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Theme Paper (Japan)

—Economic Impact of Climate Change and Actions by the Construction Industry—

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Overview

The issue of Climate change is a major and an urgent social issue for the entire world, and the importance of climate change countermeasures is increasing. In Japan, we are also promoting efforts to reduce greenhouse gas emissions toward decarbonization, aiming for carbon neutrality by 2050. In particular, the construction industry is involved in housing, transportation, and community development, and is a sector that can greatly contribute to the reduction of greenhouse gas emissions.

This paper describes the current situation and measures in the Japan and construction industries in three points.

First, the economic impact of climate change on Japan in the past and in the future. The market size of Japan decarbonization-related measures has been on an increasing trend over the last 20 years, and is expected to reach about ¥63trillion in 2050.

Second, the current situation of greenhouse gas emissions in Japan. Japan's greenhouse gas emissions in FY2020 were 1.15 billion tons (CO_2 equivalent), a decrease of 5.1% from the previous year. CO_2 emissions from the construction industry in FY2020 account for about 13.2% of the total Japan emissions. Furthermore, if we take into account the consumer sector (Residential sector and Commercial and other sectors), which corresponds to the operational stage of houses and buildings, it is considered that the construction industry is involved in about 40% of CO_2 emissions in a broad sense. It can be said that the role and expectations of the construction industry are high.

Third, the direction of measures to reduce greenhouse gas emissions in the construction industry toward the realization of a decarbonized and circulating society. When

considering greenhouse gas emissions in the construction industry, it is necessary to take measures to reduce emissions at each stage of "procurement and manufacturing," "construction," "residence," and "demolition and disposal" based on the supply chain. The main reduction measures will be introduced.

1. Issues of Climate change measures in Japan and Construction Industry

In recent years, there has been a steady increase in abnormal weather that is thought to be caused by global warming. For example, weather disasters such as floods and landslides caused by heavy rains and short-term heavy rains are becoming more severe and frequent. Japan is no exception, and frequent heavy rain disasters, landslide disasters, and extreme heat throughout the country, are typical examples. These climate change problems are major global social issues and are recognized around the world as urgent issues. In August 2021, the Intergovernmental Panel on Climate Change (IPCC) stated in a report: "*It is unequivocal that human influence has warmed the atmosphere, ocean and land.* ". This is a strong message that has been received around the world, and climate change measures are becoming even more important.

In Japan as well, efforts toward decarbonization are essential. We are promoting efforts to reduce greenhouse gas emissions toward decarbonization, aiming for carbon neutrality by 2050. In particular, the construction industry is involved in housing, transportation, and community development, and is a sector that can greatly contribute to the reduction of greenhouse gas emissions. It is also a sector related to the lives of all citizens.

In promoting these measures, the following three issues can be raised.

- What are the economic impacts of climate change? What kind of impact might it have in the future?
- What is the current situation of greenhouse gas emissions in Japan and what is the direction of efforts to reduce them?
- What is the direction of measures in the construction industry toward the realization of decarbonized and a circulating society?

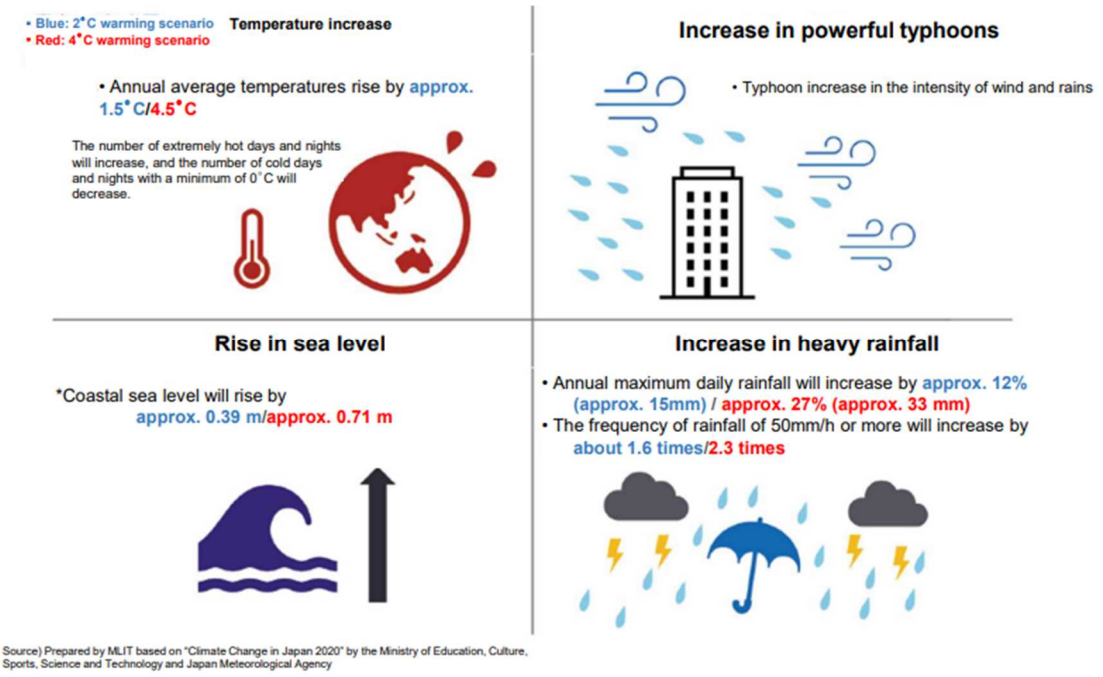
This paper summarizes the current situation and measures in the Japan and construction industries regarding these issues.

2. Economic Impact of Climate change

(1) Weather disaster risks and opportunities associated with climate change

There are concerns that climate change will increase the risk of weather disasters due to temperature rise, heavy rainfall, an increase in powerful typhoons, and a rise in sea level. 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, a rise in sea level along the Japanese coast, higher frequency of heavy rainfall, and increased typhoon intensity (Fig. 1).

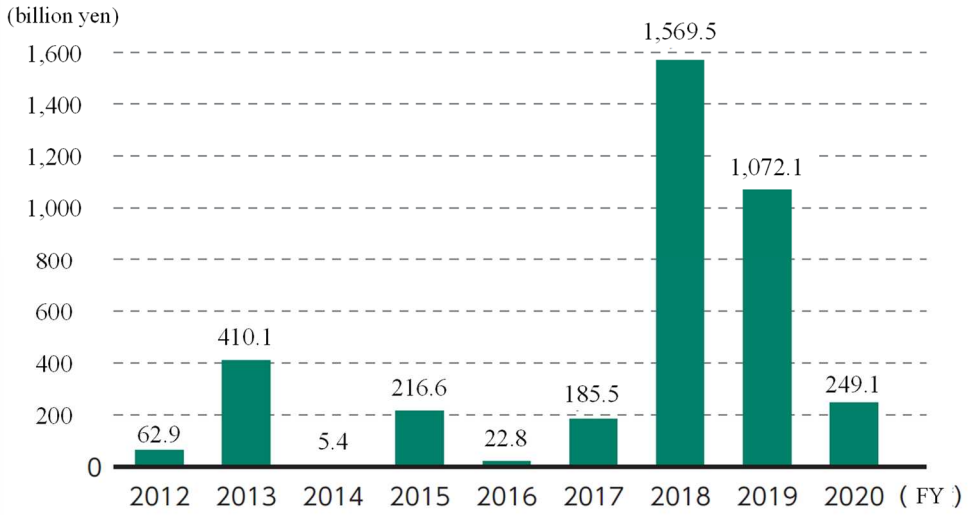
Fig. 1 Prediction of the impact of climate change



(Source) "Summary of the White Paper on Land, Infrastructure, Transport and Tourism in Japan, 2022" (MLIT)

In addition, once a weather disaster occurs, it can cause a huge amount of damage. Therefore, the climate change issue is recognized as an economic and financial risk. In Japan, the insurance amount paid by major natural disasters by non-life insurance companies reached a record high of ¥1,569.5 billion in FY2018 (Fig. 2). This is because natural disasters such as heavy rains and typhoons occurred one after another. Heavy rains were record-breaking over a wide area, and about 50,000 houses were damaged. Thus, past insurance payments due to wind and water disasters, etc., are due to disasters that occurred after 2010.

Fig. 2　The insurance payments due to wind and water disasters, etc., in Japan



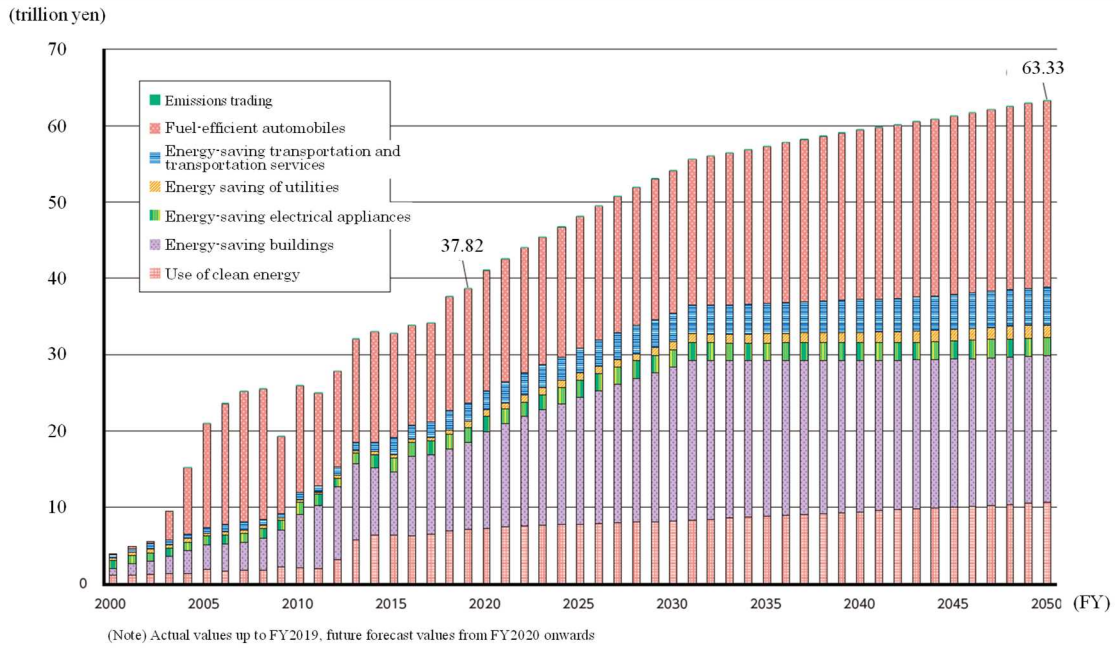
(Source) Created by RICE based on "White Paper on the environment in Japan, 2022" p.6 Fig. 1-1-3. (MOE)

On the other hand, as a response to the risk of weather disasters associated with climate change, there are movements in the market related to decarbonization. The market size of Japan decarbonization-related measures has been on an increasing trend for the last 20 years and is expected to increase in the future (Fig. 3). Specific measures are the following seven points.

a) Emissions trading
b) Fuel-efficient automobiles
c) Energy-saving transportation and transportation services
d) Energy saving of utilities
e) Energy-saving electrical appliances
f) Energy-saving buildings
g) Use of clean energy

According to Fig. 3, the ratio of fuel-efficient automobiles and energy-saving buildings is high, and the market size of Japan decarbonization-related measures is expected to be about ¥63trillion in 2050.

Fig. 3 Trends and Forecast in the market size of Japan decarbonization-related measures



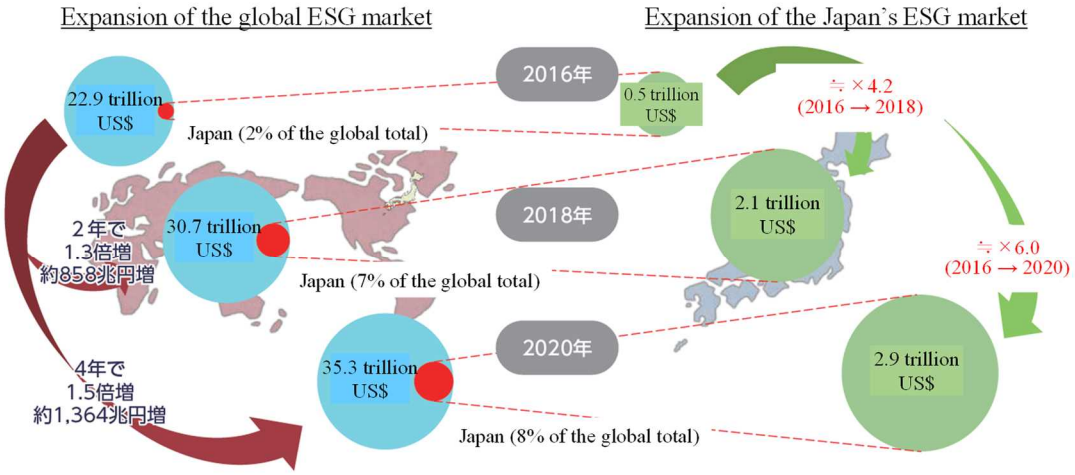
(Note) Actual values up to FY2019, future forecast values from FY2020 onwards

(Source) Created by RICE based on "White Paper on Land, Infrastructure, Transport and Tourism in Japan, 2022" p.30 Fig. I-1-1-18. (MLIT)

In addition, there are financial moves to promote decarbonization. Around the world, ESG finance[1] initiatives aimed at transitioning to a decarbonized society and creating a sustainable economic society have spread and expanded ahead of Europe and the United States. In Japan, the financial flows associated with the ESG factors have also expanded rapidly in recent years. In 2016, Japan accounted for about 2% of the global total ESG investment, but by 2020, it will account for about 8% of the global total. In 2018, the Japan's ESG investment balance was US$2.1 trillion, and in 2020 it is US$2.9 trillion, which has expanded sixfold in the last four years (Fig. 4).

[1] Investments and loans that consider non-financial information on the Environment, Social, and Governance

Fig. 4　Expansion of the ESG market



(Source) Created by RICE based on "White Paper on the environment in Japan, 2022" p.22 Fig. 2-1-2. (MOE)

(2) Promotion of Global Warming Countermeasures

As mentioned earlier, the international movement toward decarbonization is rapidly expanding amid the impact of climate change on socio-economic activities. In October 2020, Japan also set a goal of achieving carbon neutrality. In April 2021, the specific targets for reducing greenhouse gas emissions were presented. 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%." In order to achieve the target, the contents of the promotion as global warming countermeasures are Table.1. MLIT is taking the lead in various initiatives.

Table. 1 Global Warming Countermeasures

1.	Shift to carbon-neutral urban development
2.	Development and dissemination of environmentally friendly vehicles and promotion of optimal use
	a) Improvement of fuel efficiency of automobiles
	b) Establishment of a system to promote improvement of fuel efficiency
	c) Promotion of environmentally friendly vehicles
	d) Dissemination and promotion of eco-driving
3.	Development of transportation network
4.	Promoting the use of public transportation
5.	Realization of streamlined logistics services
6.	Promoting low-carbon policies in railways, ships, aviation, and ports
7.	Improvement of energy-saving performance of houses and buildings
8.	Environmental Measures for Construction Machinery

(Source) Created by RICE based on "White Paper on Land, Infrastructure, Transport and Tourism in Japan, 2022" pp.30-305. (MLIT)

(3) Promoting the formation of a circulating society

Japan aims to realize a circulating society as well as a decarbonized society. A circulating society is a society that seeks to reduce the consumption of resources and reduce the burden on the environment. Towards the realization of a circulation society, waste and recycling measures are mainly taken. Specific measures are the following five points.

a) Promotion of waste recycling
b) Construction of a recycling resource logistics system
c) Recycling of automobiles and ships
d) Efforts based on the procurement of environmental goods
e) Promotion of the use of wood

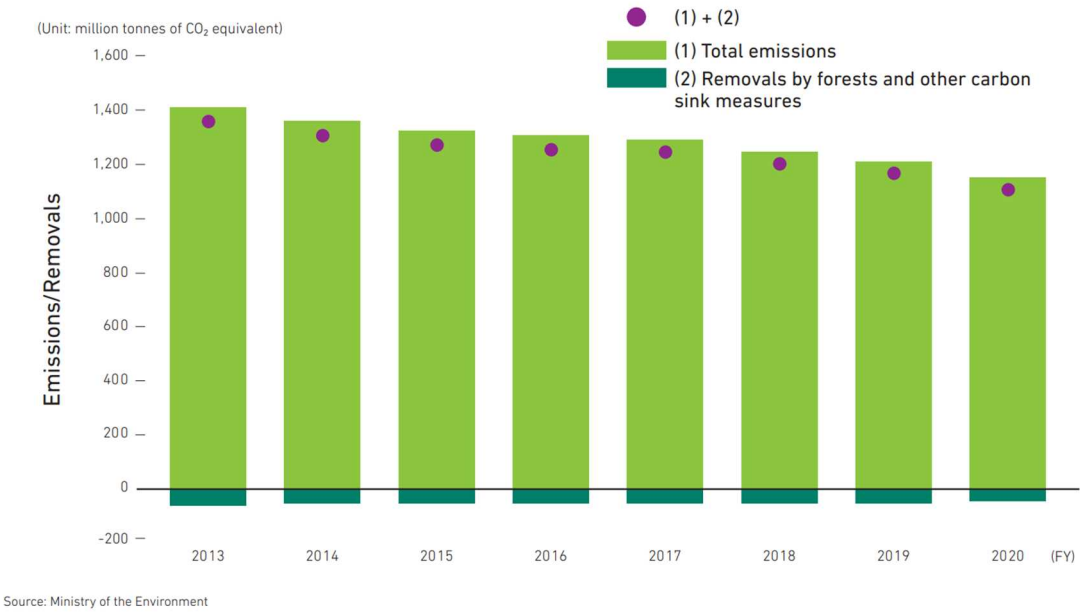
3. Current Situations of Greenhouse Gas Emissions and Reduction Measures in Japan and the Construction Industry

(1) Japan's greenhouse gas emissions

In FY2020, Japan's greenhouse gas emissions were 1,150 million tons (CO_2 equivalent) per year (Fig. 5). Compared to the total emissions of the previous fiscal year, the amount decreased by 5.1%, and due to decrease in manufacturing output in

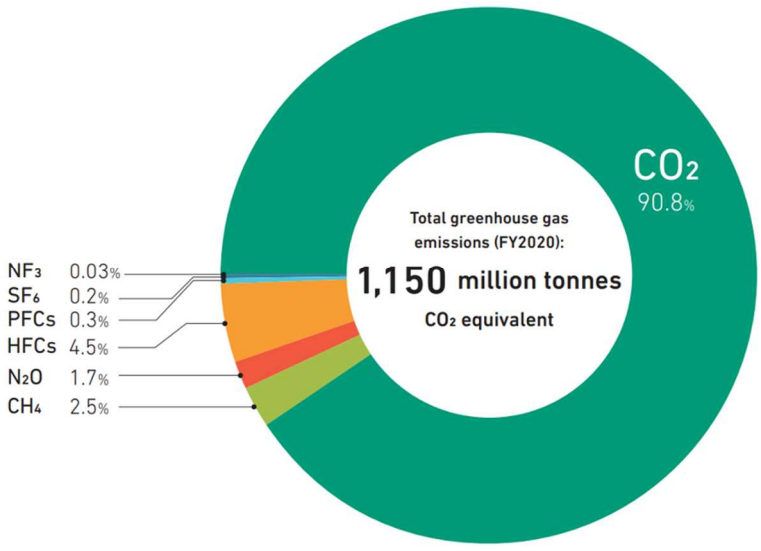
the industrial sector, decrease in passenger and freight transport in the transport sector by COVID-19. Also, compared to FY2013, it decreased by 18.4%, indicating a steady decrease. By share, about 90% of Greenhouse Gas emissions are CO_2 (Fig. 6). In terms of CO_2 emissions by sector, "Industrial sector" has the largest emissions, followed by "Transportation sector", "Commercial and other sector", and "Residential sector" (Fig. 7).

Fig. 5　Japan's greenhouse gas emissions



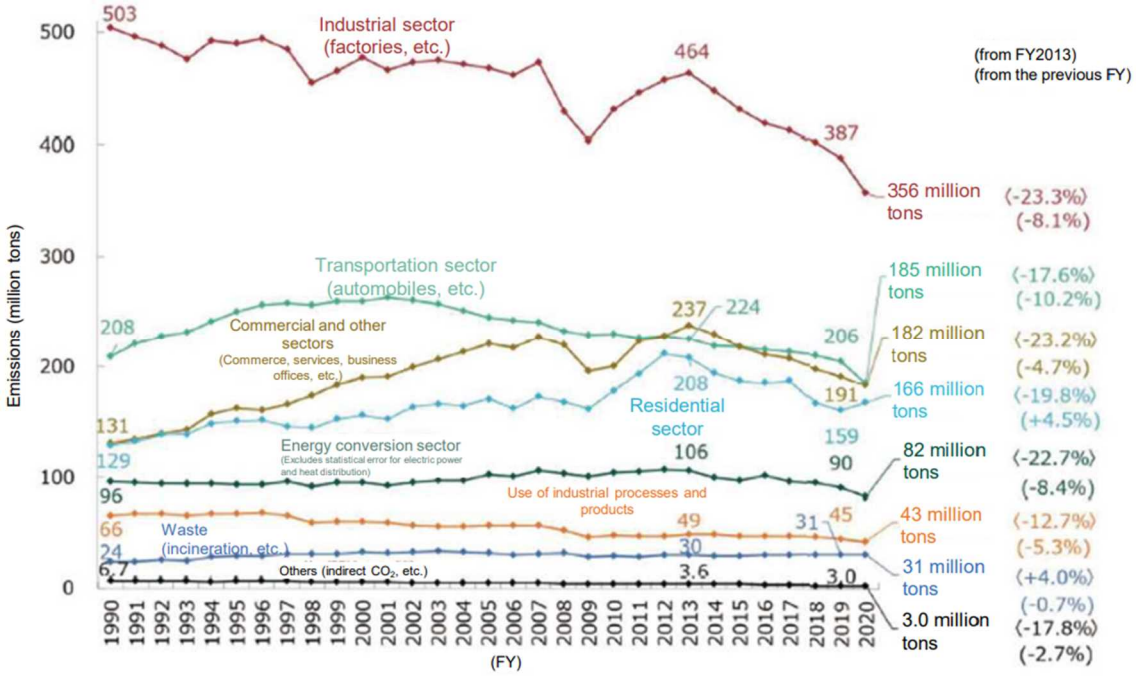
(Source) "Annual Report on the Environment, the Sound Material-Cycle Society and Biodiversity in Japan 2022" (MOE)

Fig. 6　Share of Japan's greenhouse gas emissions (FY2020)



(Source) "Annual Report on the Environment, the Sound Material-Cycle Society and Biodiversity in Japan 2022" (MOE)

Fig. 7　Changes in CO_2 emissions by sector



(Source) “Summary of the White Paper on Land, Infrastructure, Transport and Tourism in Japan, 2022” (MLIT)

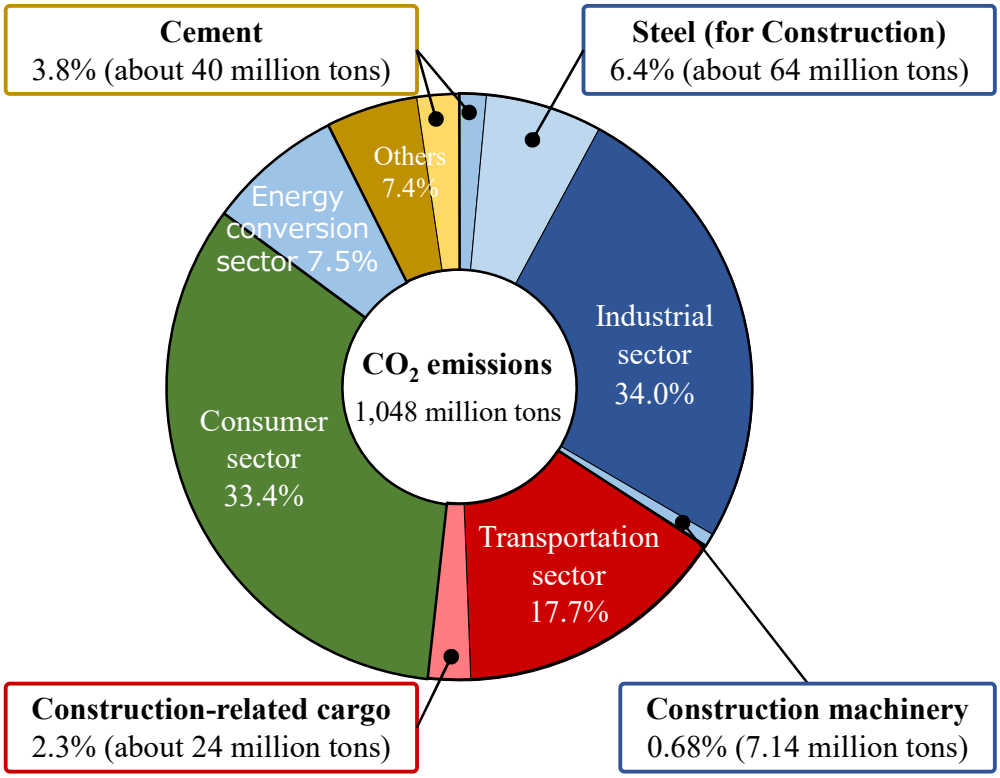
(2) Japan’s greenhouse gas emissions from the construction industry

The construction industry is categorized as "Industrial sector", and the CO_2 emissions of the construction industry are 7.14 million tons (FY2020). This is a low percentage of 0.68% of the total CO_2 emissions (1,048 million tons) shown in Fig.7. However, 7.14 million tons are emissions from direct emissions by companies involved in the construction industry themselves (Scope1) and indirect emissions from the use of electricity, heat and steam supplied (Scope2), which is only a part of the emissions in the construction industry when considered in the entire supply chain. In other words, the emissions of the construction industry must also take into account the emissions of other companies related to business activities (Scope3).

Therefore, when calculating CO_2 emissions considering Scope1~3 in the construction industry, we first consider the emission factors at the construction site. There are four main emission elements: emissions from "construction machinery, etc." used at construction sites, emissions from the manufacturing process of "steel" and "cement" used at construction sites, and "construction-related cargo" that is transportation and delivery at construction sites. The results of the accumulation of CO_2 emissions from these four emission elements are shown in Fig. 8. The sum of the four emission elements is about 13.2% (about 138 million tons) of the total CO_2 emissions (1,048 million tons), and the construction industry accounts for more than 10% of the total

emissions. In addition, CO_2 emissions from the consumer sector (Residential sector and Commercial and other sectors), which corresponds to the operational stage of houses and buildings, account for 33.4% of the total emissions. Combined with emissions at construction sites and emissions at the operation stage of houses and buildings, it can be considered that the construction industry is involved in about 40% of CO_2 emissions in a broad sense, and it can be said that the role and expectations of the construction industry are high.

Fig. 8　CO_2 emissions related to the construction industry (FY2020)



(Source) Created by RICE

4. Direction of Measures to Reduce Greenhouse Gas Emissions in the Construction Industry

When considering greenhouse gas emissions in the construction industry, it is necessary to take measures to reduce emissions at each stage of "procurement and manufacturing," "construction," "residence," and "demolition and disposal" based on the supply chain. The main reduction measures are introduced below.

(1) Procurement and manufacturing stage: Eco-friendly Concrete

The construction industry is an industry that consumes a large amount of raw materials, and concrete as the main material is known to emit a large amount of CO_2 in the manufacturing process. To reduce CO_2 emissions in concrete, the cement can be replaced with alternative materials or special powders that absorb and immobilize CO_2. The development of Eco-friendly concrete technology aimed at reducing emissions is progressing. Eco-friendly concrete is a material that can contribute to the reduction of CO_2 emissions compared to general concrete and is being put to practical use. Eco-friendly concrete is roughly divided into two types: "cement replacement type" and "cement replacement + carbon negative type".

(2) Procurement and manufacturing stage: Use of wood

Japan is a forested country where forests occupy about two-thirds of the country's land area, and 40% of the forests are plantation forests. Since many of the plantation forests were created immediately after 1945 or in the 1960s, half of them have exceeded the general main logging period of 50 years and are reaching its utilization period.

The effects of wood use can contribute to the realization of regional revitalization through the revitalization and attractiveness of the local economy and the creation of employment. In addition, a space using wood has the effect of increasing comfort and calmness, and can contribute to the creation of a good environment. As for the significance of the decarbonized society, trees grow while absorbing CO_2 from the atmosphere through photosynthesis and can store carbon as wood, and the CO_2 emissions during production are also smaller than steel structures and reinforced concrete structures. This is a point that leads to a reduction in emissions. Similarly, wood can be reproduced by planting and reusing, and it has excellent characteristics as a recycling-oriented resource, and the use of wood is accelerating.

The ratio of wooden buildings has remained unchanged at about 40% since 2010. In addition, with the support of the government, public buildings are steadily becoming wooden. As for private buildings, although the use of wood is spreading beyond low-rise houses with a high proportion of wooden structures, there is still a small number of wooden structures in non-residential buildings and medium- and high-rise buildings, so it can be said that there is opportunity for demand to expand.

(3) Construction stage: Improvement of construction machinery

One of the measures to reduce emissions at the construction stage is the ICT[2] construction of construction machinery. At construction sites where ICT construction is being carried out, the work time related to construction can be reduced compared to the past by utilizing ICT construction machinery. Due to the reduction of working time, it can be expected to reduce the CO_2 emissions emitted from construction machinery.

Also, direct emissions from the construction industry are mainly emissions associated with fuel for construction machinery at construction sites. Among fuels, we are promoting the introduction of eco-friendly fuels to reduce CO_2 emissions from diesel fuel. Typical examples of eco-friendly fuels are "BDF (Bio Diesel Fuel)" and "GTL (Gas to Liquids)". Some Japanese companies have set specific targets for the amount of use, and it is expected that they will be actively used in the future.

(4) Residence stage: Energy-saving building

According to Fig.8, CO_2 emissions from the consumer sector (Residential sector and Commercial and other sectors), which corresponds to the operational stage of houses and buildings, account for 33.4% of the total emissions. Energy-saving measures are necessary. Therefore, in order to improve the energy consumption performance of buildings, ZEB and ZEH are implemented as energy-saving measures. ZEB is an abbreviation of Net Zero Energy Building, which is a building that aims to reduce the annual primary energy consumption to zero. Also, ZEH is an abbreviation of Net Zero Energy House, which is a house that aims to reduce the annual primary energy consumption to zero. Although the penetration record is still low, it is expected to spread further as a measure that can contribute to the reduction of greenhouse gas emissions.

(5) Demolition and disposal stage: Reducing and reusing construction waste

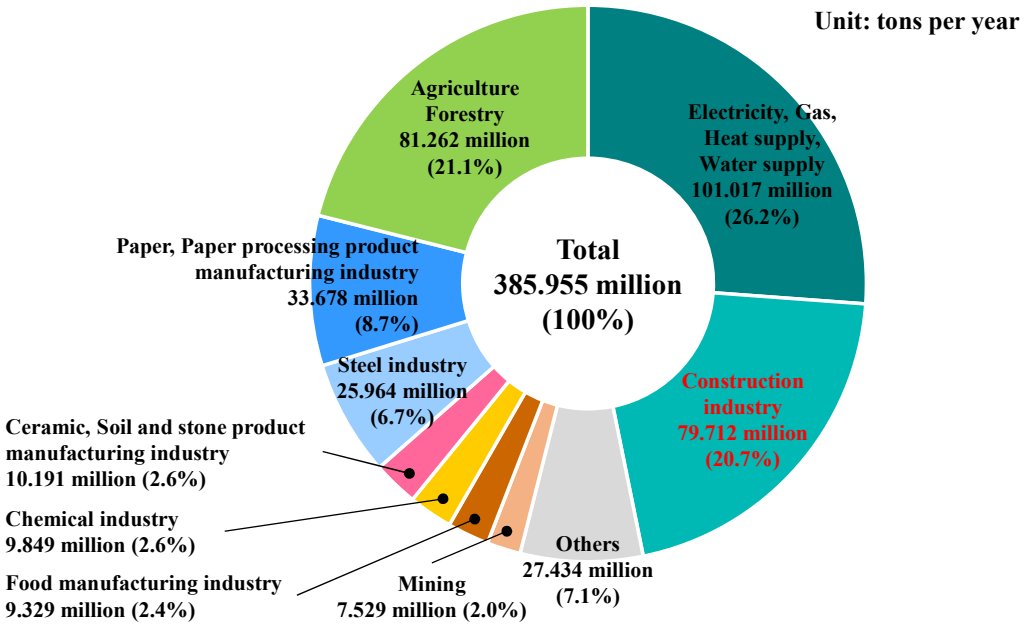
Waste is divided into two types: industrial waste and general waste. The amount of industrial waste emitted in FY2019 was 386 million tons, which has remained unchanged at about 400 million tons in the past few years. Looking at industrial waste emissions by industry, the waste in the construction industry accounted for 79.71 million tons, accounting for 20.7% of the total (Fig. 9).

In addition, the emissions of construction waste by type are shown in Fig. 10. It is mandatory to recycle certain construction materials (concrete, wood, asphalt, etc.)

[2] Information and Communication Technology

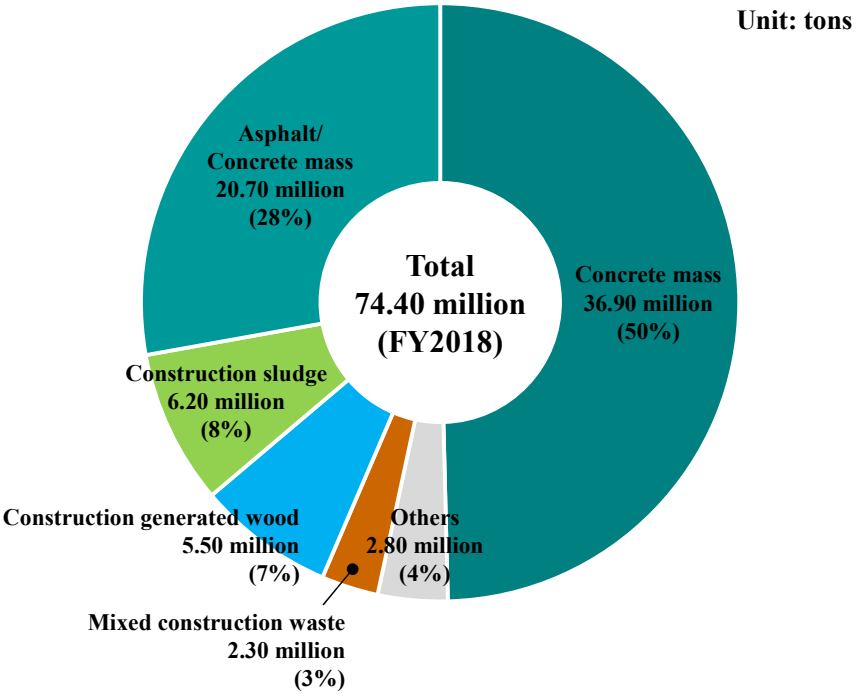
generated from target construction such as building demolition work. In FY2018, construction waste output was 74.4 million tons, and final disposal amount was 2.12 million tons. The recycling and reduction rate was 97.2%. Further reuse of construction waste is expected.

Fig. 9　Industrial waste emissions by industry



(Source) Created by RICE based on “White Paper on the environment in Japan, 2022” p.149 Fig. 3-1-16. (MOE)

Fig. 10　Construction waste emissions by type (FY2018)



(Source) Created by RICE based on "White Paper on the environment in Japan, 2022" p.144 Fig. 3-1-12. (MOE)

5.　Conclusion

This paper describes the current situation and measures in the Japan and construction industries in three points.

As for the economic impact of climate change, the expansion of the market size of Japan decarbonization-related measures has been on an increasing trend in the last 20 years or so, and it is likely to continue to expand until 2050. While it is assumed that the entire country will work on it, the construction industry is a market that can make a significant contribution.

In order to realize a decarbonized and circulating society, the construction industry is a sector that can be involved in a wide range of fields. It is necessary to implement measures to reduce greenhouse gas emissions through active infrastructure investment. It is important to implement the reduction measures that can be taken immediately. In addition, in order to achieve carbon neutrality, it is important to support technologies that contribute to the reduction of greenhouse gas emissions, from research and development to practical application, and the economic impact is also considered to be significant.

Finally, in order to achieve carbon neutrality, it is necessary to change individual

awareness and take action. We hope that individuals will change their lifestyles and tackle climate change issues as their own matter.