Zero Emission Tokyo Strategy

Zero Emission Tokyo

A decarbonization strategy to realize a Tokyo that serves as a pioneer for our brilliant future

Zero Emission Tokyo Strategy

TOKYO METROPOLITAN GOVERNMENT

Tokyo Tokyo Old meets New

A Sustainability and Resilience Strategy Pursuing 1.5°C

Zero Emission Tokyo

Formulation of the Zero Emission Tokyo Strategy

Declaration of Tokyo's Climate Crisis Mobilization

In recent years, the impacts of climate change have become increasingly serious.

In 2018, a temperature of over 40°C was recorded for the first time since records began, and 29 consecutive days with temperatures over 30°C were experienced in Tokyo, 2019. Adverse events and natural disasters have been increasing—unprecedented heavy rains caused landslides in various parts of Japan while huge tropical cyclones and wildfires have hit different regions in the world.

Climate change impacts are not something that happen in a far-off land or in the distant future, but have already affected our daily lives, causing the whole world to be in crisis. Now that the enormous impacts of climate change and the urgency of countermeasures have become apparent, the world is at a historical turning point, a paradigm shift, which requires unparalleled changes. We must take a new step to open up the future in order to protect the lives and property of Tokyo residents and businesses and ensure further growth as a city.

To this end, I announced in May 2019 that Tokyo will pursue efforts to limit the global average temperature increase to 1.5°C which entails a lower risk, bearing the responsibility of being a global megacity and realize a Zero Emission Tokyo that will contribute to achieving net zero CO_2 emissions by 2050. We have now formulated the Zero Emission Tokyo Strategy, which integrates the visions, tangible measures, as well as provides a roadmap to its realization.

Here I declare that Tokyo Metropolitan Government (TMG) recognizes that we are currently facing a climate crisis and will implement concrete policies and effective measures as well as calling for the understanding and cooperation of all of Tokyo's citizens and continuing to stand against this climate crisis.

This strategy will comprehensively develop mitigation measures to reduce CO_2 emissions and adaptation measures to avoid or reduce climate change impacts. We will also start, at full scale, the reduction of CO_2 emitted in Tokyo and other regions caused by resource use in Tokyo, advance and accelerate initiatives in all fields, such as measures to expand energy efficiency and renewable energy, and measures for the automotive environment that have been implemented.

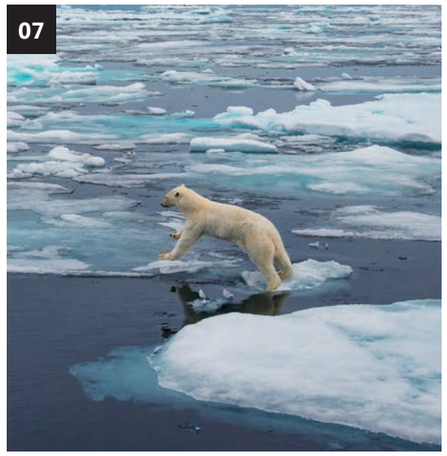
This strategy is the starting point for decarbonizing Tokyo. Setting visions as a point of departure, we will improve our goals and initiatives taking into account scientific knowledge and trends in technological development as well as listening to the voices of Tokyo residents and businesses.

To tackle the climate crisis with an all-Japan approach, we will request the national government to set ambitious goals and a clear path to achieve net zero emissions in the world by 2050, promote decarbonization of energy, technology revolution, and innovation strategies, and play a leading role in realizing a decarbonized society.

In order to achieve the ambitious goal of realizing a Zero Emission Tokyo, it is indispensable that not only administrations but also the various participants, such as Tokyo residents, businesses, and organizations, work together to take up the challenge. CO_2 emissions are closely tied to our lives, and the collective action of each one of you has a significant impact on reducing CO_2. I hope that we can help you work together on this big project by receiving your understanding and cooperation on a broad basis.

December 2019

KOIKE Yuriko
Governor of Tokyo



Zero Emission Tokyo

01 CHAPTER

IMAGE OF A ZERO EMISSION TOKYO

Image Scene in 2050

By improving energy efficiency of buildings and vehicles, establishing a society that circulates materials without wasting them, and sourcing all of the energy necessary for urban activities from solar power generation etc., we will build a city that is not only comfortable and friendly to the global environment but also resilient to disasters caused by climate change. Tokyo aims to realize a Zero Emission Tokyo by 2050.

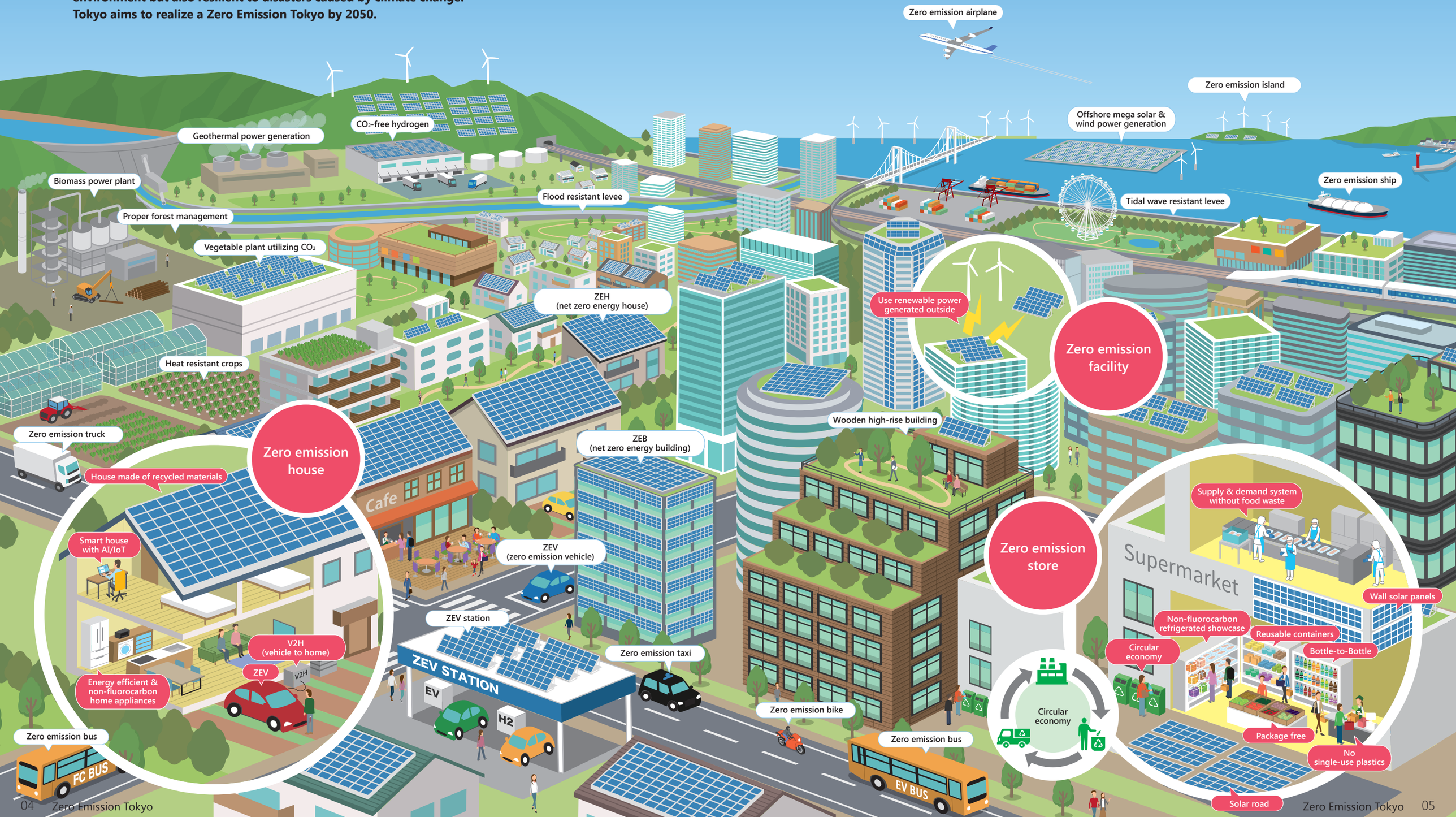


Image Scene in 2050 - Description

Energy

- A variety of renewable energy is used.
- CO_2-free hydrogen generated from renewable energy is consistently used in the city.
- Energy is managed optimally, utilizing advanced technologies.

Infrastructure

- Zero emissions in the building sector completed, including ZEHs and ZEBs.
- All cars driven in Tokyo are ZEVs. Necessary energy is free of CO_2.

Sustainable resource management

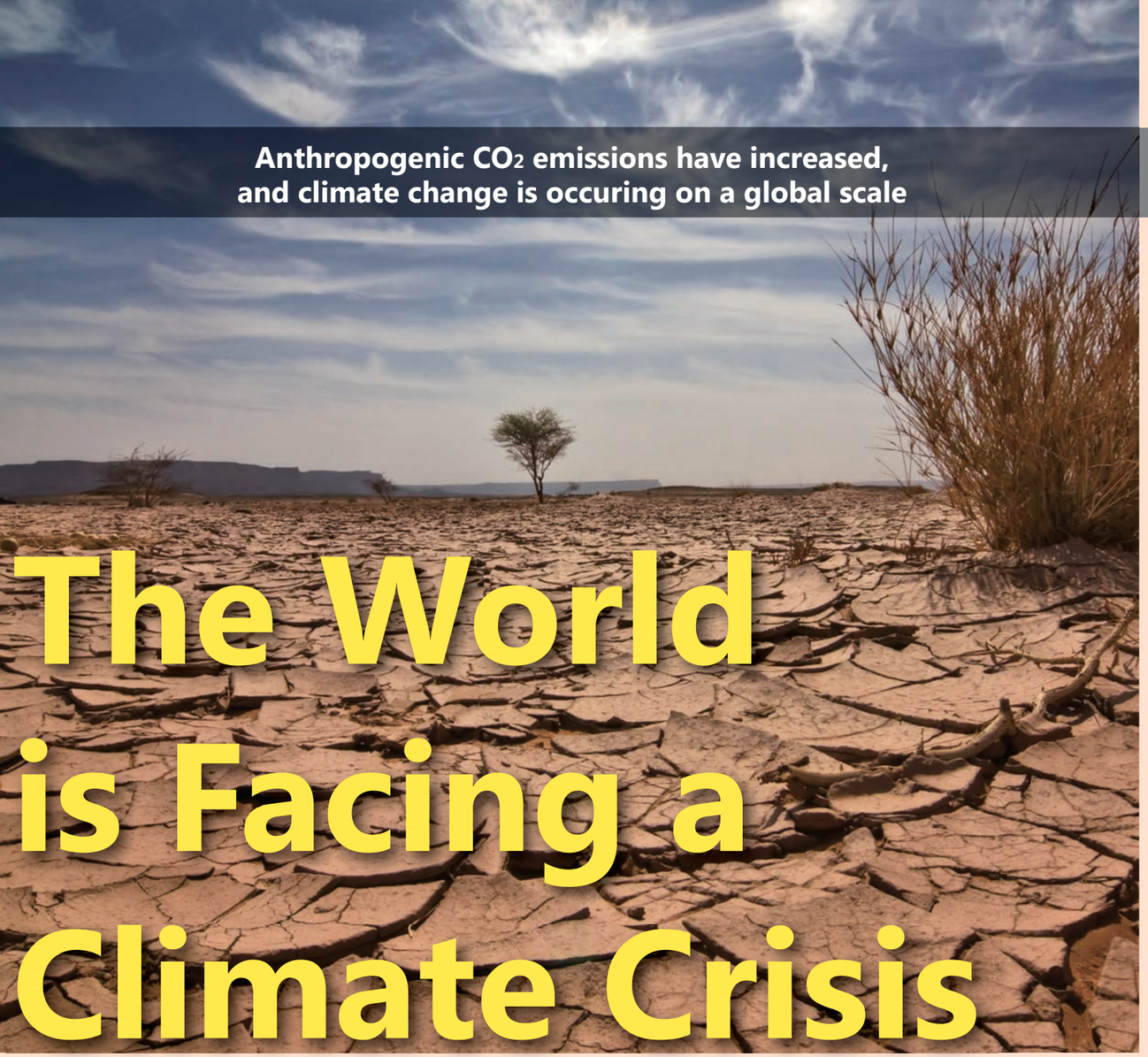
- Plastics and other resources are used in a sustainable manner.
- Environmental load is minimized at production, distribution, and consumption, including food loss and waste.

Adaptation

- Climate change adaptation measures have been fully implemented in all fields, avoiding or reducing impacts or damage on the lives of Tokyo residents and the natural environment.

02 CHAPTER

TRENDS IN CLIMATE CHANGE

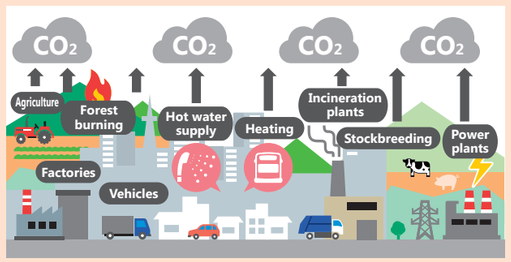


Anthropogenic CO_2 emissions have increased, and climate change is occuring on a global scale

The World is Facing a Climate Crisis

CO_2 emission sources

CO_2 is mainly generated by burning fossil fuels, including coal, oil, and natural gas. Fossil fuels are also used for power generation, bringing about CO_2 emissions directly and indirectly in all aspects of economic activities and people's lives.

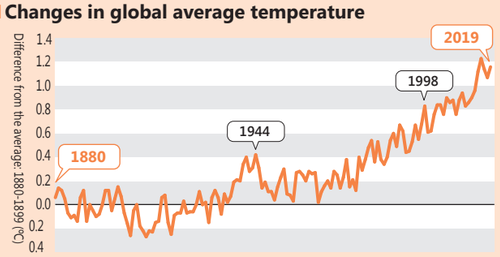


Changes in global average temperature

The global average temperature has already risen by approximately 1ºC compared to that between 1880 and 1899.

Global warming has accelerated in recent years, posing the urgent necessity of reducing CO_2 emissions that cause global warming.

Changes in global average temperature



Source: Data from National Aeronautics and Space Administration (NASA) as of September 30, 2019

Note: Greenhouse gases cause global warming. CO_2 accounts for more than 90% of greenhouse gases emitted from Tokyo. Other greenhouse gases, such as fluorocarbons, account for approximately 10% in CO_2 equivalent.

Impacts of global warming

Many phenomena are caused by the impacts of climate change.

It not only brings about irreversible changes in ecosystems, but also affects livelihoods, and resource and food security, resulting in forced displacement and social inequalities. Climate change is the most pressing challenge we face.

Global warming

Climate factors

- Temperature rise
- More frequent extreme heat events
- Decrease in rainfall
- More frequent heavy rains
- Stronger tropical cyclones
- Larger tidal waves
- Melting of snow, ice, permafrost
- Sea temperatures rising
- Sea levels rising
- Ocean acidification

Water resources	Food	Energy	Industry and infrastructure	Natural ecosystems	Disasters and security	Health
Decrease in resources	Decrease in crop production	Increase in demand	Increase in infrastructure damage	Biodiversity loss	Worsening water and food security	Increase in deaths from heat stroke and heat-related deaths
Increase in demand	Decrease in fisheries	Higher prices	Adverse impacts on tourism industry	Changes in marine habitats	Relocation of habitats	Increase in infectious diseases
Higher prices	Higher prices	Unstable supply	Decrease in timber production	Increase in forest fires	Intensified conflicts	Increase in poor nutrition
	Unstable supply				Increase in landslides and floods	
220 million people will be affected by water shortage and drought by 2050 due to 2ºC global warming.*1	Grain prices will rise by up to 23% by 2050.*1	By 2050, global energy consumption will almost double and global oil prices will rise by more than 40%.*2 Note: Reference case	UNESCO World Cultural Heritage Sites affected by sea level rise will increase to 110 due to 2ºC global warming.*3	5% of species will be at risk of extinction due to 2ºC global warming.*4	More than 140 million people in developing countries may be forced to move to other regions by 2050.*5	If global warming continues, the number of deaths from diseases, such as heat stroke and malaria, will increase by approximately 250,000/year between 2030 and 2050.*6

Adapted from "Providing Visibility into Linkage of Climate Change Impacts" (Japanese), National Institute for Environmental Studies.
*1 ***Source:*** IPCC, Special Report on Climate Change and Land.
*2 ***Source:*** U.S. Energy Information Administration (EIA), International Energy Outlook 2019.
*3 ***Source:*** IPCC, Special Report on Global Warming of 1.5°C.
*4 ***Source:*** Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), IPBES Global Assessment Report on Biodiversity and Ecosystem Services. /
*5 ***Source:*** World Bank, Groundswell: Preparation for the Internal Climate Migration.
*6 ***Source:*** World Health Organization, Climate Change and Health.

- If global warming progresses at the current rate, the temperature will rise by 1.5ºC between 2030 and 2052.
- It can have serious impacts on the poor in developing countries who are engaged in agriculture or fishery, relying on weather and nature.
- The risk of leading to irreversible, global impacts is high and the impacts will affect future generations.
- Climate change and the Sustainable Development Goals (SDGs) are closely linked, and climate change measures are an important factor for achieving the SDGs.

If we do not take any measures against global warming...

In 2100, the world will see:

Annual GDP **Loss of approx. 12%**[1]

Reference: Global GDP in 2018 was approximately 9,279 trillion yen.[2]

1 ***Source:*** Integrated Report "Investing in Climate, Investing in Growth," OECD (Organisation for Economic Co-operation and Development)
2 ***Source:*** Calculated using the closing price $1 = ¥109.5 at the end of November 2019, based on figures from the IMF-World Economic Outlook Databases (April 2019)

Impacts of climate change threatening the world

With the rise of the global average temperature, various changes are beginning to occur one after the other in the world.

Climate change has a devastating impact on people around the world, causing damage affecting lives or even threatening life in some parts of the world, including catastrophic disasters and food shortages.

Impact of major weather disasters in the world

1 Karachi, Pakistan (June 2015) — **Heat wave**

Over 1,200 deaths

- A high temperature of 44.8°C was recorded
- Tens of thousands of patients were brought to hospitals for heat stroke and dehydration

2 Texas, USA (Aug. 2017) — **Hurricane Harvey**

$125 billion economic losses (¥13,687.5 billion*calculated using ¥109.5)

- The strongest typhoon to hit the state since 1961
- The second largest economic losses in history affecting over 300,000 people with flooding and power outages

Source: National Aeronautics and Space Administration (NASA)

3 Somalia (2017) — **Drought**

6.2 million people experienced food shortages

- Nearly half of the country's population suffered severe food shortages
- Droughts increased water-borne infections, with more than 4,000 people infected with acute watery diarrhea or cholera

4 California, USA (Aug. 2018) — **Forest fires**

Over 185,000 ha burnt (Approx. 3 times Tokyo's 23 wards)

- Forest fires occurred in continuously hot and dry summer season
- The largest fire burnt an area approximately 3 times that of Tokyo's 23 wards

Source: U.S. Forest Service

5 Around the Himalayas — **Melting glaciers**

Affecting over 20% of the world's population

- Himalayan glaciers may melt more quickly in the future, with 45-90% melting by 2100. There is concern about sea levels rising due to melting glacier water
- Possible impacts, such as agricultural damage and floods, on over 1 billion people (more than 20% of the world's population) living in river basins

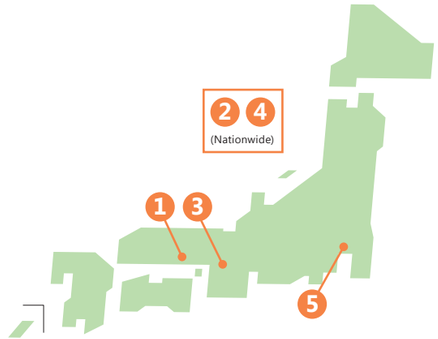
Photo courtesy of K. CHIKITA, Department of Earth and Planetary Sciences, Faculty of Science, Hokkaido University

Threats here and now

Japan's average temperature has risen by 1.2°C in the past 100 years and is expected to rise a further 3.4°C to 5.4°C by the end of this century compared to the end of the 20th century. The phenomena attributable to climate change are not something in a far-off land.

There is concern that the impacts of climate change will expand in various fields as it continues to develop.

Tokyo's temperature has risen by approximately 3°C in the past 100 years — Under the influence of global warming and heat island phenomenon, the temperature rise in Tokyo is larger than that of the world and Japan (averages).



Impact of major weather disasters in Japan

1 Western Japan (July 2018) — **Heavy rains**

237 deaths ¥1,158 billion damage

- In July, heavy rainfall of 2 to 4 times the normal monthly rainfall was recorded. The amount of damage due to flooding and mudflows was the largest since the collecting of statistic began
- Enormous damage included approximately 18,000 houses partially or completely destroyed, and approximately 28,000 houses flooded

Photo courtesy of Okayama City Fire Department

2 Throughout Japan (Oct. 2019) — **Typhoon No. 19**

over 90,000 houses damaged

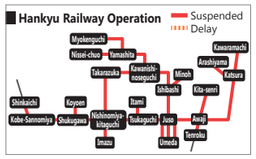
- A record rainfall mainly in the Kanto-Koshin and Tohoku regions
- More than 160,000 houses had no water supply. More than 2,000 houses were partially or completely destroyed or flooded (as of December 12, 2019)
- Combined with Typhoon No. 15 in the previous month, the insurance paid by Japanese non-life insurance companies is estimated to be more than 2 trillion yen

Source: Geospatial Information Authority of Japan

3 Kinki region (Sep. 2018) — **Typhoon No. 21**

¥208.4 billion economic losses

- Wind and flood damage caused suspension and delays in transportation
- Loss of 208.4 billion yen in economic activities, such as transportation, export, and inbound business (excluding building damage)



Source: Website of Hankyu Railway

4 Throughout Japan (2018) — **Heatstroke**

More than 95,000 patients seeking emergency care

- On July 23, 2018, a high of 41.1°C was recorded in Kumagaya City, Saitama Prefecture, the highest temperature since records began
- 160 people died of the record-breaking heat from May to September nationwide
- In July, 40.8°C was recorded in Ome City, the highest temperature in Tokyo's observation history

5 Yoyogi Park, Tokyo (Sep. 2014) — **Infectious disease (dengue fever)**

163 people infected

- Northward shift of the habitat for mosquitoes transmitting infectious diseases
- Dengue fever was contracted by visitors to Yoyogi Park etc. Yoyogi Park was closed

Cities, businesses, and other non-state actors moving ahead of national governments

The Paris Agreement, a historic accord

The Paris Agreement is a framework where all parties to the United Nations Framework Convention on Climate Change (UNFCCC) promised, in 2015, for the first time in the history, to commit to reducing greenhouse gases that cause global warming.

Global common long-term goals
- Hold the increase in the global average temperature to well below 2ºC above pre-industrial levels
- Pursue efforts to limit the temperature increase to 1.5ºC

they did it!/UNclimatechange/CC BY 2.0

Moving cities

398 cities worldwide, including Tokyo, have begun action, aiming for net zero CO_2 emissions by 2050, as announced at COP25 on December 11, 2019.

This is undoubtedly because cities understand that urgent and effective action is needed to combat the climate crisis. Such movement at the city level ahead of the national government is gaining traction around the world.

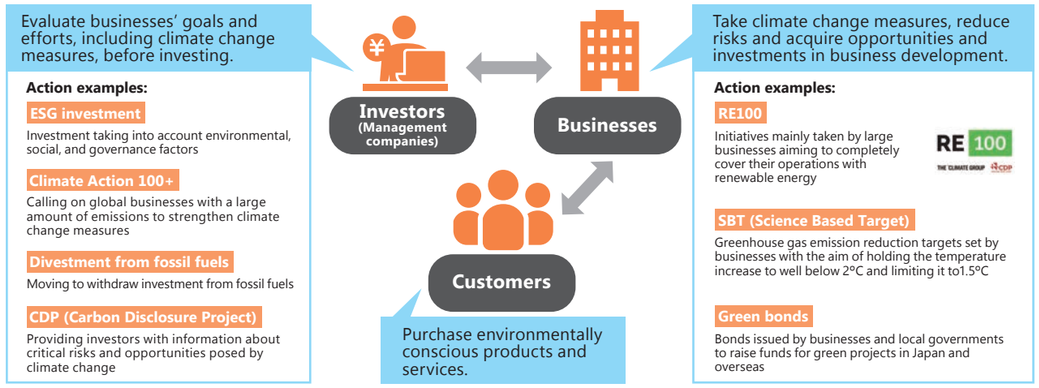
Moving global economy

In the face of the serious consequences of climate change, the global economy is starting to move toward decarbonization. Avoiding climate change risks is key to making business activities sustainable.

Investors, stockholders, customers, and business partners are increasingly requesting climate change measures from businesses. For businesses, climate change measures do not mean cost, but an opportunity that increases their value, helps encourage investment, and improves competitiveness.

786 businesses and 16 investors throughout the world have declared that they aim for net zero CO_2 emissions by 2050, as announced at COP25 on December 11, 2019.

Movement by businesses



To keep the temperature rise to 1.5ºC, CO_2 emissions need to be reduced to net zero by 2050

IPCC* Special Report on Global Warming of 1.5°C

This important report provides a scientific analysis of the impacts of an increase of 1.5ºC in the global average temperature above pre-industrial levels, CO_2 emission scenarios to keep it to 1.5ºC and the scientific basis necessary for efforts to address global warming. It was published by IPCC in October 2018.

* IPCC (Intergovernmental Panel on Climate Change) was established by the World Meteorological Organization and the United Nations Environment Program in 1988. Scientists nominated by national governments participate in IPCC to carry out scientific, technical, and socio-economic evaluation of global warming and compile it into reports.

Cover of Global Warming of 1.5°C

Summary of Global Warming of 1.5°C

- The global average temperature has already risen approximately 1°C compared to pre-industrial levels. If greenhouse gases are emitted at the current pace, it will rise to 1.5°C as early as around 2030.
- Climate change risks are lower with a 1.5°C rise than a 2°C rise.
- To keep the temperature rise at 1.5ºC, CO_2 emissions need to be reduced to net zero by 2050.
- For net zero CO_2 emissions, unprecedented rapid system changes in energy, industry, urban infrastructure, and land use are necessary (each country's current targets based on the Paris Agreement are insufficient to limit the temperature increase to 1.5ºC).
- Limiting to 1.5ºC has a synergistic effect of achieving the Sustainable Development Goals (SDGs), such as eradicating poverty and eliminating inequalities between people as well as countries.

Different impacts between 1.5ºC and 2.0ºC

1.5ºC rise		2ºC rise
14%	World population suffering severe heat wave at least once every 5 years	37%
Once every 100 years	Arctic summer without sea ice	Once every 10 years
26-77 cm	Sea level rise by 2100	10 cm higher than the case of 1.5ºC
1.5 million tonnes	Loss of fisheries	3 million tonnes
70-90%	Disappearance of coral reefs	99% or more

Reference

Sustainable Development Goals (SDGs)

- The Sustainable Development Goals were agreed upon toward 2030 at the U.N. General Assembly in September 2015.
- SDGs are applied to all countries as guidelines for the world to continue sustainable development in the future.
- SDGs consist of 17 goals (all interconnected) and 169 targets.
- The goals include items related to ending extreme poverty and climate change measures.

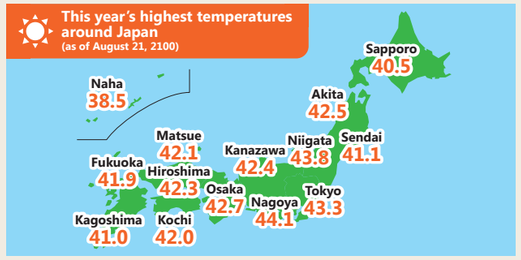
Achieving sustainable development with "no one being left behind" requires efforts by various participants, including national governments, organizations, and private businesses, through harmonization of three elements: the economy, society, and environment.
Efforts toward sustainable development have spread among many businesses in Japan.

Source: Website of United Nations Information Centre

Column 1

Weather Forecast for 2100

What will Japan's climate look like in 2100? It may be hard to imagine. The Ministry of the Environment has created a weather forecast for the future (2100) assuming global warming continues as it does now. (July 2019)



Source: The Ministry of the Environment, COOL CHOICE website, "Future Weather Forecast for 2100" (Japanese)

The weather forecast predicts that if the temperature rise cannot be controlled to within 1.5°C, the following will occur:

- Maximum temperatures exceeding 40°C throughout the country
- Over 15,000 deaths per year in Japan due to heat stress, such as heat stroke
- Tokyo will have an estimated 60 days of extremely hot weather
- Severe damage due to heavy rain or strong typhoons
- Even in winter, the maximum temperature exceeds 25°C, and there is a possibility that some people will suffer from heat stroke

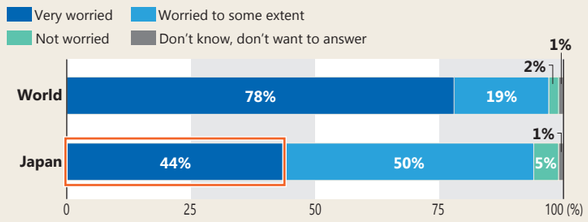
World Wide Views, "Climate and Energy"

How aware are you of climate change measures? You may have different opinions: Costly, threatening, an opportunity to create new jobs or business, etc.

The following is the result of a discussion and vote on climate change and energy by 100 people selected to represent Japanese society. (2015)

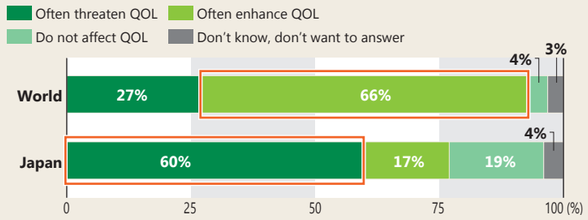
Q1 **How worried are you about the impacts of climate change?**

Only 44% of Japanese answered that they were "very worried," falling far below the rest of the world.



Q2 **What do climate change measures mean to you?**

The rest of the world recognizes climate change measures as "enhancing the quality of life," while Japan recognizes as "threatening the quality of life."



Source: Ikebe et al. (2019), "World Wide Views, 'Climate and Energy,' Citizens' Voices Created by Mini-Publics," Miraikan - The National Museum of Emerging Science and Innovation, Exhibition Activity Report Vol. 11

It is important to raise awareness that climate change measures are not a threat to quality of life, as well as to be aware of the impacts of climate change.

03 CHAPTER

BASIC CONCEPTS OF THE ZERO EMISSION TOKYO STRATEGY

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Facing a climate crisis, we have to promptly switch to decarbonization

Tokyo Is Moving Toward Net Zero CO_2

Paradigm shift* of climate change measures

- Climate change has already become a reality, having devastating impacts not only on city and business activities, but also on the entire natural ecosystem that sustains our life.
- Limited time is left to keep the temperature rise below 1.5ºC.
- With the world facing a climate crisis, we have to start moving promptly to halt climate change that is advancing faster than the measures designed to halt it.

Tokyo also has to boldly and quickly change society as a whole toward decarbonization.

* Paradigm shift: A revolutionary and dramatic change in perceptions taken for granted and values of an entire society.

Decarbonization is Tokyo's responsibility and an opportunity for further growth

Pursuing a quick shift to a social system consistent with the 1.5ºC target

To realize a decarbonized society as quickly as possible, it is essential to switch to a social system consistent with the 1.5ºC target by making fundamental changes in all fields including energy, urban infrastructure, and land use. As one of the world's largest cities, Tokyo will address global common issues by promptly changing its social system from a low-carbon approach to decarbonization, including energy efficiency improvements, while keeping pace with pioneering cities and businesses.

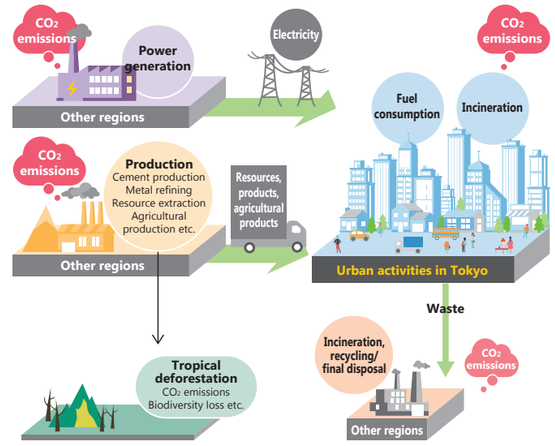
Contributing to the reductions of CO_2 emitted outside of Tokyo, and assuming the responsibility of a global megacity having a major impact on the use of energy and resources

In Tokyo, a huge amount of energy, resources, and products are consumed and then discharged as waste. Most of the energy, products, and resources used in Tokyo are produced or extracted in other regions of Japan or overseas. Tokyo also relies on other regions for the recycling and final disposal of its waste.

The environmental load generated in Tokyo is only a part of the environmental load that arises from society as a whole—a significant environmental load has already been caused before energy and products are brought into Tokyo.

Tokyo, which has a great influence on the use of energy and resources, has a responsibility to take the initiative and contribute to reducing CO_2 in Japan and overseas.

■ **CO_2 resulting from Tokyo's urban activities**



Urgent necessity to build a resilient city and protect the lives and property of Tokyo residents

It is a city's responsibility to avoid the catastrophic damage of climate change and protect the lives and property of citizens.

Tokyo will assume the responsibility to enhance its sustainability and improve resilience, the ability to quickly restore the functions of the entire city.

Society and economy in harmony with the environment bringing sustainable growth to cities

Required by investors for decarbonization efforts, businesses have come to seek the location in areas where they can take the initiative to increase their value. For cities, working on climate change measures will increase their value as an industrial location and support their competitiveness in the international community.

There is a growing awareness that climate change measures will not only reduce environmental risks but also attract businesses and investment and provide benefits, opportunities, and growth to society and the economy. Tokyo's endeavor for ambitious climate change measures will bring energy to open up the future and new opportunities to Tokyo, helping it further grow as a city.

Tokyo's vision for 2050

Realization of a Zero Emission Tokyo for Contribution to Net Zero CO_2 Emissions in the World

To fulfill its responsibility as a major consumer of energy and maintain sustainable growth even in a decarbonized society, Tokyo pursues efforts to limit the temperature increase to 1.5°C and aims to realize a Zero Emission Tokyo by 2050.

Through these actions, we will contribute to the realization of net zero CO_2 emissions in the world by 2050.

An attempt to realize a Zero Emission Tokyo is an extremely aggressive one that cannot be achieved through an extension of conventional efforts.

However, as we are now witnessing climate change that should more properly be called a climate crisis, Tokyo must promptly implement specific and effective climate change measures toward our ambitious goals by obtaining the understanding and cooperation of Tokyo residents and businesses.

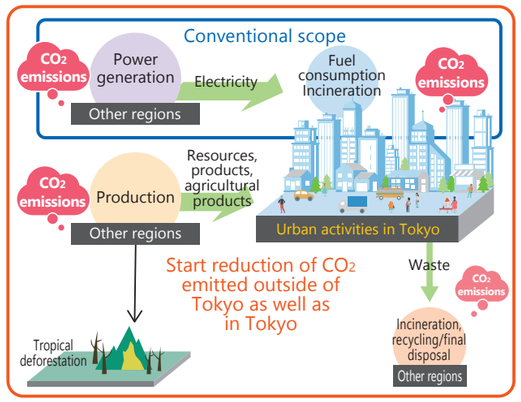
Climate change has become a major challenge in achieving the Sustainable Development Goals (SDGs). Tokyo will also contribute to the achievement of SDGs through efforts for realizing a Zero Emission Tokyo.

Basic concepts of the strategy toward 2050

Key points: Three perspectives to take a new step

- Comprehensively develop mitigation measures to halt climate change and adaptation measures to prepare for the impacts that have already begun to occur.
- Fully incorporate the sustainable resource management into climate change policy to contribute to the reduction of CO_2 emitted outside of Tokyo.
- Strengthen efforts in all fields, such as sustainable management of materials including plastics and measures for the automotive environment, in addition to measures to expand energy efficiency and renewable energy.

■ **Scope of emissions reductions envisaged by Tokyo**



Roadmap for emissions reductions by 2050

Aiming for net zero emissions in Tokyo, contributing to the reduction of CO_2 imported from other regions

We will advance various efforts in all fields as climate change measures: energy efficiency, using renewable energy to minimize CO_2 emissions, resource efficiency, using recycled resources, promotion of ZEVs*, and encouraging revolutionary innovations.

* ZEV: Electric vehicles (EVs), plug-in hybrid vehicles (PHVs), fuel cell vehicles (FCVs)

Crucial efforts in the next 10 years toward 2050 Efforts advanced and accelerated to exceed the 2030 targets— Tokyo's 2030 Targets plus Actions

2030 + Actions

Efforts to be made in the next 10 years will be important milestones for the future. We will clarify the targets and specific efforts toward 2030. Specifically, we will:

- Aim for ensured achievement of the 2030 targets by incorporating a broad range of efforts in all fields into climate change measures in addition to the fields that have been promoted, such as energy efficiency and renewable energy. By making full use of existing and advanced technologies, we will implement "Tokyo's 2030 Targets plus Actions," which are specific initiatives advanced and accelerated to exceed the 2030 targets Tokyo has already set.
- Set new goals and develop prioritized initiatives for urgent issues, such as measures for plastics and the promotion of ZEVs.
- Contribute to the reduction of CO_2 from other regions caused by resource use.

Toward a drastic leap from 2030 onwards

2030 and beyond is a stage where a new social system and next-generation technologies will be developed and endorsed. With this in mind, we will help promote necessary systems and innovations.

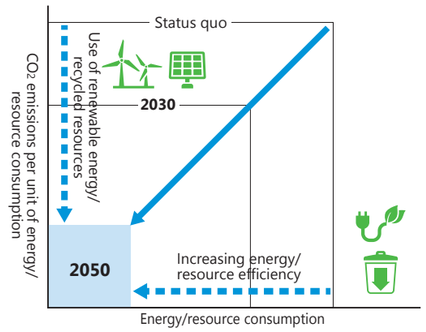
- Reform social systems and business models, including procuring all electricity from renewable energy, local renewable energy sharing implemented as the standard, and closed-loop resource recycling.
- Significantly reduce carbon intensity of electricity through large-scale introduction of renewable energy and hydrogen, decarbonization of thermal energy using biomass or hydrogen in fields where electrification is difficult.
- Help socially implement CCUS* and other technologies for separation, capture, storage, and effective use of carbon, supplying CO_2-free energy. Includes imported CO_2-free energy, such as hydrogen

* CCUS: Carbon dioxide Capture, Utilization and Storage

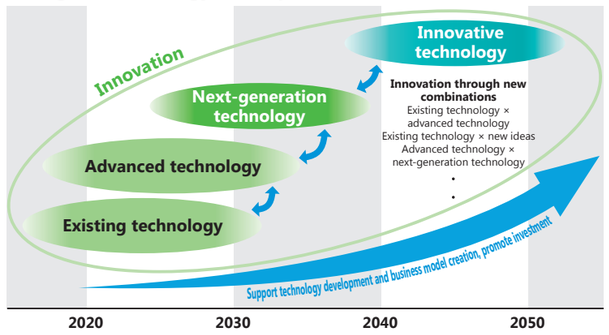
Toward net zero by 2050

- We aim for offsetting emissions still remaining after minimization by means of forest absorption through afforestation, biomass CCU, and continuous development of innovative technologies.

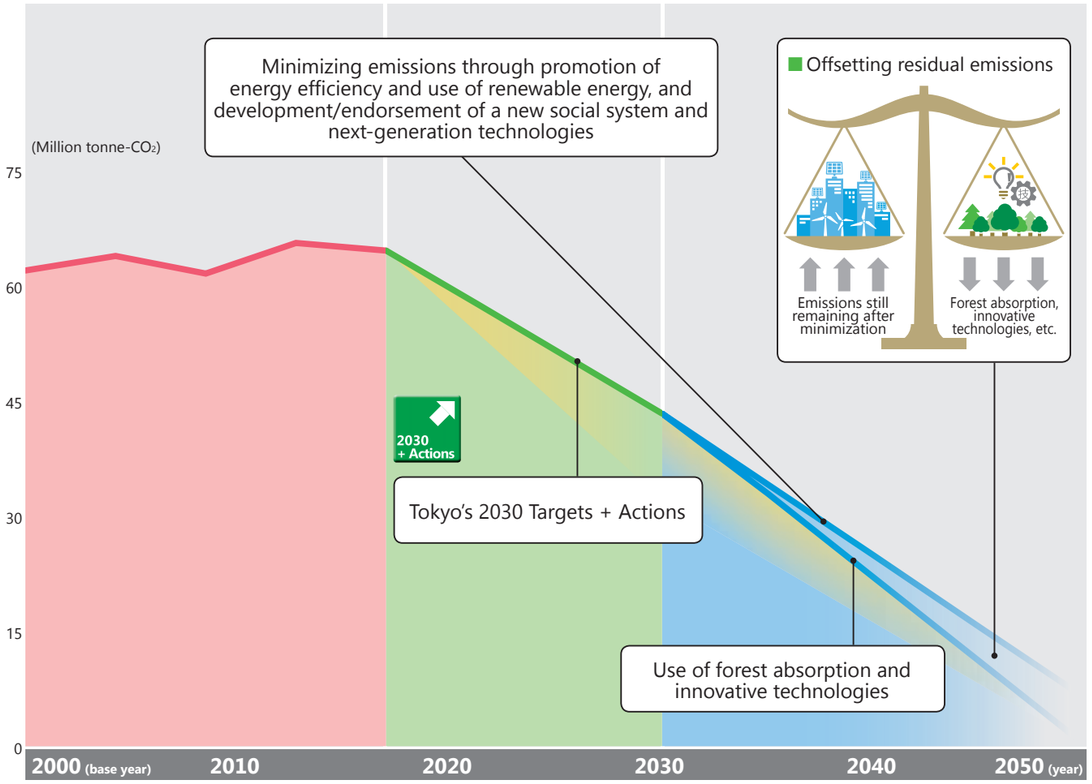
■ **Image of minimizing CO_2 emissions**



■ **Image of technology development toward 2050**



Roadmap for CO_2 emissions reductions by 2050



Efforts toward low carbon	Efforts toward decarbonization	
2017 performance **4.2% increase in CO_2 emissions**	**2030 targets** **30% reduction + actions**	**2050 goals** **Net zero CO_2 emissions**
● Pursue efforts to limit the temperature increase to 1.5ºC, taking into account the increasing severity of climate change and the urgency of countermeasures. ● Recognize the climate crisis and formulate a strategy to take action.	● Advance and accelerate initiatives, such as energy efficiency and renewable energy, to take action that exceeds Tokyo's 2030 goals. ● Set new goals and develop prioritized initiatives for urgent issues such as the promotion of ZEVs and measures for plastics. ● Contribute to the reduction of CO_2 emitted outside of Tokyo caused by Tokyo's resource use.	● Encourage the development and endorsement of a new social system and next-generation technologies. ● Offset emissions still remaining after minimization through forest absorption and by developing innovative technologies.
Formulate the Zero Emission Tokyo Strategy	**Advance and accelerate action during the crucial 10 years until 2030**	**Aim for net zero emissions in Tokyo and contribution to decarbonization in the world**

Positioning and organization of the strategy

Positioning of the strategy

The Zero Emission Tokyo Strategy clarifies Tokyo's vision, "Aiming for the realization of a Zero Emission Tokyo that contributes to achieving net zero CO_2 emissions in the world" by 2050 and encourages us to take action toward the realization. It includes the tangible measures to be implemented by Tokyo in the future and the roadmap for that process.

We will share the visions of this strategy with various participants, such as Tokyo residents, businesses, NGOs, municipalities, and cities in Japan and overseas to encourage them to take steps toward decarbonization.

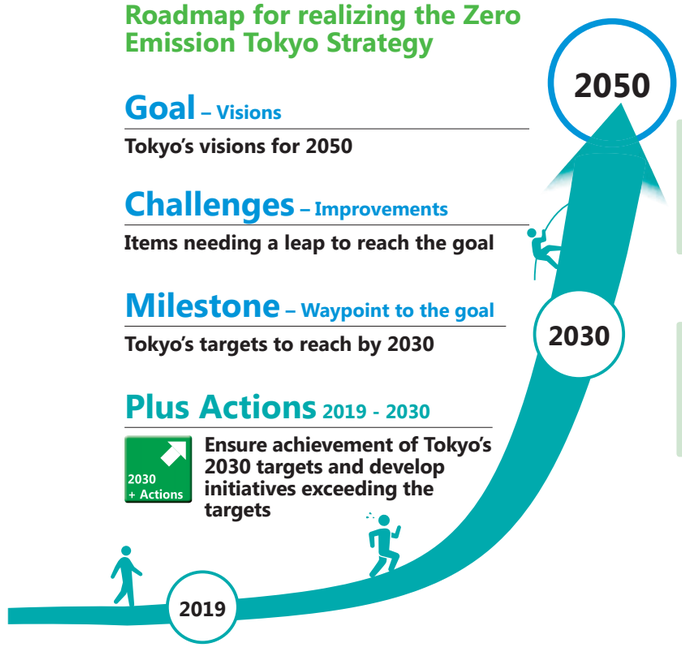
Clarifying the Tokyo's 2050 goals, 2030 targets and actions for each prioritized field

Taking into account the characteristics of Tokyo, we have organized prioritized fields into 6 sectors and 14 policies in this strategy.

From the perspective that measures toward 2030 are extremely important, we have defined 17 major targets, 47 items, and 82 actions for 2030 to strongly promote each initiative.

- Share long-term visions or goals from the perspective of net zero CO_2 emissions.
- Set 2030 targets that are important milestones for moving from the current situation to the goal.
- Clarify the ensured achievement of the 2030 targets and the development of initiatives advanced and accelerated to exceed these targets.
- Indicate systems and innovations necessary for a dramatic leap from 2030 onwards

Roadmap for realizing the Zero Emission Tokyo Strategy



Goal – Visions

Tokyo's visions for 2050

Challenges – Improvements

Items needing a leap to reach the goal

Milestone – Waypoint to the goal

Tokyo's targets to reach by 2030

Plus Actions 2019 - 2030

Ensure achievement of Tokyo's 2030 targets and develop initiatives exceeding the targets

Tokyo's 2030 targets ▶ Ensure achievement of existing targets + Advance and accelerate efforts ✚ Set new targets for urgent issues and develop prioritized efforts

Fields requiring prioritized measures ▶ Formulate individual plans and strategies
- Zero Emission Tokyo Strategy
  - Climate Change Adaptation Plans*
  - Plastic Strategy
  - ZEV Promotion Strategy
  - □
  - □
  - □

* Climate Change Adaptation Plans are local plans based on the Climate Change Adaptation Act.

Column 2

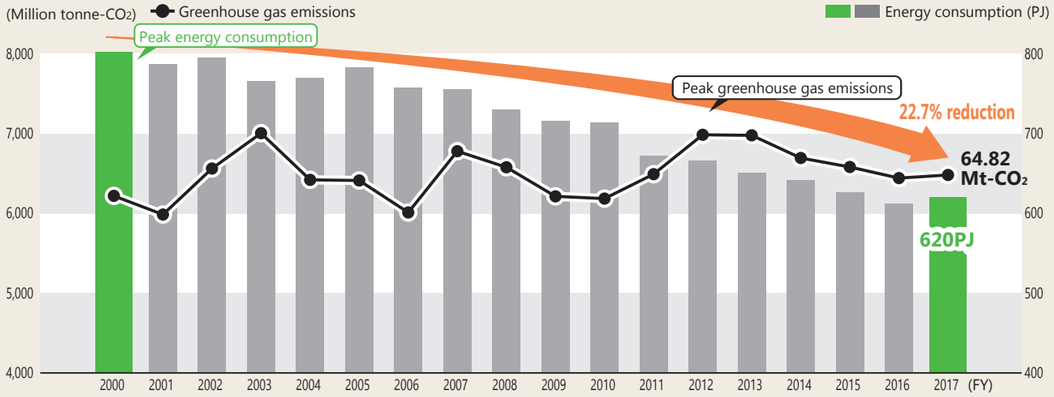
The Status Quo of Emissions in Tokyo

Changes in energy consumption and greenhouse gas emissions in Tokyo

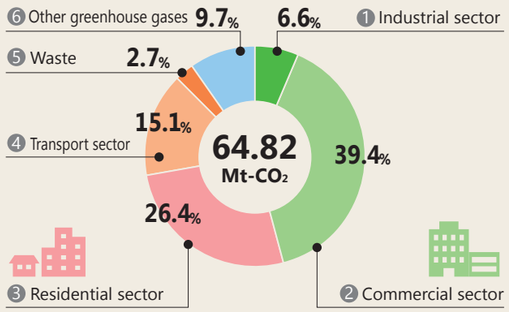
Tokyo's energy consumption peaked around 2000 and has been steadily declining since. Greenhouse gas emissions have also been declining since around 2012 due to the reduction in energy consumption and improvement in the CO_2 emission factors* of electricity. The emission factors of electricity have decreased in recent years partly because more renewable energy has been supplied to Tokyo.

*An emission factor indicates how much CO_2 is emitted to generate a certain amount of electricity.

Changes in energy consumption and greenhouse gas emissions in Tokyo (preliminary results for FY 2017)



Sector breakdown of greenhouse gas emissions in Tokyo (preliminary results for FY 2017)



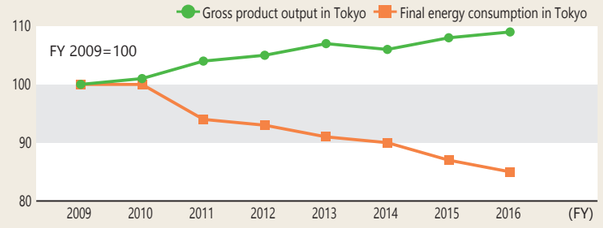
❶ Industrial: factories (manufacturing, construction, etc.).
❷ Commercial sector: offices, restaurants, schools.
❸ Residential sector: residential buildings.
❹ Transport sector: vehicles, railways.
❺ Waste: incineration of waste.
❻ Other greenhouse gases: fluorocarbons, methane.

Valuing both energy consumption reduction and economic growth

Energy consumption has decreased due to Tokyo's advanced climate change measures while its gross product output has increased.

Tokyo continues decoupling, reducing energy consumption while maintaining economic growth.

Changes in final energy consumption and gross product output



04 CHAPTER

PILLARS OF THE STRATEGY: POLICIES AND INITIATIVES

Chapter 04 Pillars of the Strategy: Policies And Initiatives

Strategy I
Energy Sector

Photo courtesy of Musashino Forest Sport Plaza

Tokyo, one of the largest cities in the world, is a major consumer of energy, with most of the energy coming from fossil fuels.

To realize a Zero Emission Tokyo, bearing responsibility for being a major consumer, it is essential to decarbonize energy itself.

Tokyo will promote efforts to introduce renewable energy from various angles, including approaches to the demand side, such as businesses and individuals, as well as the supply side, such as the construction of renewable energy equipment.

For hydrogen energy in the stage of technology development, we will strive to expand it into all fields by ensuring the understanding of Tokyo residents about its future potential.

Policy 1 Make Renewable Energy a Major Energy Source

* Renewable energy is part of the earth's resources, such as sunlight, wind, and geothermal heat, and always exists in nature.

Status quo

- Percentage of power generated by renewable energy is **14.1%** (FY 2017)
- Energy consumption reduced by **23%** compared to 2000 (FY 2017)
- Installation of **530-MW** solar power generation equipment in Tokyo (FY 2017)
- 100% renewable energy at TMG No. 1 Building (from August 2019)

Necessity of making renewable energy a major energy source and promotion of renewable energy sharing

Renewable energy as an vital key to a decarbonized society

Tokyo is a major consumer of energy, including electricity and heat. To realize a decarbonized society, it is essential to maximize energy consumption efficiency by further increasing energy efficiency, and switch from fossil fuels to decarbonized energy, such as renewable energy.

Demand for renewable energy is increasing due to efforts of pioneering businesses aiming for RE100* and others, but we need to expand its use more broadly.

* RE100: An initiative focusing mainly on large businesses that aim to completely cover their operations with renewable energy.

Starting with local production and consumption and expansion of renewable power use

Together with Tokyo residents and businesses, we will develop efforts* for further improving energy efficiency and dramatically increasing the use of local renewable power by making full use of currently available technologies. At the same time, we will also aggressively promote efforts to utilize local renewable energy through local energy networks.

* Efforts concurrently serving three purposes: decarbonization of Tokyo and Japan, enhancement of Tokyo's resilience, and energy security that makes full use of domestic energy.

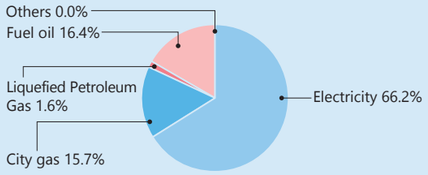
Necessity of decarbonizing both electricity and thermal energy

Approximately 70% of CO_2 emissions in Tokyo are related to power consumption. Since almost all electricity is supplied from other regions, decarbonizing the electricity supplied from the power grid is crucial. Therefore, we will strongly urge the national government to promptly and significantly expand renewable energy power sources. At the same time, we need to standardize the installation of renewable energy equipment and electricity procurement by renewable energy at the local level, and promote the decarbonization of thermal energy at the national and local levels.

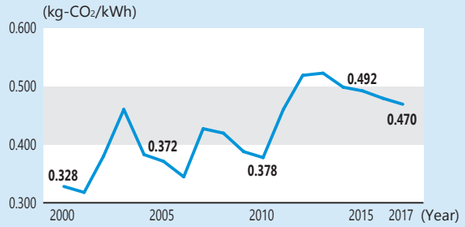
Promoting local production and consumption of energy

Considering the future era of massive introduction of renewable energy, local production and consumption of renewable energy, which does not impose a heavy load on the power grid, is also important for improving local resilience. We can also promote effective local production and consumption by encouraging energy sharing that uses the local renewable energy efficiently.

■ CO_2 emissions in Tokyo by fuel type (preliminary results for FY 2017)



■ Changes in CO_2 emission factors* of electricity supplied to Tokyo

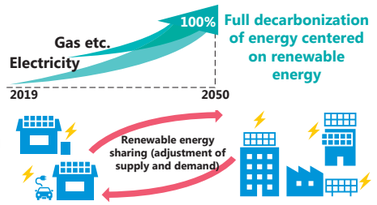


* Weighted average calculated by TMG based on the actual CO_2 emission factors of electricity suppliers for Tokyo and the amount of electricity supplied to Tokyo

2050 Visions

▶ 100% usage of decarbonized energy

- Supply of fully decarbonized electricity generated by renewable energy as a major power source
- Standardization of local production and consumption of renewable energy and energy sharing



Tokyo's Challenges toward 2050

- Significant progress in local production and consumption of renewable energy and procurement of fully decarbonized electricity
- Standard implementation of new renewable energy technologies, such as wall power generation and solar roads
- Further standardization of local renewable energy sharing
- Decarbonization of thermal energy in fields where electrification is difficult

2030 Actions

Tokyo's Key Targets toward 2030

Renewable power used at TMG facilities (Governor's bureaus/departments)

100%

***Promote expansion of RE-users, such as RE100 declaration businesses**

Installation of solar power generation equipment

1.3 GW

Percentage of renewable power usage

30%

Energy consumption compared to 2000

38% reduction

Infrastructure and mechanisms are being developed for the use of fully decarbonized energy by 2050 as well as the achievement of the above targets.

Campaign logo for model project to promote group buying of renewable energy

Tokyo's 2030 Targets + Actions

2030 + Actions

■ Local production and consumption of renewable power generated in Tokyo

- Promote self-consumption not relying on FIT program by subsidizing introduction of renewable energy equipment, such as solar panels and storage batteries, and through incentives in a taxation system.
- Promote the TMG Power Plan that will aggressively use post-FIT* electricity generated in Tokyo at TMG facilities.

* Post-FIT refers to equipment for which the purchase period of FIT (a system for purchasing renewable power at a fixed price for a certain period) has ended. Such equipment is expected to increase at an accelerating rate from November 2019.

■ Drastically increasing the use of renewable energy

- Support expansion of RE100 declaration businesses in Tokyo by matching renewable power retailers with businesses in Tokyo.
- Strengthen each system in Tokyo, such as the Tokyo Cap & Trade Program and Tokyo Green Building Program, to expand the use of renewable energy at buildings.
- Establish the framework for a power purchase agreement (PPA)* that leads to introduction of renewable energy equipment using the scale of procurement by businesses and administrations.
- Build a business model to promote household-based group buying of renewable power.

* Power purchase agreement promises to purchase power from renewable energy power sources for a certain period of time.

■ Adjustment of supply and demand (renewable energy sharing) in anticipation of the era of massive introduction of renewable energy

- Promote the realization of energy sharing that uses local renewable energy efficiently by using AI and IoT and considering with businesses. The framework of territorially-distributed renewable energy VPP* that contributes to the realization of Local RE100.
- Build a mechanism to promote the use of area networks of territorially-distributed decarbonized thermal energy.

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

2019

Policy 2 Expand the Use of Hydrogen Energy

The status quo

- **53,847** residential fuel cells (FY 2018)
- Commercial and industrial fuel cells of **approx. 2,300 kW** (FY 2018)
- **16** FC buses* (FY 2018)
- **713** FCVs* (FY 2018)
- **14** hydrogen stations (FY 2018)

* FCVs: fuel cell vehicles / FC buses: fuel cell buses

Necessity of expanding the use of hydrogen energy

Strength of hydrogen energy

Emitting only water while used, hydrogen has many excellent features, such as diversification of energy supply and emergency response.

Hydrogen-related technologies, including fuel cells and FCVs, contribute to energy efficiency in the transport, residential, commercial, and industrial sectors. Since hydrogen allows energy storage in a large amount and for a long term, it is also promising as an adjusting power at the time of the massive introduction of renewable power.

In the future, technologies, such as putting hydrogen into gas pipes and methanation*, are expected to promote the decarbonization of thermal energy that is difficult to electrify.

* Methanation refers to the synthesis of methane from hydrogen and CO_2.

Reducing CO_2 related to hydrogen energy

Currently, much of hydrogen is generated from fossil fuels. However, technological development is in progress for the practical use of CO_2-free hydrogen from renewable energy, posing the importance of reducing CO_2 emissions in hydrogen generation, storage, and transportation processes.

Promoting effective use of hydrogen-related technologies and elimination of CO_2

While hydrogen has great potential, the hydrogen-related market has just started with higher costs and immature technological innovation. Therefore, we will actively promote the effective use of hydrogen-related technologies in the market, advance energy efficiency and decarbonization in all fields, and encourage the revitalization of the market and further technological innovation, backing up the market from various perspectives, such as institutional and financial aspects.

We will also promote efforts to utilize CO_2-free hydrogen from renewable energy and proceed with examination into the use of hydrogen energy that will contribute to the era of massive introduction of renewable energy.

Tokyo Hydrogen Museum

Tokyo Hydrogen Museum
Mascot Suison

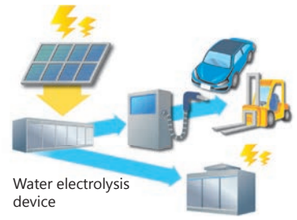
2019

2030 Actions

2050 Visions

CO_2-free hydrogen generated from renewable energy as a crucial pillar for realizing a decarbonized society

- **Supporting massive introduction of renewable power with hydrogen**
- **Full use of CO_2-free hydrogen in all fields. CO_2-free hydrogen as one of the pillars of energy supporting a decarbonized society**



Tokyo's Challenges toward 2050

- **Significant expansion of CO_2-free hydrogen production**
  - Hydrogen production (by water electrolysis) to realize output adjustment associated with massive introduction of renewable power
  - Promoting development of CO_2-free hydrogen production technologies based on photocatalysts and new transportation technologies
- **Kicking into gear CO_2-free hydrogen usage from renewable energy generated in Japan and overseas**
  - Hydrogen power generation with a CO_2 emission factor "zero"
  - Decarbonization of thermal energy such as putting CO_2-free hydrogen into gas pipes, synthesizing methane gas from hydrogen and CO_2, introducing hydrogen pipelines in city blocks
  - Expansion of applications in the mobility field and effective use of CO_2-free hydrogen in industrial processes

Tokyo's Key Targets toward 2030

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

In parallel with efforts to achieve the above targets, CO_2-free hydrogen generated from renewable energy is being actively introduced.

Tokyo's 2030 Targets + Actions

- **Promotion of utilization of hydrogen-related technologies, making use of the characteristics of hydrogen energy**
  - Support adoption and endorsement of downsized residential fuel cells and commercial and industrial fuel cells for which new products are continuously developed.
  - Support introduction of FCVs and FC buses to increase the number of vehicles and buses used and promote further development of hydrogen stations.
- **Promotion of CO_2-free hydrogen from renewable energy**
  - Support businesses that introduce hydrogen utilization equipment based on renewable energy.
  - Strengthen collaboration with other municipalities, such as utilizing CO_2-free hydrogen generated from renewable energy in Fukushima Pref.
  - Demonstrate effective use of hydrogen as energy adjustment in anticipation of the era of massive introduction of renewable power.
- **Effective use of hydrogen spurred on by the Tokyo 2020 Games**
  - In the urban development of the Olympic Village area after the Tokyo 2020 Games, use hydrogen pipelines to supply hydrogen to pure hydrogen fuel cells (the first practical use in Japan) in addition to the development of hydrogen stations.
- **Promotion of raising public awareness of hydrogen energy**
  - Raise public awareness and foster movement through the Tokyo Hydrogen Promotion Team and visual depictions of hydrogen energy.

Column 3

Let's Use Solar Power Generation Wisely!

The installation of solar electricity in Tokyo has increased significantly, by approximately 10 times from 2008 to 2017, due to TMG's subsidy projects and the enforcement of the FIT Law.

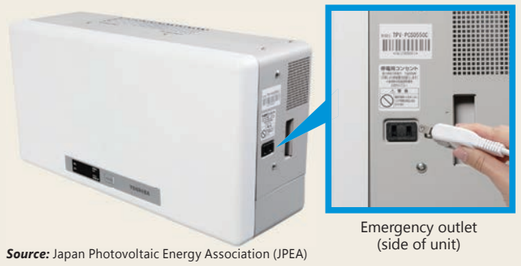
More and more people are installing solar panels on their roofs. Here we will introduce solar power generation to those who are considering installing solar panels as well as those who have completed the installation.

Ensuring power supply during power outages and disasters

In normal times, a solar power generation system operates in a linked operation mode that connects to a power company.

By switching the operation mode to the self-sustained operation mode, you can use electricity even in the event of a power outage or emergency.

There are seven steps for actual use as shown below. Practice on a regular basis in case of emergency.



Emergency outlet (side of unit)

Source: Japan Photovoltaic Energy Association (JPEA)

How to use self-sustained operation mode

❶ Check the location of the outlet for self-sustained operation.
❷ Read the instruction manual to check how to switch to the self-sustained operation mode.
❸ Turn off the main circuit breaker.
❹ Turn off the solar power generation breaker.
❺ Switch to the self-sustained operation mode.
❻ Connect the home appliance you wish to the outlet for self-sustained operation and use the appliance.
❼ Make sure to restore the unit after power restoration:
Cancel the self-sustained operation mode ⇒ Turn on the solar power generation breaker ⇒ Turn on the main circuit breaker.

Proper maintenance

Solar power generation equipment has a longer life than general home appliances, but regular maintenance is important to maintain power generation performance and ensure safety.

For residential solar power generation, a periodic inspection once every four years is recommended. Consult a specialist about inspection items as they vary depending on the number of years after installation, operating conditions, etc.

Thinking about disposal

Solar power generation equipment has spread rapidly and will start needing to be replaced or disposed of from the 2030s. We need to consider proper disposal and other measures with a view to the future.

Tokyo aims to establish a mechanism that takes into account the time of disposal of solar power generation equipment, studying methods for efficiently recycling metal and glass contained in the equipment.

Machine to separate cover glass and photovoltaic cells of a solar panel

Source: Hamada Co., Ltd.

**Solar power generation can also help ensure power supply in times of need.
Use solar power generation wisely with the future and maintenance in mind.**

Strategy II

Urban Infrastructure Sector (Buildings)

Tokyo is a densely built city with many residential and office buildings. Buildings are a major source of CO_2 emissions, accounting for 70% of the total. Buildings are fundamental to our way of life and business activities, and measures to reduce CO_2 from buildings are particularly important.

TMG has been working to reduce CO_2 emissions through measures for large-scale office buildings and others.

From now on, we have to expand zero-emission buildings by minimizing the energy used at buildings and promoting the use of renewable energy.

TMG will collaborate with Tokyo residents and businesses to promptly develop effective efforts tailored to the individual purpose of each building, whether residential or office, covering from the construction phase through to operation.

Policy 3 Expansion of Zero Emission Buildings

* Zero emission buildings are decarbonized through energy efficiency and the use of renewable energy.

The status quo

- Greenhouse gas emissions increased by **4.2%** compared to 2000 (FY 2017)
- Energy consumption decreased by **23%** compared to 2000 (FY 2017)
- Percentage of power generated by renewable energy is **14.1%** (FY 2017)

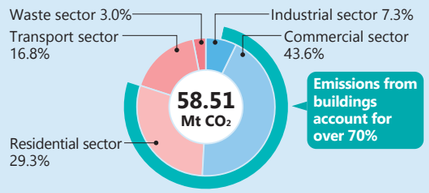
Necessity of expanding zero emission buildings

More than 70% of Tokyo's CO_2 emissions come from buildings

Eliminating emissions from buildings with high CO_2 emissions is a common goal of large cities around the world, and essential if they wish to attract investment and businesses.

Tokyo has developed pioneering efforts, including the Tokyo Cap & Trade Program, which helps Tokyo perform much better in terms of CO_2 reduction levels for large facilities compared to the nation as a whole. The proportion of large-scale new buildings with higher energy efficiency and thermal insulation performance is increasing, but only approximately 30% of them have introduced renewable energy equipment, posing the necessity of further efforts.

Ratio of building emission in total CO_2 emissions of Tokyo (preliminary results for FY 2017)
(preliminary results for FY 2017)



Buildings shaping Tokyo in 2050

Buildings are used for decades after construction, and those constructed from now on will shape the Tokyo of 2050. Therefore, it is essential that all buildings, whether new or existing, achieve high energy consumption efficiency, use renewable energy, and fully utilize materials with lower CO_2 emission levels (low-carbon materials), such as wood. It is also necessary to ensure effective thermal insulation performance from the perspective of disaster prevention and heat countermeasures, and consider the use of buildings in the future, such as increased occurrence of telework.

We need to immediately start extensive efforts for all buildings in Tokyo, helping new buildings ensure building performance to achieve zero emissions during operation and existing buildings convert to become zero emission.

Starting initiatives to standardize zero emission buildings

In certain fields, full-scale conversion to zero emission buildings requires further technological innovation. However, many buildings can immediately start working on achieving zero emission status by utilizing technologies currently available.

Utilizing different systems in Tokyo and collaborating with various participants, including advanced businesses, we will promote the design, construction, and operation of zero emission buildings by introducing energy efficient/ renewable energy equipment and focusing on the procurement of renewable power.

Measures for new buildings

Promoted through systems in Tokyo and in cooperation with businesses

- Improvement of energy efficiency performance of buildings, including thermal insulation
- Standard implementation of high-efficiency equipment/ devices and renewable energy equipment
- Planning the use of renewable power during operation
- Utilization of building materials with lower CO_2 emissions, such as wood

→ Standardization of building performance to ensure the realization of zero emission buildings

Measures for existing buildings

Promoted through systems in Tokyo and in cooperation with businesses

- Improvement of energy consumption efficiency (continuous upgrade to high-efficiency equipment/ devices and higher energy efficiency through operational measures)
- Introduction of renewable energy equipment and self-consumption
- Selection of decarbonized energy, including renewable power
- At the time of calculating emissions, add extra emissions when high-carbon electricity is used

→ Standardization of zero emission buildings

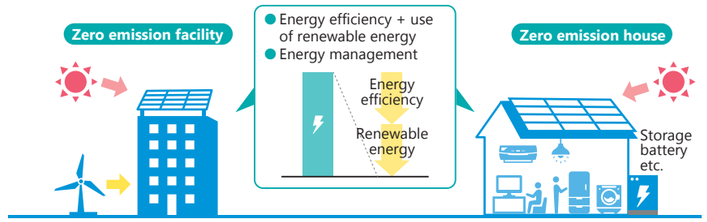
2019

2030 Actions

2050 Visions

All buildings in Tokyo to be zero emission buildings

All buildings to be zero emission buildings that account for adaptation measures, such as disaster prevention and heat countermeasures



Tokyo's Challenges toward 2050

- **Standardization of zero emission facilities**
  For new buildings, performance to achieve zero emissions during operation is standardized. For most existing buildings, the introduction of renewable energy equipment, self-consumption, and the procurement of fully decarbonized electricity are established.
- **Standardization of zero emission houses**
  All new buildings have zero emissions. For most existing buildings, high thermal insulation and self-generation/self-consumption of renewable energy are standardized.
- **Standardization of the use of decarbonized thermal energy in fields where electrification is difficult and low-carbon materials**

Tokyo's Key Targets toward 2030

Greenhouse gas emissions compared to 2000
30% reduction

Energy consumption compared to 2000
38% reduction

Percentage of renewable power usage
30%

Infrastructure and mechanisms are being developed for the use of fully decarbonized energy by 2050 as well as the achievement of the above targets.

東京ゼロエミ住宅
TOKYO ZERO EMISSION HOUSE
(Tokyo Zero Emission House logo)

Tokyo's 2030 Targets + Actions

2030 + Actions

Expansion of zero emission facilities

- Green Building Program for new facilities: Create a mechanism to realize zero emissions during operation by introducing a new ZEB* evaluation and mandatory consideration for using renewable power.
- Tokyo Cap & Trade Program for existing large facilities: Promote the expansion of renewable energy use in addition to higher energy efficiency.
- Carbon Reduction Reporting Program for existing small and medium facilities: Introduce a mechanism to evaluate CO_2 reduction levels and the use of renewable energy.
- Promote renewable power contracts making the most of the scale of procurement of electricity on the demand side and encourage the utilization of low-carbon materials.

* ZEB: Net Zero Energy Building

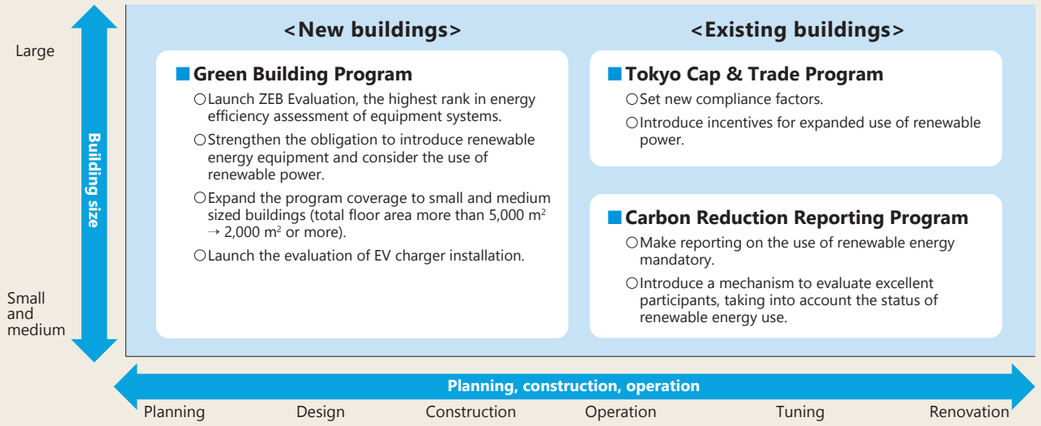
Expansion of zero emission houses

- Support the introduction and broad adoption of the Tokyo Zero Emission House which improves thermal insulation performance, contributing to the prevention of indoor heat stroke.
- Encourage switching to more energy efficient home appliances.
- Support the introduction of solar power generation and storage batteries for self-consumption.
- Build a business model for group buying of renewable power.
- Promote energy management utilizing AI and IoT.

Column 4

Facilities in Tokyo Moving Toward Zero Emissions!

Efforts starting in 2020 to expand zero emission buildings



Performance of major systems in Tokyo

Tokyo Cap & Trade Program

In FY 2010, TMG introduced the Tokyo Cap & Trade Program that requires large facilities to reduce total CO_2 emissions, mandatory under a Tokyo ordinance.

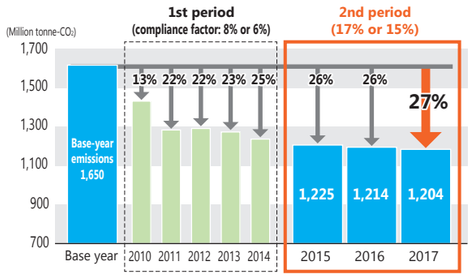
In FY 2017, the total CO_2 emissions from covered facilities were 12.04 million tonnes*1, a 27% reduction from base-year emissions*2.

*1 Emission factors of electricity etc. calculated based on the values in the second compliance period.
*2 Base-year emissions are the average emissions of any three consecutive fiscal years between 2002 and 2007.

Green Building Program

TMG implemented the Green Building Program for new buildings in FY 2002 under a Tokyo ordinance. We have seen improvements in the energy efficiency of condominium equipment every year since.

Changes in total CO_2 emissions from facilities under the Tokyo Cap & Trade Program



Carbon Reduction Reporting Program

TMG implemented the Carbon Reduction Reporting Program in FY 2010 under a Tokyo ordinance, to understand the status of CO_2 emissions from small and medium facilities and promote the implementation of energy efficiency measures. In FY 2017, the total CO_2 emissions from covered facilities*3 were 3.437 million tonnes, a 13.7% reduction from FY 2009.

*3 Facilities that submitted reports for nine consecutive years after the program launch.

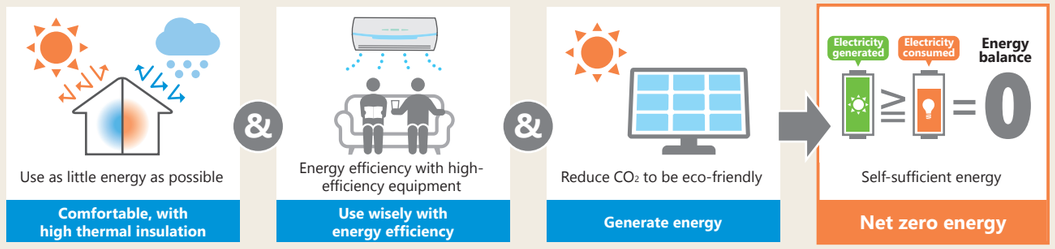
We will promote zero emissions of facilities by utilizing the mechanisms to expand the use of renewable energy introduced in each system from FY 2020.

Column 5

Self-Sufficiency in Energy! ZEH/ZEB Have Begun to Spread!

Have you ever heard of ZEH and ZEB?

With the progress made in energy efficiency measures and renewable energy technologies, we have seen the beginning of the spread of houses and buildings that greatly reduce energy consumption and create energy by solar power generation etc.



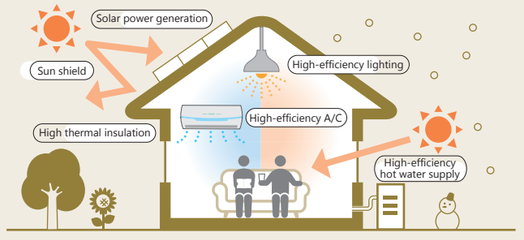
ZEH (Net Zero Energy House):
A residential building that aims to make the balance of annual primary energy generated and consumed to zero. This is done through the introduction of renewable energy, in addition to realizing significant energy efficiency, maintaining the quality of the indoor environment by significantly improving thermal insulation performance of the shell, and introducing high-efficiency equipment systems.

ZEB (Net Zero Energy Building):
A state-of-the-art building that generates energy through means including solar power generation. These buildings significantly reduce annual energy consumption, and realize significant energy efficiency through devising architectural plans that also include the use of sun shields and renewable energy, as well as thermal insulation efficiency.

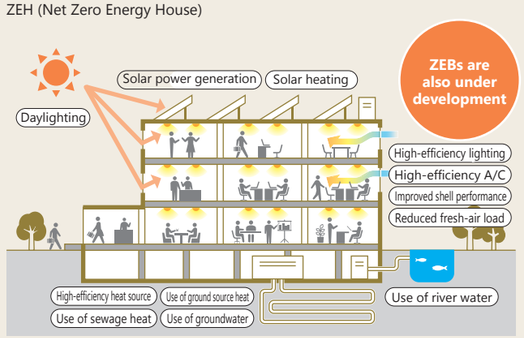
Features of ZEH/ZEB

Feature 1 Cool in summer and warm in winter

Feature 2 Lower energy bill

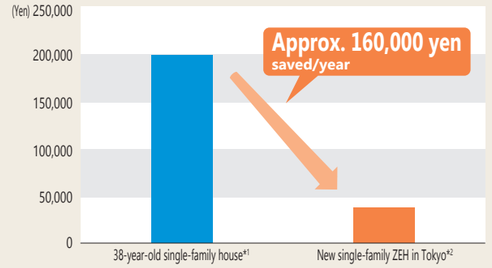


ZEH (Net Zero Energy House)



ZEB (Net Zero Energy Building)

Example of lower energy bill at a ZEH



*1 Structure: 2-story, steel framed/Total floor area: 92 m²/Water heater: Gas/Principal heating: Gas stove/Principal cooling: Individual A/C/Solar power output: None
*2 Structure: 1-story, wooden/Total floor area: 94 m²/Water heater: Gas, latent heat recovery type/Principal heating: Hot water floor heating + individual A/C/Principal cooling: High-efficiency individual AC/Solar power output: 3 kW (The annual energy bills have been calculated by subtracting selling prices of solar power from electricity and gas bills paid.)

Source: Website of the Agency for Natural Resources and Energy
https://www.enecho.meti.go.jp/category/saving_and_new/saving/2016shoueneseisaku/pdf/005.pdf
https://www.enecho.meti.go.jp/category/saving_and_new/saving/2016shoueneseisaku/pdf/005_err.pdf

Please consider ZEH/ZEB if you are thinking about buying a house or relocating your office.

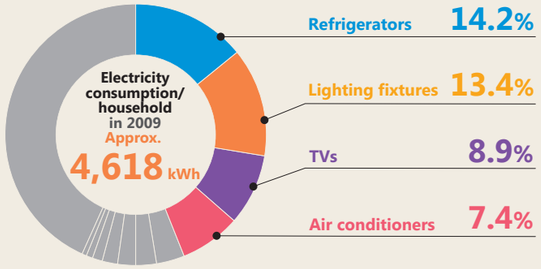
Column 6

How much CO_2 would be reduced if all home appliances in Tokyo were replaced with the latest high-energy efficient ones?

Household electricity consumption 10 years ago

In 2009, the average household in Japan used approximately 4,600 kWh of electricity annually. Familiar home appliances accounted for a large portion, with refrigerators at 14.2% and lighting at 13.4%.

The technological progress of home appliances is remarkable, improving energy efficiency every year. Let's think about the effect you could have on energy efficiency if you switched to new home appliances.



Source: Estimates made by the Institute of Energy Economics, Japan based on a survey of energy consumption in the civilian sector and a supplementary survey of equipment usage by the Agency for Natural Resources and Energy in FY 2009 ("air conditioners" includes the effects of the cold summer and warm winter of 2009)

Effects of switching to high-energy efficient home appliances

Home appliances have become more energy-efficient—for example, approximately -47% for refrigerators compared to products 10 years ago, and approximately -85% for lighting compared to incandescent bulbs. Switching to products with higher energy efficiency performance will allow you to reduce your electricity bill, as well as CO_2 emissions.

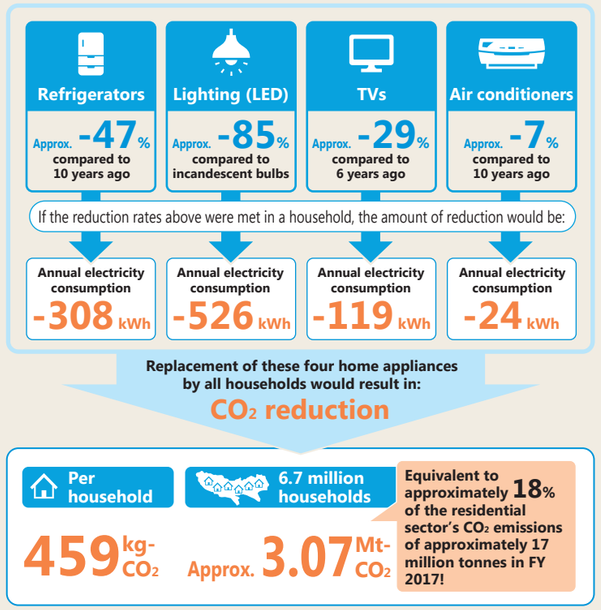
If the four home appliances shown here were replaced, approximately 977 kWh or 459 kg CO_2 would be saved per household annually. If all of the approximately 6.7 million households in Tokyo switched to new home appliances, there would be an effect equivalent to the reduction of approximately 3.07 million tonnes of CO_2, or approximately 18% of CO_2 emissions from households.

When replacing household appliances, make sure to carefully check if their sizes and functions match the number of family members.

The effect may be even greater through heat countermeasures using green living screens or reed screens, improvements in the thermal insulation performance, and daily awareness of power saving.

This case is based on a simple estimate including assumptions such as that all households have home appliances that are 10 years old. The estimate may vary by household composition, and the number, performance, capacity, and usage of the appliances.

Effect equivalent to an 18% reduction in CO_2 emissions from households



Source: The Ministry of the Environment, COOL CHOICE website (Japanese): https://ondankataisaku.env.go.jp/coolchoice/kaikae/kaden/

Won't you consider products with higher energy efficiency performance when replacing appliances?

Strategy III

Urban Infrastructure Sector (Transport)

The transport sector including vehicles and railways is an important urban infrastructure that supports business activities and people's lives in the metropolis of Tokyo.

The sector accounts for approximately 20% of CO_2 emissions in Tokyo, most of which is derived from vehicles. To achieve zero emissions in the transport sector, we have to change our behaviors to those that do not emit CO_2, for example using public transportation instead of one's own car, and walking and using bicycles instead of relying on vehicles. We also need to decarbonize the vehicles we use. A determining factor of this approach is the shift to zero emission vehicles (ZEVs) that are rapidly spreading around the world.

TMG will realize a city where ZEVs are prevalent by implementing a variety of initiatives, such as creating initial demand through the development of charging/ replenishment infrastructure and a strong support for the introduction of the vehicles.

Policy 4 Promote the Spread of Zero Emission Vehicles (ZEVs*)

* 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 (includes buses, cargo vehicles, and motorcycles in addition to passenger cars)

The status quo

- Market share of ZEVs is **1.6%** of new passenger car sales in Tokyo (FY 2018)
- Public EV chargers: **Approx. 300** fast chargers, **approx. 2,200** regular chargers (FY 2018)
- **14** hydrogen stations (FY 2018)

Necessity of promoting the spread of zero emission vehicles

Measures for the automotive environment evolving as climate change measures

CO_2 emissions from the transport sector in Tokyo account for 20% of the total with vehicles accounting for 80% of that. TMG has achieved great results in improving air quality through measures for the automotive environment. However, we have to evolve and transform the measures for automotive environmental as climate change measures, and bring them closer to decarbonization from the perspective of well-to-wheel*.

Countries and cities around the world have set goals for ZEV introduction and are actively promoting ZEVs. TMG also has to aggressively promote the social adoption of ZEVs, which is a determining factor in making the transport sector zero emission.

* Well-to-wheel: 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)

New social value brought by ZEVs

In addition to reducing CO_2, ZEVs have power storage and supply functions that are expected to be utilized as an energy infrastructure to ensure power sources in emergencies and stabilize the grid at a time of massive introduction of renewable power. Being compatible with autonomous driving technology by means of electrification technologies, ZEVs can contribute to eliminating traffic congestion and ensuring transportation of those such as elderly people, when combined with new mobility services, such as MaaS*.

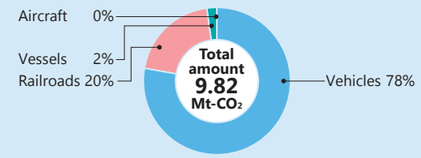
* MaaS: Mobility as a Service. Shows the optimal route for users from a point of departure to destination, and collectively provides multiple means of transportation and other services.

Encouraging changes toward the realization of a ZEV society

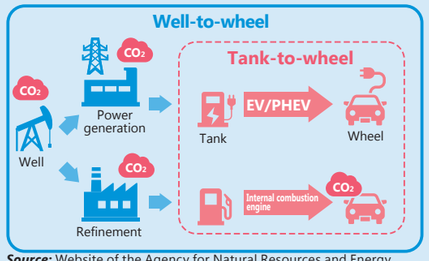
Market share of ZEVs is 1.6% of new passenger car sales in Tokyo. TMG will continue with the full-scale promotion of ZEVs by cooperating with various participants, including automotive manufacturers, Tokyo residents, and the national government, promoting the development and diversification of vehicles through the creation of initial demand, developing and expanding infrastructure, such as chargers, and encouraging the fostering of momentum.

We will support the advancement of energy management at home and in communities utilizing the power storage and supply functions of ZEVs.

Breakdown of CO_2 emissions by means of transportation in the transport sector (preliminary results for FY 2017)



Well-to-wheel



Source: Website of the Agency for Natural Resources and Energy https://www.enecho.meti.go.jp/about/special/johoteikyo/xev.html#topic03

2019

2030 Actions

2050 Visions

- **All cars driven in Tokyo to be ZEVs**
- **Realizing zero emissions from well-to-wheel due to expansion of renewable energy use**

Tokyo's Challenges toward 2050

- **By means of next-generation technologies*, passenger cars and service vehicles, including buses, taxis, and cargo vehicles, registered as new vehicles in Tokyo to be ZEVs**
  * Promotion of innovation in battery technologies, spread of contactless chargers, development of a high-efficiency hydrogen supply system etc.
- **Realizing a substantial shift to the elimination of fossil fuels by expanding the introduction of electricity and hydrogen from renewable energy**
- **Maximizing the new social value of vehicles**
  Advancement of energy management at home and in communities utilizing V2H/V2G*, contribution to measures to reduce the number of people with transportation difficulties to zero.
  * V2H/V2G is an abbreviation of vehicle to home/vehicle to grid and allows ZEVs to supply electricity to households and the grid.

Tokyo's Key Targets toward 2030

Market share of ZEVs in new passenger car sales

50%

Introduction of zero emission buses

300+

New small route buses* for sale

Limited to ZEVs in principle

* Route buses with a capacity of approx. 30 passengers

ZEV infrastructure development

1,000 fast chargers
150 hydrogen stations

In parallel with efforts to achieve the above targets, other efforts have begun to expand for local sharing of decarbonized energy by utilizing the power storage function of ZEVs.

Tokyo's 2030 Targets + Actions

2030 + Actions

- **Ensuring infrastructure to support the promotion of ZEVs**
  - Intensively develop chargers and hydrogen stations by supporting the development by businesses and through prioritized introduction at TMG facilities.
  - Create a new mechanism to encourage the installation of chargers at the building construction stage.
- **Encouraging replacement of existing vehicles, including passenger cars, buses, and motorcycles, with ZEVs**
  - Support purchase of ZEVs by individuals and businesses and introduction of large ZEVs.
  - Promote the spread of ZEVs by supporting their use as community buses and service vehicles.
  - Build a mechanism to encourage users to introduce ZEVs.
  - Research market trends for the utilization of used ZEVs.
- **Fostering momentum for social acceptance**
  - Develop multifaceted efforts, such as fostering momentum and encouraging development, by using promotion teams based on public-private partnerships.
  - Increase availability for Tokyo residents by introducing ZEVs to rental car and car sharing services.
- **Contribution to energy management**
  - Support introduction of V2H or portable vehicle to load systems for use in emergency power supply or energy management when renewable energy is introduced.

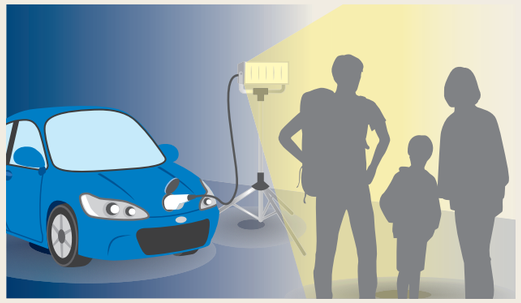
Column 7

ZEVs for Your Safety! Countermeasures in Case of Disaster

ZEVs for ensuring power sources during a disaster

In recent years, large-scale natural disasters have occurred, including Typhoons No. 15 and 19 in 2019 that caused major damage mainly in the Kanto region. ZEVs equipped with a storage battery or fuel cell can be called “moving storage batteries” and are expected to act as power sources when the lifeline is disrupted by a disaster and lives are subjected to uncomfortable living conditions.

Since electricity and hydrogen that drive ZEVs can be extracted as electric power, ZEVs can act as power sources in case of emergency to supply electric power to homes and evacuation centers.



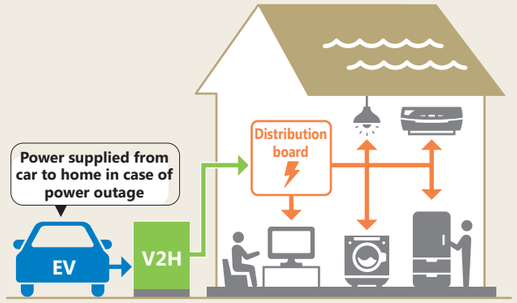
Two uses of ZEVs during a disaster

There are two main ways to extract electricity from vehicles:

① **V2H (vehicle to home)**
By installing V2H equipment at home, power can be supplied to household outlets through a distribution board.

② **Vehicle to load system**
A portable vehicle to load system connected to a vehicle provides multiple outlets available for connection.

Note: Some vehicles have small capacity outlets inside.



V2H (vehicle to home)

It is said that EV with V2H can provide power for 2 to 4 days for an ordinary household and a fuel cell bus can provide power for approximately 4.5 days for a gymnasium that is used as an evacuation center, having great potential as infrastructure in the event of a disaster.

Some ZEVs can store electricity from solar power generation in them during the day and supply the electricity to a house at night. There are a variety of benefits, including self-sufficiency in energy.


V2H

Photo courtesy of Nissan Motor Co., Ltd.


Vehicle to load system

Photo courtesy of Toyota Motor Corporation

ZEVs change the concept of the car from “used only to move” to “used when parked as well.”

Strategy IV

Resource/Industrial Sector

The world’s annual resource consumption has now exceeded 92 billion tonnes and is expected to reach nearly 170 billion tonnes by 2050. This massive consumption of resources is accompanied by deforestation as well as a huge amount of greenhouse gas emissions due to the consumption of fossil fuels and other industrial processes, causing climate change and biodiversity loss on a global scale.

Our society and economy are built on nature, luxuriant forests and the ocean. We cannot continue economic and social activities if the global environment—the basis of the survival of human beings—collapses.

Aiming to achieve a sustainable use of resources that contributes to net zero CO_2 emissions, TMG will review the mass consumption of resources and promptly promote lifestyle modification, taking into account all stages in the supply chain, including resource procurement, production, distribution, consumption, disposal and recycling.

Policy 5 3Rs

The status quo

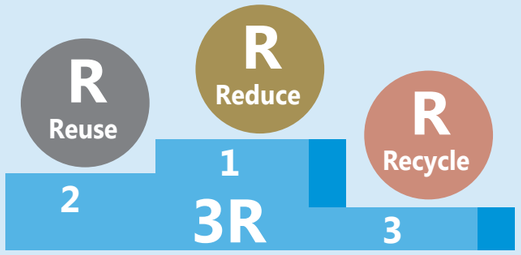
Municipal solid waste* recycling rate is 22.7%

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

Necessity of promoting 3Rs

The state of the 3Rs is in question

Aiming to create a recycling-based society as stipulated in the Basic Law for Establishing the Recycling-Based Society enacted in 2000, Japan has focused on the 3Rs (Reduce, Reuse, Recycle) of waste in particular. Partly because of the enactment of recycling laws concerning containers/packaging and home electric appliances, the recycling rate of these items has drastically improved, showing that the recycling system in Japan has developed to a certain extent. However, there is room for further efforts in the Reduce and Reuse aspects. As seen in the turmoil in the plastic waste recycling market that was triggered by the tightening of regulations on the import of recyclables by Asian countries, Japan's recycling system has big challenges yet to be resolved, such as overcoming its dependence on overseas countries.



Resource and environmental constraints on a global scale

In recent years, the consumption of natural resources has increased along with the population growth and economic development in developing countries, resulting in a global competition for resources. Furthermore, the environmental destruction and biodiversity loss associated with resource extraction are accelerating, placing a heavy burden on the earth. As population growth is expected to continue, the efficiency of resource use needs to be greatly improved.

Issues concerning the use of resources have been garnering attention on a global basis. For example, when it is discovered that illegal actions were taken in the extracting of resources, such as wood, there is a chorus of international criticism directed at the buyers importing the ill-gained product and using it domestically.

Development of an oil palm plantation by cutting tropical rainforest on Borneo Island ©FoE Japan

Significant changes in social structure

In a society that is premised on mass consumption of resources, the consumption of resources including energy only keeps growing, preventing us from ensuring sufficient resources needed by future generations.

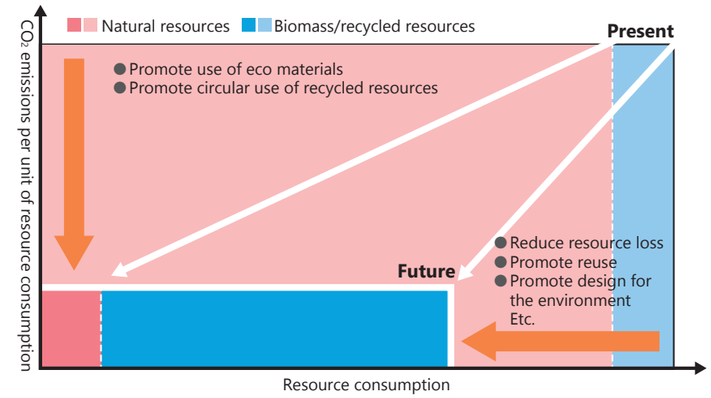
We need to significantly improve resource efficiency in consumption and production while keeping sustainability in mind, and limit resource consumption to within the range of the regenerative power of the earth.

Taking future generations into consideration, we will drastically change our values and the structure of society.

2019

2050 Visions

Establish the sustainable use of resources



Tokyo's Challenges toward 2050

- **Implementation and expansion of the use of innovative technologies**
  Promoting circular use of recycled resources and design for the environment
- **Establishment of a business model not depending on disposables**
  Creating a mechanism for rulemaking and financial incentives
- **Enhancement of advanced circulation and processing**
  Significant improvements in recycling rates and energy efficiency with the introduction of advanced technologies

2030 Actions

Tokyo's Key Targets toward 2030

Municipal solid waste recycling rate

37%

Tokyo's 2030 Targets + Actions

2030 + Actions

- **Reducing resource consumption**
  - Reduce resource consumption by promoting change of the disposable lifestyle and efforts toward design for the environment.
- **Creating a mechanism for the effective use of resources utilizing AI/ICT technologies**
  - Create a mechanism to efficiently use resources only as needed by promoting the provision of information on the characteristics and history of resources, proper evaluation of resource value by users, and matching between providers and users of resources through the maximum use of AI/ICT technologies.
- **Expanding the use of eco materials**
  - Expand the use of eco materials*, such as recycled crushed stone, by taking measures to evaluate the quality of the materials.

  * Materials that cause a low environmental load and maintain excellent characteristics and functions throughout the lifecycle of resource extraction, manufacturing, use, and disposal.
- **Promoting circular use of recycled resources**
  - Promote the circular use of recycled resources by considering and building recycling routes for waste that is expected to occur, such as solar panels, in addition to waste paper and woodchips.
- **Ensuring entirely green procurement**
  - Ensure entirely green procurement by promoting green purchase.

Policy 6 Plastics

The status quo

Incineration of plastic waste from households and large office buildings: **Approx. 700,000 tonnes** (FY 2017)

Necessity of measures for plastics

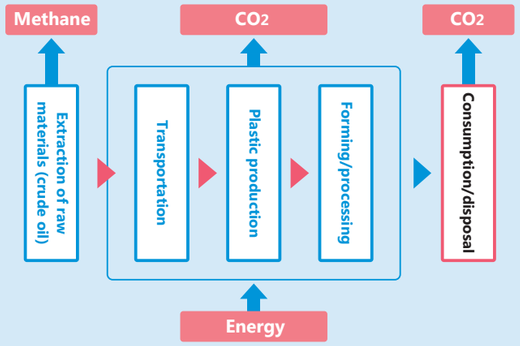
CO_2 emitted from the extraction of raw materials, production, and disposal

With their excellent properties, plastics have rapidly spread in the past 50 years, bringing a variety of conveniences to our lives.

However, the main raw materials of plastics are fossil resources with CO_2 emitted at each stage, from the extraction of crude oil used for plastic production through distribution, production, consumption, and disposal. The total amount of emissions at these stages is approximately 5 kg per 1 kg of plastics.

Much of plastic waste discharged in Tokyo is subjected to heat recovery and incineration. Out of 800,000 tonnes of plastics discharged from households and large office buildings, approximately 700,000 tonnes are incinerated, resulting in 1.45 million tonnes of CO_2.

In addition, many plastic products and containers are disposed of after a single use. It is not sustainable to continue using a large amount of plastics as we do now—how we use plastics is in question.



Ongoing marine plastic pollution

A large amount of plastics flow from land to the sea via rivers throughout the world, causing a concern that marine organisms and the marine ecosystem will be adversely affected.

With respect to countries that have imported plastic waste from developed countries, including Japan, there have been reports on risks of environmental pollution and sorting work in extremely poor conditions. There is an urgent need to expand resource circulation routes in Japan.

For sustainable use of plastics

Along with the economic growth of developing countries, global plastic consumption is expected to increase sharply in the future. Being a major city in a developed country, Tokyo must promote the 3Rs for plastics, make the use of plastics sustainable, and share its visions with the rest of the world.

Taking the Tokyo 2020 Games as an opportunity, we will build a mechanism for closed-loop recycling of plastics with net zero CO_2 by focusing on measures for plastics, reducing single-use plastics, expanding the use of recycled plastics, and enhancing circular use.

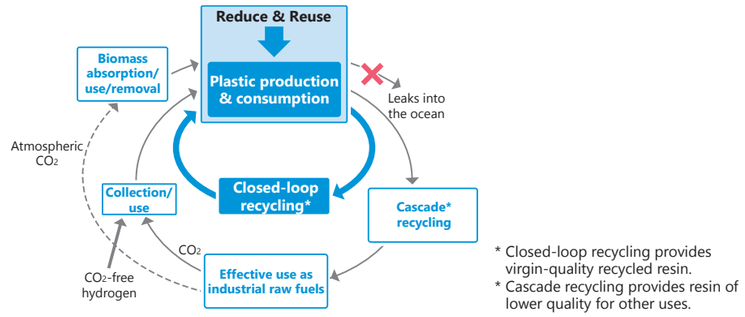
2019

2030 Actions

2050 Visions

Plastic use with net zero CO_2 (closed carbon cycle)

- **Plastic production and recycling completely covered with renewable energy**
- **Switching to biomass causing no land use change, limited within the growth rate of plants. Consider social and environmental issues, such as competition with food production**



* Closed-loop recycling provides virgin-quality recycled resin.
* Cascade recycling provides resin of lower quality for other uses.

Tokyo's Challenges toward 2050

- **Achievement of a significant reduction and elimination of unnecessary single-use plastics**
  Transforming plastics into valuable materials
- **Implementation and expansion of the use of innovative technologies, such as closed-loop recycling**
  Promoting design for the environment, including the use of high-quality recycled plastics and unification of materials for products
- **Elimination of plastics flowing into the ocean**
  Achieving significant reduction in Asian cities

Tokyo's Key Targets toward 2030

National target

Cumulative 25% reduction in single-use plastics etc.

+

Tokyo's target

Incineration of plastic waste from households and large office buildings

–40%
(Compared to FY 2017)

©TerraCycle

Example of products provided in returnable containers

Tokyo's 2030 Targets + Actions

2030 + Actions

- **Fostering empathy to promote behavior change**
  - Provide information that encourages change of consumers' behavior and lifestyle.
- **Creating innovations in cooperation with businesses**
  - Build a new business model that does not depend on single-use plastics
  - Build a mechanism for businesses to collect used products and containers, such as provision of products in returnable containers.
  - Promote bottle-to-bottle recycling of plastic bottles in cooperation with businesses.
  - Encourage the development and implementation of innovative technologies, such as closed-loop recycling.
  - Promote design for the environment, such as the use of recycled or marine biodegradable plastics.
- **Enhancing separation and recycling in cooperation with municipalities**
  - Enhance support and collaboration related to separate collection of plastic containers and packaging by municipalities.
  - Promote separation and recycling at commercial buildings by 3R advisors.
- **Building domestic resource circulation routes, curbing the generation of marine litter**
  - Support building of new domestic resource circulation routes, such as conversion into industrial raw fuels as emergency measures.
  - Implement efforts toward elimination of plastics flowing into the ocean through the TOKYO Zero Marine Litter Action and cooperation with Asian cities.

Policy 7 Food Waste

The status quo

Food waste in Tokyo: Approximately 500,000 tonnes (preliminary results for FY 2017)

Necessity of measures for food waste

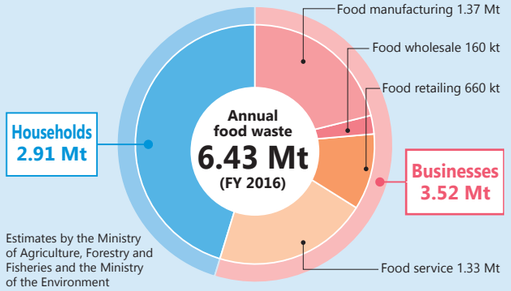
Over 6 million tonnes of food waste per year in Japan

Worldwide one person in nine is suffering from chronic hunger. On the other hand, one-third of produced food is discarded. Discarding essentially edible food in this way is called food waste.

Annual food waste in Japan in FY 2016 is estimated to be approximately 6.43 million tonnes, which is the equivalent to every person in Japan throwing away a bowl of rice every day.

Food self-sufficiency rate of Japan is only 37% on a calorie basis with much of its food depending on imports from overseas.

Food waste in Japan



Estimates by the Ministry of Agriculture, Forestry and Fisheries and the Ministry of the Environment

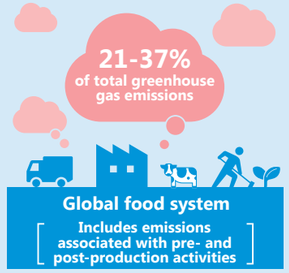
Main causes of food waste

Manufacturer/ wholesaler/retailer	Non-standard, returned, or unsold products from manufacturing, distribution, or cooking process
Food service	Preparation waste (discarded ingredients not cooked), leftovers, etc.
Household	Leftovers, direct disposal (food directly disposed of because it exceeds its use-by date), excessive removal (food disposed of despite having edible portions)

Source: Consumer Affairs Agency, reference materials related to food waste reduction

Impacts of food waste on climate change

Before reaching us, food goes through production, processing, distribution, and other processes in each of which greenhouse gases are emitted. They account for 21-37% of global emissions. CO_2 is also generated when disposing of food past its use-by date and leftovers at home. The impacts of food waste on climate change are so large that they cannot be overlooked.



Source: IPCC. Climate Change and Land 2019

Toward a virtuous cycle of food resources

Today, the abundance of food has become commonplace, diluting the sense of "mottainai" (too precious to waste). We need to make continuous efforts on consumption behavior, where consumers feel that reducing food waste is not just something special, but that buying close to their best-by date is cool and fun. For food-related businesses, food waste entails not only economic losses in terms of costs but also a prioritized issue in the aspect of CSR. We will foster momentum to work on reducing food waste and strongly promote voluntary actions and collaborative efforts by businesses and consumers.

Toward 2050, we will build a virtuous cycle of food resources, including the development of new technologies and the spread and establishment of food sharing services, giving consideration to food safety and food culture.

2019

2050 Visions

Zero food waste through reduction and food recycling

Maximize efforts to control the occurrence of food waste and eliminate remaining food waste by converting it into feed and fertilizer

Tokyo's Challenges toward 2050

- **Control of oversupply by matching food supply and demand**
  Using AI to improve the accuracy of demand forecasting systems, introducing a mechanism to minimize food waste generated from business activities
- **Product development with innovative technologies**
  Developing new long-term preservation methods and processing technologies that do not degrade food quality, food with low CO_2 emissions
- **Spread and establishment of food sharing services**
  Turning food waste at households and businesses into economic activities with food sharing becoming popular
- **Enhancement of environmentally friendly diet**
  Promoting labeling of carbon footprints* for each food, encouraging spread and establishment of technologies to minimize food waste at home

* Amount of CO_2 emissions throughout the entire lifecycle of products and services, from procurement of raw materials to disposal and recycling

2030 Actions

Tokyo's 2030 Targets + Actions

2030 + Actions

- **Reducing food waste caused by manufacturing, wholesale, retail, and food service**
  - Reduce food waste through internet retailing and provision of food to food banks, in addition to encouraging the entire supply chain to control food waste.
- **Promoting efforts in cooperation with the food supply chain**
  - Provide consumers with information on the progress of the review of the one-third rule that has become a business practice for food-related businesses, and efforts to encourage the display of expiration month and year.
- **Selecting wise consumption to prevent unsold food or leftovers**
  - Change consumption behavior, such as utilizing apps to obtain and use markdown information and fostering a culture that can tolerate stockout situations.
- **Preventing food waste at home**
  - Promote understanding of the actual situation of food waste and spread measures at home, such as a habit of checking stock before shopping and purchase of close-to-date products.
- **Cooperating with businesses and raising public awareness to change consumption styles**
  - Cooperate with businesses working on utilizing new technologies based on AI/ICT to promote the spread of pioneering efforts.
  - Foster a movement to change personal consumption styles by providing information on our website and holding events
- **Cooperation with local governments**
  - Create learning opportunities for food waste for children according to their stages of growth.
  - Encourage the effective and aggressive use of emergency food which is soon to expire.

Tokyo's Key Targets toward 2030

Food waste compared to FY 2000*

50% reduction

* Food waste in FY 2000 was approximately 760,000 tonnes.

2030

Policy 8 Fluorocarbons

The status quo

Hydrofluorocarbons (HFCs) emissions in Tokyo

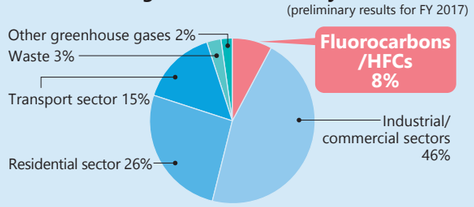
5.2 million tonne-CO_2eq in FY 2017

Equivalent to approximately 8% of greenhouse gas emissions in Tokyo

Note: CO_2eq is an abbreviation of CO_2equivalent, a value calculated using the global warming potential (GWP).

Greenhouse gas emissions in Tokyo

(preliminary results for FY 2017)



Necessity of measures for fluorocarbons

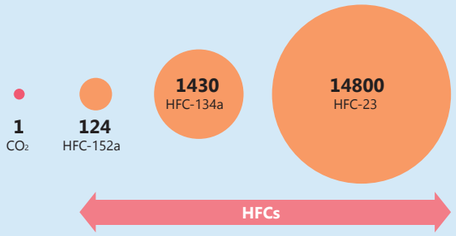
Greenhouse effect of fluorocarbons is more than tens of times higher than CO_2

Since fluorocarbons destroy the ozone layer, HFCs that do not destroy the ozone layer were developed and their use has spread rapidly. However, in recent years, it has become clear that the greenhouse effect of HFCs has a significant impact on climate change, posing a major challenge.

HFCs have an enormous greenhouse effect that is several tens to more than 10,000 times that of CO_2 and cannot be recovered once released into the atmosphere. For this reason, an international framework* has been established as a global common goal, and the national government regulates the production and import of fluorocarbons.

* The Kigali Amendment to the Montreal Protocol in 2016 starting the restriction on the production and import of HFCs in January 2019

Global warming potential (GWP) of HFCs



Source: Notification of Fluorocarbon GWP based on Act on Rational Use and Proper Management of Fluorocarbons (Japanese)

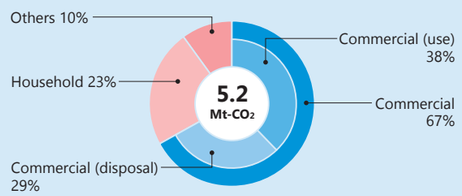
Where are fluorocarbons emitted?

Fluorocarbons are widely used in air-conditioning equipment at offices and commercial facilities as well as freezing and refrigeration equipment, such as showcases in supermarkets.

When used in such situations, fluorocarbons may leak due to corrosion of piping, aging of equipment, or inadequate inspection and maintenance. Fluorocarbons should be properly recovered when equipment is disposed of, but only approximately 40% are actually recovered. Leakage due to breakdown or disposal of equipment is a challenge with the emissions having increased in Tokyo in recent years.

Estimated breakdown of HFCs emissions in Tokyo

(preliminary results for FY 2017)



To reduce fluorocarbon emissions

We need to rapidly expand the use of non-fluorocarbon equipment that has yet to be fully commercialized.

TMG will take measures that go beyond the international framework to promote the reduction of fluorocarbons at an early stage.

In fields where non-fluorocarbon equipment has not yet been developed, we will strengthen the prevention of emissions during use and disposal, encouraging proper management with periodic inspections and ensured recovery of fluorocarbons at the time of disposal.

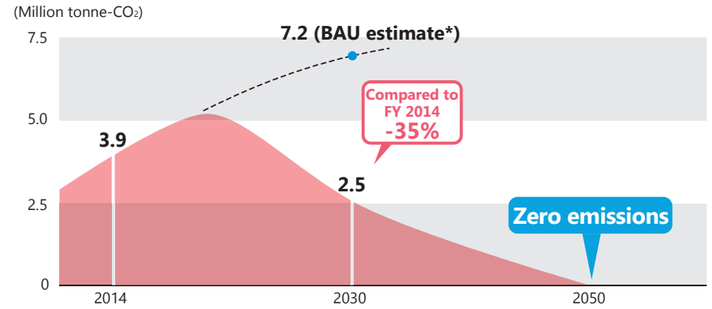
2019

2030 Actions

2050 Visions

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**



*BAU estimate is based on the case where existing measures are continued.

Tokyo's Challenges toward 2050

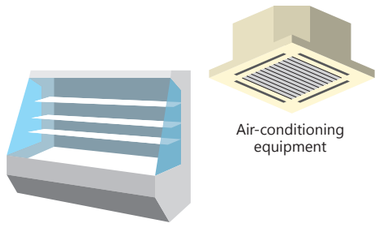
- **Spread of non-fluorocarbon equipment**
  Accelerating the spread of low-cost products and new products in undeveloped fields
- **Prevention of leakage during use**
  Promoting new technologies for leak prevention and creating a mechanism to systematically reduce the use of fluorocarbons
- **Implementation of measures against leakage during disposal**
  Refining fluorocarbon recovery technologies used for disposal and creating a mechanism to eliminate leakage

Tokyo's Key Targets toward 2030

HFC emissions by 2030 compared to FY 2014

-35%

Approx. 2.5 million tonne-CO_2



Tokyo's 2030 Targets + Actions

2030 + Actions

- **Accelerating the shift to non-fluorocarbon equipment**
  - Support the introduction of non-fluorocarbon equipment and equipment with low GWP* refrigerants.
  - Promote the spread by providing support in line with trends in equipment development.

  * GWP is an abbreviation of global warming potential, which indicates the intensity of the impacts on global warming with CO_2 defined as 1.
- **Strict control of equipment to prevent leakage during use**
  - Strengthen supervision by visiting all businesses that emit a large amount of fluorocarbons (over 1,000 tonnes of CO_2 equivalent per year) and must therefore report to the national government.
  - Promote strict control of equipment and switching to non-fluorocarbon equipment by looking into and understanding the equipment control by businesses.
  - Ensure the prevention of leakage during use in cooperation with industry organizations, such as dispatching fluorocarbon advisors to small and medium businesses.
- **Promotion of efforts to prevent release at the time of equipment disposal**
  - Ensure thorough recovery of fluorocarbons at the time of disposal by providing guidance to most demolition sites with commercial equipment installed.
  - Promote efforts to eliminate leakage when removing home air conditioners.
- **Change in user awareness to prevent fluorocarbon emissions**
  - Establish behavior that does not emit fluorocarbons being aware of the risk that they will affect global warming.

Column 8

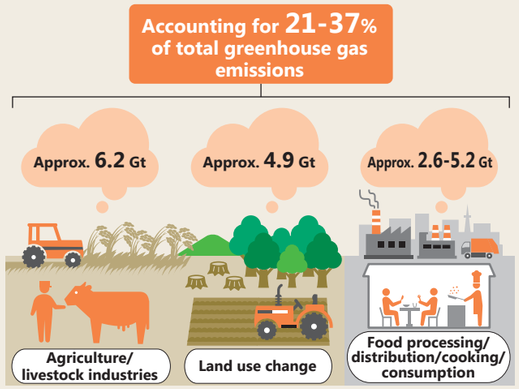
CO_2 from Food

How much does food affect the environment?

A lot of CO_2 is emitted in getting food delivered to the table. We see greenhouse gases, such as methane, emitted directly from intestinal fermentation of livestock, fertilizers, and rice cultivation as well as CO_2 emitted from land use change, such as deforestation and forest degradation due to the expansion of agricultural land. CO_2 is also emitted during energy consumption required for processing, transportation, and refrigeration after harvesting.

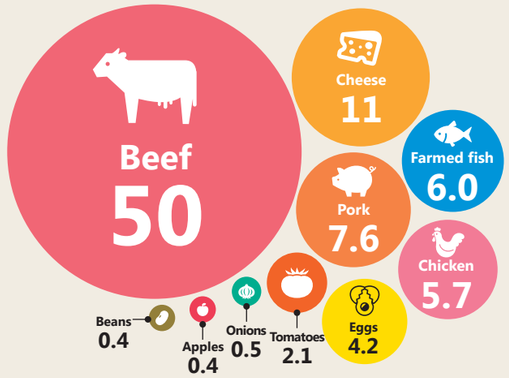
In Japan today, this food, having accrued a significant environmental load, is then delivered to the consumer, who may discard a considerable proportion of the final product even though it is still edible.

■ **Amount of greenhouse gases emitted from the food system (CO_2 equivalent/year)**



Source: IPCC. Climate Change and Land 2019.

■ **Average greenhouse gas emissions from food (kg-CO_2)**



Note: Emissions are indicated per 100 g for proteins and 1 kg for fruit and vegetables.
Source: J. Poore, T. Nemecek. Reducing food's environmental impacts through producers and consumers, 2018.

Think about global issues concerning your daily diet

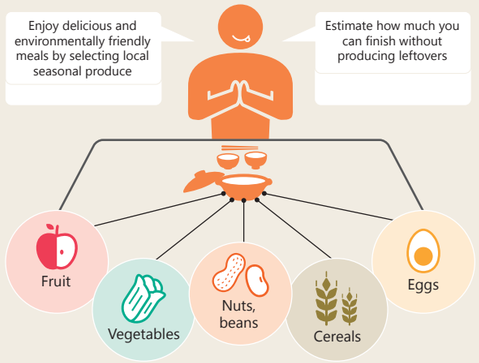
We need to understand that even the simple process of eating our daily meals could involve doing something for the earth:

①Purchase local seasonal produce;
②Eat a healthy balance of plant-based food, such as cereals, vegetables, fruit, and nuts as well as livestock products, and;
③Don't waste food.

The accumulation of these efforts will lead to payoffs in addressing climate change.

Produce from a household's neighborhood has not only less environmental impact but also the advantage of being fresher and revitalizing the local economy—a well-balanced diet will also help maintain health.

■ **Environmentally and health-friendly meals**



Why not practice what is good for the earth, starting with daily meals?

Strategy V
Climate Change Adaptation Sector

In recent years, the impacts of climate change have become more pronounced, such as rising temperatures, more frequent heavy rains, resulting in deterioration in crop quality and increased risks of heatstroke. These impacts are expected to expand for extended periods.

We will continue implementing mitigation measures to reduce CO_2 emissions, a factor of global warming. However, CO_2 emitted so far has accumulated in the atmosphere, causing the impacts of climate change to be unavoidable. Therefore, we need to work on adaptation measures as well, with the aim of avoiding or reducing damage caused by the impacts of this inevitable climate change.

Taking into account the climate change impacts that are becoming apparent, we will work on adaptation measures to protect the lives and property of Tokyo residents.

Policy 9 Strengthen Adaptation Measures

The status quo

Unprecedented extreme weather phenomena are increasing, affecting the activities of TMG, Tokyo residents and businesses

Over the past 100 years in Tokyo:

The average temperature has risen by 3ºC, and the number of sweltering days per year has increased by 16 days, with 26 more sweltering nights per year as well

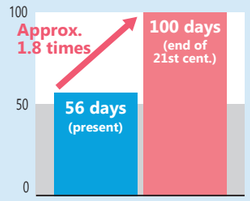
Necessity of strengthening adaptation measures

Expanded impacts and risks from climate change

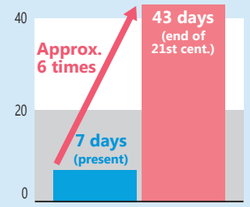
In recent years, extreme weather phenomena have been observed around the world. Disasters, such as heat waves, tropical cyclones, droughts, and wildfires, have occurred, with significant economic losses and numerous deaths reported. In Japan, record rainfall was observed during Typhoon No. 19 in 2019, resulting in enormous damage in Tokyo, including flooding due to rivers overflowing. People's lives were completely changed due to damage to buildings, and power and water outages, while businesses were directly or indirectly affected in various aspects, such as suspension of activities.

By the end of this century, the number of sweltering days is expected to increase up to approximately 1.8 times, and the number of extremely hot days is expected to increase up to approximately 6 times compared to the present, leading to a prediction of a further increase in the risks of climate change.

No. of sweltering days per year



No. of extremely hot days per year



Source: Survey of basic information on formulating the Local Climate Change Adaptation Plans of the Tokyo Metropolitan Government.

What are adaptation measures?

As a report from IPCC (Intergovernmental Panel on Climate Change) indicates that mitigation alone can no longer prevent the impacts of climate change. We need to promote not only mitigation measures to reduce anthropogenic CO_2 emissions but also adaptation measures to reduce the impacts that still remain after implementing the maximum mitigation measures.

In other countries, adaptation measures are being promoted at the city level as well. Strategically working on adaptation measures at the city level leads to sustainable economic and social development as well as protecting people's lives.

Illustration by A-PLAT

To adapt to climate change

Based on the latest scientific knowledge, we will address climate change impacts at present and in the future and strongly promote adaptation measures in all fields.

The understanding of Tokyo residents is indispensable for promoting adaptation measures. We will ensure a system to collect and provide information to actively disseminate information.

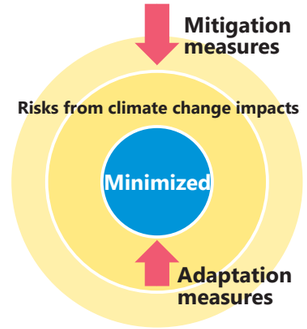
2019

2030 Actions

2050 Visions

Minimize risks from climate change impacts

Protect the lives and property of Tokyo residents and realize a city that continues to attract people and businesses



Tokyo's Challenges toward 2050

- **Promote efficient and optimal adaptation measures utilizing innovative technologies, such as highly accurate climate change prediction**
- **Establish Tokyo residents' behavior and business activities with adaptation in mind**

Tokyo's Key Targets toward 2030

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

Tokyo's 2030 Targets + Actions

2030 + Actions

Tokyo's efforts in each field affected by climate change

- **Natural disasters (measures for heavy rains etc.)**
  Promote adaptation measures both in structural and non-structural aspects, such as maintenance of regulating reservoirs and storage facilities, removal of utility poles, and enhanced publication of disaster risk information, for further improvements in initiatives.
- **Health (heat countermeasures etc.)**
  To minimize health effects, including heatstroke, further strengthen appropriate preventive and ex-post measures, such as urban greening to mitigate heat.
- **Agriculture, forestry, and fisheries**
  Realize a robust agriculture, forestry and fisheries industry by disseminating heat resistant breeds, switching to breeds that utilize the temperature rise, developing agricultural facilities, and researching the impacts of changes in the marine environment.
- **Water resources and water environment**
  Reduce the risks of droughts and deterioration of raw water quality by properly managing water conservation forests and introducing purification technologies capable of responding to changes in raw water quality. Create a comfortable water environment by improving water quality through improving the combined sewer system and developing advanced treatment facilities, and by maintaining and improving the water quality of rivers and canals.
- **Natural environment**
  Enhance efforts toward the minimization of impacts on ecosystems as well as the utilization and restoration of natural environment functions by formulating a local biodiversity strategy that takes into account climate change impacts.

Promotion of efforts by Tokyo residents and businesses

Promote efforts toward adaptation by Tokyo residents and businesses by establishing the Local Climate Change Adaptation Center to collect, organize, analyze, and provide information.

Illustration by A-PLAT

Column 9

Adaptation Measures at Households and Businesses

We need to promote adaptation measures, as climate change impacts may worsen even if strict mitigation measures are implemented. What kinds of efforts can be made at households and businesses?

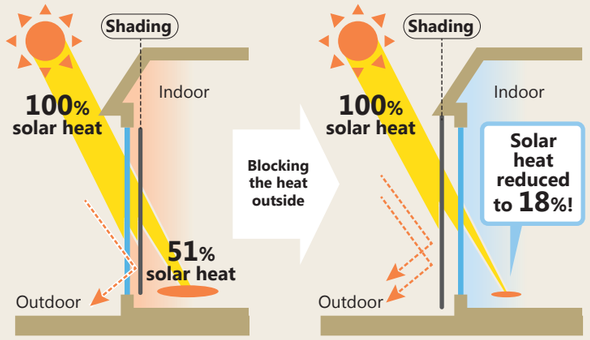
Adaptation measures at hand for households (heat countermeasures)

Green living screens and reed screens are traditional heat countermeasures, but they have a solid effect that can be expressed in numbers.

To reduce room temperature rise due to sunlight, it is effective to block the heat outside the window.

This will cut heat entering the room by more than half.

Sun shields for window



Source: The Energy Conservation Center, Japan. Lo-HOUSE.

Adaptation measures in progress at businesses

Climate change may affect various business activities. In addition to events that directly affect business activities, such as inundation of facilities and deterioration in crop quality, there is concern about indirect effects, such as the Japanese economy suffering because of overseas production bases and supply chain.

Some businesses are developing operations and taking into consideration adaptation measures and efforts to avoid the risks from climate change as new business opportunities.

Example of efforts: Daiwa House Industry Co., Ltd. (countermeasures for heatstroke at construction sites)

The number of extremely hot days is increasing, resulting in more risk of heatstroke at construction sites that entail outdoor work. For this reason, an environmental sensor was jointly developed, incorporating three sensors for a heat index (WBGT), wind speed, and human presence.

When a heat index (WBGT) or wind speed exceeding the standards is detected, a warning is given to workers and an e-mail is sent to supervisors to help take quick measures and prevent accidents.

Source: Daiwa House Group Sustainability Report 2019 (Japanese).

Example of efforts: Tokyu Corporation (countermeasures for urban heavy rains)

In the Minami-Machida Granberry Park, the company promotes urban development in collaboration with Machida city. Here, as an adaptation measure against urban heavy rains caused by climate change, green infrastructure is used in addition to conventional rainwater management methods, including regulating reservoirs and rainwater storage tanks, to implement a rainwater management plan. The company has developed a mechanism to divert some of the excess rainwater into the ground using permeable paving and infiltration gutters throughout the area.

Image of development

Source: Tokyu Corporation Environmental Report 2019 (Japanese).

Adaptation measures have become important efforts for businesses as both risk management schemes and new business opportunities.

Strategy VI

Engagement and Inclusion

The ambitious goal of realizing a Zero Emission Tokyo cannot be achieved by the administrative power of Tokyo alone.

We need to recognize that we are currently facing a climate crisis and take effective measures as well as call for the cooperation of Tokyo residents, businesses, and organizations to ensure their understanding, and continue to mobilize us against this climate crisis.

Solving the global challenge of the climate crisis can no longer be left to national governments. In an era where more than half of the world's population lives in cities, cities are required to take leadership and work together—Tokyo will lead them as an environment-conscious city.

Policy 10 Cooperate with Various Actors in Movements and Reform of Social Systems

Necessity of cooperation with various actors

A Zero Emission Tokyo cannot be realized by TMG on its own

The ambitious goal of realizing a Zero Emission Tokyo cannot be achieved by TMG's administration alone. In terms of areas, we need efforts in the Tokyo metropolitan area, across the country, and on a global scale. We also need a wide range of participation by all actors, including Tokyo residents, businesses, and organizations. With this strategy, TMG will call for the cooperation of all actors to ensure their understanding and continue collaborative action in standing against the climate crisis.

Integrating various actors' actions, technologies, and knowledge toward a bigger movement and enhanced initiatives

Since CO_2 emissions are closely tied to daily lives and activities, the collective action of Tokyo residents, businesses, and organizations has a significant impact on climate change measures. By incorporating different technologies and knowledge from home and abroad into initiatives, and changing business mechanisms and patterns of behavior, we will make significant progress in social changes toward decarbonization.

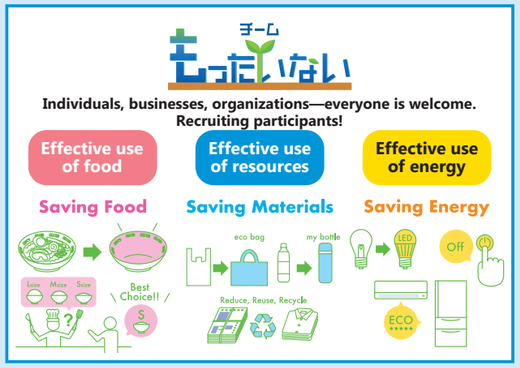
Promotion of efforts

- **Alliance with advanced businesses, NGOs, and local governments**
  Taking into account the characteristics of each initiative, we will promote various efforts to strengthen the initiatives, such as fostering movement and sharing and developing technologies and knowledge. This will be done by forming teams and alliances based on public-private partnerships with local governments, businesses, universities, and organizations.
- **Outreach to individual Tokyo residents —Team Mottainai—**
  We will communicate the consciousness of "Mottainai" (sense of "too precious to waste") to consumers, collaborate with Tokyo residents, businesses, and organizations working on activities to create an opportunity for behavioral changes, expand the scope of efforts toward decarbonization by Tokyo residents, and support actions for that purpose.
- **Collaboration with businesses and organizations taking the lead in decarbonization**
  We will develop a variety of efforts toward reform of social systems, collaborating with businesses and organizations that are actively engaged in decarbonization as well as providing support for businesses, enabling them to build advanced and innovative business models.
- **Development of broad-based initiatives beyond the borders between local governments**
  By utilizing the framework of broad-based cooperation with local governments in the Tokyo metropolitan area and large cities throughout the country, we will promote joint efforts such as raising public awareness and an approach to the national government.

- **Efforts for alliance**

Renewable energy	**RE100 Action Meeting** Collaborate with RE100 declaration businesses, renewable energy electricity suppliers
Hydrogen	**Tokyo Hydrogen Promotion Team** Collaborate with hydrogen suppliers, automotive manufacturers, local governments, universities
Food waste	**Food Waste Reduction Partnership** Collaborate with food supply chains, NPOs

- **Team Mottainai**



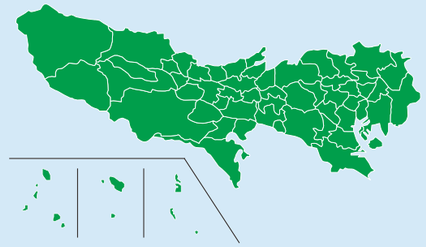
Policy 11 Strengthen Cooperation with Local Municipalities

Municipalities as important partners for policy development

To foster the understanding of nearly 14 million Tokyo residents, businesses, and organizations and take action together with them, cooperation with the municipalities most familiar to the residents is indispensable. In order to develop climate change measures with TMG and local municipalities as one body, we will further strengthen cooperation with municipalities that are familiar with local circumstances, and have the regional networks and resources of local governments.

Promotion of efforts

- **Promotion of sharing of knowledge and cooperation in initiatives**
  We will promote the sharing of technologies and expertise of climate change measures and the cooperation in human resource development of officials. We will also promote the support for and cooperation in effective efforts, such as joint examination and development of initiatives, including sustainable resource management.
- **Support for efforts toward decarbonization by municipalities**
  We will strongly support the efforts of municipalities to contribute to the realization of a Zero Emission Tokyo by identifying their needs, further utilizing a support system for revitalizing local environmental power.



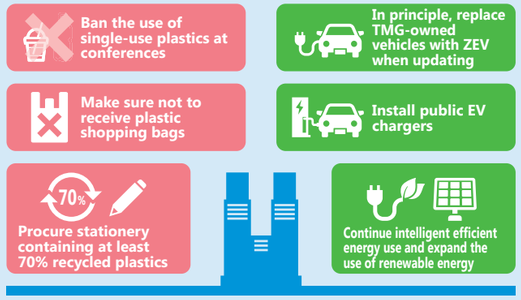
Policy 12 TMG's Initiatives for Its Own Sustainability

Implementation of "Let's Start from Here"

While it is in a position to promote various initiatives, Tokyo is also a large-scale business that consumes a lot of energy and resources. With "Let's Start from Here" in mind, TMG will take the initiative in implementing efforts contributing to the realization of a Zero Emission Tokyo, in order to foster the understanding and cooperation of Tokyo residents, businesses, and organizations.

Promotion of efforts

- **Enhancement of the promotion system in TMG toward the realization of a Zero Emission Tokyo**
  Through the "Zero Emission TMG Promotion Council," TMG will, as a unit, strongly promote a variety of zero emission actions, such as continued energy efficiency and expanded use of renewable energy, promotion of the sustainable resource management, including plastics reduction, and encouragement of the introduction of ZEV.
- **Utilization of public procurement to promote decarbonization**
  We will leverage TMG's procurement capability to support the spread and establishment of environmentally conscious products and renewable power through the promotion of green purchase and utilization of a variety of mechanisms, such as the TMG Power Plan.
- **Active use of advanced technologies at TMG facilities**
  We will proactively utilize and demonstrate promising technologies that will contribute to zero emissions to support the spread and establishment of such technologies.



Policy 13 Strengthen Cooperation with Cities and Non-State Actors around the World

Sharing knowledge and contributing to decarbonization overseas through cooperation with cities and non-state actors around the world

As climate change measures require response on a global basis, we need to enhance and strengthen cooperation with cities and non-state actors around the world. Tokyo will exercise international leadership as one of the world's largest cities and further enhance its initiatives and contribute to decarbonization around the world by deepening inter-city cooperation to share knowledge and technologies.

Promotion of efforts

■ **Further strengthening of global networks**
We will strengthen cooperation with international organizations, such as C40, ICAP, and ICLEI*, facilitate the sharing of advanced policies and knowledge around the world, and revitalize inter-city cooperation in climate change measures.

■ **Environmental support for Asian cities**
We will support efforts for decarbonization in Asian cities, aggressively providing measures and expertise Tokyo has been pioneering by utilizing the framework of international cooperation with these cities.

* C40: C40 Cities Climate Leadership Group, ICAP: International Carbon Action Partnership, ICLEI: Local Governments for Sustainability.

Policy 14 Promote Sustainable Finance

Connecting the environment and finance

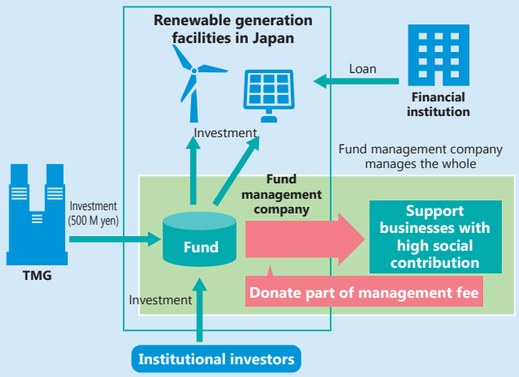
Finance plays an important role in climate change measures, with environmental finance and investment being a major trend worldwide. To improve its presence as an international financial city and contribute to solving social issues through finance, TMG will revitalize the trend of utilizing investment funds for environmental measures, creating opportunities for Tokyo residents and businesses to invest in environmental measures.

Promotion of efforts

■ **Promotion of ESG investment**
We will promote the spread of ESG investment through the formation of the Tokyo ESG Fund that invests in renewable energy projects in Japan and Tokyo Financial Award that recognizes businesses helping promote ESG investment.

■ **Revitalization of the green bond market**
Through the issue of Tokyo Green Bond, the first green bond issued by a local government in Japan, we will work to mature and expand the domestic market and establish green bonds in the domestic bond market.

■ **Scheme of Tokyo ESG Fund**



Note: Specific investment destinations are selected by fund management company.

05 CHAPTER TOWARD THE REALIZATION OF A ZERO EMISSION TOKYO

Top priority is the application of all existing and advanced technologies
New innovations and a technological revolution are also essential

Using existing and advanced technologies

To reduce CO_2 emissions, we have to make the best use of the latest, superior technologies, including AI and IoT, which are being developed at an accelerated rate, and promote measures in every field. Partly due to TMG's initiatives, there have been improvements in ZEV performance and decreases in the price of solar power generation, resulting in the spread of some technologies. On the other hand, insufficient understanding of the effects and the necessity of higher costs have prevented many existing and advanced technologies from being fully utilized.

There have been technological developments for significant improvements in performance, such as the development of all-solid-state batteries for in-vehicle storage battery applications toward 2025 and the development of innovative batteries toward 2030.

These technologies will enable a significant reduction in CO_2 when they are fully applied. We need to disseminate them as highly versatile technologies through assistance with introduction costs and infrastructure as well as support in institutional aspects.

Next-generation technologies currently in the demonstration phase include CCUS*. There are expectations for new innovations and a technological revolution, such as negative emissions technologies to reduce atmospheric CO_2.

* CCUS: Carbon dioxide Capture, Utilization and Storage.

■ Main technologies for zero emissions

○ CCS/CCU
- CCU: Technology that separates and captures CO_2 from exhaust gas from large-scale emission sources for the effective use of CO_2.
- Artificial photosynthesis: Solar energy is used to generate chemical energy (hydrogen and hydrocarbons).

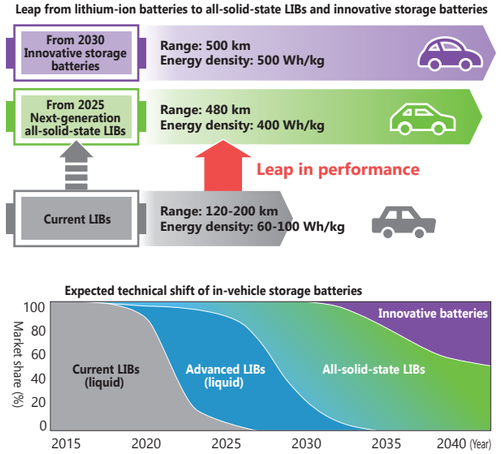
○ Renewable energy
- Biofuels: Biomass (plants, microorganisms, etc.) is used to generate chemical energy (hydrogen and hydrocarbons).

○ Energy transportation and storage
- Next-generation storage batteries: Innovative batteries include metal-air batteries, lithium-sulfur batteries, and metal cathode batteries, all of which are being studied at businesses, national research institutions, and universities.
- Hydrogen-derived fuels: Fuels using hydrogen generated from renewable energy, which assume the use of existing energy supply infrastructure, including methane, ammonia, and methanol.

○ Negative emissions
- BECCS (Bio Energy with Carbon dioxide Capture & storage): Technology that combines biomass power generation and biofuel production processes with carbon dioxide capture and storage (CCS).

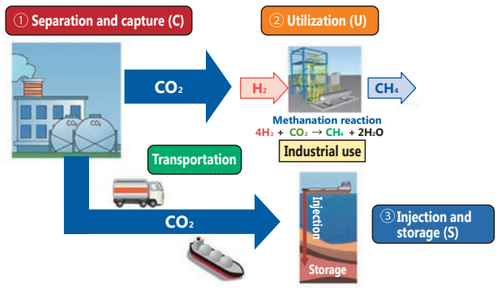
Source: Research Institute of Innovative Technology for the Earth (http://www.rite.or.jp/news/events/pdf/tsuzuku-ppt-kakushin2017.pdf)

■ In-vehicle storage batteries



LIB is an abbreviation of lithium ion battery.
Source: Ministry of Economy, Trade and Industry. List of PR materials for projects related to FY 2018 budget of the Ministry of Economy, Trade and Industry: Special account for energy measures—Development of basic technologies for commercializing next-generation in-vehicle storage batteries. (Japanese) (https://www.meti.go.jp/main/yosangaisan/fy2018/pr/en/sangi_taka_22.pdf)

■ CCUS



Source: Website of the Ministry of the Environment (http://www.env.go.jp/earth/ccs/ccus-kaigi/1-2_MOE_CCUS_gaiyo.pdf).

Realizing a virtuous cycle of technologies and initiatives

New innovations and a technological revolution are indispensable for achieving net zero CO_2 emissions by 2050.

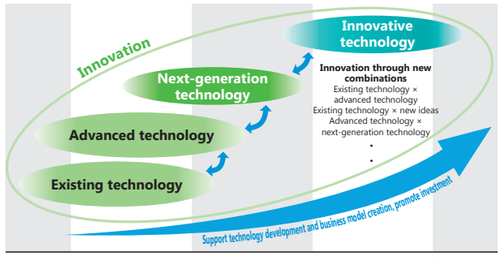
By clearly showing our initiatives and the direction we will take to achieve them through this strategy, TMG aims to realize a virtuous cycle of technologies and initiatives in which we encourage development in the private sector. As developed technologies accelerate our initiatives, the revitalized market promotes investment that leads to further development of technology.

We need to not only promote technology development but also create an environment that enables early commercialization and spread of developed technologies.

Currently, technology research and demonstration is being conducted in the national government and private businesses.

TMG will collaborate with research institutions that are introducing innovative technologies and business models to take the initiative in demonstrating, utilizing, and spreading technologies that will contribute to the realization of a Zero Emission Tokyo. We will provide support for social implementation, such as introduction support at the initial stage of market launch and support in infrastructure development and institutional aspects.

■ Technology development toward 2050



The importance of the national government's role in achieving zero emissions

The role of the national government is crucial for realizing a decarbonized society

To realize a decarbonized society, regions, businesses, and citizens in Japan as well as Tokyo need to evolve their efforts and play their individual roles, but the role of the national government is of decisive importance.

To contribute to the achievement of the 1.5ºC target, we are requesting that the national government immediately set ambitious goals and a clear path to start decreasing greenhouse gas emissions by 2020 at the latest, achieve a significant reduction by 2030, and help realize net zero emissions in the world by 2050. We are also calling on them to promote energy decarbonization, a technological revolution, and innovation strategies.

Since the national government has a major responsibility and role in energy supply, its efforts are extremely important. For this reason, we call for the maximum acceleration of efforts to make renewable energy a main power source and a major energy source as soon as possible. To this end, we will urge the national government to accelerate their efforts toward full-scale dissemination and use of renewable energy, including the promotion of better operation and enhancement of the grid for the expanded use of renewable energy and the establishment of systems necessary for the continuous use and expanded introduction of renewable energy.

We will also call on the implementation of effective measures, such as the early formulation of comprehensive initiatives including regulatory action, such as carbon pricing, and the promotion of energy efficiency measures at commercial buildings, small- and medium-sized businesses, and households.

As the national government formulates a new Nationally Determined Contribution (NDC), ahead of COP26, we will request that they aim to formulate a more ambitious plan, which will contribute to the achievement of the Sustainable Development Goals (SDGs), based on their strong commitment and specific initiatives, and to play a leading role in realizing a decarbonized society promoted by the international community.

Implement initiatives with a sense of urgency
Review the strategy in light of future changes in social structure

Future developments

In the face of the serious consequences of climate change, it is essential to implement each and every initiative based on this strategy steadily, but with a sense of urgency.

We will continue working on the strategy to make it more effective by identifying a broad range of specific indicators to understand the progress of the strategy and implementing new initiatives following an analysis of the situation.

Future outlook for decarbonization

Currently, rapid and drastic initiatives toward decarbonization are being implemented in countries and cities around the world.

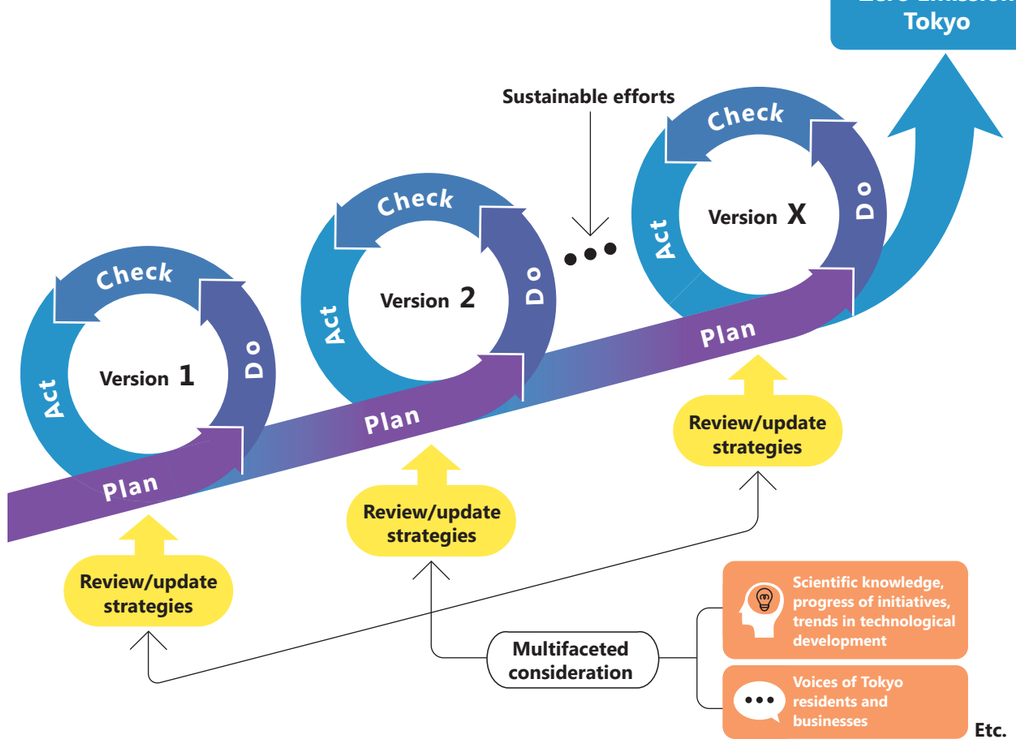
In the future, reforms will move ahead at a different speed and level from those of the conventional measures against global warming, causing significant changes in social systems.

Upgrading the strategy

This strategy is the starting point for decarbonizing Tokyo, clarifying its vision, specific efforts, and a roadmap to achieve net zero CO_2 emissions by 2050.

With an eye on anticipated major reforms, Tokyo has to aggressively and continuously contribute to decarbonization as one of the world's largest cities.

Setting our visions as a point of departure, taking into account scientific knowledge, progress of initiatives and trends in technological development, and listening to the voices of Tokyo's residents and businesses, we will consider the upgrade of our goals and initiatives from many angles to update the strategy in a timely manner, in line with changes situations and social structure that are the premise of the strategy.



Revised Edition

Zero Emission Tokyo Strategy

A decarbonization strategy to realize a Tokyo that serves as a pioneer for our brilliant future

A Sustainability and Resilience Strategy Pursuing 1.5°C

Edited and published in December 2019
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8-1 Nishi-Shinjuku 2-chome,
Shinjuku-ku, Tokyo 163-8001
TEL (03)5388-3429

Designed by Toppan Printing Co., Ltd.
Printed by Daito Industrial Printing Co., Ltd.

URL: https://www.kankyo.metro.tokyo.lg.jp/en/about_us/zero_emission_tokyo/strategy.html

FY 2019
Registration No. (31) 99
Environmental Document No. 31105

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