Summary of the White Paper on Land, Infrastructure, Transport and Tourism in Japan, 2022

Policy Bureau, Ministry of Land, Infrastructure, Transport and Tourism (MLIT)

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Ministry of Land, Infrastructure, Transport and Tourism

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Composition (Part I: Climate Change and Our Lives)

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- Global warming has progressed at a rate unprecedented in the history of the world over the last 2,000 years. Its impact can be observed in the recurrent heavy rains and short-duration intense rainfall, resulting in the increased frequency and intensity of floods, landslides and other climate-induced disasters around the world. Meanwhile, greenhouse gas emissions induced by human activities have been identified as a factor responsible for the ongoing changes in climate.
- To respond to risks of disasters caused by climate change under these circumstances, steps to promote decarbonization must be taken as a means to moderate climate change itself, along with measures to reduce and mitigate disasters. In particular, measures adopted in the field of MLIT, involving housing, transportation, and urban development, have a huge impact on the trend of carbon dioxide emissions of the entire nation. Such measures are also closely associated with the lives of individual citizens.
- For all these reasons, this paper examines the trends toward and future prospects of decarbonization with a focus on the theme of "Climate Change and Our Lives" by considering the steps to be taken by individual citizens as well as measures adopted by the government, municipality, businesses, and others in the field of MLIT towards the target of achieving carbon neutrality in 2050.

Introduction Intensification of the scale and frequency of disasters associated with climate change

○ The measures to prevent and mitigate disasters are summarized with a view to the conditions of climate change, an increase in the intensity and frequency of disasters associated with climate change and adaptation measures on climate change.

Chapter 1 Trends on the realization of decarbonized society

○ In recognition of the vital importance of measures to realize a decarbonized society to mitigate climate change, this paper classifies the latest trends of carbon dioxide emissions in 2020 in the residential and transportation sectors affected by the spread of COVID-19, as well as market trends and actions by the government of Japan aimed at creating a positive cycle involving the economy and the environment.

Chapter 2 Measures in the fields of MLIT to realize a decarbonized society

○ An urgent challenge for Japan is to accelerate measures in the consumer and transportation sectors, responsible for approximately 50% of the nation's carbon dioxide emissions. Also, carbon dioxide emissions from the residential sector began to increase in FY2020 from the previous year while the majority of emissions from the transportation sector is attributable to motor vehicles. All these and other factors make a compelling case for launching measures that promote the decarbonization of our lives. Consequently, this paper summarizes the direction of measures aimed at decarbonizing our lives in the field of MLIT, including housing, traffic and urban development, along with trends of technological innovation, social implementation and other elements.

○ This paper also summarizes the measures to expand the use of renewable energy, which is essential for the decarbonization of our lives, and to transition to a more decarbonized lives.

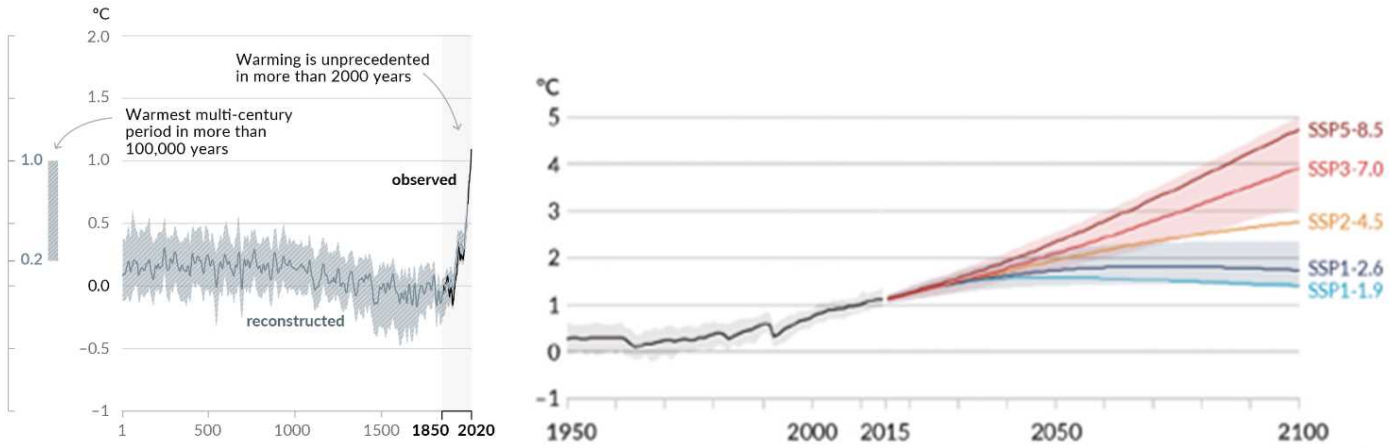
Chapter 3 Our Lives in the Era of Climate Change

○ This paper presents the results of a survey on people's attitudes toward decarbonization and pioneering cases of regional development aimed at decarbonization, as well as a look at our lives in the future that is expected to experience transformation with technological innovation.

1. Intensification of the scale and frequency of disasters associated with climate change (1)

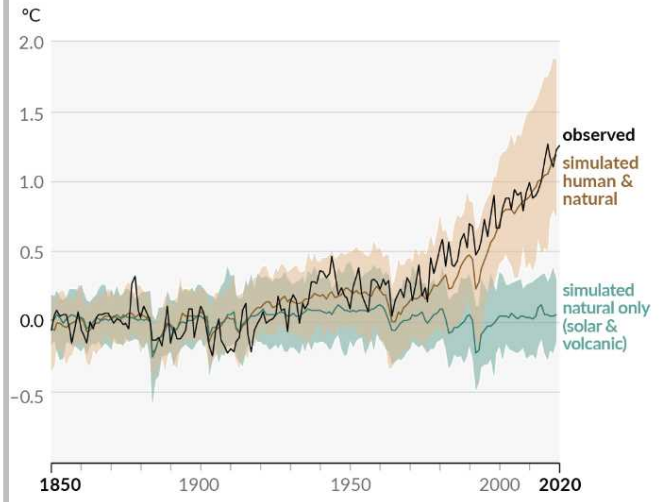
- With the advance of global warming in recent years, the global average temperature for 2011-2020 was 1.09˚C higher than that in the pre-industrial era (1850-1900).
- Warming during the 1850-2020 period is unprecedented in AD (over the last 2000 years) and further temperature increases are projected if conditions continue at this rate.
- It is unequivocal that human influence has warmed the atmosphere, ocean and land.

[Changes in the global average temperatures]



Source) Prepared by MLIT based on Figure SPM.1 and Figure SPM.8, Summary for Policymakers, WG1 report, IPCC Sixth Assessment Report
(Note)1 Left: Reconstructed (1-2000) and observed(1850-2020)
2 Right: Observed (1950-2014) and simulated (2015-2100))

[Global warming and human influence]



Source) Prepared by MLIT based on Figure SPM.1, Summary for Policymakers, WG1 report, IPCC Sixth Assessment Report

1. Intensification of the scale and frequency of disasters associated with climate change (2)

- In recent years, extreme climate events have become more intense and frequent, with changes in rainfall patterns becoming a long-term trend. Global warming is believed to be one of the factors behind the increase in the occurrence of heavy rainfall and short duration heavy rainfall that cause disasters.
- Extreme climate events have caused disasters and significant damage around the world almost every year, and Japan is no exception. With the lives and property of the nation at stake, focus should be placed on predicting climate change and its impact and accumulating scientific knowledge to brace for the growing risk of future disasters.

[Disasters caused by extreme climate events in which the impact of global warming was assessed]

○ The Japan Meteorological Agency, which is examining event attribution to assess the impact of climate change, has noted that global warming has had a certain level of impact on extreme climate events that resulted in significant disasters.

Condition of damage caused by the Heavy Rain Event of July 2018

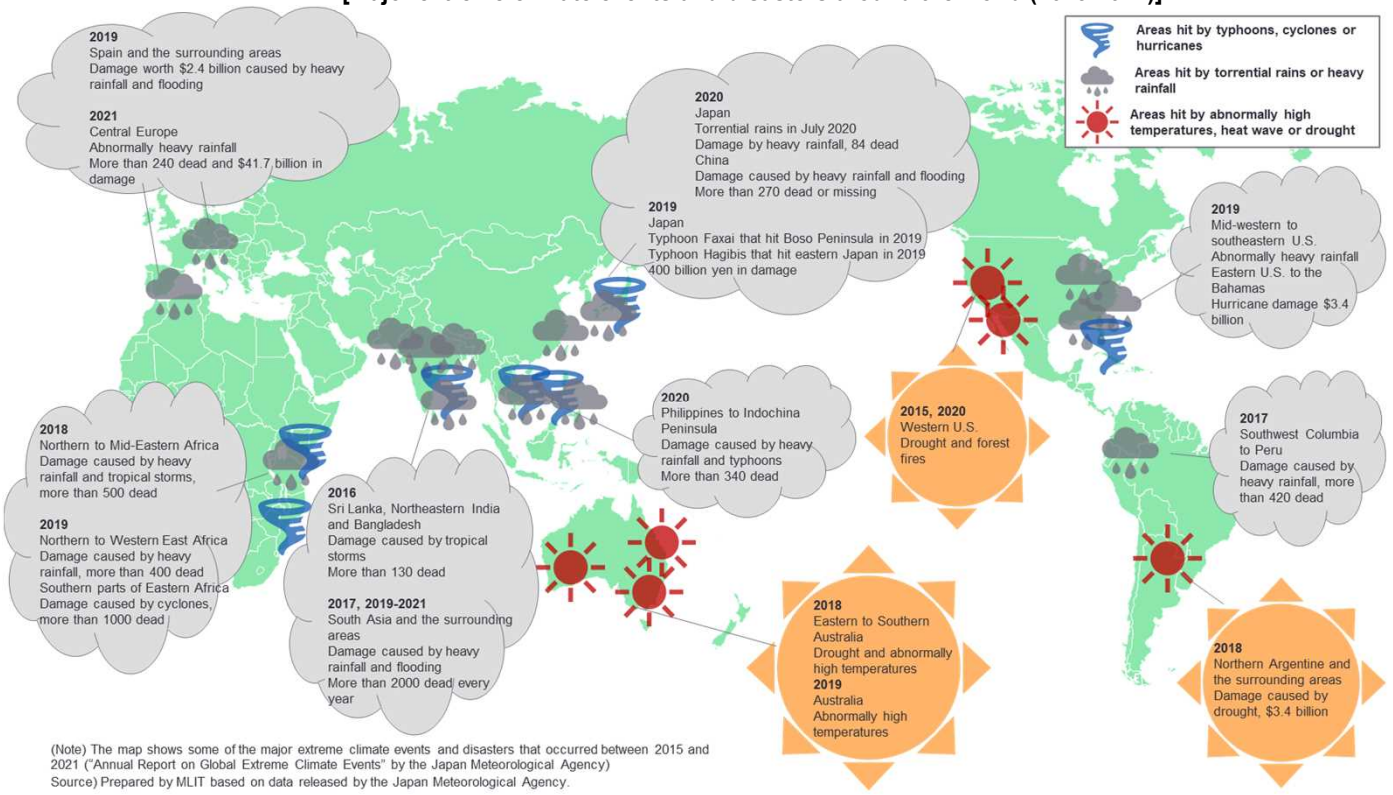
○ The probability of heavy rainfall on a level of once in 50 years has increased by about 3.3 times associated with global warming.

○ JMA says intense heat (high temperatures and heat wave) in that month would not have occurred without global warming.

Condition of damage caused by Typhoon Hagibis that hit eastern Japan in 2019

○ Total rainfall increased by 10.9% associated with temperature increase since 1980 (approx. 1 °C).

[Major extreme climate events and disasters around the world (2015-2021)]



(Note) The map shows some of the major extreme climate events and disasters that occurred between 2015 and 2021 ("Annual Report on Global Extreme Climate Events" by the Japan Meteorological Agency)
Source) Prepared by MLIT based on data released by the Japan Meteorological Agency.

○ Conditions in 2021:

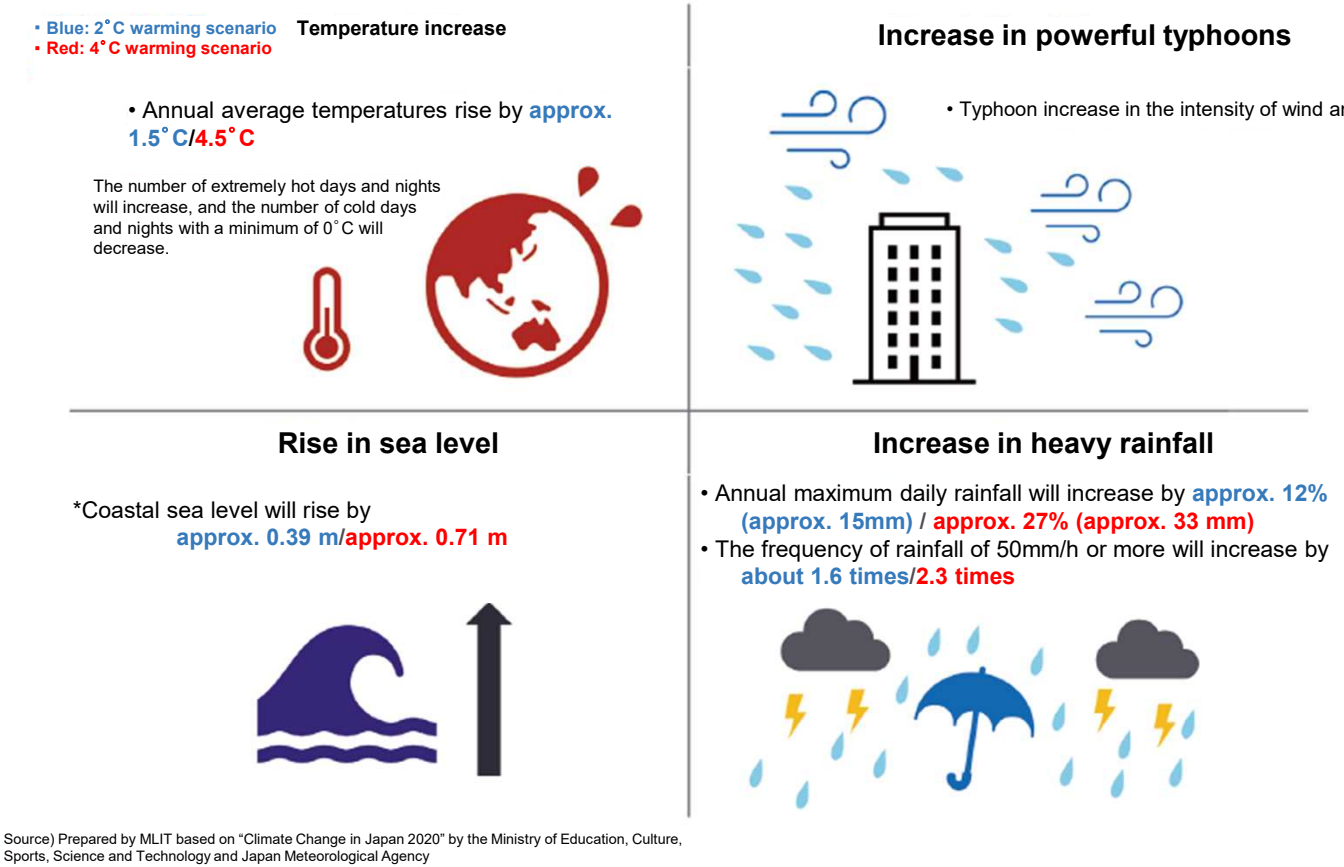
Heavy rainfall in August 2021 resulted in record rainfall from western to eastern Japan, causing significant damage. In South Asia and the surrounding areas, heavy rainfall between May and November led to a total of more than 2200 deaths. In Germany, Belgium and the surrounding areas, heavy rainfall in mid-July led to more than 240 deaths and economic damage worth US$41.7 billion.

2. Increase in disaster risks associated with climate change

(1) Impact of climate change on disaster risks

- The number of extremely hot days (with a high temperature of 35°C or above) and hot nights (with a low temperature of 25°C or above) is said to have increased over the past 100 years. More than 1,000 people have died each year associated with heat stroke in Japan in recent years.
- Experts note that climate change may cause an increase in the global occurrence of extreme climate events in the future. There are concerns over the growing risk of heat stroke and disasters associated with temperature rise and changes in the rainfall pattern.

[Prediction of the impact of climate change]



Source) Prepared by MLIT based on "Climate Change in Japan 2020" by the Ministry of Education, Culture, Sports, Science and Technology and Japan Meteorological Agency

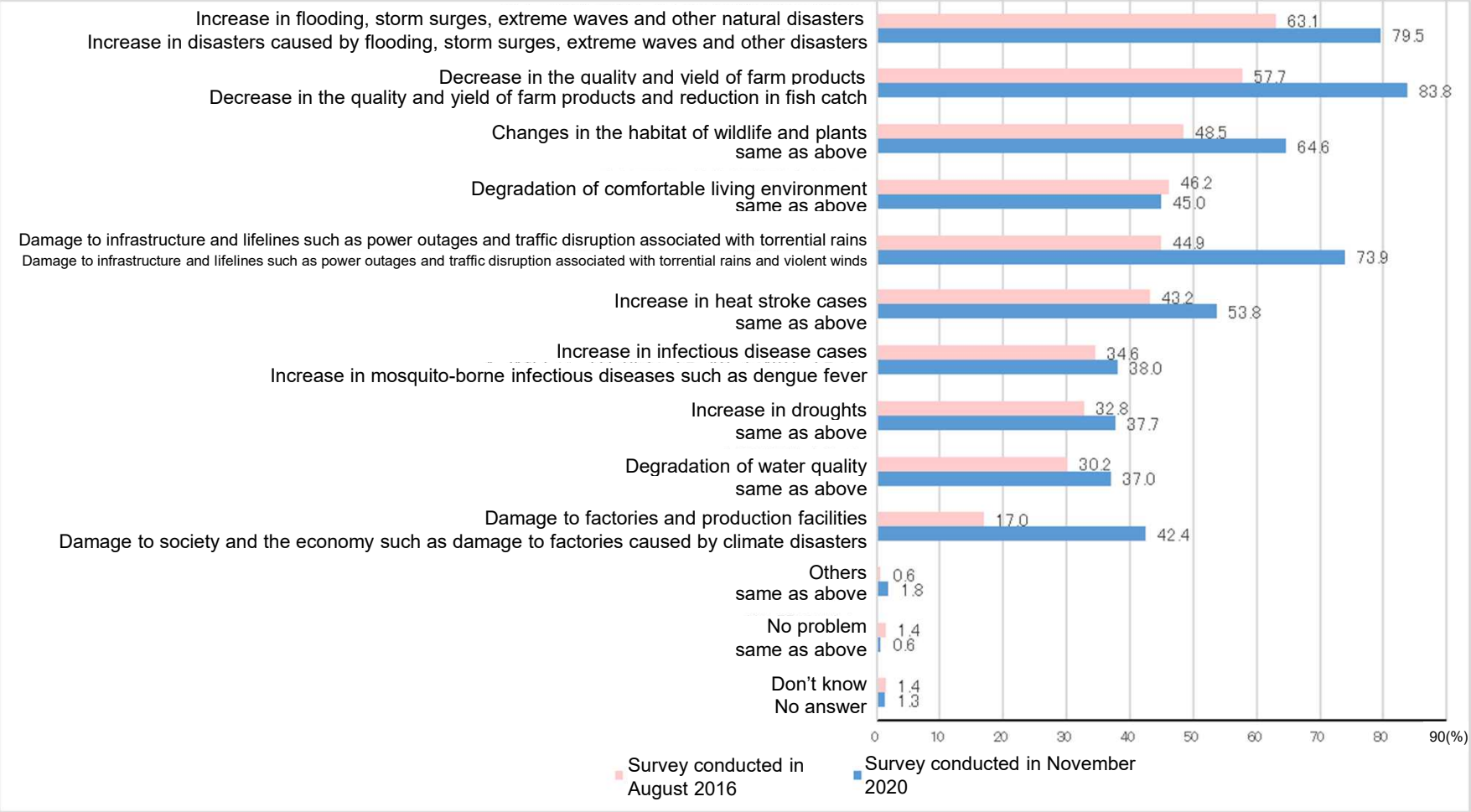
○ Compared to the end of the 20th century, Japan at the end of the 21st century is predicted to experience higher average annual temperatures and an increase in the number of extremely hot days and nights (approx. 2.8-day increase and 9.0-day increase under the 2°C warming scenario and approx. 19.1-day increase and 40.6-day increase under the 4°C warming scenario), a rise in sea level along the Japanese coast, higher frequency of heavy rainfall, and increased typhoon intensity.

* Prediction of future climate is primarily based on the 2°C warming scenario (RCP2.6, corresponding to potential climatic conditions with achievement of the Paris Agreement's 2°C target) and the 4°C warming scenario (RCP8.5, corresponding to potential climatic conditions with achievement with no future additional mitigation measures) adopted in the IPCC Fifth Assessment Report.

2. Increase in disaster risks associated with climate change
Column: Concern about the impacts of climate change including global warming

■ In recent years, the public has become increasingly concerned about the impacts of climate change including global warming. The nation needs to build resilience in the respective regions to enable the sustenance of electric power and transportation services even after a disaster.

[Concern about the impacts of global warming]

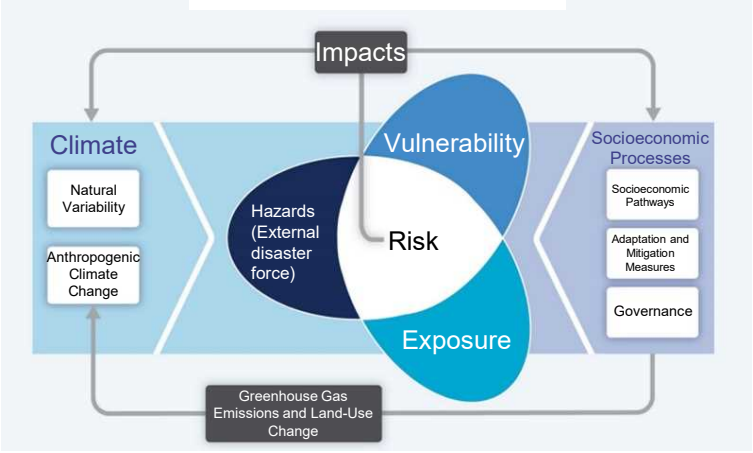


○ According to a Public Opinion Survey conducted by the Cabinet Office, there is a high level of concern about the increase in natural disasters such as floods, storm surges and extreme waves, the impact of disasters on the infrastructure and lifelines such as power outages and traffic disruption, and the impact on farm products and damage to factories and production facilities.

2. Increase in disaster risks associated with climate change
(2) Status and issues concerning climate disaster risks

- There is an idea that climate change risks are determined by the interaction of three factors: hazard (external forces of disaster caused by natural phenomena), vulnerability, and exposure.
- With the projected increase in the population and assets exposed to hazards following urbanization, there is a need to examine the current conditions of the so-called risk areas subjected to exposure so that appropriate steps can be taken against climate disaster risks.

[Climate change risks]



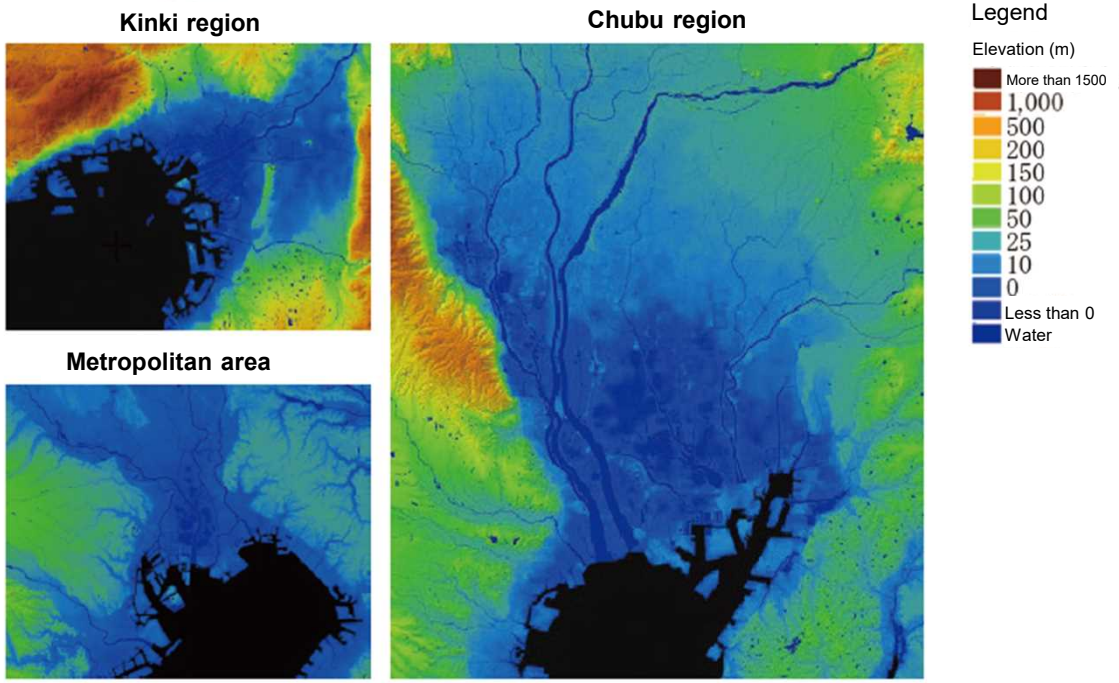
Source) Figure SPM.1, Summary for Policymakers, Working Group II contribution to the IPCC's Fifth Assessment Report

[Area of regions at risk and population]

Type of disaster	Area of regions at risk (Percentage of land area)	Population in regions at risk (2015) (Percentage of total population)	Population in regions at risk (2050) (Percentage of total population)
Flood	Approx. 19,500 km^2 (5.2%)	37.03 million (29.1%)	31.08 million (30.5%)
Sediment disasters	Approx. 10,800 km^2 (2.9%)	5.95 million (4.7%)	3.74 million (3.7%)

○ In Japan, many people live in areas with a high risk of flood and sediment disasters, and are highly vulnerable to such disasters.

[Areas below sea level in the three major urban areas]

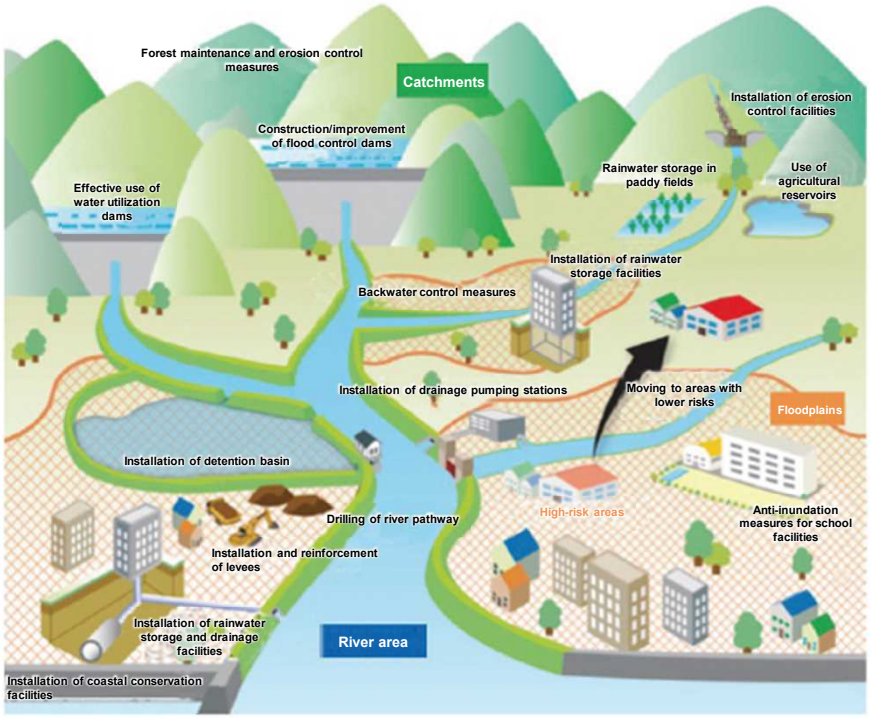


○ The geography around the Tokyo Bay, Osaka Bay and Ise Bay makes them vulnerable to storm surges with areas below sea level spreading around the bay, exposing a large number of people to the risk of storm surge disasters.
○ According to "Climate Change in Japan 2020," the scale of maximum storm surges in the Tokyo Bay, Osaka Bay and Ise Bay are expected to increase.

3. Adaptation strategies to climate disaster risks

- To respond to disaster risks from climate change, more focus should be placed on disaster prevention and mitigation measures, including infrastructure planning (flood control planning, storm surge measures) to cope with vulnerability and river basin disaster resilience and sustainability for all that integrates tangible and intangible measures against exposure.
- It is important to review flood control plans in consideration of predicted increases in rainfall associated with climate change and take other steps as necessary.

[“River basin disaster resilience” involving all stakeholders]



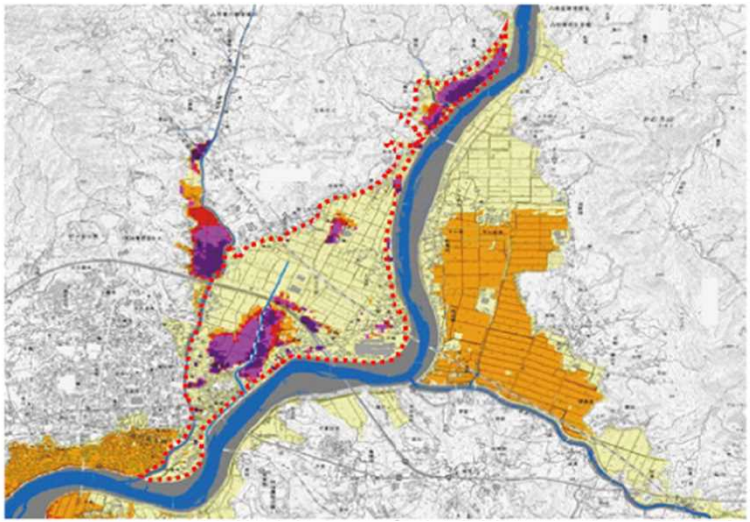
○ To respond to water-related disaster risks from climate change, it is important that all stakeholders involved in the river basin area work together on flood control measures in the entire area from tangible and intangible aspects in accordance with regional characteristics to promote “river basin disaster resilience and sustainability by all.”
○ To reduce exposure, it is important to launch measures involving land use and ways of living in the floodplains, and to promote safe urban planning which may include encouraging people to reside in certain areas based on the demographics and land use.

[Risk map for water-related disasters (Map showing inundation frequency)]

Legend for water-related disaster risk map *2

- : High frequency (1/10)
- : Medium to high frequency (1/30)
- : Medium frequency (1/50)
- : Low frequency (1/100)
- : Estimated maximum scale

*2 Figures in parentheses indicate the probability scale, which are shown for illustrative purposes only.



Areas covered by analysis of flooding of inland waters

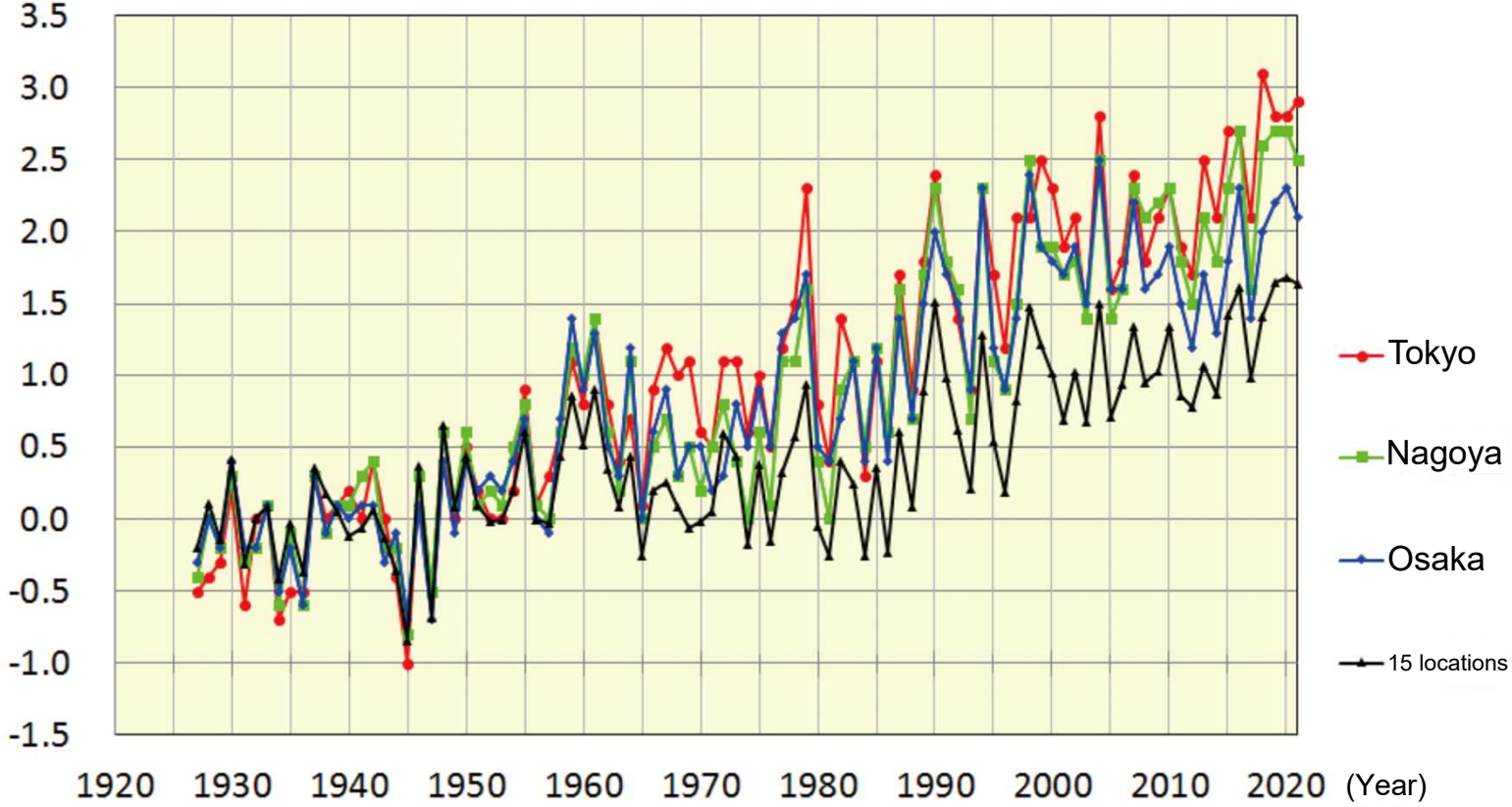
*1 The water-related disaster risk map in this document shows areas where inundation above the floor level (50 cm or more) can occur. (Provisional version)

○ Measures to mitigate damage include the development of new "Flood Risk Maps (Flooding Frequency Maps)" which illustrate the correlation between the scope and frequency of inundation in an easy-to-understand format. This helps expand the breadth of flood risk information and promote the use of land for disaster prevention and mitigation.
○ The provision of flood risk information helps support private-sector efforts to disclose climate change risks including TCFD compliance.

3. Adaptation strategies to climate disaster risks
Column: Advance of urbanization and heat island phenomenon

- Temperatures have risen by approximately 1.6˚C over about a century from 1927 to 2021 in locations where urbanization has had relatively little impact, while an increase of 3.3˚C was registered in Tokyo during the same period.
- In the face of prediction for higher temperatures and an increase in the number of extremely hot days and nights with sweltering heat, city centers that experience intense heat island phenomenon caused by urbanization would benefit greatly from the creation of cool and comfortable spaces by planting lawns, greening and other means.

[Long-term changes in annual average temperatures in major cities]



(Note)
1 Deviations in annual average temperatures refer to the differential from the mean value between 1927 and 1956.
2 The 15 locations where the impact of urbanization is considered to be relatively small were chosen from among the ground meteorological observation locations across the nation. The locations were selected without regional bias to ensure the homogeneity of observation data over the long-term (Abashiri, Nemuro, Suttu, Yamagata, Ishinomaki, Fushiki, Iida, Choshi, Sakai, Hamada, Hikone, Miyazaki, Tadotsu, Naze, Ishigakijima Island).
3 The graph shows year-to-year changes in annual mean temperature deviations between Tokyo, Osaka, and Nagoya, and 15 other locations where the impact of urbanization is considered to be relatively small.

Source) Japan Meteorological Agency

○ The heat island phenomenon occurs when a major urban area experiences much warmer temperatures than in nearby rural areas. This is caused by the expansion of areas covered by asphalt or concrete, reduction in vegetation areas, and the impact of heat generated by human activities.

1. Trends towards decarbonized society

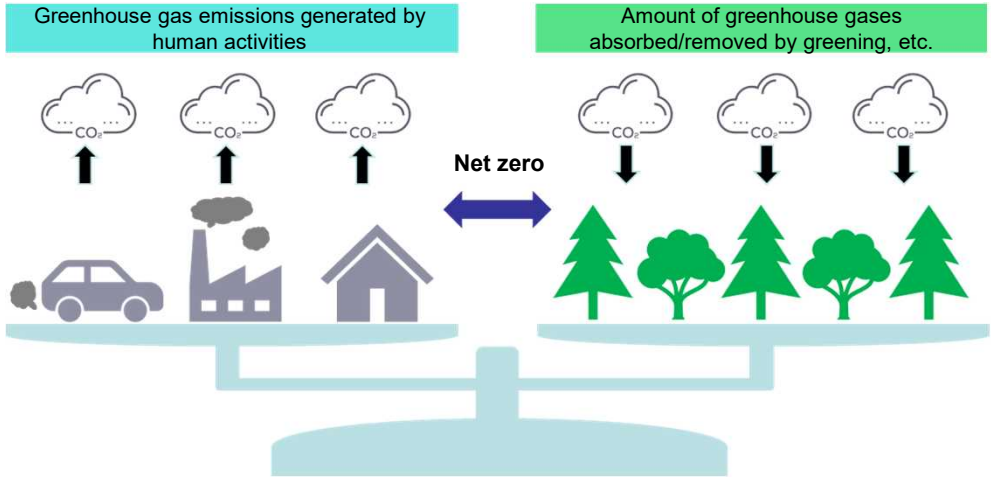
- Many countries/regions have declared carbon neutrality (more than 150 countries as of the end of COP26 (November 2021)). Major countries have also declared their 2030 targets (NDC) as well as carbon neutrality in 2050.
- In October 2020, Japan declared its goal of "achieving net zero emissions of greenhouse gases to realize a carbon-neutral, decarbonized society by 2050."

[Target of major countries based on Paris Agreement]

	2030 target (NDC)	2050 target
Japan	-46%(from FY2013) * In April 2021, Japan pledged to continue working towards a 50% reduction.	Net zero emissions
EU	More than -55% (from 1990)	Net zero emissions
U.K.	More than -68% (from 1990)	Net zero emissions
U.S.	-50 to 52% (from 2005)	Net zero emissions
Canada	-40 to 45% (from 2005)	Net zero emissions
China	Reduce emissions by 2030	Net zero emissions in 2060

○ Japan will seek to "reduce its greenhouse gas emissions by 46% in FY2030 from FY2013 levels, setting an ambitious target in alignment with the long-term goal of carbon neutrality by 2050. Japan will continue its challenge to meet the ambitious goal of cutting its emissions by 50%." Japan submitted its NDC to the UN in October 2021.

[Carbon neutrality]

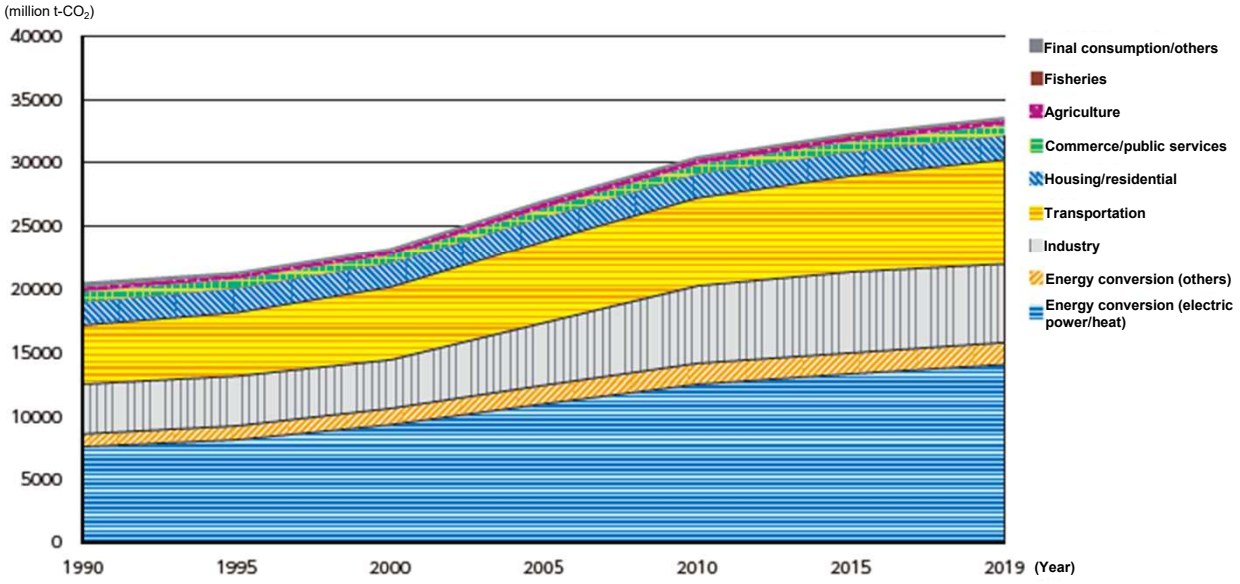


○"Achieving net zero emissions of greenhouse gases" means to bring emissions practically down to zero after subtracting the emissions absorbed by afforestation and forest management from CO_2 and other greenhouse gas emissions.

2. Trends on CO_2 emissions including the impact of COVID-19 around the world

- Global CO_2 emissions dropped in 2020 due in part to the slowdown in industrial, living-related and other human activities compelled by the COVID-19 pandemic, reversing an upward trend that was happening until then.
- According to the Emissions Gap Report 2021 by the UN Environment Programme (UNEP), the COVID-19 pandemic led to a 5.4% drop in global fossil CO_2 emissions in 2020.

[Changes in global CO_2 emissions]



Source) Prepared by MLIT from IEA website

○ Looking at the breakdown of global CO_2 emissions, energy conversion (electric power/heat and others) occupies about 50%, while transportation accounts for about 30%.

[Changes in national CO_2 emissions]

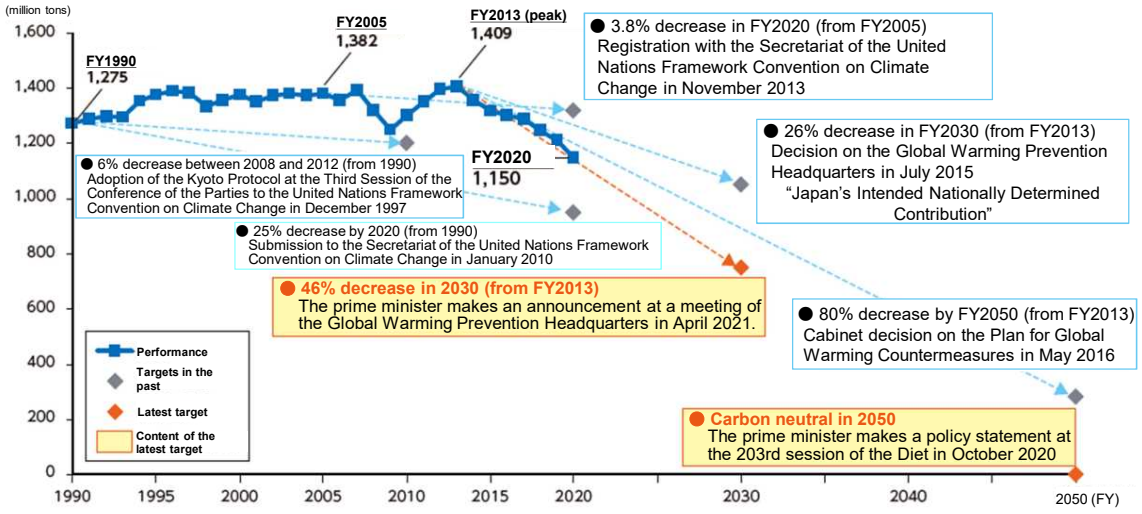
Source) UNEP "Emissions Gap Report 2021"

○ Although major countries registered a year-on-year decrease in CO_2 emissions in 2020, emissions already began to increase relative to 2019 in the first half of 2021 in some countries, such as China, Brazil, and Russia.

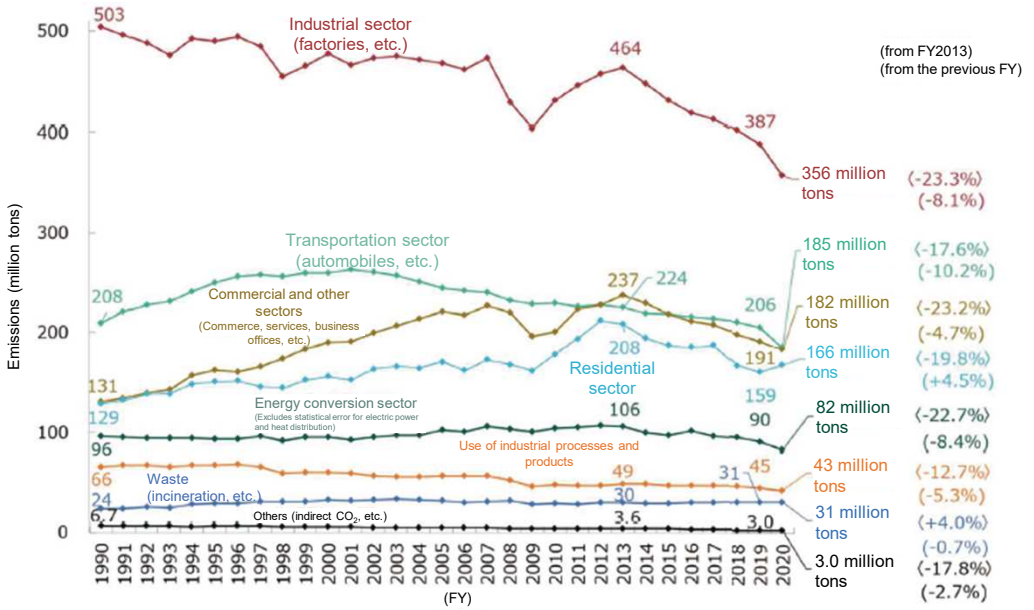
3. Trends on CO_2 emissions including the impact of COVID-19 in Japan (1)

- In FY2020, Japan's total CO_2 emissions fell by 5.8% from the previous fiscal year due in part to the impact of COVID-19. Reduced emissions were registered in all sectors except the residential sector, which showed an increase of 4.5% as more people refrained from going out and spent more time at home.
- Backed by nationwide efforts to cut greenhouse gas emissions since FY1990, emissions in Japan have declined after peaking in FY2013. This is notable in the industrial and commercial sectors, which recorded a reduction of approx. 23% in FY2020 from FY2013 levels. On the other hand, the rate of decrease in the transportation and residential sectors since FY2013 failed to reach 20%, which points to the need to strengthen measures in these sectors.

[Changes in greenhouse gas emissions in Japan]



[Changes in CO_2 emissions by sector]



[CO_2 emissions (FY2020)]

	Emissions (million tons)*	From the previous FY (%)
Total emissions	1,044	- 5.8
Residential sector	166	4.5
Transportation sector	185	- 10.2
Industrial sector	356	- 8.1
Commercial sector	182	- 4.7

The results for FY2020 are affected by the spread of COVID-19 in all sectors.
[Total CO_2 emissions] Impacts of COVID-19 → [-5.8%]
[Industrial sector] Decrease in production in the manufacturing industry due to slowdown in demand → [-8.1%]
[Transportation sector] Decrease in passenger and cargo transport → [-10.2%]
[Commercial and other sectors] Slowdown in the tertiary industry caused by voluntary restraint on going out → [-4.7%]
[Residential sector] Increase in the time people spend at home → [+4.5%]

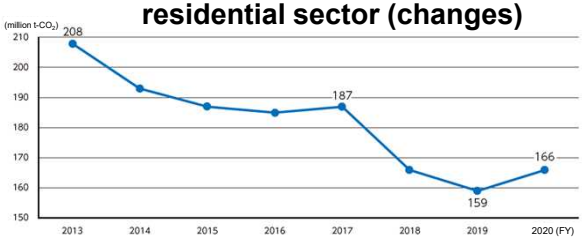
3. Trends on CO_2 emissions including the impact of COVID-19 in Japan (2)

- Energy consumption, and therefore CO_2 emissions, has dropped in the residential sector in recent years along with improvements in the CO_2 emissions intensity of electricity. This is due in part to the growing popularity of energy efficient homes and highly-efficient energy-saving equipment.
- CO_2 emissions have dropped in the transportation sector in recent years, thanks to the growing popularity of next-generation automobiles, improved fuel efficiency, and more efficient truck transportation, among other factors. In FY2020, CO_2 emissions in this sector fell by 10.2% due to a decrease in passenger and cargo transportation volume.

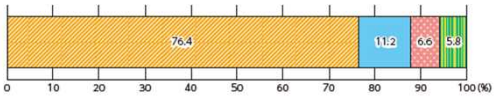
[Trends on CO_2 emissions in the residential sector]

○ With regard to reductions in CO_2 emissions (from FY2013 to FY2019), lighting and home appliances, etc. account for about three-quarters of the total in terms of contribution by application. On the other hand, when reductions in energy consumption are examined by contribution in terms of application (from FY2013 to FY2019), heating accounts for about half of total energy consumption.

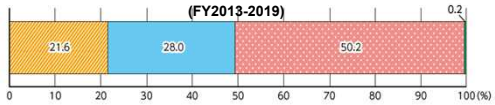
CO_2 emissions in the residential sector (changes)



Contribution to reduction of CO_2 emissions in the residential sector (FY2013-2019)

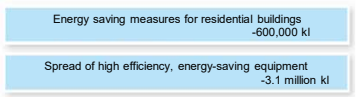


Contribution to reduction of energy consumption in the residential sector (FY2013-2019)

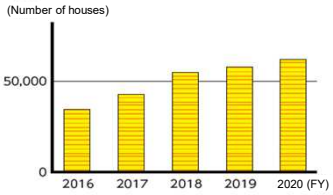


○ Lower energy consumption in the residential sector may be attributed to comprehensive efforts to save energy including the Net Zero Energy House (ZEH), which enhances the thermal insulation performance of homes, and the Top Runner Program, which promotes the use of highly efficient home appliances.

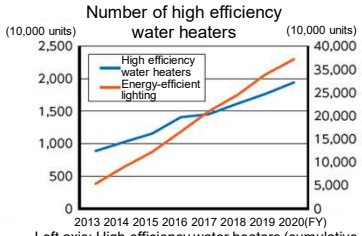
Energy savings in the residential sector (FY2013-2019)



Zero Energy House Number of (ZEH) supplied



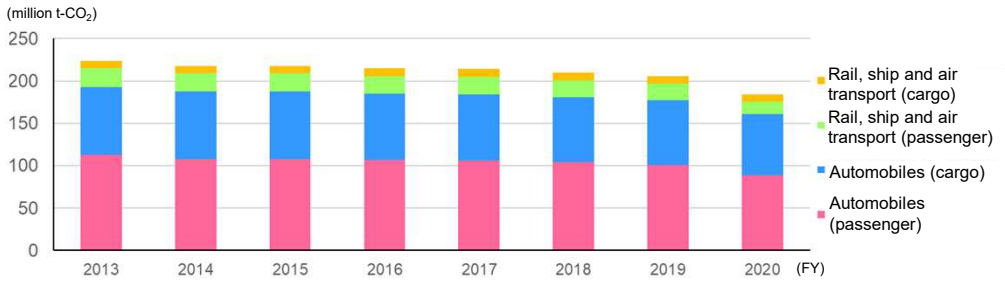
Number of highly efficient water heater and LED lighting units



Left axis: High efficiency water heaters (cumulative number shipped)
Right axis: Number of LED lighting units in use (cumulative number shipped)

[Trends on CO_2 emissions in the transportation sector]

[CO_2 emissions by mode of transportation in the transportation sector (changes)]

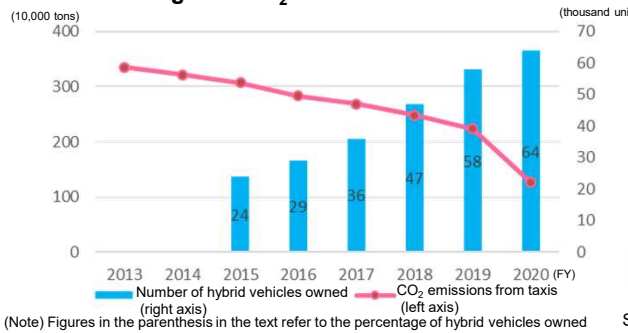


○ Regarding CO_2 emissions by mode of transportation, automobiles are responsible for the majority of the emissions.

[Changes in CO_2 emissions from taxis]

○ In recent years, CO_2 emissions from taxis have been on the decline.
○ More and more taxis have switched to hybrid vehicles, from 24 thousand units (10%) in FY2015 to 64 thousand units (31%) in FY2020.
○ About 90% of newly purchased taxis are hybrid vehicles.

Correlation of changes in CO_2 emissions from taxis and increase in hybrid vehicles



(Note) Figures in the parenthesis in the text refer to the percentage of hybrid vehicles owned among all the taxis owned

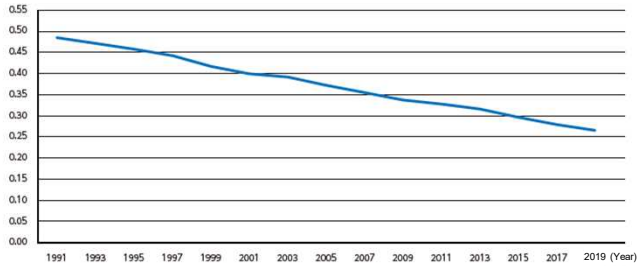
Hybrid taxi

Source) Toyota Motor Corporation

1. Trends on the positive cycle of economy and environment

- Major industrialized countries are taking steps to reduce greenhouse gas emissions while promoting economic growth. Japan, which once enjoyed the world's highest level of carbon productivity, has seen its position slide on the global scene in recent years.
- Japan should strive to realize economic growth without increasing carbon input with climate change measures that take carbon productivity into account, while reducing carbon input by saving energy and other measures.

[Greenhouse gas emissions per unit of GDP]



(Note) Total GHG excl. LULUCF per unit of GDP (Kilograms per 1,000 US dollars, Thousands)
Source) Prepared by MLIT based on OECD Stat.

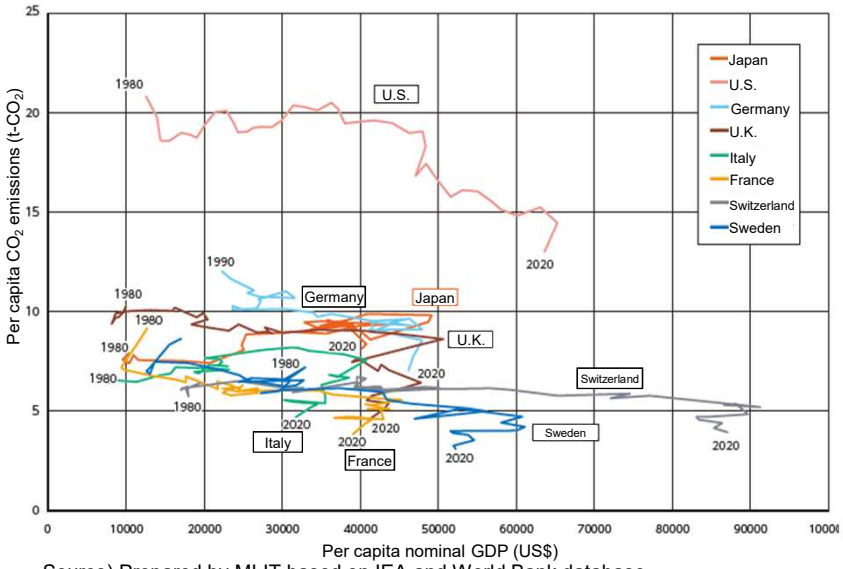
○ For example, in OECD countries, greenhouse gas emissions per unit of GDP have been declining over the past 30 years or so.

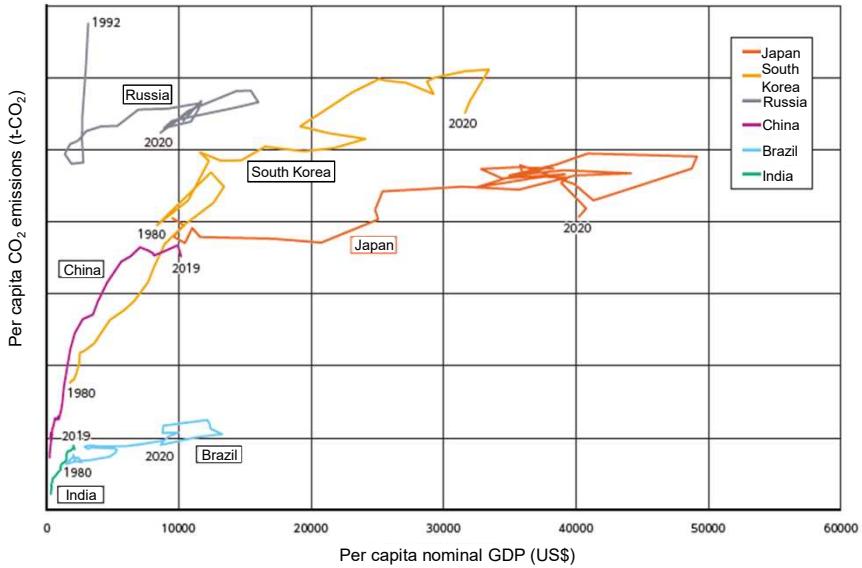
[Carbon productivity approach to climate change measures]

Carbon productivity approach to climate change measures = GDP (¥) ↑ Increase ⇒ Increase in GDP without additional carbon input (Adding value through innovation)

Carbon input (CO_2) ↓ Decrease ⇒ Promoting decarbonization by saving energy and using renewable energy

[Per capita GDP and per capita CO_2 emissions]





Source) Prepared by MLIT based on IEA and World Bank database

○ Changes in GDP per capita and CO_2 emissions differ from country to country. The U.S., Sweden, and Germany, for instance, have experienced an increase in GDP with reduced CO_2 emissions.
○ In China and South Korea, both CO_2 emissions and GDP have increased.
○ In Japan, both CO_2 emissions and GDP have been unstable in recent years. Japan needs to launch measures to increase GDP while reducing CO_2 emissions.

2. Trends of the government towards the positive cycle of economy and environment

- Japan has formulated the “Green Growth Strategy Through Achieving Carbon Neutrality in 2050” as well as the "Regional Decarbonization Roadmap," "Plan for Global Warming Countermeasures," and "Strategic Energy Plan" and launched measures based on these strategies and plans to balance carbon emissions reductions with economic growth.
- Following the formulation of the ongoing Plan for Global Warming Countermeasures, MLIT has formulated the MLIT National Environmental Action Plan.

[Reduction target in the Plan for Global Warming Countermeasures] (Energy-related CO_2 emissions)

Greenhouse gas emissions and absorption (Unit: billion t-CO_2)		Emissions recorded in 2013	Emissions in 2030	Reduction rate	Conventional targets
		14.08	7.60	-46%	-26%
Energy-related CO_2		12.35	6.77	-45%	-25%
Sector	Industry	4.63	2.89	-38%	- 7%
	Commercial and others	2.38	1.16	-51%	-40%
	Residential	2.08	0.70	-56%	-39%
	Transportation	2.24	1.46	-35%	-27%
	Energy conversion	1.06	0.56	-47%	-27%

○ The Plan for Global Warming Countermeasures (October 2021), a comprehensive plan created by the government that was revised to achieve carbon neutrality in 2050 and FY2030 reduction targets, etc., provides a sector-by-sector roadmap for achieving the targets.

○ The reduction rates in FY2030 (from FY2013) are 66% in the residential sector, 35% in the transportation sector, and 51% in the commercial and other sectors, which point to the need to further strengthen the measures.

[Measures by MLIT]

○ MLIT Green Challenge (July 2021)

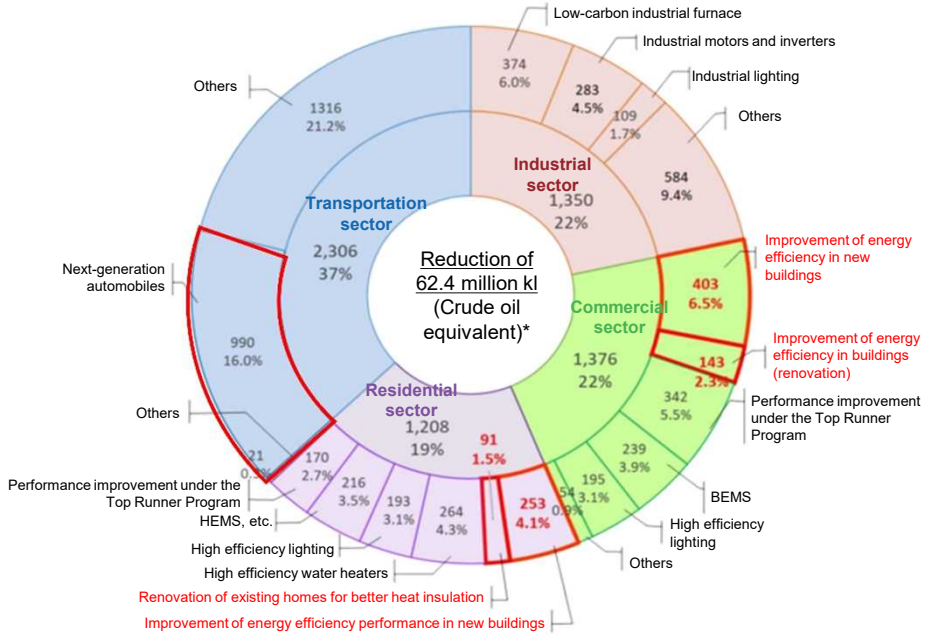
・The Challenge puts together priority projects based on cross-sectoral and public-private sector collaboration in view of FY2030 for the realization of a green society.

・ The Challenge will cover a wide range of areas from housing/buildings to urban development, automobiles/rail/ ships/aviation, traffic/logistics, ports/maritime affairs, and infrastructure to advance the decarbonization of the consumer (residential and commercial) and transportation sectors.

○ MLIT National Environmental Action Plan (December 2021)

The plan presents the direction for land and transportation administration to be tackled toward the realization of a decarbonized society by FY2030.

[Crude oil equivalent of 46% reduction target for FY2030 in the Plan for Global Warming Countermeasures]



○ The "46% reduction target for FY2030" indicated in the Plan for Global Warming Countermeasures is a reduction of 62.4 million kiloliters of crude oil equivalent.

○ Reductions recorded by sector are: 12.08 million kiloliters (19%) in the residential sector and 23.06 million kiloliters (37%) in the transportation sector.

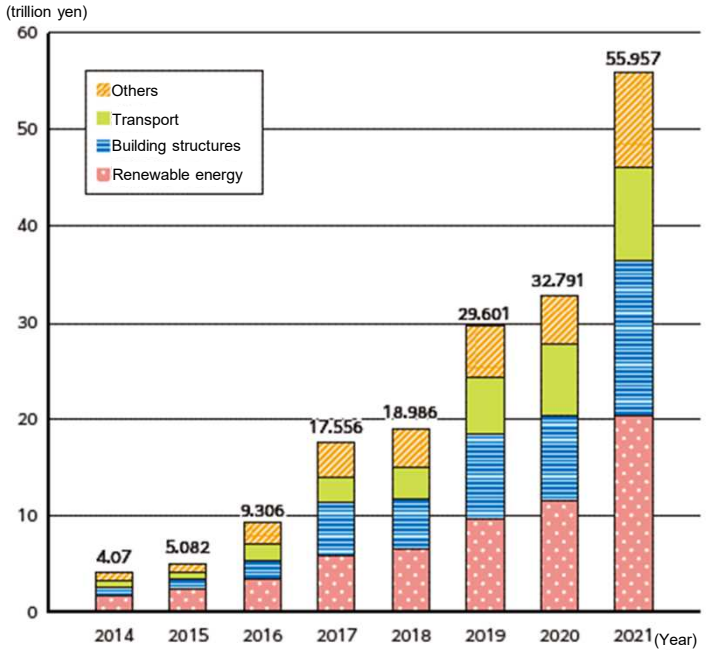
○ Regarding matters that are directly related to our lives in the residential sector, the "improvement of energy efficiency in new buildings" and "renovation of existing homes for better heat insulation," alone account for about 5% of the total (reduction of 3.44 million kiloliters).

○ “Next-generation automobiles” in the transportation sector account for approx. 16% (reduction of 9.90 million kiloliters).

3. Trends of the market towards the positive cycle of economy and environment
(1) Trends of markets related to decarbonization

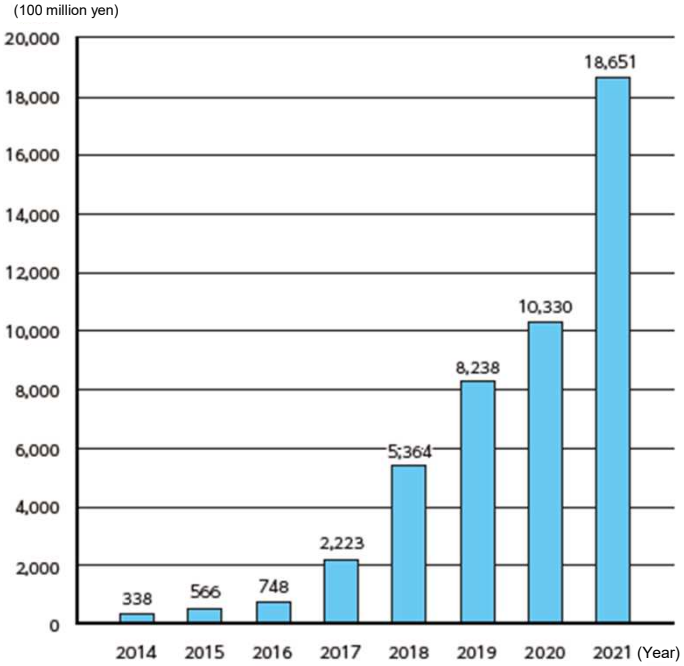
- The scale of the market for global warming countermeasures in Japan has been expanding over the last two decades. Regarding the trends of green project financing, the use of green bonds as a means of financing has accelerated globally in recent years.
- The application of green bonds is also growing in the field of land and transportation including renewable energy, building renovation for higher energy efficiency and construction of the infrastructure for next-generation automobiles.

[Green bonds issued globally]



* Converted to yen at US$1 = 110 yen.
Source) Prepared by MLIT based on the Climate Bonds Initiative website

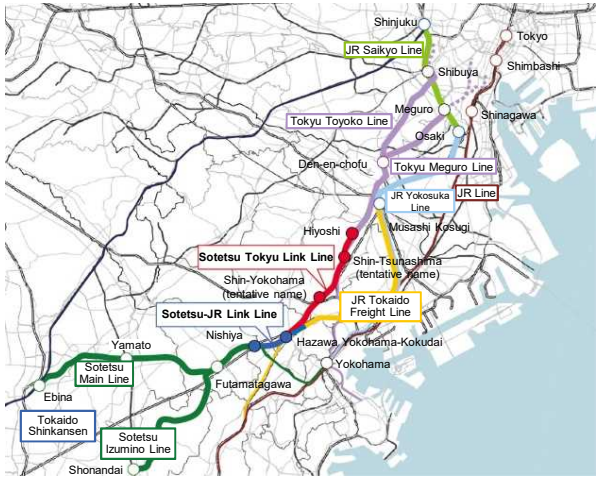
[Green bonds issued by domestic companies]



* Foreign currency-denominated issues are converted into yen at the rate of US$1 = ¥110, €1 = ¥135, and AUD1 = ¥90.

Source) Prepared by MLIT based on "Green Finance Portal" of the Ministry of the Environment

[Examples of eco-friendly transportation systems constructed with green bonds]



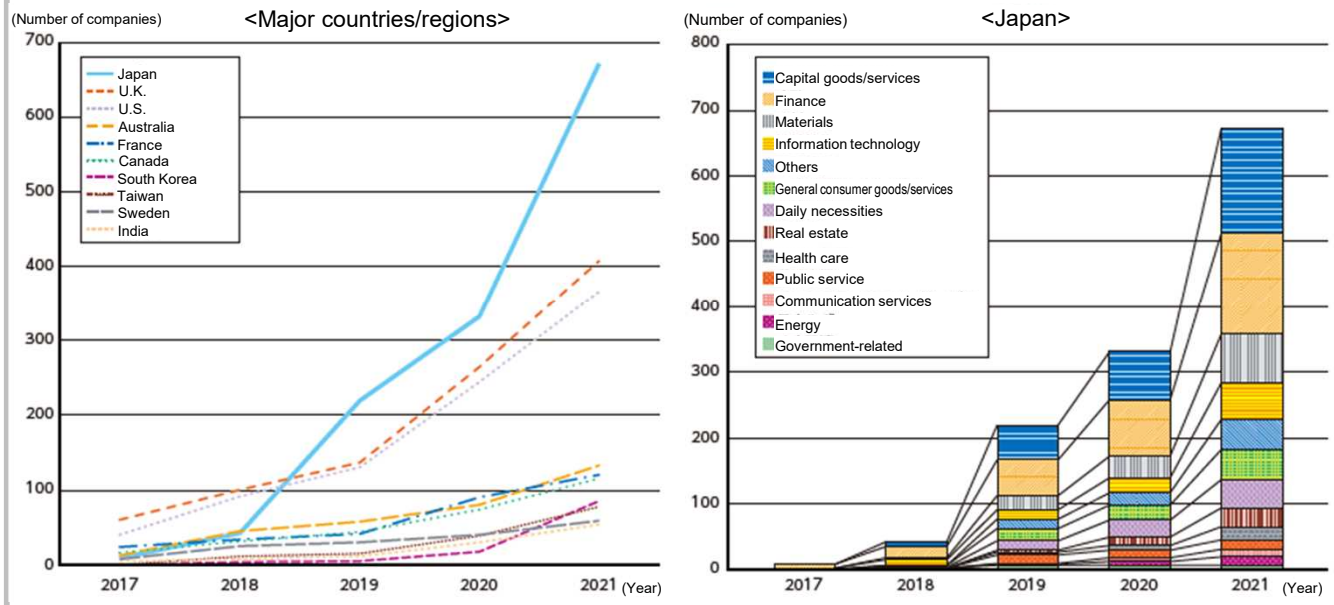
Source) Japan Railway Construction, Transport and Technology Agency

○ Japan Railway Construction, Transport and Technology Agency issued "green bonds" for the construction of "Eastern Kanagawa Lines," a project to enhance the convenience of urban railways that are expected to have an environmental impact.

3. Trends of the market towards the positive cycle of economy and environment
(2) Climate change initiatives in corporate activities

- Concerns over climate change continue to grow globally in all sectors including the private sector, meaning climate change has become a priority management agenda for businesses.
- In the international business and financial sphere, companies are increasingly called on to step up their climate change measures in their business activities. This is evidenced by the global spread of information disclosure initiatives based on the "Task Force on Climate-related Financial Disclosures (TCFD)" recommendations, which recommend the disclosure of climate-related information with financial implications in corporate annual financial reports.

[Number of TCFD supporters (major countries/regions, Japan)]



(Note) Left: Lists the country/region of ten top-ranking supporting companies as of the end of 2021
Source) Prepared by MLIT from TCFD website

○ The number of businesses that support TCFD is growing rapidly in Japan. In the real estate industry, the number of supporting businesses in 2021 has more than tripled from 2019 levels.

[Examples of response to TCFD]
(Column: Response of Kajima Corporation to TCFD)

Source) Kajima Corporation

○ Kajima Corporation has announced its support for the TCFD and has disclosed information on items and measures related to climate-related risks and opportunities.

○ For example, Kajima has identified various decarbonization-related restrictions based on national emissions targets and other factors as risks and committed itself to the development of construction materials that fix CO_2 such as CO_2-SUICOM* and other low-carbon construction materials to reduce construction-related CO_2 emissions.

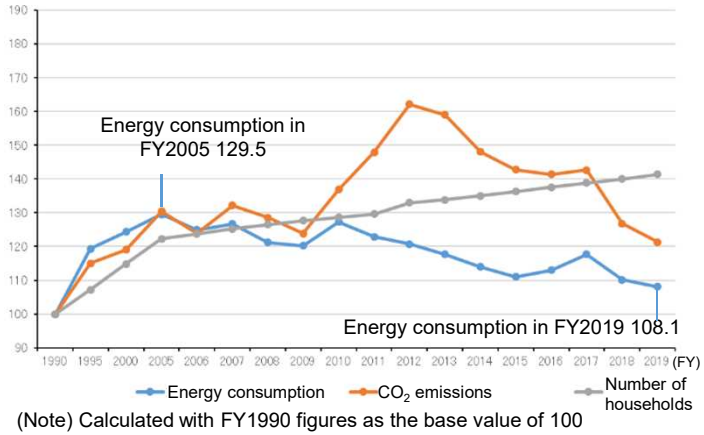
*CO_2-SUICOM：A construction material that fixes CO_2 by absorbing and storing it in the process of concrete hardening.

1. Challenges and direction of measures for decarbonization of homes and buildings (1) Trends of energy consumption in the civilian sector

■ Energy consumption in the civilian (household and commercial) sector has been on a downward trend. However, comprehensive efforts are needed to promote the decarbonization of homes and buildings by considering the steps to be taken in the operational aspects such as ways of living in addition to measures concerning houses, buildings and other tangible elements.

(1) Current situation and challenges

[Changes in CO_2 emissions, energy consumption and number of households (residential sector)]

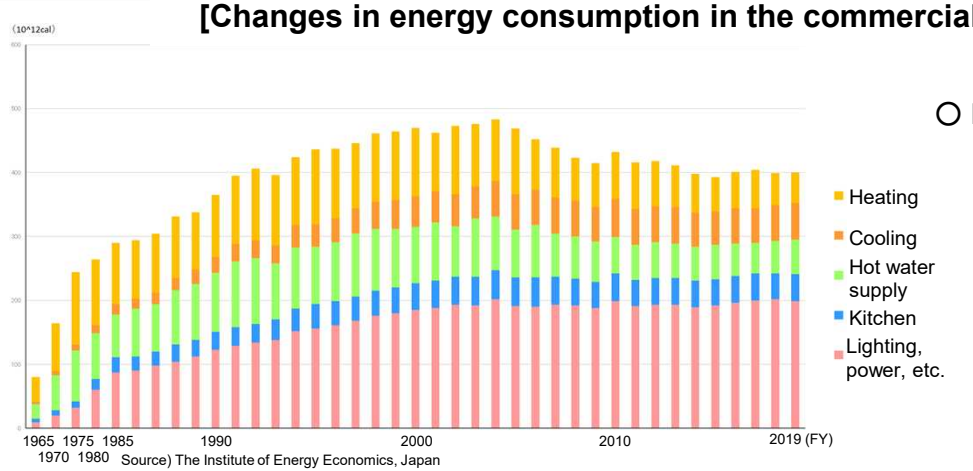


(Note) Calculated with FY1990 figures as the base value of 100
Source) The Institute of Energy Economics, Japan
[Prepared by MLIT based on "EDMC handbook of Japan's & world energy & economic statistics, FY2020 edition" (published by RIKOH TOSHO)

○ Energy consumption (residential and commercial sectors) increased from FY1990 levels to occupy some 30% of total energy consumption at present.

○ Energy consumption in the residential sector has continued to grow since FY1990, reaching 129.5 in FY2005 from 100 in FY1990. The amount, however, has since dropped to 108.1 in FY2019 due, in part, to the spread of energy-efficient technologies and the mounting power and energy consciousness among the public following the Great East Japan Earthquake.

[Changes in energy consumption in the commercial sector]



Source) The Institute of Energy Economics, Japan
[Prepared by MLIT based on "EDMC handbook of Japan's & world energy & economic statistics, FY2020 edition" (published by RIKOH TOSHO)

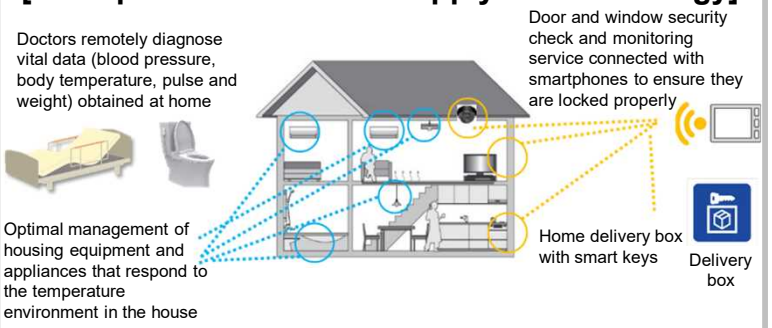
○ Energy consumption in the commercial sector continued to occupy a high percentage of total energy consumption for "lighting, power, etc." due to the impact of office automation and other factors, reaching approximately 50% in FY2019.

(2) Direction

○ To further promote energy efficiency in the civilian sector, it is necessary to strengthen the insulation of homes and buildings, improve the efficiency of heating and cooling systems, and increase the efficiency of lighting and other equipment along with improved energy management.

(3) Moves toward social implementation

[Examples of houses that apply IoT technology]



○ The introduction of HEMS (Home Energy Management System) helps optimize and visualize energy production and consumption and enables efficient energy consumption.

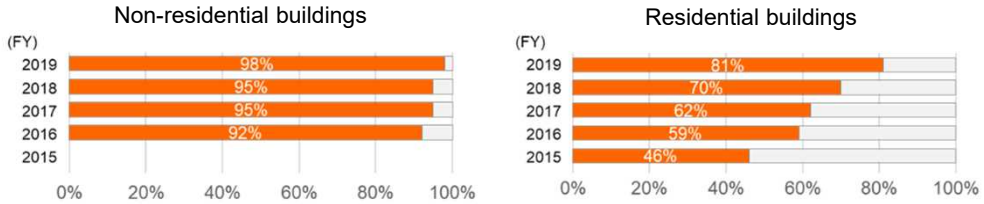
○ With IoT technology, camera-equipped door phones connected to the Internet enables the monitoring of children and elderly people from places away from home. The technology can also benefit delivery providers by reducing the instances of redeliveries when no one is home.

1. Challenges and direction of measures for decarbonization of homes and buildings (2) Challenges and direction of measures for promoting energy efficiency in homes

- The decarbonization of homes calls for a reduction of the amount of energy required for heating, cooling, and other residential uses. This will require, among others, building new houses or renovating existing ones to achieve higher energy efficiency and insulation performance, and installing energy-efficient equipment.
- Compliance with the energy efficiency standards for residential and small-scale buildings (new construction) will be mandated by FY2025. The widespread use of homes and buildings with ZEH/ZEB level energy efficiency performance targets further energy savings.

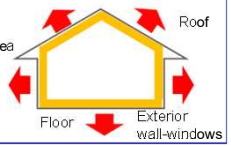
(1) Current situation and challenges

[Changes in energy efficiency standard compliance rates for homes and buildings]



○ The energy efficiency standard compliance rates for homes and buildings in FY2019 exceeded 80%, or 98% for all non-residential buildings and 81% for homes.

[Energy efficiency standard of homes]

Primary energy consumption standard (applied to both homes and buildings)	Envelope performance (applied to homes only)
Primary energy consumption must be equal to or less than the standard. * "Primary energy consumption" = AC energy consumption + ventilation energy consumption + lighting energy consumption + hot water supply energy consumption + elevator energy consumption + other energy consumption (such as OA equipment) - energy generated by photovoltaic (PV) power generation equipment, etc. (confined to self-consumed energy)	Heat loss per surface area of the envelope (exterior walls, windows, etc.) (average U-value of the envelope, etc.) must be equal to or less than the standard value. * "Average U-value of the envelope" - Total heat loss/surface envelope area <Image of heat loss through the envelope> 

○ Energy efficiency standards refer to the "energy consumption performance standards of buildings" established by the Act on the Improvement of Energy Consumption Performance of Buildings. They are the mandatory standards for building structure and equipment necessary to ensure the energy efficiency performance, comprising "envelope performance" for heat insulation performance, etc. and "primary energy consumption standard" for energy consumption.

(2) Direction

○ Residential and small-scale buildings (new construction) are not covered by the energy efficiency standards at present. Compliance with the standards for such buildings will be mandated by FY2025.
○ For new homes and buildings to be constructed in FY2030 or later, the target is to ensure energy efficiency performance on par with the ZEH/ZEB standard.
○ Another target is to ensure that the energy efficiency performance of the average stock of homes and buildings will be on par with the ZEH/ZEB standard by 2050.

(3) Moves toward social implementation

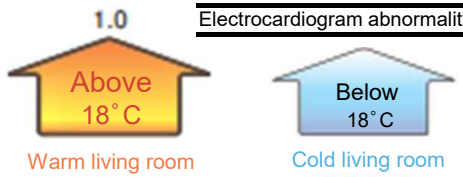
[Health impact of better heat insulation in homes]

Results of health checks

Comparison at room temperature (below 18˚C: above 18˚C)
Differences revealed in health checks

Health checks on people who live in homes with room temperatures below 18 ˚C and those living in homes with temperatures above 18˚C revealed that the former were about 1.9 times more likely to experience electrocardiogram abnormality and 2.6 times more likely to have higher-than-standard cholesterol levels.

Total cholesterol	2.6 times higher
Electrocardiogram abnormality	1.9 times



Source) Japan Sustainable Building Consortium

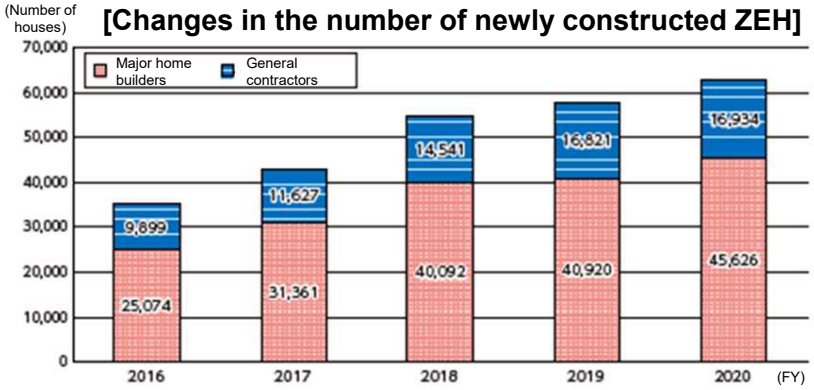
○ Homes with high insulation performance offer health benefits as well.
○ Analyses have shown that the proportion of people who experience higher-than-standard cholesterol levels and electrocardiogram abnormalities are significantly higher among those who live in homes with room temperatures below 18˚C compared with those living in homes with temperatures above 18˚C.

1. Challenges and direction of measures for decarbonization of homes and buildings
(3) Challenges and direction of dissemination of Net Zero Energy House and Buildings (ZEH, ZEB)

- It is important to promote energy conservation by using highly efficient equipment in airtight, highly insulated homes and buildings and to move towards net energy zero by generating the energy consumed in homes and buildings.
- Efforts will be made to encourage the use of ZEH/ZEB and expand the measures for existing stocks to promote the introduction of PV power generation equipment.

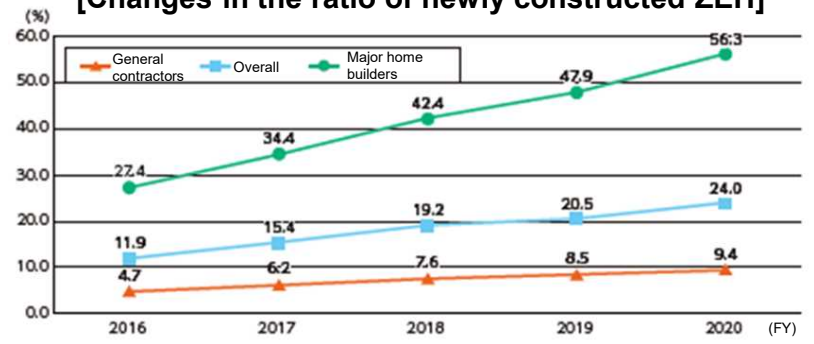
(1) Current situation and challenges

[Changes in the number of newly constructed ZEH]



○ Looking at the record of ZEH homes, the number of units supplied increased steadily from approx. 35,000 in FY2016 to approx. 63,000 in FY2020.

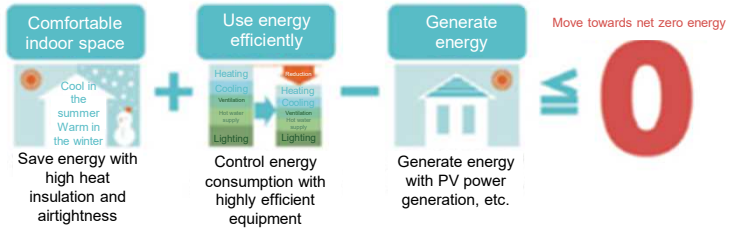
[Changes in the ratio of newly constructed ZEH]



Source) Sustainable open Innovation Initiative
Prepared by MLIT based on "Presentation of Survey on ZEH Demonstration Project 2021"

○ The percentage of ZEH among new custom-built houses is about 24% overall, although the figure is 56% for houses built by leading major home builders.

[Net Zero Energy House (ZEH)]



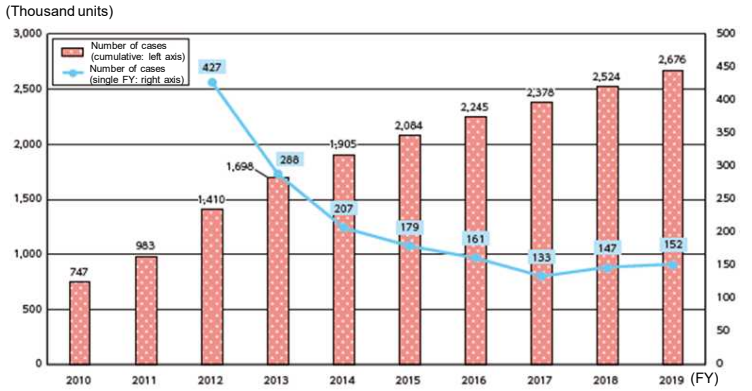
Save energy with high heat insulation and airtightness

Control energy consumption with highly efficient equipment

Generate energy with PV power generation, etc.

○ Net Zero Energy House (ZEH) refers to a house that cuts primary energy consumption by 20% or more from the energy efficiency standards with energy saving measures and reduces primary energy consumption by 100% or more with the introduction of renewable energy and other means.

[Changes in the cases of residential solar PV systems installed in homes]



Source) Prepared by MLIT based on the 62nd Procurement Price Calculation Committee (Japan Photovoltaic Energy Association)

○ The cumulative number of residential PV systems installed in homes by FY2019 reached approx. 2.67 million 6,000 units.

(2) Direction

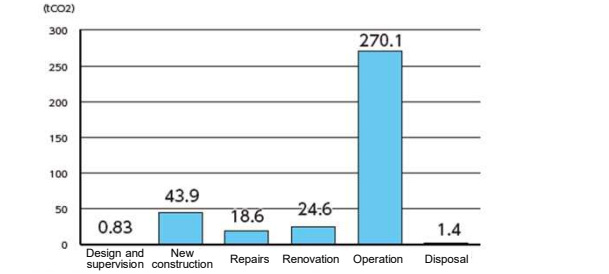
○ The goal of the Sixth Strategic Energy Plan and other plans is to establish a general practice of installing, by 2050, PV power generation equipment and other renewable energy devices in homes and buildings where such installation would be considered rational. The interim target for 2030 is to have PV power generation equipment installed in 60% of newly constructed houses.

1. Challenges and direction of measures for decarbonization of homes and buildings
(4) Challenges and direction of decarbonization through the lifecycle of a house - Part 1

■ It is important to reduce CO_2 emissions during the home construction and renovation phases, and also after the house is constructed and put to use. The reduction of CO_2 emissions during the cycle of "construction," "residency," and "repair, renovation, and demolition" can be advanced by promoting the introduction of LCCM (Life Cycle Carbon Minus) houses. At the same time, the emphasis should be placed on disseminating LCCM houses and fuel cells to encourage the use of renewable energy and to realize economic growth through the expansion of related markets.

(1) Current situation and challenges

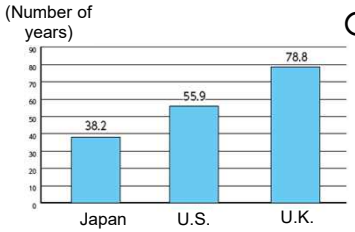
[Evaluating CO_2 emissions by life cycle assessment]



(Note) 1 Standard values are adopted for operation and LCCM house values are used for items other than operation.
2 Trial calculation using an assumption of total floor area of 145.68m² for a 60-year service period.

○ The "life cycle assessment," which evaluates the CO_2 emissions of a house at each stage from new construction to disposal, shows that CO_2 emitted during operation (during residency) constitutes about 75% of volume for the overall life cycle. On the other hand, measures should be taken with a view to the overall life cycle of a house including CO_2 emitted in stages other than operation, which accounts for about 25% of the total.

[International comparison of average post-construction life of a house]



○ Currently, the average post-construction life of a house (so-called lifespan of a house) is about 38 years in Japan. This is much shorter than approx. 56 years in the U.S. or 79 years in the U.K.

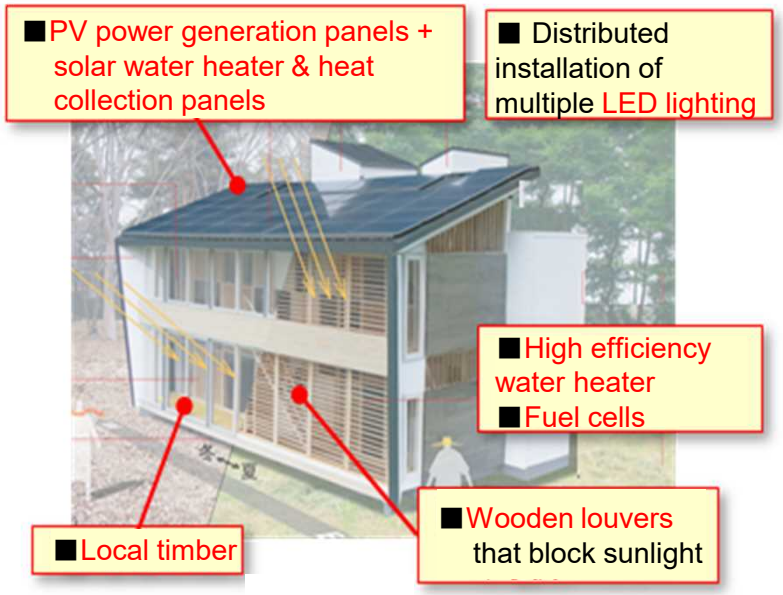
(2) Direction

○ Support for the introduction of carbon-minus houses throughout the entire lifecycle, from construction to demolition and reuse
→Related markets will expand due to better insulation performance, promotion of renewable energy use, and wider use of fuel cells, etc.

[Example of rental LCCM collective housing]

(Column: First "Rental LCCM collective housing" in Japan)

Examples of LCCM homes



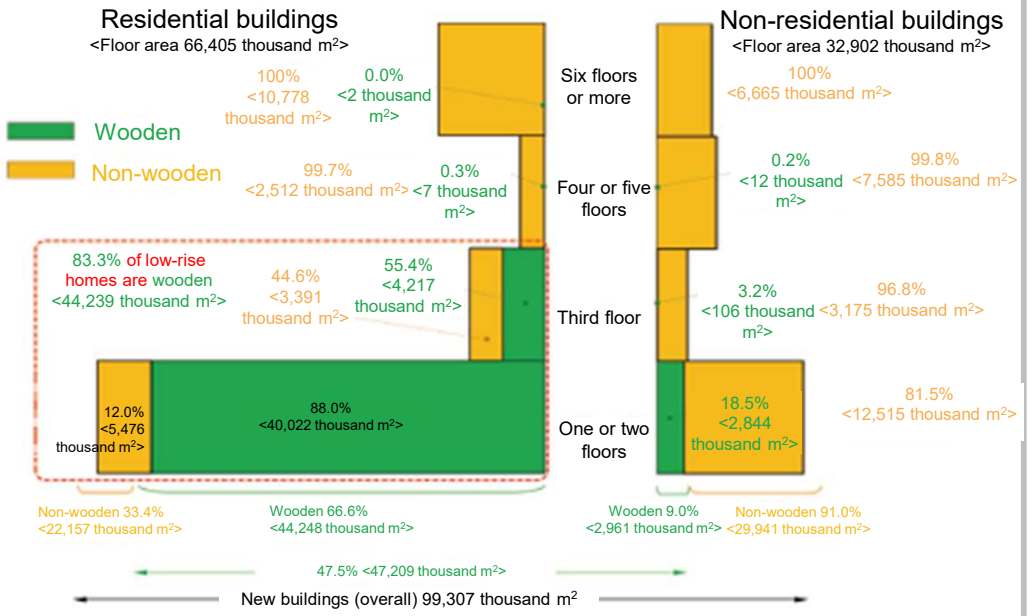
Source) Daito Trust Construction Co., Ltd.

1. Challenges and direction of measures for decarbonization of homes and buildings
(4) Challenges and direction of decarbonization through the lifecycle of a house - Part 2

■ Because trees absorb CO_2 in the course of their growth, the use of wood as a housing/building material can effectively function as a carbon sink. The application of timber for structure and interior design in homes and buildings encourages forest resource recycling as more trees are "cut, used, and planted." It is important to take steps to expand the use of wood as a carbon sink.

(2) Future direction

[Percentage of wooden buildings in new construction]



(Note) 1 Covers newly constructed houses only. Extensions and reconstructions are not included.
2 Houses include "Buildings exclusively for residential use," "quasi-residential buildings," and "residential/industrial buildings"

○ The home and building sector accounts for approx. 40% of total demand for timber in Japan.
○ Among newly constructed private buildings, some 80% of newly constructed structures are made of wood for low-rise residential buildings, while the ratio is about 20% for low-rise non-residential buildings. In the future, the use of wood should be expanded in mid- and high-rise residential and non-residential sectors.

(3) Recent moves toward technological innovation and social implementation

[Image of timber use in mid- and high-rise residential and non-residential sectors]


(Collective housing)


(Business office)

[Image of environmental tree city]
(Column: Application of timber for structure and interior design in homes and buildings)


Source) Sumitomo Forestry Co., Ltd.

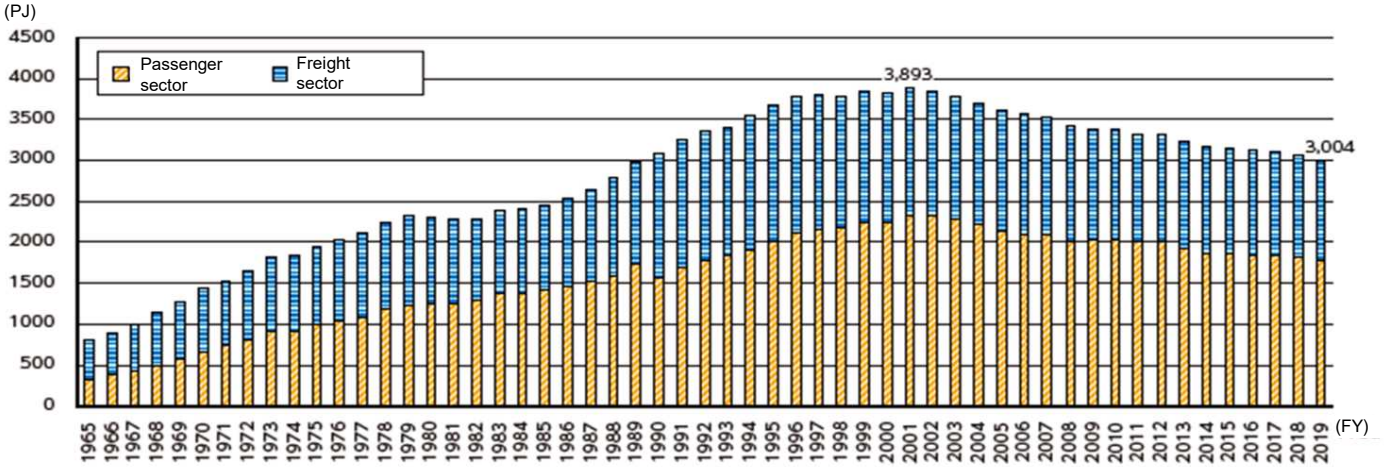
○ A research and technology development concept, which seeks to realize an environmental tree city by 2041, has been announced.

2. Challenges and direction of measures for decarbonization of transport and logistics

(1) Trends of energy consumption in the transportation sector

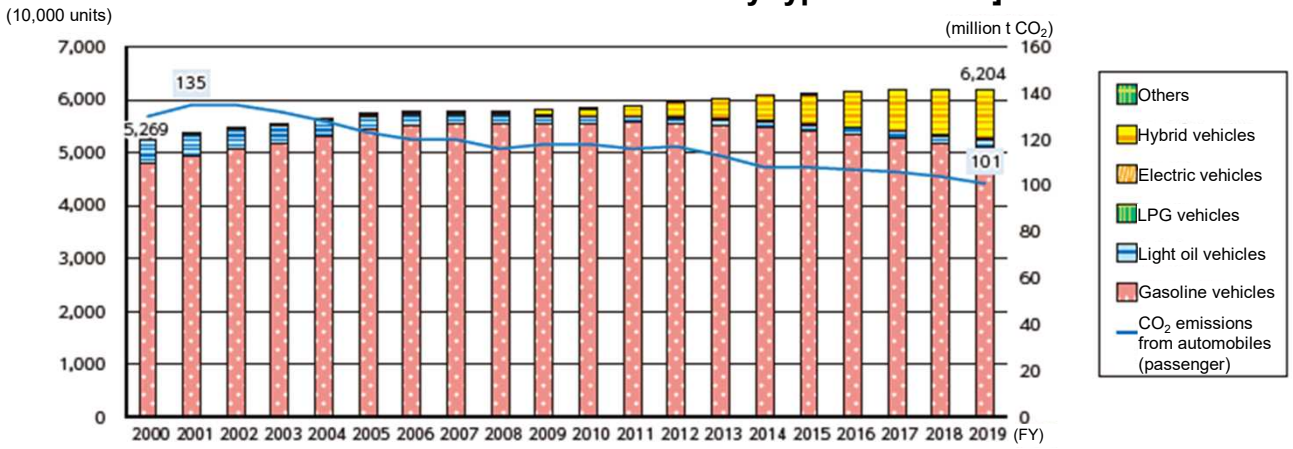
- The reduction of CO_2 emissions expanded in FY2020 due, in part, to the impact of COVID-19. To achieve the FY2030 emissions reduction target (35% reduction from FY2013), continuous efforts to reduce total energy consumption would be crucial.
- Comprehensive measures that would be required include the utilization of public transportation and modal shift, in addition to stand-alone initiatives such as the promotion of next-generation automobiles and the facilitation of traffic flow.

[Changes in energy consumption in the transportation sector (passenger and freight sectors)]



○ Energy consumption in the transportation sector was 3,004 PJ (petajoules) in FY2019.
○ Energy consumption doubled between FY1965 and FY1973, a period of rapid economic growth, peaking at 3,893 PJ in FY2001 and declining since then due to a drop in transportation volume and improved transportation efficiency.

[CO_2 emissions from automobiles in the passenger sector in the transportation sector, number of automobiles owned by type of vehicle]



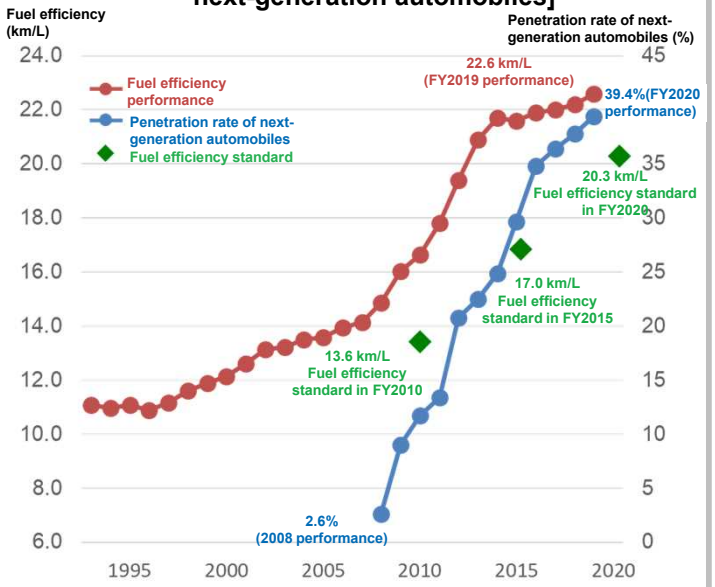
○ Regarding changes in CO_2 emissions in the transportation sector, emissions have climbed since the early 1990s due to an increase in the size of passenger cars and the number of automobiles owned. However, emissions have declined after peaking in FY2001, thanks to the introduction of fuel efficiency standards under the Top Runner Program, Green Tax System, and other factors.
○ CO_2 emissions from automobiles in the passenger sector have decreased notably since FY2013, due to improved fuel efficiency resulting from the growing popularity of hybrid and electric vehicles.

2. Challenges and direction of measures for decarbonization of transport and logistics
(2) Challenges and direction of dissemination of next-generation automobiles

- Approx. 86% of CO_2 emissions in the transportation sector (FY2019) are attributed to automobiles and about 46% to private passenger vehicles.
- Also, the percentage of new next-generation automobiles sold is growing every year, with the number of charging facilities steadily increasing.
- To encourage the use of next-generation automobiles, measures will be launched on the utilization of fuel efficiency regulations, cost reduction, and improve convenience. Other steps include the examination of the possibility of installing EV chargers on public roads and supporting research and development of systems for dynamic wireless charging of vehicles in motion.

(1) Current situation and challenges

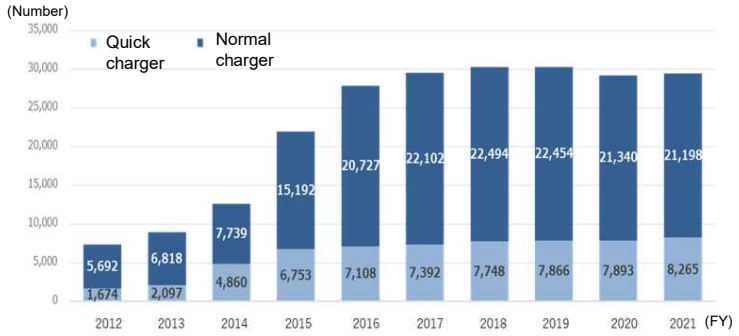
[Fuel efficiency performance and penetration rate of next-generation automobiles]



○ Next-generation automobiles (EVs, FCVs, PHVs, HVs, etc.) constituted 2.6% of newly sold automobiles in 2008. The rate climbed steadily each year, reaching 39.4% in 2020. On the other hand, the share of electric vehicles among the sales of new commercial vehicles (light-duty vehicles) remains insignificant.

○ In March 2020, the new Fuel Efficiency Standards for Passenger Vehicles (FY2030 standards), which require a 32.4% improvement from the actual fuel efficiency in FY2016, was formulated.

[Number of locations of public charging stations installed]



(Note) Number of locations of chargers for electric and plug-in hybrid vehicles
Source) Prepared by MLIT based on information by ZENRIN DataCom

○ Chargers for electric and plug-in hybrid vehicles were installed at 29,463 locations as of the end of FY2021. Quick chargers numbered 8,265, showing a steady increase.

○ There are 157 hydrogen charging facilities (hydrogen stations) in Japan (as of January 2022).

(2) Direction

○ The target is to install 150,000 charging stations including 30,000 quick chargers to achieve the convenience of gasoline-powered vehicles by 2030 at the latest. In addition, about 1,000 hydrogen stations will be installed by 2030 to realize the optimal layout by considering the flow of people and logistics.

○ The target for passenger cars is to make 100% of the new vehicles sold electric by 2035. The goal for commercial vehicles is to raise the proportion of electric vehicles among newly purchased units to 20-30% by 2030 and that of electric and decarbonized fuel-compatible vehicles to 100% by 2040 for light vehicles of 8 tons or less.

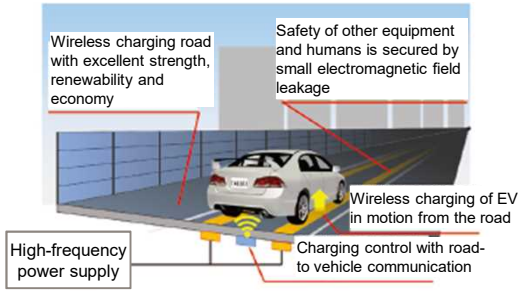
(3) Moves toward social implementation

[Technology that supports transition to next-generation automobiles]

EV charger installed on public road in Yokohama City as a social experiment

Social experiment to confirm safety, user needs, impact on surrounding traffic, etc.

Supporting research on dynamic wireless charging of vehicles in motion



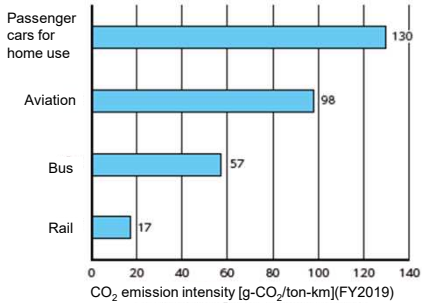
Wireless charging of vehicles in motion is expected to provide a solution to issues such as cruising distance

○ Support for the examination of the installation of EV charging facilities on public roads and research and development of dynamic wireless charging system of vehicles in motion.

2. Challenges and direction of measures for decarbonization of transport and logistics
(3) Challenges and direction of promotion of the use of public transport

- The challenge is to encourage a shift from private passenger cars to public transportation to build a transportation system with a smaller environmental impact.
- Enhancing the convenience of and revitalizing local public transportation systems will contribute to the reduction of environmental impact through the promotion of public transportation use, and support the development of the local economy. Securing means of transportation for local residents can also secure and improve their quality of life.

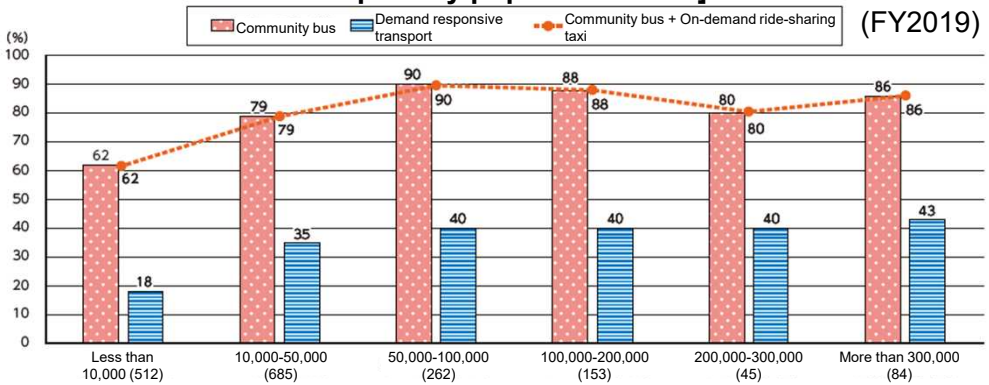
(1) Current situation and challenges



[CO_2 emissions per transport volume (passenger)]

○ Looking at CO_2 emissions per unit transportation volume (in terms of passenger-kilometers) by mode of transportation, the volume compared to private passenger cars is two-fifths for buses, three-fourths for aviation, and one-eighth for rail.

[Status of the introduction of community buses and Demand responsive transport by population scale]



○ Efforts are under way to introduce on-demand transportation as a public transportation system to secure means of transportation in the region.

○ By population size, the adoption rate among municipalities with a population of less than 10,000 is low at 62%, compared to 80% to 90% in other cities with different population sizes.

○ The challenge is to secure and maintain a regional public transportation system under threat and to revitalize transportation services to respond to the lives and mobility needs of the community in the post-COVID era.

(2) Direction

[LRT, Green Slow Mobility]

○ The target is to reduce CO_2 emissions by 1.62 million tons by promoting the use of public transportation and increasing the traffic volume switched from private automobiles, from 3.8 billion passenger-kilometers (FY2013) to 16.3 billion passenger-kilometers (FY2030).

(3) Moves toward social implementation

[Image of e-Palette services]

Source) Toyota Motor Corporation

○ New mobility services such as MaaS are expected to promote connection with next-generation vehicles as well as new technologies to further enhance convenience and reduce environmental impact.

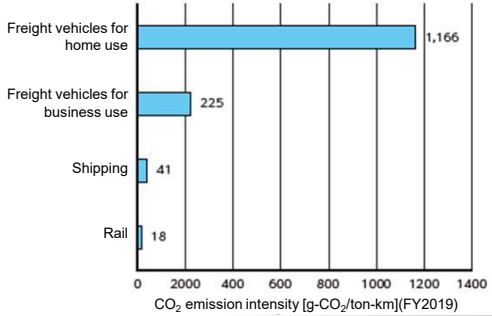
2. Challenges and direction of measures for decarbonization of transport and logistics

(4) Challenges and direction of modal shift

- As logistics constitutes an important social infrastructure that supports people's lives and industrial competitiveness, there is a need to let this function perform fully. Promote a modal shift to rail and ship to reduce CO_2 emissions from freight transportation.
- Consumers, in addition to shipper businesses, are key players in reducing CO_2 emissions in logistics. As the volume of home deliveries expands with the increase in the number of people staying and spending time at home, restraining the number of re-deliveries can help reduce the impact on the global environment.

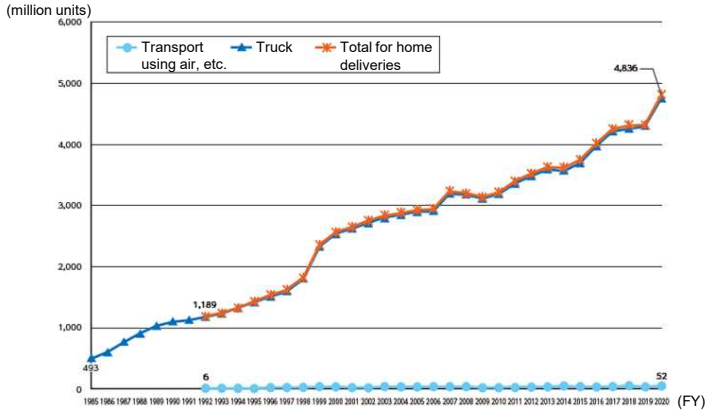
(1) Current situation and challenges

[CO_2 emissions per transport volume (freight)]



○ Compared to the per-unit CO_2 emissions of commercial freight vehicles, ships generate about one-fifth and rail about one-thirteenth the amount of CO_2.

[Changes in the number of home delivery parcels handled]



○ As “at-home consumption” became the norm with people spending more time at home to prevent the spread of COVID-19, the demand for on-line shopping, and thus the volume of home deliveries, expanded quickly.

○ Home deliveries in FY2020 totaled 4,836.47 million (of which 4,784.94 million were transported by trucks), an increase of 11.9% over the previous fiscal year.

○ The amount of CO_2 emitted from trucks for re-delivery is estimated to be around 420,000 tons per year , which points to the importance of restraining re-deliveries.

(2) Direction

○ To promote a modal shift, the target is to increase rail freight transportation volume from 19.34 billion ton-kilometers (FY2013) to 25.64 billion ton-kilometers (FY2030), which would lead to a 1.466 million ton reduction of CO_2 emissions.

○ An increase in maritime freight transportation volume from 33 billion ton-kilometers (FY2013) to 41.04 billion ton-kilometers (FY2030) is expected to cut CO_2 emissions by 1.879 million tons.

(3) Moves toward social implementation

○ In the logistics sector, efforts will be made to improve transportation efficiency through the promotion of logistics DX utilizing AI, IoT, etc., and to develop new mobility services through green logistics initiatives.

[Drones]

[Flying Vehicle]

© SkyDrive Inc.

○ Drone is expected to help sustain logistics networks in underpopulated areas and enhance convenience by eliminating shopping-related inconveniences. It also contributes to decarbonization and serves as a means of distributing supplies in times of disaster.

○ The "Flying Vehicle" is expected to provide a new means of mobility in urban areas, remote islands, and mountainous regions, as well as emergency transportation in times of disaster.

2. Challenges and direction of measures for decarbonization of transport and logistics
(5) Challenges and direction of climate change mitigation in air and marine transport

- Concerning international transportation (international aviation), the utilization of "Sustainable Aviation Fuel (SAF)" is essential to achieve the mid-term goals of the International Civil Aviation Organization (ICAO), and to promote technological development and demonstration of SAF.
- The achievement of "carbon neutrality in international maritime transport by 2050" would require the development of technologies for zero-emission ships fueled by hydrogen, ammonia, etc. and Japan needs to take the initiative in this area.

(a) Challenges and direction of climate change mitigation in aviation

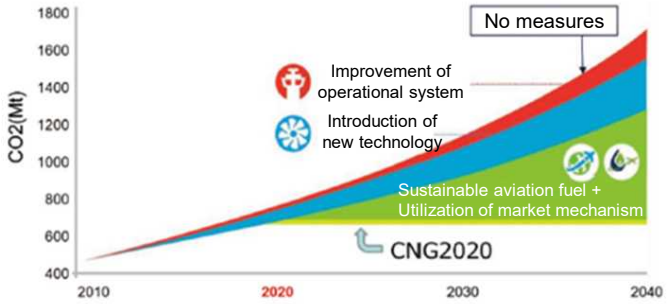
(1) Current situation and challenges

○ In 2013, the ICAO adopted its mid-term global reduction targets of (1) improving fuel efficiency by 2% per annum and (2) keeping the net carbon emissions from 2020 at the same level. The reduction measures until 2035 include the use of the CORSIA* framework for the introduction of new technologies, improvement of operation methods, use of alternative fuels, and application of market mechanisms.

* CORSIA refers to “Carbon Offsetting and Reduction Scheme for International Aviation: CORSIA”

(2) Direction

[Image of projections on CO_2 emissions from international aviation and emission reduction targets]



Source) Prepared by MLIT based on data from the 2019 ICAO Regional Workshop

○ As for long-term goals, Japan will spearhead a global international framework to accelerate energy conservation and decarbonization through ICAO.

(3) Moves toward social implementation

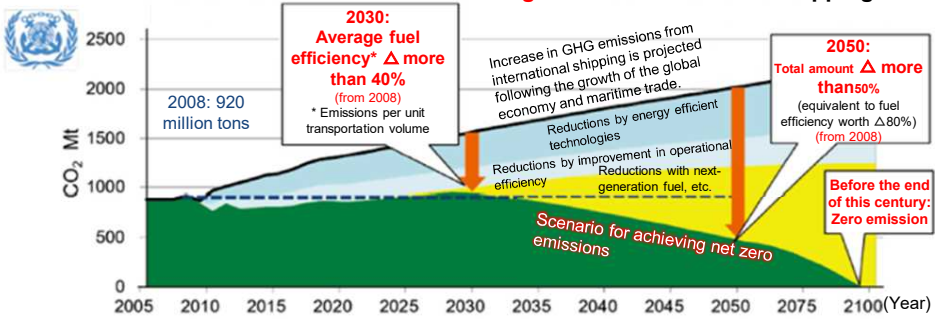
○ To promote the adoption and dissemination of SAF, Japan will take actions on the supply side, such as the development and manufacture of domestically produced SAF, and improve the environment for the utilization of SAF.

(b) Challenges and direction of climate change mitigation in international marine transport

(1) Current situation and challenges

IMO GHG reduction strategy

International Maritime Organization (IMO): International agreement on GHG emissions reduction targets from international shipping



○ The goals with 2008 as the base year are (1) improve fuel efficiency (GHG emissions per transportation volume) of international shipping as a whole by 40% or more by 2030, (2) reduce total GHG emissions from international shipping by 50% or more by 2050, and (3) achieve zero GHG emissions as early as possible before the end of this century.

(2) Direction

○ At its meeting in November 2021, the IMO agreed to review the "GHG Reduction Strategy" by 2023 and to set a more ambitious target than the current one. In reviewing the strategy, Japan proposed the target of "carbon neutrality in international maritime transport by 2050" jointly with the U.S., U.K., and others.

○ Japan will take the initiative in the development of international rules at the IMO to make this goal universal around the world.

(3) Moves toward social implementation

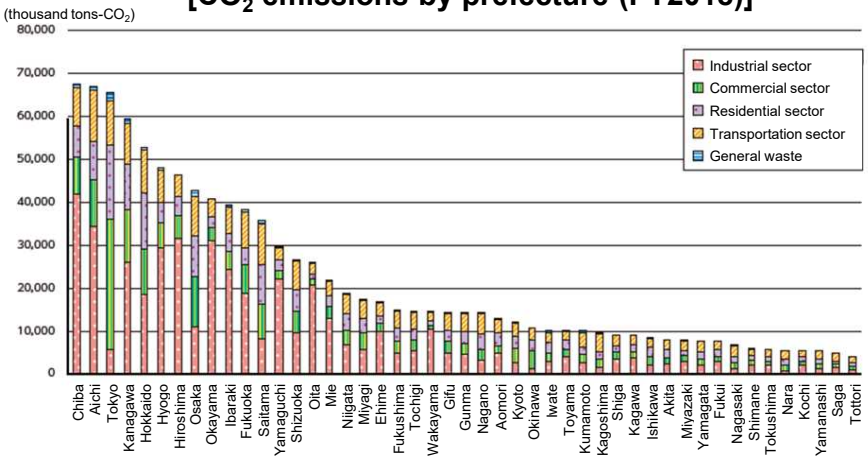
○ Japan will take active steps by leading the development of technologies for zero-emission vessels fueled by hydrogen, ammonia, etc.

3. Challenges and direction of measures for urban planning (1) Trends of regional decarbonization

- Since urban development, the building block of our everyday life, is the foundation of our livelihood, we need to take steps to reduce the environmental impact to secure the sustainability of the community along with regional vitality and quality of life.
- The achievement of regional decarbonization in the future depends on adopting measures tailored to the regional characteristics.

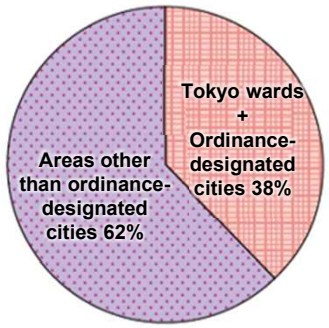
(1) Current situation and challenges

[CO_2 emissions by prefecture (FY2018)]

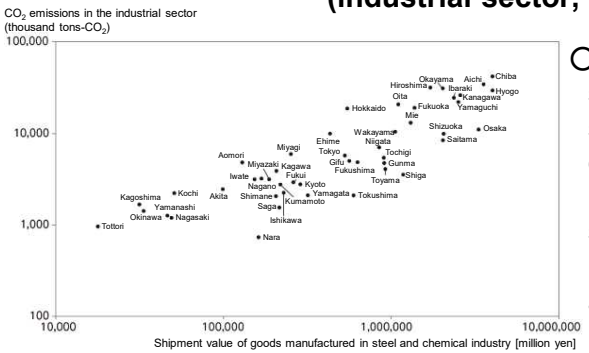


○ Annual CO_2 emissions by prefecture indicate significant regional differences, with larger emissions registered in major cities. The commercial sector is the greatest emitter in the metropolitan area while the industrial sector makes up a large share in other major cities. This is why the reason region-specific measures are needed.

[Ratio of CO_2 emission (commercial sector, FY2018)]



[CO_2 emissions and shipment of goods manufactured in steel and chemical industry (industrial sector, FY2018)]



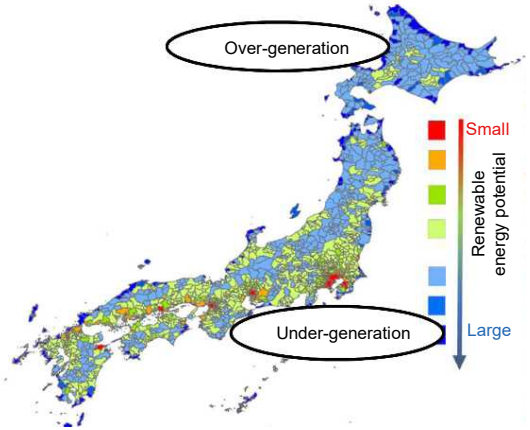
○ In the industrial sector, the chart shows that CO_2 emissions are greater in regions with large shipments of goods manufactured in steel and chemical industry.

○ In the commercial sector, Tokyo wards and ordinance-designated cities constitute some 40% of the total in analysis by municipality. The challenge is to reduce energy consumption in buildings and other structures in these cities.

(2) Direction

○ Model cases that total 100 or more will be established by FY2030 to promote regional decarbonization.

[Regional differences in the generation potential of renewable energy]



○ It is important to promote coordination among regions to ensure a wide-area supply-demand balance by transmitting electricity from rural and other regions, which have power generation potential that exceeds regional energy demand, to urban areas that find it difficult meet their own energy needs.

(3) Moves toward social implementation

Promotion of efficient extended energy use in urban areas

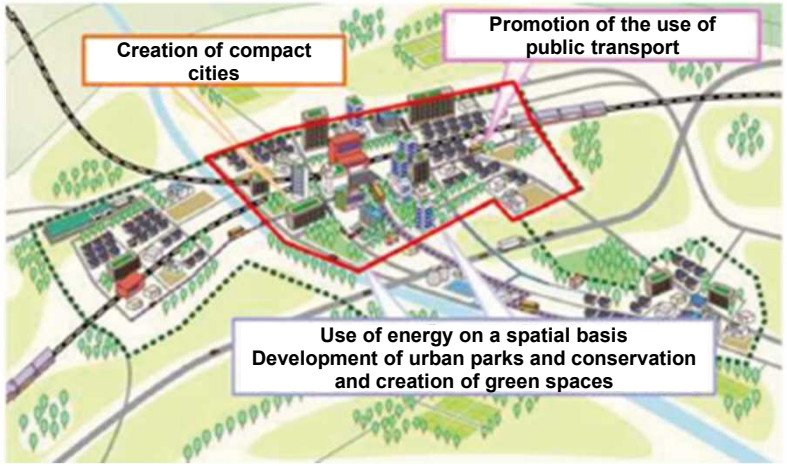
○ The Business Continuity District (BCD), which ensures a stable supply of energy necessary for business continuity in the event of a disaster, is developed along with efforts for CO_2 reduction.

3. Challenges and direction of measures for urban planning
(2) intensive urban development, (3) decarbonized urban development using green infrastructure, (4) eco-friendly urban development using digital technology and private-sector financing, etc.

- Urban sprawl poses a challenge from the aspect of reducing environmental impact, which points to the need for intensive urban development. Decarbonization can be promoted through the development of a walkable city and public transportation system to create a mobility environment that is not overly dependent on private cars. From the perspective of enhancing everyday convenience, it is also important to develop attractive urban areas with concentrated urban functions that draw people.
- Also, the living environment can be improved through the preservation and restoration of green spaces and waterfront areas, which would also help reduce the impact on the global environment.
- Other measures for decarbonization that require consideration include improving the efficiency of energy integration through the use of digital technology, and using human flow and traffic data to visualize the emissions of CO_2 and other gases in the area.

(1) Current situation and challenges

[Compact Plus Network that contributes to decarbonization]



○ The challenge is to promote Compact Plus Networks (creating compact cities and rebuilding public transportation networks) and other measures because urban structures and transportation systems will continue to affect CO_2 emissions over the mid- to long-term through traffic volume and other factors.

○ The realization of the Compact Plus Network would require local public bodies to launch measures based on location optimization plans and local public transportation plans with an eye on decarbonization.

(2) Future direction

Measures will be taken to create compact cities and walkable space to transform car-oriented space to people-oriented space and to decarbonize each area unit in the city.

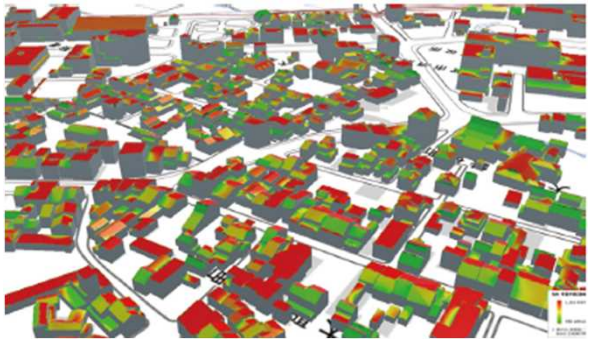
(3) Moves toward social implementation

[Example of green infrastructure (Otemachi Forest)]

Source) Tokyo Tatemono Co., Ltd.

○ The presence of green space helps to conserve biodiversity and mitigate the heat island effect. Urban spaces rich in greenery and water attract human resources, companies, and private investment that are highly environment-conscious, which in turn can stimulate the economy.

[Example of application of 3D city models (Image of the results of annual solar radiation)]



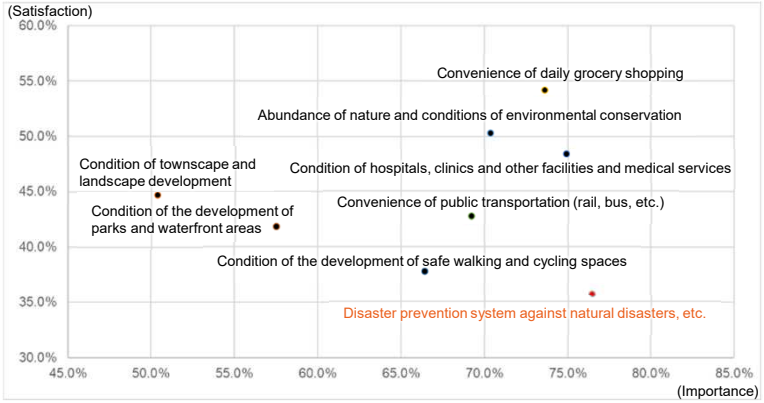
○ Smart cities, Project PLATEAU, and other "Urban DX" initiatives are under way to solve urban issues and create new value through the use of digital technology to realize “human-oriented city planning.”

3. Challenges and direction of measures for urban planning Column: Living environment and quality of life of local residents

- With a constant awareness of the relationship between the quality of life and the vitality, history, and culture of the region, the maintenance and improvement of the richness of life and of the region need to be balanced with reducing environmental impact. The living environment in cities and regions, represented by the richness of nature, the condition of environmental conservation, and disaster prevention, is important from the perspective of securing the quality of life of local residents as well as sustainability in the region.
- From the viewpoint of securing the quality of life, the measures to be taken should accommodate trends in people's awareness. For example, more focus can be placed on areas of high importance but low satisfaction, such as strengthening disaster prevention systems, enhancing the convenience of public transport in small cities and other measures that take regional differences into consideration, or measures that address inter-generational differences.

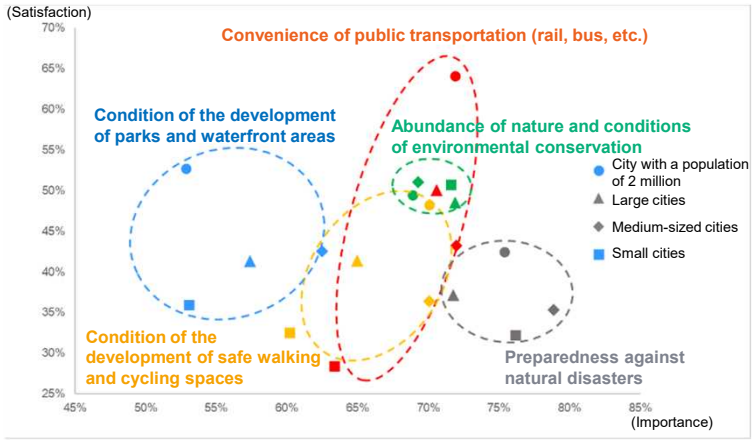
[National awareness survey]

Distribution of the importance of living environment in the region of residence and degree of satisfaction



○ The importance of "disaster prevention system against natural disasters" is high, but its degree of satisfaction is low.

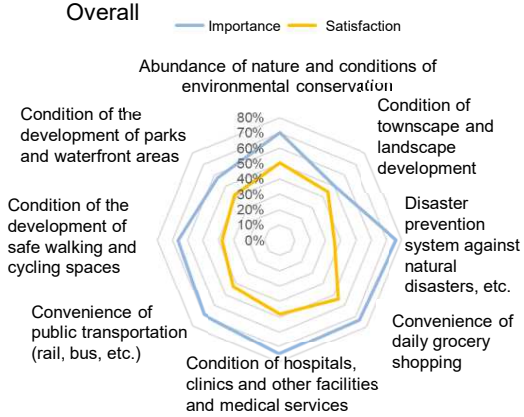
Distribution of the importance of local living environment and degree of satisfaction by the scale of cities



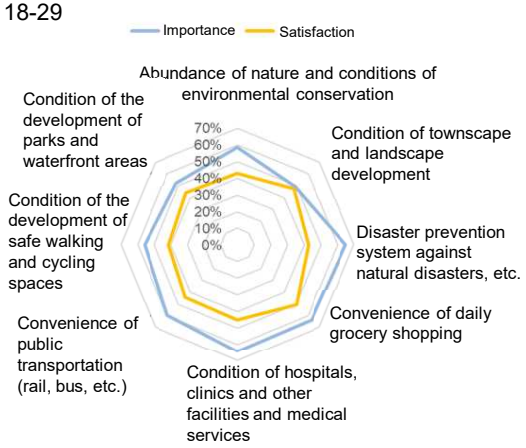
○ By city size, satisfaction with public transportation and safe walking space is notably low in small cities.

Importance of living environment in the region of residence and degree of satisfaction (by age)

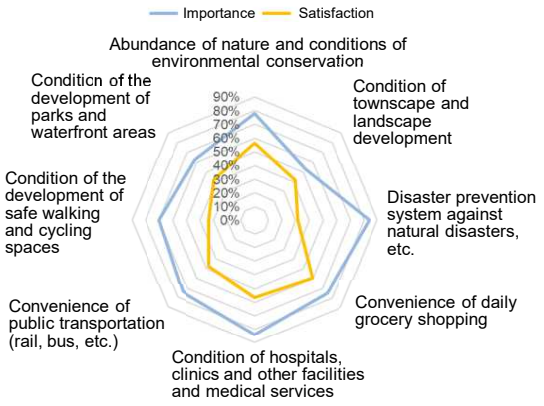
Overall



18-29



60 years old and over

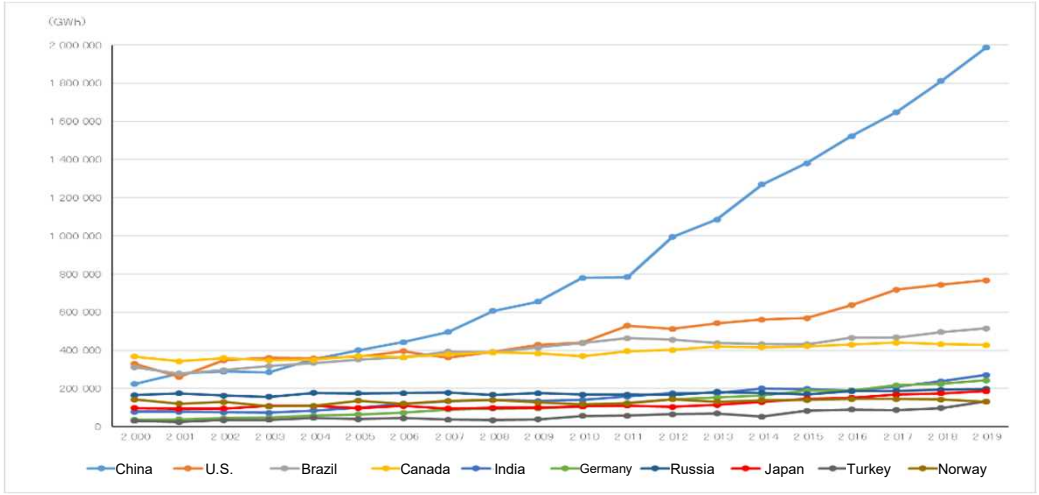


○ By age, overall satisfaction tends to be higher among the younger age groups and lower among the older age groups.

1. Trends of renewable energy

- The nation needs to promote electrification on the energy demand side in the consumer and transportation sectors, and maximize the use of renewable energy as the main source of power to accelerate the decarbonization of electricity that supports our daily lives. The nation also needs to promote the decarbonization of key infrastructures that support our daily lives, such as airports and ports, by using hydrogen/ammonia, etc. to meet heat demand that cannot be fulfilled by electrification, and to transition our lives and economic society to a carbon-neutral style.
- The government has decided to put top priority on measures to make renewable energy the main source of power. In MLIT, the government will work to maximize the introduction of renewable energy by promoting the introduction of offshore wind power generation through accelerated project development and upgrading port functions and the introduction of PV power generation in infrastructure space.

[Changes in power generated by renewable energy by country]



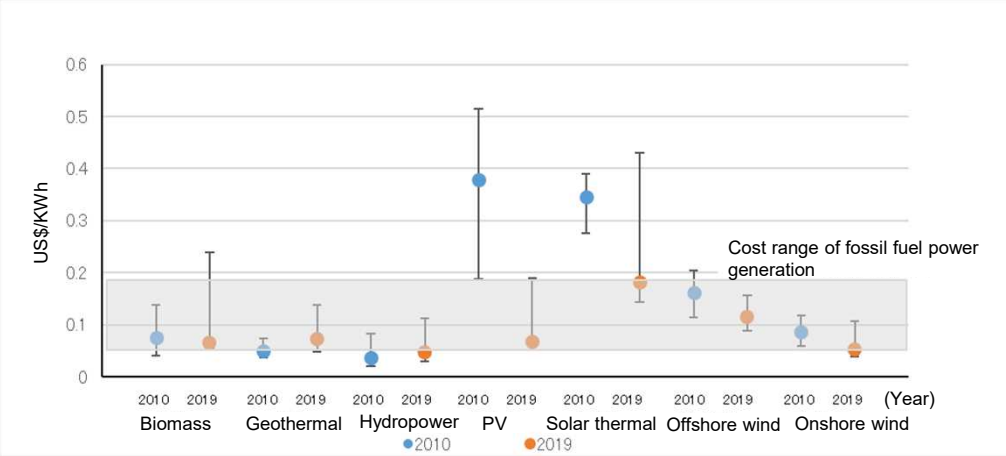
(Note) Renewable energy: Hydropower, wind, PV, geothermal, biomass, etc.
Source) Prepared by MLIT based on "Renewable Electricity Capacity and Generation Statistics" by IRENA.

○ Renewable energy refers to energy from non-fossil energy sources such as PV, wind, geothermal, hydropower, and biomass. Renewable energy sources account for 19.8% of Japan's total energy supply: the ratio is 7.8% for hydropower (including large hydropower), 2.9% for biomass, 0.3% for geothermal, 0.9% for wind, and 7.9% for PV. Japan relies on imports for much of its fossil fuels such as oil and coal.

○ Regarding the supply of renewable energy in other countries, electric power generation has increased rapidly in China, the U.S., and other countries in recent years.

○ In the future, Japan will seek to expand the supply of renewable energy from the perspective of energy self-sufficiency as well as decarbonization.

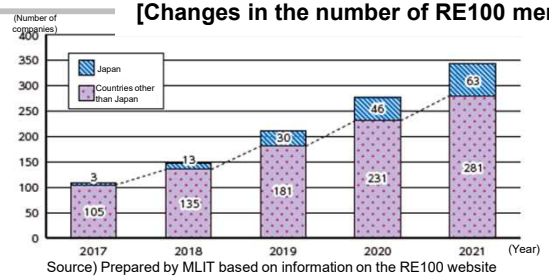
[Changes in renewable power generation costs (2010, 2019)]



Source) Prepared by MLIT based on "RENEWABLE POWER GENERATION COSTS IN 2019" by IRENA.

○ The graph shows that renewable power generation costs have declined globally over the past decade, mostly to the range of fossil fuel power generation costs.

[Changes in the number of RE100 member companies]



Source) Prepared by MLIT based on information on the RE100 website

○ The number of RE100 member companies is increasing globally. Japanese companies account for about 20% of the total, which exhibits their growing commitment to use renewable energy.

2. Expansion of the use of renewable energy using infrastructure (1) Measures to promote the introduction of offshore wind power generation

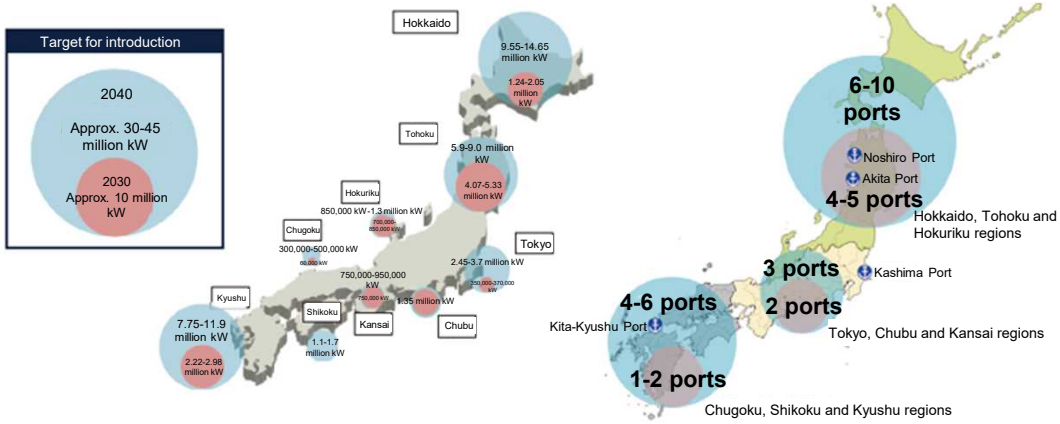
- Regarding wind power generation, the introduction of offshore wind power, in particular, is expanding globally, notably in Europe. Wind power generation is expected to grow rapidly in the Asian market, especially in China and South Korea towards 2050.
- Cost reduction with mass introduction and economic spillover effects are expected for offshore wind power generation. It is imperative to accelerate the development of technologies such as wind turbines and floating structures adapted to the climatic and oceanic conditions in Asia so that they will result in social implementation.
- This would also require the systematic development of base ports, which are indispensable for the installation and maintenance of offshore wind power generation facilities.

[Forecast of offshore wind power market]

Source) IRENA “FUTURE OF WIND”

○ IRENA projects the offshore wind power generation market in Asia will reach 613 GW by 2050.

[Optimal placement of base ports, reference number of base ports required by region (trial calculation)]



○ The target for the introduction of offshore wind power generation is approx. 10 million kW in 2030 and 30-45 million kW in 2040. About half of the generation capacity is projected to be installed in Hokkaido, Tohoku, and Kyushu.

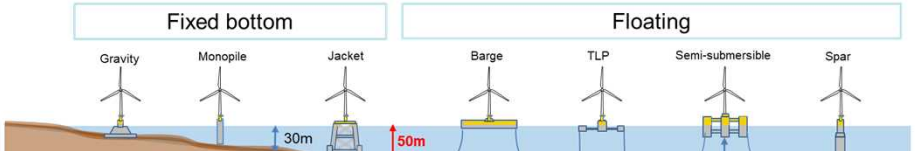
○ It is estimated that up to three to five new ports will need to be put into service by 2030 as base ports.

[Development of floating offshore wind turbine]

○ According to the "White Paper on renewable sources of energy 2021," the amount of offshore wind energy introduced around the world expanded from 2.9 million kW in 2010 to 35 million kW in 2020, an increase of approx. 32 million kW over a decade.

○ Offshore wind power generation facilities can be classified into two types: the fixed type with wind turbines installed on a foundation fixed to the seabed; and the floating type that has turbines installed on a floating structure in the ocean.

○ Due to the climatic conditions in Japan, there are high expectations for the introduction of floating offshore wind turbines that are less susceptible to earthquakes, and they can be installed in offshore areas with strong winds and deeper waters.



	Fixed bottom			Floating			
	Gravity	Monopile	Jacket	Barge	TLP	Semi-submersible	Spar
Advantages	・Requires little maintenance and inspection	・Low-cost installation ・Does not require seabed improvement in principle	・Can be installed in relatively deep waters ・Does not require concrete placing	・Simple structure enables cost reduction ・Easy construction for installation	・Requires small space for mooring ・Controlled vertical motion of the floating structure	・Can be assembled inside the port facility ・Floating body shaking is small	・Simple structure and ease of manufacture ・Projected cost reduction due to structure
Challenges	・Requires seabed improvement ・High degree of construction difficulty	・Requires ground thickness ・Generates contamination during installation	・Complex structure and high cost ・Incompatible with soft ground	・Significant shaking of the floating body during a storm Requires verification of safety, etc.	・High cost of mooring system	・Complex structure and high cost ・Downsizing poses challenges from the viewpoint of cost and construction efficiency	・Cannot be installed in shallow waters ・Water depth requirements for installation make installation difficult
Installation water depth	Less than 15m	Less than 30m	Less than 50m	50-100m	50-100m	More than 100m	More than 100m

(Note) The water depth for installation for the fixed type is based on records in Europe as of 2018 shown in Foundations in OffshoreWind Farms: Evolution, Characteristics and Range of Use. Analysis of Main Dimensional Parameters in Monopile Foundations and on NEDO materials, etc. for the floating type.
Source) MLIT

2. Expansion of the use of renewable energy using infrastructure
(2) Introduction and expansion of the use of PV power generation in infrastructure space

- It is important to expand the introduction and use of renewable energy by utilizing existing infrastructure and other resources.
- Efforts to promote the introduction of PV power generation are under way at government facilities, airports, ports, and other facilities to the extent possible without compromising their intended functions and with considerations for reducing the impact on the surrounding environment.

[Introduction and expansion of the use of PV power generation in infrastructure space]

Public rental housing and governmental facilities

Promote the introduction of PV power generation at public rental housing (UR and public housing)

- To be established for new construction beginning this fiscal year
- Promote introduction for existing buildings

Promote introduction into governmental facilities (common buildings)

- Launch efforts for standard introduction in newly constructed facilities
- Examine the possibility of expanding introduction into existing facilities based on results of feasibility study

Roads

Promote the introduction of PV power generation using the road space

- Experimentally introduce PV power generation facilities on the road
- Plans are under way to examine and prepare technical guidance on the installation of PV power generation facilities on the road

Utilization of PV power generation facilities on the road

Airports

Promote the conversion of airports into renewable energy hubs

- Prepare a timeline for the decarbonization of airports including PV power (February) and establish a plan guideline (March)
- Revise the Airport Act (submitted at the current session of the Diet) to promote the conversion of airports into renewable energy hubs

(The goal is to introduce 2.3 million kW of renewable energy by 2030.)

* Photograph presented by: Kansai International Airport

Ports

Promote the introduction of PV power generation at ports

- Examine the potential for introduction into administrative buildings, shelters, warehouses, etc. at container terminals

Yokohama Port

Rail/track facilities

Promote the introduction of PV power generation at rail/track facilities

- Examine the feasibility of introducing renewable energy by utilizing railroad assets and in collaboration with communities along railway lines
- A public-private council to promote measures is scheduled to be established in the fall of this year

Yotsuya Station, Marunouchi Line, presented by Tokyo Metro

Parks

Promote the introduction of PV power generation in national and urban parks

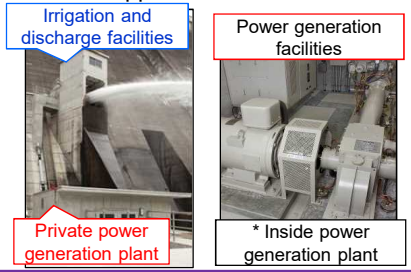
- Promote and expand introduction on the rooftop of existing facilities in national parks
- Promote introduction at urban parks based on a survey

Uminonakamichi Seaside Park

Dam

Promote the introduction of private hydroelectric power generation and PV power generation at dams

- Introduce private hydroelectric power generation at dam management facilities where it has not yet been introduced (increase of approx. 28 million kwh in 2030)



Sewage systems

Promote the introduction of PV power generation in sewage systems

- Promote the introduction of PV power generation using the space above sewage treatment plants (increase of 190 million kwh in 2030*)

PV power generation using the space above sewage treatment plants

* Established as the potential of installation when facilities are introduced in the space above sewage treatment plants (unused area) at all plants

3. Building a supply chain for hydrogen, ammonia, etc.

(1) Transport hydrogen/ammonia and powered by hydrogen/ammonia　(2) Carbon Neutral Port

- Measures to build a supply chain for hydrogen using marine transportation are required to secure inexpensive hydrogen from overseas as we move towards decarbonization. Technological innovation and social implementation in the maritime and port sectors will play an important role.
- Along with the development of technologies necessary to transport hydrogen/ammonia, it is imperative to develop zero-emission ships that run on hydrogen/ammonia and improve the receiving environment in port areas to enable the import and storage of hydrogen/ammonia, etc.

○The development of technology that is required to transport hydrogen/ammonia from other countries is under way, which includes the development of technology for long-distance transportation of liquefied hydrogen in large quantities.
○The target is to commercialize hydrogen production by 2030 by taking advantage of international supply chains and surplus renewable energy. Steps towards that goal include building larger hydrogen carriers and other facilities for transportation and supply, and the improvement of the receiving environment at ports.

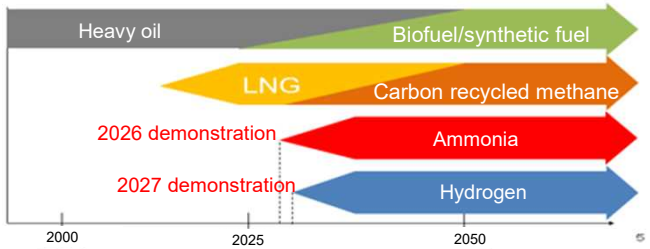
[Development of zero emission ships fueled by hydrogen/ammonia]

○ Promote technological development of engines and other parts for zero-emission ships fueled by hydrogen/ammonia, etc.

○The goal is to start commercial operation at the earliest date before 2028 by taking advantage of technological development and demonstration of zero-emission ships, including domestic engines, utilizing the Green Innovation Fund. Also, efforts will be made to capture new markets to strengthen the international competitiveness of the maritime industry.

Image of zero-emission ship

Schematic diagram of ship



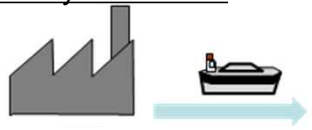
[Carbon Neutral Port]

○ Ports constitute the hubs of the international supply chain, through which 99.6% of imports and exports pass through. They are also major energy consumption centers as bases for coastal industries where many power plants, steel and chemical industries, responsible for approximately 60% of Japan's total CO_2 emissions, are located.

○ Plans are under way to establish Carbon Neutral Port, which help improve the environment for receiving hydrogen/fuel ammonia, etc. and decarbonize port areas.

Utilization of hydrogen/ammonia, etc. through ports

* Example of hydrogen/ammonia, etc. utilization by businesses

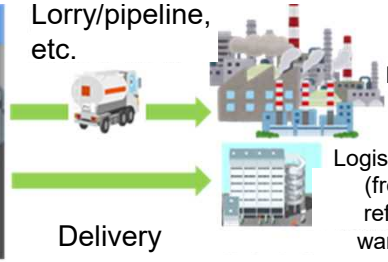


Produce biomass fuel, hydrogen, ammonia, etc. [Other countries].

Maritime transportation

Unloading and storage at Japanese ports

Lorry/pipeline, etc.



Delivery

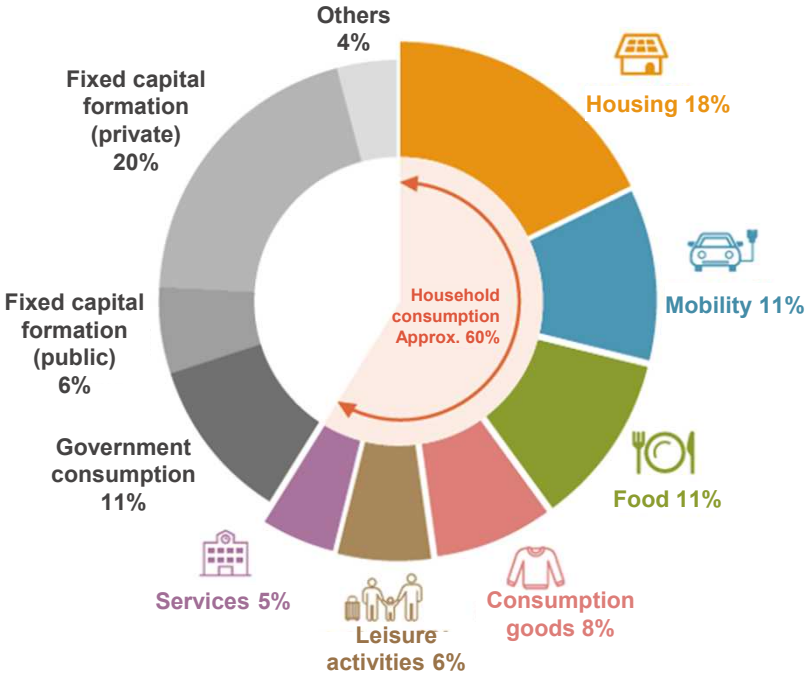
Utilized by local companies engaged in decarbonization

(Collaboration with relevant ministries and agencies will be applied to decarbonize power plants and industries located at ports as well as port operations, and to promote the development of the environment necessary for receiving hydrogen and other resources).

1. Greenhouse gases from household consumption

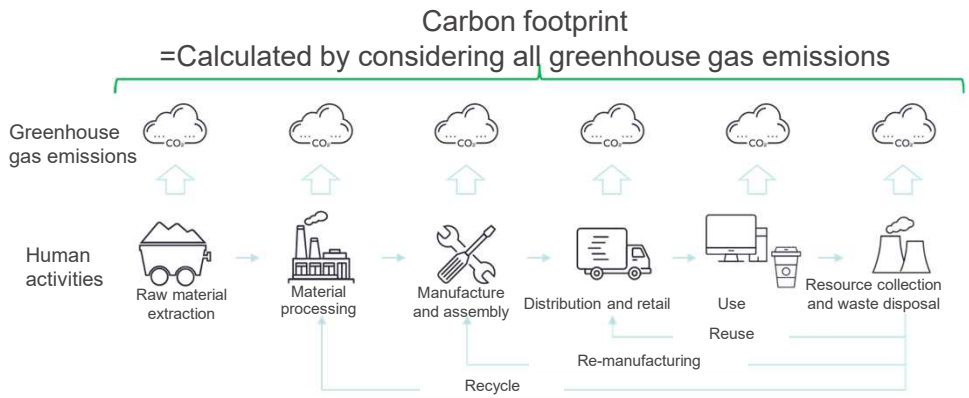
- Along with initiatives adopted by businesses, measures that encourage changes in our lives toward decarbonization also play an important role.
- The "carbon footprint of household consumption," which effectively provides an overall picture of greenhouse gas emissions from household needs, accounts for about 60% of Japan's total carbon footprint, of which about 30% is related to housing and mobility.
- It is important that we shift to a decarbonization-oriented lifestyle by reviewing our everyday lifestyle from the perspective of reducing CO_2 emissions, including our living and mobility as well as the consumption of products and services that support our daily lives.

[Breakdown of carbon footprint in Japan (2015)]

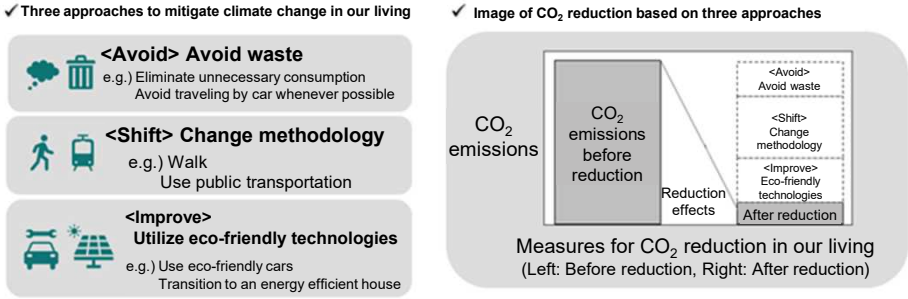


○ This graph effectively illustrates the overall picture of greenhouse gas emissions from household demand, as it includes not only direct emissions such as fuel use by households, but also indirect emissions associated with products and services purchased.

[Carbon footprint]



[Approaches to reducing carbon footprint in housing and mobility]



○ An effective step would be to incorporate three perspectives in the aspects of housing and mobility: “avoid waste (avoid),” “change methodology (shift),” and “utilize eco-friendly technologies (improve).”

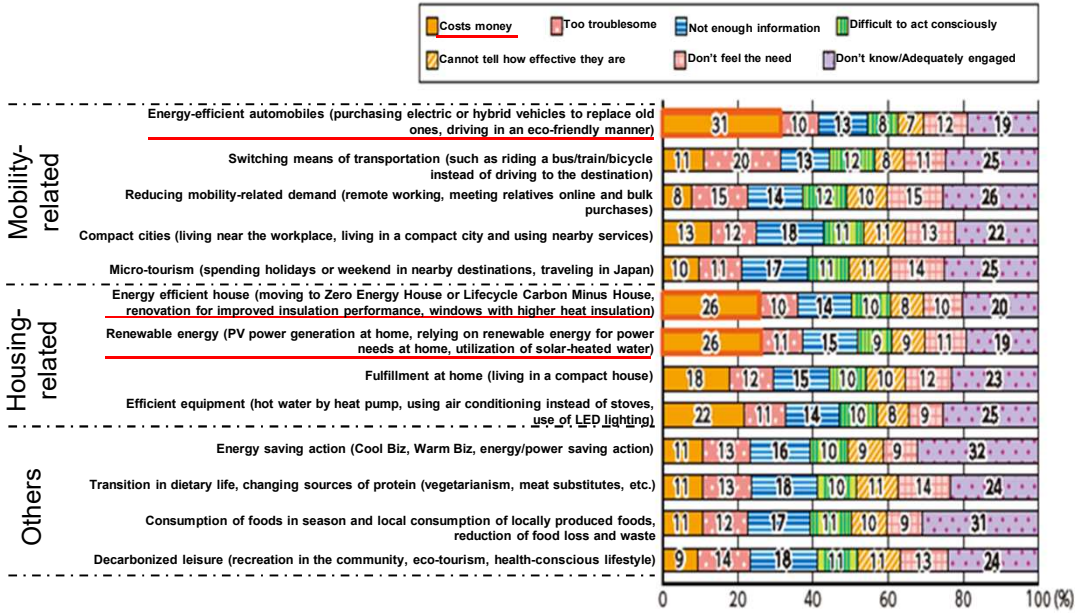
2. Status of and commitment to decarbonization-oriented lifestyle

- Regarding the adoption of a decarbonization-oriented lifestyle, nearly 50% of the respondents said they “intend to take action in the future” for items such as switching to electric vehicles, energy efficient houses, and use of renewable energy.
- On the other hand, a high percentage of respondents cited cost as a reason behind their insufficient commitment to address those items.

[Status of commitment and future intentions to a decarbonization-oriented lifestyle]

- ○ In mobility, a high percentage of the respondents are committed to reducing travel opportunities through remote working or switching from a private car to a bus/train/bicycle as a means of travel compared to those who are committed to switching to energy-efficient automobiles by replacing their cars with electric vehicles.
- ○ In housing, a high percentage of respondents are committed to efficient use of equipment such the use of LED lighting compared to those committed to moving to energy efficient houses and using renewable energy.
- ○ Other actions to which many respondents gave a positive answer are energy saving action, using consumer goods over the long term and preventing re-delivery of home deliveries, which shows that these actions are relatively easier to approach.

[Reasons that hamper full commitment to a decarbonization-oriented lifestyle]

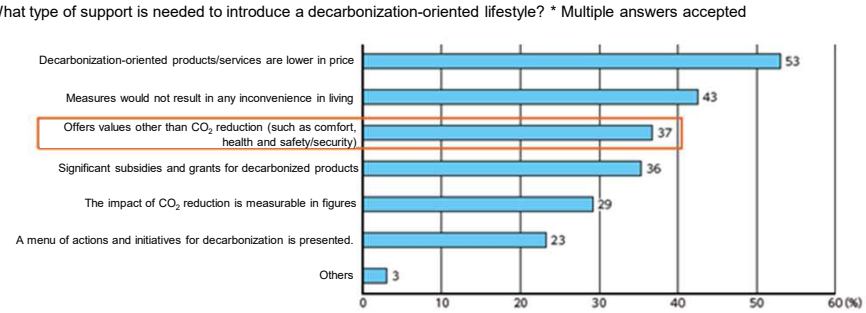


- ○ Regarding planned commitment in the future, a high percentage of respondents are committed to moving to energy efficient houses and using renewable energy, which is an indication of the high level of commitment among the population. In addition, more than one in four respondents cited “costs money” as the reason why they are not fully committed to a decarbonization-oriented lifestyle, suggesting that cost is one of the obstacles.

3. Measures to reduce greenhouse gas emissions from household consumption

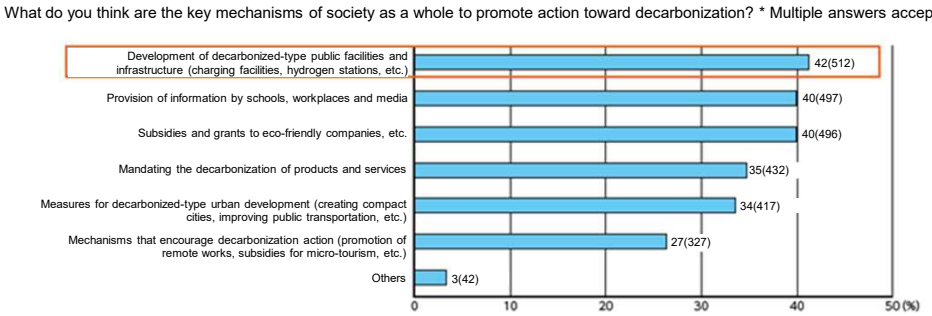
- The survey shows that people's expectations on a decarbonization-oriented lifestyle go beyond CO_2 reductions to incorporate other values such as the absence of a sense of cost burden and the maintenance of the convenience of daily life. This points to the importance of creating added values on comfort, health and other factors that comprise the quality of life.
- Also, the survey revealed high expectations for the development of related infrastructure and urban development measures as a social mechanism to promote actions toward decarbonization.

[Things required to adopt a decarbonization-oriented lifestyle]



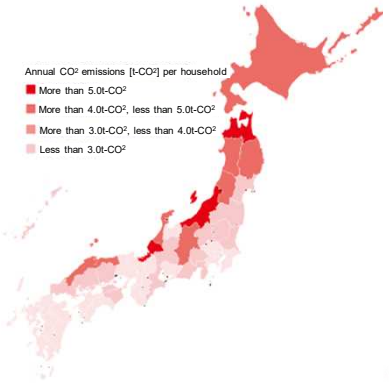
○ A high percentage of respondents believe that the most important factors for adopting a decarbonized-oriented lifestyle are price, convenience in living, and added values other than CO_2 reduction (comfort, health, safety/security, etc.)

[Important social mechanisms for decarbonization]



○ Expectations are particularly high for environmental improvements to promote the dissemination of next-generation vehicles, such as charging facilities and hydrogen stations.

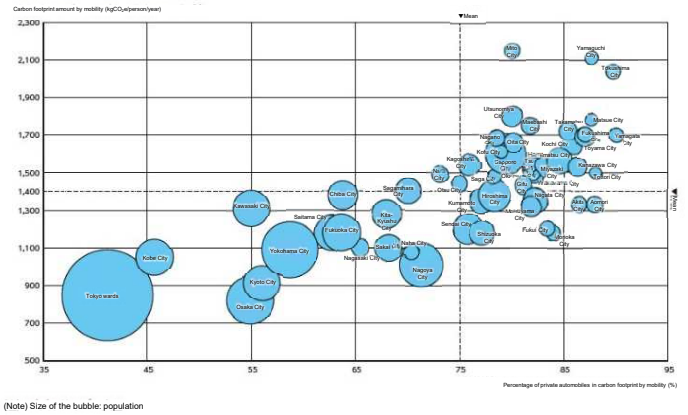
[CO_2 emissions by prefecture (Residential sector, per household)]



○ CO_2 emissions per household are larger along the Sea of Japan side from northern Japan to the Chugoku region.

○ The introduction of decarbonization-oriented lifestyles in the housing sector, such as switching to eco-friendly housing and renovation for improved insulation performance, will be effective.

[Greenhouse gas emissions from mobility]



○ Looking at the carbon footprint of mobility by population size, cities with smaller populations tend to have a larger carbon footprint for mobility, in line with their share of automobiles.

○ Reducing the carbon footprint of mobility would require the development of an environment that supports decarbonized mobility, including an environment that supports the dissemination of next-generation vehicles.

1. Requirements for future community building

2. Direction of community building in the era of climate change (1) Housing

- Regarding community building in the era of climate change, we need to create a resilient and vibrant community that addresses local challenges such as disaster-resistant urban planning and improved quality of life along with decarbonization of the region.
- In order to cope with the growing risk of climate disasters until 2050, the target period for carbon neutrality, we need to consider not only decarbonization (mitigation measures) but also resilience (adaptation measures) in community building, including energy self-sufficiency in the event of a disaster.

[Actual examples of measures toward decarbonization and resilient and vibrant community building (1)]

Actual examples involving detached houses, apartment buildings, and municipal housing are presented below as case studies in housing, the foundation of our lives.

○ Highly insulated and airtight housing

◆ Regional revitalization with Yamagata Kenko Jutaku (Yamagata Healthy Housing) (Yamagata Prefecture)

・The intent behind the promotion of the "Yamagata Kenko Jutaku" is to prevent health hazards for residents, including the avoidance of heat shock-related accidents.

・These houses seek to benefit the local community in many ways beyond the reduction of CO_2 emissions. In addition to supporting households by cutting utility costs, the project also promotes the use of lumber harvested in the prefecture and construction by local contractors who are familiar with the local climate and environment.

Yamagata Kenko Jutaku Source) Iide Town

* Yamagata Kenko Jutaku is certified by the prefecture for their superior insulation performance and airtightness that enhances this insulation effect. These features prevent the room temperature from dropping below 10˚C in the morning after the heating is turned off before bedtime during the coldest season.

○ Nearly ZEH condominium

◆ Collecting houses that are safe in disasters

・Nearly ZEH condominiums in Ashiya City, Hyogo Prefecture, are highly insulated, energy-efficient apartment buildings, with PV power generation and fuel cells installed in all units to provide a comfortable living space with superior heating and cooling efficiency.

・Its system is designed to sustain essential services such as daily water supplies, elevators, lighting, and emergency power outlets for about one week in the event of a power failure during a disaster. This creates a resilient and secure living environment in an apartment that offers energy self-sufficiency and maintenance of lives.

Nearly ZEH condominium
Source) DAIKYO INCORPORATED

○ Introduction of distributed energy in municipal housing and Michi-no-Eki (roadside stations)

◆ Health and disaster prevention centers that are energy self-sufficient in the event of a disaster (Mutsuzawa Town, Chiba Prefecture)

・The “Mutsuzawa Smart Wellness Town,” which integrates municipal housing and Michi-no-Eki, is designed to be both eco-friendly and a base in the event of a disaster. For example, the Town generates distributed energy from locally produced natural gas in addition to PV power, transmits power to the roadside station and municipal housing via underground lines, and uses waste heat from power generation at its hot bath facilities.

・When a powerful typhoon in 2019 hit the Boso Peninsula and triggered a widespread power failure for a few days in all areas of the town, the Smart Wellness Town continued to supply power even after the disaster. This allowed more than 800 town residents to take a shower and recharge their cell phones at its thermal bath facilities as the Town functioned as a disaster prevention center (energy self-sufficiency center).

Mutsuzawa Smart Wellness Town (Regionally designated high-quality housing)
Source) Mutsuzawa Smart Wellness Town CO., LTD.

Supplied electricity during extensive power failure after Typhoon Faxai hit the Boso Peninsula in 2019
Source) CHIBA Mutsuzawa Energy CO., LTD.

2. Direction of community building in the era of climate change (2) Mobility

[Actual examples of measures toward decarbonization and resilient and vibrant community building (2)]

With regard to mobility that is an essential component of our lives, this section introduces a new mobility approach in depopulated areas for people who have difficulty getting around, in addition to mobility with private cars and public transportation that support our daily lives.

○ Multipurpose use of next-generation automobiles

◆ Mobility for everyone that is helpful in emergencies (Toyota City, Aichi Prefecture)

・The share of automobiles among all modes of transportation is 72.9% (approx. 82% for senior citizens) in Toyota City, which faces the challenge of reducing CO_2 emissions and supporting the mobility of the elderly. The City is launching measures to utilize eco-friendly next-generation automobiles for resolving social issues.

・Specifically, the City supports the sharing of next-generation automobiles that can be driven safely at low speeds and the introduction of next-generation automobiles that can be used easily for farm work to encourage senior citizens residing in mountainous areas to go out.

・Also, with a focus on the external power supply function of next-generation automobiles, the city has developed a system of supplying power to homes and evacuation centers as an emergency power source in the event of a disaster.

Training on power supply assistance to evacuation centers Source) Toyota City

○ Integrated energy management of vehicles and buildings

◆ Electric buses that can also supply power to a bus office (Hankyu Bus)

・The operation of large electric buses is designed to achieve zero-emission bus operations. When the buses are not in operation, power stored in the buses is supplied to the bus office for integrated energy management of the bus fleet and the building.

・From the perspective of business continuity (BCP), the system can also be used as a power source in the event of a disaster.

Source) Hankyu Bus Co., Ltd.

○ Drone logistics based at Michi-no-Eki

◆ Public drone delivery service for shopping assistance (Ina City, Nagano Prefecture)

・In villages located in the mountainous regions of Ina City, residents in their senior years have difficulty going grocery shopping. Delivery with trucks is not a viable option due to driver shortages and profitability issues. The municipal government therefore launched shopping assistance services by drone.

・In addition to incorporating new technologies and business know-how, the system also helps to confirm the safety of senior residents by engaging local residents in the last-mile delivery.

・Plans are under way to utilize drones for multiple uses including transporting supplies in the event of a disaster and inspecting river facilities.

Public drone delivery service for shopping assistance

Source) Ina City

* It is a mechanism where goods are transported by drone for up to 10km from the drone port at Michi-no-Eki to a landing point in the mountain village. From there, the goods are delivered by volunteers in the village from the landing point to the homes of residents including senior citizens.

2. Direction of community building in the era of climate change (3) Urban planning

[Actual examples of measures toward decarbonization and resilient and vibrant community building (3)]

This section presents examples of housing, mobility and other elements of urban planning that comprise our lives including the Compact Plus Network approach in the rural areas, spatial use of energy in large cities and disaster-resistant urban planning.

○ Compact Plus Network

◆ Creating a bustling town and reducing the environmental impact of mobility (Komoro City, Nagano Prefecture)

・In consideration of its declining and aging population, Komoro City is consolidating and reorganizing facilities that serve as a hub of vitality around the city center to promote compact urban development for community sustenance.

・The City is also working to save energy through heat interchange between buildings at municipal halls and hospitals and reduce environmental impact with collective power receiving.

・In addition, a community bus operation project named the "Komoro Ai-Nori-Kun" has been launched as a transport system that "supports people's daily lives." The project aims to reduce environmental impact by promoting the use of public transportation and to create opportunities for senior citizens to go out.

Community bus named "Komoro Ai-Nori-Kun"

Source) Komoro City

○ Spatial use of energy in large cities

◆ Urban microgrid concept (Otemachi, Marunouchi and Yurakucho districts in Tokyo)

・The Otemachi, Marunouchi and Yurakucho districts must be able to respond to large-scale power outages and provide a stable energy supply in view of concentration of energy demand during weekday business hours and the importance of business continuity in the event of a disaster.

・By maximizing the use of district heating/cooling networks and improving the overall efficiency of heat and power supply, the City aims to enhance environmental value in normal conditions and establish an energy independence system for emergencies with the introduction of renewable energy and the integrated operation of self-supplied power sources in the area.

Source) MITSUBISHI ESTATE Co., Ltd.

Otemachi, Marunouchi and Yurakucho districts with aims to realize an "urban microgrid" that contributes to strengthened business continuity and decarbonization

○ Introduction and expanded use of renewable energy at municipal level

◆ Responding to decarbonization and resiliency (Hamamatsu City, Shizuoka Prefecture)

・As disaster prevention and mitigation measures on the predicted Nankai Trough earthquake, Hamamatsu City aims to build a robust, decarbonized city that is free of energy concerns as part of its environmental considerations.

・Based on its "'RE100' strategy in Hamamatsu City," Hamamatsu City has launched efforts to introduce PV power generation facilities, as well as ZEH and ZEB, in schools, governmental buildings, and other public facilities. The City has focused on PV power generation to capitalize on its local solar resources, which boast one of the longest average annual hours of sunlight in Japan.

・The goal in the future is to secure the renewable energy power generation capacity that equals total power consumption needs in the city, and to build a robust, decarbonized community through local production and local consumption of renewable energy.

Support for installation on residential rooftop

Established in public facilities

Source) Hamamatsu City

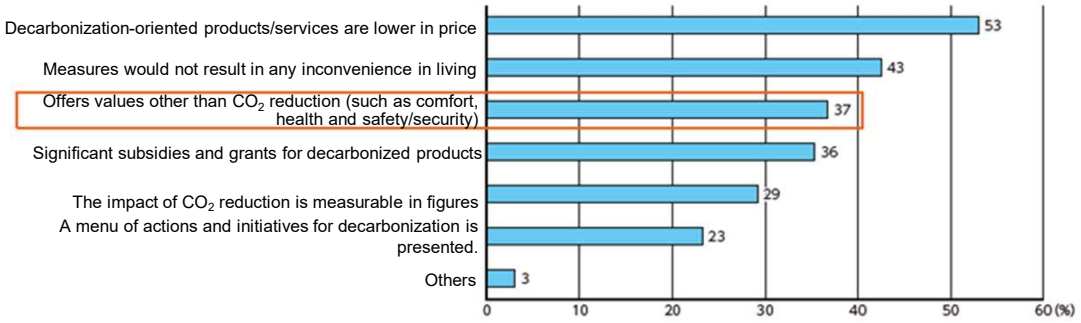
- There are substantial differences in people's awareness of the relationship between measures to decarbonize their ways of life and their quality of life.
- The reduction of CO_2 emissions may not be sufficient to realize sustainable decarbonization measures in people's lives. Along with decarbonization, the creation of values (comfort, health, safety, security, etc.) other than carbon reduction may play an important role in improving the quality of life and building vibrant communities.

○ About 60% of the respondents agreed or somewhat agreed with the idea that "Global warming is caused by human activities, and I feel I must do what I can to move towards decarbonization."
→ A majority of people feel the need to make an effort toward decarbonization.

○ Some 40% agreed that "efforts toward decarbonization would make our lives richer," while 40% disagreed with the idea. On the other hand, 37% agreed and 45% disagreed with the idea that "efforts toward decarbonization will increase inconveniences in our life."
→ We can assume that people's awareness is divided on the impact of decarbonization measures on personal lives and quality of life.

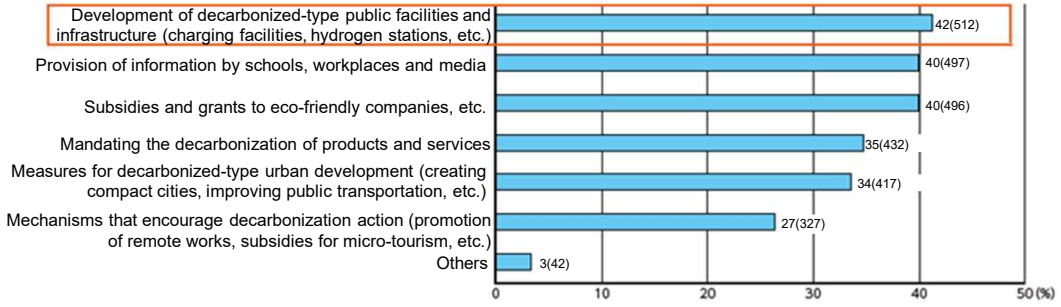
[Repeat] Requirements for adopting a decarbonization-oriented lifestyle

What type of support is needed to introduce a decarbonization-oriented lifestyle? * Multiple answers accepted



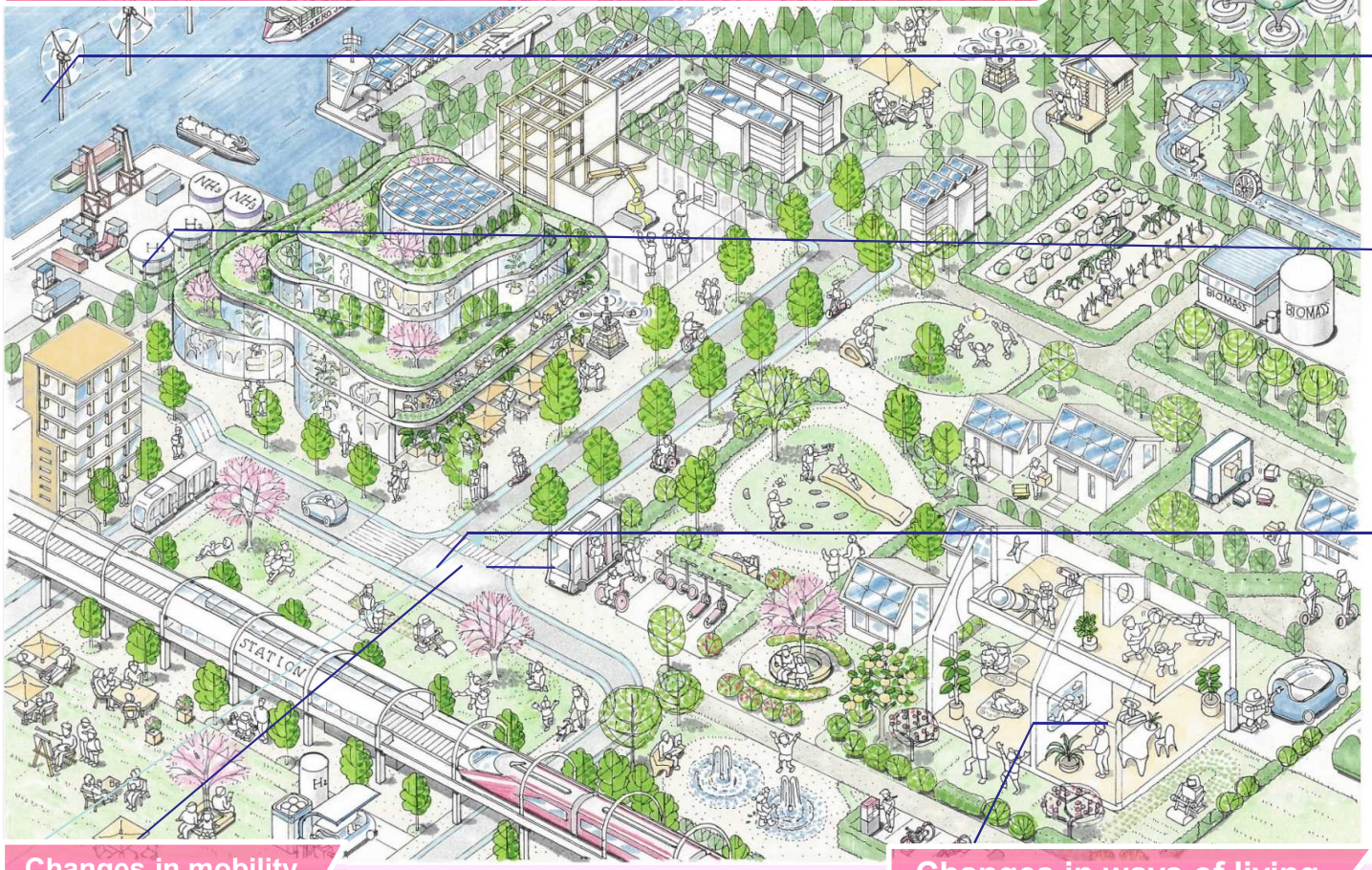
[Repeat] Important social mechanisms for decarbonization

What do you think are the key mechanisms of society as a whole to promote action toward decarbonization? * Multiple answers accepted



- The image shows how our life is projected to change in different phases of our daily life with a view to technological innovation toward decarbonization. The focus is placed on the aspects of the quality of life that will see improvements along with climate change measures.
- Our lives in the era of climate change will be supported by the progress of measures that draw the best from our ways of living, mobility, urban and natural environment, and key infrastructure everywhere.

Our lives in the era of climate change (future image)



Utilization of natural energy

・Local production and local consumption of renewable energy with offshore wind power, small-scale hydroelectric power generation, biomass power generation, etc.

Conversion of key infrastructure into renewable energy centers

・Conversion of airports into PV power generation centers
・Development of ports into hydrogen/ammonia receiving/storage hubs
・Promotion of zero emission ships, etc.

Changes in urban environment

・Walking space with lush greenery, comfortable, high-quality urban space
・Utilization of PV and other renewable energy sources in buildings and facilities
・Comfortable indoor environment with the use of locally harvested timber
・Disaster-resistant city with energy self-sufficiency in the event of power outages, etc.

Changes in mobility

・Improvement in the environment for using public transportation and next-generation mobility
・Wider use of bicycle sharing
・Comfortable pedestrian-centered space in front of the station, etc.

Changes in ways of living

・Comfortable living with high energy efficiency
・Healthy living with improved insulation
・Secure house with energy self-sufficiency in the event of power outages, etc.