions still remain tight.

TMG's efforts to date

Making emergency requests to the national government and Tokyo Electric Power Company Holdings, Inc. (hereinafter referred to as "TEPCO") for a stable energy supply and acceleration of decarbonization

On April 22, 2022, TMG made urgent requests to the national government and TEPCO, as the entities responsible for the supply of electricity, for a stable electricity supply and the acceleration of decarbonization, requiring prompt and effective efforts from them.

The urgent requests include:

- ✓ Stabilizing electricity supply by restarting operable but suspended/shutdown power plants and maximizing renewable energy sources
- ✓ Improving/enhancing the operation of power grids, including strengthening the power storage capability in grid operation and prioritizing the use of renewable energy
- ✓ Disclosing/disseminating information and reaching out to Tokyo residents and businesses, such as the early provision of information and the creation of incentive measures to encourage power saving

On June 28, 2022, TMG submitted a shareholder proposal to TEPCO about ensuring a stable supply of electricity. On June 24, a few days before TMG made its submission, it had concluded a partnership agreement with TEPCO to concretely and steadily advance the stable supply of electricity and carbon neutrality.

The agreement includes:

Efforts for the stable supply of electricity and carbon neutrality:

- ✓ Applying the items in the shareholder proposal to the agreement: Stable supply, strengthening grids, information dissemination, and removal of utility poles
- ✓ Dissemination of information on electricity demand and requests for power-saving actions
- ✓ Collaboration to promote the spread of the HTT initiatives

Acceleration of the HTT efforts

TMG develops campaigns, such as Tokyo Cool Home & Biz, using HTT (Ⓗ Herasu (save), Ⓣ Tsukuru (generate), and Ⓣ Tameru (store) electricity) as a keyword, implements timely public relations according to the season and the tightness of electricity supply and demand, and promotes outreach activities in cooperation with businesses and organizations.

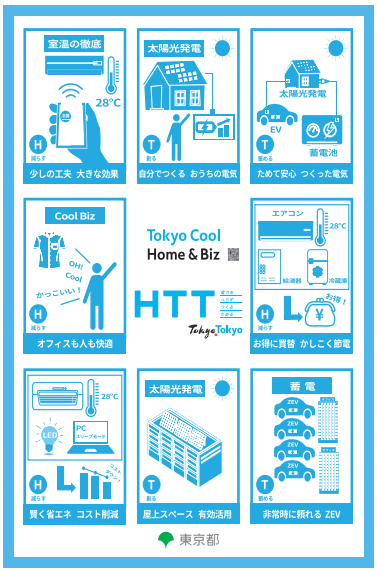
We also work with neighboring local governments, and issued joint messages along with three prefectures on June 3, 2022 and with eight prefectures in the service area of TEPCO just over a month later on July 7. On July 1 of the same year, we established the HTT/Zero Emissions Promotion Council, chaired by the governor of Tokyo, to strengthen cooperation with economic organizations, municipalities, and neighborhood associations.

To accelerate HTT efforts by Tokyo residents and businesses, a supplementary budget was formulated in June of the same year in order to strengthen and expand the support program, including the expansion of Tokyo Zero Emission Points, the relaxation of subsidy requirements for solar power generation equipment and power storage equipment, and the raising of upper limits of the subsidy.

Thoroughly implement its own initiatives in energy efficiency, power saving, and the introduction of renewable energy

On May 24, 2022, TMG set up a Headquarters for Energy and Other Issues headed by the governor, through which the entire government has been working together to accelerate its efforts to deal with changes in the social structure and realize decarbonization beyond that. In addition to preparing in advance a Power Saving Plan based on the forecast of electricity supply and demand at TMG facilities, we confirm and review the BCP (Business Continuity Plan) so that we are fully prepared to minimize the impact on the lives of Tokyo residents.

Tokyo Cool Home & Biz awareness poster



Column

TMG's Initiatives for Tight Supply and Demand of Electricity

Based on the experience of power saving when the supply and demand of electricity was tight after the Great East Japan Earthquake and spurred on by the power shortage warning issued in March 2022, we strengthened our power-saving measures in June 1 of the same year and have made all possible preparations since then, such as helping TMG facilities draw up the Power Saving Plan in advance (Step 2), in addition to the power saving measures that have already been in place (Step 1).

This enabled us to call for power-saving actions by municipalities and economic organizations and smoothly implement our own initiatives in power saving (Step 3) when the power shortage advisory was issued in late June of the same year. We will continue to take proactive actions in case of tight supply and demand of electricity.

Step 1: Existing measures From April 22, 2022

- ✓ Turn off half of the corridor lighting
- ✓ Keep room temperature at 28°C
- ✓ Turn off toilet seat heating and warm water
- ✓ Practice Cool Biz

Step 2: Enhancing power-saving measures From June 01, 2022

- ✓ Turn off part of office lighting, including passages on the corridor side
- ✓ Use motion sensors to control corridor lighting (turn off all or half)
- ✓ Make sure to turn off lights in unoccupied areas
- ✓ Form TMG Power-Saving Patrols
- ✓ Turn off air conditioners along the windows
- ✓ Reduce cooling load by lowering blinds whenever necessary

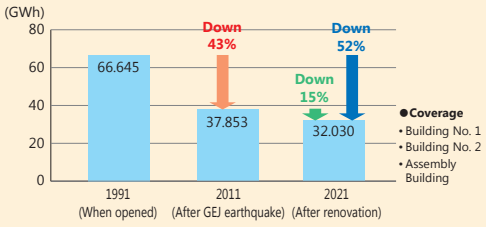
Step 3: Tight electricity supply

Implement power safeguards

According to the Power Saving Plan prepared in advance:

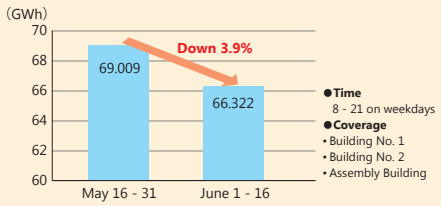
Save power upon advisory
Save more power upon warning

Progress in power saving at TMG buildings



Effects of initiatives taken since June 1

Power consumption at TMG buildings per day (average of 12 days)



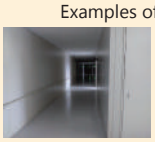
■ TMG's response to the power shortage advisory since June 26, 2022

Course of events

- Sun. June 26: 16:00: Advisory for June 27 issued by ANRE* (Advisory indicates wide-area reserve margin of 3 - 5%)
- Mon. June 27: **10:30: Holding of Crisis Management Meeting**
- Mon. June 27: 16:00: Advisory for June 28 issued by ANRE
- Mon. June 27: 18:00: Preliminary information for June 29 announced by TEPCO PG (Area reserve margin under 5%)
- Tue. June 28: 16:00: Advisory for June 29 issued by ANRE*
- Tue. June 28: 18:00: Preliminary information for June 30 announced by TEPCO PG
- Wed. June 29: 16:00: Advisory for June 30 issued by ANRE*
- Thu. June 30: Restarting of Anegasaki Thermal Power Station in Chiba Prefecture
- Thu. June 30: 18:00: Advisory canceled by ANRE* (*ANRE = Agency for Natural Resources and Energy)

- •Sunday, June 26:
  Calling for power-saving actions by municipalities, economic organizations, and bureaus
- •10:30, Monday, June 27:
  Holding of Crisis Management Meeting
  Implementing power safeguards; Checking efforts made at TMG facilities
  Calling for power-saving actions by Tokyo residents and businesses

Examples of efforts made at TMG buildings


Corridor lights off

Reminders

Memo requesting cooperation


Power saving through working area control in smart offices
(Calling for the development in smart offices throughout TMG)

Direction of Policies

TMG will overcome the crisis through all-out efforts together with Tokyo residents and businesses by taking all possible measures from the perspective of the HTT (Ⓗ Herasu (save), Ⓣ Tsukuru (generate), and Ⓣ Tameru (store) energy) initiatives in preparation for the impending tight supply and demand of electricity in summer and winter. At the same time, in order to realize a truly sustainable city that will not be shaken by any crisis, we will drastically strengthen and thoroughly implement our initiatives to promptly realize the decarbonization of energy that is indispensable for ensuring energy security.

Dealing with the impending energy crisis

TMG will take the lead in addressing the impending energy crisis, and promote behavior changes of Tokyo residents and businesses under the catchphrases of HTT.

Efforts for a stable supply of electricity in collaboration with various entities

To seek the cooperation of Tokyo residents and businesses in saving power, it is essential to disclose background information promptly and accurately.

To this end, TMG will take every opportunity to request the stable supply of electricity and the early disclosure of the supply and demand situation from the national government and TEPCO, as well as promptly building a strong communication system between the parties concerned.

We will ensure even greater effectiveness by expanding efforts to reach out to stores, businesses, and economic organizations, and strengthen cooperation with neighboring local governments.

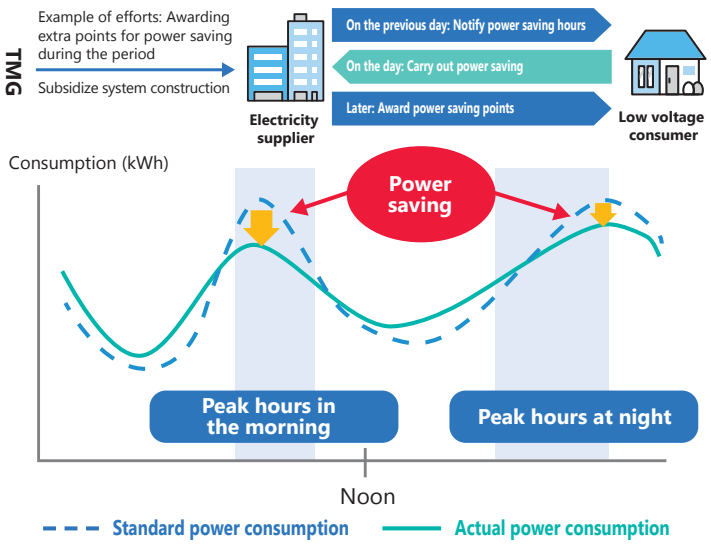
Development of strategic public relations and support measures to ensure the effectiveness of efforts

TMG will link the HTT efforts to the continuous promotion of decarbonization by strategically and aggressively developing "convincing" publicity so that Tokyo residents and businesses can continue to work on energy efficiency and power saving measures as their own issues without bearing excessive burden.

In addition, we will encourage power saving management (demand response)* in which general electricity utilities set up price incentives and ask Tokyo residents and businesses to reduce power consumption in the case of the tight supply and demand of electricity as well as efforts by electricity suppliers in which they expand an adjusting mechanism for the supply and demand of electricity, such as the use of hydropower, storage batteries, and hydrogen, in order to maximize the connection of renewable energy to the grid.

* A mechanism that encourages the reduction of electricity usage, curbs power consumption during peak hours, and ensures a stable supply of electricity through such methods as setting electricity prices for each time period and paying consumers for not using electricity during peak hours.

Schematic representation of power saving management (demand response)



Further pursuing TMG's initiatives for its own sustainability

TMG will deepen its proactive measures for power saving and energy efficiency throughout the organization as a major energy consumer by consolidating and sharing best practices, including the Power Saving Plan prepared and reviewed based on the forecast of electricity supply and demand at its facilities. We will also spread the know-how to businesses and municipalities.

In addition to introducing solar power generation equipment with maximum capacity to our facilities where possible, we will accelerate efforts for ⓉTsukuru (generating) and ⓉTameru (storing) electricity by promoting the introduction of power storage equipment and the expansion of the use of hydrogen.

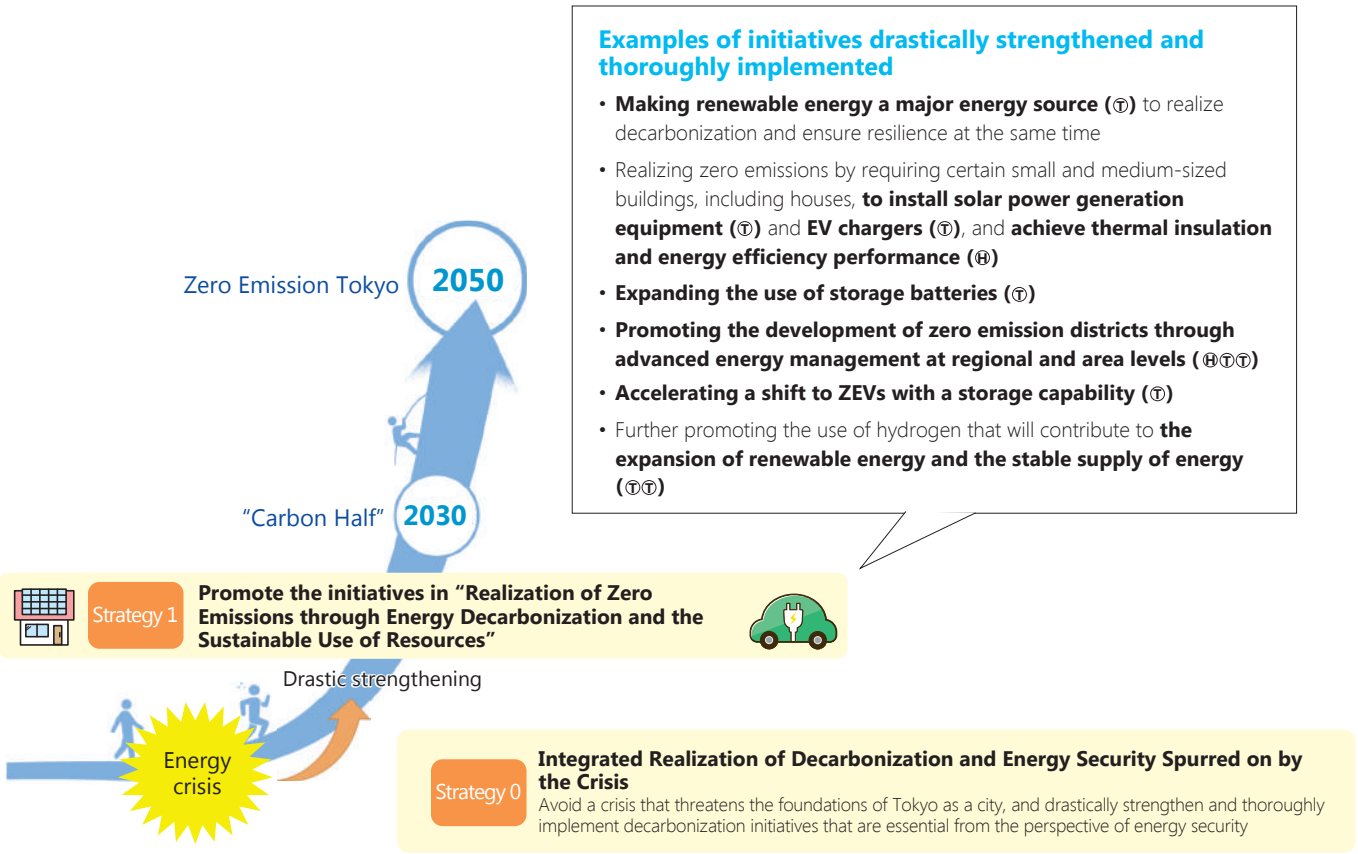
Drastic strengthening of energy decarbonization initiatives

TMG has made every possible effort on initiatives toward decarbonization, maximizing energy efficiency and expanding the installation and use of renewable energy equipment.

In light of the recent energy crisis, we will drastically strengthen and thoroughly implement energy efficiency measures and decarbonization initiatives, such as expanding the introduction of renewable energy and hydrogen, to break away from dependence on fossil fuels.

To this end, we will significantly deepen the initiatives in Strategy 1 "Realization of Zero Emissions through Energy Decarbonization and the Sustainable Use of Resources" to realize decarbonization and energy security in an integrated manner.

Relationship between Strategies 0 and 1



Strategy 1

Realization of Zero Emissions through Energy Decarbonization and the Sustainable Use of Resources

Realization of Zero Emissions through Energy Decarbonization and the Sustainable Use of Resources

For the early realization of a decarbonized society, it is essential to shift to a social system consistent with the 1.5°C target by promoting drastic transformations in various fields, including energy, urban infrastructure, and land use. In the shift process, Tokyo needs to consider every stage of the supply chain and contribute to CO_2 reduction not only in Tokyo but also in other regions, fulfilling the responsibility of a big city that has a great influence on the use of energy and resources.

It is the responsibility of cities to protect the lives and property of their citizens from climate change impacts. Having an economy and society that is resilient and in harmony with the environment is indispensable for increasing the value of cities and strengthening their international competitiveness.

Tokyo will attract vitality and new opportunities to open up the future, and grow and mature as an even more attractive city by striving for net zero CO_2 emissions by 2050 and creating a paradigm shift in climate change measures.

Status Quo

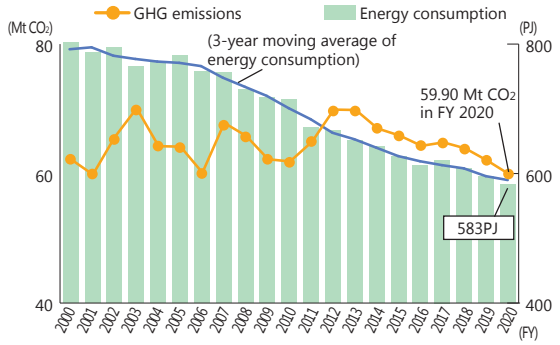
GHG emissions and energy consumption

Greenhouse gas emissions in Tokyo in FY 2020 were 59.90 million tonne-CO_2, resulting in a decrease of 3.7% from FY 2000. They have been trending slightly down since FY 2012 because of reduced energy consumption*1 and improvements in the CO_2 emission factors of electricity*2.

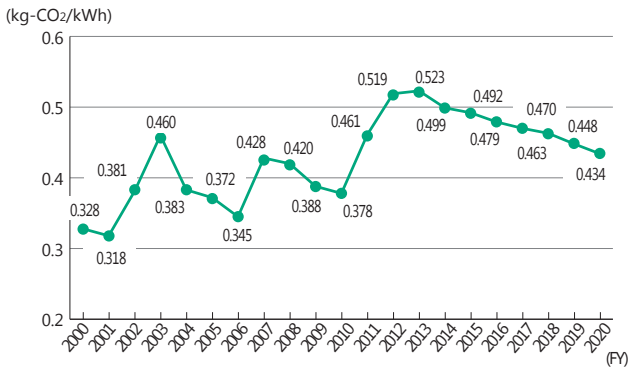
*1 The final energy consumption by the final demand sectors. As for electricity, secondary energy is used to calculate the final energy consumption excluding losses during generation, transmission, and distribution.

*2 A value indicating CO_2 emissions per kWh of electricity, which changes depending on the percentage of fossil fuels, such as coal, consumed for power generation.

Changes in GHG emissions and energy consumption

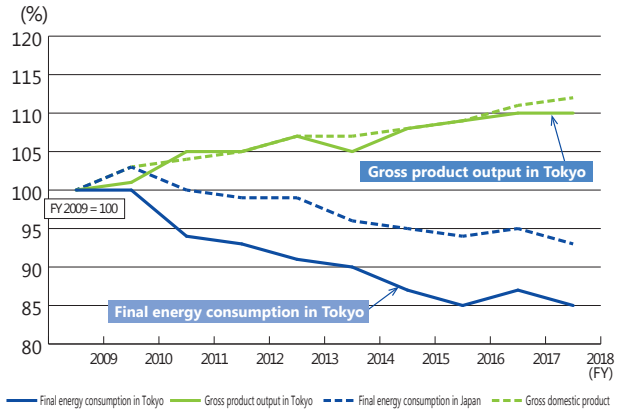


CO_2 emission factors of electricity in Tokyo



Energy consumption in Tokyo in FY 2020 was 583.4 PJ, resulting in a decrease of 27.3% from FY 2000. It peaked around FY 2000 and has been on a downward trend since then but the nominal gross product output in Tokyo has increased. This is indicative of a continuation of the process of decoupling, a state whereby energy consumption is reduced while maintaining economic growth.

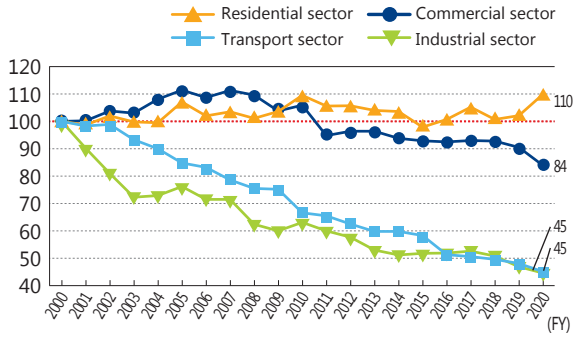
Changes in final energy consumption and gross production of Tokyo and Japan



Source: Tokyo Metropolitan Government. Tokyo Metropolitan Accounts.
Cabinet Office. National Accounts (GDP Statistics).
Agency for Natural Resources and Energy. Energy Supply and Demand Report.

For sectoral changes in energy consumption, the industrial and transport sectors have shown an overall relatively consistent decrease since FY 2000. The commercial sector shifted to a downward trend after peaking around FY 2007. The downward trend in the residential sector has stagnated since FY 2015. Final energy consumption in the residential sector in FY 2020 increased by 7.7% from the previous fiscal year, partly because of longer times spent at home due to the COVID-19 crisis. It was the only sector that showed an increase from FY 2000 Sector breakdown of energy consumption in FY 2020 consists of 7.4% for industry, 37.8% for commercial, 35.0% for residential, and 19.9% for transport.

Sectoral growth in final energy consumption



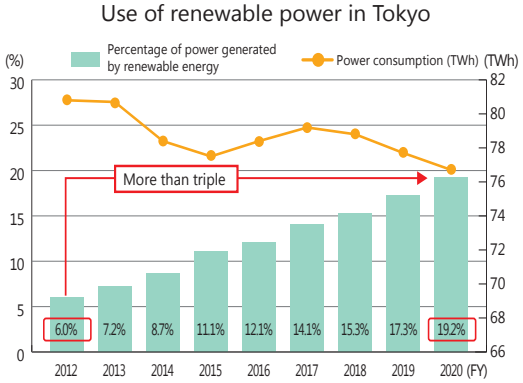
Introduction of renewable energy

The percentage of power generated by renewable energy in Tokyo in FY 2020 was 19.2%, more than tripling in the last eight years. However, further expansion of the percentage of renewable energy is essential for decarbonization.

In addition to maximizing the introduction of renewable energy equipment in Tokyo, it is necessary to further increase the percentage of renewable energy used for the electricity provided by electricity suppliers.

Along with renewable power, heat from renewable energy sources, such as solar heat and ground source heat, is utilized as a measure to reduce the use of fossil energy.

Use of renewable power in Tokyo



Source: Survey on the use of renewable energy in Tokyo.

Trends in climate change measures

Trend of decarbonization expanding around the world

Efforts to achieve carbon neutrality, which means reducing greenhouse gas emissions to net zero, are accelerating around the world.

China, the world's largest greenhouse gas emitter, declared that it will achieve net zero greenhouse gas emissions by 2060. The United States, the second largest emitter, announced net zero greenhouse gas emissions by 2050. Furthermore, Europe, which is at the forefront of decarbonization, has legislated the achievement of climate neutrality by 2050 as a binding target in the EU region.

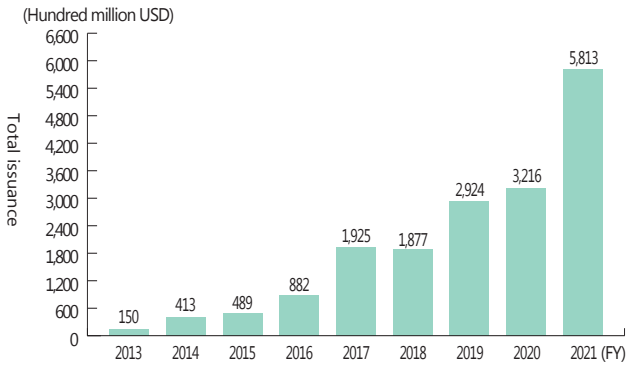
Japan declared that it strives for carbon neutrality by 2050. It also aims to reduce its greenhouse gas emissions by 46% in FY 2030 from its FY 2013 levels, and continue strenuous efforts in its challenge to meet the lofty goal of cutting its emissions by 50%, submitting the NDC (Nationally Determined Contribution) reflecting the new reduction targets to the United Nations.

With the role of non-state actors, including cities around the world, becoming increasingly important, the number of cities participating in Race To Zero, an international campaign to bring together ambitious efforts of non-state actors toward a shift to a decarbonized society, has more than doubled in the past year.[*3]

*3 The number of participating cities was 1,124 as of July 2022.

Efforts for decarbonization are becoming an essential element of business activities. Sustainable finance to realize a sustainable society is expanding rapidly, and green or sustainability bonds are actively used to promote business that contributes to environmental improvement, resulting in an increase in the amount issued.

Changes in the issuance of green bonds in the world



Source: Green Finance Portal website of the Ministry of the Environment.

In addition to reducing emissions directly from their own business activities, businesses are accelerating efforts to enjoin their partners to also take measures for decarbonization to enhance emission reductions throughout the supply chain. In Japan, the Tokyo Stock Exchange, Inc. revised the Corporate Governance Code in June 2021 to request climate change disclosure based on the TCFD*4 or an equivalent international framework from businesses listed on the Prime Market.

The level of climate change measures required of businesses is rising, with an increasing number of businesses participating in CDP*5, SBT*6, and other climate change initiatives.

*4 Task Force on Climate-related Financial Disclosures established to explore how climate-related information should be disclosed and how financial institutions should deal with that. The TCFD published its final report in June 2017 with a recommendation that businesses disclose items pertinent to climate change-related risks and opportunities.

*5 An NGO headquartered in London, UK, which acts as an agent for institutional investors, such as pension funds, and large client businesses, and surveys businesses and local governments, disclosing and labeling their answers.

*6 SBT or Science-Based Targets is one of the target setting schemes that identifies businesses working on environmental issues. As of July 7, 2022, it has 3,282 participants consisting of 1,504 certified companies and 1,778 committed companies.

Introduction and use of renewable energy accelerated at home and abroad

An analysis by the International Energy Agency (IEA) says that the capacity (stock) of renewable power generation facilities in the world increased to about 2,000 GW in 2015, making it the largest power source. Since then, the capacity of renewable power generation facilities has grown by about 180 GW every year.

Some countries in Europe and other regions have already started using renewable energy, such as hydropower, wind power, and solar power, as their main power sources. Strategies launched against this backdrop clarify the promotion of hydrogen from renewable energy (Green Hydrogen) in anticipation of the era of the massive introduction and supply of renewable energy.

RE100, in which businesses aim to cover 100% of the electricity used for their operation with renewable energy, increases its membership every year. The situation surrounding renewable energy is changing significantly, with some global businesses requiring that their Japanese subsidiaries and partners in the supply chain use 100% renewable power.

"Sector coupling" initiatives have begun to advance the decarbonization of an entire society by extending efforts in the power sector to other consumption fields, including transport, industrial, and heat sectors.

A wide range of industries are involved in the movement accelerating toward building a decarbonized energy system that combines renewable energy, power storage, and digital control technology. An increasing number of businesses have embarked on the development of distributed energy systems capable of advanced energy management focusing on renewable energy and have started trials on hydrogen and methanation.

Importance of measures based on a consumption-based perspective

Consumption-based greenhouse gas (GHG) emissions is a concept that counts the GHGs emitted when a product is produced as the emissions in the region where it is finally consumed. On the other hand, production-based GHG emissions is a concept that attributes the GHGs emitted when a product is produced to the place of production.

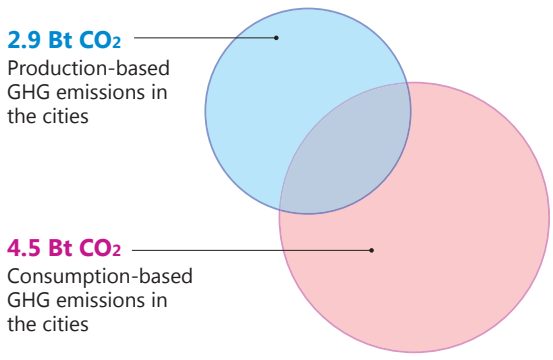
In a report released in 2019, the C40 Cities Climate Leadership Group shows the importance of considering consumption-based CO_2 emissions as cities have a significant impact on GHG emissions across geographic boundaries via the global supply chain.

Research on the calculation method for consumption-based emissions has been advanced because they help identify the actual state of energy consumption more clearly.

TMG estimated consumption-based GHG emissions related to the final demand in Tokyo in 2015 and found that they were approximately 210 million tonne-CO_2, which is more than double production-based GHG emissions.

As a global metropolis and a major consumer of energy and resources, TMG needs to take the lead in reducing CO_2 emissions at home and abroad, taking into consideration the consumption-based perspective.

GHG emissions from 96 C40 member cities based on production and consumption



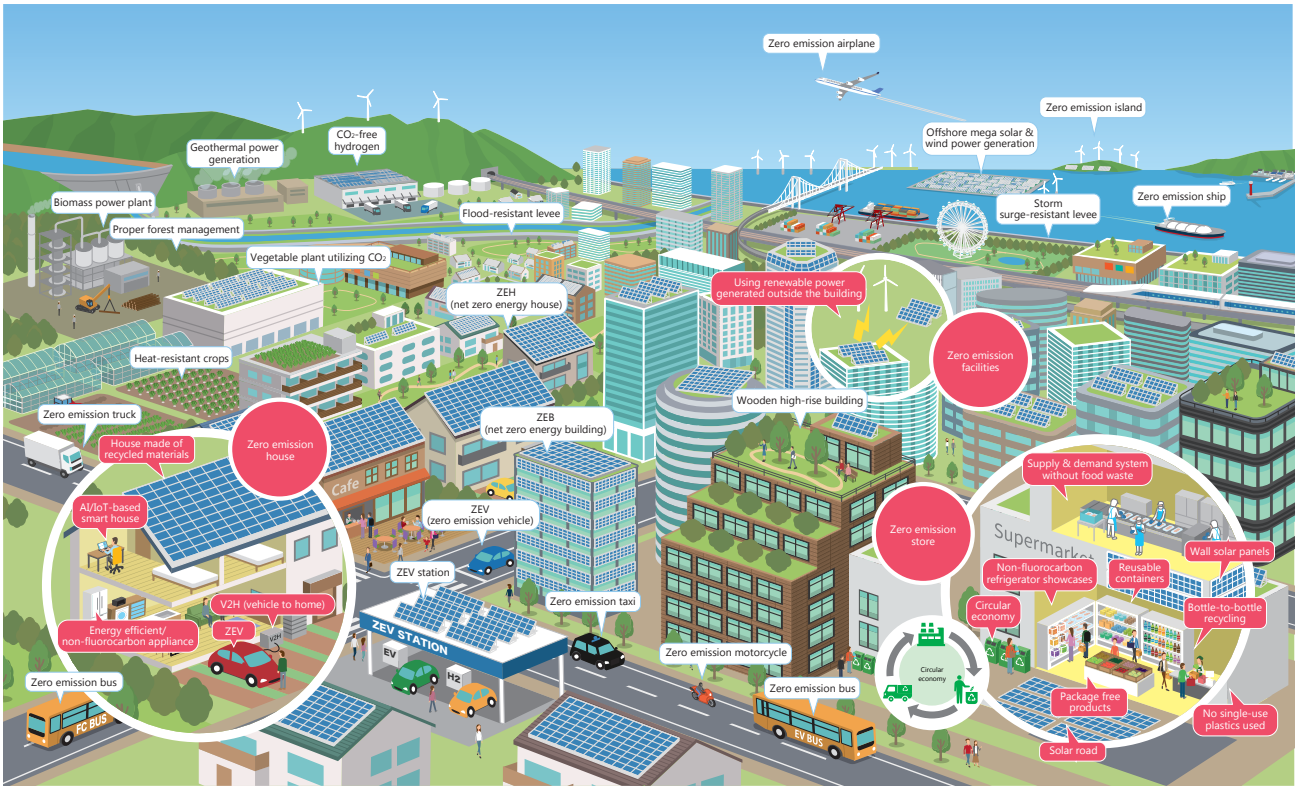
Source: The Future of Urban Consumption in a 1.5°C World, C40 Cities Headline Report

Visions for 2050

As one of the world's largest cities, Tokyo aims to realize a Zero Emission Tokyo by pursuing efforts to limit the temperature increase to 1.5°C in order to fulfill its responsibility as a major energy consumer and continue to be a city that achieves resilient and sustainable growth in a decarbonized society. Tokyo will strive for achieving net zero CO_2 emissions in itself and contributing to the reduction of CO_2 in other regions by developing climate change measures based on efforts in a wide range of fields: Energy efficiency, the use of renewable energy, minimizing CO_2 emissions through hydrogen etc., resource efficiency, the utilization of recycled resources, the spread of ZEVs, measures for fluorocarbons, and the encouragement of revolutionary innovation.

- Realize a Zero Emission Tokyo that will contribute to achieving net zero CO_2 emissions worldwide

Imagined Community in 2050



2030 Targets

Actions in the period up to 2030 are extremely important to establish the social infrastructure for the realization of a decarbonized society. Ensuring the economy, health, and resilience, and accelerating decarbonization actions in all fields are essential for achieving the well-being of Tokyo residents and businesses. Based on this recognition, we aim to achieve "Carbon Half," a plan to halve greenhouse gases by 2030.

- GHG emissions in Tokyo compared to 2000: 50% reduction ("Carbon Half")
- Energy consumption in Tokyo compared to 2000: 50% reduction
- Percentage of power generated by renewable energy: Approx. 50% (Intermediate target: Approx. 30% by 2026)

To promote reduction measures in each sector toward a 2030 Carbon Half, new sectoral targets have been set for energy-related CO_2 emissions and energy consumption based on the following concept:

● Sectoral targets

Energy-related CO_2 emissions

These targets have been set for each sector to make a 50% reduction from the status quo (2019), taking into account sectors that had already made a significant reduction by 2019.

(Unit: Mt CO_2eq)

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

Energy consumption

The targets set in the Tokyo Environmental Master Plan formulated in 2016 have been strengthened by one step for each sector. The target for the residential sector has been set taking into account that energy consumption has increased due to an increase in the number of households, up approximately 30% from 2000, in spite of a decrease in energy intensity per household, and the number of households in Tokyo is expected to increase until 2035.

(Unit: PJ)

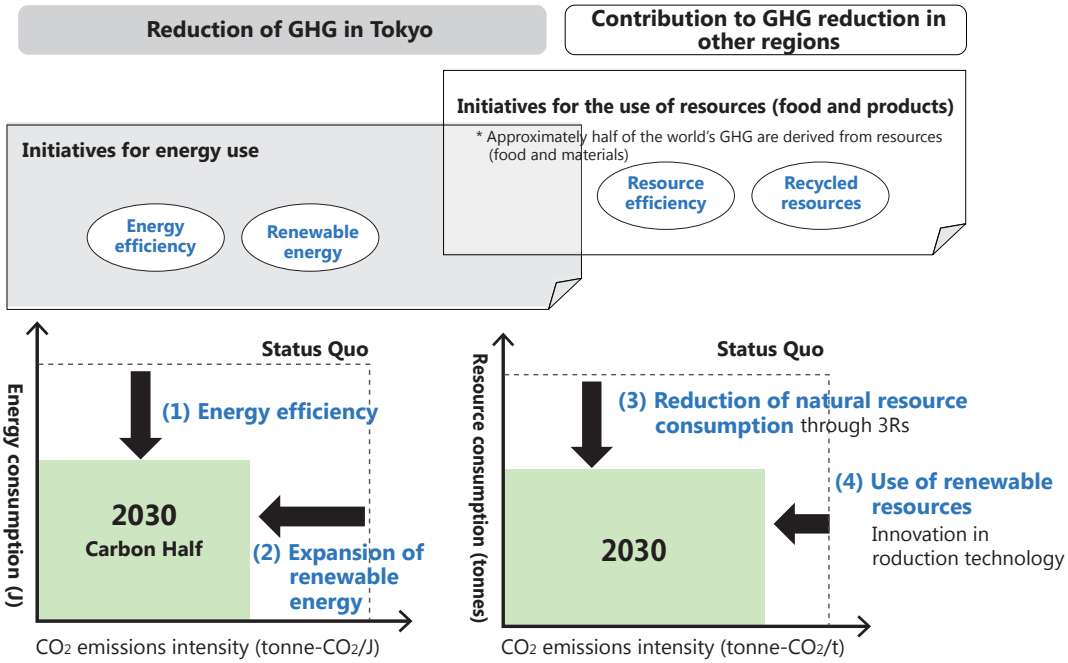
	2000 (Baseline)	2019 (Status quo)		2030			Tokyo Environmental Master Plan in 2016 (from 2000)
	Consumption	Consumption	From 2000	Consumption (Estimate)	Sectoral targets (From 2000)	From 2019	
Industrial/ commercial sectors	359	284	-20.9%	233	Approx. 35% reduction	-18%	Approx. 30% reduction
Industrial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

Basic Concept for Actions toward 2030

- To realize "Carbon Half," promote both mitigation and adaptation measures to minimize risks from climate change impacts.
- Develop sustainable resource management initiatives that consider all stages of the supply chain, including the procurement, manufacturing, distribution, use by consumers, and disposal/recycling of resources, to realize the sustainable use of resources, as initiatives for sustainable resource management also contribute to climate change measures.
- Decisively develop efforts (1) to (4) shown below in the industrial, commercial, residential, transport, and other sectors through improvements in efficiency, switching of energy/material, and behavior change, taking into account the timeline.
- Promptly lay the foundation for further emission reductions from 2030 to 2050.
- Promote efforts from the perspective that climate change is interconnected with other fields, such as biodiversity and air quality. Since biodiversity plays an important role in climate change mitigation and adaptation, we will also promote the conservation of forests, which act as habitats for a variety of living things and sinks for carbon dioxide.

While promoting our efforts, we will further accelerate the following strategies:

(1) Making Renewable Energy a Major Energy Source
(2) Expanding Zero Emission Buildings
(3) Promoting Zero Emission Mobility
(4) Expanding the Use of Hydrogen Energy
(5) Realizing the Sustainable Use of Resources
(6) Efforts toward Zero Hydrofluorocarbon Emissions
(7) Promoting Climate Change Adaptation Measures
(8) Bold Acceleration of TMG's Initiatives for Its Own Sustainability



Making Renewable Energy a Major Energy Source

Tokyo is a major consumer of energy. To realize a Zero Emission Tokyo, it is essential to maximize energy consumption efficiency and switch to decarbonized energy centering on renewable energy that emits no greenhouse gases.

Renewable energy is a purely domestic energy source that makes use of local nature, and superior from the perspective of energy security compared to fossil fuels that depend on foreign imports. As heavy rains and other natural disasters increase, local production and consumption of renewable energy, which is distributed energy, can be continued when the energy supply network is disrupted, contributing to improvements in the resilience of cities.

Amid concerns over the prolonged rise in energy prices, the burden on households and small and medium-sized businesses has become even heavier. Self-consumption of energy by installing renewable energy equipment is economically advantageous.

TMG will decisively promote the introduction and standardized use of renewable energy by correctly responding to the energy crisis and accurately identifying the global trend of the accelerating expansion of renewable energy.

Status Quo

Characteristics and trends of renewable energy

Making renewable energy a major energy source is an important pillar for achieving zero emissions by 2050 and "Carbon Half" by 2030. The amount of power generated by renewable energy sources, such as solar power and wind power, depends on the season and weather. However, this inconvenience can be compensated by introducing multiple renewable energy sources with different characteristics as for example wind power can generate power at night or on cloudy days while the output of solar power generation is reduced due to bad weather. It is also effective to utilize stored renewable energy in case of power shortages through energy management based on IoT and storage batteries.

On the other hand, most of the mainland of Tokyo is not suitable for wind power generation due to weak winds, and there is not sufficient land for installing mega solar systems. In order to further expand the introduction of renewable energy, it is important not only to install renewable energy equipment for local production and consumption in Tokyo, but also to actively use renewable energy generated in other regions with more favorable conditions for its implementation. To that end, it is necessary to enhance cross-regional interconnection lines on a nationwide scale and strengthen adjustment mechanisms for both the supply and demand of electricity.

While the introduction and use of renewable energy is rapidly expanding around the world, government, industry, and academia in Japan are working together to accelerate efforts to make the most effective use of the potential for the introduction of renewable energy that is estimated to be seven times the amount of power generated in Japan today.[*1] For example, the operation of regulations for geothermal power generation with a high potential for introduction will be reviewed to double its amount by 2030. Efforts are also underway to commercialize next-generation technologies, such as perovskite solar cells that are lighter and more flexible than existing solar cells.

*1 Ministry of the Environment. Study on the Potential for the Introduction of Renewable Energies.

Various Renewable Energy/Power Sources

Renewable energy presents different challenges for each power generation method, such as the amount of power generated fluctuating depending on the weather and time of day, and the cost of installation and management. However, it is expected to be further utilized as energy that is friendly to the environment and can be produced in Japan.

Solar power generation
Solar panels are installed to convert sunlight into electricity. They are becoming popular among households as they can be installed in ordinary houses.

Geothermal power generation
The hot steam and water heated by underground magma are used to turn turbines and generate electricity.

Wind power generation
The force of the wind is used to rotate blades, and the rotating force is used to generate electricity. Wind generators are being installed on the windy sea in addition to land.

Biomass power generation
Electricity is generated using fuel made from resources derived from animals and plants, such as livestock manure, garbage, and wood chips.

Hydropower generation
The force of flowing water is used to turn a waterwheel to generate electricity. Hydropower generation ranges from large ones that use dams and small and medium-sized ones that use agricultural water.

Introduction of renewable power in Tokyo

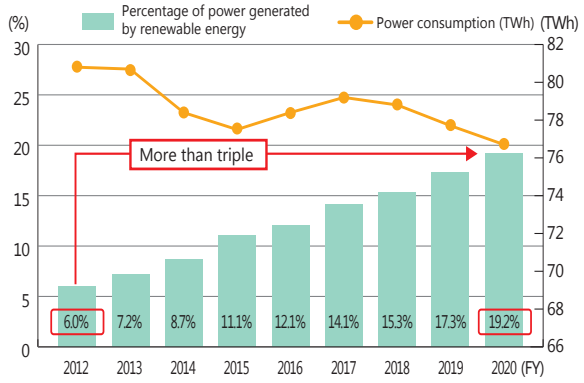
Percentage of power generated by renewable energy in Tokyo (repeat)

The percentage of power generated by renewable energy in Tokyo in FY 2020 was 19.2%, more than tripling in the last eight years. However, further expansion of the percentage of renewable energy is essential for decarbonization.

In addition to maximizing the introduction of renewable energy equipment in Tokyo, it is necessary to further increase the percentage of renewable energy used for the electricity provided by electricity suppliers.

Along with renewable power, heat from renewable energy sources, such as solar heat and ground source heat, is utilized as a measure to reduce the use of fossil energy.

Use of renewable power in Tokyo



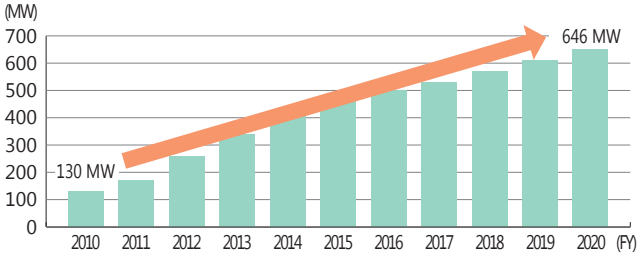
Source: Survey on the use of renewable energy in Tokyo.

Introduction of solar power generation equipment in Tokyo

In FY 2020, the capacity of solar power generation equipment installed in Tokyo was 646 MW.

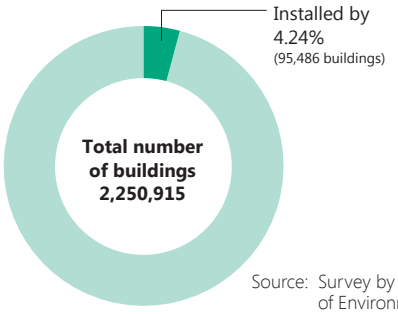
Installed capacity is increasing year by year, but there is still great untapped potential in Tokyo, as the equipment has been installed on only approximately 4% of houses, excluding island housing, deemed "suitable (including conditionally suitable)" for such installation in the Tokyo Rooftop Solar Register.

Capacity of solar power generation equipment installed in Tokyo



Percentage of installation of solar power generation equipment in Tokyo

Equipment has been installed on approximately 4% of houses, excluding island housing, deemed "suitable (including conditionally suitable)" for such installation in the Tokyo Rooftop Solar Register (potential map).

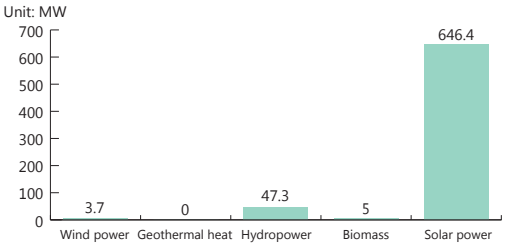


Source: Survey by the Bureau of Environment, Tokyo Metropolitan Government.

Introduction of other renewable energy

The capacity of renewable energy power generation equipment installed in Tokyo, including wind power, biomass, or small and medium-sized hydropower, is less than that of solar power generation equipment.

Capacity of renewable energy equipment installed in Tokyo at the end of FY 2020



Source: Survey by the Bureau of Environment, Tokyo Metropolitan Government.

Introduction example of solar power generation in Tokyo: Morigasaki Water Reclamation Center

Introduction example of hydropower generation in Tokyo: Tamagawa Power Plant No. 1

Supply of renewable power in Tokyo

Although the amount of renewable power supplied to Tokyo has been increasing year by year, only 20 electricity suppliers (approximately 7%) sourced at least 50% of their power from renewable energy in FY 2020.

TMG's efforts to promote renewable energy

In various programs based on ordinances, TMG has been encouraging the use of renewable energy through a mechanism for evaluating the use of renewable energy, an obligation to consider the introduction of renewable energy, and a mechanism for calculating the amount of renewable energy used as the amount reduced.

We have promoted the introduction and procurement of renewable energy by businesses, subsidizing self-consumption renewable energy equipment that contributes to mitigating power grid load and improving disaster preparedness and new renewable energy power generation equipment installed by consumers in Tokyo in other regions.

In addition to improving energy efficiency and disaster preparedness, we have promoted energy management that encourages energy interchange between areas. We also verify energy sharing methods to efficiently use regional renewable energy, and promote efforts to ensure advanced cases of utilizing regional renewable energy and improvements in resilience.

For households, given that Tokyo has many buildings, including houses, TMG supports the installation of solar energy equipment on roofs with a high potential for introduction, and raises public awareness through the Tokyo Rooftop Solar Register. To create an environment that makes it easier for Tokyo residents to switch to renewable power, we are carrying out the "Renewable Electricity Together" campaign in cooperation with other members of the Nine Local Governments Coalition, which recruits prospective purchasers of renewable power, allows group buying of renewable power, and helps reduce prices through economies of scale. The campaign has been expanded with Tochigi Prefecture participating in it in FY 2021.

Tokyo Rooftop Solar Register

As a measure for electricity suppliers, we work to expand the supply of renewable power through the Energy Environment Program that requires general electricity utilities to set targets for the percentage of renewable energy used and disclose the results.

Visions for 2050

TMG will pursue maximum energy efficiency and convert the energy used in all fields to decarbonized energy based on renewable energy. By expanding the introduction of renewable energy equipment for local production and consumption that enhances regional resilience and standardizing energy sharing to efficiently utilize renewable energy, we will maximize the introduction and use of renewable energy and establish a social infrastructure that allows productive urban activities.

- All energy used to be decarbonized
  - Supply of fully decarbonized electricity using renewable energy as a major power source
  - Standardization of local production and consumption of renewable energy and energy sharing

2030 Targets

- Percentage of power generated by renewable energy: Approx. 50% (Intermediate target: Approx. 30% by 2026)
- Capacity of solar power generation equipment installed in Tokyo: 2.0 GW or more

Direction of Policies

As approximately 70% of energy-related CO_2 emissions in Tokyo are associated with power consumption, and decarbonization technology of renewable energy power generation has already been established with regard to electricity, TMG will pursue maximum energy efficiency and promote the decarbonization of energy by decarbonizing electricity in particular by 2030.

In addition to accelerating the introduction of renewable energy equipment and the use of renewable power in Tokyo, we will decisively promote the procurement of renewable power from other regions taking into account sustainability. We will also promote the introduction of storage batteries and energy management systems.

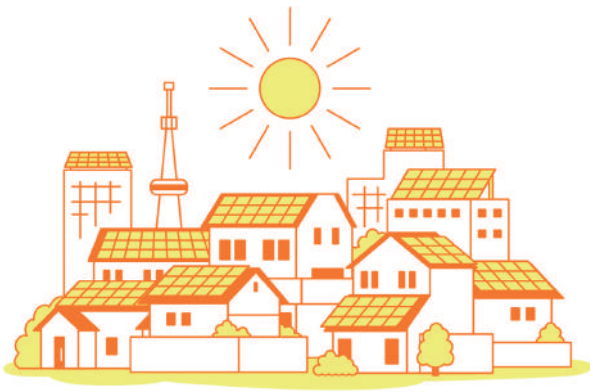
We aim to promote an approach from both the supply and demand sides of electricity by encouraging an increase in the percentage of renewable energy in the electricity supplied to Tokyo through the support for general electricity utilities that actively work to expand the supply of renewable energy.

In addition, we will work to expand the use of heat from renewable energy sources based on trends in technological development.

Standardization of the introduction and use of solar power generation equipment etc.

TMG will develop initiatives focusing on the use of solar power generation equipment that has a high potential for installation at buildings as Tokyo has been increasingly urbanized and has many buildings. The installation of solar power generation equipment benefits building users in terms of improved resilience and economic efficiency. The burden of installation has been greatly reduced due to the development of mass production and manufacturing technology for panels and a long-term drop in introduction costs. Private companies are developing various businesses, such as introduction with no setup cost, providing an environment that makes introduction much easier. The national government is also promoting the installation of solar power generation equipment by setting the goal of introducing it at 60% of new detached houses by 2030.

TMG will go beyond existing efforts to get into a new stage toward 2030, and decisively and swiftly promote the standardization of the new installation and use of solar power generation equipment, including the revision of programs based on ordinances.

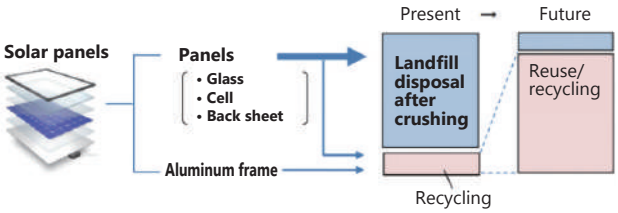


In standardizing the installation of solar power generation equipment, we will provide easy-to-understand and detailed information and raise public awareness on precautions for introduction and appropriate maintenance so that Tokyo residents can use the equipment safely and securely.

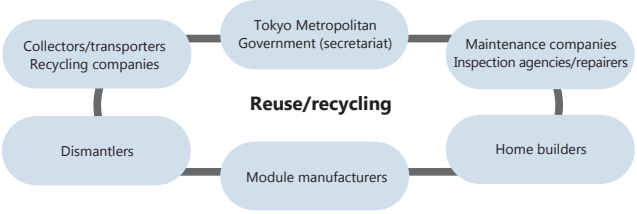
The mass disposal of solar panels installed through the FIT system is expected to begin by the mid-2030s. Based on the study by the Tokyo Metropolitan Government Council on Recycling Used Solar Power Generation Equipment, we will build a reuse and recycling system for residential use, which utilizes existing mechanisms for commercial solar panels, with help from a council composed of related businesses.

New options for installing solar power generation equipment

Shift of processing methods for residential modules in Tokyo



Outline of Recycling Council



Column

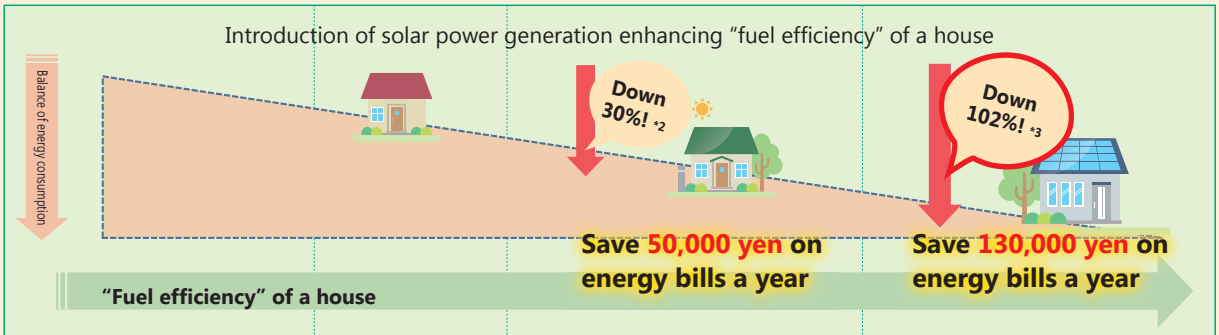
Improved thermal insulation and energy efficiency performance and the introduction of solar power generation enhance the "fuel efficiency" of a house! It's economical as the costs can be recovered!

Just as there are cars with good fuel efficiency or not, houses also have "fuel efficiency."

By choosing a house with high energy efficiency performance, using highly insulated walls and windows, and high-efficiency air conditioners, you can reduce energy (electricity and gas) consumption and save on energy bills.

A zero emission house*1 with high environmental performance provides economic benefits that exceed any additional outlay for equipment or construction!

In addition, by installing solar power generation equipment to generate energy, the balance of energy consumption will be virtually zero, greatly improving the "fuel efficiency" of a house!



Housing performance		Standard house*3	Tokyo Zero Emission House	Tokyo Zero Emission House with solar power generation (4 kW)
Saving on energy bills	1 year	– (Baseline)	-¥55,000	-¥130,000
	30 years	– (Baseline)	-¥1,650,000	-¥3,650,000
Increase in equipment and construction costs		– (Baseline)	+¥800,000	+¥1,780,000
Subsidies for Tokyo Zero Emission House*4		–	-¥300,000	-¥700,000
Subsidies from the national government*5		–	-¥800,000	-¥800,000
Decrease in housing loans*6		–	-¥220,000	-¥30,000
Total balance for 30 years		**– (Baseline)**	**-¥2,170,000**	**-¥3,400,000**

Economic benefits exceeding an increase in equipment and construction costs!

(As of September 2022)

*1 A house that uses thermal insulation materials and windows with high thermal insulation performance and incorporates home appliances with high energy efficiency performance as specified by TMG. (Level 1 is applied to the above estimate)

*2 Applicable to annual energy consumption for air conditioning, ventilation, hot water supply, and lighting at a 100 m2 detached house for a family of three. Source: Building Research Institute, Japan. Programs Based on Energy Saving Standards for Houses.

*3 A house in a ward of Tokyo, which meets the mandatory standards based on the Building Energy Efficiency Act scheduled to come into force in FY 2025.

*4 A subsidy of 200,000 yen to 2,100,000 yen will be provided according to the environmental performance (Levels 1 to 3) and categories of houses. If solar power generation equipment and/or storage batteries are installed as well, the subsidy will be increased according to the scale (Example: 100,000 yen/kW for solar power generation).

*5 Subsidies for home purchases by child-rearing families.

*6 Estimates based on the case when the Flat 35 S Interest Rate B Plan is applied and 30M yen is borrowed for a standard house.

For more information, visit the Solar Portal: **Tokyo Solar Portal**

Expansion of the introduction and use of renewable energy at businesses

The use of renewable energy has come to have a significant impact on business management as there is a rapid increase in the number of businesses aiming for RE100 and other initiatives in response to the global trend toward decarbonization and requests for information disclosure on climate change measures. To encourage businesses to introduce and procure renewable energy and decarbonize their business activities, TMG will promote the expanded installation and use of renewable energy equipment at buildings by strengthening and expanding programs based on ordinances, such as the Tokyo Cap-and-Trade Program[*2] and Tokyo Green Building Program.[*3]

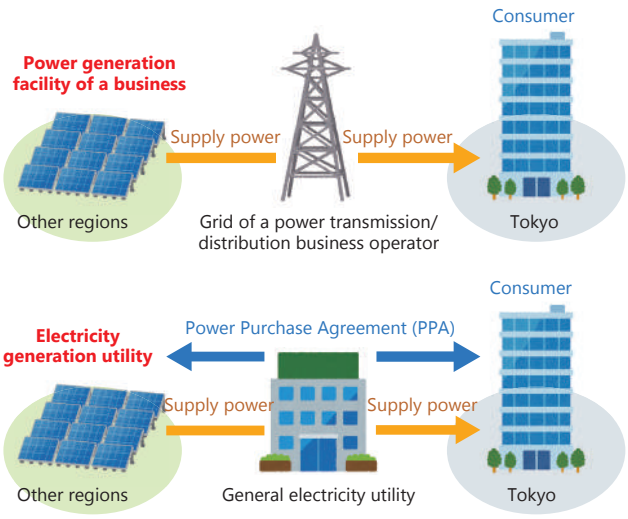
In anticipation of the era of the massive introduction and supply of renewable energy, we will expand the use of self-consumption renewable energy equipment that contributes to mitigating power grid load and improving regional disaster preparedness.

TMG will promote efforts to procure renewable power sources off-site, or from locations far away from the point of demand. In doing so, we will promote initiatives that lead to the installation of renewable energy equipment and work to return profits to the area where it is installed, such as enabling it to be used in the event of a disaster. We will also consider the perspective for the sustainability of renewable energy sources. In addition, we will encourage the use of renewable energy by disseminating the know-how for procuring renewable energy, including contract methods and risk sharing, to businesses and other organizations.

*2 The world's first urban cap-and-trade system launched in 2010. It is a method of carbon pricing.

*3 See "Expanding Zero Emission Buildings" on page 37 for information on strengthening and expanding programs based on ordinances.

Procuring renewable power sources off-site



Expansion of the introduction and use of renewable energy at home

Taking advantage of the installation potential, TMG will decisively promote the installation of solar power generation equipment and storage batteries at new and existing houses. We will establish a program based on an ordinance, which requires certain new, small and medium-sized houses to install solar power generation equipment and a charger for ZEVs with a power storage function, standardizing the installation and use of renewable energy equipment.[*4] These efforts will also contribute to improving resilience in times of disaster.

To encourage the use of renewable power by Tokyo residents, we will continue the "Renewable Electricity Together" campaign with a view to its nationwide expansion.

We will expand the introduction of solar heat, ground source heat, and other renewable energy, which also contributes to energy efficiency.

*4 See "Expanding Zero Emission Buildings" on page 37 for information on strengthening and expanding programs based on ordinances.

"Renewable Electricity Together" campaign logo

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自然の電気

Measures for energy suppliers

As the world is aiming for a decarbonized society, Tokyo will create an attractive business environment that allows the easy procurement of renewable energy. We will strengthen and expand the Energy Environment Program, which has encouraged the supply of renewable power by general electricity utilities supplying electricity to Tokyo, from these perspectives:

- Expansion of electricity suppliers with a higher percentage of renewable power
- Development of an environment with a wide variety of renewable power options to choose from
- Creation of a mechanism to support businesses with an aggressive approach

Realization of zero emission islands (ZEIs)

The islands are blessed with nature and have diverse potential for renewable energy, such as woody biomass and geothermal heat. Since each island has an independent power grid, it is important to expand the introduction of renewable energy and realize zero emission islands (ZEIs) from the perspective of securing electricity in the event of a disaster. TMG will actively provide support toward expanding the use of renewable energy as the islands have issues specific to them, such as the conditions of their location, and introduction costs being higher than those on the mainland.

It is necessary to establish adjustment technology for supply and demand, which does not rely on an adjustment mechanism for thermal power generation, in order to ensure a stable supply of electricity. We will establish and develop new technologies that utilize storage batteries etc. to gradually mitigate connection restrictions on each island.

Since the islands with unique ecosystems are important areas in terms of biodiversity, we will give full consideration to the conservation and restoration of biodiversity while promoting our efforts.

Ogasawara Islands

Promoting and responding to technological innovation

Technological innovation is essential for making renewable energy a major energy source. TMG will actively use renewable energy equipment and other new technologies, for which research and development is progressing rapidly, at its facilities, acting as a showcase for visually raising awareness of Tokyo residents and businesses and triggering expanded efforts at private facilities. For promising advanced technologies that have entered the implementation stage, we will actively support their spread to increase the options for decarbonization technologies.

Pavement solar panels

Vibration power generation

In order to achieve decarbonization by 2050, it is necessary to develop and commercialize new technologies, such as the use of carbon-neutral methane*5 for fields in which electrification is difficult, such as high temperature areas, in addition to electrification in applicable fields.

As these technologies are under development for commercialization from 2030 onwards, we will promote the decarbonization of energy by decarbonizing electricity in particular until 2030. With regard to the decarbonization of heat, we will continue to explore the shape of programs and mechanisms while paying close attention to the progress and international trends in technological development.

*5 A product made by synthesizing CO_2-free hydrogen from renewable energy and CO_2 recovered from exhaust gas of LNG-fired power plants and purifying the resultant. Such process is called the decarbonization of gas itself.

Column

Let's use a familiar renewable energy, ground source heat!

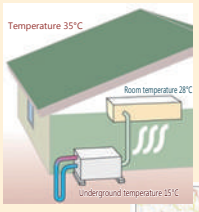
Ground source heat is a familiar renewable energy buried below us.

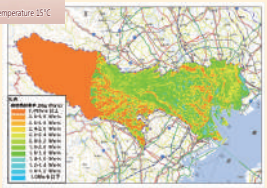
Since the temperature difference in the ground is smaller than that in the air throughout the year, the cooler ground source heat can be used for cooling (by dissipating heat) in summer, and the warmer ground source heat can be used for warming (by collecting heat) in winter. This means you can heat and cool your home with much less energy.

TMG has publicized the Tokyo Ground Source Heat Potential Map on its website, a web map that provides an estimate of the amount of ground source heat that can be collected (potential of introduction).

We also subsidize the costs of introduction to houses and facilities.

Example of a ground source heat system





Tokyo Ground Source Heat Potential Map

Expanding Zero Emission Buildings

With a population of approximately 14 million, Tokyo is the capital and political and economic center of Japan. It is home to densely built office buildings, residences, and other structures, serving as the base for global business and the lives of Tokyo residents. On the other hand, the majority of CO_2 emissions from the commercial/industrial sectors and the residential sector are from these buildings, accounting for 70% of the total. TMG will accelerate the realization of zero emissions by making energy use at buildings as efficient as possible, decarbonizing the energy we use, and making the most effective use of it through storage batteries.

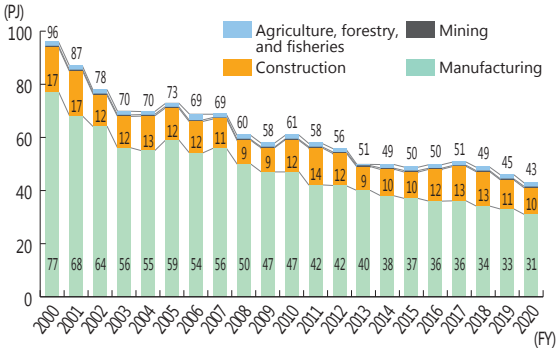
Realizing zero emission buildings makes cities more attractive as they provide stronger resilience and a more comfortable living environment. To ensure that Tokyo continues to be a safe, secure, vital, and sustainable city, we will strengthen our measures in a focused and drastic manner.

Status Quo

Trends in the commercial/industrial sectors

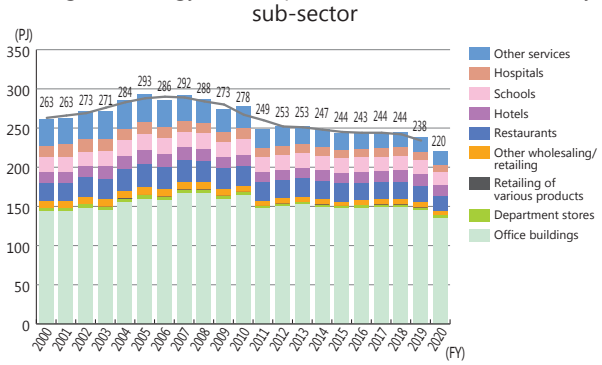
Final energy consumption in the industrial sector in FY 2020 was 43.0 PJ, a decrease of 55.4% from FY 2000. Overall, it has been trending downward since FY 1990.

Changes in energy consumption in the commercial sector by sub-sector



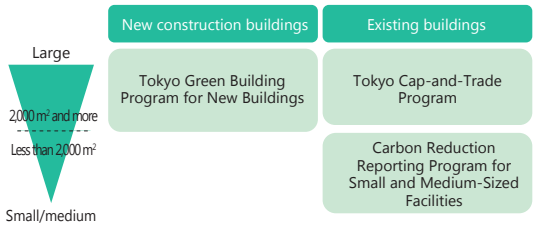
Final energy consumption in the commercial sector in FY 2020 was 220.4 PJ, decreased by 16.1 % from FY 2000 Though it rose from FY 1990 to a peak around FY 2007, it has since been trending down.

Changes in energy consumption in the industrial sector by sub-sector



Following the revision of all of its ordinances in 2000, TMG introduced the Tokyo Green Building Program in 2002, the Tokyo Cap-and-Trade Program and the Carbon Reduction Reporting Program for Small and Medium-Sized Facilities in 2010 in a proactive manner, according to the age (new or existing) and scale (large or small and medium-sized) of buildings. We have been developing effective initiatives ever since by strengthening and reviewing these programs.

Programs based on ordinances supporting TMG's initiatives

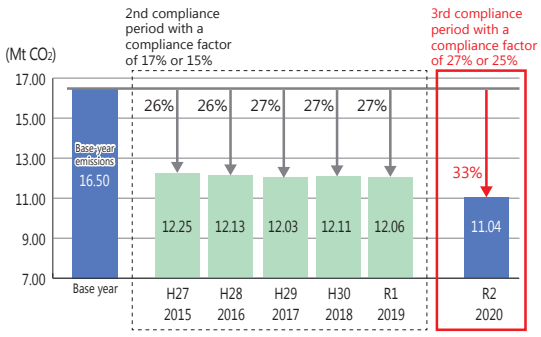


For large new buildings, TMG operates the Tokyo Green Building Program to encourage building owners to take proactive efforts for the environment from the construction planning stage. The environmental performance of large buildings and houses, including condominiums, has been improving since the start of the program.

As a measure for existing large buildings, the Tokyo Cap-and-Trade Program (C&T Program) is operated to impose CO_2 reduction obligations on large facilities that account for about 40% of the CO_2 emissions of the commercial and industrial sectors in Tokyo.

All covered facilities have fulfilled their CO_2 reduction obligations in compliance periods so far. In FY 2020, the first fiscal year of the third compliance period continuing through

Historical emissions in the C&T Program

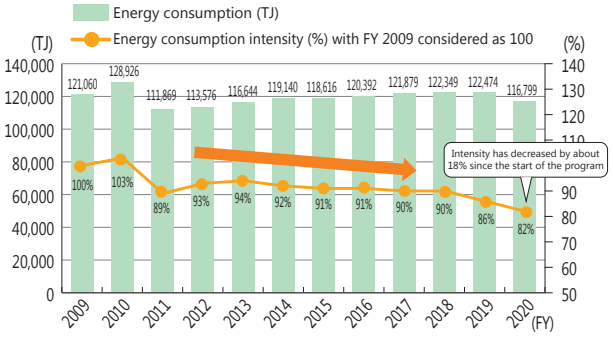


FY 2024, emissions from covered facilities totaled 11.04 million tonne-CO_2, which is a significant reduction of 33% compared to base-year emissions.

As a measure for existing small and medium-sized buildings, the Carbon Reduction Reporting Program for Small and Medium-Sized Facilities is operated to identify the status quo of CO_2 emissions and encourage energy efficiency measures at small and medium-sized facilities that account for about 60% of the CO_2 emissions of the commercial and industrial sectors in Tokyo.

While the energy consumption per unit of floor area has decreased due to the energy efficiency efforts of facilities, energy consumption as a whole has been flat because the number of facilities and the total floor area owned by entities subject to report submission has increased.

Changes in energy consumption and energy consumption intensity at businesses subject to report submission

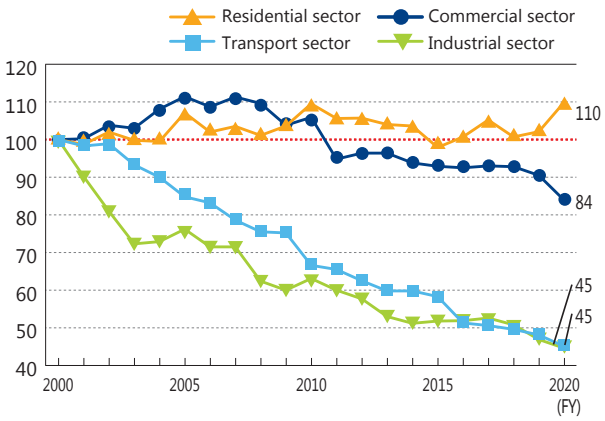


Through these programs, TMG has been encouraging the expanded use of renewable energy through a mechanism for evaluating the use of renewable energy, and by obligating businesses to consider the introduction of renewable energy and calculating the amount of renewable energy used as the amount reduced.

Trends in the residential sector

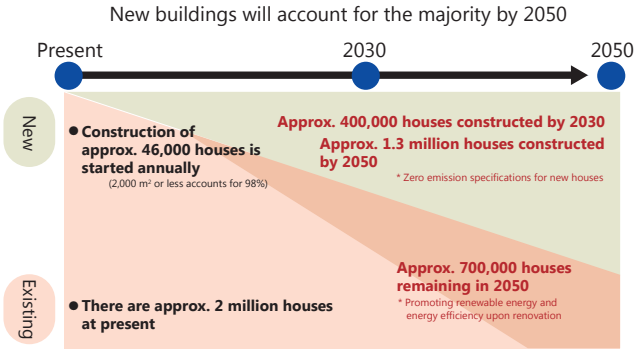
Final energy consumption in the residential sector in FY 2020 was 204.0 PJ, an increase of 9.9 % from FY 2000. The downward trend since 2011 has slowed to the point of stagnation recently. Partly because of longer times spent at home due to the COVID-19 crisis, it was the only sector that showed an increase in the consumption from FY 2000, indicating the need to strengthen the relevant measures.

Sectoral growth in final energy consumption



The annual number of new building starts in Tokyo has been around 50,000, of which new houses account for 90%. New houses are expected to account for the majority by 2050, and their environmental performance will have a major impact on the realization of a decarbonized society.

Status of houses in Tokyo (transition toward 2050)



* Calculations are based on the average number of construction starts over the past 10 years.
Source: Survey by the Bureau of Environment, Tokyo Metropolitan Government.

It is difficult to improve the environmental performance of houses in Tokyo as many of them are built on narrow plots of land and land prices are high. Therefore, based on the regional characteristics of Tokyo, TMG has formulated and implemented its own Tokyo Zero Emission House Standards, which requires higher thermal insulation and energy efficiency performance than that stipulated by the national government, and has subsidized new houses that meet the standards since FY 2019. While there is a high level of interest in the decarbonization of new houses, as evidenced by the number of applications exceeding the quota for subsidy projects, about 80% of the applications are from major home suppliers, posing the need to call for local contractors' participation.

東京ゼロエミ住宅
TOKYO ZERO EMISSION HOUSE

There are 6.81 million houses with residential households in Tokyo. For the decarbonization of such a large number of existing houses, insulating windows and doors would be effective, as a large amount of heat both enters and escapes through these openings. Insulating the doors and windows on a house not only saves energy, but also contributes to the health and comfort of its residents, such as reducing the risk of heat shock, alleviating allergic diseases, and preventing dew condensation. However, about 60% of houses in Tokyo were built before the standardization of double glazing glass and the adoption rate of double glazing glass in Tokyo is only 20%, which is significantly lower than the national level of about 30%. TMG is implementing support measures to promote upgrading to highly insulated windows and doors, but needs to further strengthen these efforts.

Trends in effective use of district energy and energy management

Under the Program on Effective Use of District Energy, TMG requires developers to take measures for the effective use of energy at the early stages of planning a large-scale development. For district heating and cooling areas, performance reports are required every fiscal year to promote improvements in energy efficiency. As of April 2022, approximately 1,479 ha of 90 zones were designated for district heating and cooling and heat was supplied in 84 zones, which has been effective in reducing CO_2 emissions and primary energy consumption.

TMG has promoted energy management that encourages energy interchange between districts in addition to improving energy efficiency and disaster preparedness. We also promote efforts to ensure advanced cases of efficiently using renewable energy introduced to local buildings and make sure of improvements in resilience.

Visions for 2050

The nature of buildings that form Tokyo will shape the city in 2050. In order for Tokyo to continue to be a city that will attract investment and businesses in the future, it is essential to realize zero emission buildings. TMG will establish a social infrastructure for sustainable urban activities by improving the thermal insulation and energy efficiency performance of buildings to ensure healthier and more comfortable living spaces, and enhancing resilience to power outages in the event of a disaster by means of distributed energy resources*1, such as solar power generation and storage batteries.

- All buildings in Tokyo to be zero emission buildings*2
  - All buildings to be zero emission buildings that account for adaptation measures (resilience), such as disaster prevention and heat countermeasures

*1 General term for power generation equipment, power storage equipment, and load systems.
*2 Buildings decarbonized by ensuring energy efficiency and using renewable energy.

2030 Targets

- GHG emissions in Tokyo compared to 2000: 50% reduction
- Energy consumption in Tokyo compared to 2000: 50% reduction
- Percentage of power generated by renewable energy: Approx. 50% (Intermediate target: Approx. 30% by 2026)
- Capacity of solar power generation equipment installed in Tokyo: 2.0 GW or more

Direction of Policies

Basic concept for efforts

Expansion of zero emission buildings

For new buildings, TMG will standardize those with performance that can eliminate CO_2 emissions and improve resilience while in operation by making maximum use of technology currently available. We will also actively evaluate efforts to encourage a shift to the use of low-carbon materials.

For existing buildings, we will further encourage more thorough energy efficiency and the expanded use of renewable energy to start a shift to zero emission buildings.

Expansion of zero emission houses

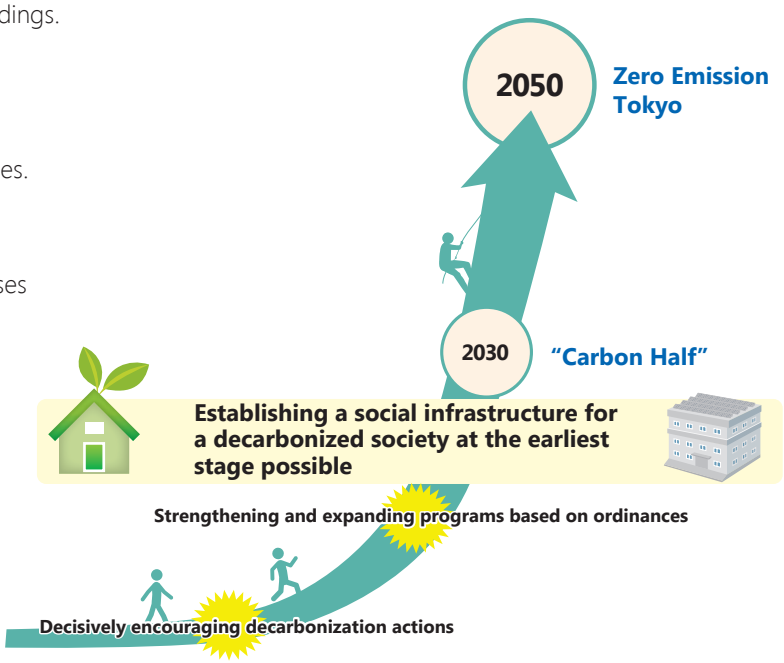
For new houses, TMG will standardize zero emission specifications to make them resilient and healthy houses.

For existing houses, we will encourage high levels of insulation, promote the installation of high-efficiency equipment, and convert them into zero emission houses equipped with distributed energy resources, such as renewable energy equipment and storage batteries.

We will actively raise public awareness about how to effectively use houses and their equipment, including in response to a disaster, measures for heat or health, and tips for a better home experience.

Direction of strengthening efforts

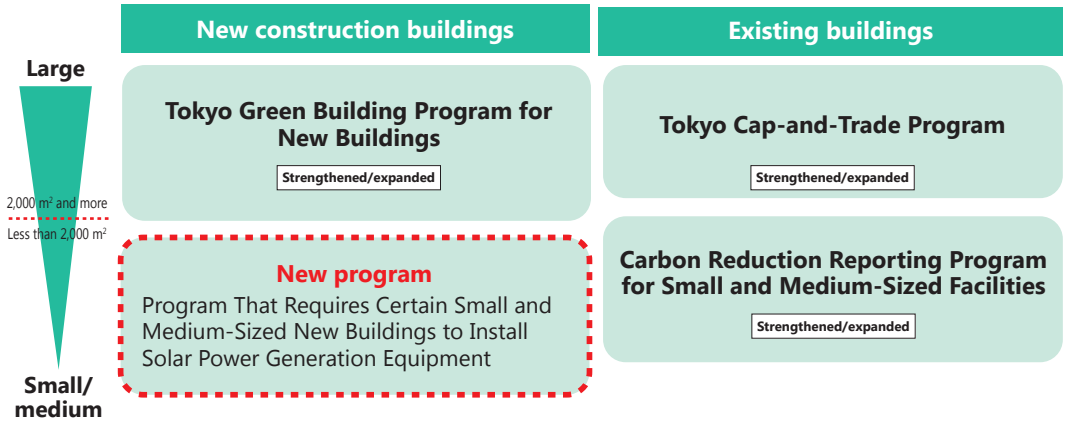
To establish a social infrastructure for a decarbonized society at the earliest stage possible, TMG will strengthen and expand the existing programs based on ordinances, and decisively encourage decarbonization actions by Tokyo residents and businesses.



Measures in the commercial/industrial sectors

Strengthening and expanding programs based on ordinances

In addition to strengthening and expanding the Tokyo Cap-and-Trade Program and other programs currently in place, TMG will establish a new program for small and medium-sized new buildings, which have so far eluded such institutional framework, in order to decisively promote the decarbonization of buildings in the commercial and industrial sectors.



■ Standardization of zero emission buildings by strengthening and expanding the Tokyo Green Building Program

To ensure in the planning stage of large new buildings that they will deliver performance that enables a significant reduction in CO_2 while in operation, TMG will promote the standardization of zero emission buildings by strengthening and expanding the Tokyo Green Building Program from the following perspectives:

- Further strengthening of standards for thermal insulation and energy efficiency performance, and the installation of renewable energy equipment.
- Mandatory installation of renewable energy equipment so that it will make full use of the potential of installation.
- Decisively encouraging efforts to procure renewable energy, including off-site installation and the purchase of renewable power, in addition to installation in buildings.
- Introduction of a mechanism to standardize the installation of ZEV chargers.
- Actively evaluating the use of low-carbon materials, consideration for biodiversity, and response to disaster preparedness and heat countermeasures (resilience).

■ Establishment of the Program That Requires Certain Small and Medium-Sized New Buildings to Install Solar Power Generation Equipment

Since most of the new buildings in Tokyo are small and medium-sized buildings, TMG will establish programs based on ordinances that require and encourage certain buildings of this type to improve thermal insulation and energy efficiency performance, and install renewable energy equipment and ZEV chargers, making TMG's measures more effective. We will also promote the use of low-carbon materials.[*3]

*3 As the programs should cover new small and medium-sized buildings that include houses, the detailed direction of policies is described in "Establishment of the Program That Requires Certain New Small and Medium-Sized Buildings, Including Houses, to Install Solar Power Generation Equipment" on page 44.

■ Expansion of "Carbon Half Buildings" (tentative name)*4 by strengthening and expanding the Tokyo Cap-and-Trade Program

To further accelerate the CO_2 reduction movement at large facilities and support businesses that are actively working on decarbonization efforts, TMG will encourage the realization of "Carbon Half Buildings" (tentative name) and other steps towards zero emission buildings by strengthening and expanding the Tokyo Cap-and-Trade Program from the following perspectives:

- Implementation of efforts to further raise the level of measures taken by covered facilities, including the setting of compliance factors to realize a 2030 Carbon Half.
- Introduction of a mechanism to further promote the use of renewable energy, including measures that require the reporting and publication of the targets set and status of initiatives related to the use of renewable energy, as well as the handling of renewable energy in consideration of trends in businesses and their diversified ways of procurement.
- Expansion of incentive measures to support proactive efforts, including incentives for facilities that have realized "Carbon Half Buildings" (tentative name) before 2030, efforts to allow such facilities to be more favorably evaluated in terms of financial values, and new measures to reduce their burden.

*4 Assuming facilities actively working on more through energy efficiency and the expanded use of renewable energy to realize Tokyo's 2030 Carbon Half.

■ Promotion of a shift to zero emission facilities by strengthening and expanding the Carbon Reduction Reporting Program for Small and Medium-Sized Facilities

To support efforts to respond to changes in the environment surrounding small and medium-sized facilities, such as requests from business partners for decarbonization, TMG will encourage the movement toward zero emissions at these facilities by strengthening and expanding the Carbon Reduction Reporting Program for Small and Medium-Sized Facilities from the following perspectives:

- Introduction of a mechanism to develop and expand the efforts for energy efficiency and the installation and use of renewable energy equipment by entities subject to report submission, including the presentation of target achievement levels by TMG, and the expansion of contents to be reported by businesses on the status of achievement and the use of renewable energy.
- Strengthening and expanding incentive measures to encourage efforts, such as a mechanism in which businesses and facilities making active efforts are evaluated in terms of financial values as well through the publication and utilization of more effective statistical data.

Column

TMG's Efforts for Information Disclosure on Climate Change Measures

■ Open data comprehensible to third parties

Under the Tokyo Cap-and-Trade Program and Carbon Reduction Reporting Program for Small and Medium-Sized Facilities currently in place, a wealth of data has been reported and accumulated, including the excellent environmental measures taken by facilities and the environmental performance of buildings (CO_2 emissions data, for example).

In the world today, where efforts to combat climate change are evaluated in terms of their financial values as well, it is essential to provide open data that is easily collected, analyzed, and understood by third parties.

While strengthening and expanding programs based on ordinances, TMG will more actively disclose various data so that businesses working on excellent climate change measures will be more highly valued by investors and financial institutions.

■ Utilization of the Tokyo Digital Twin* 3D Viewer

Since October 2021, TMG has been identifying facilities with excellent efforts to combat global warming on the Tokyo Digital Twin 3D Viewer.

We will continue to add and disclose data on the energy field.

* Based on data from sensors, infrastructure, such as buildings and roads, economic activities, the flow of people, and other elements are reproduced in cyberspace as "twins."

Encouragement of decarbonization actions by businesses

TMG will help establish decarbonization actions at an early stage by decisively encouraging active efforts by businesses to achieve zero emissions, such as expanding the use of renewable energy and improving the efficiency of energy use, prior to the strengthening and expansion of programs.

■ Expansion of the introduction and use of renewable energy at businesses

As the use of renewable energy has come to have a significant impact on business management, TMG will encourage the introduction and procurement of renewable energy by businesses to promote the installation and use of renewable energy equipment at buildings.

In anticipation of the era of the massive introduction and supply of renewable energy, we will expand the use of self-consumption renewable energy equipment that contributes to mitigating power grid load and improving regional disaster preparedness.

TMG will promote efforts to procure renewable power sources off-site, or from locations far away from the point of demand. In doing so, we will promote initiatives that lead to the installation of renewable energy equipment and work to return profits to the area where it is installed, such as enabling it to be used in the event of a disaster. We also need to consider the perspective for the sustainability of renewable energy sources. In addition, we will encourage the use of renewable energy by disseminating the know-how for procuring renewable energy, including contract methods and risk sharing, to businesses and other organizations.

■ Promotion of decarbonization at small and medium-sized facilities

TMG will strengthen efforts for small and medium-sized facilities that account for about 60% of the CO_2 emissions of the commercial and industrial sectors in Tokyo. Since they are not as well-financed as large businesses and their knowledge of decarbonization is limited, we will develop initiatives fine-tuned to their characteristics.

○ Promotion of decarbonization in cooperation with local financial institutions

In cooperation with local financial institutions that are familiar with the operational conditions of small and medium-sized businesses, TMG will encourage specific energy efficiency practices by raising their awareness about the importance of energy efficiency improving operational efficiency and providing energy efficiency consulting services with experts.

In order to promote the greening of bank loans in the indirect financial field, we will revitalize green finance and support the establishment of that approach, urging financial institutions to create a sustainability linked loan*5.

*5 A loan in which a borrower sets ambitious sustainability goals and the loan terms are linked to the achievement levels.

○ Provision of know-how in decarbonization and the enhancement of support measures based on social conditions

TMG has provided knowledge and know-how in energy efficiency to small and medium-sized facilities through various support measures, such as free-of-charge energy efficiency audits and business type-specific energy efficiency workshops. We will continue to flexibly respond to the social conditions surrounding small and medium-sized businesses (SMBs), by for example enhancing the support menu.

○ Promotion of decarbonization through a tax system for SMBs

One of effective approaches to further promote efforts that contribute to decarbonization at SMBs is the use of the tax system as a means of supplementing regulations and subsidies. We will use financial incentives in the tax system to encourage SMBs' efforts, continuing measures to reduce or exempt a business tax imposed when SMBs introduce energy efficiency and/or renewable energy equipment.

○ Promotion of zero emissions through the creation of green innovation

Tokyo will lead the world in the decarbonization field and promote the further growth and development of SMBs that serve as an industrial infrastructure by increasing the number of players taking the lead in the rapidly growing decarbonization industry. To this end, we will support technology development and create startups among SMBs working on decarbonization projects by promoting open innovation and utilizing venture funds.

Measures in the residential sector

Strengthening and expanding programs based on ordinances

In addition to strengthening and expanding the Tokyo Green Building Program currently in place, TMG will establish a new program for small and medium-sized new houses, which until now have eluded such an institutional framework, in order to decisively promote the decarbonization of houses that account for 90% of new buildings.

We will strengthen efforts to enhance communication with Tokyo residents and businesses as it is important to convey accurate information on solar power generation equipment and the benefits of installing it in an easy-to-understand manner in order to build a program and ensure its smooth operation.We will also develop appropriate measures in a multifaceted manner so that Tokyo residents and businesses can introduce solar power generation equipment with peace of mind, including careful support for owners of the equipment according to its life cycle.

■ Realization of new condominiums with zero emissions by strengthening and expanding the Tokyo Green Building Program

New large condominiums with zero emissions will greatly contribute to CO_2 reductions in the residential sector, as well as stronger resilience and improved living comfort. Based on the perspectives described in “Standardization of zero emission buildings by strengthening and expanding the Tokyo Green Building Program” on page 41, TMG will not only establish new energy efficiency performance specifications, but also require the installation of renewable energy equipment and standardize the installation of ZEV chargers, raising the level of our efforts. We will also expand the Green Labeling for Condominiums program to provide comprehensible information that will allow Tokyo residents to easily select condominiums with higher environmental performance.

■ Program That Requires Certain Small and Medium-Sized New Buildings, Including Houses, to Install Solar Power Generation Equipment

For certain small and medium-sized houses that account for the majority of new buildings, TMG will establish a program based on ordinances that require and encourage such houses to improve thermal insulation and energy efficiency performance, and install renewable energy equipment and ZEV chargers, making TMG’s measures for houses more effective. We will also promote the use of low-carbon materials.

For the installation of renewable energy equipment, TMG expects that attractive product lineups with standardized installation will be expanded by imposing the mandatory installation on each individual business. The effectiveness of the installation can be ensured by considering the conditions of location, such as sunshine, and the shape of houses.

Rather than requiring the installation by each house, we will fine tune the program so that major home suppliers that supply a certain amount of small and medium-sized new buildings will be able to meet the installation criteria across all houses supplied while considering the condition of each house as well.

Column

Efforts toward the Mandatory Installation of Solar Panels in Progress in Cities Overseas

In Europe, Germany is leading the way, and the EU has proposed the mandatory installation of solar power generation equipment at public/commercial buildings and new houses.

In the United States, California and New York City have already started mandating the installation of solar power generation equipment.

EU

- ✓ In May 2022, the European Commission announced the details of the REPowerEU plan to break away from dependence on Russia for energy.
- ✓ In the European Solar Rooftops Initiatives in the plan, it proposed to mandate the installation of solar power generation equipment at public and commercial buildings and new houses in stages by 2029.

Germany

- ✓ The state governments are introducing an ordinance mandating the installation of solar power generation equipment.
  * 7 out of 16 states in Germany have mandated the installation of solar power generation equipment.
- ✓ On January 1, 2023, Berlin will mandate the installation of solar power generation equipment at houses.

California, USA

- ✓ In 2020, the installation of solar power generation equipment was mandated for all new low-rise houses in the state.
  * Houses in the shade or without sufficient roof space were exempted from the obligation.
- ✓ By 2023, the coverage of the mandatory installation will be expanded to apartment buildings except low-rise ones, in addition to almost all non-residential buildings.

New York City, USA

- ✓ A plan to increase the percentage of power generated by renewable energy to 70% by 2030 was approved in 2019.
- ✓ In 2019, the installation of solar power generation equipment or greening was mandated for new buildings and those undergoing major roof renovations.
  * This does not apply in regulated areas or to roofs used for stormwater management, terraces, or entertainment purposes.

Decisively encouraging decarbonization actions by Tokyo residents and businesses

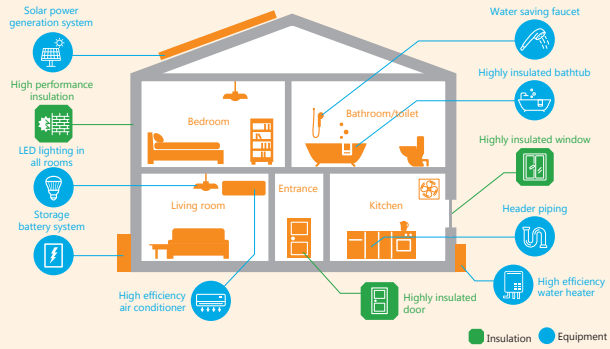
Prior to the strengthening and expansion of programs, TMG will decisively encourage decarbonization actions by Tokyo residents and businesses to turn the living environment and lifestyle of Tokyo residents into a decarbonized version through a creative approach using the perspective of nudge*6, such as the construction of Tokyo Zero Emission Houses, the energy efficiency retrofits of existing houses, and the installation and use of renewable energy equipment.

*6 Nudge is a mechanism or technique that encourages people to choose desirable behavior voluntarily rather than by force.

■ Further promotion of Tokyo Zero Emission House and a continuous review of the standards

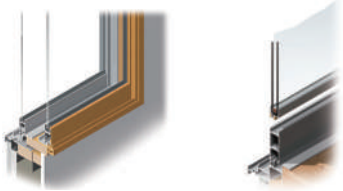
TMG will promote the spread of Tokyo Zero Emission House at the time of new construction. To further promote highly insulated houses and encourage the installation of high-efficiency equipment and renewable energy equipment, we will call for efforts by local contractors and raise the environmental performance of all new houses by continuously reviewing the Tokyo Zero Emission House Standards.

Insulation and equipment focused on in a Tokyo Zero Emission House



■ Promotion of thermal insulation renovation and expansion of solar power generation equipment at existing houses

Taking advantage of opportunities, such as home renovations, regular inspections of houses, and major repairs of condominiums, we will promote energy efficiency audits, the development of energy efficiency plans, the renovation of openings and frames using highly insulated windows and doors, and improvements in equipment efficiency. We will also decisively encourage the installation of solar power generation equipment and storage batteries. In these occasions, we will raise, in a comprehensible way, Tokyo residents' awareness about information that helps improve the energy efficiency performance of houses, and the benefits of installing solar power generation equipment, such as reduced energy bills and contribution to peak shifting during the daytime, as well as the optimization of energy management integrated with digital technology.



Images provided by AGC Inc.

Source: Bureau of Environment, Tokyo Metropolitan Government. Household Energy Efficiency Handbook 2022.

■ Encouragement of switching to more energy efficient home appliances

Since the energy efficiency performance of home appliances has greatly improved, and the replacement will lead to significant energy efficiency and savings, TMG will encourage Tokyo residents to switch to products with higher energy efficiency performance.

■ Expansion of the use of renewable power through further development of group buying projects

TMG needs to create an environment that allows Tokyo residents to easily switch to renewable power as about 70% of them are interested in using renewable power but only about 5% have changed their contracts to renewable power. We will carry out a campaign with a view to its nationwide expansion, which recruits prospective purchasers of renewable power, allows group buying of renewable power, and helps reduce prices through economies of scale. This scheme will be used to expand the installation of solar power generation equipment and storage batteries.

■ Strengthening of efforts to promote a shift to a decarbonized lifestyle

There are a variety of energy efficiency measures in daily life, and some of them are not recognized even though they help save energy and are profitable for household budgets. TMG will develop a campaign like Tokyo Cool Home & Biz, using HTT (㊊Herasu (save), ⓉTsukuru (generate), and ⓉTameru (store) electricity) as a keyword, in order to effectively raise awareness about efforts that contribute to decarbonization. In that process, we will strategically utilize SNS and other media while analyzing messages and approaches that match the behaviors of applicable people, including children, students, and the elderly.

We will encourage behavior change in Tokyo residents by presenting examples easily understood by them, such as changes in room temperature and energy bills before and after taking energy efficiency measures, and the impact on health of living in houses with poor insulation performance.

■ Promotion of the spread of energy efficient and renewable energy-oriented houses in collaboration with housing-related organizations

TMG will promote the spread of energy efficient and renewable energy-oriented houses by strengthening the collaboration with industry organizations and the collaboration between them through the platform set up by TMG and housing-related organizations.

On the platform, in addition to sharing information, we will promote the decarbonization of houses by advancing the efforts toward the supply of energy efficient and renewable energy-oriented houses, such as holding technology improvement support seminars for small and medium-sized contractors sponsored by the participating organizations and developing energy efficiency performance labeling programs.

■ Promotion of decarbonization through the tax system

TMG will also promote efforts for decarbonization through the tax system, continuing measures to reduce or exempt the real estate acquisition tax that started in FY 2022 for the spread of Tokyo Zero Emission House. We will support efforts toward the decarbonization of houses by requesting the national government to prioritize houses with excellent environmental performance as targets for reducing the fixed asset tax.

Column

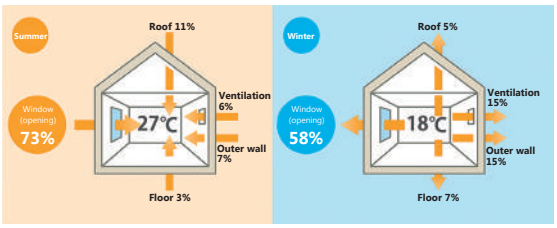
Lowers energy bills as well!

Insulating your home makes you healthier?!

Insulating your home not only improves energy efficiency performance, but also reduces the temperature difference between rooms, alleviating a rise in blood pressure when taking a bath or waking up, and reducing the risk of myocardial infarction and stroke. Would you like to experience a healthy and comfortable life with insulation renovation?

Heat and cold come through the window

In most cases, the heat entering a room during cooling in summer and the heat escaping from a room during heating in winter passes through windows.



Source: Guidebook for Energy Efficiency Home Renovation.

Insulation of windows with renovation

It is recommended you replace windows that are susceptible to outside air as the insulation effect can be clearly seen.

Inner window installation
Install a window inside an existing window.

Replacing glass
Fasten double glazing glass with attachment to an existing sash.

Replacing window
Replace glass and sash with models with higher thermal insulation performance.


Inner window

Double glazing glass with attachment

Images provided by AGC Inc.

Source: Bureau of Environment, Tokyo Metropolitan Government. Household Energy Efficiency Handbook 2022.

Improved insulation performance of home

Benefit 1
Health promotion
- Lower blood pressure
- Improved health check results
- Relief from overactive bladder etc.

Benefit 2
Reduced risk of heat shock
*The key is to eliminate the temperature difference between rooms.

Benefit 3
Growth of mold and mites reduced with less condensation → Reduced risk of developing allergies and asthma

Benefit 4
Satisfied with the good condition of the skin

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Asahi Kasei Construction Materials Corp. "Women who live in homes with high thermal performance are more satisfied with their skin," WEB media "Quality Life."
https://akk-kAItekilab.com/health/3046

Promoting the development of zero emission districts and advanced energy management

Urban development will define the shape of Tokyo in the future. To realize "Carbon Half," TMG will proceed from the stage of urban development to the development of zero emission districts and a decarbonized society. We will promote efforts toward the societal implementation of advanced energy management that utilizes digital transformation.

Development of zero emission districts

TMG will encourage the development of zero emission districts from the development stage of building construction and urban redevelopment, ensuring close collaboration between the Tokyo Green Building Program, Program on Effective Use of District Energy, Special Development Areas for Urban Renaissance, and Urban Redevelopment Systems.

In order to ensure the development of zero emission districts, it is important to go beyond the conventional framework of the effective use of energy and encourage multifaceted efforts that will contribute to decarbonization. We will strengthen and expand the Program on Effective Use of District Energy from the following perspectives:

- Rebuilding the program so that businesses will formulate their policies with a view to decarbonization at an earlier stage in the development planning process.
- Promotion of efforts that contribute to the effective use of energy beyond the development project areas.
- Expansion of publication methods and content for the evaluation of developers who have started aggressive efforts that are expected to spread to other development projects.
- Evaluation of efforts that contribute to decarbonization, such as the use of renewable energy for heat supply in district heating and cooling areas.
- Introduction of a mechanism to encourage the consideration of efforts, including demand response and VPP[*7].

*Virtual Power Plant. A mechanism for centrally controlling, as if it were a single power plant, demand, generation, and storage of electricity, utilizing IoT and the cloud

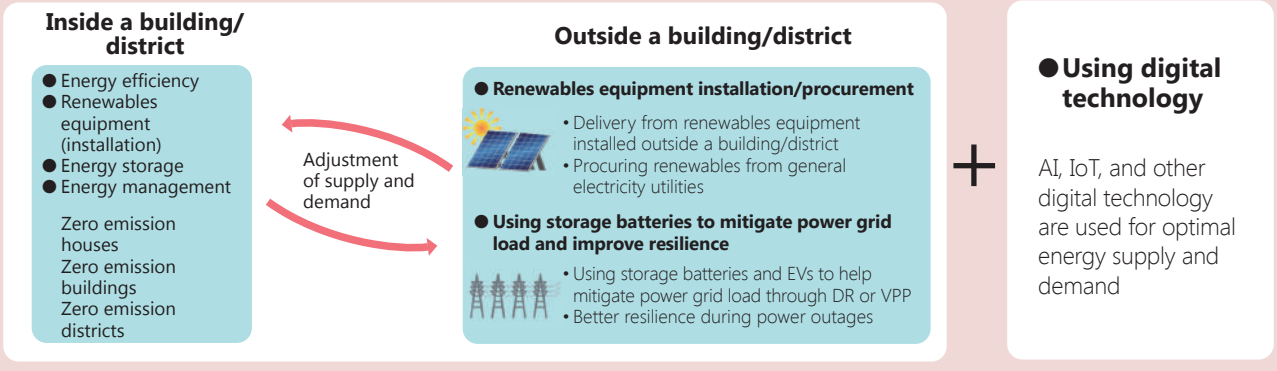
Efforts for promoting advanced energy management

In addition to promoting energy efficiency and maximizing the introduction of renewable energy equipment in buildings and districts, TMG will promote efforts to realize zero emissions by introducing and procuring renewable energy from outside the buildings and districts.

We will encourage the creation of an adjustment mechanism for the supply and demand of electricity, such as the introduction of distributed energy resources, including storage batteries, and the consideration of the construction of control systems. We will promote the use of EVs as a mobile storage battery that will not only improve resilience in the event of a disaster, but also can be used as an adjustment mechanism contributing to the mitigation of power grid load during normal times.

In addition to basic functions, such as the visual depiction of measured energy data, TMG will promote the introduction and use of an advanced energy management system that utilizes AI and IoT for optimized adjustment of supply and demand based on energy use inside and outside buildings.

Outline of advanced energy management using DX for zero emissions



Promoting Zero Emission Mobility

As cities develop and mature, mobility has always been key to ensuring quality of life and plays a major role in supporting socioeconomic activities as part of urban functions. Easy access to a range of mobility options has allowed people and products to move quickly over long distances, and society has enjoyed the convenience such mobility offers. There are drawbacks however, to mass levels of mobility, such as air and noise pollution that may negatively affect our daily lives. Against this backdrop, TMG has made great achievements in improving the environment through vehicle emission reduction measures, including diesel vehicle control.

TMG will evolve and convert these efforts into climate change measures to realize decarbonization in transportation. As efforts to combat climate change also often have knock-on effects in reducing air pollution, with positive impacts on the health of society and the environment, TMG will develop appropriate initiatives so that efforts in both aspects will be more effective.

* Hydrogen energy in the mobility field is discussed in the next section, "Expanding the Use of Hydrogen Energy," and air pollution from automobile exhaust gas is described in Strategy 3-1: Further Improving Air Quality Etc.

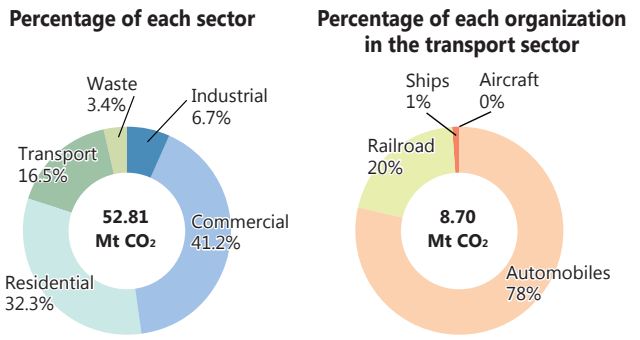
Status Quo

CO_2 emissions in the transport sector

Total CO_2 emissions in the transport sector in Tokyo in FY 2020 amounted to 8.7 million tonnes, a decrease of 50.7% from FY 2000. Since such emissions account for about 20% of total emissions in the whole of Tokyo, with 78% of these caused by automobiles, it is important to further reduce CO_2 emissions from automobiles.

It is noteworthy that various transportation organizations are moving toward decarbonization as evidenced by a shift to renewable power and the development of fuel cell trains by railroad companies and the use of biofuels and synthetic fuels for ships and aircraft.

Sector breakdown of CO_2 emissions in Tokyo (preliminary results for FY 2020)



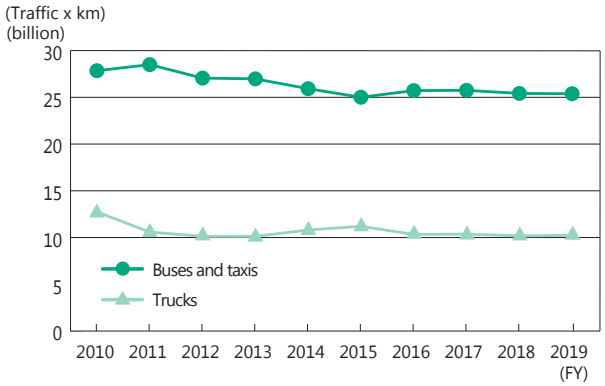
Trends in the transport sector

Vehicle traffic and the number of vehicles owned

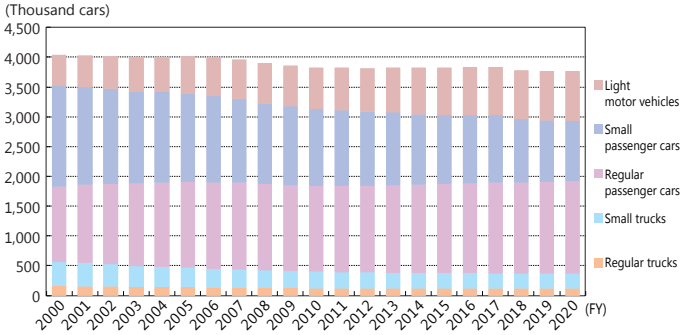
Vehicle traffic in Tokyo has remained flat for the past few years. The number of vehicles owned in Tokyo has gradually decreased as a whole: Small passenger cars and trucks have decreased while regular passenger cars and light motor vehicles have increased.

Although the transportation mode share of automobiles in Tokyo decreased compared to 2008, the use of buses has remained flat.

Changes in vehicle traffic in Tokyo

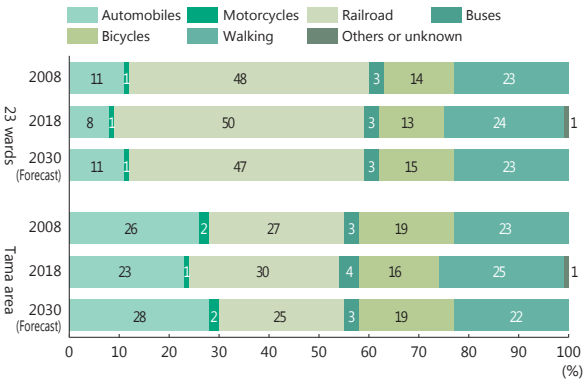


Changes in the number of vehicles owned in Tokyo



* Light motor vehicles include light motor passenger cars and light motor trucks.
Source: Tokyo Statistical Yearbook
Automobile Inspection & Registration Information Association.
Number of Vehicles Owned Based on Material of the Automobile Bureau, Ministry of Land, Infrastructure, Transport and Tourism.

Transportation mode share in Tokyo



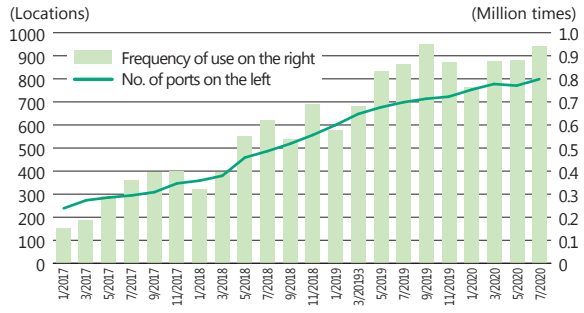
Source: Tokyo Metropolitan Area Person Trip Survey FY 2018.

Use of bicycles

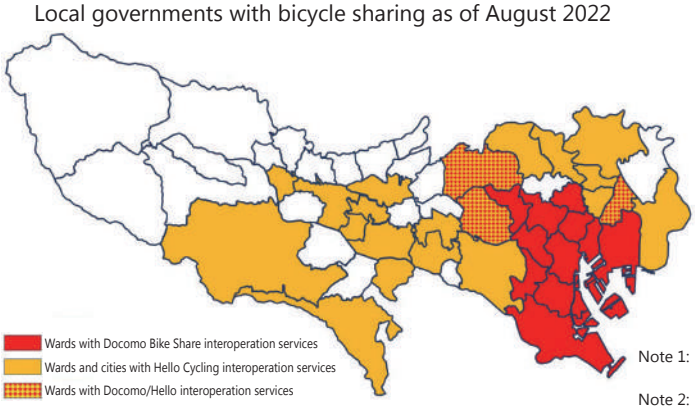
Bicycles are a familiar means of transportation that have less environmental load and contribute to better health outcomes for their users. Given the COVID-19 crisis, the incentive for using bicycles has increased as a means of avoiding the three C's: Closed spaces, crowded places, and close-contact settings. Taking advantage of this upswing in public interest, TMG is working to develop comfortable cycleways and strengthen safety measures so that Tokyo residents can safely choose bicycles as a means of transportation.

Bicycle sharing systems that are open to the general public have been added to the menu of local transportation services. As of August 2022, they are offered by local governments in 21 wards and 11 cities, resulting in an increased number of cycle ports and frequency of use.

Frequency of use and the number of cycle ports in Docomo wide-area interoperation areas



Local governments with bicycle sharing as of August 2022



Note 1: "Local governments with bicycle sharing" refer to those that provide public land to or are otherwise involved with other local governments or businesses that implement bicycle sharing.
Note 2: Setagaya Ward also implements its own bicycle sharing.

Efficient use of automobiles

Under the Tokyo Vehicle Emission Reduction Program, TMG has mandated that businesses using 30 or more automobiles must submit a plan and results report on reduction targets for exhaust gases and efforts for the rationalized use of automobiles.

Under the Freight Transportation Evaluation System, TMG evaluates truck transportation businesses that promote eco-driving and other initiatives based on actual fuel efficiency to encourage their efforts to reduce CO_2 emissions.

Introduction of low-emission/fuel-efficient vehicles by businesses

Under the Program of the Mandatory Introduction of Low-Emission/Fuel-Efficient Vehicles, TMG has mandated that businesses using 200 or more automobiles must systematically introduce low-emission/fuel-efficient vehicles such that they account for a specified percentage of their fleet. We established the mandatory introduction of non-gasoline passenger cars in April 2022.

Spread of ZEVs in Tokyo

Market share of ZEVs in new passenger car sales was 2.3% in FY 2020. Challenges regarding the adoption of ZEVs include higher prices, shorter cruising range, and an insufficient lineup of models compared to gasoline vehicles of the same class.

The number of zero emission buses introduced by FY 2020 was limited to 108 in total due to higher prices and fewer vehicle types.

EV motorcycles are still in the early stages of spread due to issues, such as limited cruising range, long charging times, and higher prices.

The development of infrastructure, including EV chargers, is progressing steadily, backed up by the support system of TMG. As of the end of FY 2020, 2,746 public chargers are installed, including 326 fast chargers.

Visions for 2050

Tokyo has one of the world's most advanced public transportation networks. TMG will develop sustainable urban transportation by leveraging that strength, and promote zero-emission mobility while advancing a people-centered development of the city that will be convenient and comfortable, enabling everyone to walk around with peace of mind.

With an eye on advancements in the field as shown by new technologies adopted in newly-developed mobility services, we will realize, keeping a well-to-wheel*1 approach in perspective, a decarbonized, highly convenient city that incorporates comfortable mobility options for everyone.

*1 A concept that indicates the environmental load generated through the entire process, from the stage of obtaining fuel (well) to the stage of actual driving (wheel).

- Optimized flow of people and products
- All cars driven in Tokyo to be ZEVs
- Expanded use of renewable energy realizing zero emissions from well to wheel

2030 Targets

- Phasing out the sale of new gasoline-only passenger cars: 100%*2
- Phasing out the sale of new gasoline-only motorcycles: 100%*2
  (2035 targets)
- Market share of ZEVs*3 in new passenger car sales: 50%
- Introduction of zero emission buses: 300+
- New small route buses for sale: Limited to ZEVs in principle
- ZEV infrastructure development: 1,000 fast chargers
- ZEV infrastructure development: 150 hydrogen stations

*2 Only ZEVs*3 and hybrid vehicles to be allowed.
*3 ZEVs: Electric vehicles (EVs), plug-in hybrid vehicles (PHVs) (in EV mode), and fuel cell vehicles (FCVs) that do not emit CO_2 or other exhaust gases during driving.

Direction of Policies

To achieve zero emissions in the transport sector, TMG will encourage a shift to actions to curb CO_2 emissions, such as walking, using bicycles and public transportation. We will streamline the flow of people and products through initiatives that contribute to curbing vehicle traffic volume and facilitating traffic flow. In order to decarbonize the vehicles we use, we will decisively promote a shift to ZEVs that do not emit CO_2 while driving.

Shift to transportation means to curb CO_2 emissions

Enhancement of public transportation networks

Toward a shift to transportation means that contribute to decarbonization, TMG will promote the development and enhancement of the railroad network, and expand the transportation environment centering around stations and other facilities that will enable everyone to move around easily by combining buses, taxis, and on-demand transportation. We will encourage behavior change to reduce CO_2 emissions by promoting the formation of comprehensive and efficient local public transportation networks according to regional characteristics, such as improving transfers at transportation hubs and operating BRT*4 that connects central Tokyo to the coastal area.

*4 Abbreviation for Bus Rapid Transit. A bus-based transportation system that has capacity and functions comparable to those of streetcars and ensures punctuality and speed through the adoption of articulated buses and the development of dedicated driving lanes.

Further enhancement of the environment for bicycle use

To further enhance the environment so that everyone can use bicycles comfortably and safely toward the expanded use of bicycles, TMG will work to develop cycleways, encourage the wide-area use of bicycle sharing, construct bicycle parking lots according to needs, and strengthen traffic safety measures.

Bicycle lane

Along with promoting the development of cycleways according to local road conditions, the national government, TMG, and municipalities will work together to promote the development and networking of continuous cycleways.

Wide-area use of bicycle sharing will be promoted by ensuring collaboration between businesses, such as the sharing of cycle port sites. We will promote the broader use of bicycle sharing by working to improve convenience for users in cooperation with municipalities and public transportation.

Cycle port shared by multiple businesses

Promotion of mobility management utilizing digital technology

In order to curb vehicle traffic, TMG will develop initiatives to promote the use of public transportation and a shift to behaviors that reduce CO_2 emissions, including using bicycles and walking.

In light of recent developments in digital technology, we will explore the introduction of new mobility management methods, such as the use of SNS and other communication tools and the provision of optimal means of transportation through MaaS[*5].

*5 Abbreviation for Mobility as a Service, which shows the optimal route for users from a point of departure to destination, and collectively provides multiple means of transportation and other services.

More efficient and rationalized use of automobiles

More efficient freight transportation

Under the Freight Transportation Evaluation System, TMG will examine how to evaluate the reduction of environmental load based on the status quo of freight transportation in recent years. We will work to improve the transportation efficiency of transportation businesses through the optimization of delivery planning. At the same time, we will attract attention to this project by allowing transportation businesses with a better evaluation to be selected on a priority basis.

Regarding container transportation capable of carrying large amounts of cargo, we will promote the efficiency of port logistics, including the development and reorganization of container wharves in the Port of Tokyo and the sophistication of container terminals utilizing AI and other digital technologies.

Promotion of eco-friendly driving (eco-driving) and the rationalized use of automobiles

TMG will hold seminars on eco-driving in collaboration with other members of the Nine Local Governments Coalition and strengthen the guidance on the rationalized use of automobiles for businesses subject to the Tokyo Vehicle Emission Reduction Program.

Seminar on eco-driving in collaboration with the Nine Local Governments Coalition

Decarbonizing automobiles

ZEVs, which do not emit CO_2 while driving, not only are expected to resolve the air pollution (due to exhaust gases) and noise issues generally caused by automobiles, but also have the capability of ⓉTameru (storing) electricity. This latter capability will ensure a power source in emergencies, and further serve to stabilize the power grid at a time of massive introduction and supply of renewable energy. Making the most of this potential will greatly contribute to maximizing the use of renewable energy and improving urban resilience. It will also contribute to the spread of new mobility services, such as future promising MaaS.

With a view to the decarbonization of fuels through the use of biofuels etc., TMG will realize the full-scale spread of ZEVs, which are indispensable for decarbonization in the transport sector, by encouraging ongoing development and the diversification of vehicle types as well as developing charging infrastructure to foster momentum.

Encouraging the switch to ZEVs

■ Passenger cars

To ensure ZEVs are widely adopted, TMG will encourage the expansion of vehicle types and technology development by increasing their market share through a reduction in vehicle prices and building a mechanism to give incentives to manufacturers. In order to deal with the structural change in the industry associated with a shift to non-gasoline vehicles, we will promote the autonomous spread of ZEVs in the market by providing technical support and accelerating human resource development through workshops and seminars in collaboration with mobility-related businesses. We will promote the use of ZEVs on the islands as well, to fully take advantage of their dual potential in the event of a disaster.

PHV

© Toyota Motor Corporation

EV

© Nissan Motor Co., Ltd.

■ Buses and trucks

TMG will encourage the adoption of ZEVs, in parallel with infrastructure development, in commercial mobility as it will see significant CO_2 savings through the switch to ZEVs due to the long travel distances and relatively large number of vehicles associated with this sector.

By supporting the switching of buses to ZEVs and steadily creating initial demand, we will promote the expansion of vehicle types, technology development, and cost reductions for their widespread adoption. Since EVs for small route buses are expected to be mass-marketed, we will provide effective support for their introduction by for example encouraging municipalities to switch to ZEVs community-based buses, for which there is a growing need as a means of transportation due to the aging population.

A challenge for the switch of trucks to ZEVs has been balancing cruising range with load capacity. As the technology for fuel cells and batteries has made advances in recent years, TMG will accelerate the use of ZEV trucks according to purposes and vehicle sizes. In consideration of the characteristics of the vehicle type and the possibility of mass-marketing in the future, we will clarify initiatives for the early implementation and optimal use of ZEV trucks by determining the direction of support measures in cooperation with the national government.

■ Taxis

Since taxis travel a long distance per vehicle and emit a large amount of CO_2, TMG will promote switching to vehicles with higher environmental performance. From the perspective of community usefulness, taxis are required to extensively incorporate universal design (UD) which ensures accessibility for everyone. As there are no ZEV models with UD at the moment, we will first promote the expansion of HVs, then decisively encourage the introduction of UD taxis to small and medium-sized businesses with a low percentage of UD taxis to facilitate their spread. At the same time, we will promote the expansion of ZEV models.

■ Motorcycles

TMG will actively promote the introduction of EV motorcycles as they have many advantages, such as quiet performance as well as environmental performance. To realize their expanded use, we will create initial demand and promote price reduction and the diversification of vehicle types.

By supporting the spread of battery exchange infrastructure, including BaaS*6, TMG will work to solve issues with travel distance and charging times. We will incorporate sharing and other new services to draw users' attention to EV motorcycles.

Example of BaaS

*6 Abbreviation for Battery as a Service which enables the sharing of batteries.

EV motorcycle

© Honda Motor Co., Ltd.

■ Strengthening the Program of the Mandatory Introduction of Low-Emission/Fuel-Efficient Vehicles

Since the lineup of ZEVs is expected to expand in the future, TMG will review the mandatory introduction ratio in line with trends and encourage the introduction of ZEVs. We will promote the introduction of low-emission/fuel-efficient vehicles to businesses whose mandatory introduction ratio is low by providing support and raising awareness of the benefits of such vehicles.

■ Automobile-related tax system etc.

In order to expand the use of ZEVs, TMG will continue its own preferential treatment in the automobile tax system taking into account the spread of ZEVs.

For tolls for the Metropolitan Expressway and other highways, we will encourage the national government to provide support for the continuous use of ZEVs, such as giving discount points when ZEVs are acquired and providing incentives through toll reductions and exemptions.

Ensuring infrastructure to support the spread of ZEVs (EV chargers)

Toward the full-scale spread of ZEVs, TMG will develop an environment where people can use ZEVs with peace of mind by promoting the development of public charging as a social infrastructure that allows charging while on the go as well as helping establish basic charging at home and office.

■ Basic charging

TMG will actively support the introduction of standard chargers that allow charging at homes and offices. Standard chargers are inexpensive to install and suitable for basic charging as they make effective use of the time when a car is not in use. We will promote their introduction so that charging at home will become a matter of course. In cooperation with municipalities and condominium-related organizations, we will strive to create a mechanism to standardize their installation at the time of construction with effective support for introduction ensured. We will also promote their installation at existing apartment buildings by establishing a cooperative system with businesses related to the introduction of chargers.

Wall-mounted outlet type

Stand type

■ Public charging

TMG is decisively promoting the installation of public chargers to ensure that EV chargers are widely available as part of the social infrastructure. Aiming for their broader spread, we will accelerate the introduction of fast chargers in particular (including so-called super fast chargers that are effective in further shortening charging times) that allow charging in a short time while on the go and contribute to avoiding congestion due to charging. In addition to effective support measures to reduce the cost burden, we will encourage the installation of chargers when large buildings are constructed. When applying the rules in the Tokyo Metropolitan Parking Lot Ordinance for installing parking lots according to the characteristics of the district, we will encourage the installation as a measure to contribute to the community. The potential for installing chargers will be further explored through such effective initiatives. Moreover, we will take the lead in the spread of ZEVs by decisively requesting that the national government expand the installation of fast chargers on expressways and accelerating their introduction to TMG facilities.

Fast charger with 50-kW output

Fast charger with 90-kW output (2-port type)

Column

Is EV a "Driving Storage Battery"?

You Can Use a ZEV When Electricity Is Scarce.

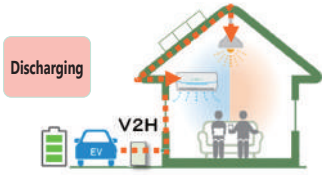
By installing V2H (Vehicle to Home)* at your home, you can discharge electricity charged in EV and supply power to your home. For example, an EV with a 40-kWh battery can provide enough power for a typical household for about three days.

Storing electricity from solar power generation in an EV during the day and supplying it to a house from the EV in the evening not only contributes to peak shifting when electricity is scarce, but also provides an emergency power supply in the event of a disaster. The use of EVs in this way has raised expectations for new potential capacities of the vehicles.

* A device that supplies power to home from the battery of ZEVs.

When there is electricity to spare:

When electricity is scarce:



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Expanding the Use of Hydrogen Energy

Hydrogen energy has many excellent features, such as not emitting any CO_2 while in use. Since hydrogen allows the large-scale long-term storage of energy, it holds promise as a pillar for the realization of a decarbonized society. As electricity generated from renewable energy can fluctuate depending on the season and weather, hydrogen could serve as an adjustment mechanism for its massive introduction and supply. With the stable supply of energy being in jeopardy due to the recent international situation and frequent natural disasters, hydrogen that can be produced from a variety of resources will also help diversify energy sources and contribute to energy security and improved resilience. TMG will lead the world by accelerating the societal implementation of hydrogen energy, which is a decisive measure in terms of both climate action and the stable supply of energy, particularly in Tokyo where industry and population are concentrated and a large amount of energy is consumed.

Status Quo

Trends in hydrogen energy at home and abroad

Efforts are underway around the world to expand the introduction of hydrogen that is key to achieving carbon neutrality, as evidenced by major countries formulating national strategies for that purpose.

As Japan is technologically ahead in multiple areas of hydrogen-related technology, hydrogen is expected to become an internationally competitive industry in the future. The national government formulated the world's first Basic Hydrogen Strategy in December 2017. The 6th Strategic Energy Plan formulated in October 2021 states that the societal implementation of hydrogen will be accelerated as shown by the fact that hydrogen and ammonia has been included in the power generation mix for FY 2030 for the first time.

In the EU, the European Commission announced the Hydrogen Strategy for a Climate-Neutral Europe in July 2020 to clarify the promotion of the use of hydrogen from renewable energy. Since the announcement of the strategy, EU member states and the UK have formulated hydrogen strategies one after another, leading to an active movement to expand the use of hydrogen from renewable energy and introduce fuel cell trains.

In California, the United States, fuel cell vehicles (FCVs) (passenger cars) have been introduced under a regulation that specifies a minimum percentage of ZEVs to be achieved out of the total new car sales.

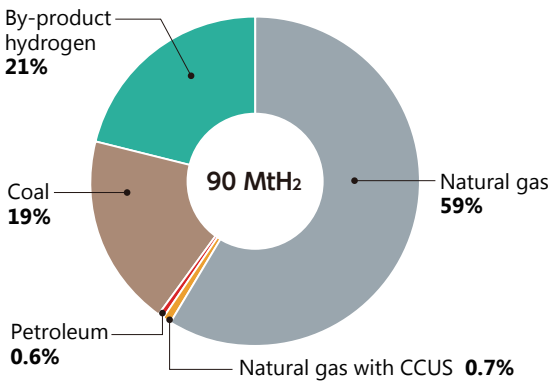
Types of hydrogen

Hydrogen may be expressed in different colors, due to differences in the production process and raw materials. Most of the hydrogen currently produced is Gray Hydrogen from fossil fuels due to such factors as production costs. We need to aim to expand both supply and demand of Green Hydrogen from renewable energy, which does not emit CO_2 even during production.

■ Hydrogen types

- Green Hydrogen is produced through electrolysis using electricity derived from renewable energy.
- Blue Hydrogen is made from fossil fuel but does not release CO_2 into the air as CO_2 generated during the production process is captured and stored (CCS).
- Gray Hydrogen is made from fossil fuel, such as natural gas and petroleum.

Hydrogen production in the world in 2020



Source: IEA. Global Hydrogen Review 2021.

Introduction of hydrogen energy in Tokyo

Fuel cell vehicles

Since 2014 when FCVs went on general sale for the first time in the world, they have been gradually introduced in Tokyo, but the limited number of models for sale prevents their spread.

As of the end of FY 2021, 93 fuel cell (FC) buses have been introduced in Tokyo, but they have not yet begun to spread autonomously because they are more expensive than diesel buses, and the difference in fuel costs between hydrogen and light oil is large.

For commercial fuel cell vehicles other than buses, private businesses are verifying the feasibility of using fuel cell (FC) trucks. TMG is developing fuel cell (FC) garbage trucks and carrying out their trial operation in collaboration with universities and municipalities.

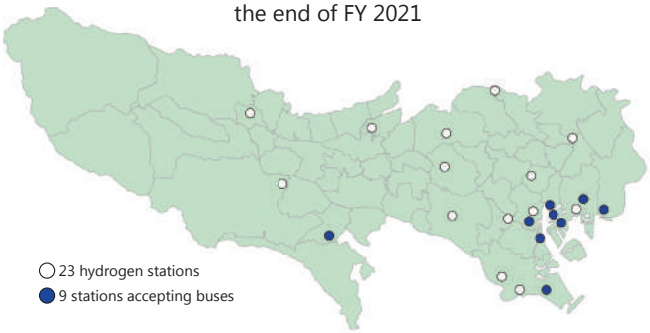
Fuel cell vehicle (FCV)

© Toyota Motor Corporation

Hydrogen stations

Hydrogen stations are indispensable for the spread of fuel cell vehicles. As of the end of FY 2021, there are 23 hydrogen stations in Tokyo, of which nine stations capable of refueling FC buses have been installed mainly in the coastal area. Challenges at present include the limited demand for hydrogen and the uneven distribution of hydrogen stations. Although regulations have been relaxed to a certain extent, there are still strict regulations on for example the separation distance between hydrogen-related equipment and public roads.

Installation of hydrogen stations in Tokyo as of the end of FY 2021



Fuel cells

More than 10 years have passed since 2009 when a residential fuel cell "ENE-FARM" went on general sale for the first time in the world. Thanks to support for broader use, including subsidies for introduction from TMG, the total number of sales of residential fuel cells has steadily increased, resulting in lower prices. On the other hand, commercial and industrial fuel cells are still in the early stages of introduction due to issues, such as high introduction and maintenance costs that prevent their spread.

Visions for 2050

By 2050, Green Hydrogen will be fully utilized in all fields and support the massive introduction and supply of renewable energy. Hydrogen will be utilized for ships, aircraft, and other large transportation equipment as well as automobiles, and heat demand in the industrial, commercial, and residential fields. Hydrogen power generation, which burns hydrogen instead of fossil fuels to generate electricity, will be widespread in the power generation field. A society where these are realized will allow the effective use and stable supply throughout the energy spectrum by helping store hydrogen produced from renewable power for extended periods and convert it into electricity, heat, and transportation fuel required at any specific time. In addition, it will be possible to promote local production and consumption of energy, which enhances local resilience.

TMG will promptly start building the foundation in preparation for the Visions for 2050. There are still challenges for the spread of Green Hydrogen, such as cost reduction and the establishment of the supply chain. In cooperation with related businesses and other organizations, we will accelerate the implementation of hydrogen energy by expanding hydrogen demand and promoting technological development and mass production.

- Green Hydrogen serving as a pillar for realizing a decarbonized society
- Support massive introduction and supply of renewable energy with hydrogen
- Make full use of Green Hydrogen in all fields to make it one of the pillars of energy supporting a decarbonized society

2030 Targets

- Phasing out the sale of new gasoline-only passenger cars: 100%
- Phasing out the sale of new gasoline-only motorcycles: 100% (by 2035)
- Adoption of residential fuel cells: 1 million
- Adoption of commercial and industrial fuel cells: 30 MW
- Introduction of zero emission buses: 300+
- Market share of ZEVs in new passenger car sales: 50%
- Development of hydrogen stations: 150

Direction of Policies

TMG will build the foundation for the use of Green Hydrogen by accumulating cases of utilizing it and accelerate societal implementation of hydrogen by expanding demand for it in various fields.

Building the foundation for the use of Green Hydrogen

Cost reduction and efficiency improvement of hydrogen production equipment

In order to spread and expand the use of Green Hydrogen, TMG will increase cases of utilizing Green Hydrogen in Tokyo, including introduction at TMG facilities, by supporting the introduction of water electrolyzers that produce hydrogen using renewable energy and pure hydrogen fuel cells that generate electricity from hydrogen. We will encourage the development of a competitive hydrogen industry by promoting cost reduction and efficiency improvement of water electrolyzers that constitute the core technology for Green Hydrogen production.

Example of utilizing Green Hydrogen
(refueling equipment for fuel cell forklifts)

© Toshiba Energy Systems & Solutions Corporation

Consideration of incentives for evaluation and utilization of environmental values

What is important for the spread of Green Hydrogen is to encourage businesses to actively choose Green Hydrogen by evaluating its environmental value.

TMG will consider efforts for the evaluation and utilization of environmental values through the introduction support program, including strengthening incentives according to the production process of hydrogen to be used and promoting the early introduction of the certification or crediting of Green Hydrogen. We will request that the national government establish an evaluation of environmental value and set up incentive measures and mechanisms, including regulatory methods, such as the introduction of carbon pricing. In addition, we will also consider evaluating the introduction of Green Hydrogen utilization equipment under our own programs.

Consideration of procurement methods of Green Hydrogen

To increase the supply of Green Hydrogen in the future, in cooperation with local governments and businesses TMG will explore methods for mass transportation to Tokyo from sites that accept hydrogen from abroad and hydrogen production sites in Japan.

Expansion of hydrogen use in the transport field

Fuel cell vehicles, which have advantages such as emitting no CO_2 while driving and short hydrogen refueling times, are needed in a variety of ways in the transport field. TMG will first promote the use of fuel cell vehicles by positioning the transport field as a driving force for the expansion of hydrogen energy. By expanding the installation of hydrogen stations in Tokyo at the same time, we will significantly expand the use of hydrogen in terms of both supply and demand.

Broader use of fuel cell vehicles

In order to promote the spread of FCVs, which are being developed for mass production, TMG will encourage the diversification of vehicle types to expand the range of FCV use in addition to developing support measures for introduction. We will strengthen measures that focus on the purpose of use and convenience by for example supporting the expansion of commercial use, including rental or shared cars. Commercial vehicles, such as buses, are in an ideal position to utilize hydrogen as they need to be capable of long-distance transportation and consume a large amount of hydrogen. FC buses have been introduced mainly in the Toei Bus Lines so far. In order to further expand their use, including entry into private bus lines, we will encourage their autonomous spread by taking measures to reduce the burden for vehicle prices and fuel costs.

For other commercial vehicles, such as FC trucks, FC garbage trucks, and fuel cell forklifts (FC forklifts), support measures will be taken according to the needs of vehicle types and their development status to promote their introduction. Regarding the use of hydrogen in transportation means other than automobiles, such as ships, we will promote early implementation and expanded demand for hydrogen in collaboration with various entities.

Fuel cell truck (FC truck)

© Toyota Motor Corporation

Fuel cell forklift (FC forklift)

© Toyota Industries Corporation

Installation of hydrogen stations supporting fuel cell vehicles

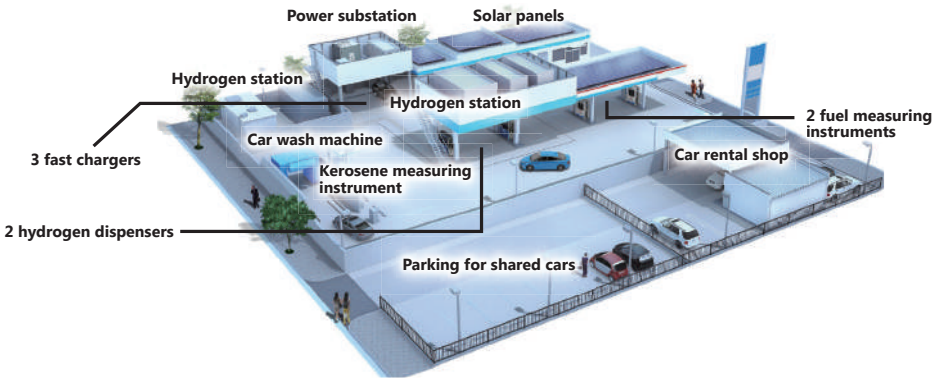
TMG will enhance a hydrogen refueling environment at hydrogen stations so that they can deal with commercial vehicles, such as FC buses and trucks, as well as passenger cars. We will actively utilize TMG-owned land for the installation of hydrogen stations and support the construction of small hydrogen stations that can be located on narrow plots of land. In addition, we will request that the national government further ease regulations for installation and operation. TMG will work to ensure the business viability of hydrogen stations by for example exploring support for improving the functionality of existing hydrogen stations.

Bus-capable hydrogen station

© Iwatani Corporation

It is important to utilize existing gas stations in Tokyo where sites cannot be acquired easily. To help them act as an environment-friendly local energy supply base, TMG will work to convert existing gas stations into multi-energy stations by encouraging the installation of a hydrogen station or fast chargers and incorporating rental or shared ZEVs into the sites.

Multi-energy station



Expansion of hydrogen use in various fields

In addition to the transport field, hydrogen energy is expected to contribute to decarbonization in different fields, such as fuel for power generation and heat demand in the industrial, commercial, and residential fields. To this end, the initial requirement is expanding the use of fuel cells etc., which will then enable us to reduce CO_2 emissions in the commercial and residential fields, encourage development for introducing hydrogen in the power generation and industrial fields in the future, and expand the demand for hydrogen.

Broader and versatile use of fuel cells, promotion of hydrogen use in various fields

With regard to residential, commercial, and industrial fuel cells, which allow the effective use of heat during power generation, TMG will promote further price reduction and technology development, such as downsizing, through continued support for their introduction, striving for the expanded use of hydrogen and autonomous spread of these fuel cells.

We will encourage the additional installation of residential fuel cells in apartment buildings, and expand the use of commercial and industrial fuel cells by communicating the benefits of their introduction to consumers.

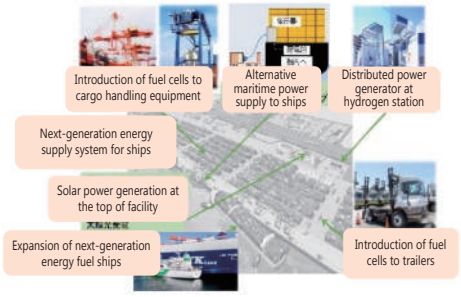
The range of utilization of fuel cells will be widened by applying them to different applications, such as agricultural and construction machinery.

In anticipation of the use of hydrogen in a wide range of fields in the future, we will in close cooperation with the national government and related businesses encourage development that will help commercialize the combustion of hydrogen or synthetic fuels, including synthetic methane and e-fuel, for use in various fields, such as power generation and ships.

Promotion of efforts in the coastal area

TMG will also accelerate its efforts in the coastal area as that is an area expected to play a major role in realizing a decarbonized society. Based on a public-private partnership at the Port of Tokyo, we will formulate a carbon-neutral port building plan to work on decarbonization by means of hydrogen. We will promote the spread of hydrogen energy among private businesses by building a model for the utilization of hydrogen energy at buildings in the Tokyo Waterfront City.

Carbon neutral port



Source: Future Tokyo: Tokyo's Long-Term Strategy Upgrade 2022.

Urban development as a legacy of the Tokyo 2020 Games

In the redevelopment district of Harumi, where the Olympic Village was located during the Tokyo 2020 Games, TMG will encourage the use of hydrogen through urban development, including hydrogen supply to blocks through pipelines, which is in practical use for the first time in Japan.

Column

Hydrogen in Use at the Tokyo 2020 Games

At the Tokyo 2020 Games, hydrogen was used for the first time in the history of the Games for the Olympic cauldron and some of the relay torches. Hydrogen was also used at the Relaxation House and in some of the residential buildings in the Olympic Village. Such hydrogen included that produced with renewable energy in Fukushima Prefecture.

Fuel cell vehicles (FCVs) were used as transportation vehicles for the Games officials.

Holding these matters as a legacy, we will further promote the use of hydrogen.

Cauldron at the Tokyo 2020 Games

© Tokyo 2020

Fostering momentum

Fostering movements in collaboration with various actors

For the societal implementation of hydrogen energy, it is important to share information, such as technological knowledge on hydrogen and the significance of its use. By making maximum use of the framework for raising public awareness cultivated with private organizations and local governments in Tokyo, TMG will encourage further cooperation between businesses and promote awareness raising in collaboration with various entities, including other prefectures, the Tokyo Metropolitan Research Institute for Environmental Protection, Tokyo Environmental Public Service Corporation (hereafter referred to as the "Tokyo Metropolitan Research Institute for Environmental Protection"), and national research institutes.

Provision of easy-to-understand information

To promote understanding of hydrogen energy, TMG will show the Tokyo of 2050 with hydrogen energy widespread through the Tokyo Hydrogen Vision formulated in March 2022, and provide information in an easy-to-understand manner by means of awareness-raising activities and the Tokyo Hydrogen Museum. We will take a continuous approach to a wide range of generations by enhancing our platforms for providing information and by disseminating information in a variety of ways on the themes of the significance of and safety measures for hydrogen as well as the latest research and new technologies related to hydrogen.

Tokyo Hydrogen Vision

Hydrogen information center "Tokyo Hydrogen Museum"

© Tokyo Environmental Public Service Corporation

Column

Movement toward Green Hydrogen Production

○Namie Town, Fukushima Prefecture

One of the world's largest hydrogen production research facilities using solar power generation was completed* in Namie Town, Fukushima Prefecture, in March 2020, and is now in operation. It is actively developing technology related to hydrogen production, as shown by testing the production of Green Hydrogen with a large water electrolyzer.

○Yamanashi Prefecture

Since June 2021, at the Yonekurayama Electric Power Storage Technology Research Site in Kofu City, Yamanashi Prefecture, the Yamanashi Prefectural Enterprise Bureau, Toray Industries, Inc., Tokyo Electric Power Company Holdings, Inc., etc. have been engaged in an experimental study* that ranges from production to utilization of hydrogen using renewable power from solar power generation and the electrolysis of water.

* Implemented as a project of NEDO (New Energy and Industrial Technology Development Organization).

Hydrogen production research facility

© NEDO (New Energy and Industrial Technology Development Organization)

Yonekurayama Electric Power Storage Technology Research Site

© Yamanashi Prefectural Enterprise Bureau

Realizing the Sustainable Use of Resources

The period of rapid economic growth came at a cost, with the large amounts of waste causing a social problem of a shortage of final disposal sites. TMG has been working to solve this by setting several goals, such as reducing the final disposal volume. As the existing linear economic model of extracting resources from the earth, making products, and throwing away unwanted items has a major impact on climate change, TMG has been actively working to promote sustainable resource management by positioning it as one of the array of climate change measures in the Zero Emission Tokyo Strategy formulated in 2019.

The linear economic model is causing not only climate change, but also various problems on a global scale, including biodiversity loss. In order to secure the global environment that is the basis for the existence of humans, we will change the ways to make, sell, buy, and use things to realize the sustainable use of resources with net zero CO_2 emissions.

Status Quo

Material flow in Japan

The following figure shows the flow of resource collection, consumption, and disposal.

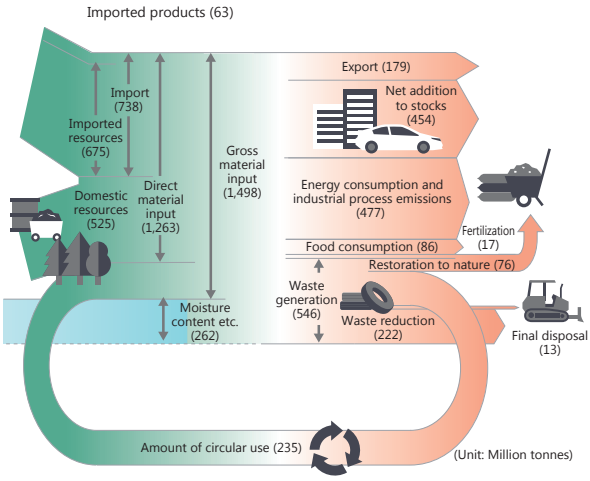
The diagram of material flow in FY 2019 shows that the direct material input consumed in Japan was 1.26 billion tonnes, of which 680 million tonnes (approximately 53%) was dependent on imports. The gross material input including the amount of circular use was 1.50 billion tonnes, of which recycled resources (the amount of circular use) were 240 million tonnes (approximately 16%).

Status quo of waste recycling in Tokyo

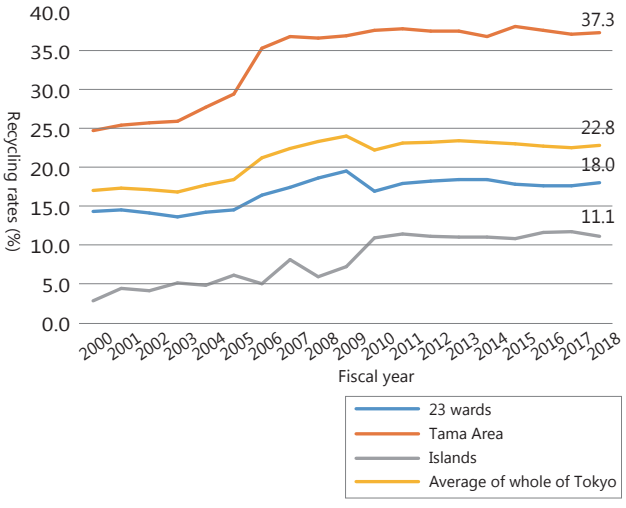
Recycling of municipal solid waste

Municipal solid waste recycling rates have been almost flat since 2010. However, recycling rates vary by region. In the Tama Area, where recycling is being promoted by controlling the amount of disposal by charging for household waste and through strict separation of waste, the municipal solid waste recycling rate has reached 37%. TMG is promoting efforts to contribute to improving recycling rates by for example encouraging and supporting recycling based on laws and regulations, and has started exploring the feasibility of a recycling system for disposable diapers etc.

Material flow in Japan (FY 2019)



Changes in municipal solid waste recycling rates in Tokyo

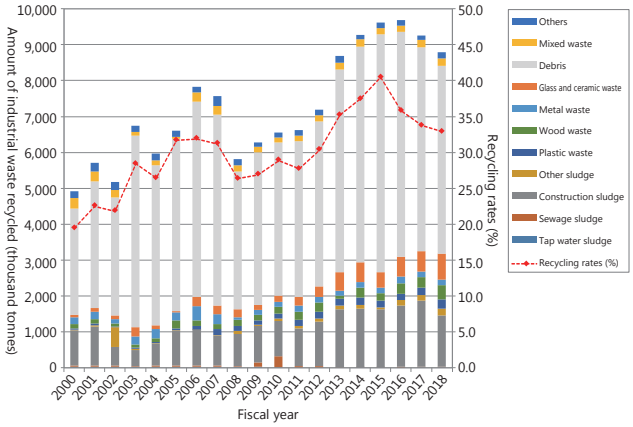


Source: Annual Report on the Environment, the Sound Material-Cycle Society and Biodiversity in Japan 2020.

Recycling of industrial waste

The amount of industrial waste recycled in Tokyo was on an upward trend but has been declining since FY 2015. When viewed by type, there is an increase in the amount of recycled debris, construction sludge, and the like discharged from construction work.

Amount of industrial waste recycled and its recycling rates in Tokyo



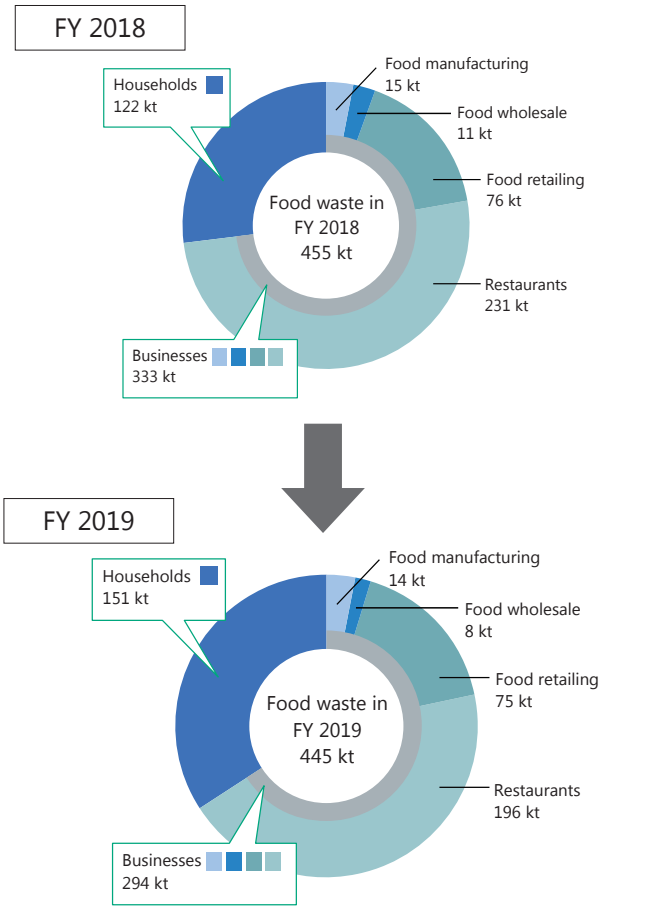
Status of plastic treatment and food waste in Tokyo

Plastics familiar to our lives are discharged as waste after use and the majority of this waste is subjected to heat recovery and incineration. Incineration of plastic waste from households and large office buildings in Tokyo amounted to approximately 700,000 tonnes in FY 2019, resulting in 1.45 million tonnes of CO_2.

Based on the Plastic Strategy formulated in December 2019, TMG is advancing efforts for plastic use with net zero CO_2 emissions, such as a thorough review of single use, enhancement of circular use, and a shift from incineration and heat recovery.

Of the total amount of approximately 445,000 tonnes of food waste in Tokyo in FY 2019, approximately 294,000 tonnes were estimated to come from businesses and approximately 151,000 tonnes from households. Compared to FY 2018, food waste from households increased by 29,000 tonnes, but that from businesses decreased by 39,000 tonnes due to reductions in the restaurant business in particular. In light of the discussions at the Tokyo Food Waste Reduction Partnership Council, TMG formulated the Tokyo Food Loss and Waste Reduction Plan in March 2021, promoting food waste reduction measures that involve the administration, consumers, businesses, and related organizations.

Breakdown of food waste in Tokyo

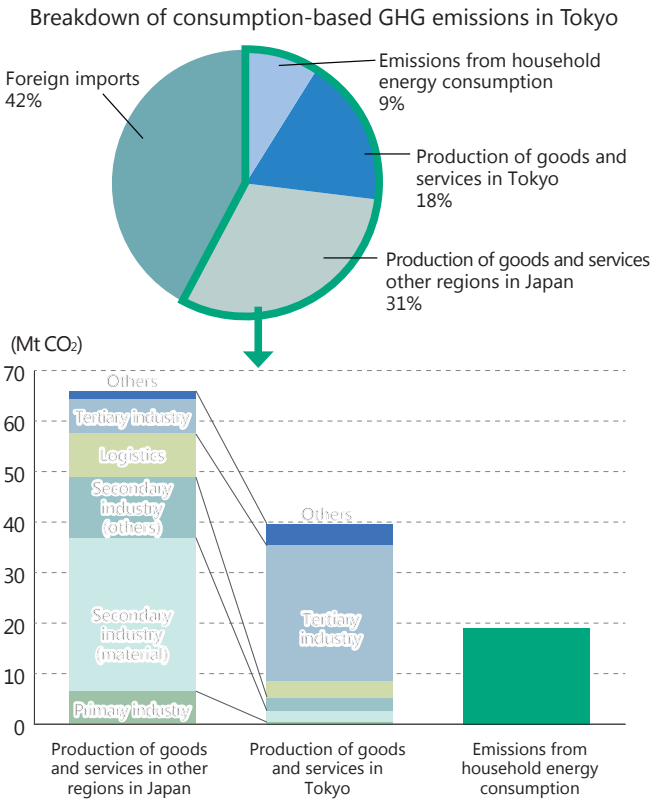


The total may not match the sum of the details due to rounding.

Consumption-based greenhouse gas emissions in Tokyo

Consumption-based greenhouse gas (GHG) emissions, a concept that assigns the GHGs emitted when a product is produced to the region where it is finally consumed, have been studied over recent years as an indicator to clarify the actual state of energy use. An estimate of consumption-based GHG emissions in Tokyo in 2015 resulted in approximately 210 million tonne-CO_2, which is more than 2.6 times production-based GHG emissions.

For production outside Tokyo, emissions from secondary industries including construction and manufacturing are quite heavy—those from the material industry are particularly sizable. For production in Tokyo, emissions from the tertiary industry including information and communication and service are the most significant.



Trends in the use of resources at home and abroad

As the conventional linear economic system of a "take-make-waste" model is causing enormous greenhouse gas emissions and the destruction of ecosystems, there is an active movement, particularly strong in European countries, to try to transition to a circular economy. The circular economy is a model of a sustainable, decarbonized, and resource-efficient production and consumption based on these principles:

(1) Reducing resource consumption through dematerialization and minimized loss (Material sufficiency, resource decoupling);

(2) Maintaining the value of products and resources for as long as possible in the economic system through long-term use, sharing, reuse, repair, and recycling (Circularity); and

(3) Producing and consuming biomass resources within a sustainable range (Regeneration).

In May 2020, Japan formulated the Circular Economy Vision 2020 in which it encouraged the transition of the whole of society to a circular economy, presented specific efforts expected of relevant entities, and clarified the direction for businesses to implement their business activities.

In April 2022, the Plastic Resource Circulation Act came into force as a comprehensive legal system focusing on raw materials for the purpose of taking measures to encourage efforts, such as sustainable plastic resource management (3R + Renewable), at all entities involved in product design through to waste treatment.

Visions for 2050

To fulfill the responsibility that comes with being a large city with a great impact on the world economy, TMG will realize the following by 2050 in order to review the conventional use of resources on a mass-consumption basis and change the ways to make, sell, buy, and use things toward the achievement of decarbonized resource use with a view to all stages of the supply chain, including resource procurement, manufacturing, distribution, use by consumers, disposal, and recycling:

- Sustainable use of resources in place with minimized CO_2 emissions per unit of the amount of resources used and resource consumption
- Plastic use with net zero CO_2 emissions
  - Plastic production and recycling completely covered with renewable energy
  - Switching to biomass causing no land use change, limited within the growth rate of plants, and with consideration for social and environmental issues, such as competition with food production
- Zero food waste through reduction and food recycling
  - Maximized efforts to control the occurrence of food waste and eliminate remaining food waste by converting it into feed and fertilizer

2030 Targets

- Municipal solid waste*1 recycling rate: 37%
- Incineration of plastics from households and large office buildings compared to FY 2017: 40% reduction
- Food waste compared to FY 2000: 50% reduction

*1 Municipal solid waste is divided into household waste and general waste generated from business activities.

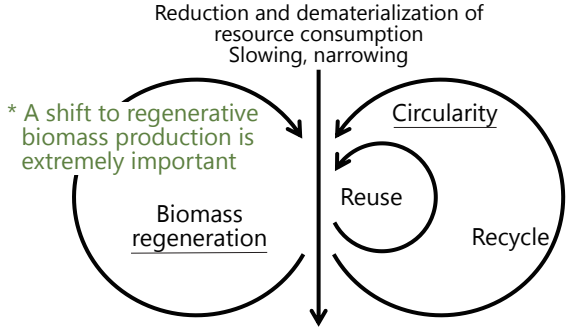
Direction of Policies

To realize the sustainable use of resources and achieve net zero CO_2 emissions, we need to consider environmental load in the supply chain of products and food. TMG will help shift to a circular economy by supporting new businesses that incorporate Reduce and Reuse, encouraging the commercialization of innovative recycling technologies, and promoting the improvement of recycling systems.

In the shift process, TMG will give top priority to the reduction and dematerialization of resource consumption on the premise of creating a mechanism that does not generate waste at the design and following stages. We will decisively advance the circular use of resources by promoting the reuse of products that have eluded the above scheme, and encouraging the recycling of remaining products as raw materials for the same or other products. As for construction materials with large amounts of emissions in particular, it is necessary to improve resource efficiency by controlling the generation of waste by extending the life of structures and promoting further utilization in construction work. With regard to biomass resources, we will promote a shift to regenerative*2 production.

*2 Sustainable agricultural and forestry production in harmony with the ecosystem.

Concept of circular economy



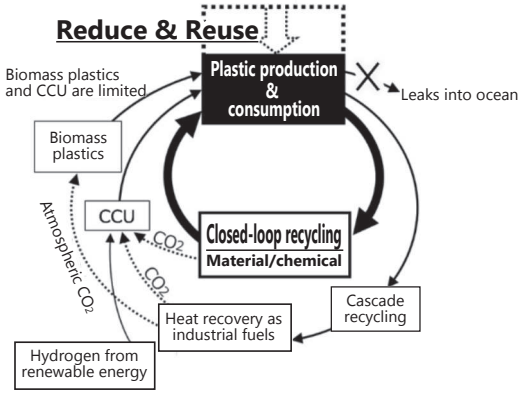
New ways of using plastics

Carbon closed cycle

While plastics are widely used in our lives because they have a wide range of excellent properties, they affect climate change and biodiversity loss throughout the stages of production to disposal. TMG will realize a "carbon closed cycle," which represents the sustainable use of plastics with net zero CO_2 emissions, by mainstreaming 2R*3 businesses, including selling by weight, sharing, and reusable containers, and implementing closed-loop recycling.

*3 2R stands for Reduce & Reuse.

Concept of carbon closed cycle



Closed-loop recycling provides virgin-quality recycled resin.

Material recycling provides recycled resin from used plastic products.

Chemical recycling provides chemical raw materials from used plastic products.

Cascade recycling provides resin of lower quality for other uses.

Expansion of closed-loop recycling

For the expansion of closed-loop recycling, which provides virgin-quality recycled resin eliminating the need for new resin, TMG will build an effective mechanism in collaboration with recycling businesses, manufacturers, and retailers, as it entails not only technical issues but also social system issues, such as the setting of separation categories and the operation of the Waste Management Law.

The use of biomass plastics*4

As for the use of biomass plastics, it is necessary to confirm for example that tropical forests will not be destroyed during the resource extraction stage as well as what materials are used. TMG will promote the appropriate conversion to biomass materials while disseminating information on the importance of giving full consideration to the conditions in the upstream and downstream of the materials.

*4 Plastics made from raw materials derived from plants, such as corn and sugar cane.

Creating innovations in cooperation with businesses

Since the use of plastics with net zero CO_2 emissions cannot be realized by extending past efforts, innovative technologies and business models different from those in the past are needed. Therefore, TMG will promote inter-business collaboration by supporting the efforts of voluntary business groups with a view to creating a new business that will contribute to the realization of a carbon closed cycle.

Pool Project Tokyo
FY 2020 Innovative Technologies and Business Models Promotion Project

Fostering a society with less single-use plastics and more reuse

In reducing plastic use, TMG will continue to review familiar single-use products by considering the necessity of the products and their containers and packaging. We will also provide information that will help establish a lifestyle firmly based on the reuse principle.

More environmentally friendly behavior on the part of Tokyo residents will be encouraged through public relations activities featuring water dispensers at TMG facilities.

Encouraging the recycling of plastics by municipalities

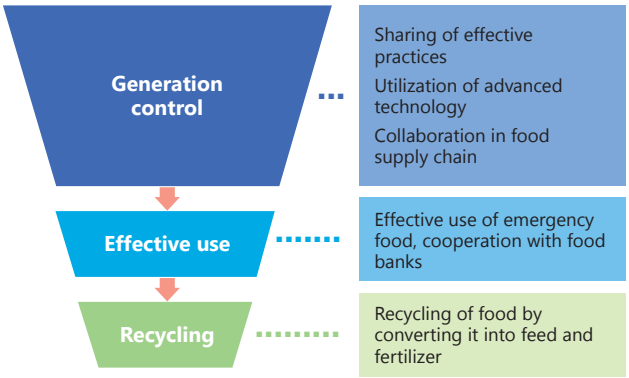
With the implementation of the Plastic Resource Circulation Act in April 2022, municipalities are required to separately collect and recycle plastic products in addition to plastic containers and packaging. TMG will decisively support efforts by municipalities to further promote sustainable plastic resource management.

Measures for food waste

Reducing food waste will reduce deforestation caused by land use for producing food to be disposed of and the amount of pesticides and fertilizers also used for that purpose, helping to mitigate the degradation of biodiversity.

In order to reduce food waste, TMG will promote measures focusing on Reduce, involving the administration, consumers, businesses, and related organizations.

Priority of efforts for food waste reduction



Source: TMG. Food Loss and Waste Reduction Plan.

Promoting behavior change among Tokyo residents and businesses

TMG will encourage Tokyo residents to change their behavior by for example promoting a better understanding of the food waste issue and helping to develop habits that reduce food waste, including checking the refrigerator before shopping. We will disseminate our know-how to businesses by sharing best practices for food waste reduction.

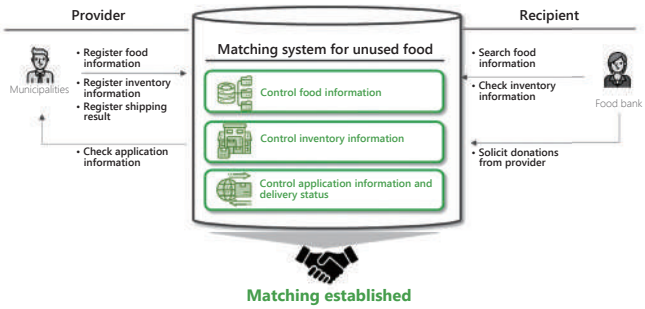
Utilizing advanced technology for food waste reduction

In addition to encouraging the use of highly accurate demand forecasts based on ICT, TMG will promote efforts to reduce food waste by supporting the building of new business models, such as extending the life of food through advanced packaging and freezing technologies.

Establishing and expanding efforts for the effective use of unused food

Cross-sectoral efforts will be made to support the provision of emergency food stockpiled at municipalities and TMG for the effective use by food banks. Toward the broader use of a matching system for that purpose, TMG will actively promote the effective use of emergency food while sharing information with municipalities, and establish and expand a distribution model for mutual help by sharing information on best practices.

Matching system for unused food

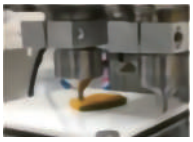


Promoting food recycling

TMG will aim for the circular use of food in which businesses will make maximum efforts to Reduce and Reuse, as well as work on the recycling (conversion to feed, fertilizer, or energy) of food waste that is still generated, and use and sell agricultural and livestock products made with recycled feed and fertilizer. We will also promote upcycling*5 through food technology.

Tacos made with germinated soybeans

Functional domestic feed using insects



Nursing care food made with a 3D food printer

Source: Ministry of Agriculture, Forestry and Fisheries. Material for the 4th Council for Public-Private Partnership in Food Technology held on March 11, 2022.

*5 Producing products with new added value from food that previously was commonly disposed of.

Further promotion of 3Rs

In terms of resource use, TMG will expand recycling routes and facilitate the spread of recycled products taking into account resources that are not recycled sufficiently, while maintaining a focus on Reduce and Reuse.

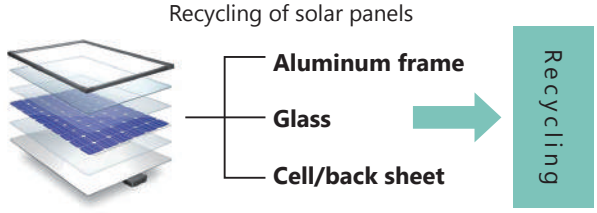
Further promotion of recycling

Recycling technologies have been established for using incinerated ash as raw material for cement, miscellaneous paper as raw material for paper products, and disposable diapers as raw material for pulp. TMG will expand recycling routes for these wastes that are incinerated or landfilled because of a lack of recycling routes.

The mass disposal of solar panels installed through the FIT system will begin by the mid-2030s and the amount is expected to increase thereafter. At the Tokyo Metropolitan Government Council on Recycling Used Solar Power Generation Equipment established in 2018 and other occasions, TMG has been examining the advanced circular use of solar panels. The findings at the council showed the need to build a mechanism for advanced circulation through the collaboration between panel manufacturers, home builders, maintenance companies, dismantlers, collectors/transporters, and reuse/recycling companies as well as the need to develop reuse/recycling routes promptly.

To that end, TMG launched a council composed of related businesses in September 2022. Through the council, we will build a reuse and recycling system for residential use, which utilizes existing mechanisms for commercial solar panels, to promote the sustainable resource management of solar panels.

Recycling of solar panels



Source: NEDO. Outline of Ex-Post Evaluation Report (Draft) on the Solar Power Generation Recycling Technology Development Project.

Promoting the use of eco materials*6 etc.

By promoting the procurement of environment-friendly materials through its own initiative of expanding the use of recycled crushed stone*7 and recycled aggregate concrete*8 as well as encouraging the efforts of businesses in Tokyo, TMG will ensure that environmentally symbiotic and recyclable construction materials, goods, etc. will be selected in business activities in Tokyo and become part of the regular consumption behavior of Tokyo residents.

It is also important to consider the effective use of untapped resources, such as utilizing phosphorus removed in the sewage treatment process as agricultural fertilizer.

*6 Human-friendly materials that maintain a low environmental load and excellent properties and functions throughout the life cycle, from resource extraction to manufacturing, use, and disposal.

*7 Crushed concrete chunks with particle size adjusted.

*8 A new concrete aggregate made by extracting stone, gravel, and sand from concrete chunks generated by structure demolition, or concrete using that aggregate.

Utilizing biomass resources

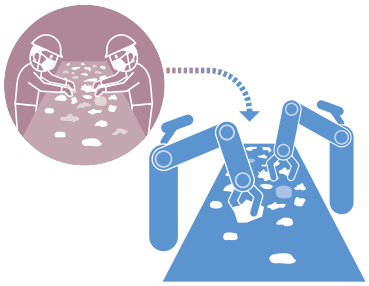
While biomass resources, such as garbage and pruned branches, are expected to attract more attention for their role in achieving zero emissions, their potential as sustainable resources have not been fully exploited. For this reason, TMG will consider policies for utilizing these biomass resources and a regional circulation mechanism for them.

We will promptly process wood chips and other biomass resources generated at the time of disaster for early restoration and recovery while considering their recycling.

Creating a mechanism for the effective use of resources utilizing AI/ICT technologies

TMG will support the introduction of advanced technologies, including AI and ICT, and help advance the treatment processes at recycling and waste treatment companies.

Promoting DX in waste treatment, such as automatic sorting of waste



Promoting optimized office work through digitization

By expanding the use of electronic manifests, TMG will promote optimized and rationalized office work at waste treatment companies. We will promote efforts that will contribute to not only cost reduction but also improved business continuity by introducing RPA into office work. We will also actively digitize reports and permit applications to the administration based on laws and regulations in cooperation with the national government.

Super Eco Town Project

With the aim of solving the waste problem in the Tokyo metropolitan area, promoting the establishment of new environmental industries, and encouraging the transformation to a circular society, TMG has been working on the Super Eco Town Project to develop waste treatment and recycling facilities on its land in the coastal area. Along with other public organizations, we are promoting the recycling of waste generated in Tokyo, and have been successful in reducing the final disposal volume. We will work with businesses involved in the project to promote advanced and reliable waste treatment and recycling.

Decarbonizing waste treatment facilities

To help switch garbage trucks to ZEVs and ensure energy efficiency of equipment and machinery at waste treatment facilities, TMG will reach out to owners of these vehicles or facilities while considering efforts for decarbonization at waste treatment facilities. We will consider promoting the use of area energy networks so that the energy generated at incineration plants can be utilized efficiently.

Promoting behavior change

By identifying the flow of resource use in terms of life cycles and supply chain, TMG will promote efforts that will contribute to decarbonization and avoid impacts on forests, soil, water, air, and biological resources. We will also effectively disseminate information to encourage behavior changes among Tokyo residents and businesses.

Promoting efforts in collaboration with the Tokyo Circular Economy Promotion Center*9

TMG will provide information on the sustainable use of resources and support efforts for sustainable resource management in cooperation with the Tokyo Circular Economy Promotion Center. As a hub for collaboration that provides information on sustainable resource management, the center will offer a one-stop consultation service for Tokyo residents and businesses and coordinate a variety of efforts in an effective manner. It will raise public awareness to encourage changes in consumer behaviors, and support the creation of circular businesses that entail reuse and upcycling.

*9 Established at the Tokyo Environmental Public Service Corporation in April 2022 to provide information on the sustainable use of resources to Tokyo residents and businesses and support their efforts toward that.

Tokyo Circular Economy Promotion Center

Awareness reform of each individual

Tokyo depends on other regions for a large amount of resources and energy, and the consumption of resources in Tokyo is causing biodiversity loss in other regions and health problems due to the occurrence of PM2.5.

To contribute to the shift to sustainable consumption and production around the world, TMG has incorporated environmental considerations in the supply chain into the guidelines for consideration in the Tokyo Environmental Master Plan, and will work to disseminate easy-to-understand information for Tokyo residents and businesses.

Video for raising public awareness of the necessity to reduce food waste and single-use plastics

Promoting ethical consumption*10

Through the development of the Tokyo Ethical Action Project, carried out in collaboration with businesses and organizations proactive in promoting ethical consumption, TMG will further disseminate the philosophy of ethical consumption among Tokyo residents and promote efforts that will lead to its practice.

*10 Consumption behavior that considers people, society, and the environment.

Promoting measures for marine litter

A large amount of plastic waste flows into the sea of Tokyo, causing concerns about its impact on marine life and ecosystems. In order to prevent littering on the streets, TMG will raise awareness of the marine litter issue, encourage participation in activities for cleaning up marine and river litter, and continue surveys to monitor the conditions of waterways.

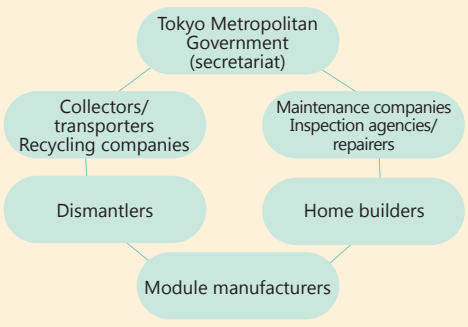
It is important to deal appropriately with river litter, as it is more manageable to capture litter in these waterways before it flows into the sea. To this end, we will explore measures for marine litter by working with local governments, residents, NPOs, and businesses located in the basins of rivers that flow into the Bay of Tokyo.

Column

Sustainable Use of Solar Panels through Recycling

An estimate of TMG on the disposal of solar power generation equipment in Tokyo shows that approximately 2,000 tonnes will be disposed of in the mid-2030s, when the effects of the rapid expansion of introduction to offices and apartment buildings under the FIT system are expected. In anticipation of this forecast of mass disposal, a variety of recycling facilities are already in operation in the Tokyo metropolitan area, undertaking the treatment of commercial solar power generation equipment. TMG launched a council composed of related businesses in September 2022. We will work to establish recycling routes for residential solar power generation equipment by making use of existing routes for commercial purposes.

Structure of the council



Source: Material of Japan Photovoltaic Energy Association

Recycling facilities in the Tokyo metropolitan area

Efforts toward Zero Hydrofluorocarbon Emissions

As chemical substances that are harmless to the human body and efficiently carry heat, fluorocarbons have been used in many products, such as air conditioners in offices and commercial facilities, and freezer/refrigerator showcases in supermarkets.

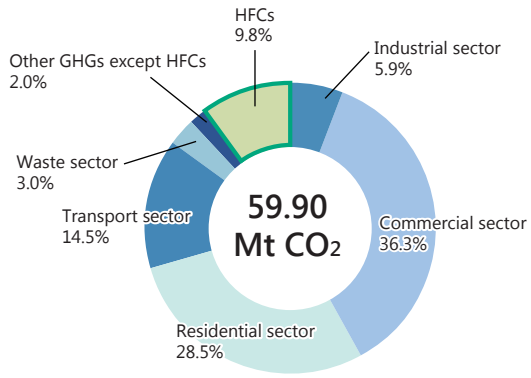
Hydrochlorofluorocarbons (HCFCs) were once used in large quantities, but they have been replaced with hydrofluorocarbons (HFCs) after it became clear that the former were depleting the ozone layer. However, since fluorocarbons have an enormous greenhouse effect that is several tens to more than 10,000 times that of CO_2, TMG will decisively promote the reduction of fluorocarbon emissions as one of climate change measures.

Status Quo

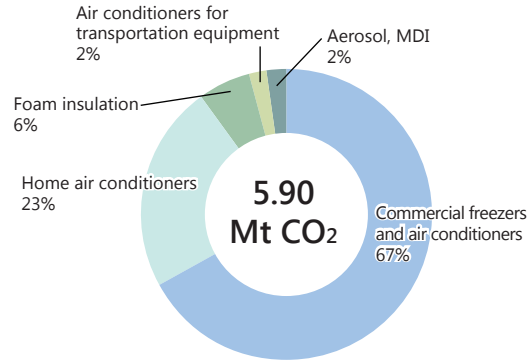
Fluorocarbon emissions

Hydrofluorocarbon (HFCs) emissions in Tokyo have been trending upward, with emissions of 5.9 million tonne-CO_2 in FY 2020 accounting for about 10% of greenhouse gas emissions in Tokyo. Emissions from commercial freezers and air conditioners in offices and commercial facilities account for nearly 70% of the total amount. The main causes of these emissions are leakage that occurs when using equipment with corroded pipes or aged or inadequately inspected or maintained equipment, and leakage caused by the disposal of equipment.

Sector breakdown of greenhouse gas emissions in Tokyo
(preliminary results for FY 2020)



HFCs emissions in Tokyo
(preliminary results for FY 2020)



Trends in fluorocarbons at home and abroad

The production of hydrochlorofluorocarbons has been constrained by the Montreal Protocol, an international regulation for fluorocarbons aimed at protecting the ozone layer. With the adoption of the Kigali Amendment to the Montreal Protocol in 2016, hydrofluorocarbons were also subject to the regulation, and control over their production and consumption started in 2019.

In Japan, the new production and import of hydrochlorofluorocarbons was completely banned in January 2020. Under the revised Act on Rational Use and Proper Management of Fluorocarbons coming into effect in April 2020, obligations and penalties have been made stricter to ensure the recovery of fluorocarbons from commercial freezers and air conditioners.

Although inspections of commercial freezers and air conditioners are legally required, awareness of the Act is insufficient, with many businesses not carrying out legal inspections. In addition, it is often the case that regular inspections are inadequate.

The recovery of fluorocarbons is mandatory when disposing of commercial freezers and air conditioners, but the recovery rate is sluggish at around 40% all over the country.

Introducing non-fluorocarbon equipment

The development of non-fluorocarbon equipment that does not use fluorocarbons is underway. As for home appliances, there is progress in the shift to non-fluorocarbon refrigerators and air conditioners as well as low GWP[*1] refrigerants. However, the introduction of non-fluorocarbon equipment by businesses is stagnant as a commercial version has a limited lineup and is expensive. Therefore, it is necessary to promote the introduction of non-fluorocarbon equipment by providing support in line with its development trends.

*1 Global warming potential, a value that indicates the intensity of the global warming impact with CO_2 defined as 1.

Visions for 2050

Fluorocarbons have an extremely strong greenhouse effect and cannot be recovered once released into the air. Therefore, TMG will curb the use of new fluorocarbons and eliminate leakage from existing equipment containing fluorocarbons.

- Zero fluorocarbon emissions
  - Significantly reduce equipment with fluorocarbons by expanding the use of non-fluorocarbon equipment
  - Completely prevent leakage during use and disposal by strictly controlling equipment that contains fluorocarbons

2030 Targets

- Hydrofluorocarbon emissions compared to FY 2014: 65% reduction to approx. 1.4 million tonne-CO_{2eq}

Reference

The reduction rate for 2014 (base year) is calculated with respect to the target emissions for 2030.

(Mt CO_2)

BaU emissions*2 in 2030	Estimated reductions for 2030	Target emissions for 2030	Emissions in 2014 (base year)	Target reduction rate for 2030 compared to base-year level
8.19	6.81	1.38 (=8.19-6.81)	3.93	65%

Remarks: The BaU value in 2030 indicated by the national government and the expected reductions (target emissions) resulting from measures taken by TMG in the future are used to calculate the reduction rate compared to the 2014 (base year) level.
Reference: In 2021, the national government set a new target of reducing fluorocarbon emissions by 55% from the 2013 level.
*2 Emissions based on the case where existing measures are continued.

Direction of Policies

To achieve zero fluorocarbon emissions, TMG will promote emission reduction measures throughout the life cycle of equipment, from manufacture, use, through to disposal, in cooperation with the national government and businesses.

In particular, we will encourage preventive measures against leakage at the time of the use or disposal, accelerate the spread of non-fluorocarbon equipment, and increase the awareness of equipment managers and all other people involved.

Manufacture/import	Use	Disposal
• Phasing out fluorocarbon production and consumption based on a treaty of the national government	• Ensuring equipment control by administrators • Shift to non-fluorocarbon equipment	• Ensuring the recovery of fluorocarbons • Recycling/destruction by the national government

Measures for commercial equipment

Measures for the use of equipment

For the further promotion of appropriate inspections to prevent the leakage of fluorocarbons when using equipment, TMG will deepen the understanding of the law by businesses and raise their awareness through seminars and on-site guidance.

We will promote initiatives that will enable businesses to actively work on advanced measures, such as the early detection of fluorocarbon leakage to control emissions using IoT tools that find leakage through remote monitoring.

Measures for the disposal of equipment

When disposing of equipment containing fluorocarbons, it is necessary to prevent leakage at the time of removing the equipment and ensure the recovery of fluorocarbons. TMG will promote the reliable recovery of fluorocarbons when equipment is disposed of by having fluorocarbon inspectors visit the demolition site and provide guidance to raise awareness of administrators, dismantlers, and site workers regarding the importance of preventing leakage at the time of disposal. We will take rigorous action against malicious businesses to eradicate the release of fluorocarbons without due care.

Spread of non-fluorocarbon products

TMG will provide introduction support and raise public awareness to encourage more businesses to select non-fluorocarbon products taking into account their development trends. We will disseminate management methods for the safe and secure use of toxic or flammable natural refrigerants that are often used in non-fluorocarbon equipment.

Measures for home appliances

The collection rate of air conditioners is lower than that of other representative home appliances, and they account for the majority of fluorocarbon emissions from home appliances. For this reason, we will raise consumers' awareness to ensure that air conditioners are properly disposed of according to the Home Appliance Recycling Law.

TMG will also crack down on illegal recovery operators and scrap dealers to prevent the leakage of fluorocarbons due to improper treatment.

Column

Reduction of Fluorocarbon Emissions by Businesses

TMG is promoting on-site guidance and other efforts by fluorocarbon inspectors. In November 2021, the first arrests were made after the revision of the Act on Rational Use and Proper Management of Fluorocarbons. The Metropolitan Police Department announced that one of the causes was the businesses' lack of knowledge about releasing fluorocarbons, posing the need to further publicize the Act.

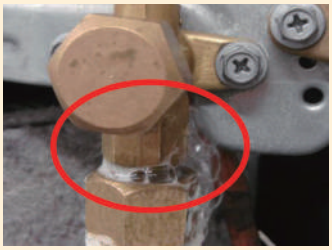
A survey in FY 2021 conducted by the Japan Refrigerants and Environment Conservation Organization on integrated reports* of businesses indicates that some of them have a high level of awareness and understanding of measures for fluorocarbons, as evidenced by an appropriate description of legal compliance. However, the number of such businesses is limited, which highlights a lack of recognition of measures for fluorocarbons.

TMG will strive to further raise awareness of the Act so that the implementation of appropriate measures for fluorocarbons will become widespread.

* A report that integrates a business's financial information and non-financial information, including environmental and social considerations.

On-site guidance by fluorocarbon inspectors

Leakage of fluorocarbons



Source: Material for the councils of the Ministry of Economy, Trade and Industry and the Ministry of the Environment.

Promoting Climate Change Adaptation Measures

The impacts of global climate change have included unprecedented extreme heat and heavy rains as well as natural disasters, increased risk of heatstroke, and deterioration in crop quality as a byproduct of such extreme weather. These phenomena are occurring throughout Japan and appearing here in Tokyo as well. The IPCC Working Group II Contribution to the Sixth Assessment Report released in February 2022 pointed out that Human-induced climate change, including more frequent and intense extreme events, has caused widespread adverse impacts and related losses and damages to nature and people, beyond natural climate variability.

In order to realize a sustainable society and open up a bright future for Tokyo, TMG will decisively work on adaptation measures, along with mitigation measures, to enhance our resilience and ability to adapt to the impacts of climate change.

Status Quo

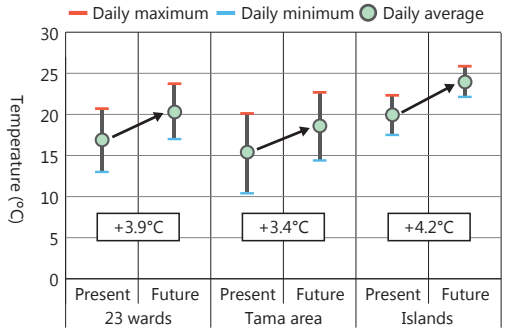
Predicted future changes of climate in Tokyo

Using the forecast by the Japan Meteorological Agency based on RCP8.5 Scenario used in the IPCC Fifth Assessment Report, which assumes the case where no climate policy has been introduced and presents larger greenhouse gas emissions than any other scenarios therein, the future (10-year average for 2086-2095) and present (10-year average for 2009-2018) of Tokyo have been compared and the following results obtained.

Temperatures

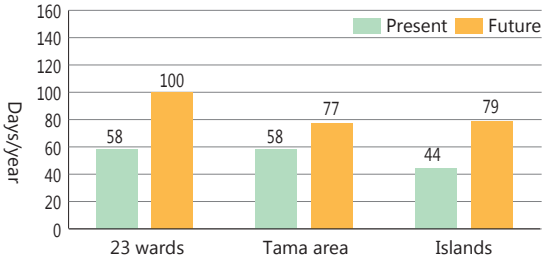
- Temperatures are expected to rise in the 23 wards, Tama area, and islands. It is also predicted that daily minimum temperatures in all areas will increase more sharply than average temperatures and daily maximum temperatures.

Comparison of present and future temperatures

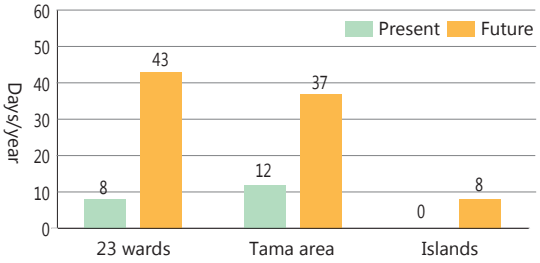


- The number of sweltering days (days when the temperature rises above 30ºC), extremely hot days (days when the temperature rises above 35ºC), and sweltering nights (nights when the temperature does not drop below 25ºC) are expected to increase in the 23 wards, Tama area, and islands.

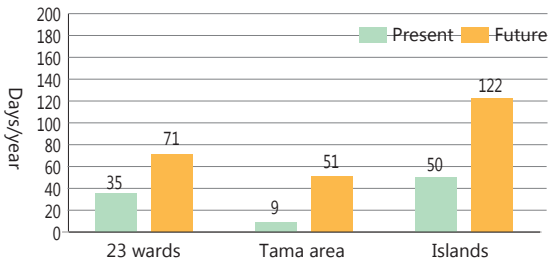
Comparison of the number of sweltering days at present and in the future



Comparison of the number of extremely hot days at present and in the future



Comparison of the number of sweltering nights at present and in the future



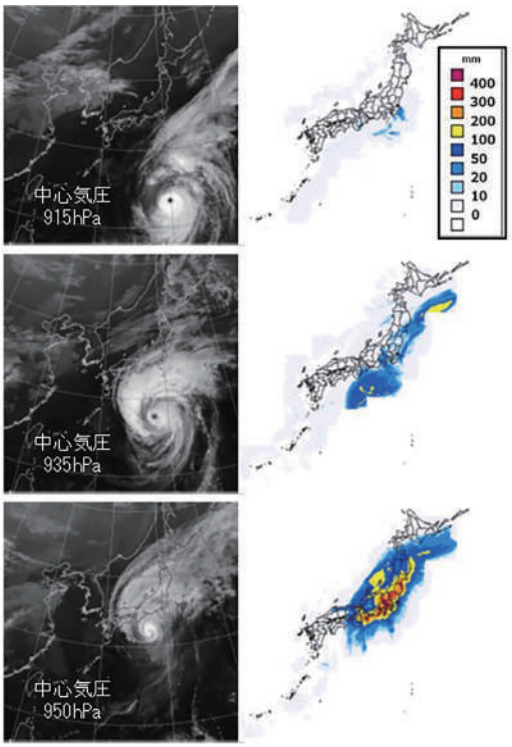
Precipitation

- Annual precipitation in the 23 wards and islands shows a decrease in the future while that in the Tama area shows an increase, indicating different trends between the areas.
- Torrential rains and days with no precipitation show an increase in all areas.

Typhoons

Although there is much uncertainty when it comes to future projections of typhoons, it is predicted that:

- Fewer typhoons will approach Japan as fewer typhoons will be formed in the Northwest Pacific and the zone responsible for forming the highest number of typhoons will shift east from the Philippines.
- Typhoons near Japan will become stronger, making landfall on Japan at an intensity classified as "Super."
- The annual total amount of precipitation associated with typhoons will not change, as fewer typhoons will approach Japan although the precipitation intensity of individual typhoons will increase resulting in larger amounts of rainfall.
- The frequency of extremely heavy precipitation associated with typhoons will be higher as the effect of an increase in the precipitation intensity of individual typhoons is greater than that of the decrease in the number of approaching typhoons.



Weather satellite image (infrared) of Typhoon Hagibis in 2019, Daily Precipitation Distribution Map (rainfall analysis)
(Editing made to a figure in the Report on Natural Phenomena at the Time of Disasters No. 3 in 2020, the Japan Meteorological Agency)

Sea levels*1

It is estimated that the average annual sea levels for coastal areas around Tokyo will rise by 0.70 m by the end of the 21st century.

*1 Climate Change in Japan 2020 - Report on Observations and Projections Assessment on Atmosphere, Land, and Oceans (Detailed Version) (December 2020).

Formulation of the Tokyo Climate Change Adaptation Plan and the establishment of the Tokyo Climate Change Adaptation Center

Climate change measures to be taken differ by region, as the climate change impacts differ according to the geographical, economic, and social conditions of each region. The Climate Change Adaptation Act requires each region to establish a local climate change adaptation plan that includes the implementation of adaptation measures according to its natural and socioeconomic conditions.

In March 2021, TMG formulated the Tokyo Climate Change Adaptation Plan, which summarizes adaptation measures in five fields: (1) natural disasters, (2) human health, (3) agriculture, forestry, and fisheries industries, (4) water resources and the water environment, and (5) the natural environment. In January 2022, the Tokyo Climate Change Adaptation Center was established in the Tokyo Metropolitan Research Institute for Environmental Protection, based on the Act and Tokyo Climate Change Adaptation Plan.

Tokyo Metropolitan Research Institute for Environmental Protection

Visions for 2050

The effects of climate change adaptation are appearing in a broad range of fields, including natural disasters, human health, and agriculture, forestry, and fisheries. By incorporating climate change adaptation into all the relevant initiatives, TMG will comprehensively develop both mitigation and adaptation measures for climate change to build a robust city that protects the lives and property of Tokyo residents from extreme changes in climate.

● Minimizing risks from climate change impacts

- Realize a city that protects the lives and property of Tokyo residents as well as continues to attract people and businesses

Natural disasters	The environment in place is able to avoid or mitigate flood inundations and landslides caused by heavy rains or typhoons.
Human health	Adverse health effects due to temperature rise, including heatstroke and infectious disease as well as health problems due to air pollution, are minimized.
Agriculture, forestry, and fisheries industries	Agriculture, forestry, and fisheries industries resilient to temperature rise and disasters, such as typhoons, are realized.
Water resources and the water environment	Risks, such as droughts and deterioration of water quality, are reduced, and a stable supply of high-quality water and a comfortable water environment are realized.
Natural environment	Impacts on biodiversity are minimized, and the luxuriant natural environment is safeguarded.

2030 Targets

● Through the activities of TMG, Tokyo residents and businesses, efforts made in all fields affected by climate change will take into account climate change impacts in the future, incorporating the concept of sustainable recovery and the perspective of digital transformation.

Direction of Policies

Based on the Tokyo Climate Change Adaptation Plan, TMG will decisively promote adaptation measures throughout its organization by working with a variety of entities, and collecting, analyzing, and disseminating information in cooperation with the Tokyo Climate Change Adaptation Center.

Promoting adaptation measures in a broad range of fields

Through the Tokyo Climate Change Adaptation Plan Promotion Council, TMG will develop the following initiatives stipulated in the Tokyo Climate Change Adaptation Plan in every relevant area, making sure of the progress management with the PDCA cycle.

Natural disasters

In response to natural threats, such as floods, inland floods, storm surges, and landslides due to intensified heavy rains and typhoons, TMG will promote the utilization of state-of-the-art technologies and the development of urban facilities in both structural and non-structural aspects. To cope with increasingly larger typhoons and more frequent heavy rains in recent years, we will further improve our initiatives.

■ Structural measures

○ Infrastructure development

Measures for rivers against heavy rains

- Promote the development of regulating reservoirs under construction, such as the Wide-Area Regulating Reservoir under Loop Road No. 7, in parallel with that of river revetment.
- Continue to work on the goal of operationalizing new regulating reservoirs of 1.5 million m3 by FY 2030.
- Improve the discharge capacity of rivers through local improvements in the Tama area damaged by Typhoon Hagibis in 2019.
- Start efforts to formulate the Vision for River Facilities that takes

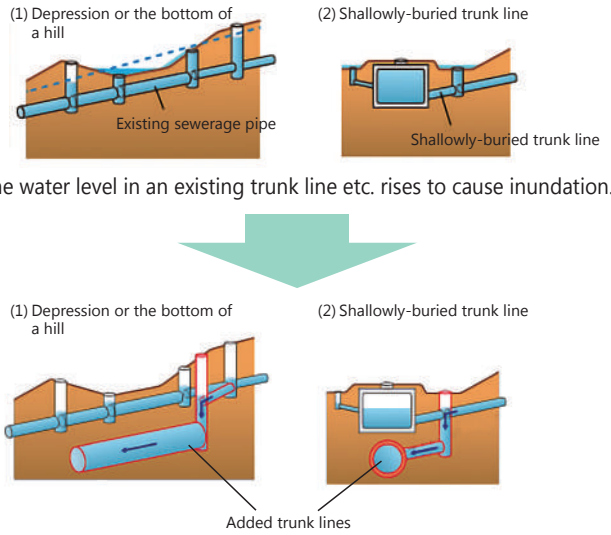
into account increased rainfall, rising sea levels, and larger typhoons due to climate change impacts, and work to set development targets to be pursued in the future, determine facility development policies, including underground rivers, and decide on policies for cooperating with other facilities.

Inside of the Regulating Reservoir under Loop Road No. 7

Flood control in sewerage systems

- Develop trunk lines, pump stations, and other infrastructure and promote the development of stormwater storage facilities to mitigate flood inundations at an early stage, focusing on areas with a high risk of inundations.

Flood control by developing sewerage trunk lines

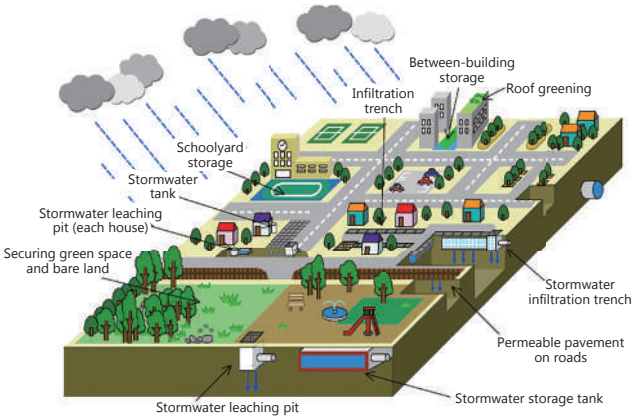


Inundation is prevented for a probable maximum precipitation by installing a new trunk line to lower the water level in an existing trunk line.

Promotion of measures for river basins

- To encourage municipalities to make voluntary and systematic efforts to control rainwater runoff equivalent to precipitation of 10 mm/hour, set non-binding targets for the amount to be controlled and post information on progress made towards achieving such targets.
- Carry out model projects in cooperation with municipalities to verify methods of effective installation of facilities and raise the awareness of Tokyo residents.
- Promote efforts to create and conserve greenery and reduce flood damage through a rainwater infiltration function.

Measures for river basins



Promoting the removal of utility poles

- Promote the removal of utility poles to prevent their collapse during earthquakes, storms and flooding, and facilitate a smooth response to disasters.
- Work to strengthen support for municipality roads in addition to Tokyo metropolitan roads and efforts for urban development based on the Tokyo Utility Pole Removal Plan revised in June 2021.
- Use expanded subsidies for community roads for disaster preparedness and start building a program for private roads in areas with densely-built wooden houses.
- In order to prevent power outages and communication failure in the event of intensified typhoons and other natural disasters, promote the removal of utility poles throughout the islands to achieve the development targets indicated in the Plan for the Removal of Utility Poles in the Islands of Tokyo formulated in January 2022.

Before

After

Strengthening the disaster preparedness function of forests

- Improve benefits to the general public from forests and water conservation forests in the Tama area by thinning and pruning and reduce flood damage by preventing the runoff of earth and sand and conserving water resources.
- Develop disaster-resistant forests through proper management using cutting-edge technologies, such as drones and lasers, and the promotion of forest circulation.

○ Development of materials and equipment

Strengthening disaster response in rescue activities

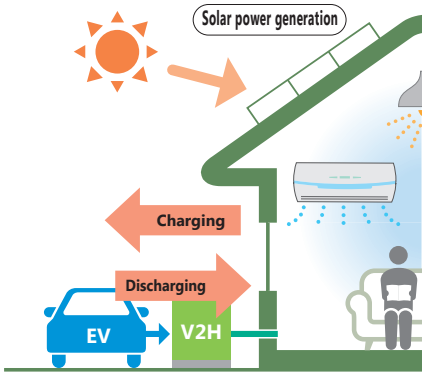
- Strengthen the flood prevention activity system by developing personal materials and equipment for flood disasters.
- Introduce mini-crawler cranes that can remove earth and sand in places that large cranes cannot access, and rubber boats with electric outboard motors that facilitate rescue operations in inundated areas.
- Introduce vehicles that can suction accumulated earth and sand to facilitate the rescue of people in need of evacuation.

Expansion and installation of emergency power supplies

- To ensure electricity is available at residential buildings, private facilities, and public facilities, including evacuation centers, even in the event of a disaster, promote the spread of self-consumed renewable generation, such as solar power generation and storage batteries, as well as fuel cells, for better regional disaster preparedness.
- Promote the installation of emergency power supplies at TMG facilities, municipalities' buildings, and other important bases.

Promoting the spread of ZEVs

- Promote the spread of zero emission vehicles (ZEVs) as "mobile storage batteries" in order to enable the supply of power and ensure power supply (V2H, V2B, etc.) at evacuation centers in the event of a disaster.
- Promote the installation of public chargers and hydrogen stations necessary for the spread, as well as the introduction of portable vehicle-to-load systems and V2H equipment necessary for the supply of power.



Better resilience in regions

- Improve the resilience of the islands by promoting the installation of solar power generation equipment and storage batteries on the islands.
- Promote the sharing of regional renewable energy and aim to enhance the effective use of renewable energy and regional disaster preparedness.

Promoting the spread of residential solar power generation and storage batteries

- Establish a new program that requires certain small and medium-sized new buildings, including houses, to install solar power generation equipment to standardize the installation of solar power generation equipment in new buildings.
- Encourage upgrading to highly insulated windows and doors and the installation of storage batteries, expand the installation of solar power generation equipment and storage batteries, and promote the spread of thermally insulated solar powered homes that are resistant to disasters and contribute to health of residents.

■ Non-structural measures

○ Preparation

Digitization of disaster measures

- Work to provide information and ensure a stable communication environment in the event of a disaster by utilizing digital signage capable of providing disaster information and smart poles with smartphone chargers.
- Promote the digitization of disaster preparedness, taking into account the utilization of public-private data platforms for disaster preparedness, in which various actors share various data through open APIs*2 etc.
- Simulate the damage caused by inundation and landslides on the 3D city model of the Tokyo Digital Twin. Use it in training and other occasions for more effective disaster response operations by the administration.

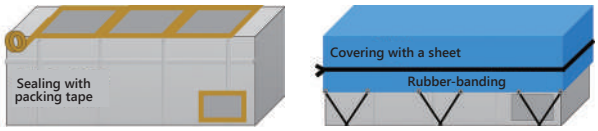
*2 Application Programming Interfaces for calling and using functions of a computer program (software) or data under its control from another external program.

Smart pole with 5G base stations in Nishi-Shinjuku

Corporate support etc.

- To promote flood control measures taken by businesses handling chemical substance, provide technical and financial support for flood control measures implemented by small- and medium-sized businesses based on the Tokyo Metropolitan Government Chemical Substance Control Guidelines.

Examples of preventing the outflow of chemical substances (sealing and covering)



○ Response in the event of a disaster

Improved provision of information on disaster preparedness

- To implement smooth flood prevention activities and encourage prompt evacuation, consider specifying additional flood forecast rivers and water level information rivers for which flood danger information is provided.
- Improve the provision of information on disaster preparedness to facilitate proper evacuation of Tokyo residents by strengthening the Flood Control Integrated Information System and starting the operation of the Storm Surge Disaster Prevention Information System.
- Continue to provide rainfall information through Tokyo Amesh.
- Promote the development of information gathering and utilization tools, such as the installation of live cameras to improve the convenience of checking on-site conditions at island ports and the use of drones and satellites to map the shape of structures. Strengthen the disaster preparedness of the islands by building a platform for the aggregation of such information, accelerating disaster response, and improving remote control and efficiency of facility management.

Efforts for early restoration and recovery

- To dispose of disaster waste properly, smoothly, and promptly, support the formulation of disaster waste treatment plans and manuals for municipalities and carry out wide-area collaboration and cooperation.
- Promote the development of a system to provide temporary housing and emergency repairs in the event of a disaster.

Officials dispatched for Typhoon Hagibis in 2019

Health

Further enhance preventive and ex-post measures to minimize adverse health effects due to temperature rise, such as patients with heat stroke or infectious diseases and health hazards caused by air pollution.

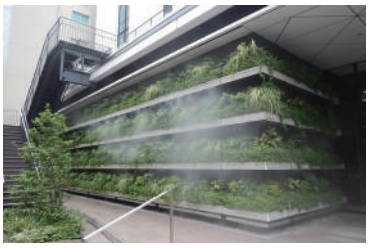
■ Fostering momentum and raising public awareness of heat countermeasures

- Foster momentum for "Uchimizu" (water sprinkling) and other heat countermeasures through the distribution of "Uchimizu" goods and public relations activities.
- Communicate the knowledge and expertise in heat countermeasures gained by the Tokyo 2020 Games to Tokyo residents and businesses.

■ Creation of cool spots

- Install heat countermeasure equipment, including fine misting devices, in cooperation with municipalities.

Example of installation of fine misting devices (OASE Shibaura, Minato-ku)



■ Construction of heat blocking pavement etc.

- Construct a total of approximately 245 km of heat blocking and water-retaining pavements on Tokyo metropolitan roads in the priority area centering around the center core area by FY 2030.

■ Promotion of urban greening

- Steadily operate the Greenery Program in development and building plans aiming for the creation of high-quality greenery throughout the city and ensure greenery by encouraging active efforts of the private sector through the Urban Redevelopment Systems.
- To conserve agricultural land in urbanization promotion areas, which is in marked decline, promote the designation as productive green land or specific productive green land in cooperation with municipalities.
- To ensure the quality of roadside trees whose numbers have been doubled by the roadside tree enhancement project, utilize digital technology in the roadside tree project to manage them in a prompt and efficient manner. Maintain roadside trees as a green infrastructure suitable for street space in the future.

■ Heat countermeasures in residential buildings

- In order to diminish the high incidence of home-based heat stroke, encourage energy efficiency retrofits of existing houses and increase the number of Tokyo Zero Emission Houses with high levels of heat insulation and energy efficiency performance, furnished with highly insulated windows to block heat in summer and high-efficiency air conditioners. Support the efforts of municipalities that apply heat-shielding paint to residential buildings or encourage the uptake of refurbished home appliances with high energy efficiency performance.

■ Development and utilization of smart poles

- Collect temperature and humidity data through smart poles to be used for heat countermeasures and other initiatives.

■ Measures for mosquito-borne infectious diseases

- Reduce the risk of infectious disease outbreak by providing information on the occurrence of mosquito-borne infectious diseases, infection prevention measures, and appropriate measures to control mosquito sources.
- Conduct surveillance of mosquitoes, which transmit infectious diseases, and ensure an inspection system for pathogens.

■ Measures against alien species which cause damage to humans

- Since there is concern about an increased risk of invasion and settlement of alien species, such as fire ants that breed in a hot and humid environment, reduce the risk to the lives and health of Tokyo residents by working with the national government and municipalities, conducting surveillance of fire ants, and raising awareness of Tokyo residents.

■ Reduction of air pollutant emissions

- To decrease the concentrations of PM2.5 and photochemical oxidants, reduce the emissions of causative substances by encouraging measures taken at factories, vehicle emission reduction measures, and voluntary efforts by businesses.
- Work with other members of the Nine Local Governments Coalition to analyze the mechanism and take measures accordingly as air pollutants and their causative substances move across prefectural borders.
- Make air quality data available as open data in order to link it with measures for air pollution that make use of 5G, AI, and other state-of-the-art technologies.

Agriculture, forestry, and fisheries industries

TMG will promote the use of digital technology in response to changes in the cultivation environment for agricultural products and the marine environment due to climate change impacts, and concerns about damage from typhoons and heavy rains. We will realize robust agriculture, forestry, and fisheries industries by providing technical support and detailed guidance for the switch to items and varieties compatible with temperature rise, developing agricultural facilities, promoting forest circulation, and developing methods for growing the fisheries industry.

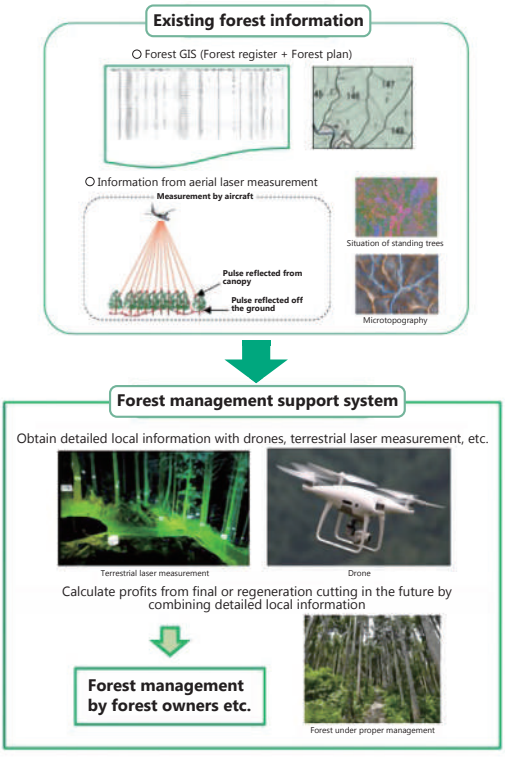
■ Promotion of Tokyo-Style Smart Agriculture

- Promote Tokyo-Style Smart Agriculture that maintains stable agricultural production even under climate change, including large typhoons and extreme heat, and realizes high profits even on a small scale.
- Accelerate efforts to implement smart agriculture in the islands by verifying the use of digital technology suitable for the islands given the limited infrastructure and natural environmental conditions.

■ Development of forests resistant to forest disasters (smart forestry)

- Build and operate a system that helps create a forest management plan, guidelines for the forest management by municipalities, forest owners, and forest management entities.
- Promote proper forest management and forest circulation by using the information obtained with cutting-edge technologies, such as drones and laser measurement, in the system.

Scheme of forest management support



■ Development of marine product supply infrastructure (smart fisheries)

- Using fishing ground environment observation services based on state-of-the-art systems, provide forecast information on conditions of each fishing ground, such as seawater temperature, direction and velocity of current, to assist fishermen in preparing for future impacts at their own discretion.

Water resources and the water environment

TMG will reduce the risks posed by severe droughts and deterioration of raw water quality as much as possible to ensure stable supply of high-quality tap water. In addition to conducting continuous monitoring, we will create a comfortable water environment through improvements in water quality by enhancing the combined sewer system and developing advanced treatment facilities as well as through maintenance and improvement of the water quality of rivers and canals.

■ Conservation and management of water conservation forests

- Implement thinning, pruning, and other conservation tasks and take measures against deer damage in water conservation forests to enhance their capability.
- Purchase devastated privately owned forests and cooperate with local governments to restore such forests.
- Efficiently conserve and manage water conservation forests by using drones for checking forest conditions in ordinary times and on-site investigations in the event of a disaster.

■ Improvement of quality of treated water

- Introduce advanced and semi-advanced treatment facilities at water reclamation centers to further improve the quality of treated sewage.

■ Monitoring of water quality as well as research and study of aquatic organisms

- Continue monitoring of water quality as well as research and study of aquatic organisms to verify the effects of initiatives and identify the improvements in the waterfront environment for better initiatives in the future.

Research and study of aquatic organisms

Natural environment

TMG will minimize impacts on biodiversity, such as changes in the distribution of organisms, resulting from the impacts of climate change. In order to improve resilience, we will strive to enhance efforts to utilize and restore the functions of the natural environment.

■ Expansion of conservation areas to protect valuable biodiversity

- By designating parcels of good natural land as conservation areas and appropriately conserving and managing them, maintain such areas to serve as a base for biodiversity in Tokyo and reduce flood damage through rainwater infiltration.
- Implement a project to improve biodiversity and attractiveness in collaboration with experts in the field and various entities.

■ Reforestation in the Tama area

- To restore public benefits of plantation forests of Japanese cedar and cypress in the Tama area that have been devastated, ensure their reforestation through thinning and pruning.

■ Creation and conservation of greenery

- Steadily operate the Greenery Program in development and building plans aiming for the creation of high-quality greenery throughout the city and ensure greenery by encouraging active efforts of the private sector through the Urban Redevelopment Systems.
- To conserve agricultural land in urbanization promotion areas, which is in marked decline, promote the designation as productive green land or specific productive green land in cooperation with municipalities.
- Secure green spaces by steadily operating the Development Permit System in development that involves alteration of natural land.
- Systematically promote the greening of riverbanks, which are valuable waterfront areas in central Tokyo, and implement efforts to improve the quality of river facilities by making use of the natural environment.
- Promote appropriate maintenance of park forests to improve their comfort and safety according to the characteristics of each park. Improve the quality of greenery by efficiently maintaining roadside trees.

■ Promoting the conservation and sustainable use of natural parks

- Promote the conservation and proper use of natural parks by deploying rangers and deepen users' understanding of the value of nature by using digital technology.

■ Proper management of wildlife

- To prevent deer damage to agriculture, forestry, and ecosystems, based on the deer management plan, conduct monitoring surveys, install and manage vegetation protection fences, and promote capture enhancement and damage control measures while verifying the progress and effects of the projects.

Collecting and providing information in collaboration with the Climate Change Adaptation Center

Through a collaboration with the Climate Change Adaptation Center, TMG will collect, organize, and analyze information on the actual conditions of temperature etc. in Tokyo and neighboring areas, impacts of climate change, and examples of climate change adaptation measures at home and abroad as well as actively disseminating information to encourage efforts by Tokyo residents.

Providing support and advice to municipalities

TMG will provide support for municipalities that formulate climate change adaptation plans, and encourage them to promote initiatives according to their natural, economic, and social conditions by working with the Climate Change Adaptation Center and giving advice as necessary.

Column

Urban Resilience Project (tentative name)

In addition to storms and flooding that are expected to become more intensified and frequent due to climate change, large earthquakes, volcanic eruptions, epidemics of new infectious diseases, or a scarcity of electricity could occur at any time in Tokyo. There is also the risk of complex disasters, such as being hit by a typhoon during the recovery process after a major earthquake.

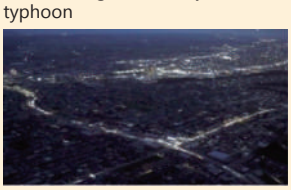
The Urban Resilience Project (tentative name) to be formulated within FY 2022 will clarify what should be developed and improved to further strengthen preparedness for disasters with a focus on infrastructure development. It will also show the course of efforts for the future, combining non-structural measures, including digital technology and cooperation with a variety of entities. When determining what efforts need to be made, we will set a common point of view to improve initiatives through a perspective of backcasting, using simulations and all available data.

To realize the safest and most secure city in the world which maximizes the protection of the lives of its residents, minimizes damage, and quickly restores urban functions in the event of a disaster, we will put initiatives we should work on into a project and promote it to achieve a resilient and sustainable Tokyo.

The Tama River swollen with Typhoon Hagibis in 2019

Utility poles collapsed by an earthquake

Power outage caused by a typhoon



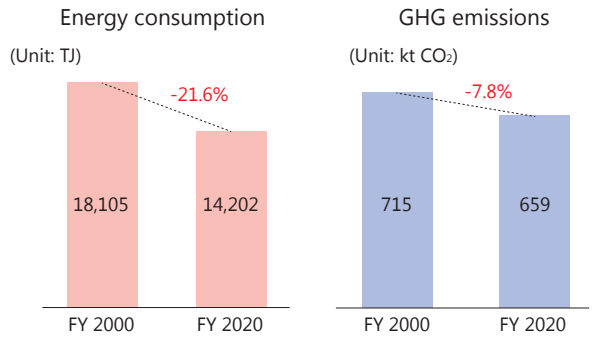
Bold Acceleration of TMG's Initiatives for Its Own Sustainability

To realize a 2050 Zero Emission Tokyo and a 2030 Carbon Half, TMG needs to encourage the drastic behavior change of all entities, including Tokyo residents and businesses. That cannot be achieved by administrative capability alone, meaning the understanding and cooperation of Tokyo residents and businesses are essential. As a large business that consumes a lot of energy and resources, TMG will take the initiative in implementing reforms with "Let's Start from Here" in mind, and decisively take the lead in the decarbonization of the whole of society.

Status Quo

Greenhouse gas emissions etc. at TMG facilities (governor's bureaus/departments)

Energy consumption at TMG facilities (governor's bureaus/departments) decreased by 21.6% in FY 2020 from FY 2000 due to power saving and energy efficiency measures taken after the Great East Japan Earthquake in 2011. Greenhouse gas emissions in FY 2020 only decreased by 7.8% from FY 2000 due to the worsening of the emission factor of electricity caused by an increase in thermal power plants used following nuclear power station closures after the earthquake.



The use of renewable energy

The percentage of power generated by renewable energy at TMG facilities (governor's bureaus/departments) in FY 2020 was 23.1%. TMG has been promoting the TMG Power Plan, in which it actively utilizes 100% renewable electricity, including post-FIT electricity generated in Tokyo, at its facilities, resulting in a steady increase in the amount of renewable power used.

The total capacity of solar power generation equipment installed at governor's bureaus/departments was 8,585 kW in FY 2020. Solar power generation equipment is installed in principle at the time of new construction or renovation, contributing to an increase in the amount of installed capacity.

Promoting ZEV introduction

Among the TMG-owned vehicle fleet as of FY 2020, non-gasoline passenger cars accounted for 69% and non-gasoline motorcycles accounted for 4%, excluding special-purpose vehicles. FC buses have been introduced ahead of others in the Toei Bus Lines since FY 2016, with 71 in operation as of the end of FY 2021.

As of the end of FY 2020, 58 public chargers were installed at 17 TMG facilities, principally parks.

Reducing single-use plastics

As a result of a call for reducing single-use plastics, the amount of plastic waste ("other plastics") discharged from TMG buildings was 143,450 kg in FY 2020, a reduction of about 24% compared to FY 2017.

Reducing food waste

In FY 2020, the amount of food recycled at TMG buildings (TMG No. 1 and No. 2 Buildings as well as the Assembly Hall) was 36,677 kg (85,693 kg in FY 2019), and the ratio of food recycled to municipal solid waste was 40.1% (49.9% in FY 2019).

* The amount of food handled decreased in FY 2020 due to temporary closures and shortened business hours to prevent the spread of COVID-19.

Promoting measures for fluorocarbons

Large amounts of fluorocarbons are used as refrigerants for air conditioners, refrigerators, and freezers at TMG facilities. The amount of leakage calculated based on the Act on Rational Use and Proper Management of Fluorocarbons for all TMG facilities in FY 2020 was 5,148 tonne-CO_2.

Formulating the Zero Emission TMG Action Plan

TMG took the lead in reducing greenhouse gases associated with its office work and business activities based on TMG's Smart Energy Action Plan covering five years from FY 2015 to FY 2019. In March 2021, the Zero Emission TMG Action Plan covering five years from FY 2020 to FY 2024 was formulated to accelerate actions toward the realization of a 2030 Carbon Half at TMG.

In addition to the enhancement of energy efficiency and expanded use of renewable energy in the past, all organizations in TMG are working on promoting ZEV introduction, reducing single-use plastics, reducing food waste, and promoting measures for fluorocarbons.

FY 2024 Targets

To demonstrate that the TMG is accelerating its efforts toward a 2030 Carbon Half throughout Tokyo, the following targets for FY 2024 set forth in the Zero Emission TMG Action Plan have been incorporated into the new Tokyo Environmental Master Plan.

Enhancement of energy efficiency and expanded use of renewable energy to realize zero emission buildings

- GHG emissions compared to FY 2000: 40% reduction
- Energy consumption compared to FY 2000: 30% reduction
- Percentage of power generated by renewable energy: Approx. 50%
- Installation of solar power generation equipment at all applicable TMG facilities by FY 2030
- Total capacity of solar power generation equipment installed: 20 MW

Promoting ZEV introduction

- Replacement of all TMG-owned vehicles with non-gasoline counterparts: Passenger cars by FY 2024/ motorcycles by FY 2029

  * Except special-purpose vehicles
- Installation of public chargers at TMG facilities: 300+

Reducing single-use plastics

- Incineration of plastic waste from TMG buildings compared to FY 2017: 20% reduction through less single-use plastics and more recycling
- Introduction of advanced recycling, such as bottle-to-bottle recycling of plastic bottles
- Using reusable cups etc. in principle at events hosted by TMG

Reducing food waste

- Users taking action to reduce food waste in restaurants and shops
- Food recycling expanded at restaurants and shops in TMG buildings
- Action for food waste reduction ensured at events that provide food and drink
- Minimum disposal of emergency food stockpiled at TMG

Promoting measures for fluorocarbons

- Replacing equipment with non-fluorocarbon or low GWP counterpart in principle
- Managers ensuring the prevention of leakage when equipment is used or disposed of

Direction of Policies

In order to demonstrate that TMG will lead by example to Tokyo residents and businesses, we will mobilize all bureaus and departments throughout TMG to promote our initiatives promptly and decisively.

Expansion of the use of renewable energy

Expanding the installation of solar power generation equipment

To make maximum use of the potential of public facilities, TMG will accelerate the installation of solar power generation equipment at its existing facilities in addition to those newly constructed or renovated and complete the installation at all of its applicable facilities by FY 2030.

TMG will accelerate the installation of solar power generation equipment at Tokyo public housing (including that for middle-income residents; the same applies hereinafter) as part of its range of proactive efforts. As for public corporation housing, in order to promote the installation of equipment at private housing, TMG will verify installation methods and procedures for self-consumption and sale of electricity, and develop a model that will serve as a reference when installing the equipment at private condominiums.

Promoting the procurement of renewable power

TMG will expand the scope of the TMG Power Plan for utilizing renewable power generated in and outside Tokyo to switch all electricity used at its facilities (governor's bureaus/departments) to renewable power by 2030. We will also consider the sustainability of renewable power sources when concluding renewable power contracts.

For facilities not covered by the TMG Power Plan, we will accelerate the use of electricity with a higher percentage of renewable energy through green purchasing of electricity.

Realization of zero emission TMG facilities

Promotion of zero emissions by applying the Tokyo Energy Savings & Renewable Energy Specifications

TMG will maximize the introduction of energy efficiency technology and renewable energy equipment indicated in the Tokyo Energy Savings & Renewable Energy Specifications at the time of new construction or renovation, and make sure to achieve zero emissions at TMG facilities by improving energy efficiency at buildings in operation.

Tokyo Metropolitan Archives demonstrating ZEB characteristics

We will decisively promote zero-emissions at existing TMG facilities by formulating new standards that define energy efficient operations and their effects, and upgrading the facilities in a systematic manner.

Ensuring operational measures are in place through automatic energy management

TMG will improve the efficiency of energy use by building a management system that does not rely on people to achieve both energy efficiency and comfort, such as automatic air conditioning based on AI, IoT, and other new technologies.

Promoting ZEV introduction

TMG will ensure the replacement of TMG-owned vehicles (except special-purpose vehicles) with ZEVs at the time of renewal in principle, upgrade them to ZEVs and other non-gasoline vehicles in a systematic manner, and actively introduce EV motorcycles and FC buses.

TMG-owned ZEV

Fuel cell bus (FC bus)

TMG will decisively promote the broader use of ZEVs by for example introducing chargers to its facilities with 10 or more parking spaces in principle according to the policy of public charger installation at TMG facilities, as infrastructure development in line with the introduction of ZEVs.

We will also install chargers for residents of Tokyo public housing and public corporation housing as well as public chargers available for everyone.

Since it is difficult to acquire land for hydrogen stations in Tokyo, we will promote their installation by for example utilizing TMG-owned land.

Public chargers at TMG facility

Measures for single-use plastics

TMG will work to further reduce plastic use by promoting bottle-to-bottle recycling and advanced plastic recycling at TMG facilities in addition to calling on officials to reduce single-use plastics.

Measures for food waste

TMG will make sure to control food waste and call for action for food waste reduction at restaurants and shops in TMG facilities, and encourage action for food waste reduction at events.

Measures for fluorocarbons

TMG will incorporate non-fluorocarbon equipment in the procurement of goods and public works, and introduce such equipment at the time of new construction or renovation of TMG facilities in a planned manner. We will make sure to prevent leakage of fluorocarbons during the use and disposal of equipment by providing technical support for inspections and conducting on-site guidance as necessary.

Lifeline facilities

In order to reduce energy consumption and greenhouse gas emissions in the water supply service, TMG will promote efforts to introduce solar power generation equipment, small hydropower generation equipment, and energy-efficient pump equipment in conjunction with the development and renewal of facilities.

To make sure of energy efficiency and the expanded use of renewable energy in the sewerage service, we will promote efforts to introduce energy-efficient equipment in the water treatment and sludge treatment processes, in addition to the introduction of solar power generation equipment and energy self-sustaining sludge incinerators.

Small hydropower generation equipment

Realization of an Environmentally Symbiotic, Prosperous Society that Continues to Benefit from Biodiversity

Realization of an Environmentally Symbiotic, Prosperous Society that Continues to Benefit from Biodiversity

The term "biodiversity" refers to a situation where there is a variety of plants, where there are creatures with unique characteristics, and where these various elements are able to coexist in harmony. Biodiversity is something irreplaceable created over long periods through a variety of lifeforms, including human beings. It provides us with a wealth of benefits that are essential for our lives, such as the supply of food and water, the adjustment of climate, the purification of water, peace of mind, art and culture, and the production of oxygen through photosynthesis.

However, biodiversity has declined throughout the world primarily due to the impacts of human activity and climate change, which has developed into a serious environmental issue on a global scale comparable with climate change, posing the immediate need for appropriate measures. The conservation and restoration of biodiversity contributes to the mitigation of and adaptation to climate change and is closely related to people's quality of life by means of the absorption of carbon dioxide by plants and the alleviation of damage caused by heavy rains through rainwater infiltration.

TMG will put biodiversity on a path to recovery in order to realize an environmentally symbiotic, prosperous society that will enable us to continue to benefit from biodiversity.

Status Quo

Blessings of biodiversity (four ecosystem services)

Our lives are supported by the blessings of ecosystems based on biodiversity. These blessings are called ecosystem services that are classified into four categories:

Provisioning services

Supply the resources needed for our daily lives, such as food, wood, and water. The metropolis of Tokyo relies on areas outside of Tokyo (other regions and countries) for food, wood, and other resources.

Regulating services

Bring about a healthy and safe environment for people to live in by absorbing carbon dioxide, reducing heavy rain damage, and purifying water. There has been growing interest in NbSs (Nature-based Solutions) and green infrastructure that help solve social issues by utilizing the diverse functions of the natural environment.

Tidal flats capable of purifying water

Cultural services

Provide artistic and cultural inspiration, educational effects, and physical and mental peace through contact with nature and fauna.

Supporting services

Support other ecosystem services as the basis for the survival of all life based on natural material cycles, such as oxygen generation by photosynthesis, soil formation, nutrient cycling, and water cycling.

Blessings of biodiversity form the basis of all life

Trends in biodiversity

Setting of new global targets

A new set of global targets, the Post-2020 Global Biodiversity Framework, is under consideration for adoption at the 15th Conference of the Parties to the Convention on Biological Diversity (COP15). At Part 1 of the conference held in Kunming, China in October 2021, the Kunming Declaration was adopted, emphasizing putting biodiversity on a path to recovery (a nature-positive framework). The Post-2020 Global Biodiversity Framework will be adopted at Part 2 held in Montreal, Canada in December 2022. The national government is considering the next National Biodiversity Strategy in light of international trends. In anticipation of this development, the TMG is exploring the revision of the Local Biodiversity Strategy as of September 2022.

Biodiversity affecting business activities

The financial world and private businesses are also required to consider and restore biodiversity, including supply chains. Current trends show that investment in businesses with environmental load is slowing as they are not seen as sustainable assets, with investment preferentially going to businesses that consider environmental issues, such as the need for sustainable procurement and so on.

Efforts to disclose information on businesses' natural capital are underway as evidenced by the fact that in June 2021 four organizations, including the United Nations Development Program (UNDP), launched the Taskforce on Nature-related Financial Disclosure (TNFD) to create a mechanism to identify and disclose businesses' dependence and impacts on nature. As SBTs related to climate change are being set, target setting methods for SBTs for Nature (Science Based Targets for Nature)*1 are also being developed to make guidance available to the public in 2022.

*1 Measurable, actionable, and time-bound objectives, based on the best available science, that allow actors to align with Earth's limits and societal sustainability goals with regard to a system in which freshwater, biodiversity, land, and ocean are interrelated through the value chain.

Issues facing biodiversity in Tokyo

Biodiversity is deteriorating due to the impacts of four crises, including development and climate change (direct factors), and those of underlying socio-economic conditions (indirect factors).

Direct factors

■ First crisis (the impact of development and other human activity)

The first crisis refers to a decrease in the habitats of living things and the decrease and extinction of species due to development, overexploitation, and overuse. Biodiversity in Tokyo has been greatly affected by deforestation due to development, a decrease in agricultural land, such as paddy fields and dry fields, and reduced tidal flats and shallow areas.

TMG is promoting efforts to increase greenery in the whole of Tokyo by taking every opportunity to increase the quantity and improve the quality of greenery, as shown by the development of parks and green spaces in cooperation with municipalities, the conservation of agricultural land and natural land, and the creation of greenery in urban development by the private sector. From the previous survey in 2013, the green rate in 2018 increased by 0.1 points for parks and green spaces, but decreased by 0.5 points in total, showing a continuous long-term downward trend.

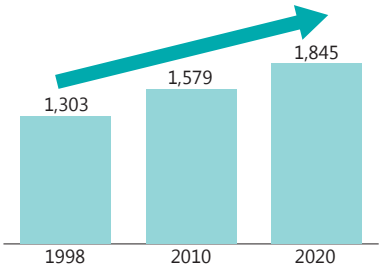
Changes in the green rate in Tokyo

Categories		Green rate by use				
Areas	Survey years	Parks/ green spaces	Agricultural sites	Water surfaces/ rivers/ waterways	Forests/ wilderness/ grass	Green rate in total
Tokyo	2013 (reference)	3.8%	3.7%	2.6%	42.9%	53.0%
	2018	3.9%	3.4%	2.6%	42.6%	52.5%
	Changes in 2013 - 2018	0.1	-0.3	0	-0.3	-0.5
23 wards	2013 (reference)	5.6%	1.0%	4.5%	13.3%	24.5%
	2018	5.7%	0.9%	4.5%	13.0%	24.2%
	Changes in 2013 - 2018	0.1	-0.1	0	-0.3	-0.3
Tama area	2013 (reference)	2.8%	5.1%	1.5%	59.0%	68.4%
	2018	2.9%	4.7%	1.5%	58.7%	67.8%
	Changes in 2013 - 2018	0.1	-0.4	0	-0.3	-0.6

We can still see the alteration of habitats for rare wild fauna and flora, and the over-collection and robbing of individual organisms.

Wildlife Species in Serious Need of Conservation in Tokyo - Tokyo Red List (Mainland) 2020 Edition published by TMG in 2021 shows that the number of species on the Red List has increased by about 40% over the past 20 years in the mainland of Tokyo. In the last 10 years, 80 species, mainly plants and insects, have been added to the list of extinct species.

Changes in the number of species on the Mainland Red List

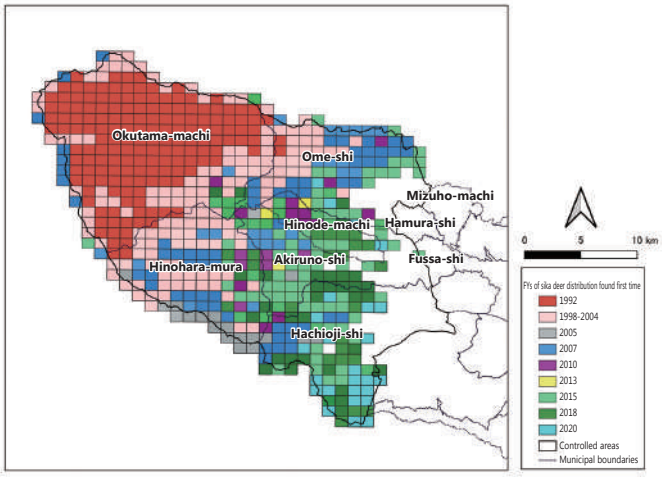


■ Second crisis (the impact of reduced care afforded to the natural environment)

The second crisis refers to the deterioration of the quality of nature due to reduced care afforded to the natural environment. For example, as the management of wooded areas continues to be abandoned and deciduous forests are replaced by dense evergreen forests, plants and insects that favor bright forest floors are declining. In addition, a decrease in the number of hunters has increased the number of wild animals, causing feeding damage to crops and trees.

Sika deer (Cervus nippon) in particular overeat trees and alpine plants, bringing about serious problems, such as a decrease in rare alpine plants, deterioration of habitats for living things, and a lessening of the mitigating effects of plants against landslides. Although TMG is taking measures against the sika deer in cooperation with municipalities, their distributional ranges are expanding to the east and south, and their population has remained flat. TMG revised the Second Stage Plan for Sika-Deer Management in March 2022 and is taking further measures.

Expansion of sika deer distributional ranges in Tokyo



■ Third crisis (the impact of things brought in by humans)

The third crisis refers to the impact of alien species, chemical substances, etc. brought in by humans from home and abroad. It has been pointed out that ecosystems are adversely affected by alien species that are unintentionally brought in, as they prey on native species, deprive them of their habitats, and cause genetic pollution by crossbreeding with them. Fire ants, red fire ants, etc. can hitch a ride along with imported materials from the port of Tokyo or elsewhere, and pose a threat not only to native ecosystems but also to the human body. Genetic contamination may be caused by things brought in by humans from other regions in Japan as well as imports from abroad.

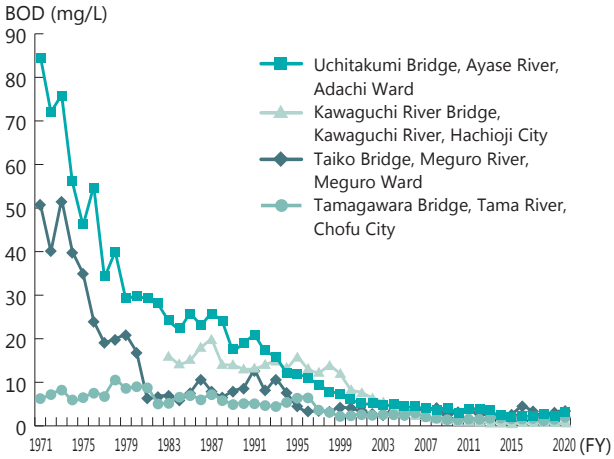
A green anole preying on Chrysochroa holstii, a protected species

American crayfish

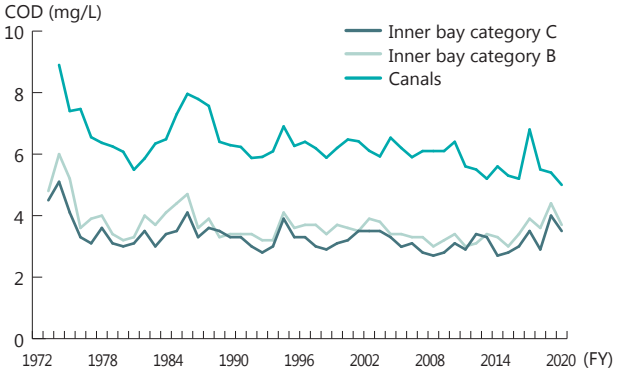
Plastic waste flowing into rivers and the ocean is affecting marine life, and the heavy use of chemical substances, such as pesticides and chemical fertilizers, is affecting insects and microorganisms, leading to the deterioration of soil and groundwater.

The water quality of rivers and the inner bay of Tokyo in FY 2020 indicated that the environmental standards for BOD[*2] for rivers were 98% achieved. On the other hand, the environmental standards for COD[*3] in the inner bay of Tokyo were only 25% achieved. Red tides and hypoxic water masses formed in the summer in particular, making the waters unfavorable habitats for fauna.

Yearly changes in fiscal year average BOD in rivers



Yearly changes in fiscal year average COD in the Bay of Tokyo



*2 Biochemical oxygen demand which refers to the amount of oxygen consumed when organic matter in water is decomposed by microorganisms. It is a representative index for measuring organic pollution in rivers.
*3 Chemical oxygen demand which refers to the amount of oxygen consumed when organic matter in water is oxidized with an oxidant. It is a representative index for measuring organic pollution in lakes and waters.

■ Fourth crisis (the impact of changes in the global environment)

The fourth crisis refers to the impact of changes in the global environment, including global warming, acid rain, and the depletion of the ozone layer. Climate change caused by global warming has a direct impact on ecosystems and a major impact on the provisioning services, such as a decrease in crop production and fish catches. It is predicted that climate change impacts will become even more pronounced in the next several decades if global warming continues at this rate.

Indirect factors

The four crises (direct factors) of biodiversity are caused by a complicated interaction between factors related to human activity, such as changes in the industrial structure, people's interest in nature, and consumption and production, and indirect factors underlying them, such as people's values and behaviors.

To solve problems of biodiversity, we have to not only take measures for the direct factors, but also implement social change that will fundamentally change the indirect factors behind them, or in other words, our society, economy, and way of life.

Visions for 2050

TMG aims for an environmentally symbiotic, prosperous society that will respect nature, consider sustainability on a global scale, and continue to benefit from biodiversity.

Our vision for each of the four ecosystem services includes:

- Provisioning services: A city that uses natural resources inside and outside it in a sustainable manner
  Products made in Tokyo will be sustainably consumed as a Tokyo brand through local production and consumption. The natural environment of Tokyo will be accessed in a sustainable manner. Sustainable economic activities with a low environmental load will be ensured when purchasing food, products, and materials from other regions.

- Regulating services: A resilient city with the functions of nature
  Resilient urban development will be in progress by making full use of the functions of nature, such as mitigation of the heat island effect through green spaces and alleviation of flood damage through rainwater infiltration and storage.

- Cultural services: A city that enriches life with the blessings of nature
  The natural environment of Tokyo, including familiar greenery, will be used as resources in a sustainable manner, such as valuable outdoor spaces that bring healing and comfort. The value of Tokyo's natural environment will be reassessed to take into account how it enriches people's lives by serving as a conduit of history and culture based on nature.

- Supporting services: A city full of luxuriant nature and living in harmony with creatures
  Ecologically friendly green spaces will fill central parts of the city, while nature will be maintained and restored in the suburbs with living things brought back. Tokyo will be a leading eco-friendly city centered on nature with environmentally symbiotic living spaces and work environments realized.

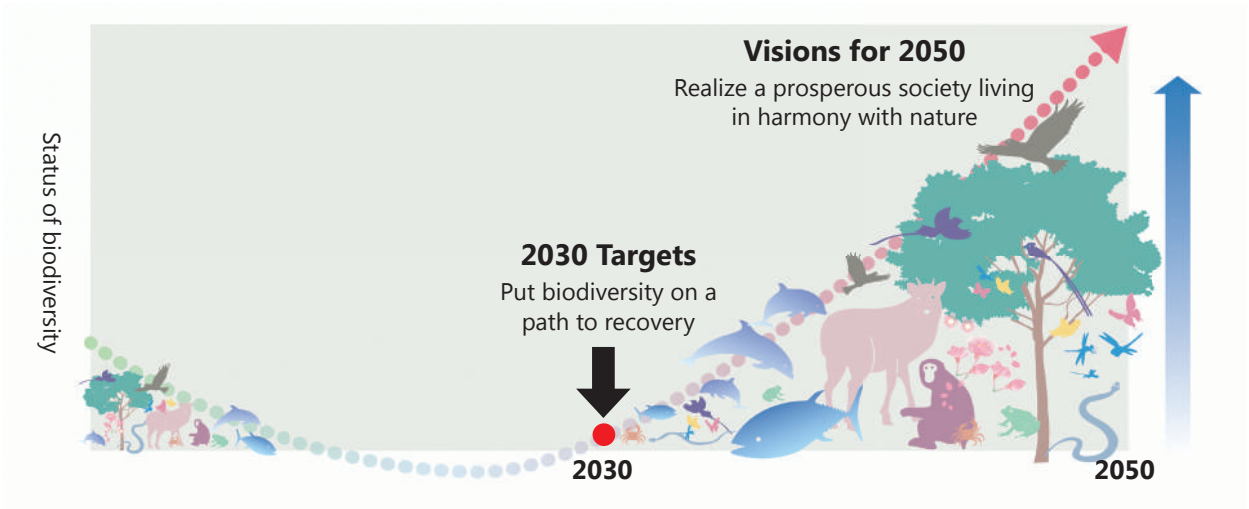
Tokyo's vision specific to a metropolis in addition to that for each ecosystem service includes:

- Conservation and sustainable use of biodiversity established throughout Tokyo
- Behavior changes in place taking account of biodiversity not only in Tokyo but also across Japan and on a global scale

2030 Targets

- Biodiversity will be put on a path to recovery by all entities that aim for an environmentally symbiotic, prosperous society, working together to promote the conservation and sustainable use of biodiversity.
  = Achieving a nature-positive framework

Image of achieving a nature-positive framework



Three Basic Strategies for 2030

- Tokyo residents, businesses, private organizations, the administration, and other entities will collaborate to advance efforts based on the following three basic strategies. To steadily promote these strategies, a variety of entities will set goals they can work on together.

Basic Strategy I — **Promoting the conservation and recovery of biodiversity, handing down the luxuriant nature of Tokyo to future generations**

Basic Strategy II — **Using the blessings of biodiversity in a sustainable manner, utilizing the functions of nature to improve the lives of Tokyo residents**

Basic Strategy III — **Recognizing the value of biodiversity, changing that idea into actions that address global issues as well as those in Tokyo**

* The development of initiatives related to biodiversity will be consistent with the Tokyo Local Biodiversity Strategy that is being formulated as of September 2022.

Promoting the conservation and recovery of biodiversity, handing down the luxuriant nature of Tokyo to future generations

In Tokyo, urban development and reduced care afforded by humans have led to the fragmentation and shrinkage of green spaces as a base for biodiversity and a decrease in habitats for a variety of fauna. Invasive alien species prey on native species including rare species, compete or crossbreed with native species, eat crops, and injure people.

TMG will hand down the luxuriant nature of Tokyo to future generations by conserving good biodiversity that remains today and restoring biodiversity that has become somewhat deteriorated based on basic information on the nature of Tokyo.

2030 Targets

- Biodiversity upgrade areas: 10,000+*

  By conserving and managing natural land, ensuring new greenery, and opening new parks and green spaces, 10,000 ha of biodiversity upgrade areas will be realized by 2030, where habitats for fauna and ecosystem services are maintained and improved, encouraging efforts to maintain and improve the quality of greenery as well as ensure and expand the quantity of greenery.

  * Private sector efforts, such as OECM (Other Effective area-based Conservation Measures), are expressed as "+ (plus)" so that the target can be pursued together with various entities.

- Zero Wild Extinction Action

  By 2030, efforts will have been made in collaboration with a variety of actors to conserve and restore declining wildlife so that no species will become extinct in the wild.

Direction of Policies

Conservation of local ecosystems and habitats for a variety of fauna

Conserving and expanding important areas for biodiversity conservation

TMG will designate or make publicly-owned additional conservation areas based on the Tokyo Metropolitan Nature Conservation Ordinance, and work with rangers and volunteer groups to appropriately conserve the natural environment in Tokyo, including natural parks, conservation areas, and water conservation forests. We will properly safeguard the islands in particular as they have unique ecosystems and are important areas in terms of biodiversity.

Yokosawairi satoyama conservation area

TMG will also open new Tokyo Metropolitan parks and marine parks, expand greenery that has strong sustainability prospects, and promote the conservation of biodiversity in existing greenery and that of the natural environment in cooperation with the private sector.

By thinning degraded plantation forests to turn them into forests with needle-leaved and broad-leaved trees, and ensuring habitats for wild birds and beasts through the designation of wildlife sanctuaries, we will safeguard the forest environment that serves as the basis for biodiversity conservation in Tokyo.

TMG will expand waters in natural park areas and designate marine park areas in cooperation with the national government, and appropriately conserve the habitats for fauna in waters through the preservation and creation of tidal flats and seaweed beds as well as the preservation and maintenance of coasts with consideration for aquatic organisms.

Forest properly managed by thinning

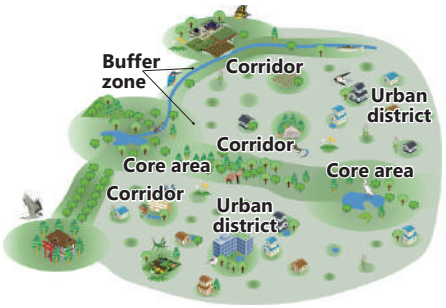
Forming ecological networks

TMG will promote the development and conservation of parks, green spaces, agricultural land, rivers, waterways, roadside trees, canals, and greenery along cliff lines, and realize the networking of fragmented greenery by encouraging efforts from the private sector and enhancing the linkage between habitats for fauna. We will ensure the continuity of biodiversity by valuing the green connection with neighboring local governments.

Conservation and creation of familiar greenery in urban districts

TMG will promote the conservation of greenery in urban districts, such as homestead woodland, wooded areas, and agricultural land, in cooperation with a variety of entities. We will also encourage the conservation and creation of familiar greenery—more specifically, promote efforts to improve biodiversity by making the most of limited spaces, such as greening with native species and creating waterfront areas in city parks, public facilities, and residential areas, and along roadsides.

Ecological networks and improvements in the quality of greenery in urban districts



TMG will improve water quality in the Bay of Tokyo and rivers by implementing such measures as dredging sludge accumulated in rivers and canals, and contribute to the conservation and improvement of the waterfront environment as a habitat for aquatic organisms.

Amount of dredged sludge expected for FY 2021 to 2030

(Unit: 1,000 m³)

Rivers

Names	Dredging volume
Sumida River	543.8
Shingashi River	9.7
Nihonbashi River	40.8
Shin Naka River	6.4

Names	Dredging volume
Naka River	71.6
Kanda River	27.0
Shakujii River	5.2
Meguro River	5.2
Total	709.7

Bay of Tokyo

District names	Dredging volume
Koto	160
Shibaura	80
Total	240

Consideration for biodiversity and creation of new greenery during development

TMG will appropriately examine development projects based on the ordinance, avoid or reduce their impacts on biodiversity, and promote ecologically friendly greening by for example planting native species suitable for each region.

In public works and facility renovations implemented by the administration, we will actively strive to create ecologically friendly green spaces and waterfront areas in addition to avoiding or reducing their impacts on biodiversity. We will utilize Urban Redevelopment Systems to encourage efforts that will contribute to the conservation of habitats for living things in and outside development areas.

Conservation of rare wild fauna and flora, and measures for alien species

Conservation of rare wild fauna and flora

TMG will collect and understand the latest information on wild fauna and flora in Tokyo, and conduct basic surveys as necessary to update the Red List on a regular basis. We will designate important natural land where rare fauna and flora grow and live as protected areas, conserve rare wild fauna and flora, and protect and breed endangered species through ex-situ conservation. In addition, we will provide technical support and develop human resources in order to promote conservation activities for endangered species through cooperation between municipalities and citizens, and encourage collaboration between participants in the activities.

Chloris sinica kittlitzi

Promoting measures against alien species, which cause damage to ecosystems and humans

TMG will implement effective measures that take into account the latest damage and habitat conditions to prevent the spread of alien species. We will reduce damage caused by invasive alien species, which affect ecosystems and human lives and bodies, through capture or other means, and will not use alien plants that damage ecosystems when planting in a range of projects. To help promote measures against alien species through cooperation between municipalities and citizens, we will collaborate with NPOs and experts to develop human resources involved in the measures and raise awareness of effective control techniques.

In the islands with unique ecosystems vulnerable to the invasion of alien species and closed water bodies, such as ponds and swamps, we will work to detect invasion at an early stage through "border measures" for the prevention of damage.

TMG will raise public awareness of the proper care of animals to ensure that pets are not abandoned.

Building appropriate relationships between humans and wild animals

Protection and management of wild animals and coexistence between humans and wild animals

With the exception of birds and animals that cause damage to Tokyo residents, TMG will rescue injured or diseased birds and animals to return them to the wild. We will capture wild animals for the purpose of preventing damage to agricultural, forestry, and fishery products and our daily lives, capture as part of population control wild animals that have a significant impact on ecosystems, or protect such animals by segregating them from humans. In addition, we will identify the latest trends and conduct monitoring surveys to reflect the results in our measures.

We will conduct surveillance for zoonotic diseases to identify the outbreak status of infectious diseases.

Collection, storage, and dissemination of information on the natural environment

Collection, storage and dissemination of information on wild fauna and flora and ecosystems in Tokyo

TMG will enhance the collection, storage, and dissemination of information on the natural environment and strive to promote conservation measures by conducting basic surveys of living things and the natural environment in Tokyo in cooperation with a variety of entities. We will continue periodic monitoring surveys focusing on species that serve as indicators, understand changes in the natural environment in each region over the long term, and share relevant information widely. Furthermore, we will strive to centralize information on the natural environment in Tokyo, and based on such information, we will explore the development of hubs to disseminate the attractiveness of Tokyo's nature by making use of digital content.

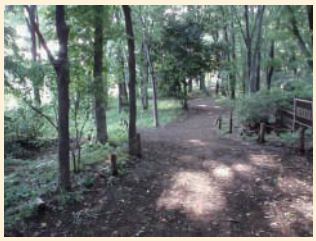
Column

Preservation and Utilization of Conservation Areas

TMG designates conservation areas in order to preserve forests etc. that have become integrated with areas of good natural land and historical heritage sites as important assets for Tokyo residents for extended periods.

Starting with the designation of Nobidome Yosui in 1974, a total of 50 areas of approximately 760 ha have been designated as conservation areas on the plateaus, hilly terrain, and mountain terrain of Tokyo as of the end of July 2022. We have set a goal of designating or making publicly-owned additional conservation areas of about 100 ha by FY 2050 and are promoting efforts toward the goal.

Historical and environmental conservation area, Nobidome Yosui, designated in 1974



Satoyama conservation area, Takiyama, Hachioji, designated in 2013

Conservation areas have nature rich in biodiversity, but pose a challenge in that their value and attractiveness are often not fully communicated to the public. They are supported by the activities of volunteer groups, which in itself presents yet another challenge as the number of people volunteering is dwindling, and there are concerns about how that trend can be reversed.

Under these circumstances, TMG is formulating a Plan for the Preservation and Utilization of Conservation Areas as a comprehensive framework to further improve their value and attractiveness.

In addition to designating additional conservation areas, we will actively promote the management of existing conservation areas according to their characteristics and encourage younger generations to participate in volunteer activities.

Environmental learning opportunities for children

Using the blessings of biodiversity in a sustainable manner, utilizing the functions of nature to improve the lives of Tokyo residents

Natural environments, including forests and green spaces, not only serve as habitats for living things, but also offer many other benefits, such as the prevention of landslides, conservation of water resources, absorption of carbon dioxide, healing and enrichment opportunities, and the revitalization of local communities.

On the other hand, these multifaceted functions of nature are declining as evidenced by an increased risk of landslides and floods due to the deterioration of water retention or infiltration ability caused by the insufficient management of forests, ruined satoyama landscape, and diminishing woods and agricultural land.

To improve the lives of Tokyo residents, TMG will use the blessings of biodiversity in and outside Tokyo in a sustainable manner, and utilize the functions of the natural environment to meet various social challenges, such as disaster preparedness and mitigation.

2030 Targets

- Promotion of Tokyo-NbS Action - Tokyo as a city supported by nature

  A variety of entities, such as the administration, businesses, and private organizations, will promote efforts that will lead to nature-based solutions (NbS).

Direction of Policies

Use of Tokyo's natural bounty (provisioning services)

Promoting sustainable forestation and local production and consumption of wood

TMG will establish a sustainable forest circulation that provides public benefits, including the conservation of water resources, by retaining and developing foresters who will take the initiative in forest maintenance and expanding the use of wood made in the Tama area. We will also proactively use Tama-made wood for public facilities and works, and promote the use of Tama-made and other domestically produced wood by taking advantage of opportunities in housing construction.

By developing and managing forests across the entire upper basin of the Tama River, we will contribute to the stabilization of the river flow rate, conservation of the Ogouchi Reservoir, and preservation of biodiversity, passing on the luxuriant nature environment to the next generation.

Abundant forests in the Tama area

Promoting agriculture with consideration for agricultural land conservation and biodiversity

By conserving productive green land and developing farms for various purposes, such as allotment gardens, TMG will conserve and utilize the agricultural land and spaces remaining in urban districts, and encourage the retention and training of new farmers. We will also increase the value of local agricultural products in Tokyo to promote local production and consumption.

TMG will support producers working on environmentally friendly agriculture with the reduced use of chemical pesticides and fertilizers to encourage the production of agricultural products with consideration for biodiversity. By restoring abandoned paddy fields in valleys in hilly terrain in cooperation with private organizations, we will conserve the paddy fields as habitats for living things.

Sustainable management of fishery resources in Tokyo

To promote the resource management of major fish species, such as alfonsino, TMG will enhance surveys and evaluations and back up the efforts of fishermen who are engaged in resource management. Efforts will be promoted to control common cormorants that eat native fish, exterminate alien species, and clean up rivers and coasts to conserve fishing ground environments. In addition, we will encourage the adoption of marine eco-labels*1, such as MEL and MSC, to enable businesses and consumers to selectively consume marine products with consideration for resources and the environment.

*1 A mechanism for labeling marine products so that consumers can selectively purchase those that have been caught or produced with consideration for the sustainability of ecosystems and resources. The MEL certification is operated by the Marine Eco-Label Japan Council while the MSC certification is operated by the Marine Stewardship Council headquartered in the UK.

Use of functions of nature to encourage disaster preparedness and mitigation(regulating services)

Promoting green infrastructure that contributes to disaster preparedness and mitigation

By thinning and pruning forests and water conservation forests in the Tama area and conserving valleys in hilly terrain in satoyama landscape, TMG will contribute to the prevention of the runoff of earth and sand, the alleviation of flood risks by conserving water resources, and improvements in biodiversity. We will promote improvements in rainwater infiltration and storage, the mitigation of the heat island effect, and measures against the heat by appropriately conserving and managing parks, green spaces, and agricultural land, developing rain gardens*2, and promoting rainwater infiltration at building sites. In addition, we will work to control land subsidence through regulations based on laws and ordinances, and conserve and use groundwater in a sustainable manner by steadily promoting the collection and accumulation of scientific data and the understanding of actual conditions.

*2 A planting area that collects rain falling around it and causes rainwater to infiltrate underground.

Use of nature to ensure a comfortable and enjoyable life (cultural services)

Promoting health and educational benefits that makes use of local natural resources

Through the appropriate maintenance and management of natural parks and conservation areas, as well as the development and management of parks, green spaces, and allotment gardens that serve as lively places with diversity to get people close to nature, TMG will create a comfortable and high-quality living environment that allows its residents to feel close to nature in their daily lives, and contributes to health and education, promoting the health of Tokyo residents and improving non-cognitive skills of children. We will also promote tourism with consideration for biodiversity by for example encouraging ecotourism in the islands, and disseminate information on attractiveness specific to a region or cultural aspects that are rooted in local nature.

Conserving and passing on history and culture making use of local natural resources

TMG will conserve paddy fields in valleys in hilly terrain, wooded areas, and reservoirs through traditional farming methods, and conserve and pass on beautiful scenery, history, culture, and luxuriant ecosystems of satoyama landscape. We will raise awareness of the traditional food culture of Tokyo to pass it on to the next generation.

We will also conserve agricultural landscapes where agricultural land and homestead woodland remain together as well as nature integrated with historical heritage sites. In addition, we will appropriately protect and manage natural monuments designated as cultural properties, and pass on history and culture linked to local nature.

Column

Efforts to Promote Green Infrastructure in Tokyo

Green infrastructure is an initiative to develop sustainable and attractive national land, cities, and regions by utilizing the diverse functions of the natural environment in both structural and non-structural aspects of social capital development and land use. There is an increasing number of good examples of green infrastructure in Tokyo.

Marunouchi Street Park - Using outdoor spaces to disseminate information

With natural turf laid along the street, the multi-functionality of greenery greatly contributes to improving the comfort of the city.

Jindaiji Garden - Housing development

In an area with a lot of productive green land, a rain garden and urban farm have been developed along with housing and restaurants.

Charel Ogikubo - Reconstruction of apartment buildings

Reconstruction helps build a green network, pass on biodiversity, and ensure air circulation through breeze paths.

Toshima Green Disaster Prevention Park - Development of a park

As a hub for disaster preparedness and urban development, a park has been developed to make the most of the multifunctionality of green spaces.

Source: UR PRESS Vol. 63

Recognizing the value of biodiversity, changing that idea into actions that address global issues as well as those in Tokyo

Understanding, interest, and awareness of biodiversity in Tokyo unfortunately remains at low levels. To conserve and restore biodiversity and use its bounty in a sustainable manner, Tokyo residents and other actors need to correctly recognize the value and status quo of biodiversity, and deepen their understanding and interest in it. In addition, the globalization of supply chains from production to consumption has caused local economic activities and consumption behavior to indirectly affect biodiversity not only in Japan but also throughout the world.

Enabling each and every Tokyo resident to recognize the value of biodiversity and treat it as vital will turn all actors' actions into those dealing with issues across Japan and throughout the world as well as in Tokyo.

2030 Targets

- Biodiversity Actions Taken by All Tokyo Residents - Individual's Actions Change Society

  Toward the conservation and sustainable use of biodiversity, all actors working in Tokyo, including its residents, businesses, and private organizations, will treat the biodiversity crisis as vital, and subsequently modify their actions so as to consider and contribute to biodiversity.

Direction of Policies

Promotion of understanding of biodiversity

Promoting understanding of biodiversity by all actors

TMG will promote the formulation and revision of local biodiversity strategies at municipalities. We will consider the development of a hub that will promote cooperation between the parties concerned and provide necessary information and advice.

The Internet and related facilities will be used to raise awareness of biodiversity, and the understanding of biodiversity will be deepened in the lives and economic activities of Tokyo residents through TMG's initiatives and plans in various fields with consideration for biodiversity.

Symposium on biodiversity

TMG will actively raise awareness of places and events in Tokyo where people can enjoy observing living things and experiencing nature and agriculture. To prevent visitors from concentrating too heavily in specific places or overusing mountain trails on natural land, we will disseminate information on the attractiveness of Tokyo's diverse nature and raise public awareness of the rules for visiting natural parks and Tokyo Metropolitan parks.

Development of environmental human resources

Development of human resources to support biodiversity

Promoting environmental education and human resource development in the field of the natural environment

Using hubs where people can learn about various natural land and biodiversity in Tokyo, TMG will encourage natural environment education and nature experience activities. We will develop human resources who will safeguard Tokyo's nature and use it in a sustainable manner, such as green volunteers and nature guides, as well as retain and develop people who will take the lead in the agriculture, forestry, and fisheries industries in Tokyo and traditional techniques that are rooted in nature.

Experiencing rice threshing in satoyama conservation area

Behavior change which will consider and contribute to not only the environment of Tokyo but also the global environment

Consideration of biodiversity in economic activities and consumption behavior

TMG will reduce environment load by promoting green purchasing, and encourage the expanded use of environmentally certified or biodiversity-friendly products. We will also promote green finance that will lead to biodiversity conservation.

Contribution to biodiversity by promoting sustainable resource management

To realize the sustainable use of resources, TMG will explore sustainable consumption and production in Tokyo and implement initiatives to achieve it. We will also implement measures to mitigate the load on global biodiversity by reducing plastic and food waste.

Balancing climate change measures and biodiversity conservation

TMG will promote initiatives toward "Carbon Half," a plan to halve greenhouse gas emissions in Tokyo by 2030 to realize a Zero Emission Tokyo that will contribute to achieving net zero CO_2 emissions worldwide by 2050. In light of the relationship between climate change measures and biodiversity conservation, we will promote various initiatives that will help meet both challenges.

Marine plastic waste

Column

Hands-on Environmental Learning in Collaboration with the Private Sector

Tokyo has many bases for environmental education and nature experience activities related to biodiversity.

At natural parks, including national parks, quasi-national parks, and Tokyo Metropolitan natural parks, TMG volunteers provide outdoor classes and usage guidance in cooperation with guides at visitor centers.

In conservation areas, a hands-on program for satoyama conservation activities, "Experience Nature in Tokyo - Satoyama," has been carried out, which includes forest maintenance, craft workshops, and rice paddy activities in familiar community-based forest areas.

In addition, TMG has concluded agreements with universities to implement the Tokyo Green Campus Program, which provides university students with opportunities to participate in green space conservation activities.

Businesses are also making a variety of efforts. For example, the Seven-Eleven Memorial Foundation is promoting efforts to develop human resources who will protect biodiversity and pass on local nature, history, and culture to the next generation, as shown in its Takao Forest Nature School run in collaboration with TMG to provide a hands-on environmental learning program that includes nature observation and forest maintenance experience for ordinary Tokyo residents.

Explanation to visitors at the Takao Visitor Center

"Experience Nature in Tokyo - Satoyama" website

Observing living things at Takao Forest Nature School

Strategy 3

Realization of a Better Urban Environment that Ensures the Safety and Health of Tokyo Residents

Realization of a Better Urban Environment that Ensures the Safety and Health of Tokyo Residents

In our pursuit of an affluent lifestyle, we have emitted hazardous substances and waste, threatening our own health, the safety of the urban environment, and affecting ecosystems.

TMG has promoted a variety of environmental initiatives and achieved great results in resolving a variety of environmental problems. However, we need to further expand efforts in order to ensure that all Tokyo residents can experience and enjoy a high-quality living environment with peace of mind. In addition, many of the risks and impacts of chemical substances on human health and ecosystems have not been clarified yet, and new findings may reveal health hazards and adverse effects on the environment.

Relying on scientific research, TMG will steadily implement measures for air pollution and waste management to realize a comfortable and high-quality environment and minimize health risks for Tokyo residents.

Further Improving Air Quality Etc.

TMG's environmental initiatives have mitigated the enormous health risks caused by air pollution etc. as levels of contaminants have been reduced significantly compared to those during the period of rapid economic growth. However, we will further promote measures for air pollution as challenges still remain evidenced by the fact that we are yet to meet the environmental standards for concentrations of photochemical oxidants and photochemical smog advisories are issued every year. We will also develop initiatives to avoid health risks due to negative legacies arising from economic activities in the past, such as asbestos. In addition, appropriate measures will be taken to deal with noise and vibration, which are interconnected with daily life and have a major impact on the urban environment.

Status Quo

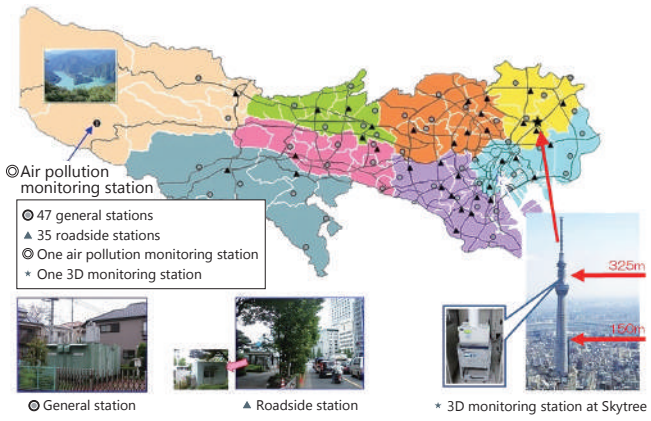
Air quality

To identify air quality in Tokyo, TMG is constantly monitoring air pollution at 84 stations as of March 2022. These include 47 general ambient air monitoring stations (hereinafter referred to as "general stations") installed in residential areas, 35 vehicle exhaust gas monitoring stations installed on the roadside (hereinafter referred to as "roadside stations"), the Hinohara Air Pollution Monitoring Station, and the Tokyo Skytree 3D Monitoring Station.

We have implemented emission control for soot and smoke from factories and facilities, and have taken reduction measures for vehicle exhaust gases, based on laws and ordinances. As a result, the environmental standards for nitrogen dioxide (NO_2), suspended particulate matter (SPM), sulfur dioxide (SO_2), and carbon monoxide (CO) have been consistently achieved at all monitoring stations.

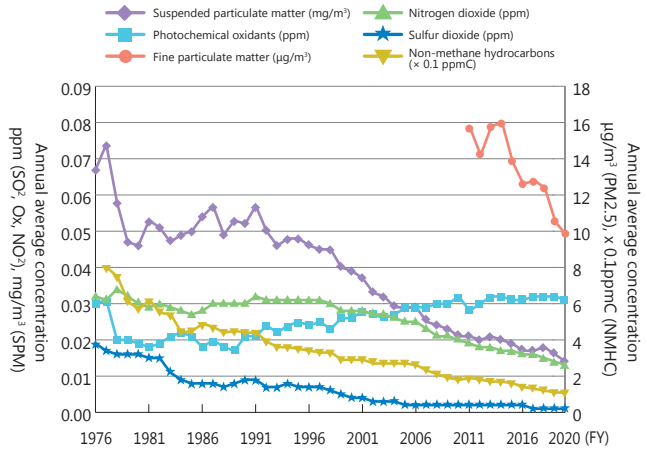
The environmental standards for fine particulate matter (PM2.5) were also met at all monitoring stations for the first time in FY 2019 after a long period of non-fulfillment. The concentration of PM2.5 has been trending downward since then, but there are variations among monitoring stations. To make air quality in Tokyo better than that of other big cities, such as New York and London, measures to further reduce the concentration are desired.

Constant monitoring of air pollution in Tokyo

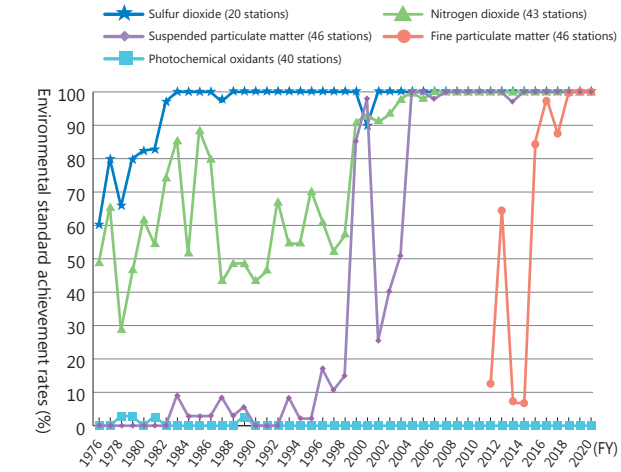


Monitored items:
Sulfur dioxide (SO_2), carbon monoxide (CO), photochemical oxidants (Ox), suspended particulate matter (SPM), nitrogen dioxide (NO_2), nitric oxide (NO), non-methane hydrocarbons (NMHC), hydrocarbons (HC), fine particulate matter (PM2.5), weather (wind direction, wind speed, temperature, humidity), solar radiation, acid rain

Changes in atmospheric concentrations (average at general stations)



Changes in environmental standard achievement rates (general stations)



PM2.5 environmental standards in cities around the world and annual average concentration of all monitoring stations in 2020 (μg/m³)

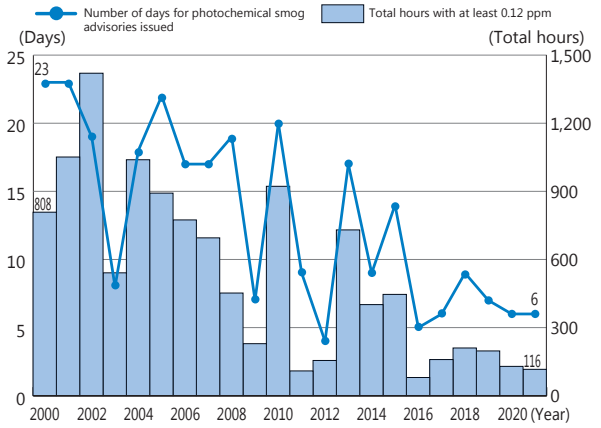
	Tokyo	China	Europe	USA
Concentrations	10.1	37.5 in Beijing	9.6 in London 12.2 in Paris	14.6 in Los Angeles 6.5 in New York
Standards	15	35	20	12

Source (data for overseas cities): 2020 World Air Quality Report: IQAir (July 2021)

The concentration of photochemical oxidants (Ox) has not met the relevant environmental standards at any stations. TMG issues photochemical smog advisories etc. when the concentration of photochemical oxidants exceeds a certain level as they can cause damage to eyes or throats. The number of days and hours for photochemical smog advisories issued has been trending downward but they are inevitably issued on several days every year.

To facilitate achieving reductions in PM2.5 and Ox, TMG has been targeting their causative agents, nitrogen oxides (NOx) and volatile organic compounds (VOCs).

Number of days and hours for photochemical smog advisories issued



Asbestos

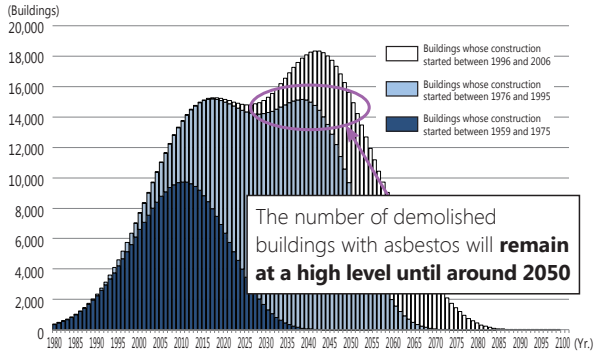
Asbestos has excellent heat resistance, thermal insulation and soundproofing properties, and for this reason was once used extensively to create building materials and other industrial products. Now however, its production, import, or use is prohibited as it has become clear that inhaling asbestos floating in the air is extremely hazardous to health.

Nevertheless, there are still many buildings containing asbestos in Tokyo, causing concern about the dispersion of asbestos when these buildings are demolished. The number of demolished buildings with asbestos in Tokyo is expected to remain at a high level until around 2050.

The risk of asbestos dispersing from damaged or collapsed buildings and disaster waste is increasing as heavy rains become more intensified due to the impacts of climate change.

In June 2020, the national government revised the Air Pollution Control Act in response to cases where asbestos fibers were mistakenly dispersed into the air as a result of inappropriate work practices during demolition or renovation work of structures containing asbestos. The revised Act now requires dismantlers to report the results of asbestos surveys of the structure to the administration, with a wider range of building materials containing asbestos subject to regulation.

Forecast of the number of demolished buildings with asbestos in Tokyo



Disaster site in Tokyo in September 2019

Noise and vibration

Over the years, TMG has received an extremely large number of complaints about noise and vibration coming from a wide variety of sources as these issues have a significant impact on our daily lives. TMG implements measures in cooperation with wards and cities and provides training and other support for them as guidance for the sources of noise and vibration is the domain of wards and cities (guidance for towns and villages is provided by TMG).

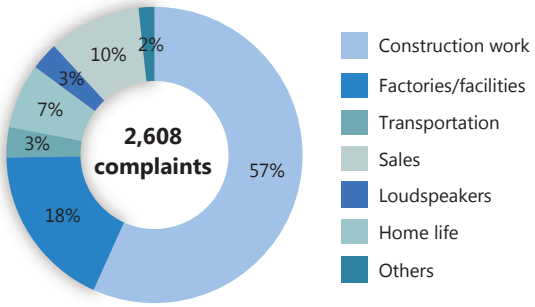
Daily life noise and vibration

In FY 2019, there were approximately 2,600 complaints about noise in Tokyo, more than 50% of which were against construction work. More than 90% of complaints about vibration were also related to construction work. At construction sites, businesses use low-noise heavy machinery and take other measures, but there are still a certain number of complaints.

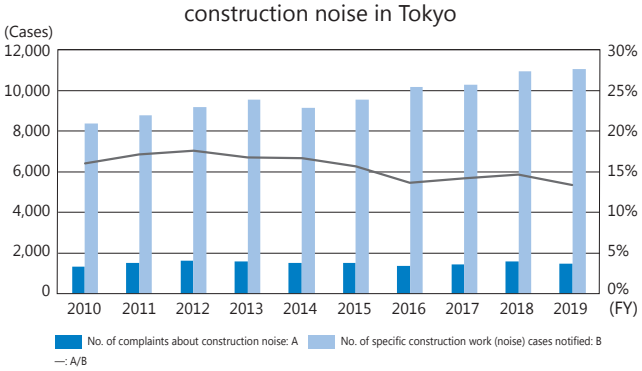
Traffic noise and vibration

As of 2020, TMG conducts noise surveys for the Shinkansen bullet train at 15 locations in Tokyo, of which six locations do not meet the environmental standards. Noise measurement for aircraft is carried out around the Tokyo International Airport (Haneda), US military bases, and Chofu Airport. Two points out of 16 at the Yokota Air Base, one of the US military bases, do not meet the standards. As for the Haneda Airport where new flight routes have started operation, TMG monitors noise at seven locations directly below the new routes and publishes the results on its website.

Number of complaints by noise source in FY 2019



Changes in the number of complaints about construction noise in Tokyo



Visions for 2050

TMG will: Minimize the health risks caused by air pollution to allow everyone to enjoy a safe and comfortable air environment; Reduce PM2.5 to below the WHO guidelines which are the strictest in the world; Prevent the dispersion of asbestos during demolition or renovation work and establish measures to prevent asbestos from dispersing from collapsed buildings in the event of a disaster; and Build an environment in which all Tokyo residents can live comfortably without being bothered by noise and vibration.

- Air quality
  - The highest level of air quality will be achieved among large cities around the world.
- Asbestos
  - Dangerous building materials with asbestos remaining in buildings will be managed and treated properly to prevent dispersion into the air.
- Noise and vibration
  - Noise and vibration problems will be resolved to improve the comfort of the lives of Tokyo residents.

2030 Targets

- Air quality
  - PM2.5: Annual average of 10 μ/m^3 or less over all monitoring stations*1
  - Photochemical oxidant concentration: Less than 0.07 ppm (fourth-highest daily maximum, averaged across three consecutive years, averaging time unit of eight hours)
  - Number of days for photochemical smog advisories issued: Zero
- Asbestos
  - In normal times, appropriate measures will be taken to prevent the dispersion of asbestos at building demolition/renovation work sites and other places.
  - A system will be built to promptly take measures to prevent the dispersion of asbestos from collapsed buildings in the event of a disaster.
- Noise and vibration
  - Effective measures will be well established to reduce noise generated at construction sites.

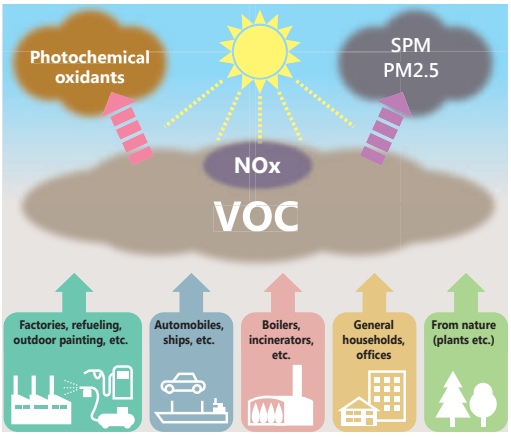
*1 Annual average over all monitoring stations has been chosen to avoid high concentrations in specific areas.

Direction of Policies

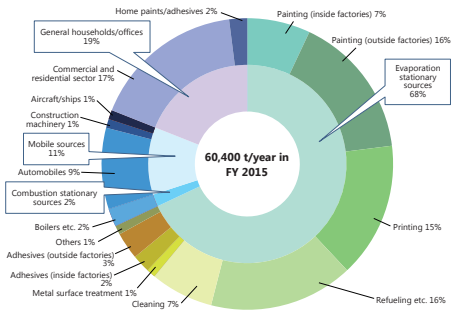
Air quality

Sources of substances that cause air pollution are mainly divided into stationary sources, such as factories and facilities, mobile sources, such as automobiles, and consumer products, such as paints and adhesives. TMG will reduce NOx and VOCs from these sources to reduce PM2.5 and photochemical oxidants. In order to further improve air quality, we will develop initiatives from a wide range of perspectives: Measures for the sources, monitoring of air quality, studies in the mechanism of how air pollutants are generated, which is still largely unexplained, and cooperation with neighboring local governments.

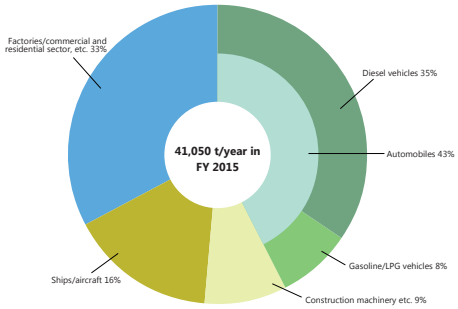
Generation mechanism of PM2.5 and Ox



Breakdown of VOC emissions in FY 2015



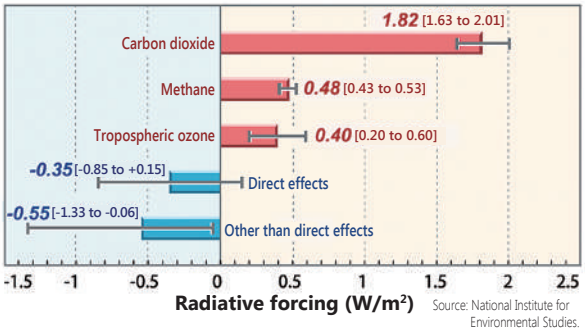
Breakdown of NOx emissions in FY 2015



* Percentages may not add up to 100 due to rounding.
* Automobile emissions include those affected by startup.

TMG will develop measures for both air quality and climate change as air pollutants, such as photochemical oxidants (tropospheric ozone), affect climate change and many efforts to reduce air pollutants also have the effect of reducing CO_2 emissions.

Estimated changes in radiative forcing*2 due to changes in climate forcing factors from pre-industrial times to 2011



Source: National Institute for Environmental Studies.

*2 Indication of the degree of impacts that cause climate change. A positive radiative forcing warms the atmosphere, and a negative one cools the atmosphere.

Measures for stationary sources

■ Strengthening on-site inspections and guidance

Based on laws and ordinances, officials of TMG, wards, and cities visit factories and facilities that generate soot and smoke for on-site inspections and guidance. We will further increase the effect of the regulation by laws and ordinances by improving the knowledge and skills of the officials who visit the sites so that they can more comprehensively deal with advanced equipment and give advice according to the situation of individual businesses.

■ Strengthening the Certification Program for Small Combustion Appliances with Low NOx/CO_2

For small combustion appliances not regulated by law, TMG has a certification program for those with low NOx and CO_2 emissions. In FY 2021, we promoted the technological development and introduction of equipment with high environmental performance by for example adding a certification category for hydrogen fuel boilers. We will provide support for the technological development of products and the expansion of product lineup and develop initiatives that provide incentives to encourage the expanded use of certified equipment.

Certification labels

Hydrogen fuel boiler certified by TMG

■ Measures for VOCs at gas stations

TMG will encourage gas stations to switch to fuel dispensers that are highly effective in reducing VOC emissions (Stage II). We support the proactive introduction of Stage II in place of overhead fuel dispensers installed at many gas stations in Tokyo. We will ensure the expanded use of Stage II by accumulating cases of utilization and finding solutions to problems with its introduction and installation.

Measures for mobile sources

TMG will steadily implement the initiatives shown in Strategy 1-3: Promoting Zero Emission Mobility as the reduction of air pollutant emissions will be facilitated by the streamlined flow of people and products in the transport sector and the decarbonization of the vehicles we use indicated in the strategy.

Even if ZEVs become widespread, PM2.5 will still be generated from the tires and other parts of the vehicles while driving. Therefore, we will raise public awareness of eco-driving, including better braking practices, to curb the generation of PM2.5. In cooperation with the Tokyo Metropolitan Research Institute for Environmental Protection, we will develop a system for continuously monitoring air pollutants emitted from automobiles, which will contribute to further technological development of automobiles and help respond to laws and regulations.

Measures for consumer products

Many of the daily necessities sold at home centers and variety stores and used in general households and offices contain VOCs, and the demand for them is growing in line with new lifestyles. TMG will promote the adoption of low-VOC products by encouraging the development of such products, the selling of them in stores, and the selection of them by consumers through a variety of public relations media and seminars.

Encouraging voluntary actions by Tokyo residents and businesses

To further improve air quality, TMG will promote behavior change across society to ensure that all Tokyo residents and businesses will take voluntary actions and select products and services that consider air quality.

■ Technical support for VOC-emitting businesses

TMG will enhance technical support for reducing VOC emissions and raise public awareness in a convincing manner to help implement effective measures by distributing a VOC control guidebook summarizing emission control technologies, dispatching VOC control advisors, and holding technical seminars.

■ Expanding the use of low-VOC painting

In order to expand the use of low-VOC painting for buildings and steel structures and control VOC emissions from painting work, TMG will accelerate technical support, such as performance surveys of low-VOC paints, and awareness-raising activities through seminars and other means.

■ Awareness raising through systems that encourage voluntary efforts and by means of SNS

TMG will increase the number of businesses registered for the Clear Sky Supporters project, which widely publicizes the voluntary efforts of businesses, by expanding the benefits of the project. We will also raise public awareness through a variety of public relations media, including SNS, to ensure that Tokyo residents will be interested in air quality.

Awareness raising through an SNS event

Effective measures and air quality monitoring based on research and study and wide-area cooperation

TMG has been trying to identify the VOC components that greatly contribute to the generation of photochemical oxidants and PM2.5, but a large part of the generation mechanism remains unknown. We will strengthen the research and study capabilities of the Tokyo Metropolitan Research Institute for Environmental Protection and those of ourselves to identify the actual situation and develop effective initiatives.

As particular attention should be given to transboundary movements in terms of air pollution, TMG will take measures in collaboration with the national government, research institutes, and the Nine Local Governments Coalition.

Furthermore, TMG will quickly aggregate a large amount of data collected by constantly measuring air pollutants and publish it in a convenient form to enable private companies to create their own value through the use of that data.

Asbestos

There are still many buildings containing asbestos in Tokyo, and the number of buildings demolished is expected to remain at a high level until around 2050. Therefore, TMG will enhance measures taken at the stage of demolition in normal times as well as strengthening other measures to prevent dispersion from collapsed buildings in the event of a disaster.

Measures in normal times

■ Further guidance and technical support for businesses

TMG will ensure that the knowledge and skills of preventing asbestos dispersion during construction are firmly established in dismantlers by making sure that they are thoroughly informed of measures for asbestos based on the law, and strengthening on-site guidance and technical support for demolition crews.

On-site guidance on asbestos

■ Strengthening administrative support for wards and cities

To further enhance the effectiveness of on-site guidance, TMG will strengthen support for ward and city officials who visit sites in both structural and non-structural aspects by for example preparing manuals, holding training sessions, and supporting the purchase of necessary equipment.

■ Organizing data on buildings containing asbestos

In order to establish a system that prevents asbestos dispersion and develop relevant measures efficiently, it is important to know in advance where buildings with asbestos are located. TMG will aggregate its data on buildings with asbestos to share it with wards and cities.

Measures for a disaster

■ Enhancing systems in municipalities

TMG will develop and strengthen a system (including the preparation of disaster manuals and support for the introduction of necessary equipment and materials) which allows municipalities with limited human and material resources to appropriately prevent asbestos from dispersing in the event of a disaster.

■ Promoting collaboration with private organizations

Since a flexible response in a short period of time is required in the event of a disaster, TMG will strengthen cooperation with local governments, private organizations, and businesses to enhance public-private measures for asbestos at the time of a disaster.

Noise and vibration

In order to effectively implement measures for noise and vibration, TMG will collect measurement data to identify the sources. We will promote measures in cooperation with businesses and municipalities, and provide detailed information to Tokyo residents.

Measures for daily life noise and vibration

TMG will enhance training for municipal officials to improve their skills for the guidance of businesses. We will encourage businesses to implement measures that consider the surrounding environment, such as installing soundproof walls, and to strengthen communication by holding briefing sessions for local residents.

In addition, TMG will encourage the installation of thermal insulation renovation materials, including double glazing windows in buildings, as they contribute to not only energy efficiency but also noise reduction.

Measures for traffic noise

Regarding railroad noise, TMG will survey noise levels on Shinkansen and conventional lines in Tokyo, and request their operators to implement effective measures for noise, such as installing soundproof walls.

As for aircraft noise, we will survey noise levels at airports and airfields in Tokyo, and request the relevant ministries and agencies to further promote measures for aircraft noise. We will continuously monitor the generation of noise below the new Haneda routes to provide information to Tokyo residents in cooperation with the national government and relevant wards.

Aircraft noise measurement

Column

Measures for VOCs at Gas Stations

VOCs (Volatile Organic Compounds) is a general term for organic compounds that turn into gas in the atmosphere. In addition to being widely used in paints, printing inks, and cosmetics and other daily necessities, VOCs are known to be generated as gasoline vapor when refueling.

TMG supports businesses in implementing VOC reduction measures. For example, we encourage the introduction of Stage II*, which is highly effective in reducing VOC emissions, in place of overhead fuel dispensers (on the ceiling) installed at many gas stations in Tokyo. As a result, a Stage II overhead fuel dispenser was installed in FY 2021 for the first time in Japan.

* At gas stations, VOCs are emitted mainly when unloading tank trucks and refueling automobiles. The Stage II dispenser can collect VOCs emitted during refueling.

Overhead fuel dispenser capable of collecting fuel evaporation gas

Reducing Risks Caused by Chemical Substances Etc.

Various chemical substances exist in our lives, and it is said that tens of thousands of different kinds of chemical substances are used in Japan. Some of these chemical substances are harmful to human health and ecosystems due to their properties, toxicity, or usage. The air, water, or soil contaminated with these chemical substances may affect human health.

TMG will strive to prevent impacts of chemical substances on human health and ecosystems by sharing accurate information on health and environmental risks from them with all parties concerned, including Tokyo residents, businesses, and the administration.

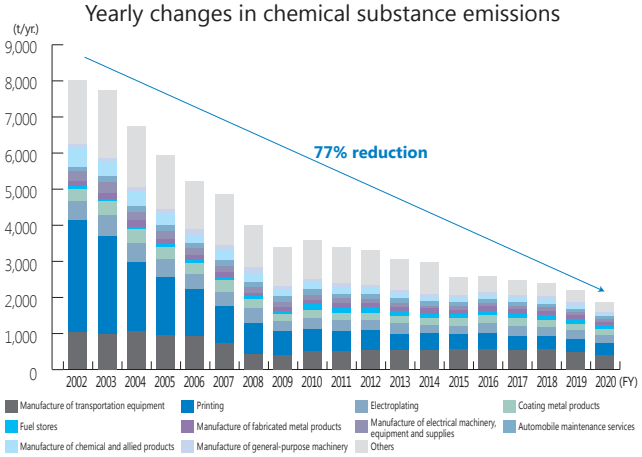
Status Quo

Chemical substances

Through two programs, the PRTR program*1 based on law and the chemical substance control program based on ordinances, TMG has identified and properly controlled chemical substance emissions from businesses, and has been committed to reducing the amount of chemical substances emitted into the environment. As a result, chemical substance emissions have been significantly reduced compared to those of the early 2000s.

*1 A program in which a business identifies and reports to the government the amount of chemical substances that may be harmful to human health and ecosystems released from facilities into the environment (air, water, soil) and the amount of chemical substances contained in waste and carried out of facilities, and the government aggregates and publishes the amount released and carried based on the reported data and estimate.

Yearly changes in chemical substance emissions



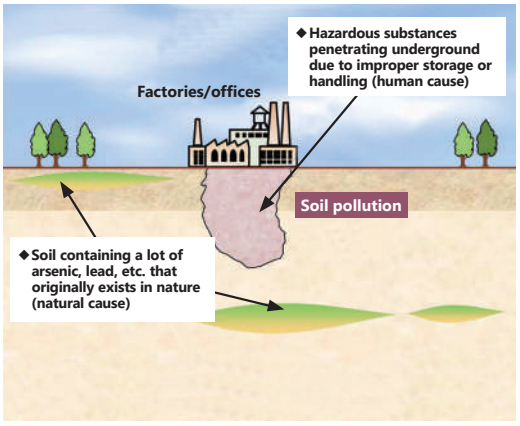
Soil pollution

To prevent the impact of soil pollution on human health, TMG has mandated since FY 2001 that businesses handling hazardous substances or greatly changing land characteristics conduct soil pollution surveys in the wake of factory closures or development construction and take appropriate measures when non-conforming soil is found.

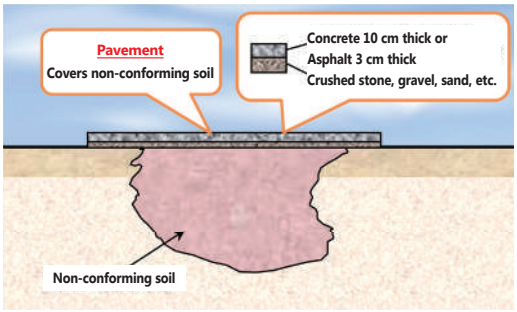
Though non-conforming soil should be appropriately managed according to the conditions, the excavation and removal method is common in Tokyo because land can be transferred sooner, and it accounts for nearly 50% of all relevant measures. The excavation and removal method has an impact on the natural environment due to energy consumption during operation and the extraction of mountain sand for backfilling, and entails a large cost burden that may affect the use of land. It may also result in land becoming brownfield*2. In addition, there are only a few cases of effective utilization of soil that exceeds the standards of laws and regulations due to natural causes (hereinafter referred to as "naturally contaminated soil"). The excavation and removal method is not a sustainable solution for dealing with soil pollution at many sites.

*2 Land that has been left unused or used at a significantly lower level compared to its potential value due to pollution or concerns about harmful effects.

Causes of soil pollution



An example of measures: Pavement



Measures taken for soil pollution in Tokyo in FY 2020

Visions for 2050

TMG will develop initiatives focusing on health risks caused by chemical substances as they contain harmful matter although they are essential to enriching our lives.

As for soil pollution, TMG will promote information disclosure to prevent health hazards caused by non-conforming soil. We will implement sustainable measures for soil pollution, taking into account the reduction of environmental load (environmental aspect), cost reduction (economic aspect), and the promotion of understanding of neighboring residents (social aspect) in all processes of the measures.

- Chemical substances
  - Risks to the health of Tokyo residents due to the release of chemical substances will be minimized.
- Soil pollution
  - Sustainable measures will be selected for soil pollution, and information, such as the concentration of hazardous substances in soil or groundwater, will be shared and managed by society as a whole.

2030 Targets

- Chemical substances
  - Concentration of chemical substances in the environment will be sufficiently reduced below environmental target values.
- Soil pollution
  - Measures for soil pollution subject to laws and ordinances will take into account the 3Rs of soil, and information reported on soil and groundwater will be shared throughout society.

*3 3Rs of soil
- Reduce: Reducing the amount of soil carried in/out of the site
- Reuse: Using the soil as a resource, such as for embankments under appropriate management
- Remediation: In-situ remediation for contaminated soil and groundwater

Column

Supporting the Development of Environmental Initiatives Efforts of the Tokyo Metropolitan Research Institute for Environmental Protection

The Tokyo Metropolitan Research Institute for Environmental Protection conducts research and study that contributes to the promotion of environmental initiatives by TMG and helps improve the environment of Tokyo.

For example, with regard to chemical substances that may affect the environment, it is working to clarify their sources and environmental risks by studying the available information and literature, and analyzing samples collected in Tokyo.

The institute is also exploring comprehensive methods for analyzing chemical substances in the environment for the purpose of environmental risk management assuming the leakage of chemical substances in the event of a disaster or accident.

High-performance liquid chromatography-mass spectrometer

Direction of Policies

Chemical substances

To prevent health hazards caused by chemical substances, TMG will ensure that businesses handling chemical substances properly control them. In addition to normal times, we will prevent leakage and outflows of chemical substances caused by flood at the time of large earthquakes or typhoons to curb the spread of environmental pollution.

New findings may reveal problems with substances once considered safe, including health hazards or adverse effects on the environment. By predicting the potential effects of different substances from multiple perspectives, TMG will create an environment in which the natural ecosystem will not be exposed to danger and Tokyo residents will be able to live in a safe, secure, and more sustainable manner.

Promoting emission reductions through a notification system

Through the PRTR program and the chemical substance control program, TMG will identify and properly control the amount of chemical substances emitted by businesses, and eventually encourage their voluntary control of chemical substance emissions.

Identifying risks, taking measures based on monitoring

TMG will identify the risks of chemical substances, including their impact on health, from various perspectives to set the priority of measures in collaboration with the national government, the Tokyo Metropolitan Research Institute for Environmental Protection, and other related organizations. We will monitor substances with a high risk of health effects and promptly publish the resulting data so that Tokyo residents and businesses can avoid such risks.

View of monitoring equipment

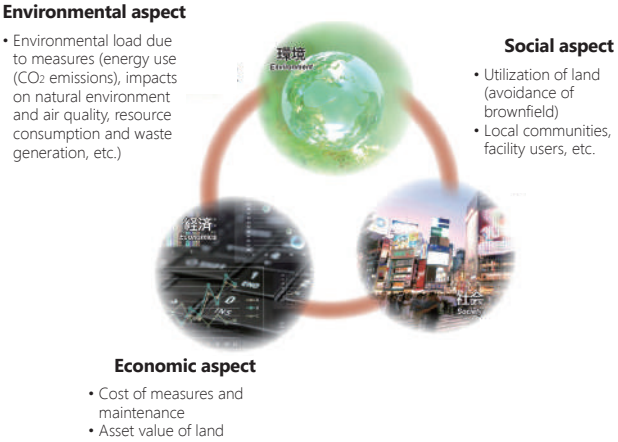
Measures for a disaster

To promote measures for chemical substances in the event of a disaster, TMG will decisively encourage action to prevent outflow by providing support to businesses in Tokyo and raising their awareness. We will strengthen systems responding to the leakage of chemical substances by studying techniques for checking the state of pollution, such as a qualitative analysis of leaked substances in the event of a disaster, in collaboration with the Tokyo Metropolitan Research Institute for Environmental Protection.

Soil pollution

TMG will establish measures for soil pollution that consider the 3Rs of soil, and provide support for businesses and raise their awareness so that they can voluntarily compare and consider these measures to choose a rational option. Through the open data methodology, we will ensure smooth land use, control land with non-conforming soil, identify the actual state of naturally contaminated soil, and keep traceability in place.

Sustainable measures for soil pollution



System improvements

In order to promote sustainable measures for soil pollution, TMG will request the national government to make proposals for system improvements necessary for more effective use of naturally contaminated soil, and will also appropriately deal with TMG's systems.

Promoting voluntary efforts

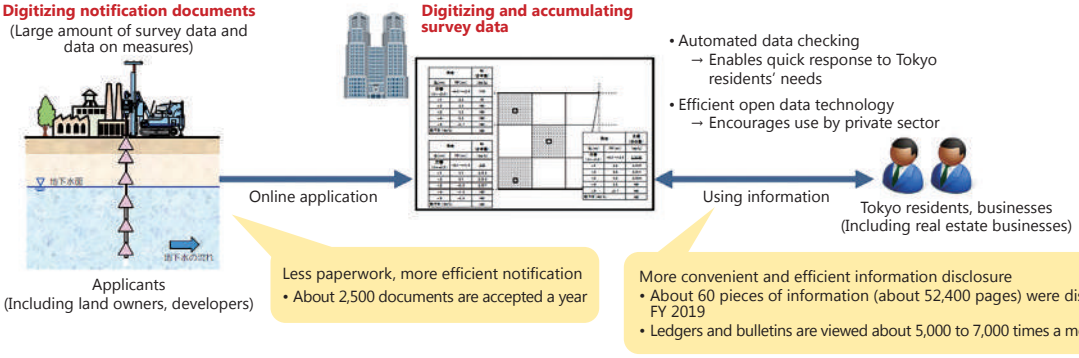
TMG will promote the provision of necessary information and technical support to enable businesses to choose sustainable measures for soil pollution on a voluntary basis. We will encourage small and medium-sized businesses to use our advisors to promote their voluntary efforts.

Enhancing information sharing and management

TMG will digitize notification documents related to measures for soil pollution to facilitate notification procedures, control land with non-conforming soil, identify the actual state of naturally contaminated soil, and keep traceability in place. We will also provide data on non-conforming soil as open data.

Image of open data

- Digitizing notification documents related to measures for soil pollution, developing an online application environment
- Information on measures for soil pollution to be used by the private sector thanks to automated checking of survey data and efficient open data technology



Column

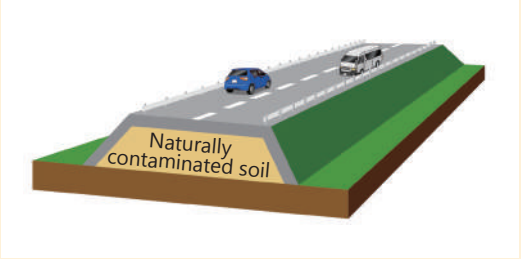
Effective Use of Naturally Contaminated Soil

There is a general perception that soil pollution is caused by human-induced leakage of harmful substances, but some soil may contain harmful substances that exist in the natural world. Such soil that exceeds the standards of laws and regulations due to natural causes is called "naturally contaminated soil."

One of the characteristics of land in Tokyo is that naturally contaminated soil slightly exceeding the standard values is often found in addition to human-induced non-conforming soil.

Naturally contaminated soil has been treated at contaminated soil treatment facilities so far in the same manner as human-induced non-conforming soil. However, since the enforcement of the Revised Soil Contamination Countermeasures Act in 2019, it has become available for embankment and other purposes if certain conditions are met. Effective use of this system will make it easier to utilize naturally-induced non-conforming soil under proper management, enabling the 3Rs of soil to be achieved.

Example of the effective use of naturally contaminated soil



Source: Material of the Ministry of the Environment.

TMG will promote the 3Rs of soil by featuring best practices, including examples of the effective use of naturally contaminated soil, at seminars and forums related to measures for soil pollution.

Further Promoting the Proper Treatment of Waste

In addition to focusing on the 3Rs of waste, Japan has enforced the recycling law for containers/packaging, home appliances, etc., improving the recycling rate for such items.

Hazardous wastes are also treated appropriately according to various ordinances, and the number of cases of illegal dumping has significantly decreased from the peak due to cooperation between the national government and prefectural governments.

On the other hand, new challenges are emerging, such as how we should respond to changes in social structure associated with for example the advent of a super-aged society. Frequent storms and flooding have caused enormous damage in recent years, and there is concern about a Tokyo inland earthquake, which is said to have a 70% probability of occurring in the next 30 years. In the treatment of waste generated by such disasters, we have to keep resilience in mind to maintain a safe and secure living environment, restore urban functions, and ensure the sustainability of the metropolis of Tokyo.

TMG will further promote the proper treatment of waste while reinforcing the efforts made so far and appropriately addressing new challenges.

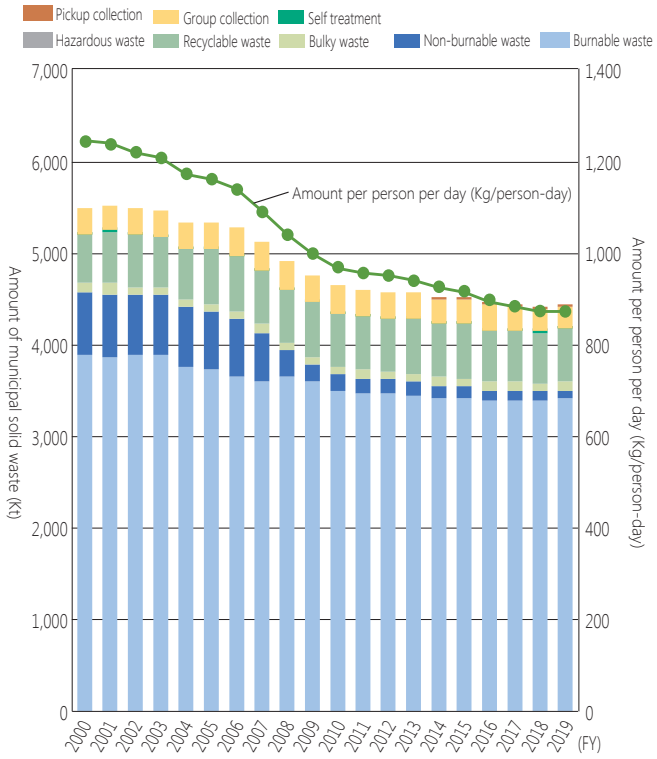
Status Quo

Amount of municipal solid waste and its final disposal volume

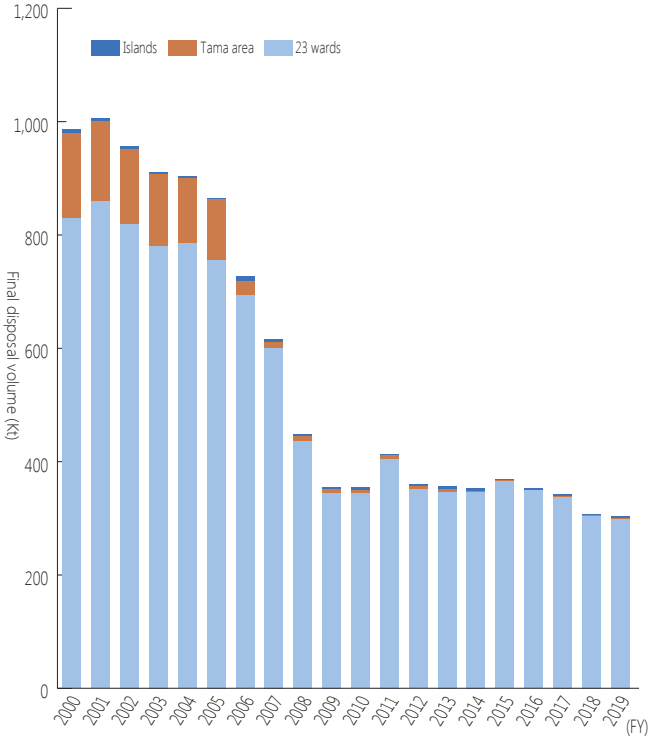
The amount of municipal solid waste generated in Tokyo per year decreased from approximately 5.5 million tonnes in the early 2000s to approximately 4.4 million tonnes in FY 2018. While the population of Tokyo increased by approximately 15% from FY 2000 to FY 2018, the amount of waste per day per Tokyo resident decreased by approximately 30%, partly due to progress in 3R initiatives.

The final disposal volume of municipal solid waste in Tokyo steadily decreased until FY 2009 due to improvements in the recycling rate and other reasons, but has remained flat in recent years.

Changes in the amount of municipal solid waste in Tokyo



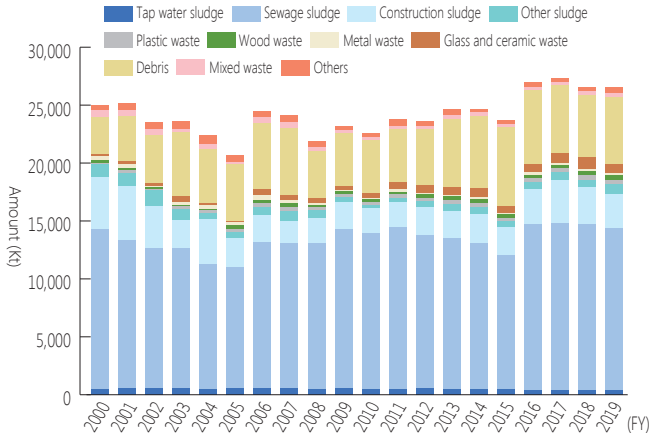
Changes in municipal solid waste final disposal volume in Tokyo



Changes in the amount of industrial waste and its final disposal volume

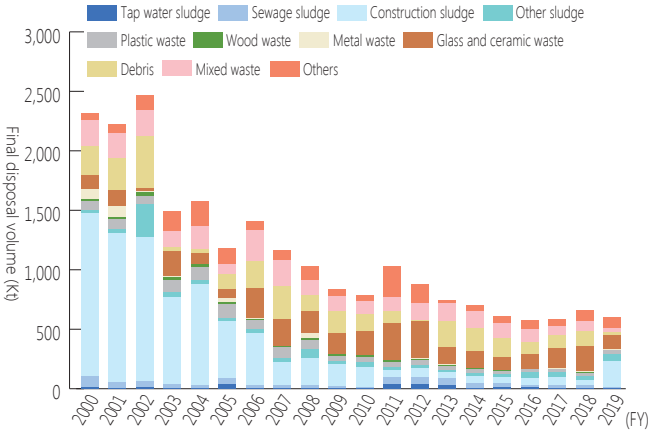
The amount of industrial waste generated in Tokyo has hovered around 25 million tonnes in recent years with some fluctuations between fiscal years. When considering the array of industrial waste, the largest volume comes from sludge discharged during sewage treatment (sewage sludge), which accounts for about half of all industrial waste.

Changes in the amount of industrial waste in Tokyo



Final disposal volume trended downward but it has remained flat since 2016. Compared to FY 2000, the amount of final disposal volume in FY 2018 shows a significant decrease in construction sludge discharged from tunnel excavation and building piling work.

Changes in final disposal volume of industrial waste in Tokyo



Treatment of disaster waste

Partly because of TMG's support of municipalities in formulating treatment plans, the rate of formulating a municipal disaster waste management plan has increased year after year, reaching 79% as of the end of FY 2021.

Of disaster waste generated by the Great East Japan Earthquake in 2011, 167,891 tonnes were crushed or incinerated by TMG and local governments and private businesses in Tokyo. When considering disaster waste in Osaki City, Miyagi Prefecture, which was damaged by Typhoon Hagibis in 2019, about 5,800 tonnes were incinerated at 21 incineration plants in Tokyo.

Visions for 2050

In cooperation with municipalities in Tokyo and neighboring local governments, TMG will work to promote the proper treatment of waste by establishing a robust waste treatment system that can pass on a good urban environment to the next generation and steadily advancing preparations for a Tokyo inland earthquake and other disasters.

- Environmental risks from hazardous waste will be minimized with no illegal dumping of industrial waste.
- Preparedness in normal times will be ensured to quickly and appropriately treat waste caused by a disaster, such as a Tokyo inland earthquake.

2030 Targets

- Amount of municipal solid waste: 4.1 million tonnes
- Final disposal volume: 770,000 tonnes
- Building a system to quickly and appropriately treat disaster waste throughout Tokyo

Direction of Policies

To further promote the proper treatment of waste, TMG will strengthen the waste treatment system in normal times by for example thoroughly implementing measures for hazardous waste and illegal dumping, and build a system that allows the treatment of disaster waste in a quick and appropriate manner in the event of a disaster.

Strengthening the waste treatment system

Measures for hazardous waste

It is mandatory to finish disposing of waste containing PCBs and their mixtures, which have been used in a wide range of applications, by the deadline set by law. TMG will also promote the separate collection of products containing mercury, such as fluorescent tubes, discharged from homes and facilities.

In addition to promoting appropriate measures for waste containing asbestos through on-site inspections and guidance at the time of a structure's demolition, TMG will appropriately treat the increasing amount of home medical waste* and lithium-ion batteries indispensable for electronic devices.

* Injection needles, tubes, plastic bags, and other waste generated from home medical care

Logo to raise awareness of proper disposal of PCBs by the deadline

PCB
TIME LIMIT
期限内処理
九都県市

Measures for illegal dumping

Illegal dumping of waste, which has a huge impact on the local environment, has not been eradicated yet though it has been steadily reduced both in the number of cases and volume, thanks to the tightening of regulations in the Waste Management Law and the strengthening of efforts by local governments. TMG will continue to provide on-site guidance at demolition sites, which are considered to be major contributors to the issue. In addition, we will decisively tackle the inappropriate disposal of industrial waste, which is geographically expanding and becoming more sophisticated, by ensuring information exchange and wide-area cooperation between local governments.

Roadside survey to prevent illegal dumping

Integration of waste treatment and consolidation of facilities

TMG will consider the treatment of municipal solid waste across borders—the integration of waste treatment—in cooperation with municipalities. From the viewpoint of more efficient operation and less maintenance/management costs, we will also explore the consolidation of treatment facilities. As for recycling and waste treatment on the islands, we will consider a system to provide the services in a stable and continuous manner, taking into account geographical restrictions.

Although industrial waste has been treated across municipal borders, TMG expects that a more efficient and higher-quality treatment will be needed in order to reduce environmental load. We will consider how we should deal with industrial waste in Tokyo, including the introduction of advanced treatment technology and the realization of more efficient treatment in Tokyo.

Traditionally in the 23 wards, municipal solid waste has been collected and transported in an integrated manner, but in the Tama area, the service is provided separately in individual districts of municipalities according to various permission agreements. TMG will work with municipalities to consider a mechanism for smooth transportation across these districts.

For the treatment of business waste, tenants in the same building may hold a contract with different waste treatment companies, leading to inefficient operations in which multiple collectors/transporters visit one building. TMG will promote efficient collection and transportation in collaboration with waste treatment companies.

Strengthening measures for disaster waste

Enhancing the disaster waste management plan of TMG

In light of the frequent landfall of large typhoons in recent years, TMG will enhance its disaster waste management plan by properly identifying challenges, such as the strengthening of measures for waste generated by storms and flooding.

Encouraging the formulation of municipal disaster waste management plans

Municipalities are primarily responsible for treating disaster waste that is classified as municipal solid waste under the Waste Management Law. TMG will take necessary support measures for municipalities, and encourage the formulation of disaster waste management plans by municipalities.

Establishment of joint organizations and implementation of training and drills

The TMG Disaster Waste Management Plan stipulates that the 23 wards and the Tama area set up a joint organization respectively in preparation for the case where municipalities cannot treat their disaster waste by themselves. Since the Tama area has not yet developed a treatment scheme, TMG will work with municipalities to discuss the establishment of a joint organization as soon as possible.

We will continue to provide training and drills for municipal officials in cooperation with the national government as we need to improve their skills so that they can appropriately demonstrate their abilities in the event of a disaster.

Collaboration with related organizations

Collaboration with a variety of industries is essential to treat disaster waste as debris waste is treated as industrial waste in normal times, and materials, equipment, and technology necessary for treatment belong to industrial waste treatment companies and construction companies. TMG will promptly promote the coordination necessary for building a system for collaboration with related organizations.

Types of disaster waste

Concrete debris

Metal waste

Ensuring a wide-area treatment system

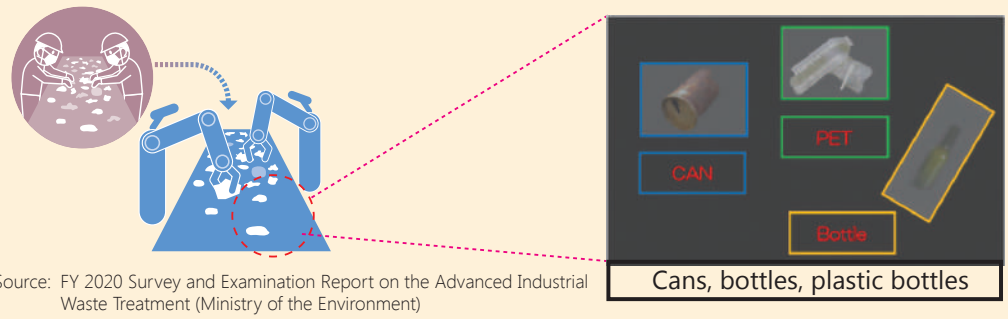
In the event of a catastrophic disaster, a wide-area treatment in cooperation with neighboring local governments will be necessary as there is a limit to the capacity for waste treatment in Tokyo. To ensure a wide-area treatment system, TMG will participate in the Kanto Region Block Action Program to develop the treatment system in the block.

Column

Promotion of DX in the Waste Treatment Field

Digital transformation (DX) has been attracting attention in the field of waste treatment. Due to the declining labor force population and restrictions on human contact and the scope of work caused by the COVID-19 crisis, it has become difficult to secure human resources who manually sort waste at recycling facilities. Against this backdrop, there is a move to use artificial intelligence (AI) in the waste sorting process to solve these issues through advanced mechanization and automation.

Automatic sorting of waste using AI shape recognition



Source: FY 2020 Survey and Examination Report on the Advanced Industrial Waste Treatment (Ministry of the Environment)

Part 3

Cross-Sectional and Comprehensive Initiatives to Enhance the Effectiveness of Policies

118 Acceleration of Environmentally Friendly Behavior in Cooperation with All Actors

Part 3: Cross-Sectional and Comprehensive Initiatives to Enhance the Effectiveness of Policies

To solve the impending environmental issues and build a green and resilient global city Tokyo opening up a future, we must promote cross-sectional and comprehensive efforts in addition to sectional initiatives mentioned in Part 2. Not only the administration, but also Tokyo residents, businesses, organizations, and all other entities concentrated in Tokyo are expected to work together to proactively and aggressively promote environmental measures. All of us need to build a social system that allows the realization of that vision.

Acceleration of Environmentally Friendly Behavior in Cooperation with All Actors

The crisis we are facing right now cannot be overcome by administrative power alone. Efforts are required of all the municipalities of Tokyo, in the metropolitan area, across Japan, and on a global scale. And, it goes without saying that the participation of Tokyo residents, businesses, and organizations is essential. All these efforts will contribute to achieving the 17 Sustainable Development Goals (SDGs) agreed on by the world and help resolve complex social issues.

Gaining the understanding of all actors and calling for their engagement, TMG will take a stand against the environmental problems together with them.

Collaboration with Tokyo Residents, Businesses, etc.

In Tokyo, where about 14 million people live and about 630,000 facilities conduct business, the cooperation of Tokyo residents, businesses, and organizations has a huge impact on the promotion of initiatives.

By presenting specific actions that each and everyone of us can take, TMG will create a movement involving Tokyo residents and businesses to change people's lifestyles and business structures and activities.

Project development in collaboration with Tokyo residents, businesses, and organizations

TMG will expand creative initiatives that are open to Tokyo residents and businesses and have a high ripple effect, building on its successful experience with campaigns such as Team Mottainai, the Air Quality Improvement Project to Realize Clear Sky, and the Tokyo Cool Home & Biz Event.

By fostering a further movement to actively involve Tokyo residents and businesses, we will raise awareness of environmental issues and strengthen our cooperation and engagement with these actors.

• Team Mottainai

- Recruiting businesses, organizations, including NGOs, and individuals that are working to convey the sense of "mottainai" (too precious to waste) and create opportunities for behavior change
- A framework aimed at changing the consumption behavior of individuals through initiatives for the reduction of food waste and single-use plastics or the improvement of energy efficiency

• Air Quality Improvement Project to Realize Clear Sky

- Encouraging emission reductions based on voluntary efforts by recruiting businesses working on measures for NOx and VOCs to widely publicize their efforts
- Using SNS to call for action and hold events so that Tokyo residents will be interested in air quality

• Tokyo Cool Home & Biz Event

- An event to call for the acceleration of power-saving actions
- Holding a Cool Biz Collection event in which the governor and TMG officials presented Cool Biz Style, and introducing specific efforts, equipment, and ZEVs for power saving and energy efficiency at home and office as well as local production and consumption of energy

Publicizing best practices of Tokyo residents and businesses

By actively publicizing excellent efforts made by Tokyo residents and businesses to solve environmental issues through its systems and awareness raising projects, TMG will foster a social infrastructure and momentum that allows entities developing ambitious activities to have that reflected in their value to the market and communities.

Top-level facility certification logo

Tokyo Cap and Trade Program

Freight Transportation Evaluation System logo (showing fulfillment for 10 consecutive years)

Retaining and developing human resources, promoting behavior change

TMG will enhance the development of the generation that will lead the future to retain human resources that will take on the task of resolving environmental issues that have become more complex and sophisticated. To encourage the participation of more Tokyo residents and businesses, we will provide information and create a mechanism to enable them to take concrete actions more easily.

■ Enhancement of efforts for future generations

TMG will develop human resources who can act for the creation of a sustainable future and society through its environmental learning programs in cooperation with businesses, related organizations, and municipalities.

As for environmental education in elementary and junior high schools, we will further enhance teaching/learning materials and programs in connection with Education for Sustainable Development (ESD) and SDGs, and promote environmental education during hours for subjects and integrated learning so that children can think about what they can do for solving environmental problems around them. To achieve the SDGs that the whole world should aim for, we will help children acquire the qualities and abilities to contribute to the realization of a sustainable society and a bright and hopeful future through the practice of thinking about how the structure of society should be.

Through dialog with young people, TMG will implement initiatives that take into account their perspectives. We will encourage environmentally friendly behavior at home involving children by for example implementing a project in which they play a leading role to enjoy working on energy efficiency, waste reduction, and food waste reduction at home.

- **Environmental learning programs implemented by TMG**
- **Environmental education workshops for elementary school teachers**
  Practical training in environmental education is provided for teachers at elementary schools, including private schools, in Tokyo to develop teaching staff who can conduct lessons on the environment in a cross-curricular and comprehensive manner.
- **Environmental learning courses by subject for Tokyo residents**
  These courses are held to deepen the understanding of Tokyo residents about environmental issues so that all of them can consciously choose to act for the benefit of the environment.
- **Comprehensive portal site for environmental learning**
  Basic knowledge of the environment can be learned from this site on a sectoral basis.

- **Environmental learning videos**
  Videos for environmental learning have been created to enable Tokyo residents to learn about the environment at any time and place.
- **Environmental learning at the waste landfill management offices**
  In parallel with school education, opportunities will be provided for students to experience environmental learning on waste treatment and the 3Rs, including Reduce, through exhibits and study tours.

- **TMG's environmental teaching/learning materials for school education**
- **TMG's teaching guidelines for environmental education**

  To enhance environmental education in elementary and junior high schools, these guidelines show specific contents and methods of teaching in connection with Education for Sustainable Development (ESD) and SDGs.

  In addition to reference information for teaching, the guidelines include examples that clarify what to teach through environmental education and what kind of qualities and abilities children should acquire.

- **Teaching/learning materials for posting and supplementary materials for environmental education**

  These materials feature different environmental issues related to global environmental protection at each session, and encourage children and students to take an interest in global environmental protection and act with consideration for the environment.

  To match the content with each developmental stage, there are four versions of materials corresponding to lower, middle, and upper grades of elementary schools, and junior high schools, which are posted on the website and made available for use by children and students on their tablets.

Column

You Are Director General, Bureau of Environment, at Home from Today!

Since FY 2022, TMG has been promoting the "Director General, Bureau of Environment, at Home" project principally aimed at fourth graders of elementary schools and above, in which they act as Director General, Bureau of Environment, leading the way in promoting environmental measures, saving electricity and enjoying other benefits with their family members. As part of this project, in May 2022, Tokyo Governor KOIKE Yuriko visited an elementary school in Shinjuku Ward and gave a special HTT class, "Let's think about electricity - I appoint you as Director General, Bureau of Environment, at Home." First, the governor explained that most of the electricity used in Tokyo is sent from power plants located outside of Tokyo, and most of that electricity is generated from resources dependent on imports, including natural gas, coal, and oil. Second, using HTT (H - Herasu (save), T - Tsukuru (generate), and T - Tameru (store) electricity) as a keyword, she explained how to save power in their day-to-day surroundings in an easy-to-understand manner.

At the end of the class, she held a ceremony to appoint the Director General, Bureau of Environment, at Home, asking each student who listened to the class to act as the director at home and carry out the HTT actions.

During the summer vacation of 2022, a special content called Tokyo Cool Home BINGO was provided for families to enjoy working on energy-saving actions. It was an online initiative to help research and learn about measures for electric power energy and other topics to take specific power saving actions.

TMG will provide a variety of content to encourage each child to act as director and enjoy working on energy-saving and other actions with their family members.

- Tokyo Cool Home BINGO was an online initiative held in the summer of 2022 to help research and learn about measures for electric power energy and other topics and take specific actions.
- 3 bingos earned 1 point. Those who collected 8 points could apply for a fun event (participants were determined by lottery).

■ Retaining human resources to work together

TMG will strengthen the retention of human resources who work together to solve environmental issues by for example encouraging participation in nature experience activities through the dissemination of information about a wide variety of activities, such as the recruitment of volunteers to promote the conservation of green spaces, via the website in an easy-to-understand manner.

- **"Experience Nature in Tokyo - Satoyama" (website with information on forest and green space conservation activities)**

TMG encourages nature experience activities by disseminating a wide variety of information on green space conservation activities in an easy-to-understand manner through the website.

■ Effective dissemination of information

TMG will disseminate comprehensive information integrating effective environmentally friendly behavior in different fields rather than raising awareness for individual fields, such as energy efficiency or the reduction of fluorocarbon emissions. Taking thermal insulation renovation as an example, we will pursue effective ways of communicating that emphasize comprehensive benefits, not only energy efficiency and CO_2 reductions, but also lower running costs, health benefits, and improved resilience. We will also aim for effective awareness raising by strategically utilizing media while exploring messages and approaches that match the behaviors of different generations of applicable people, including children, young people, and the elderly.

■ Using a variety of policy approaches

○ Improving accessibility to decarbonization actions for Tokyo residents and businesses

TMG will create mechanisms that make it easier for Tokyo residents and businesses to take concrete actions together with the administration, such as group buying of renewable power by Tokyo residents, in cooperation with neighboring local governments.

○ Utilizing the nudge theory

TMG will further enhance the effectiveness of its initiatives by actively incorporating the nudge theory, which helps people voluntarily make better choices for themselves based on precepts from behavioral science.

Promoting green finance

Efforts to evolve Tokyo into a city with world appeal require a large amount of funds. Developing green finance systems that funnel domestic and international funds to such efforts and expanding finance that supports the transition to decarbonization will help improve the prominence of Tokyo as an international financial city. By decisively promoting the Tokyo Green Finance Initiative (TGFI), a strategic initiative to develop green finance in Tokyo, TMG will create a virtuous cycle between the environment and economy from Tokyo to simultaneously encourage the greening of an urban system and financial system.

Support for technology development

To assist the sustainable development of small and medium-sized businesses acting as the base of industry, TMG will help them create green innovations and encourage them to move into a new growth industry by providing management support in light of decarbonization and technical support for the mobility industry as well as supporting start-ups.

We will also support the efforts of corporate groups aiming to create advanced technologies and business models, and encourage inter-company collaboration and the joint implementation of new technologies and businesses.

TMG will utilize subsidy programs that call for active efforts of each entity, including subsidies with a mechanism to promote the development and spread of products that contribute to decarbonization, and subsidies in proportion to the level of efforts.

Promoting digital transformation

Through the active use of digital technology in such ways as making its data accumulated under various systems open and realizing the social implementation of cutting-edge technologies (including energy management with AI and IoT), TMG will improve its QOS (Quality of Service) in the environmental field and the QOL (Quality of Life) of Tokyo residents and businesses.

Cooperation with policy collaboration organizations (TMG's partners)

TMG will deepen its partnership with the Tokyo Environmental Public Service Corporation, which has a wealth of know-how and on-site capabilities cultivated at Cool Net Tokyo (Tokyo Metropolitan Center for Climate Change Actions) and the Tokyo Metropolitan Research Institute for Environmental Protection, to further encourage a change in the behaviors of Tokyo residents and businesses by making the most of the resources of the public service corporation.

Collaboration between Local Governments, TMG's Initiatives for Its Own Sustainability

In order to gain the understanding of Tokyo residents, businesses, and organizations and act with them, TMG will promote efforts that involve more entities by strengthening cooperation with municipalities that are most familiar to the residents, and utilizing a framework for wide-area cooperation with local governments in the Tokyo metropolitan area and major cities nationwide. We will boldly accelerate our own initiatives toward our goals to lead Tokyo residents and businesses with "Let's Start from Here" in mind.

Support for proactive efforts by municipalities, more cooperation with municipalities

TMG will promote combined efforts with municipalities by further strengthening cooperation with them as they are familiar with local circumstances, and have the regional networks and resources as local governments.

■ Support for efforts toward decarbonization according to local characteristics

TMG will support efforts aimed at resolving environmental issues by providing cooperation and support according to the actual situation of municipalities, such as financial support for those working on local environmental issues, and by understanding their needs and challenges by sharing information and exchanging opinions with them to examine and review the content of the support.

■ Promoting the horizontal development of effective efforts implemented by municipalities

Environmental issues and social issues have to be addressed in an integrated manner as they are interconnected. For example, an effective approach would be to keep an eye on both environmental and social issues in such a way that considers the status of food banks and other efforts when reducing food waste. From this perspective, TMG will encourage municipalities to expand their effective efforts by creating and utilizing tools that indicate subsidy options for each policy area, TMG's initiatives for its own sustainability, and best practices of other local governments. TMG will actively provide support for municipalities by sharing knowledge and challenges they have learned while working to solve environmental issues taking advantage of liaison meetings and other opportunities.

Collaboration with local governments in the Tokyo metropolitan area, approaches to the national government

To solve issues that require wide-area measures and new issues accompanied by changes in the environment, TMG will not only implement initiatives on its own, but also expand its efforts to the Tokyo metropolitan area and then throughout Japan for wide-area cooperation that improves the effectiveness of the initiatives.

■ Wide-area cooperation in the Tokyo metropolitan area and at the national level

TMG will implement effective efforts through the Nine Local Governments Coalition to address wide-area or new issues with a sense of urgency. We will promote the sharing and dissemination of information on advanced initiatives, such as the cap-and-trade program jointly implemented by TMG and Saitama Prefecture, and the Program That Requires Certain New Small and Medium-Sized Buildings, Including Houses, to Install Solar Power Generation Equipment under consideration by TMG.

In order to encourage the procurement of renewable power from other regions by businesses, we will enhance a wide-area cooperation system to ensure the smooth progress of excellent initiatives by for example building a cooperative system between TMG and local governments outside Tokyo that have renewable energy equipment.

■ Approaches to the national government

The role of the national government is crucial in initiatives that should be developed on a nationwide scale, such as the realization of a decarbonized society and the conservation of biodiversity. TMG will decisively request in collaboration with the National Governors' Association that the national government work on the formulation of initiatives to support the independent and proactive efforts of Tokyo and other regions, strive for further technological development, and play a leading role in the international community.

TMG's initiatives for its own sustainability

■ Zero Emission TMG Action Plan (repeat)

To demonstrate that TMG will lead by example to Tokyo residents and businesses, TMG will mobilize all of its bureaus and departments to promote promptly and decisively its initiatives for the realization of a Zero Emission Tokyo based on the Zero Emission TMG Action Plan.

■ Green purchasing

TMG will promote green purchasing by taking the lead in procuring environmentally and socially friendly products and services. Considering its procurement activities as a starting point from the perspective of the supply chain, TMG will expand the market for environmentally friendly products and encourage efforts by manufacturers to reduce the environmental load of product development and supply. We will actively promote the realization of a sustainable society by further encouraging the purchase of environmentally friendly products by Tokyo residents, businesses, and other local governments.

International Contribution and Exchange (Cooperation with cities and businesses around the world)

TMG will further enhance its initiatives and contribute to the solving of global environmental issues by exercising international leadership as one of the world's largest cities, promoting cooperation with overseas cities, and sharing knowledge and technologies with them. We will improve our international presence by making the most of the benefits of the online environment and strengthening information dissemination and approaches to the rest of the world.

Strengthening and utilization of global networks

TMG will deepen cooperation with overseas cities and businesses to achieve common objectives, including climate change measures and the promotion of a circular economy, by strengthening the international promotion system in Tokyo and actively participating in international inter-city network activities, such as C40[*1] and ICLEI[*2], as well as international conferences.

*1 C40: C40 Cities Climate Leadership Group
*2 ICLEI: Local Governments for Sustainability

Active approaches and contribution to the international community

Through the mutual learning of knowledge and technologies with overseas cities, TMG will further improve its environmental initiatives and share knowledge on its advanced environmental policies with them. We will further contribute to the international community by playing a leading role in international conferences and other occasions to actively help resolve environmental issues.

Improving international presence

Taking advantage of the connections with overseas cities, TMG will disseminate information on its pioneering initiatives, which lead the world in measures for buildings and the expanded use of hydrogen energy. We will strategically develop the climate action movement "TIME TO ACT" from Tokyo, which calls on the world to accelerate effective actions, to improve our international presence.

Promotion of Environmental Consideration in Urban Development

TMG will promote environmental considerations in all aspects of urban development, including the development and renewal of urban infrastructure, and encourage the reduction of environmental load from the perspective of sustainable urban development.

Steady promotion of the Environmental Impact Assessment System

The Environmental Impact Assessment System consists of a series of procedures for minimizing the environmental impact of large-scale development projects implemented by businesses. Before the start of such projects, a business is required to predict and evaluate their environmental impact, publish the results, listen to the opinions of residents and the relevant local government, and examine the project details from the perspective of an expert.

Since October 1981, TMG has implemented environmental impact assessment procedures based on the Tokyo Metropolitan Environmental Impact Assessment Ordinance as an environmental impact assessment system at the project implementation stage to ensure that due consideration is given to the prevention of pollution, the preservation of natural and historical environments, and the conservation of landscapes when implementing projects over a certain size.

■ Applicable projects

26 types of projects, including roads, railroads, waste treatment facilities, residential complexes, and high-rise buildings

■ 17 items to be predicted/evaluated

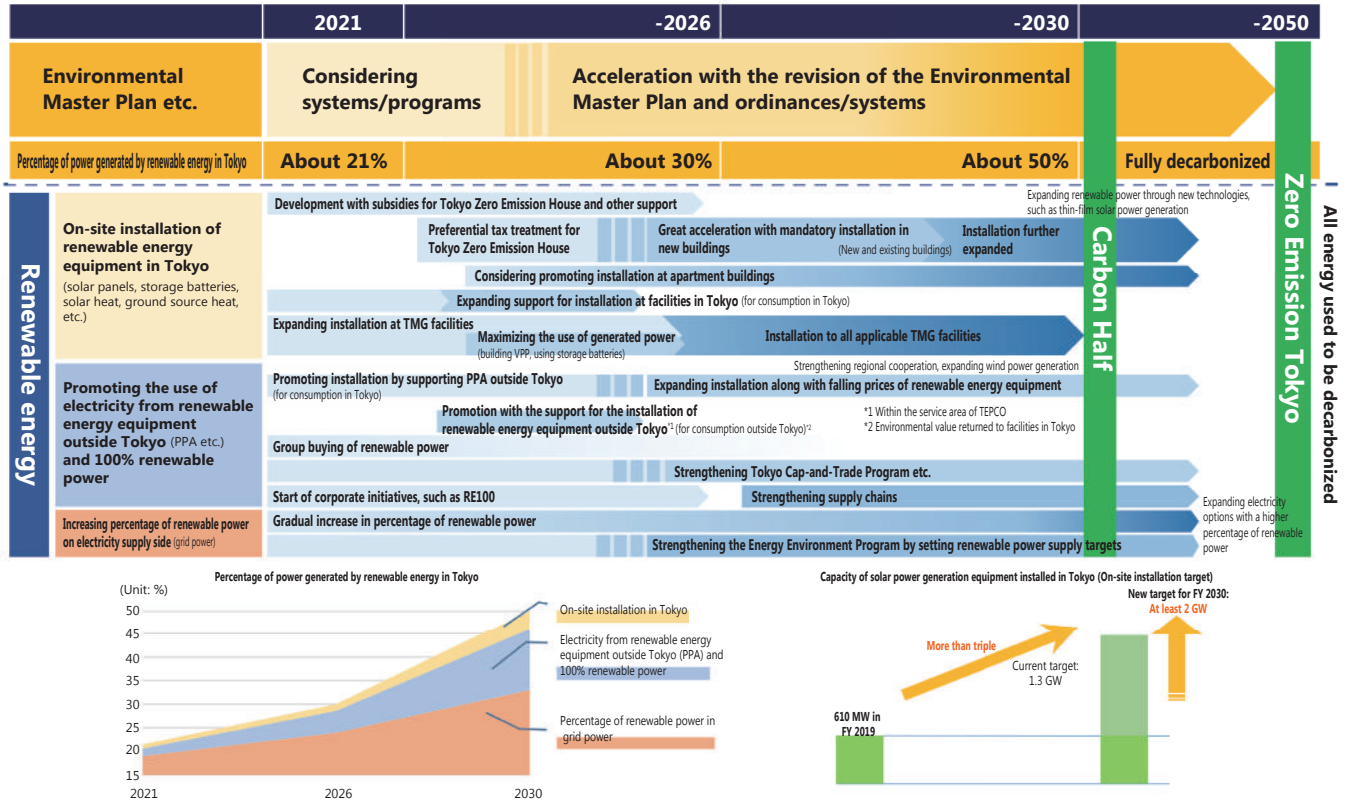
1	Air pollution	10	Shade
2	Bad odors	11	Radio interference
3	Noise/vibration	12	Wind environment
4	Water pollution	13	Landscape
5	Soil pollution	14	Historic sites/cultural properties
6	Ground	15	Places for getting closer to nature
7	Topography/geology	16	Waste
8	Water cycle	17	Greenhouse gases
9	Creatures/ecosystems		

TMG will continue to promote sustainable urban development by steadily carrying out environmental impact assessment procedures for large facilities according to the ordinance.

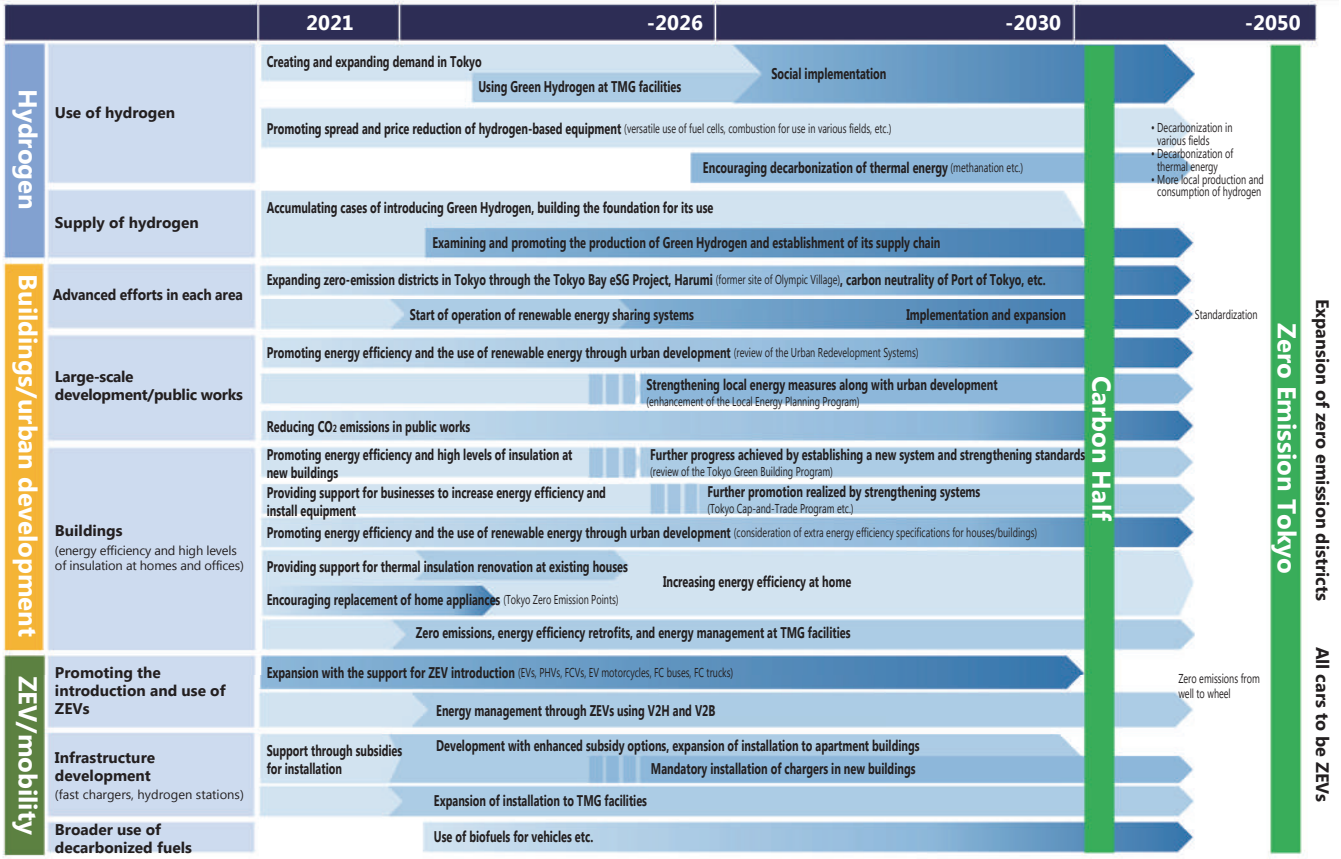
We will work to obtain the understanding and cooperation of businesses concerning the online publication of assessment documents that will contribute to promoting the understanding of Tokyo residents about the Environmental Impact Assessment System and applicable projects and improving techniques for prediction and evaluation.

TMG will mobilize all of its initiatives to realize a 2050 Zero Emission Tokyo and a 2030 Carbon Half in a strategic and systematic manner according to the roadmap below:

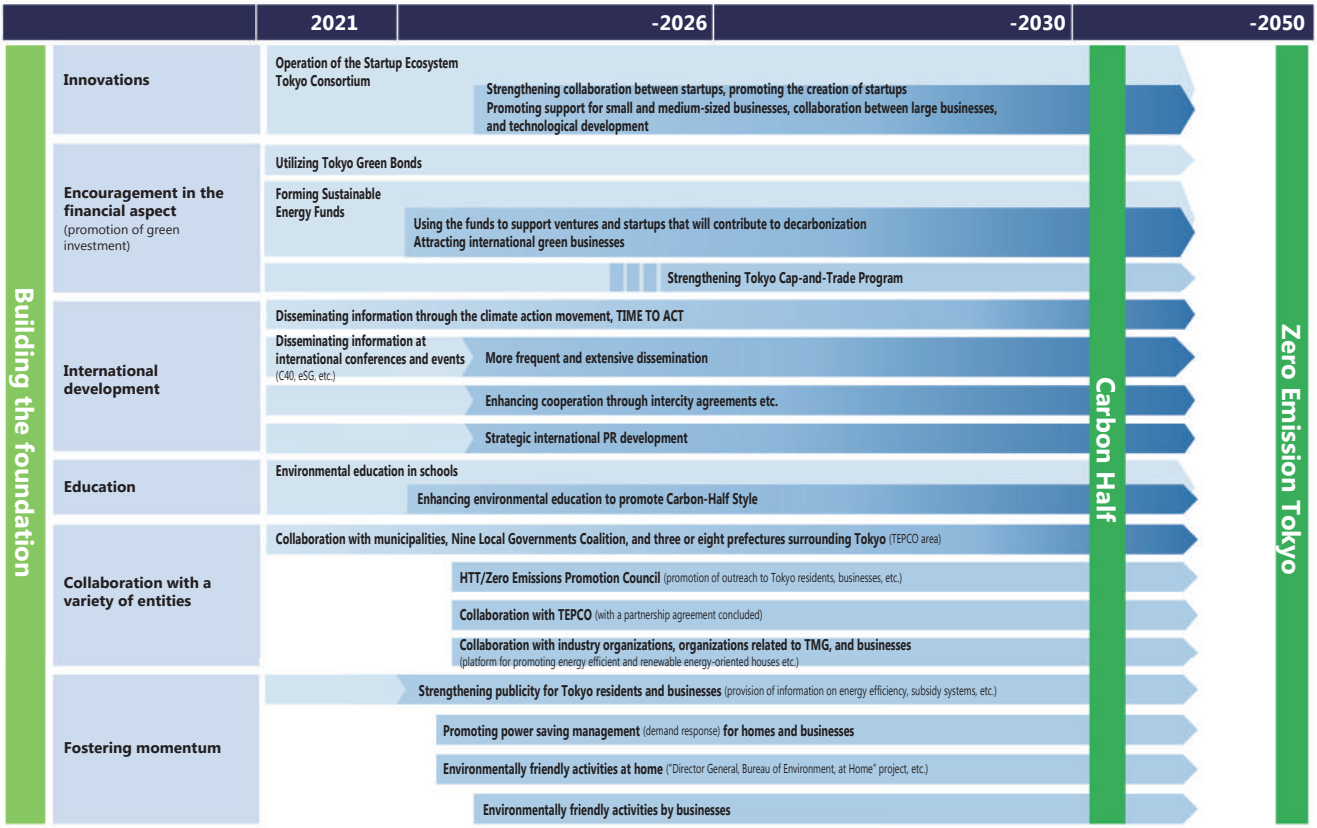
Decarbonization Roadmap (1)



Decarbonization Roadmap (2)



Decarbonization Roadmap (3)



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TIME TO ACT
CLIMATE ACTION