Port and Harbor Decarbonization Plan
for the Port of Yokohama

March 2025

City of Yokohama

（Port Management Body of the Port of Yokohama）

＜CONTENTS＞

*“Port Management Body” refers to a port authority or a local public entity.

1. Basic Policy on the Promotion of Effective Use of Ports and Harbors that Contribute to the Promotion of Decarbonization through Public-Private Partnership

1-1. Outline of the Port of Yokohama

(1) Characteristics of the Port of Yokohama

Since its opening in 1859, the Port of Yokohama has been Japan's leading international trading port and a driving force of the Japanese economy. While developing as one of Japan's leading commercial ports, with Tokyo, a huge consumption center, and a vast hinterland extending beyond it, the Port of Yokohama has also played an important role as an industrial port based in the Keihin Industrial Zone and other waterfront industrial zones. In addition, until the advent of the aircraft era, it was a busy gateway not only for goods but also for people, and has continued to grow as a comprehensive port. The number of ocean-going vessels calling at the Port of Yokohama has been the highest in Japan since 1964, making it a port that represents Japan as a gateway to the world.

The Port and Harbor Bureau of the City of Yokohama, the port management body of the Port of Yokohama, aims to create a comprehensive port that revitalizes Yokohama's economy and enriches the lives of its citizens, based on the three pillars of “an internationally competitive port,” “a port of tourism and prosperity,” and “a safe, secure, and environmentally friendly port”. The City is working to create a carbon neutral port by developing and deepening its efforts to become a “safe, secure, and environmentally friendly port.”

① Overview of the Port of Yokohama, number of vessels entering the port, and cargo handled

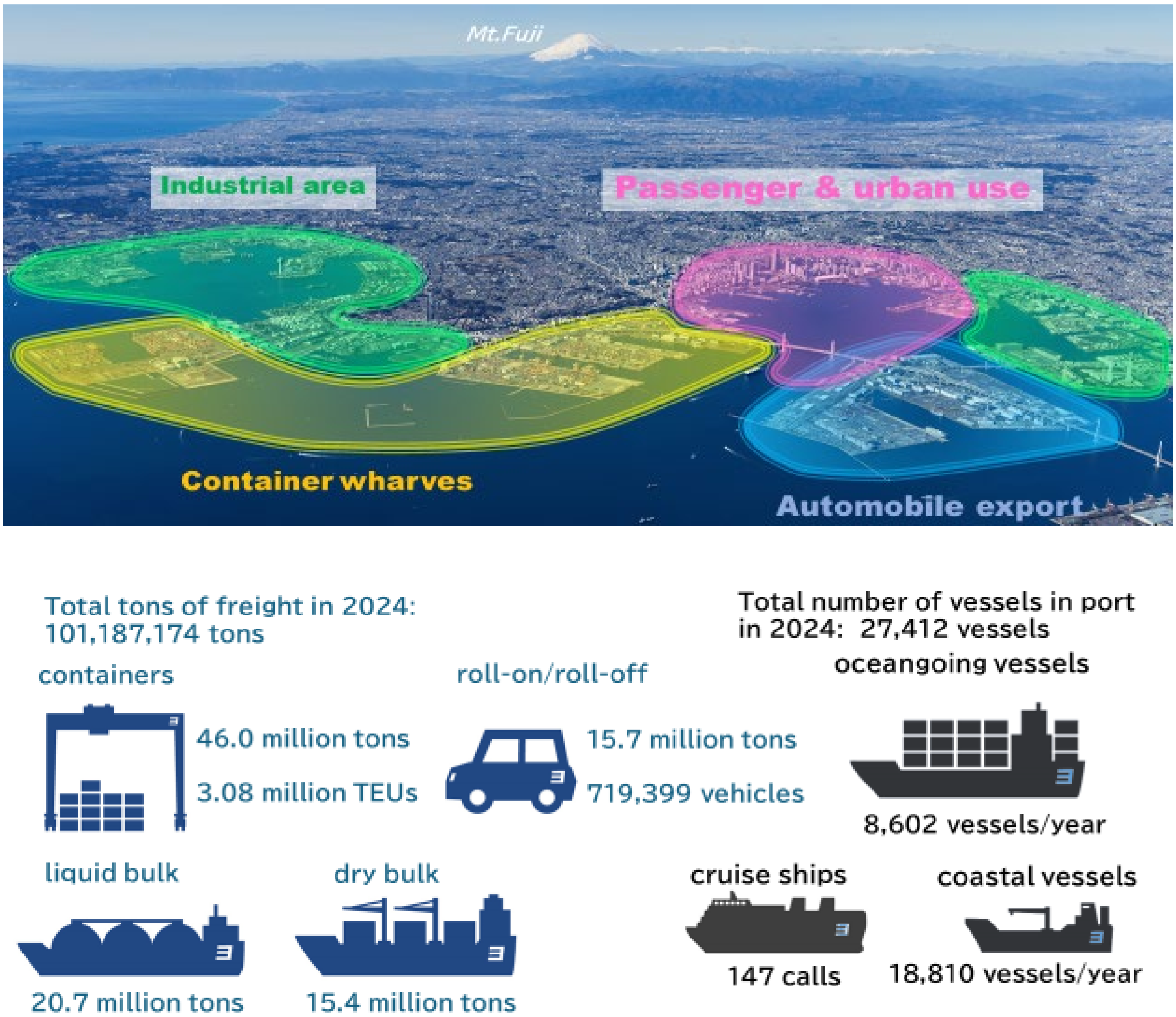


Figure 1: Overview of the Port of Yokohama, number of vessels in the port, and cargo handled

② Public Terminal Status

As a strategic international container port, in order to respond to the rapid increase in the size of vessels and to maintain and expand key shipping routes, we are promoting the development of Shin Honmoku Pier, the integrated operation of Minami Honmoku Pier, and the redevelopment of Honmoku Pier.

Furthermore, Daikoku Pier is being enhanced as the largest automobile handling base in eastern Japan.

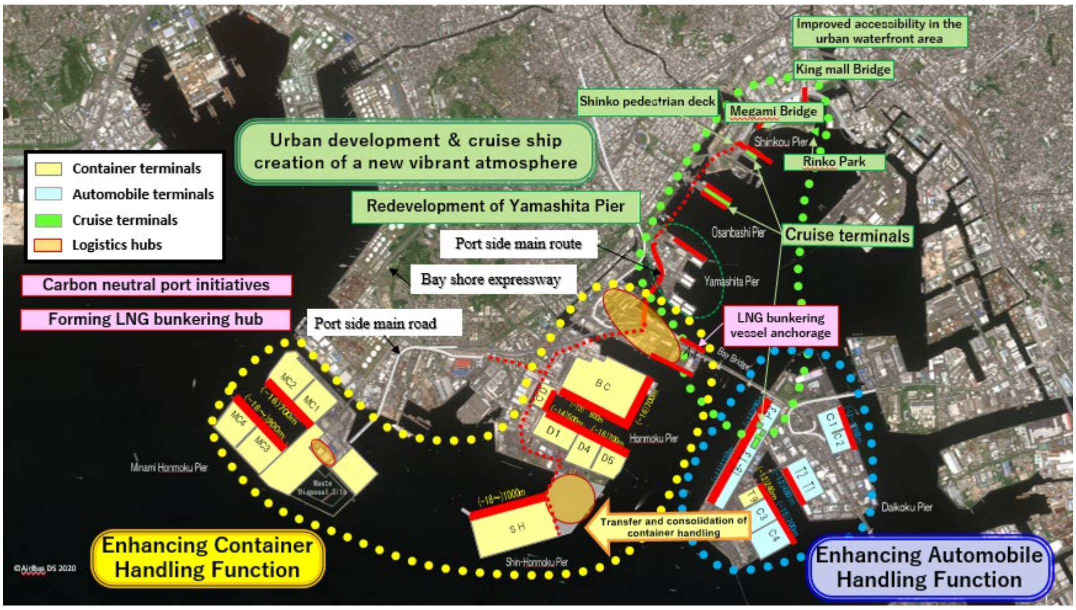


Figure 2: Major Public Terminals

③ Location of energy infrastructure

Energy-related infrastructure facilities such as power plants and LNG terminals are clustered in the northern and southern parts of the Port of Yokohama. The northern Yokohama area is expected to be linked to the Kawasaki area, while the southern Yokohama area is independent.

Figure 3: Location of existing infrastructure such as commercial power plants

④ Trends in Ocean Freight and Import/Export Freight

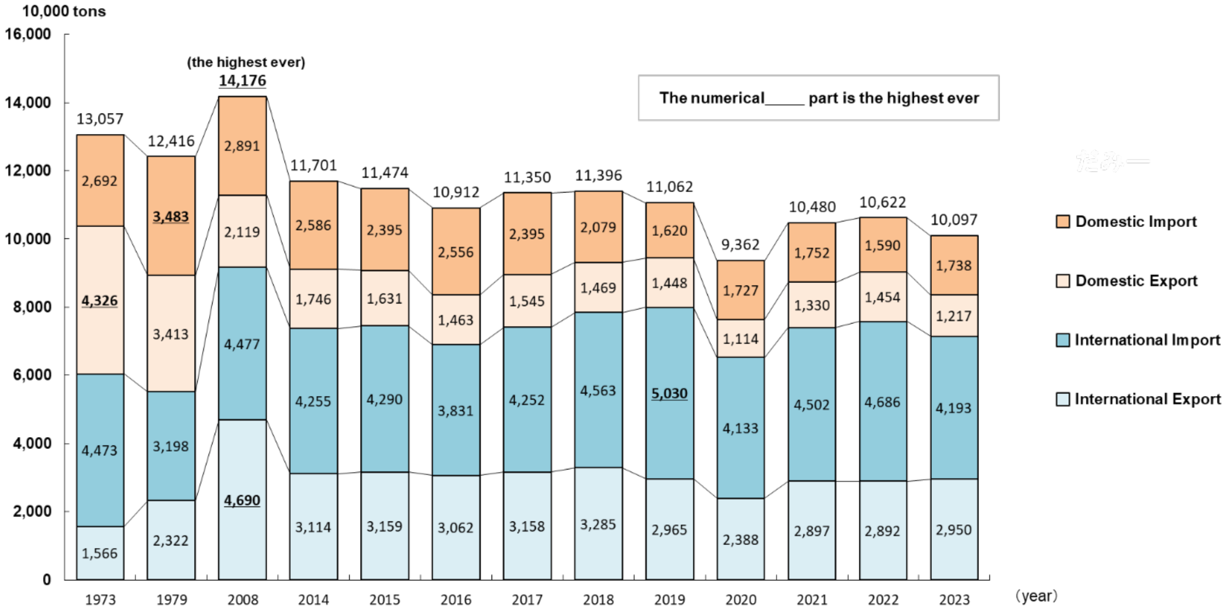


Figure 4: Trends in incoming and outgoing cargo at sea

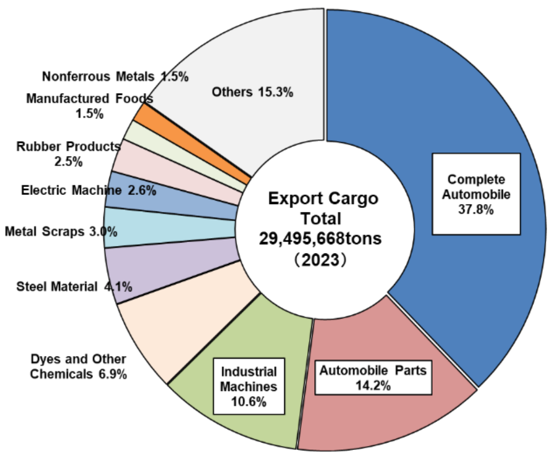


Figure 5: Export Cargo (major product types)

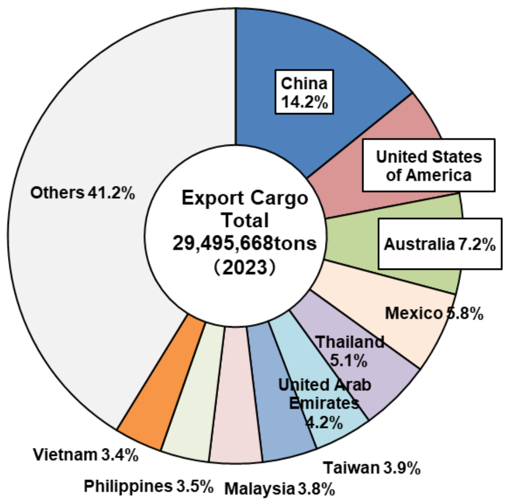


Figure 6: Export Cargo (major countries)

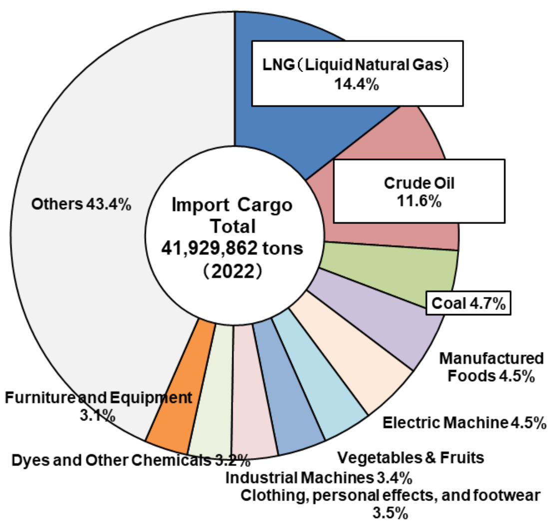


Figure 7: Import Cargo (major product types)

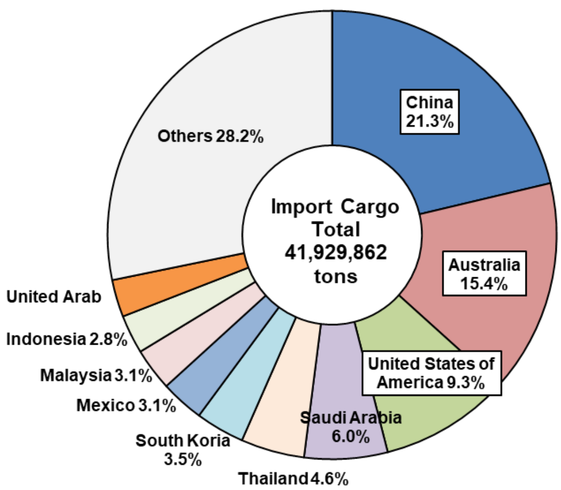
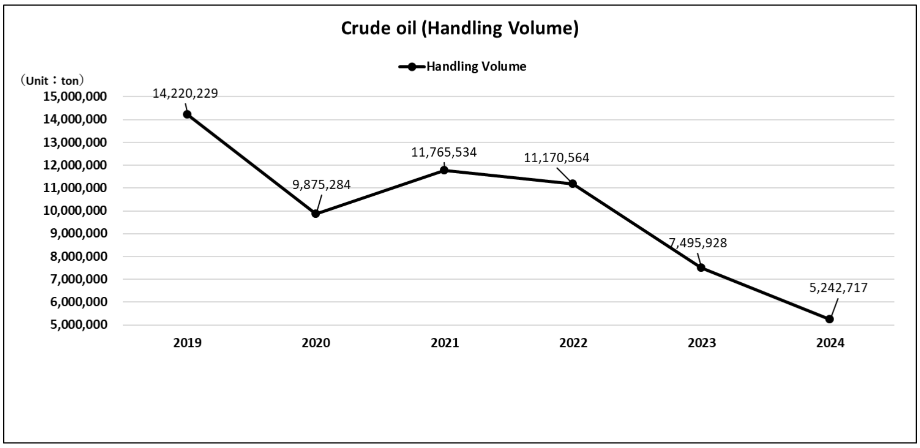


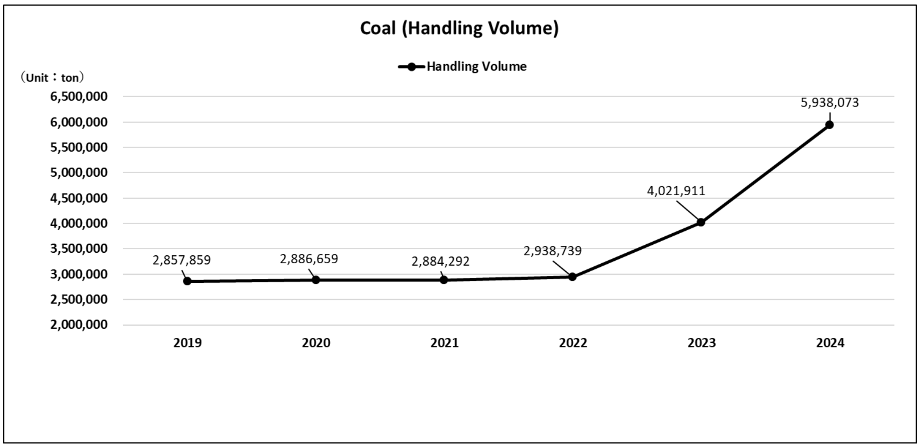
Figure 8: Import Cargo (major countries)

Source: 2023 Yokohama Port Statistical Yearbook

⑤ Crude oil, coal, and liquefied natural gas handling volume* status

Crude oil volume has decreased due to the decommissioning of partial refinery units at partial equimment decommisioning of ENEOS Corparation's Negishi Refinery in October 2022. Coal handling volume did not change during the period when only the Isogo Thermal Power Station of Electric Power Development Co., Ltd. was in operation but is on an increasing trend with the start of operation of Unit 1 (June 2023) and Unit 2 (December 2023) at the JERA Yokosuka Thermal Power Station. Liquefied natural gas (LNG) was imported at the Negishi and Ohgishima terminals of Tokyo Gas Co., Ltd., but without considering factors such as the purpose of use or the breakdown of the terminals, the total volume is on a downward trend.





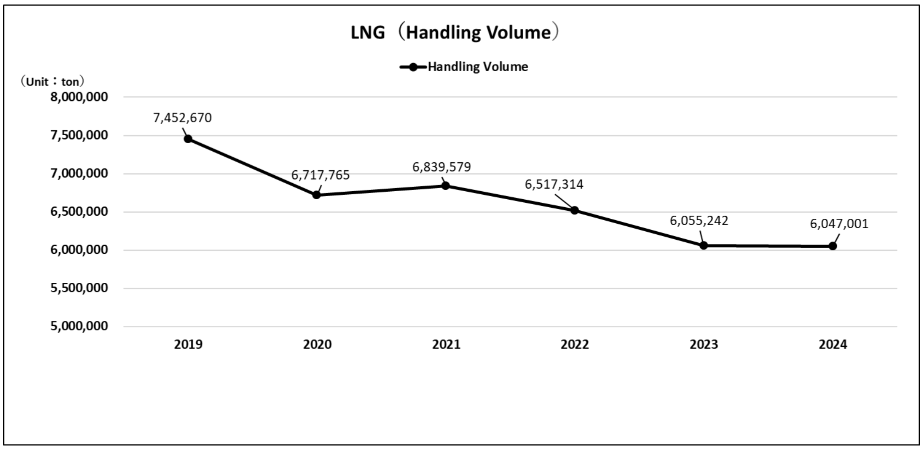


Figure 9: Trends in Crude Oil, Coal, and LNG Transaction Volume

*Transaction volume is the total value of exports, imports, transfers (positive numbers) at the Port of Yokohama.

(2) Positioning of this plan and related plans

①Positioning of this plan

The purpose of this plan is to promote the effective port usage that contributes to the promotion of decarbonization through public-private partnership, in accordance with the provisions of Article 50-2-1 of the Ports and Harbors Act.

②Positioning in the Port and Harbor Plan

The Yokohama Port and Harbor Plan, which was revised in November 2014, sets forth the three pillars of “an internationally competitive port,” “a port where citizens can gather and relax,” and “a safe, secure, and environmentally friendly port,” and aims to create a comprehensive port that will revitalize Yokohama’s economy and enrich the lives of its citizens. One of the policies to achieve this goal is to promote environmental preservation efforts, such as measures against climate change.

In addition to the Yokohama Port and Harbor Plan, this plan will be promoted in line with the Ministry of Land, Infrastructure, Transport and Tourism's “Basic Policy on Development, Use and Preservation of Ports and Harbors and Development of Development and Preservation Passages,” the “Comprehensive Plan for Keihin Port (Yokohama Port Long-term Concept),” and other related policies.

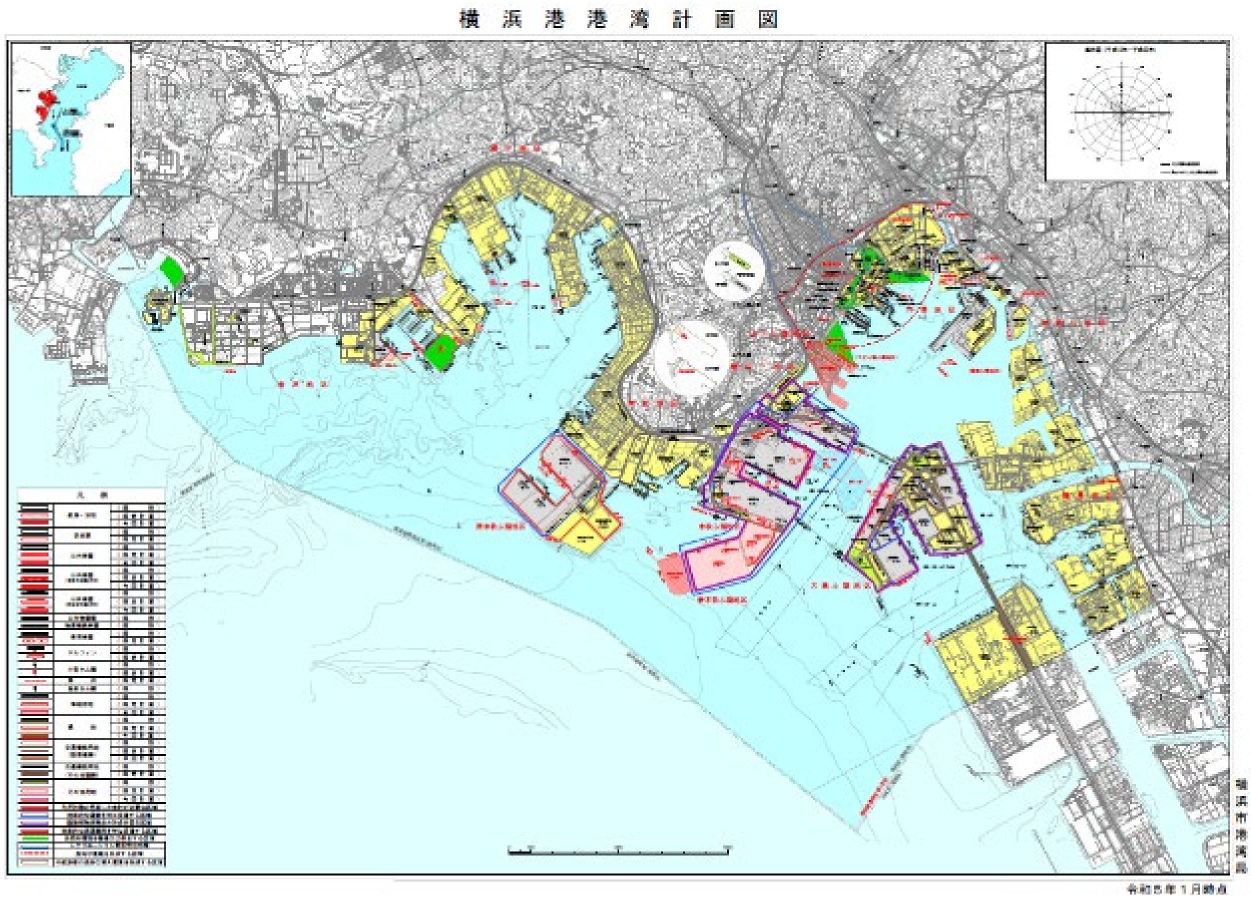


Figure 10: Map from the Yokohama Port and Harbor Plan

③ Positioning in the Yokohama Medium-term Plan
In the Yokohama Medium-term Plan for 2022 to 2025 (December 2022), the formation of a carbon neutral port is positioned as Strategy 3 “Realization of Zero Carbon Yokohama”
Policy 18 “Promotion of a Decarbonized Society,” and Strategy 9 “Urban Development Supporting Citizens' Life and Economic Activities” Policy 37 “Development of an Integrated Port with International Competitiveness.”

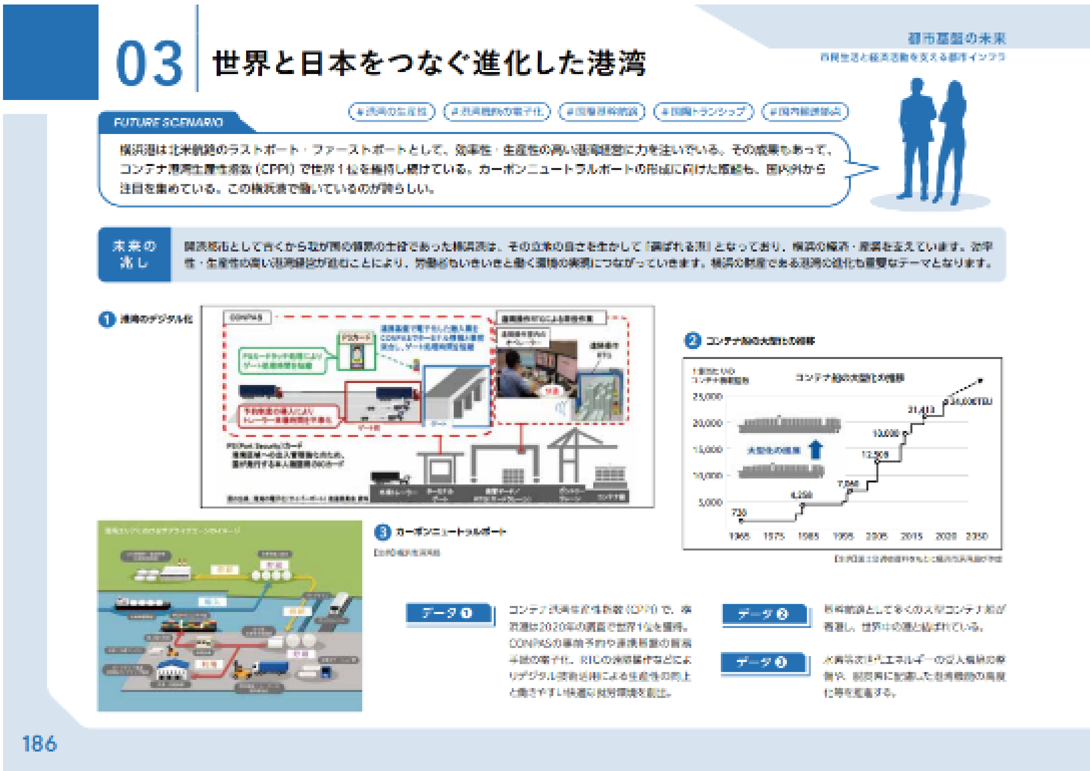


Figure 11: Yokohama Medium-term Plan for 2022 to 2025
“Future of Urban Infrastructure”

④ Positioning in the action plan of local governments based on the Act on Promotion of Global Warming Countermeasures (the local government’s action plan for entire municipal jurisdictions)

The Yokohama Action Plan for Global Warming Countermeasures (revised on January 27, 2023) calls for a 50% reduction of greenhouse gas emissions in Yokohama in FY2030 compared to the FY 2013 level, and for virtually zero greenhouse gas emissions from the city by 2050.
In addition, one of the measures in Basic Policy 1 “Creation of environmental and economic synergies” is “(Priority Action 1) Creation of decarbonization innovation in the Yokohama waterfront area in collaboration with the national government and industry.” The direction of this initiative is “taking advantage of the city’s potential, especially in the waterfront area, we will promote activities to create new decarbonization innovations in hydrogen, ammonia, synthetic methane, liquid synthetic fuels, etc., in cooperation with various entities, such as companies located in the area, and promote the formation of a carbon neutral port in collaboration with waterfront industries.” The formation of carbon neutral ports is positioned as an important measure to combat global warming.

【Examples of specific measures】

・Promoting Carbon Neutral Port Formation

・Promote the construction of supply chains for hydrogen, ammonia, synthetic methane, liquid synthetic fuels, etc., in cooperation with the private sector and Kawasaki City, etc.

・Promoting the use of hydrogen and other next-generation energy

・Attracting companies and promoting investment in the decarbonization sector

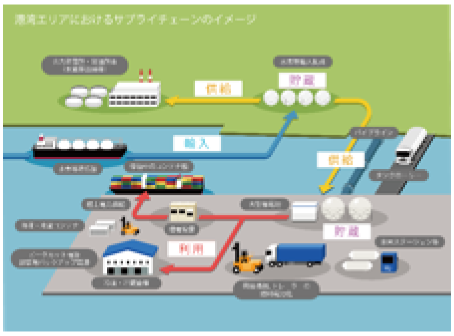


Image of carbon neutral port formation

Image of building a hydrogen supply chain

Initiatives in the Suehiro Decarbonization Model District

【Indicators (reiterated)】

Item	Standard Value	Target Value
CO2 Emissions in Waterfront Area	7.423 million t-CO_2 (FY2019)	4.8 million t-CO_2 (FY2030)

【Roadmap】

FY2030 — Demonstration and implementation for the creation of decarbonized innovation

2050 — Implementation and development for the creation of decarbonized innovation

Figure 12: Yokohama City Action Plan for Global Warming Countermeasures (the local government’s action plan for entire municipal jurisdictions), page 55

⑤ Positioning in the action plan of local governments based on the Act on Promotion of Global Warming Countermeasures (Administrative business section)

In the Yokohama City Action Plan for Global Warming Countermeasures (City Hall version), which was revised at the same time as Yokohama City Action Plan for Global Warming Countermeasures (the local government’s action plan for entire municipal jurisdictions), the initiatives of the port management body (Port and Harbor Bureau of the City of Yokohama) are classified as “government buildings, etc.” and include the introduction of LEDs in public facilities and renewable energy facilities such as solar power generation.

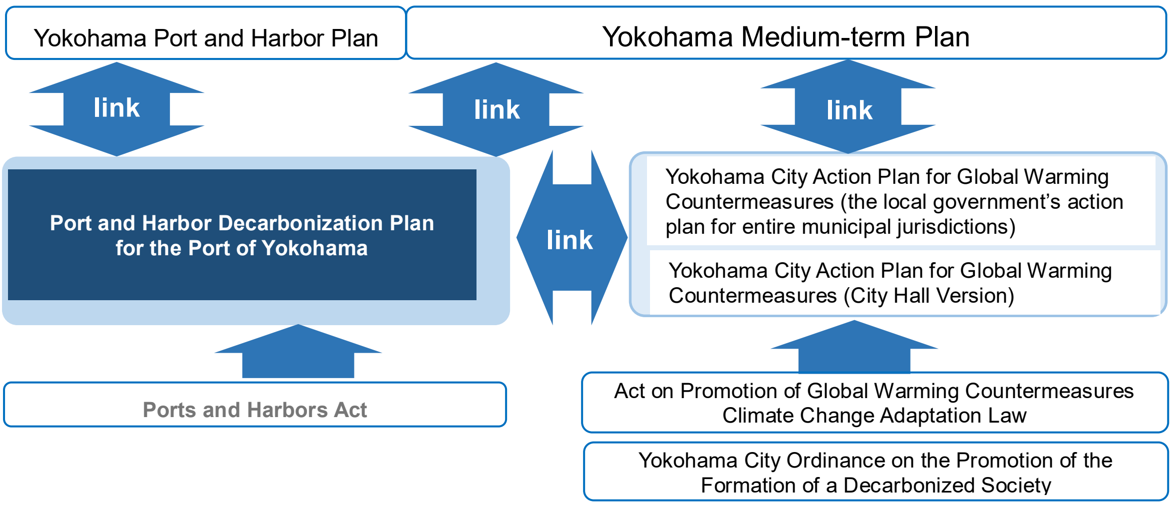


Figure 13: Summary of plans, laws and ordinances related to this plan

1-2. Scope of Port and Harbor Decarbonization Plan for the Port of Yokohama

In addition to decarbonization initiatives at terminals, the scope of this plan includes initiatives related to logistics activities (marine transportation, truck transportation, warehousing, etc.) conducted via terminals, initiatives related to activities of businesses located in waterfront areas (power generation, steel, chemical industry, etc.) that use ports for production, power generation, and initiatives such as sinks utilizing blue carbon ecosystems.

In addition to logistics functions at the piers, the Port of Yokohama has manufacturing functions in the Keihin Waterfront Area and Negishi District, and tourism and cultural functions in the urban waterfront area. Since these functions cover business activities in the waterfront area and adjacent areas, the geographical coverage of this plan is as follows. Note that the scope of this coverage is the estimated scope of GHG emissions and the scope of the economic ripple effect.

Table 1: Scope of the plan (district/street)

Ward	District name
Tsurumi Ward	Anzencho, Ougishima, Onocho, Suehirocho, Daikokucho, Daikoku Pier, Kanseicho, Namamugi 1 Chome, Namamugi 2 Chome, Bentencho
Kanagawa Ward	Izutacho, Ebisucho, Kanagawa 1 Chome, Sakaecho, Suzushigecho, Takaracho, Chiwakacho, Hashimotocho, Hoshinocho, Mizuhocho, Yamanouchicho, Oonocho, Shinurshimaho, Moriyacho, Kinkocho
Nishi Ward	Takashima 1 Chome, Takashima 2 Chome, Minatomirai 1 Chome, Minatomirai 2 Chome, Minatomirai 3 Chome, Minatomirai 4 Chome, Minatomirai 5 Chome, Minatomirai 6 Chome
Naka Ward	Kaigan-dori, Kamomecho, Shinko 1 Chome, Shinko 2 Chome, Shinyamashita 1 Chome, Shinyamashita 2 Chome, Shinyamashita 3 Chome, Toyouracho, Nishikicho, Honmoku Pier、 Minami Honmoku、 Yamashitacho, Chidoricho, Honmokuzhuniten, Kitanakadori, Nihon-odori, Honcho, Minaminakadori, Motohamacho, Motomachi, Yamatecho
Isogo Ward	Isogo 1 Chome, Ootoricho, Shinisogocho, Shinsugitacho, Shinnakaharacho, Sugita 1 Chome, Sugita 5 Chome, Haramachi,Shinmoricho
Kanazawa Ward	Sachiura 1 Chome, Sachiura 2 Chome, Showamachi, Shiraho, Torihamacho, Hakkeijima, Shibacho, Fukuura 1 Chome, Fukuura 2 Chome, Fukuura 3 Chome

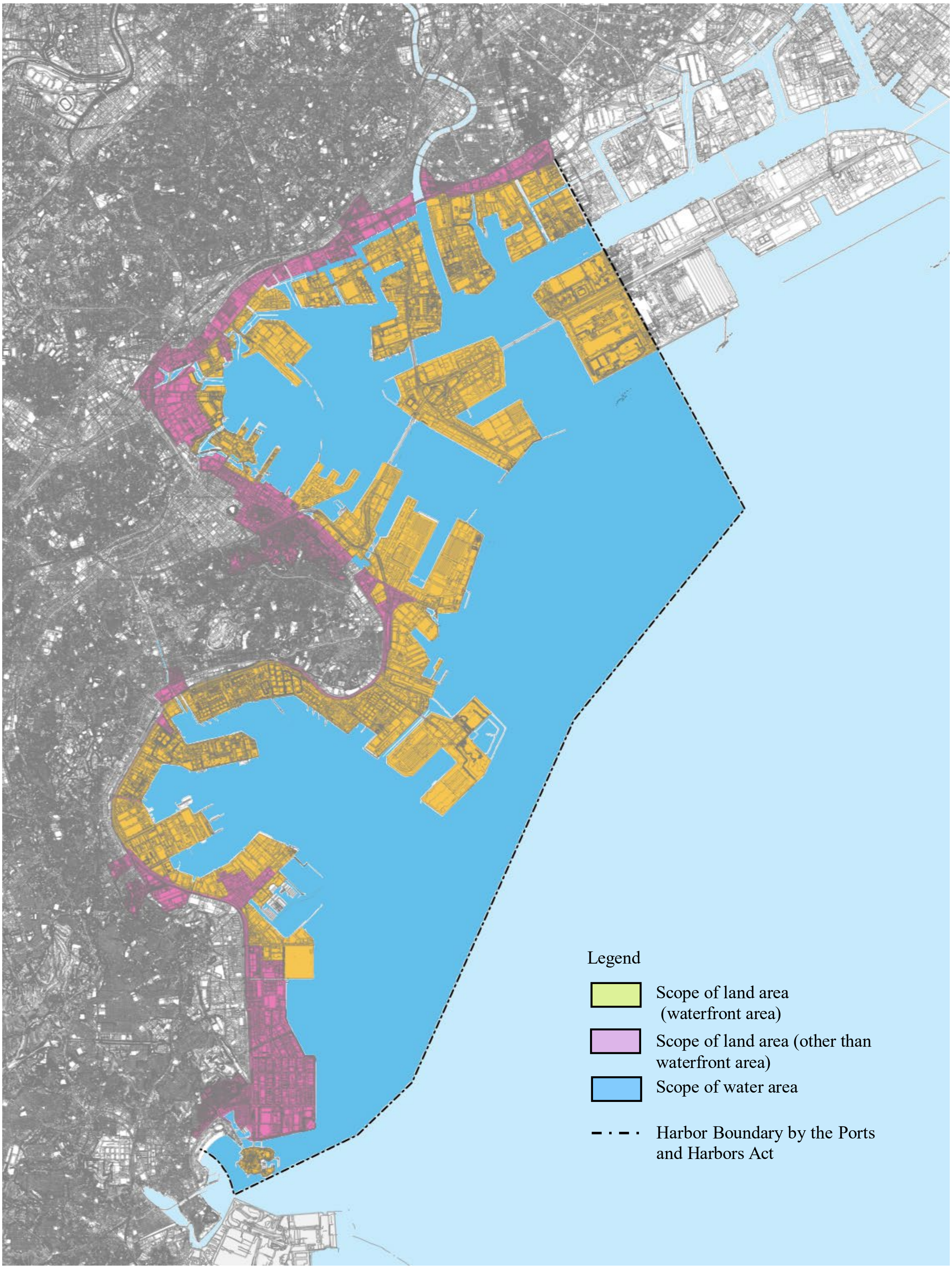


Figure 14: Scope of Port and Harbor Decarbonization Plan for the Port of Yokohama

Note: The map above shows the approximate scope of the initiatives in the Port and Harbor Decarbonization Plan for the Port of Yokohama (port decarbonization promotion projects, future concepts that contribute to the promotion of port decarbonization, and decarbonization-related initiatives that contribute to strengthening the competitiveness of ports and industries.)

Table 2: Major public terminals located within the scope of the plan

Category	Target District	Main target facilities, etc.		Owners and managers
Container Terminals	Honmoku Pier Minami Honmoku Pier Daikoku Pier	Handling equipment	Transfer cranes Straddle Carrier Top Lifter Reach Stacker Forklifts Container tractors	Terminal Lessee, etc.
			Gantry cranes	City of Yokohama Yokohama Port Corporation Yokohama Kawasaki International Port Corporation Yokohama Port Megaterminal Co.,Ltd
		Administration buildings lighting equipment reefer power supply		City of Yokohama Yokohama Port Corporation Yokohama Kawasaki International Port Corporation
Other Terminals (conventional freight, automobiles, etc.)	Honmoku Pier Daikoku Pier	Administration buildings, lighting equipment, inspection building, shed, Other facilities, etc.		City of Yokohama Yokohama Port Corporation
Vessels and vehicles entering and leaving the terminal	Honmoku Pier Minami Honmoku Pier Daikoku Pier	Vessels at anchor		Unspecified (shipping company)
		Container tractors, trucks		Unspecified (freight forwarder)

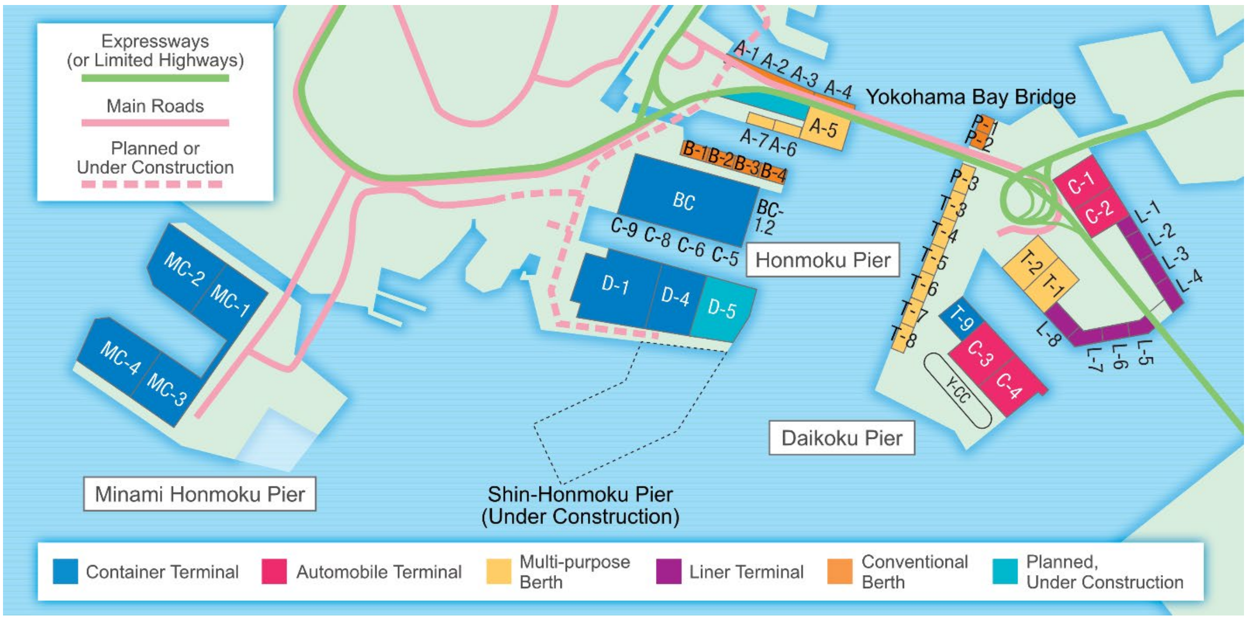


Figure 15: Major public terminals at the Port of Yokohama

1-3. Policy on efforts to promote effective use of ports and harbors that contribute to the Promotion of Decarbonization through public-private partnership

(1) Policy for efforts to create a carbon neutral port

Following the national government's decarbonization declaration in October 2020, the Port of Yokohama was selected by the Ministry of Land, Infrastructure, Transport and Tourism in February 2021 as a port to consider forming a carbon neutral port and began studies.

While we will continue to study this issue in light of technological progress and changes in social conditions related to decarbonization, the following chart shows the initiatives that are expected of the Port of Yokohama at this time.

In addition, specific initiatives and future plans are positioned as three action policies and are described in items 4-1, 6-1, and 6-3 of this plan.

① Policies for decarbonization of the waterfront area

This initiative, led by companies located in the Yokohama waterfront area, will promote energy conversion using hydrogen and hydrogen derivatives (methanol, ammonia, synthetic methane, etc.), introduction of renewable energy, introduction of energy-saving facilities, and development of new technologies.

② Policy for decarbonization initiatives at the terminals

As a strategic international container port, this is an initiative to promote decarbonization at public terminals such as container terminals and to become a port of choice.

Specifically, the project aims to use low-carbon and decarbonized loading and unloading machinery, LEDs for administrative buildings, sheds, and lighting equipment, and electricity derived from renewable energy sources. For vessels, we will promote the realization of bunkering to next-generation fuel vessels and developing onshore power supply facilities, while for vehicles, electrification and modal shift will be promoted.

③ Policy for efforts for the creation of an abundant ocean

Promote the use of blue carbon ecosystems, including the formation of seaweed beds and shallow water.

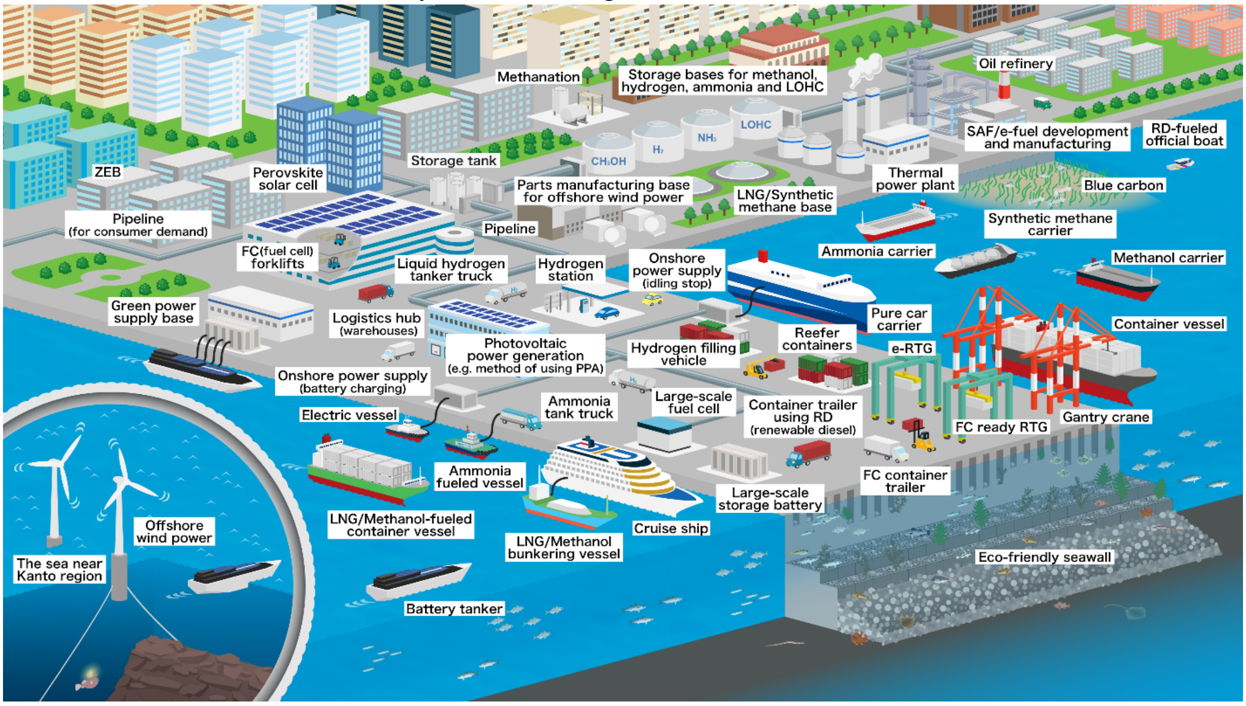


Figure 16: The Port of Yokohama's future vision for a Carbon Neutral Port

(2) Regional collaboration on next-generation energy

In July 2022, the City of Yokohama City a partnership agreement with the City of Kawasaki, which is promoting the Kawasaki Carbon Neutral Industrial Complex Plan, regarding next-generation energy such as hydrogen, in order to maintain and strengthen industrial competitiveness while creating a carbon neutral waterfront area, which plays a central role in the regional economy.

In December 2022, the City of Yokohama signed a partnership agreement with Ibaraki Prefecture for the development of ports in Ibaraki Prefecture and the Port of Yokohama, including decarbonization and industrial revitalization.

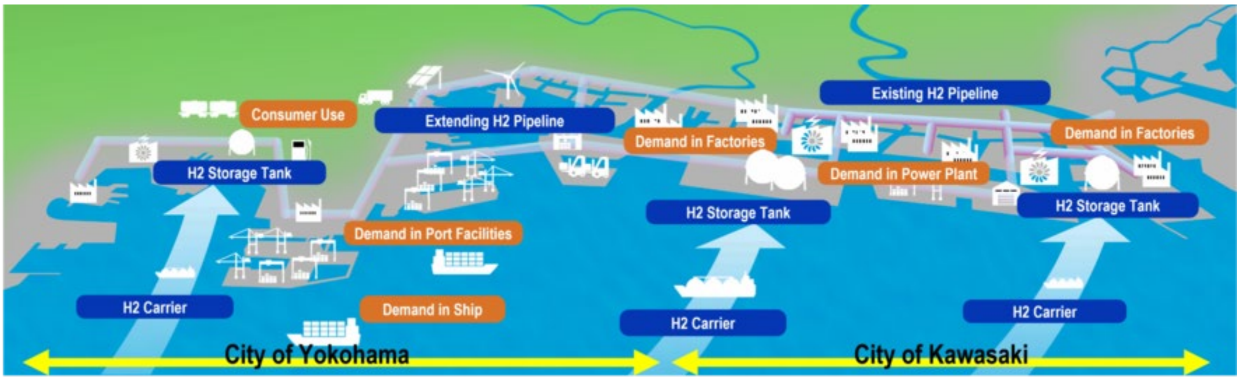


Figure 17: Image of regional cooperation between the Ports of Yokohama and Kawasaki

(3) Efforts to form green shipping corridors

Green Shipping Corridors are a newly proposed concept for decarbonizing shipping and port operations that are gaining traction worldwide. It refers to efforts to promote the reduction of greenhouse gases and other emissions from shipping and port activities through the introduction of new technologies on shipping routes connecting ports and collaborative efforts and policies by the public and private sectors.

(4) CNP Certification (Container Terminal)

The Port Authority of the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) has established a certification system to objectively evaluate decarbonization efforts at port terminals in order to respond to the needs of shippers and others seeking to decarbonize their entire supply chains.

Table 3: CNP Certification (Container Terminal) Evaluation Items (Excerpt)

Category		Evaluation Item			Plan Indicators	CertificationLevel				
		Broad Category	Medium (Subcategory)			Level 1	Level 2	Level 3	Level 4	Level 5
(1) Decarbonization efforts related to cargo handling at terminals	Common	Commitment	・Plan to decarbonize the terminal ・CO2 emissions per unit of cargo handled at the terminal		・Creation of an effective plan to decarbonize the terminal ・Calculation of CO2 emissions per unit of cargo handled at the terminal	○	○	○	○	○
	Facilities & Equipment	Cargo Handling Equipment	Loading and unloading containers between vessel and yard	Gantry crane	Introduction of gantry cranes with inverter control system	−	○ More than 10%	○ More than 50%	○ More than 80%	○ 100%
			Container loading/ unloading and transportation in the yard	①Transfer crane	Fuel saving through the introduction of electrification, hybridization, and other low-carbon and decarbonization-compatible equipment, as well as automation, etc.	−	○ More than 10%	○ More than 50%	○ More than 80%	○ 100%
				②Straddle carrier	Fuel saving through the introduction of electrification, hybridization, and other low-carbon and decarbonization-compatible equipment, as well as automation, etc.	−	○ More than 10%	○ More than 50%	○ More than 80%	○ 100%
				③On-site tractors (including AGVs), other cargo handling equipment	Introduction of low-carbon and decarbonization-compatible equipment such as electrification or hybridization	+	+	+	+	+
		Facilities in the Yard	Yard Lighting		Introduction of LED lighting, etc.	−	○ More than 10%	○ More than 50%	○ More than 80%	○ 100%
			Reefer and other facilities		Power saving and temperature rise control through installation of pavement and roofs to reduce reflected heat to reefer facilities, energy saving in administrative buildings, etc.	+	+	+	+	+

source: https://www.mlit.go.jp/kowan/kowan_fr4_000093.html

(5) Blue Carbon

Since it is difficult to create new large-scale forests in the highly urbanized city of Yokohama, the City is promoting the formation of seaweed beds and shallow areas to expand "blue carbon," in which eelgrass, wakame seaweed, and other seagrasses absorb CO2.

【Cross-sectional image of seaweed beds and shallow areas】

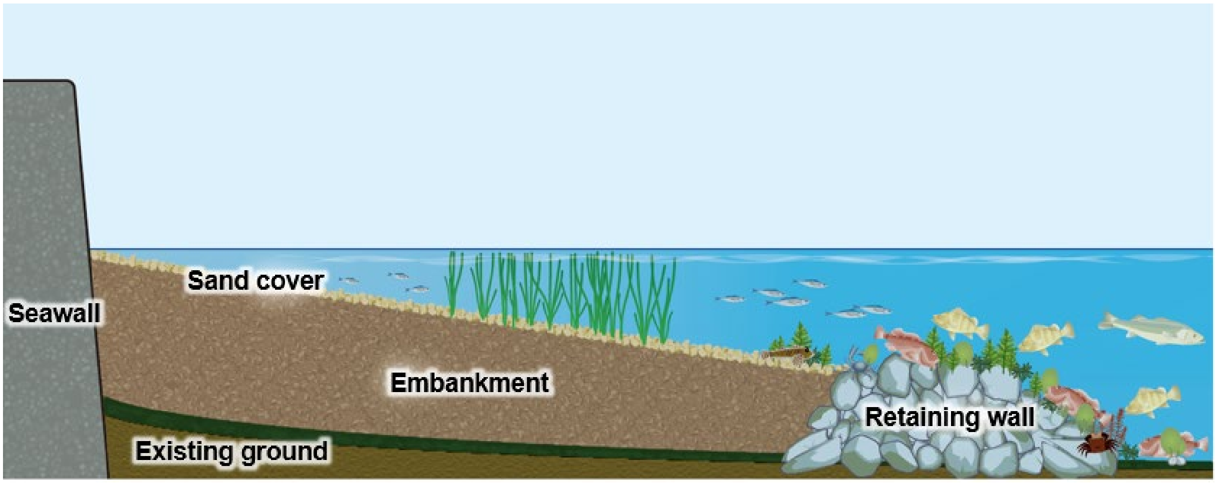


Figure 19: Formation of blue carbon

2. Plan Term

The term of this plan is until the year 2050. The target years are FY2030 for the short-to-medium term, FY2040 for the medium term, and FY2050 for the long term. This plan will be reviewed in a timely and appropriate manner with consideration for the government's greenhouse gas reduction targets and advances in technologies that contribute to decarbonization.

Furthermore, the term of the plan and the timing of reviews will be addressed after taking into consideration the review status of related plans such as the Port Plan and Yokohama City Action Plan for Global Warming Countermeasures based on the Act on Promotion of Global Warming Countermeasures.

3. Goals of Port and Harbor Decarbonization Plan for the Port of Yokohama

3-1. Goals of Port and Harbor Decarbonization Plan for the Port of Yokohama

The target years in this plan are FY2030 for the short-to-medium term, FY2040 for the medium term, and FY2050 for the long term. The medium term target year was set as FY2040, as discussed in the Seventh Basic Energy Plan. Key Performance Indicators (KPI) were established for each target year to serve as indicators for each type of initiative.

Carbon dioxide emissions from the Yokohama waterfront area (KPI-1) were set based on the reduction rate by sector in the Yokohama City Action Plan for Global Warming Countermeasures. Although the targets will not be reached through the accumulation of carbon dioxide emission reductions from the port decarbonization promotion projects alone, they will be positioned alongside decarbonization efforts by the private sector, starting with those ready for implementation, with the aim of achieving the target.

Preservation, revitalization, and creation of blue infrastructure (KPI-2) was established with reference to various data on port facilities, interviews with experts, field surveys, and potential sites for the creation of new habitats.

Table 4: Goals of the plan

KPI (Key Performance Indicators)		Target values		
		Short-to-medium term (FY2030)	Medium term (FY2040)	Long term (FY2050)
1	Carbon dioxide emissions from the Yokohama waterfront area	4.8 million t-CO_2/year (reduced by 47% from FY2013)	2.4 million t-CO_2/year * (reduced by 74% from FY2013)	Effective 0 t-CO_2/year
2	Preservation, reproduction and creation of blue infrastructure (CO_2 absorption)	Approx. 150 t-CO_2/year	Approx. 200 t-CO_2/year	Approx. 250 t-CO_2/year

【Reference 1】

The Outcome of the First Global Stocktake, adopted at the 28th session of the Conference of the Parties (COP28) to the United Nations Framework Convention on Climate Change in December 2023, stated that the level of greenhouse gas emissions must be "reduced by 43% by 2030 and 60% by 2035 compared to 2019 levels.
Therefore, although not listed as a KPI in this plan, reference values for carbon dioxide emissions from the Yokohama waterfront area in each fiscal year are shown below, taking this information into account.
〇 FY2030 4.23 million t-CO_2/year (Reduced by 43% compared to FY2019)
〇 FY2035 2.96 million t-CO_2/year (Reduced by 60% compared to FY2019)

【Reference 2】

Japan's new NDC (National Reduction Target) was set in the Global Warming Prevention Plan (Cabinet decision on February 18, 2025) at 60% reduction in FY2035 and 73% reduction in FY2040 (compared to FY 2013). Reference values are shown below:
〇 FY2035 3.64 million t-CO_2/year (60% reduction compared to FY2013)
〇 FY2040 2.46 million t-CO_2/year (73% reduction compared to FY2013)

3-2. Estimation of greenhouse gas emissions

(1) Summary of Estimation Methodology

The Port of Yokohama is a comprehensive port that spans across six wards of Yokohama (Tsurumi, Kanagawa, Naka, Nishi, Isogo, and Kanazawa) and consists of an industrial area that is part of the Keihin Industrial Zone, a logistics area consisting of public berths such as container terminals and warehouses, and a commercial area represented by the Minato Mirai 21 district.

First, emissions from the land area were estimated based on the “Greenhouse Gas Emissions from Yokohama City Area” estimated annually by the Zero Carbon and GREEN×EXPO Promotion Bureau of the City of Yokohama, and for unique groups of companies, mainly in the manufacturing industry, data from the “Yokohama City Global Warming Action Plan System” implemented by the same bureau were used.

Next, emissions from ocean-going vessels at anchor were estimated using statistical data on vessels entering port held by the Port and Harbor Bureau of the City of Yokohama, the IMO’s (International Maritime Organization) REDUCTION OF GHG EMISSIONS FROM SHIPS Fourth IMO GHG Study 2020, and other sources.

By adopting the City of Yokohama's own estimation method, the estimates obtained based on this plan can be linked to the estimates obtained by the City of Yokohama's environmental department for the land area, and for emissions from ships at anchor, the estimates can be based on the IMO's required level.

The City of Yokohama has also adopted RIGHTSHIP's (headquartered in Melbourne) Maritime Emissions Portal to obtain estimates of greenhouse gas emissions (CO2, CH4, N20, PM, and other IMO-regulated greenhouse gases) from ships operating in the Port of Yokohama area. Since the inclusion of this figure would result in a discrepancy with other ports in Japan, it is presented here for reference only.

The details of the estimation method are detailed in a research report commissioned by the New Energy and Industrial Technology Development Organization (NEDO), “Study on Hydrogen Utilization System for Formation of Carbon Neutral Port at the Port of Yokohama” (March 2023, Yokohama City, Yokohama Kawasaki International Port Corporation, Yokohama Port Corporation). The report is detailed and published in the NEDO Outcome Report Database.

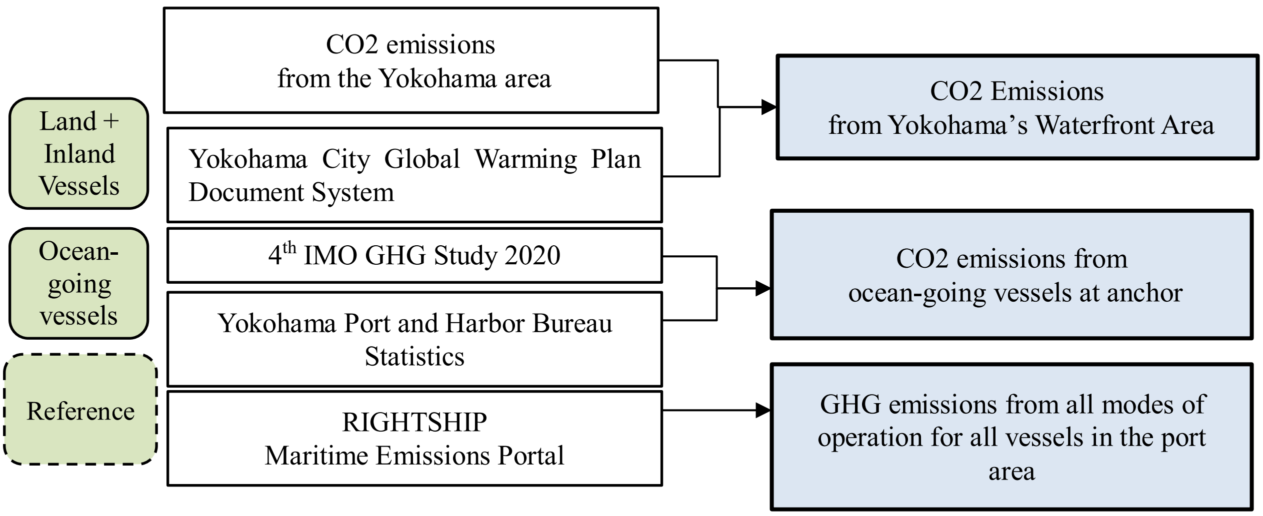
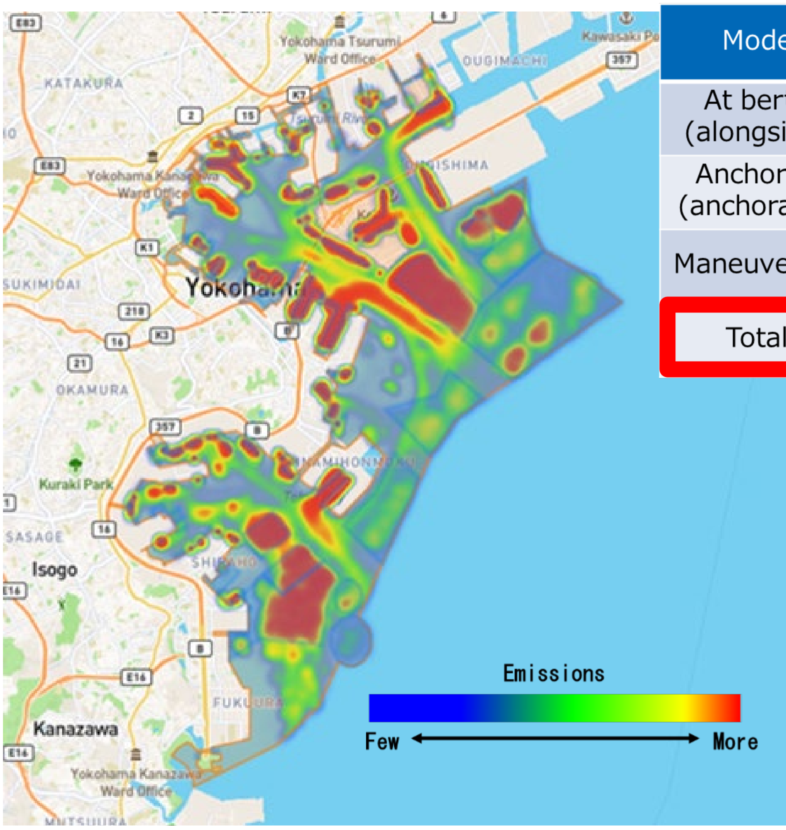


Figure 20: Overall flow of emissions estimation

Initiative 1: Use of the Maritime Emissions Portal to monitor greenhouse gas emissions in the port area of the Port of Yokohama

The system has made it possible to ascertain the amount of emissions from ships while underway in port areas, which had previously been difficult to estimate, as well as the amount of all greenhouse gases (CO_2, N_2O, CH_4) and environmental pollutants (SOx, NOx, PM2.5, PM10, and VOCs) regulated by the IMO (International Maritime Organization).



Mode	CO_2 emissions(t)	CO_2 Equivalent(t)
At berth (alongside)	187,556	191,349
Anchored (anchorage)	48,838	49,540
Maneuvering	70,349	71,433
Total	306,743	312,341

Name	Amount (t/year)
CO_2	308,147
N_2O	16
CH_4	53
SOx	891
NOx	3,523
PM2.5	123
PM10	134

Figure 21: Greenhouse gas emissions in the port area of Yokohama Port according to MEP (actual results for 2024)

Initiative 2: Participation in the Blue Visby Consortium (https://bluevisby.com/)
To reduce greenhouse gas emissions in the port area as identified through initiative 1 above, the City of Yokohama has become the first port in Japan to join the Blue Visby Consortium, which aims to reduce greenhouse gas emissions from ships by using digital technology to optimize vessel navigation.

In the shipping industry, it is customary to "Sail Fast, then Wait," referring to the practice of reaching the destination quickly and waiting nearby, resulting in more greenhouse gas emissions. According to the Consortium's analysis and empirical studies, if a fleet of vessels jointly adjust their sailing speed and arrival time using the system (Blue Visby Solution) that the Consortium is building, it is possible to reduce greenhouse gas emissions by 15% or more.

BLUE VISBY SOLUTION

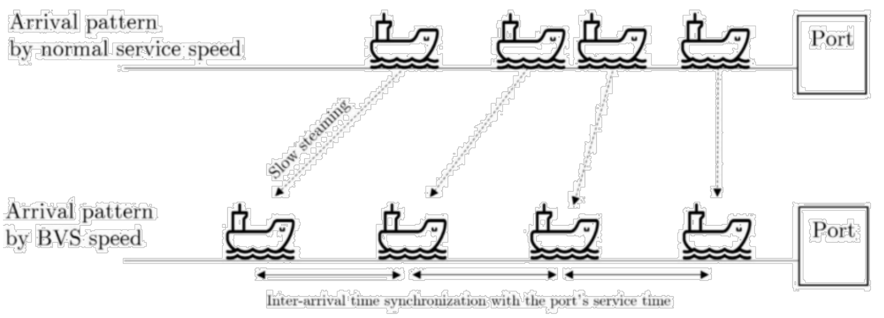


Figure 22: Optimization and dispersion of arrival times for groups of vessels heading for the same port

(2) Carbon dioxide emissions from the Yokohama waterfront area

In FY 2013, CO_2 emissions were 9,093,000 t-CO_2, accounting for 42.4% of the total emissions from entire city. The breakdown of CO_2 emissions in the city's waterfront area shows that the energy conversion sector accounts for about 50% of the total, followed by the industrial sector and the business sector. Of these emissions, those from the public wharf complex, which is the port authority's primary area of operations, are estimated primarily as part of the operations sector.

CO_2 emissions from the waterfront area in FY 2019 and FY 2022 were 7,423,000 t-CO2 and 6,394,000 t-CO_2, respectively, showing a downward trend compared to FY 2013, and in FY 2022 they accounted for 39.5% of Yokohama's total emissions. The breakdown of CO_2 emissions in the city's waterfront area is the same as in 2013, with the energy conversion sector accounting for approximately 50%, followed by the industrial sector and the business sector.

Table 5: Estimated CO_2 emissions from the Yokohama waterfront area (FY2013)

	Yokohama Waterfront Area		Entire City Area		Yokohama Waterfront Area ／Entire City Area (%)
	Emissions (10,000t-CO_2)	Proportion (%)	Emissions (10,000t-CO_2)	Proportion (%)	
Land emissions	890.6	97.9	2125.4	99.1	41.9
Energy Conversion Sector	450.4	49.5	450.7	21.0	99.9
Industrial Sector	185.7	20.4	245.1	11.4	75.8
Business Sector	121.7	13.4	486.7	22.7	25.0
Transportation Sector	82.6	9.1	389.5	18.2	21.2
Waste Sector	40.0	4.4	52.5	2.4	76.2
Residential Sector	10.1	1.1	500.9	23.4	2.0
Emissions from ocean-going vessels at anchor	18.7	2.1	18.7	0.9	100.0
Total	909.3	100.0	2144.2	100.0	42.4

(Note 1) Although the Zero Carbon and GREEN×EXPO Promotion Bureau includes CH4 and N2O emissions in its GHG estimates, the estimates for the harbor area for these gases are subject to future improvement, so only CO2 emissions were estimated in this study.

(Note 2) The reason why the emissions from ocean-going vessels at anchor are shown in a cloud shape outside the circle is that CO2 emissions from ocean-going vessels are not included in the Japanese inventory and are not included in the statistics collected by the Zero Carbon and GREEN×EXPO Promotion Bureau.

(Note 3) Energy consumption of cargo handling equipment at port terminals is categorized as transportation ancillary services* in the business sector. However, energy consumption of cargo handling equipment owned by manufacturers is classified as "industrial sector" because it is incidental to factories. * Establishments that provide services incidental to transportation by rail, motor vehicle, ship, and aircraft

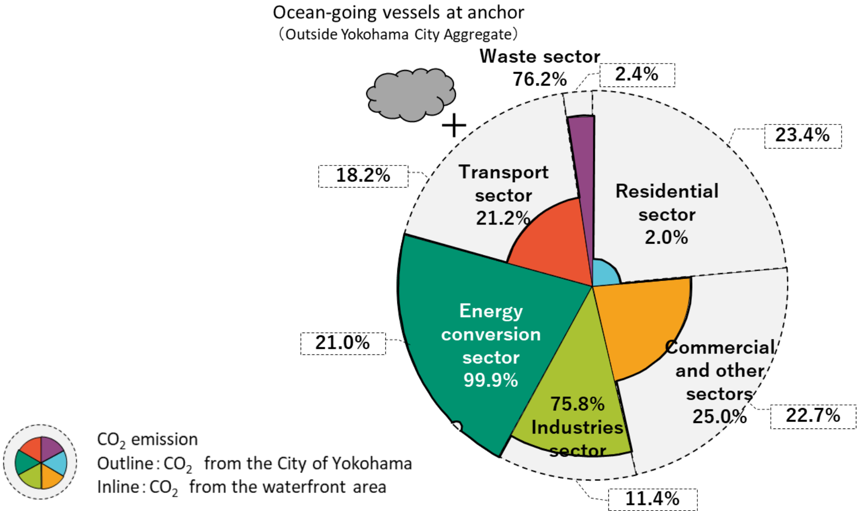


Figure 23: Graph of estimated CO_2 emissions in 2013

Table 6: Estimated CO_2 emissions from the Yokohama waterfront area (FY 2019)

	Yokohama Waterfront Area		Entire City Area		Waterfront Area ／Entire City Area (%)
	Emissions (10,000t-CO_2)	Proportion (%)	Emissions (10,000t-CO_2)	Proportion (%)	
Land Emissions	723.3	97.4	1,738.7	98.9	41.6
Energy Conversion Sector	385.0	51.9	385.5	21.9	99.9
Industrial Sector	139.0	18.7	181.5	10.3	76.6
Business Sector	83.1	11.2	336.4	19.1	24.7
Transportation Sector	71.5	9.6	356.0	20.3	20.1
Waste Sector	35.9	4.8	48.2	2.7	74.5
Household Sector	8.7	1.2	431.1	24.5	2.0
Emissions from ocean-going vessels at anchor	19.0	2.6	19.0	1.1	100.0
Total	742.3	100.0	1,757.7	100.0	42.2

Table 7 Estimated CO_2 Emissions from Waterfront Area of the City of Yokohama (FY2022)

	Yokohama Waterfront Area		Entire City Area		Waterfront Area ／Entire City Area (%)
	Emissions (10,000t-CO_2)	Proportion (%)	Emissions (10,000t-CO_2)	Proportion (%)	
Land Emissions	622.7	97.4	1,604.2	99.0	38.8
Energy Conversion Sector	294.4	46.0	294.8	18.2	99.9
Industrial Sector	130.7	20.4	168.6	10.4	77.5
Business Sector	84.1	13.2	318.8	19.7	26.4
Transportation Sector	70.8	11.1	334.2	20.6	21.2
Waste Sector	33.7	5.3	47.4	2.9	71.2
Household Sector	9.0	1.4	440.4	27.2	2.0
Emissions from ocean-going vessels at anchor	16.7	2.6	16.7	1.0	100.0
Total	639.4	100.0	1620.9	100.0	39.5

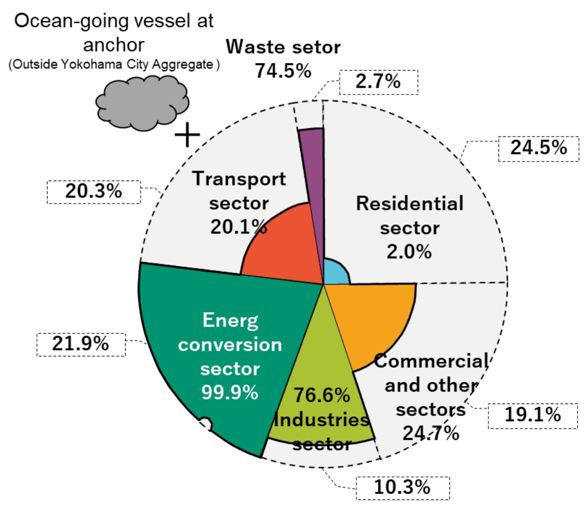


Figure 24: Graph of estimated CO_2 emissions in 2019

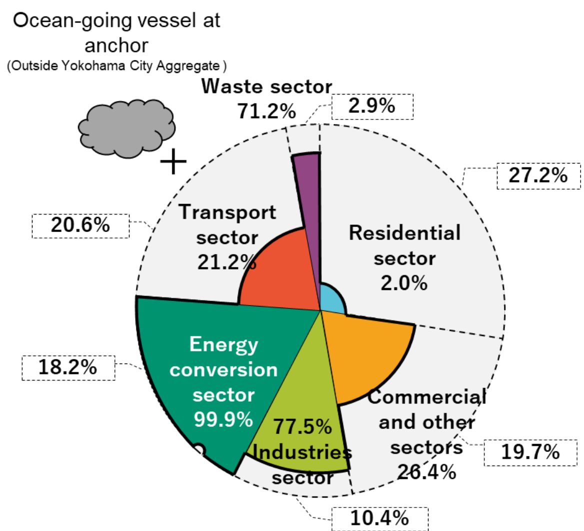
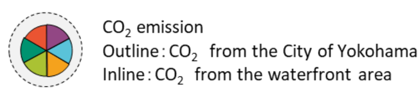


Figure 25: Graph of estimated CO_2 emissions in 2022



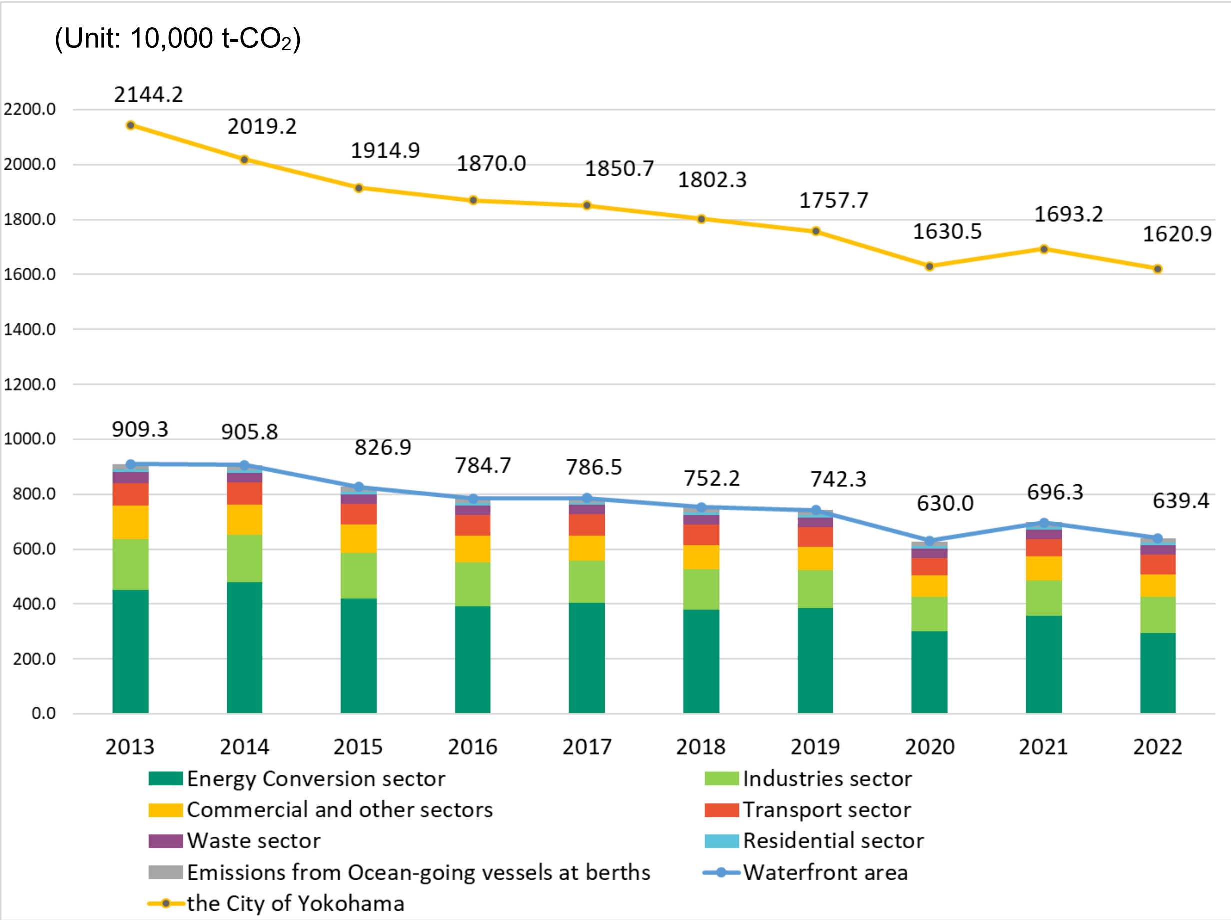


Figure 26: CO_2 Emissions in the Entire City Area and Yokohama Waterfront Area

(3) Carbon dioxide emissions from ships at anchor

Table 8: CO_2 emissions from ships at anchor (by ship type)

(Unit：t-CO_2)

Ship Type	2013			2019			2022		
	Ocean-going vessels	Domestic vessels	Total	Ocean-going vessels	Domestic vessels	Total	Ocean-going vessels	Domestic vessels	Total
LNG Vessels	19,934	–	19,934	10,560	–	10,560	13,571	–	13,571
LPG Vessels	2,373	11,785	14,158	2,721	12,701	15,422	6,530	17,447	23,977
RORO Vessels	14,509	1,165	15,674	3,654	458	4,112	4,521	893	5,414
Semi-container Vessels	571	10	581	972	100	1,072	1,321	18	1,339
Cement Vessels	216	1,271	1,487	105	1,273	1,378	104	1,462	1,566
Other Tankers & Tank Vessels	625	3,341	3,966	40	4,208	4,248	108	2,825	2,932
Other Specialized Vessels	879	1,238	2,117	4,885	28	4,913	5,261	35	5,296
Other vessels	1,352	12,972	14,325	4,205	11,537	15,742	2,440	11,341	13,781
Chip Vessels	–	–	–	–	1	1	–	–	–
Barges	–	297	297	–	179	179	–	–	–
Patrol Ships	–	2,684	2,684	34	3,069	3,103	243	3,305	3,549
Full Container Ships	47,168	6,266	53,434	46,163	7,842	54,005	42,914	12,226	55,140
Product Oil Tankers	1,465	–	1,465	739	359	1,097	500	950	1,450
General Cargo Vessels	32,095	4,170	36,265	25,149	3,466	28,615	19,612	3,378	22,990
Tugboats	168	615	783	6	632	639	31	432	463
Cargo and Passenger Ships	–	–	–	–	36	36	–	–	–
Ocean-going Chemical Vessels	7,696	–	7,696	10,173	–	10,173	11,967	183	12,149
Passenger Vessels	5,808	5,706	11,513	13,322	5,504	18,827	159	15,717	15,877
Fishery Vessels	–	–	–	–	2	2	–	2	2
Training Vessels	73	1,320	1,394	8	1,168	1,177	–	1,313	1,313
Military Vessels	409	40	449	3,847	55	3,903	6,963	422	7,385
Ore Ships	448	95	543	–	71	71	22	59	81
Steel Vessels	745	2,743	3,488	61	1,889	1,949	35	1,485	1,519
Grain Ships	2,464	15	2,480	138	15	153	–	27	27
Gravel, Sand and Stone Vessels	–	5,056	5,056	–	4,874	4,874	–	4,896	4,896
Work Vessels	1,248	48	1,296	2,533	131	2,664	2,033	107	2,141
Motor Carriers	23,803	5,302	29,105	18,197	2,804	21,001	15,878	2,306	18,185
Coal Ships	798	751	1,548	73	567	641	44	500	544
Inland Chemical Vessels	–	5,388	5,388	–	3,905	3,905	–	9,149	9,149
Oil Tankers	22,430	44,415	66,845	42,619	26,968	69,587	32,924	32,458	65,382
Total	187,278	116,693	303,971	190,205	93,841	284,045	167,182	122,935	290,116

Table 9: CO_2 emissions from vessels at anchor (by wharf) (Unit：t-CO_2)

Wharf Name	2013			2019			2022		
	Ocean-going Vessels	Domestic Vessels	Total	Ocean-going Vessels	Domestic Vessels	Total	Ocean-going Vessels	Domestic Vessels	Total
Honmoku Pier	29,578	4,626	34,203	32,384	3,125	35,509	31,194	4,405	35,599
Mianami Honmoku Pier	5,928	656	6,584	10,783	905	11,687	14,280	1,186	15,467
Daikoku Pier	34,745	7,937	42,682	29,221	1,772	30,993	21,101	2,303	23,403
Yamashita Pier	3,739	7,076	10,815	924	3,473	4,397	630	4,885	5,514
Detamachi Pier	253	4,254	4,507	270	4,566	4,836	139	6,166	6,305
Mizuho Pier	2,175	921	3,096	9,119	621	9,740	11,501	691	12,192
Yamanouchi Pier	–	179	179	–	–	–	–	–	–
Shinko Pier	98	285	382	410	404	814	109	326	436
Kanazawa Mokuzai Pier	1,232	408	1,640	1,542	530	2,072	485	322	807
Osanbashi Pier	5,006	3,942	8,948	7,837	3,397	11,234	185	15,688	15,873
MM21 (Pukari Sanbashi)	–	141	141	2	774	776	–	249	249
Private	72,905	66,035	138,940	74,217	46,580	120,797	68,980	50,470	119,450
Other (Public Office)	–	2,676	2,676	30	3,065	3,095	–	3,279	3,279
Point of Anchorage	31,619	17,558	49,177	23,466	24,630	48,096	18,577	32,965	51,542
Total	187,278	116,693	303,971	190,205	93,841	284,045	167,182	122,935	290,116

CO_2 emissions from ships are estimated using a combination of several estimation methods.
The following is a supplementary explanation.

・CO_2 emissions from domestic vessels are included as part of the transportation sector in order to adopt the estimates provided by Yokohama City Action Plan for Global Warming Countermeasures. For domestic vessels, the estimates are based on the estimation method specified by the Ministry of the Environment, and thus theoretically include estimates while at anchor and while underway.

・CO_2 emissions from ocean-going vessels are outside the scope of the Japanese inventory, i.e., outside the scope of the Action Plan on Global Warming Countermeasures, so estimates from the Fourth IMO GHG Study 2020 are used. For ocean-going vessels, only estimates while at anchor are included.

Table 10: Explanation of the numbers used as estimates of CO_2 emissions from ships in the estimation of CO_2 emissions from the Yokohama waterfront area

	Domestic Vessels	Ocean-going Vessels
Estimates based on the Action Plan for Global Warming Countermeasures	Utilized	Not included in the estimate
Estimates from Fourth IMO GHG Study 2020	Not included (Priority is given to the Action Plan)	Utilized

Table 11: CO_2 emissions from vessels (breakdown of domestic and international vessels)

(Unit: 10,000t-CO_2)

	FY2013	FY2019	FY2022	Note
Domestic Vessels	15.0	15.4	15.9	Estimated as within the transportation sector in Tables 5, 6, and 7.
Ocean-going Vessels	18.7	19.0	16.7	Estimated as total of ocean-going vessels in Tables 8 and 9
Total	33.7	34.4	32.6	

(4) CO_2 Emissions from Container Terminals

For carbon dioxide emissions from container terminals, energy consumption was surveyed by interviewing each terminal lessee to estimate carbon dioxide emissions for each fiscal year. The estimation method and results are as follows.

Table 12: Estimation Methods for CO_2 Emissions at Container Terminals

Category	Main Facilities	CO_2 Emission Sources	Emissions Estimation Method
In Terminal	Cargo Handling Equipment	Electricity use and light oil use for handling equipment	Light-weight oil usage ×CO_2 emission factor ＋Electricity usage ×CO_2 emission factor
	Container Terminal Facilities & Administration Buildings, etc.	Electricity for administration buildings, lighting facilities, reefer power supply, and other facilities	Electricity consumption x CO_2 emission factor

Table 13: Estimated CO_2 Emissions at Container Terminals

	CO_2 Emissions（t-CO_2）			CO_2 reduction FY2013⇒FY2022 (Reduction rate in 2013)
	FY2013	FY2019	FY2022	
Total for Container Terminals in the Port of Yokohama	37,930	37,980	26,112	11,818 （31.2% decrease）

*CO_2 emissions per TEU in each fiscal year were calculated from the CO_2 emissions in the year of the hearing (FY2023), taking into account the emission factors for electricity and fuel in each year and the introduction status of handling equipment such as hybrid RTGs.

*Calculated by multiplying CO_2 emissions per TEU by the number of containers handled (TEU) by wharf for each fiscal year.

*The reason for the decrease in CO_2 emissions since FY2022 is due to the introduction of electricity derived from renewable energy sources.

3-3. Estimation of greenhouse gas sequestration

Blue carbon ecosystems with the ability to capture and store CO_2 include seagrasses and seaweeds, wetlands and tidal flats, and mangroves. Here, the amount of blue carbon captured and stored by seagrasses and seaweeds inhabiting port areas in Yokohama was estimated as the amount of GHG absorption based on the characteristics of their growth and distribution. The specific estimation method was based on a survey of the area of seaweed beds, etc. that have flourished as a result of the creation, preservation, and reproduction of blue carbon ecosystems, and the amount of CO_2 captured was estimated by multiplying these areas by the CO_2 absorption coefficient.

Table 14: Estimated carbon dioxide sequestration

Category	Target District	Target Facilities, etc.	Owner/ administrator	CO_2 absorption
				FY2024
Non-Terminal	Harbor area, etc.	Seaweed inhabiting seawalls Location: Seawalls, wave dissipating blocks, shallow areas, etc.	City of Yokohama	Approx. 100t-CO_2/year

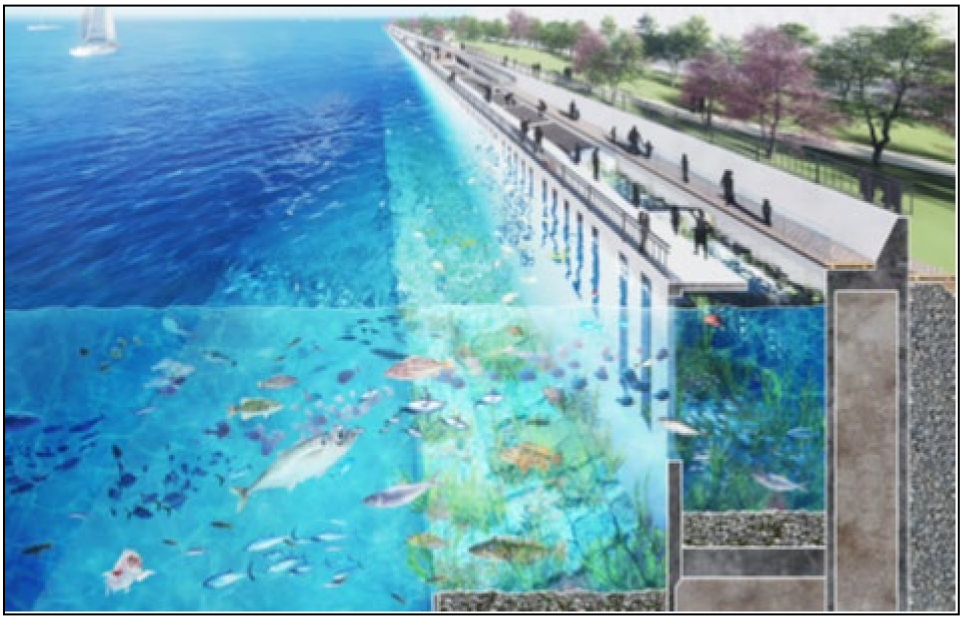


Figure 27: Image of a biosymbiotic seawall

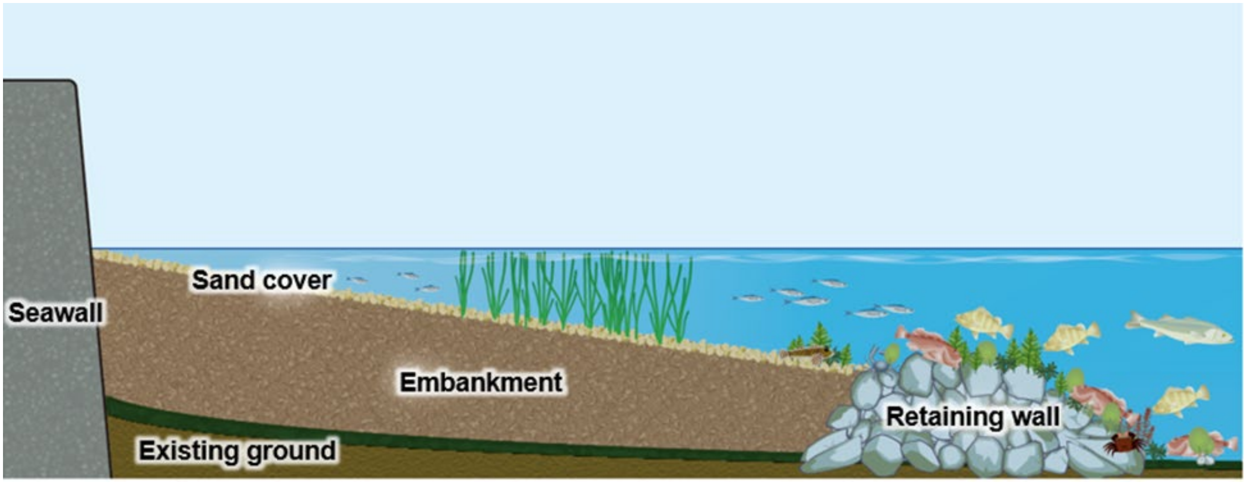


Figure 28: Image of seaweed and other plants inhabiting shallow areas, etc.

3-4. Consideration of greenhouse gas emission reduction targets

3-4-1. Carbon dioxide emissions from the Yokohama waterfront area

The goals set forth in KPI-1 were established based on the following concepts.

(1-1) Targets for FY2030

CO_2 reduction targets for the Yokohama waterfront area were set based on the sector-specific reduction rates in the Yokohama City Action Plan for Global Warming Countermeasures. The goal is to reduce CO_2 emissions from 9.09 million t-CO_2 in FY2013 to 4.8 million t-CO_2 in FY2030 (47% reduction compared to FY2013).

Table 15: CO_2 Reduction Targets for FY2030 from Waterfront Area of Yokohama

(Unit: 10,000 t-CO_2)

Sector		FY2013 Emissions	FY2030 Target values	Compared to FY2013 Reduction rate
Land emissions		891	467	▲48%
	Energy Conversion Sector	450	252	▲44%
	Industrial Sector	186	87	▲53%
	Business Sector	122	41	▲66%
	Transportation Sector	83	56	▲32%
	Waste Sector	40	26	▲36%
	Residential Sector	10	5	▲55%
Emissions from ocean-going vessels at anchor		19	13	▲32%
Total		909	480	▲47%

(1-2) Reference values for FY2030 and FY2035 based on the COP28 Global Stocktake results

Although not listed as a KPI, reference values for CO_2 emissions that take into account the results of the global stocktake adopted at COP28 in 2023 are shown. In this case, CO_2 emissions would be 4.23 million t-CO_2 in FY2030 (43% less than in FY 2019) and 2.96 million t- CO_2 in FY2035 (60% less than in FY 2019).

Table 16: CO_2 Reduction Targets for FY2035 for Yokohama Waterfront Area

(Unit: 10,000 t-CO2)

Sector	FY2019 Emissions	FY2030 Emissions (Reference values)	Reduction rate compared to FY2019	FY2035 Emissions (Reference values)	Reduction rate compared to FY2019
Land emissions	723	412	▲43%	289	▲60%
Emissions from ocean-going vessels at anchor	19	11	▲43%	7	▲60%
Total	742	423	▲43%	296	▲60%

(1-3) Reference values for FY2035 and FY2040 based on Japan's new NDC (Nationally Determined Contribution) levels

As in (1-2), reference values for CO2 emissions based on Japan's new NDC (National Reduction Targets) levels as indicated in the Global Warming Prevention Plan (Cabinet decision on February 18, 2025) are shown below. In this case, CO2 emissions would be 3.64 million t-CO2 in FY2035 (60% reduction from FY13) and 2.46 million t-CO2 in FY2040 (73% reduction from FY13).

Table 17: CO_2 Reduction Targets for FY2040 from the Waterfront Area of Yokohama

(Unit: 10,000 t-CO_2)

Sector	FY2019 Emissions	FY2035 Emissions (Reference values)	Reduction rate compared to FY2013	FY2040 Emissions (Reference values)	Reduction rate compared to FY2013
Land emissions	891	356	▲60%	241	▲73%
Emissions from ocean-going vessels at anchor	19	8	▲60%	5	▲73%
Total	909	364	▲60%	246	▲73%

(2) Targets for FY2040

As for the target for FY2040, the 7th Basic Energy Plan and other details are still under discussion for formulation, and the target values have not yet been determined. Therefore, the target values were set by finding an approximate straight line from the FY2030 target value to the FY2050 target value. Based on the above, we will proceed with the goal of reducing CO_2 emissions to 2.4 million t- CO_2 (74% reduction compared to FY2013).

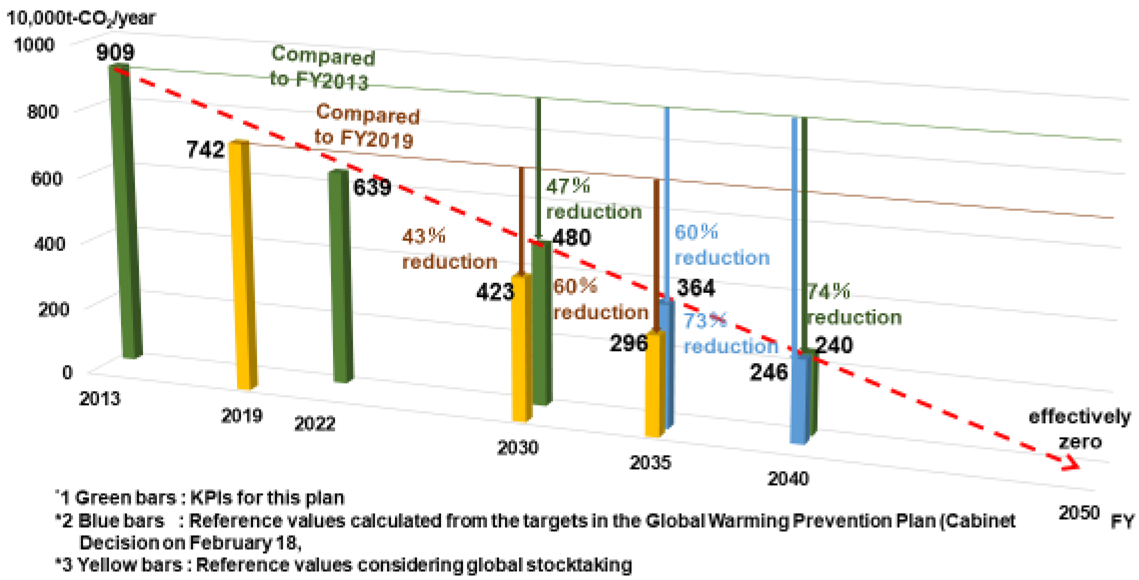


Figure 29: CO_2 Reduction Targets

(3) Targets for FY2050

Carbon neutrality will be achieved throughout the entire scope of this plan, and CO_2 emissions will be virtually zero (9.09 million t-CO2 less than in FY2013).

Table 18: Carbon Dioxide Emissions Targets

KPI (Key Performance Indicators)		Specific numerical targets		
		Short-to-medium term (FY2030)	Medium term (FY2040)	Long term (FY2050)
1	Carbon dioxide emissions from the Yokohama waterfront area	4.8 million t-CO2/year (47% reduction in 2013)	2.4 million t-CO2/year (reduced from 74% in 2013)	Real 0t-CO2/year

3-4-2. CO_2 emissions from container terminals

The goals in this plan, which are not listed in the KPIs, are as follows.

(1) Targets for FY2030

The same reduction target for CO_2 emissions from the Yokohama waterfront area set in 3-4-1 (47% reduction in CO_2 emissions compared to FY2013) will be promoted as the target for CO_2 emissions reduction from container terminals.

(2) Targets for FY2040

The same method was used to calculate target values as in 3-4-1. The CO_2 emissions reduction target from container terminals is to reduce CO_2 emissions by 74% from the fiscal 2013 level.

*See 3-4-1 for target value calculation method.

(3) Targets for FY2050

As stipulated in 3-4-1, the plan will achieve carbon neutrality over the entire scope of the plan, which means that CO2 emissions will effectively be zero (100% reduction compared to FY 2013).

Table 19: CO_2 Reduction Targets at Container Terminals （Unit：t-CO_2）

	Estimated values		Target values (Reduction target compared to FY2013)		
	FY2013	FY2019	FY2030 (47%reduction)	FY2040 （74% reduction）	FY2050 (100% reduction）
Container Terminals in Port of Yokohama Total	37,930	37,980	20,102 (47%reduction)	9,862 （74%reduction）	0 （100% reduction）

3-4-3. Carbon dioxide sequestration through conservation, reproduction, and creation of blue infrastructure

The objectives in this plan listed in KPI-2 are as follows. Detailed efforts are described in 4-1-3.

Table 20: Targets for carbon dioxide absorption

KPI (Key Performance Indicators)		Specific numerical targets		
		Short-to-medium term （FY2030）	Medium term （FY2040）	Long term （FY2050）
2	Blue Infrastructure Conservation, revitalization, and creation (carbon dioxide capture/sequestration)	Approx. 150t-CO_2/year	Approx. 200t-CO_2/year	Approx. 250t-CO_2/year

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3-5. Estimated demand for hydrogen and other next-generation energies and study supply targets

The estimation of hydrogen demand in the Yokohama waterfront area was calculated as part of a NEDO-commissioned study (March 2023) in the form of a questionnaire survey of companies located in the area. However, survey responses varied depending on the method used to set survey items, and in many cases, respondents refrained from answering questions about future estimates for individual regions.

Therefore, in the same study, the City independently compiled a forecast of primary energy supply in 2050 (hereinafter referred to as "2050 Primary Energy Supply Outlook Estimates" or "Hydrogen Utilization Pathway") from the perspective of primary energy supply, and this roadmap for hydrogen utilization will be used in this plan as well.

In its Sixth Basic Energy Plan (October 2021), the national government presents a primary energy supply forecast for 2030 but does not present a primary energy supply forecast for 2050. Therefore, we examined the primary energy supply outlook for 2050 by utilizing several scenarios published by several research institutes and consulting firms.

3-5-1. Scenario development organizations used as references

Table 21: List of Reference Scenarios

Development Agency	Document Title	Scenario Type	Publication
Advanced Industrial Science and Technology (AIST) *1	Japan's pathways to achieve carbon neutrality by 2050 – Scenario analysis using an energy modeling methodology (presented in 2022)	Base Case	Renewable and Sustainable Energy Reviews
The Institute of Energy Economics (IEEJ) *2	Model estimates of carbon neutrality in 2050 (presented in 2021)	Base Case	Advisory Committee on Natural Resources and Energy Basic Policy Subcommittee (44th)
McKinsey & Company (McK) *3	Decarbonizing Japan - Prospects for 2050 (presented in 2021)	Main Scenario	
Mitsubishi Research Institute, Inc. (MRI) *4	Social and economic impacts of carbon neutrality in 2050 (presented in 2022)	Demand Reduction & Technology Innovation	MRI Economic Review
National Institute for Environmental Studies (NIES) *5	One Analysis of Scenarios for Achieving a Decarbonized Society in 2050 (presented in 2021)	+ Social Change	Advisory Committee on Natural Resources and Energy Basic Policy Subcommittee (44th)
Research Institute of Innovative Technology for the Earth (RITE) *6	Scenario analysis of carbon neutrality in 2050 (interim report) (presented in 2021)	Reference Value Case	Advisory Committee on Natural Resources and Energy Basic Policy Subcommittee (43rd)
Institute for Global Environmental Strategies (IGES)*7	IGES 1.5°C roadmap (presented in 2023)	Balanced Scenario	IGES Home Page

*1：https://doi.org/10.1016/j.rser.2022.112943
*2：https://www.enecho.meti.go.jp/committee/council/basic_policy_subcommittee/2021/044/
*3：https://www.mckinsey.com/jp/~/media/mckinsey/locations/asia/japan/our%20insights/mck_jp_decarb_jp3.pdf
*4：https://www.mri.co.jp/knowledge/insight/20220704.html
*5：https://www.enecho.meti.go.jp/committee/council/basic_policy_subcommittee/2021/044/
*6：https://www.enecho.meti.go.jp/committee/council/basic_policy_subcommittee/2021/043/
*7：https://www.iges.or.jp/jp/pub/onepointfive-roadmap-jp/ja

3-5-2. Japan's Energy Supply and Demand Structure in 2050 by Scenario

(1) Primary energy supply

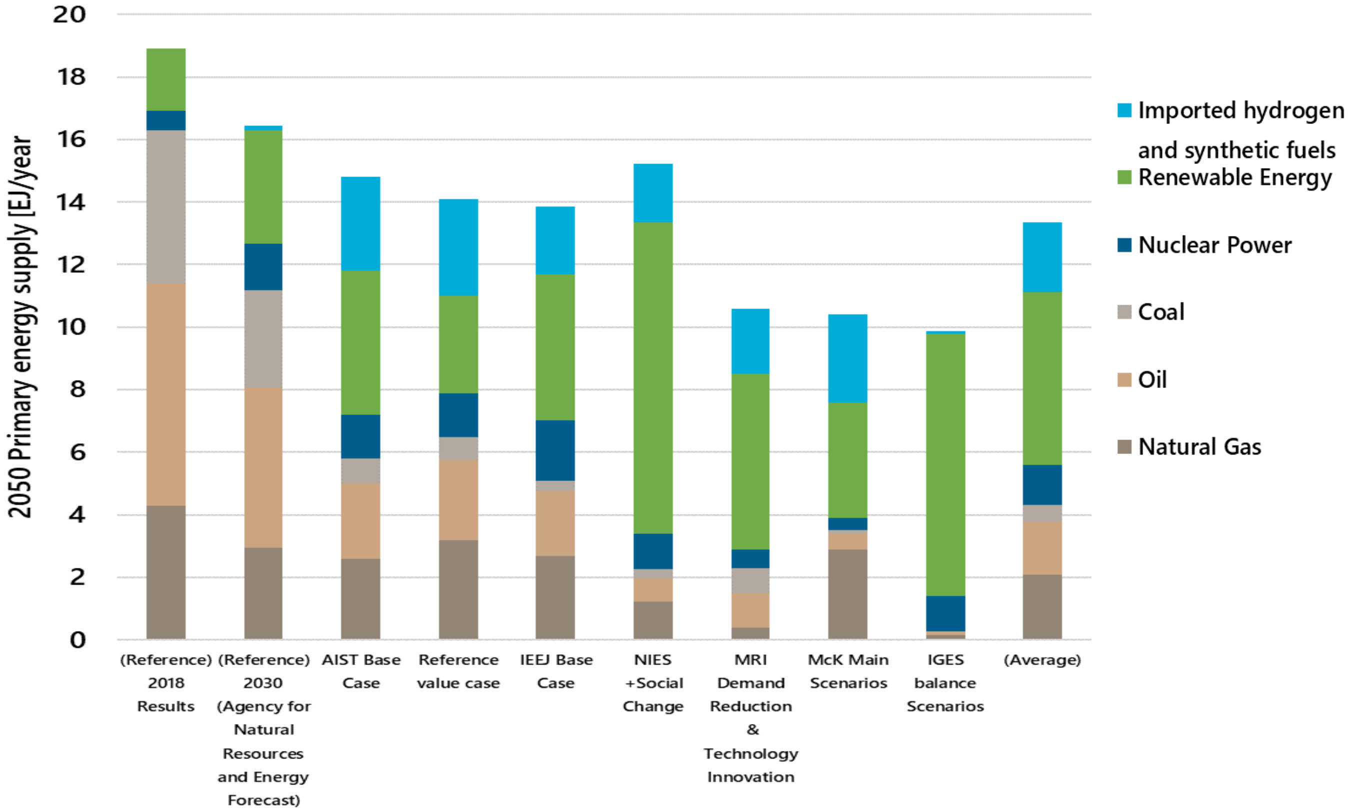


Figure 30: Primary Energy Supply

(2) Final energy consumption

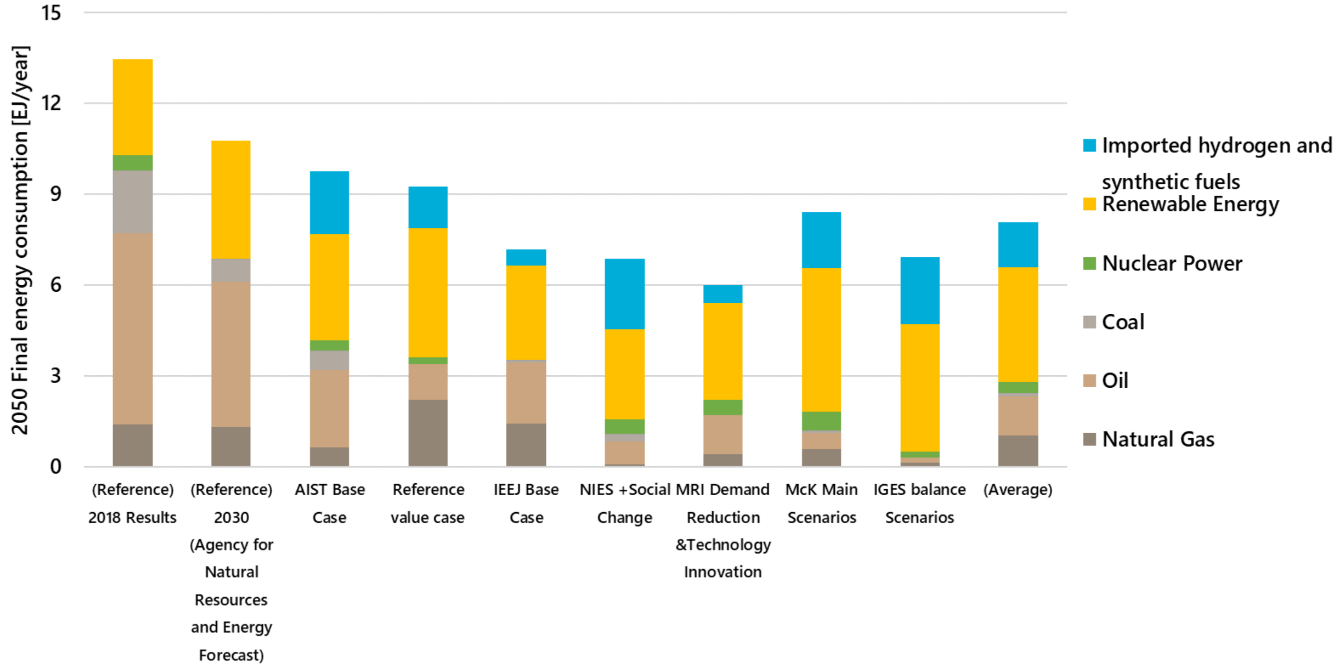


Figure 31: Final energy consumption

3-5-3. Estimated Forecast of Primary Energy Supply Outlook in 2050 (Pathways to Hydrogen Utilization)

Although each of the scenarios described in the previous section has a different approach and should be kept in mind when making simple comparisons as well as integrations, the following graph shows the results of integrating each scenario, as we believe there are no problems in developing an approximate roadmap.

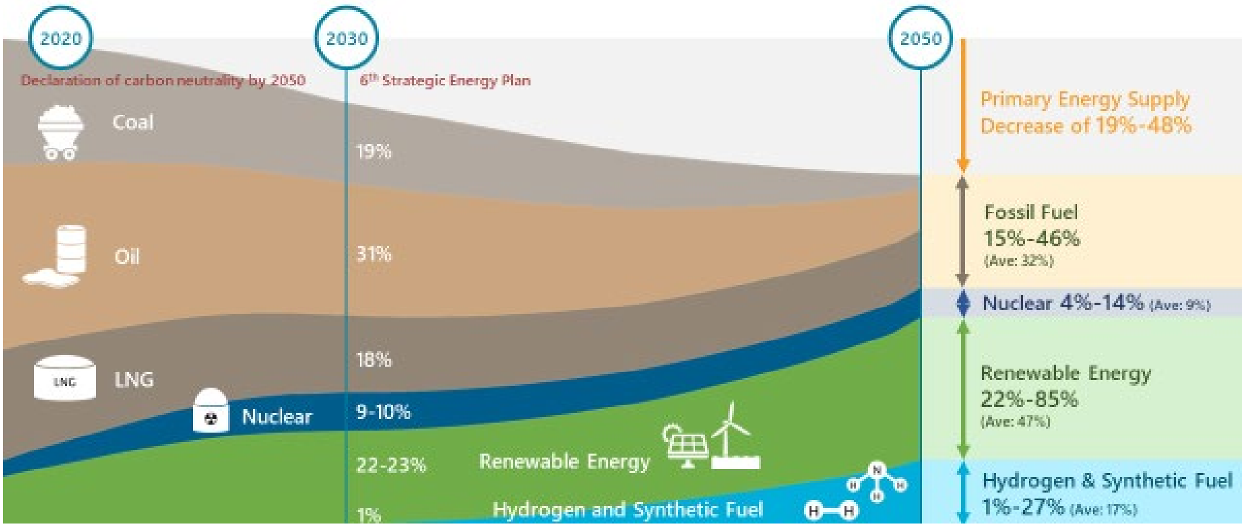


Figure 32: Estimated Forecast of Primary Energy Supply (Pathways to Hydrogen Utilization)
(Prepared by Yokohama Port and Harbor Bureau and Hiroaki Onodera (National Institute for Environmental Studies))

【Notes】

・The energy supply structure includes primary energy supply and hydrogen and synthetic fuel imports.
・The energy supply structure in 2030 is based on “Outlook for Energy Supply and Demand in FY2030” (Agency for Natural Resources and Energy).
・The current (far left) energy supply structure is based on 2018 results.
・The transition from the current status to 2030 and 2050 is supplemented with time series scenarios from McK, AIST, and IEEJ.
・Each scenario is calculated according to the conditions assumed by each research institution, and there is no consensus among the government or academic community.

3-5-4. Hydrogen Utilization Potential - As a result of NEDO survey (March 2023)

The Port and Harbor Bureau of the City of Yokohama does not necessarily consider the use of hydrogen as the primary means of next-generation energy conversion in the waterfront area, but believes that next-generation fuels should be selected to suit each type of use and equipment.

However, the Manual for Port and Harbour Decarbonization Plan by the Ministry of Land, Infrastructure, Transport and Tourism stipulates that the volume of hydrogen demand should be calculated, so this section presents the volume when the hydrogen utilization potential is maximized, as organized in a NEDO-commissioned study (March 2023).

The hydrogen potential for (1) inside public terminals and (2) inbound and outbound vessels and vehicles at the public terminals were estimated under different conditions. The estimates for 2040 were assumed to be the same as those for 2030. (3) Hydrogen potential outside the terminals and inside the dedicated terminals was calculated using independently developed primary energy supply outlook estimates for 2030, 2040, and 2050.

(1) Inside public terminals

① Hydrogenation of cargo handling equipment, etc.

2030：Install two FC-RTGs

2040：same as above

2050：Assumes that all cargo handling equipment at container terminals is converted to hydrogen (excluding gantry cranes)

② Energy management at wharfs utilizing renewable energy, fuel cells, etc.

Assumes that wind power generation will be installed at the hypothetical container terminal to utilize hydrogen produced using surplus electricity

2030：Utilized for two FC-RTG units. As for the volume of hydrogen demand, it overlaps with the “hydrogenation of cargo handling equipment, etc.” mentioned in (1) ① above.

2040：same as above

2050：FC generators are expected to be installed at container terminals. Utilize hydrogen produced by utilizing surplus electricity from wind power generation in addition to hydrogen procured externally.

(2) Inbound/outbound vessels and vehicles (public)

① Power supply to vessels at anchor

2030：Assumed installation of FC generators dedicated to cold ironing at container terminals under consideration for cold ironing facilities.

2040：same as above

2050：Assuming the installation of FC generators dedicated to cold ironing at all applicable terminals for ships to which cold ironing will be applied in the future

② Fueling of hydrogen-fueled vessels

2030：Although smaller hydrogen-fueled vessels are being developed, we assume that they will gradually become more popular toward 2050, and we assume zero

2040：same as above

2050：Assumed that all pleasure boats and service vessels berthed at the Port of Yokohama will be converted from existing gasoline and diesel to hydrogen fuel

③ Hydrogenation of ocean containers for land transportation

2030：Assumed zero because the 2030 introduction target for heavy-duty vehicles over eight tons from the Green Growth Strategy is 5,000 electric vehicles.

2040：same as above

2050：Assumes that all container trucks entering and leaving the Port of Yokohama and all large and small trucks associated with the Port of Yokohama will be hydrogenated

Table 22: Targets for Electrification of Automobiles in the “Green Growth Strategy” (June 18, 2021)

Targets for electrification *Electric vehicles = EVs (electric vehicles), FCVs (fuel cell vehicles), PHEVs (plug-in hybrids), HVs (hybrids)

✓ Achieve 100% electric vehicles in new passenger car sales by 2035

✓ For commercial vehicles,

・For light-duty vehicles weighing eight tons or less, aim for 20-30% of new vehicle sales to be electric vehicles by 2030, and 100% of new vehicle sales to be electric vehicles and vehicles which are suitable for the use of synthetic fuels and other decarbonized fuels by 2040.

(3) Outside the terminal/Inside the terminal (dedicated)

〇 Hydrogenation in industrial facilities such as port facilities, factories and industrial complexes

Conversion of fossil fuels to hydrogen fuel was studied for business sites located in the waterfront area of Yokohama. Specifically, hydrogen demand was estimated by multiplying (A) the fuel and heat consumption of waterfront establishments by (B) the hydrogen conversion rate.

(A) Fuel and heat consumption at waterfront sites

＜Estimation Procedures＞

a) Utilizing information from the City of Yokohama's Global Warming Countermeasure Plan System (FY2020) and other sources, calculate the annual primary energy consumption of business establishments located in waterfront areas and tabulate by industry

b) Calculate the ratio of electricity to primary energy consumption by industry using the energy balance table provided in the Regional Energy Supply and Demand Database (SIP)*.

c) Annual primary energy consumption by industry (a) multiplied by electricity ratio by industry (b) to calculate annual electricity consumption, and the remainder estimated as annual fuel and heat consumption

*The Strategic Innovation Program (SIP) of the Cabinet Office has published an energy consumption statistics table that summarizes annual energy consumption by type of energy and industry for each municipality.

source: https://energy-sustainability.jp/

Table 23: Primary Energy Consumption of Waterfront Businesses

Number of offices		Primary energy use (TJ/year)		
Facility type	Total	Electricity	Fuel & Heat	Total
Factories (46), Warehouses (17) Power generation facilities (4), Heat supply facilities (1) Other (68)	136	22,056 (6%)	321,879 (94%)	343,935 (100%)

(B) Hydrogen Conversion Rate

The hydrogen conversion rate from the current primary energy use was assumed for 2030 based on the government's target value, and for 2050 based on the ratio of imported hydrogen and synthetic fuels in "3-5-3. Estimated Forecast of Primary Energy Supply Outlook in 2050 (Pathways to Hydrogen Utilization)".

2030：1% of primary energy use converted to hydrogen (6th Energy Basic Plan, October 2021)

2040：5% of primary energy use converted to hydrogen (estimated by the City of Yokohama: average percentage of adoption)

2050: 27% of primary energy use converted to hydrogen (estimated by the City of Yokohama: maximum introduction ratio of 1% to 27%)

Table 24: Hydrogen Demand (FY2030, FY2040, FY2050)

Sorting	Item	Hydrogen demand (t-H_2/year)		
		FY2030	FY2040	FY2050
In Terminal (Public)	Hydrogenation of cargo handling equipment, etc.	20	20	4,844
	Energy management at wharfs utilizing renewable energy, fuel cells, etc.	(24*)	(24*)	957
Vessels and Vehicles Entering and Leaving Japan (Public)	Power supply to vessels at anchor	377	377	4,483
	Fueling of hydrogen-fueled vessels	0	0	1,421
	Hydrogenation of ocean containers for land transportation	0	0	18,789
Outside/Inside Terminal G1 (Dedicated)	Hydrogenation in industrial facilities such as port facilities, factories and industrial complexes	26,823	134,116	724,228
Total		27,220	134,513	754,722

*Demand is excluded from the total because it overlaps with "Hydrogenation of cargo handling equipment, etc."

The details of the estimation method are detailed in a research report commissioned by the New Energy and Industrial Technology Development Organization (NEDO), "Study on Hydrogen Utilization System for Formation of Carbon Neutral Port at the Port of Yokohama" (March 2023, City of Yokohama, Yokohama Kawasaki International Port Corporation, Yokohama Port Corporation). The report is detailed and published in the NEDO Outcome Report Database.

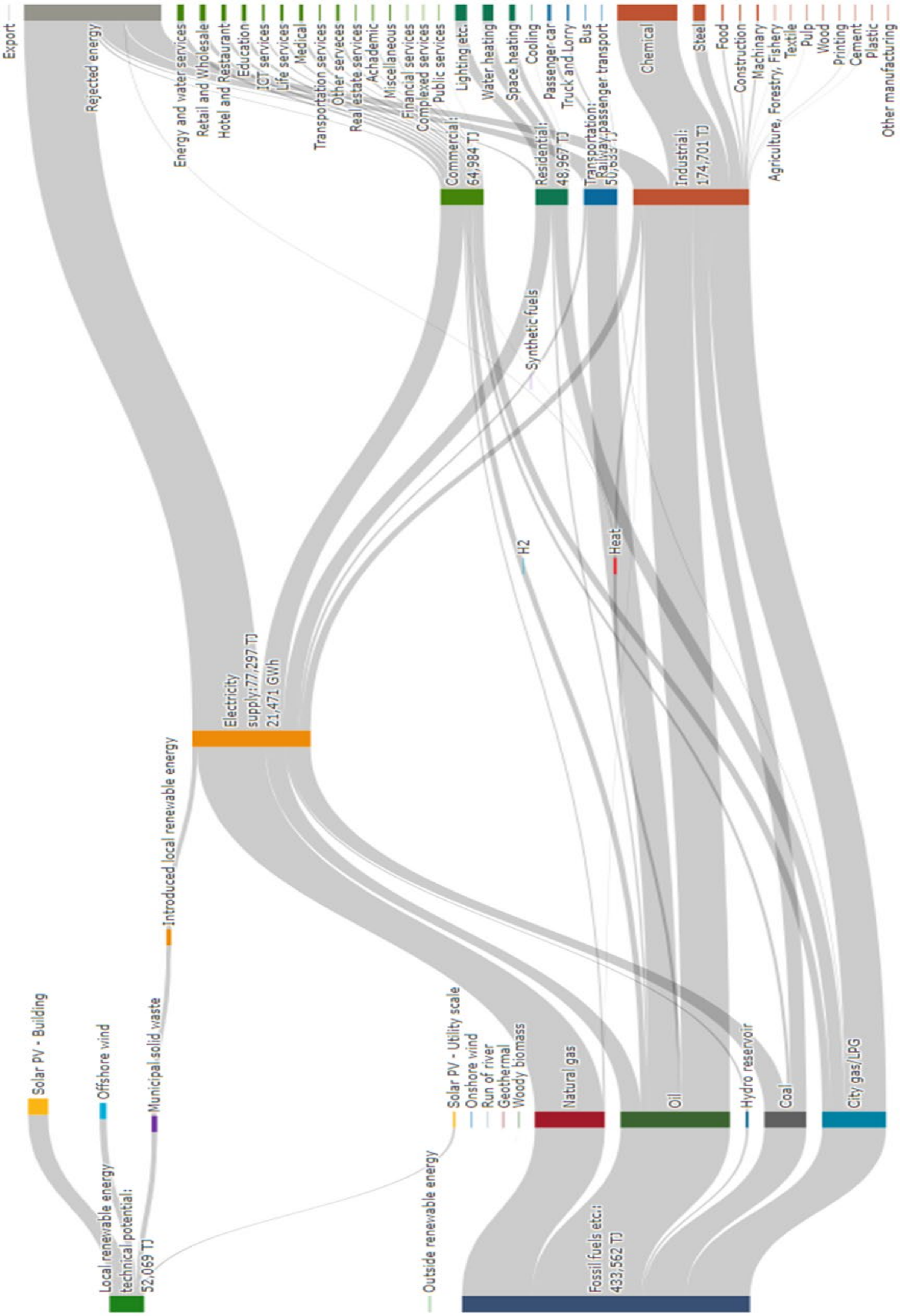


Figure 33: Energy Supply and Demand Flow Diagram for the City of Yokohama (2013)
(Source: Regional Energy Supply and Demand Database（Version 2.10） https://energy-sustainability.jp/)

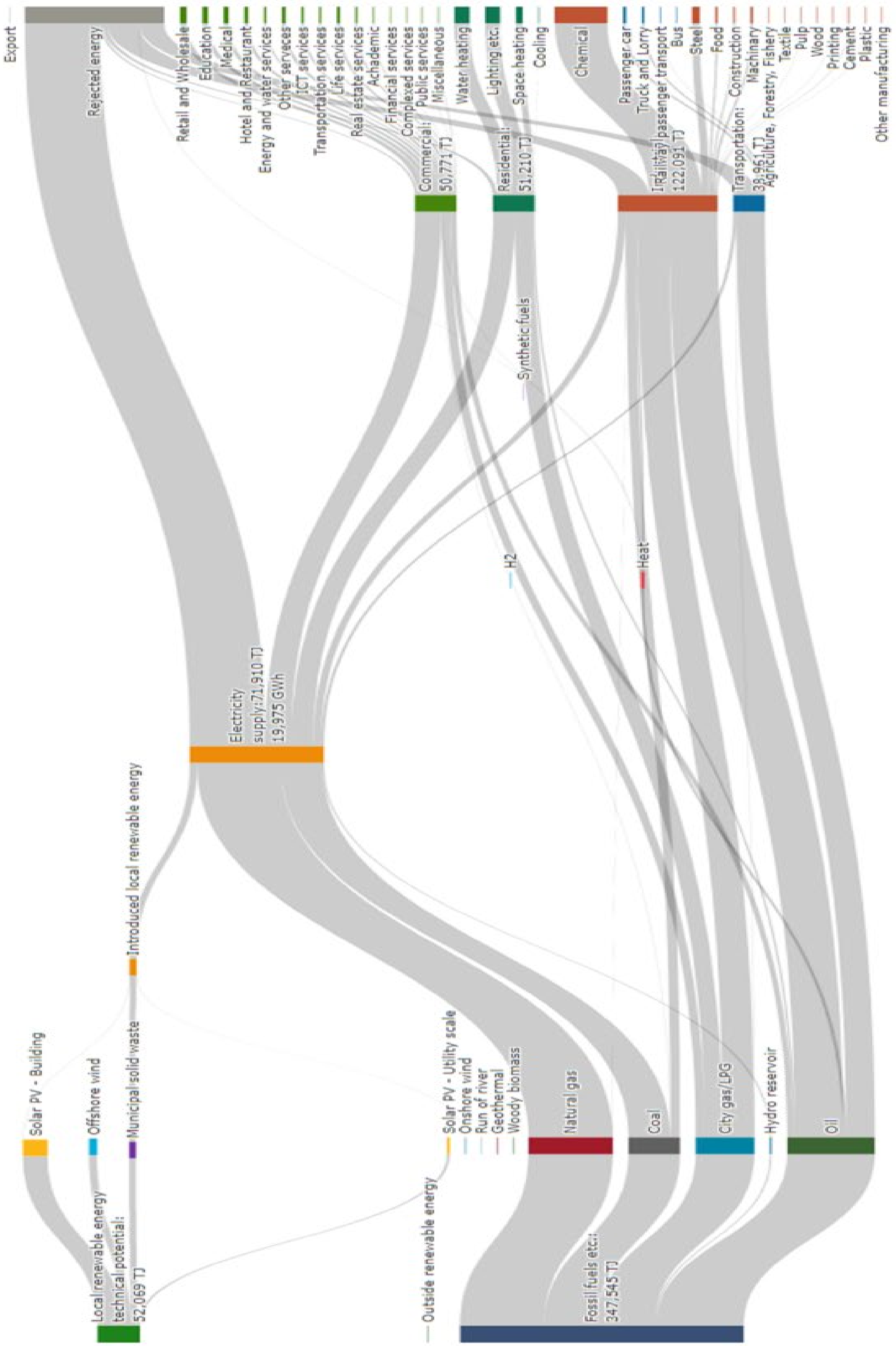


Figure 34: Energy Supply and Demand Flow Diagram for the City of Yokohama (2020)
（Source：Regional Energy Supply and Demand Database（Version 2.10） https://energy-sustainability.jp/）

4. Port decarbonization promotion projects and their implementers

4-1. Projects related to the reduction of greenhouse gas emissions and the conservation and enhancement of absorption

4-1-1. Efforts to decarbonize the waterfront area

The project to promote decarbonization of ports and harbors in the waterfront area of Yokohama City (initiatives to decarbonize the waterfront area) and its implementing entities are as follows.

These are the current status of studies conducted by each entity. The report will be updated to reflect the consideration of each entity in light of future developments in technologies that contribute to decarbonization and changes in social conditions, as well as the progress of inter-company collaboration and the participation of new entities.

(1) Short to medium term (FY2030)

Table 25: Efforts to decarbonize the waterfront area (short- and medium-term)

Waterfront Area Initiatives

Initiatives	Implementing Entity	Place	Implementation period	Scale and Breakdown of Initiatives	Project Effectiveness (CO2 reduction t/year)	Note
Energy-saving lighting equipment (LEDs, etc.)	AGC	Yokohama technical center	2019～2021	1,200,000kWh	—	
	ENEOS	Yokohama Factory	FY2023～	FY2023 110lights 9.2kW	58	
	Ohgishima Power	Ohgishima power station	FY2013～FY2023	full implementation	169	
			FY2024～FY2025 （Plan）	full implementation	7	
	Tokyo Gas	Tsurumi ward	FY2024 introduction	full implementation	2	
	Toshiba Energy Systems & Solutions	Keihin office	FY 2024～	72% introduction rate	40	
	Yokohama City University	All campuses	2021～FY2026	58.3MWh	27	
	IHI	Yokohama office	2021～FY2024	Adoption rate 95%	800	
	JFE Engineering	Yokohama head office	Implemented in FY2022	full implementation	350	
Energy conservation in air conditioning and heat source equipment, etc. (Equipment renewal, energy management, DHC improvement, etc.)	AGC	Yokohama technical center	～2030	Energy Management in Development and Common Sector	5,400	Scope1,2 down 30% from 2019
	TOAGOSEI	YOKOHAMA PLANT	Implemented in FY2020-2024, with effects occurring after completion.	Renewal of No. 1 turbo refrigerator	341	
	Yokohama City University	Fukuura campas and affiliated hospital	2021～FY2026 2021～FY2027 2021～FY2024	A. Renewal of power receiving and transforming equipment and high-efficiency transformers B.Renewal of aging air conditioning equipment C.Steam piping repair (leak), hospital vertical piping (south side) repair	47	The Citizen's Medical Center and Kanazawa Hakkei Campus will work on the same basis, but since they are outside the scope of the project, CO_2 emissions reductions will not be recorded.
		Tsurumi campus	2022～FY2026 2022～FY2026 2023～FY2026	A. Fin cleaning of PAC outdoor unit. B. Cooling water pump INV conversion C. Renewal of cooling unit in low-temperature room	5	
	JFE Engineering	Yokohama head office	Operation to start in FY2023	Introduction of storage batteries(2.5MW/5MWh)	—	
	Mitsubishi Heavy Industries	Honmoku	FY2027 Plan	Electrification of hot water supply and cooking facilities	4	
			FY2027 Plan	Renewal of hot water supply, air conditioning, and substation facilities (increasing efficiency)	44	
Energy conservation in production facilities	ENEOS	Negishi refinery	at any time	Energy-saving modification of existing facilities	—	
			FY2022～	Reducing Crude Oil Processing Capacity	—	
			FY2023～	Introduction of large storage batteries	—	
		Yokohama Factory	FY2022～	Removal of unnecessary piping(0.241 Ton/h)	310	
			FY2024～	Reduction of steam use during long vacations(GW 10 days Obon 10 days)	33	

Waterfront Area Initiatives						
Initiatives	Implementing Entity	Place	Implementation period	Scale and Breakdown of Initiatives	Project Effectiveness (CO2 reduction t/year)	Note
Building decarbonization (multiple initiatives)	NTT Communications	1 telecommunications building	2023～2030 （one part～2040）	Decarbonization of bases （Energy savings through equipment upgrades, Purchase of non-fossil certificates, etc.）	1,200	
		4 office locations	2023～2030	Decarbonization of Group sites （Energy savings through equipment upgrades, Purchase of non-fossil certificates, etc.）	300	
	Hitachi	Systemplaza Yokohama	implementation	・Replacement with high-efficiency air conditioners ・Review of appropriate number of air conditioners and humidifiers in operation ・Purchase of non-fossil certificates	2,105	7.7% reduction from the previous year
	the City of Yokohama	Minato Mirai 21 district	FY2022～ FY2030,currently being carried out	Decarbonization Leading Areas (thorough energy conservation, introduction of renewable energy, etc.)	190,000	Ministry of the Environment Regional Decarbonization Transition and Renewable Energy Promotion Grant ［Joint Applicant] City of Yokohama, General Incorporated Association Yokohama Minato Mirai 21 ［Participating Businesses] 41 facilities in the district(as of July R6)
	MUFG Bank	Global Learning Center	FY2024	Decarbonization of heat (10,199 GJ/year)	(680)	Included for reference only, as they are included in the reductions in the Decarbonization Leading Areas.
Utilization of unused energy	TOAGOSEI	YOKOHAMA PLANT	Implemented from 2021 to FY2024, with effects occurring after completion	Reduction of steam consumption through heat recovery	836	
			Implemented from 2022 to FY2026, with effects occurring after completion.	Demonstration test of effective use of incinerated waste heat	6,349	FY2024 Subsidy for Carbon Dioxide Emission Control Project(Project to promote the construction of a regional recycling and symbiosis zone with a waste treatment facility at its core)
Solar Power Generation	IHI	Yokohama office	2023～FY2030	1,000kW	100	
Offshore Wind Power Generation	Toshiba Energy Systems & Solutions	Keihin Office	FY2028～	Manufacture of wind turbine nacelles 72 units per year 12.5MW/unit	—	(reference) CO2 reduction 1,241,000t-CO2/year
Use of decarbonized electricity and fuels (CO2-free electricity, certificates, credits)	AGC	Yokohama technical center	2022～	Appro.35,000,000kWh/year	16,000	
	Tokyo Gas	the City of Yokohama	FY2023 introduction	full implementation	13,454	
	JFE Engineering	Yokohama head office	To be introduced sequentially from FY2021	100% introduction in Yokohama area	5,000	
	MUFG Bank	Branches and other facilities	FY2022	100% introduction rate	—	
Renewal of generators, hydrogen and ammonia utilization	The Nisshin OilliO Group	Isogo office	FY 2025～operation	Gas Turbine Renewal(8,000kW class)	1,200	
			After 2027, by 2030	Gas turbine 1% hydrogen co-firing per year	1,100	
Next Generation Fuel Bunkering	Mitsubishi Gas Chemical	Port of Yokohama	Aiming for implementation in 2025	Supply of fuel methanol and bunkering for domestic and ocean-going vessels	TBD	
Development and demonstration of various technologies	ENEOS	Central Research Laboratory	2025 Development and technical demonstration of large electrolyzer 2030s Aim for social implementation	Direct MCH®：Development of low-cost production technology for MCH, a type of hydrogen carrier	—	
			Scale-up demonstration at plant scale will begin in FY2022.	Development of synthetic fuel production technology	—	
			Starting from 2023	Demonstration of DAC technology	—	
			Starting from 2022	Development of chemical recycling technology to produce raw materials for tires from used tires	—	
	Tokyo Gas	Tsurumi ward	Demonstration from FY2022	Production demonstration test of e-methane (synthetic methane)	—	Preparing to acquire Clean Gas Certificate
Other	ENEOS	the City of Yokohama	FY2014～	Hydrogen station operation(4 locations)	—	
	Mizuho Bank	Port of Yokohama	Plan	Support for the creation of new financial schemes to promote initiatives for the formation of a carbonneutral port	—	
	Mitsui E&S	—	April 2024～	Widespread use of high-pressure, high-flow hydrogen compressors	—	
				Short to Medium Term Combination	245,280	
(Reference) Total amount of reductions by CNP Council members (15 companies) calculated from the global warming action plan system (2013 → 2022)					1,163,695	

(2) Medium-term (FY2040)

Table 26: Efforts to decarbonize the waterfront area (midium-term)

Waterfront Area Initiatives						
Initiatives	**Implementing Entity**	**Place**	**Implementation period**	**Scale and Breakdown of Initiatives**	**Project Effectiveness (CO2 reduction t/year)**	**Note**
Decarbonization of heat (synthetic methane utilization, etc.)	The Nisshin OilliO Group	Isogo office	FY2030～	Synthetic methane (e-methane) (minimum 1% of supply)	860	
Synthetic methane supply	Tokyo Gas	the City of Yokohama	To be introduced sequentially from FY2030 onward	Supply of e-methane (synthetic methane)	TBD	Studying the possibility of introducing more than 1% of city gas in 2030. Project effects will be discussed in conjunction with future concretization.
				Total Mid-term Initiatives	**860**	

Table 27: Efforts to decarbonize the waterfront area (long-term)

Waterfront Area Initiatives						
Initiatives	**Implementing Entity**	**Place**	**Implementation period**	**Scale and Breakdown of Initiatives**	**Project Effectiveness (CO2 reduction t/year)**	**Note**
Energy-saving lighting equipment (LED, etc.)	Nissan Motor	Honmoku	Plan	Conversion to LED lighting in the factory	―	
Energy saving in production facilities	JFE Steel	Ohgishima	Plan	Energy saving by downsizing pumps, etc.	―	
Use of decarbonized electricity and fuels(CO2-free electricity, certificates, credits)	JFE Steel	Ohgishima	Plan	Conversion from natural gas to carbon neutral fuel for heating furnaces, etc.	―	
	The Nisshin OilliO Group	Isogo office	Plan	Amount of electricity received	600	
Renewal of generators, hydrogen and ammonia utilization	The Nisshin OilliO Group	Isogo office	Plan	Gas turbine hydrogen co-firing GT：60%、Reheating：100%	15,700	
	IHI	Yokohama office	Plan	Gas engine power plant fuel conversion (City gas ⇒ Ammonia)(4,000kW)	TBD	
	the City of Yokohama	Minato Mirai 21 district	Creation of a roadmap to 2050 in FY2023	Hydrogen Utilization in District Heating and Cooling （Minato Mirai Hydrogen Project)(Boiler facilities, Scale undecided)	90,000	
Hydrogen use in LNG- and coal-fired power generation	JERA	―	TBD	Hydrogen conversion of LNG-fired power plants, etc.	―	Promote company-wide conversion of LNG-fired power plants to hydrogen to reduce emissions intensity of thermal power generation. *We would like to refrain from giving a definite answer on the scale and period of implementation at each location at this time.
	Electric Power Development(J-POWER)	Isogo Thermal Power Plant	TBD	Transition of thermal power sources based on J-POWER BLUE MISSION 2050 (2 units)	―	In accordance with the J-POWER BLUE MISSION 2050 roadmap, high-efficiency coal-fired power plants will also select the most appropriate technology based on the characteristics of the site and contribute to a stable supply of electricity while reducing carbon emissions and decarbonization. *In May 2024, we presented the direction of transition for our seven thermal power plants, including the Isogo Thermal Power Plant.However, it may be revised according to preconditions such as policy, electricity supply and demand conditions, and progress in industrial development.

Waterfront Area Initiatives						
Initiatives	**Implementing Entity**	**Place**	**Implementation period**	**Scale and Breakdown of Initiatives**	**Project Effectiveness (CO2 reduction t/year)**	**Note**
Establishment of electric power supply bases and supply of renewable energy power	the City of Yokohama,Ocean Power Grid, MUFG Bank,etc.	Port of Yokohama	TBD	Introduction of renewable energy from offshore wind power by battery tankers	TBD	5 parties MOU concluded with the City of Yokohama,TEPCO Power Grid, Ocean Power Grid, TODA CORPORATION, MUFG Bank (January 2025)
Next Generation Fuel Bunkering	Idemitsu Kosan	Honmoku Pier Minami Honmoku Pier	Plan	eMethanol fueling for container ships	TBD	eMethanol demand calculation in progress
Development and demonstration of various technologies	ENEOS	Central Research Laboratory	Implementation	MCH-FC Technology Development	—	
			Implementation	Biofuel production technology development	—	
Consideration of land use conversion	JFE Holdings	Ohgishima	FY2023～	Land use conversion to areas leading the way in carbon neutrality	TBD	
				Total Long-term Initiatives	**106,300**	
				Total Promotion Project Initiatives	**352,440**	

(4) Reduction Effect of CO_2 emssions

Table 28: CO_2 Emissions Reduction Effects of Decarbonization Initiatives in the Waterfront Area

Item	Total
① ：CO_2 emissions in the base year (2013)	9,093,000t
② ：CO_2 emissions in the most recent year (2022	6,394,000t
③ ：CO2 emission reductions from port decarbonization promotion projects (2023-2050)	379,000t *
④ ：Reduction of CO2 emissions from base year (2050)（①-②+③）	3,078,000t
⑤ ：Reduction rate（④／①）	33.9%

*The total of 352,000 tons for the port decarbonization promotion projects in the waterfront area and 27,000 tons for the port decarbonization promotion projects at wharves.

4-1-2. Initiatives for decarbonization at the wharf

The project to promote decarbonization of ports and harbors in the waterfront area of Yokohama City (initiatives to decarbonize at the wharf) and its implementing entities are as follows.

These are the current status of studies conducted by each entity. The report will be updated to reflect the consideration of each entity in light of future developments in technologies that contribute to decarbonization and changes in social conditions, as well as the progress of inter-company collaboration and the participation of new entities.

(1) Short to medium term (FY2030)

Table 29: Efforts to decarbonize at the wharf (short- and medium-term)

Efforts at the wharf (in the terminal)

Initiatives	Implementing Entity	Place	Implementation period	Scale and Breakdown of Initiatives	Project Effectiveness (CO2 reduction t/year)	Note
Energy-saving lighting equipment (LEDs, etc.)	the City of Yokohama	In Terminal public facilities	～FY2030	adjusting	—	
	Yokohama Kawasaki International Port Corporation	Minami Honmoku Pier MC-4	FY2021	Six lighting towers, gantry crane lighting facilities, etc.	—	Effects of the project are accounted for in the introduction of renewable electricity
		Honomoku Pier D-4	FY2025～	Six lighting towers, gantry crane lighting facilities, etc.	—	
		Honmoku Pier D-5	FY2025～	Four lighting towers, gantry crane lighting facilities, etc.	—	
	Yokohama Port Corporation	Daikoku Pier C-1～4,L-1～8	FY2014～2024	Adoption rate 100%	—	40%-50% reduction in electricity consumption for lighting
Solar Power Generation	Yokohama Port Corporation	Minami Honmoku Pier MC-1,2	FY2014～	520kW	249	FIT
		Minami Honmoku Pier MC-3	FY2015～	310kw	184	FIT
	the City of Yokohama	Daikoku Pier T-4	FY2014～	300kW	160	FIT
		Daikoku Pier Y-CC	FY2016～	24.5kW	13	
Use of decarbonized electricity and fuels (CO2-free electricity, certificates, credits)	Yokohoama Kawasaki International Port Corporation	Honmoku Pier D-1	FY2022～	2,145MWh/year	948	
		Honmoku Pier D-4	FY2022～	5,645MWh/year	2,495	
		Honmoku Pier BC	FY2022～	9,459MWh/year	4,181	
		Daikoku Pier T-9	FY2022～	675MWh/year	299	
	Terminal lessee, etc.*	Minami Honmoku Pier MC-1～4	～FY2029 conceptual stage	27,000kWh/year	10,176	
	Yokohama Port Corporation	Daikoku Pier C-1	FY2022～	252MWh/year	110	
		Daikoku Pier C-2	FY2022～	198MWh/year	80	
		Daikoku Pier L-1～8	FY2022～	1,389MWh/year	580	
		Honmoku Pier A-5,6	FY2022～	142MWh/year	50	
		—	FY2023～	Use of J-credits (gasoline)(Adoption rate 100%)	16	
Introduction of decarbonized cargo handling eqipments	Yokohama Kawasaki International Port Corporation	Honmoku Pier D-1	FY2021～FY2024	Introduction of energy-saving gantry cranes (3 units)	—	Effects of the project are accounted for in the introduction of renewable electricity
		Honmoku Pier D-4	2024～FY2027	Introduction of energy-saving gantry cranes (2 units)	—	
		Minami Honmoku Pier MC-4	After 2026	Introduction of energy-saving gantry cranes (2 units)	—	
		Honmoku Pier BC	After 2026	Introduction of energy-saving gantry cranes (3 units)	—	
		Honmoku Pier MC-1,2	FY2020～FY2024	Introduction of energy-saving gantry cranes (5 units)	—	
		Honmoku Pier BC	FY2021～FY2023	Introduction of energy-saving gantry cranes (2 units)	—	
		Honmoku Pier BC	FY2025～FY2026	Introduction of energy-saving gantry cranes (1 units)	—	
		Honmoku Pier D-5	After2028	Introduction of energy-saving gantry cranes (3 units)	—	

Efforts at the wharf (in the terminal)

Initiatives	Implementing Entity	Place	Implementation period	Scale and Breakdown of Initiatives	Project Effectiveness (CO2 reduction t/year)	Note
Introduction of decarbonized cargo handling eqipments	Suzue Corporation, Sankyu, Sumitomo Warehouse, Tokyo International Terminal, Mitsubishi Logistics Corporation, Port of Yokohama Mega Terminal	Honmoku Pier BC	FY2015～FY2023	Low-carbon RTGs 50% of total installed	501	
	Nippon Express Kamigumi	Honmoku Pier D-1	～FY2021	Low-carbon RTGs 87.5% of total installed	374	
			FY2025～FY2026	Low-carbon RTGs 100% of total installed	53	
	CMACGMJAPAN	Honmoku Pier D-4	FY2013	Low-carbon RTGs 100% of total installed	701	
	APM Terminals Japan	Minami Honmoku Pier MC-1～4	FY2015～FY2023	Low-carbon RTGs 93% of total installed	2,134	
			FY2025～FY2026 conceptual stage	Low-carbon RTGs 100% of total installed	305	
	Terminal lessee, etc.*	Minami Honmoku Pier MC-1～4	FY 2027～FY 2029 conceptual stage	RTG 100% adoption rate	4,551	
			FY 2027～FY 2029 conceptual stage	Reach Stacker 100% adoption rate	2	
			FY 2027～FY 2029 conceptual stage	Top Lifter 100% adoption rate	1,232	
			FY 2027～FY 2029 conceptual stage	Forklift 100% adoption rate	107	
			FY 2027～FY 2029 conceptual stage	Truck on the premises 100% adoption rate	3,013	
	Mitsui E&S	Port of Yokohama	FY2023～FY2024	On-site demonstration of hydrogen-fueled cargo handling equipment (Our near-zero emission RTGs is powered by a fuel cell)	—	Reduce CO2 emissions to zero
				Total short- and medium-term in terminal	**32,514**	

Efforts at the wharf (incoming/outgoing vessels and vehicles)

Initiatives	Implementing Entity	Place	Implementation period	Scale and Breakdown of Initiatives	Project Effectiveness (CO2 reduction t/year)	Note
Next Generation Fuel Bunkering	the City of Yokohama	Port of Yokohama	—	Work with companies to implement initiatives	TBD	Assuming an increase in fuel types, listed for all periods.
Decarbonization of vessels	NYK Line	Tokyo Bay	FY2024～	Ammonia-fueled tugboat	—	Green Innovation Fund of the New Energy and Industrial Technology Development Organization (NEDO) Reference: GHG reduction rate of 60% or more compared to conventional vessels is planned.
		Port of Yokohama etc.	Completion scheduled for 2025	(Asuka III) LNG Fueled Vessels / Onshore Power Support	—	NYK CRUISES CO., LTD.
	Daito Corporation	Port of Yokohama etc.	FY2027～	Battery-electric propulsion tugboat	—	Project to Promote Innovative Operation Efficiency and Non-Fossil Energy Conversion for Coastal Shipping by the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) and the Ministry of Economy, Trade and Industry (METI)
	City of Yokohama	Port of Yokohama	FY2025～	Introduction of biofuel-compatible engines in harbor boat		
			FY2024～	Participation in the Blue Visby Consortium	—	
			FY2023～	Use of Maritime Emissions Portal (Lightship)	—	
Installation of onshore power supply facilities	the City of Yokohama	Honmoku Pier A-4	FY2024～	Low-voltage onshore power supply facilities	5	Subsidy for International Strategic Port Rehabilitation Project (Yokohama Port Rehabilitation (International Strategic) Project)
		Osanbashi Pier	April 2027~	High-voltage onshore power supply facility (for large cruise ships)	—	
	Yokohama Kawasaki International Port Corporatioin etc.	Honmoku Pier D-4,5	Under planning conceptual stage	High-voltage onshore power supply facilities (for container ships)	—	
		Minami Honmoku Pier MC-3,4	Under planning conceptual stage	High-voltage onshore power supply facilities (for container ships)	—	
Introduction of gate reservation system	Kanto Regional Development Bureau, Ministry of Land, Infrastructure, Transport and Tourism	Minami Honmoku Pier	FY 2021～	full implementation	—	
		Honmoku Pier	after FY 2025	full implementation	—	
Incentives for environmentally friendly vessels	City of Yokohama	Port of Yokohama	FY2017～	・ESI (Environmental Ship Index) system ・Programs by the Green Award Foundation ・LNG bunkering and LNG bunkering vessels	—	Assuming that the type of incentive will increase with the increase in fuel types, the incentives are listed for the entire period.
				Inbound/Outbound Vehicles Vessels Medium/Short Term Total	**5**	

(2) Medium-term (FY2040) Table 30: Efforts to decarbonize at the wharf (med-term)

Efforts at the wharf (in the terminal)

Initiatives	Implementing Entity	Place	Implementation period	Scale and Breakdown of Initiatives	Project Effectiveness (CO2 reduction t/year)	Note
Energy-saving lighting equipment (LEDs, etc.)	Terminal lessee, etc.*	Minami Honmoku Pier MC-1～3	TBD conceptual stage	15 lighting towers, gantry crane lighting facilities, etc.	—	Effects of the project are accounted for in the introduction of renewable electricity
		Honmoku Pier BC	TBD conceptual stage	13 lighting towers, gantry crane lighting facilities, etc.	—	
		Honmoku Pier D-1	TBD conceptual stage	6 lighting towers, gantry crane lighting facilities, etc.	—	
Introduction of decarbonized cargo handling eqipments	Yokohama Kawasaki International Port Corporation	Minami Honmoku Pier MC-1,2	～FY2040 conceptual stage	Introduction of energy-saving gantry cranes (5 units)	—	Effects of the project are accounted for in the introduction of renewable electricity
		Honmoku Pier BC	～FY2040 conceptual stage	Introduction of energy-saving gantry cranes (6 units)	—	
		Shinhonmoku Pier	～FY2040 conceptual stage	Introduction of energy-saving gantry cranes (8 units)	—	
		Minami Honmoku Pier MC-3	～FY2040 conceptual stage	Introduction of energy-saving gantry cranes (4 units)	—	
		Minami Honmoku Pier MC-4	～FY2040 conceptual stage	Introduction of energy-saving gantry cranes (1 units)	—	
		Honmoku Pier BC	～FY2040 conceptual stage	Introduction of energy-saving gantry cranes (2 units)	—	
		Honmoku Pier D-1	～FY2040 conceptual stage	Introduction of energy-saving gantry cranes (3 units)	—	
	Terminal lessee, etc.*	Honmoku Pier D-5	～FY2040 conceptual stage	RTG 100% introduction rate	925	
			～FY2040 conceptual stage	Top Lifter 100% adoption rate	227	
			～FY2040 conceptual stage	Forklift 100% adoption rate	14	
			～FY2040 conceptual stage	Truck on the premises 100% adoption rate	549	
		Honmoku Pier BC	～FY2040 conceptual stage	RTG introduction rate 50%	1,077	
			～FY2040 conceptual stage	Top lifter introduction rate 13.3%	113	
			～FY2040 conceptual stage	Trucks on premises indroduction rate 22.9%	284	
				Total mid-term in terminal	**3,189**	

Efforts at the wharf (incoming/outgoing vessels and vehicles)

Initiatives	Implementing Entity	Place	Implementation period	Scale and Breakdown of Initiatives	Project Effectiveness (CO2 reduction t/year)	Note
Next Generation Fuel Bunkering	the City of Yokohama	Port of Yokohama	—	Work with companies to implement initiatives	TBD	Assuming an increase in fuel types, listed for all periods.
Decarbonization of vessels	the City of Yokohama	Port of Yokohama	FY2024～	Promotion of the Blue Visby Consortium	—	
Incentives for environmentally friendly vessels	the City of Yokohama	Port of Yokohama	FY2017～	・ESI (Environmental Ship Index) system ・Programs by the Green Award Foundation ・LNG bunkering and LNG bunkering vessels	—	Assuming that the type of incentive will increase with the increase in fuel types, the incentives are listed for the entire period.

(3) Long-term (FY2050) Table 31: Efforts to decarbonize the waterfront area (long-term)

Efforts at the wharf (in the terminal)

Initiatives	Implementing Entity	Place	Implementation period	Scale and Breakdown of Initiatives	Project Effectiveness (CO2 reduction t/year)	Note
Introduction of decarbonized cargo handling eqipments	Terminal lessee, etc.*	Honmoku Pier BC	～FY2050 conceptual stage	RTG 100% adoption rate	1,077	
			～FY2050 conceptual stage	Top Lifter 100% adoption rate	735	
			～FY2050 conceptual stage	Reach Stacker 100% adoption rate	122	
			～FY2050 conceptual stage	Truck on the premises 100% adoption rate	959	

Efforts at the wharf (in the terminal)						
Initiatives	**Implementing Entity**	**Place**	**Implementation period**	**Scale and Breakdown of Initiatives**	**Project Effectiveness (CO2 reduction t/year)**	**Note**
Introduction of decarbonized cargo handling eqipments	Terminal lessee, etc.*	Honmoku Pier D-1	～FY2050 conceptual stage	RTG 100% adoption rate	990	
			～FY2050 conceptual stage	Top Lifter 100% adoption rate	199	
			～FY2050 conceptual stage	Stranded carriers 100% adoption rate	33	
			～FY2050 conceptual stage	Trucks on premises 100% adoption rate	279	
			～FY2050 conceptual stage	Forklift trucks 100% adoption rate	3	
			～FY2050 conceptual stage	Reach Stacker 100% adoption rate	1	
				Long-term total in terminal	**4,398**	

Efforts at the wharf (incoming/outgoing vessels and vehicles)						
Initiatives	**Implementing Entity**	**Place**	**Implementation period**	**Scale and Breakdown of Initiatives**	**Project Effectiveness (CO2 reduction t/year)**	**Note**
Next Generation Fuel Bunkering	the City of Yokohama	Port of Yokohama	—	Work with companies to implement initiatives	—	Assuming an increase in fuel types, listed for all periods.
Decarbonization of vessels	Nissan Motor Co., Ltd.	whole company	—	Adoption of container Bio Fuel vessels for Europe	—	
	the City of Yokohama	Port of Yokohama	FY2024～	Promotion of the Blue Visby Consortium	—	
Incentives for environmentally friendly vessels	the City of Yokohama	Port of Yokohama	FY2017～	・ESI (Environmental Ship Index) system ・Programs by the Green Award Foundation ・LNG bunkering and LNG bunkering vessels	—	Assume that the type of incentive will increase with the increase in fuel types, the incentives are listed for the entire period.

Effect of the project (CO2 reduction t/year)	2013～2050	2013～2022	After 2023
Total terminal promotion project initiatives	40,101	13,059	27,042
Container terminal only	38,360	11,633	26,727
Total Initiatives for Inbound/Outbound Vehicle Vessel Promotion Projects	5	0	5

*The details of initiatives with "etc." added as an executing entity are stipulated in the Manual for Port Decarbonization Promotion Plan Preparation (March 2023, Industrial Port Division, Port and Harbor Bureau, Ministry of Land, Infrastructure, Transport and Tourism) to be included in the 6-1. However, in this plan, we have focused on the listing of Port Decarbonization Promotion Project and have included them in 4-1-2. Efforts to decarbonize at the docks. We are aware that these efforts do not currently fall under the port decarbonization promotion projects stipulated in Article 50-2, Paragraph 5 of the Port and Harbor Act.

(4) Reduction Effect of CO_2 emssions

Table 32: CO_2 Emissions Reduction Effects of Decarbonization Initiatives at the Wharf

Item	In Terminal*1	Incoming and outgoing vessels and vehicles*2	Total
① ：CO_2 emissions in the base year (2013)	37,000t	337,000t	374,000t
② ：CO_2 emissions in the most recent year (2022	26,000t	326,000t	352,000t
③ ：CO2 emission reductions from port decarbonization promotion projects (2023-2050)	26,000t	0t	26,000t
④ ：Reduction of CO2 emissions from base year (2050)（①-②+③）	37,000t	11,000t	48,000t
⑤ ：Reduction rate（④／①）	100%	3.3%	12.8%

*1 Only figures for container terminals are reported.

*2 Outbound and inbound vessels account for CO2 emissions from vessels at anchor (including anchorages). CO2 emissions from inbound and outbound vehicles are not reported because measures such as electrification and modal shift are qualitative at this time.
In the future, this plan will be reviewed and added to the Port Decarbonization Promotion Project as the private sector and others take concrete steps to decarbonize their operations, thereby promoting the project and achieving its goals.

4-1-3. Efforts to create an abundant ocean

The project to promote decarbonization of ports and harbors (initiatives to create a rich ocean) at the Port of Yokohama and its implementing entities are defined as shown in the table below.

(1) Short to medium term (FY2030)

Table 33 Efforts to create a rich ocean (short-to-medium term)

Name (Business Name)	Position	Scale	Implementing Entity	implementation period	Effects of the Project (CO_2 absorption)	Note
Preservation, reproduction and creation of blue infrastructure	Harbor area, etc.	Seawalls, wave dissipating blocks, shallow areas, etc.	City of Yokohama, etc.	～FY2030	Approx.150t-CO_2/year	

(2) Medium term (FY2040)

Table 34 Efforts to create an abundant ocean (medium term)

Name (Business Name)	Position	Scale	Implement Entity	Implementation period	Effects of the Project（CO_2 absorption）	Note
Preservation, reproduction and creation of blue infrastructure	Harbor area, etc.	Seawalls, wave dissipating blocks, shallow areas, etc.	City of Yokohama, etc.	～FY2040	Approx. 200t-CO_2/year	

(3) Long-term (FY2050)

Table 35 Efforts to create a rich ocean (long-term)

Name (Business Name)	Position	Scale	Implementing Entity	Implementation period	Effects of the Project（CO_2 absorption）	Note
Preservation, reproduction and creation of blue infrastructure	Harbor area, etc.	Seawalls, wave dissipating blocks, shallow areas, etc.	City of Yokohama, etc.	～FY2050	Approx. 250t-CO_2/year	

(4) CO_2 absorption effect

Table 36: Effects of increased CO_2 absorption through efforts to create a rich ocean

	① ：CO_2 Absorption（FY2024）	② ：Cumulative amount of CO_2 absorption（Cumulative amount by FY2050）	③：rate of increase（②／①）
Total	Approx. 100t/year	Approx. 250t/year	2.5times

4-2. Matters listed in article 50-2, paragraph 3 of the Port and Harbor Act

(1) Matters concerning facilities that intend to apply for accreditation under Article 2, Paragraph 6 of the Act

None

(2) Matters relating to acts requiring permission under Article 37, Paragraph 1 of the Law

None

(3) Matters concerning acts requiring notification pursuant to Article 38-2, Paragraph 1 or Paragraph 4 of the Act

None

(4) Matters related to the business of operating specified piers prescribed in paragraph 1 of Article 54-3, paragraph 2 of the Act, which are necessary to obtain the authorization prescribed in paragraph 2 of Article 54-3 of the Act

None

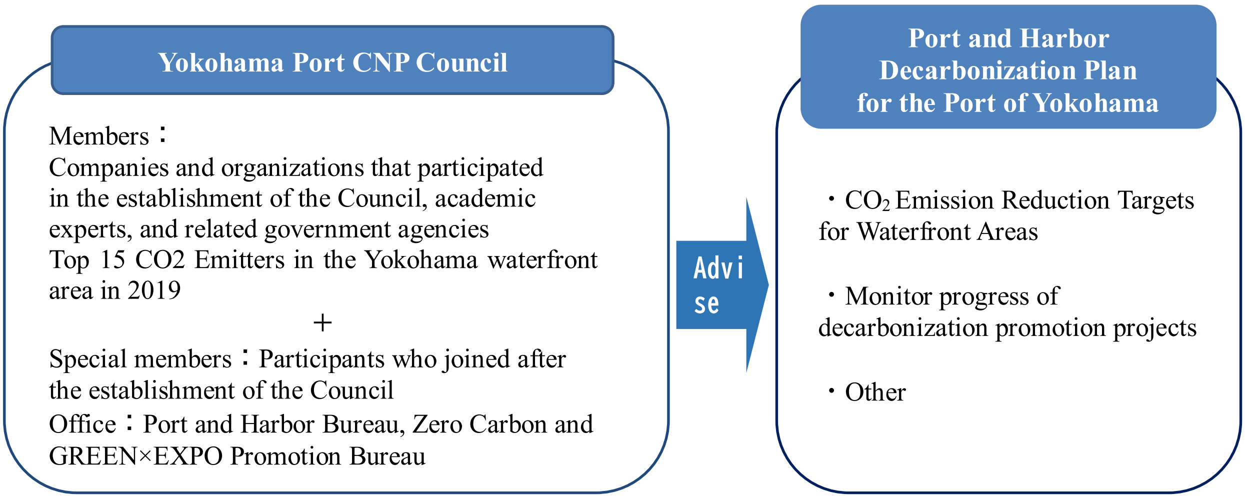
(5) Matters concerning the person who constructs or improves the port facilities for specified use prescribed in Paragraph 2 of Article 55-7, which is conducted under the loan by the port administrator pertaining to the loan by the Government of Japan, which is prescribed in Paragraph 1 of the Act

None

5. Matters related to progress evaluation

5-1. Implementation system for progress evaluation, etc

This plan was developed by the City of Yokohama, the port authority of the Port of Yokohama, based on the opinions of the Yokohama Port CNP Council (hereinafter referred to as “the Council”) and other organizations. In the future, the Council and other bodies will meet regularly to promote this plan and to confirm and evaluate its progress. In addition, the City of Yokohama will revise the plan in a timely and appropriate manner based on the results of the evaluation, the national government's greenhouse gas reduction targets, and the progress of technologies that contribute to decarbonization.



Members

○ Companies and Organizations

AGC, NTT Communications, ENEOS, Ohgishima Power, JFE Steel, JERA, Electric Power Development (J-POWER), TOAGOSEI, TOKYO GAS, Toshiba Energy Systems & Solutions, Nissan Motor, The Nisshin OilliO Group, Hitachi, the City of Yokohama, Yokohama City University

○ Academic Experts

Takeo Kikkawa, President, International University of Japan and Professor Emeritus, University of Tokyo and Hitotsubashi University

Akihisa Kuriyama, Research Manager, Institute for Global Environmental Strategies

○ Administrative Agencies

Kanto Regional Development Bureau, Ministry of Land, Infrastructure, Transport and Tourism

Special Members

IHI, Idemitsu Kosan, JFE Engineering, NYK Line, Ocean Power Grid, Inc., Mizuho Bank, MITSUI E&S, Mitsubishi gas chemical company, Mitsubishi Heavy Industries, MUFG Bank, Yokohama Kawasaki International Port Corporation, Yokohama Port Corporation

Figure 35: Implementation structure of the Yokohama Port CNP Council

5-2. Progress evaluation methods

Evaluations of the plan's progress will be made at regularly scheduled council meetings. In addition to the progress of the port decarbonization promotion projects, the evaluations will include a quantitative understanding of the decarbonization effect achieved, such as the reduction of carbon dioxide emissions by aggregating the actual fuel and electricity consumption of the companies participating in the Council. In the evaluations, the specific numerical targets and actual performance will be compared in the target year with respect to the KPIs established in advance. In other years, whether the actual performance is achievable by the target year is evaluated.

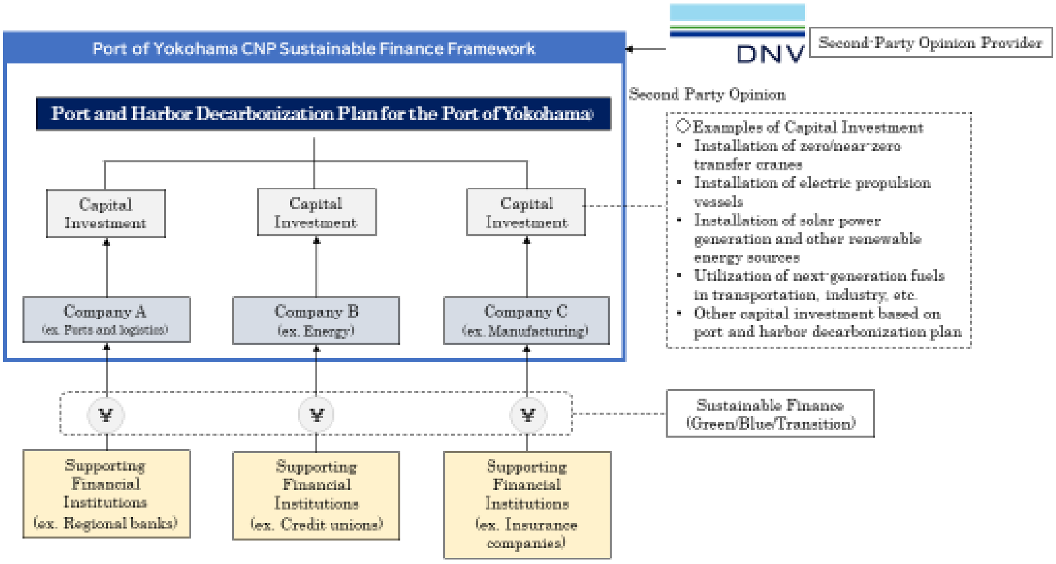
The top 15 carbon dioxide emitters located in the Yokohama waterfront area produce approximately 70% of the total carbon dioxide emissions from the waterfront area in the city of Yokohama.

The main measurement (estimation) method is to extract the waterfront area from the estimated figures of the Zero Carbon and GREEN×EXPO Promotion Bureau. With regard to greenhouse gas emissions from ships, although estimates using the IMO GHG Study 2020 are used, we will use the Maritime Emissions Portal of RIGHTSHIP (headquartered in Melbourne) to obtain estimates at a level closer to actual results, and we will also consider comparing targets and estimates in the future.

5-3. Efforts to promote completion of the plan

5-3-1. Financial framework using sustainable finance, etc.

In April 2024, the City of Yokohama and Mizuho Bank, Ltd. signed a Memorandum of Understanding (MOU) to jointly study the creation of a new financial support scheme for the activities of companies and organizations in the waterfront area of Yokohama toward decarbonization, in the formation of a carbon neutral port at the Port of Yokohama.



The size of companies operating within the scope of this plan varies widely, and even large companies face certain hurdles in disclosing information, such as the formulation of environmental policies, which may make it difficult for them to engage in sustainable finance in the first place. Even if they were able to work on it, many would abandon it due to the cost of third-party evaluation, manpower, and other factors.

Therefore, the City of Yokohama will develop the “Port of Yokohama CNP Sustainable Finance Framework” and position companies' own initiatives as part of this plan's port decarbonization promotion projects, which will broaden the base of initiatives to include companies that may be unable to act on their own due to their cale, by enabling access to sustainable finance. This will also promote the decarbonization of the Port of Yokohama as a whole.

【Reference 1】
Of the 27 members of the Yokohama Port CNP Council, 12 have developed financial frameworks for sustainable finance. (As of August 2024)

【Reference 2】
The City of Yokohama selected DNV Business Assurance Japan K.K. as a third-party evaluation organization. The reasons for this are, of course, the company's track record as a certification body, but also its world-leading market share in ship classification services and its track record in evaluating GX Economic Transition Bonds.

5-3-2. Examples of Sustainable Finance Use Cases

In the future, we would like to introduce case studies that utilize the Port of Yokohama CNP Sustainable Finance Framework.

6. Matters deemed necessary by the port authority with respect to the implementation of Port and Harbor Decarbonization Plan for the Port of Yokohama

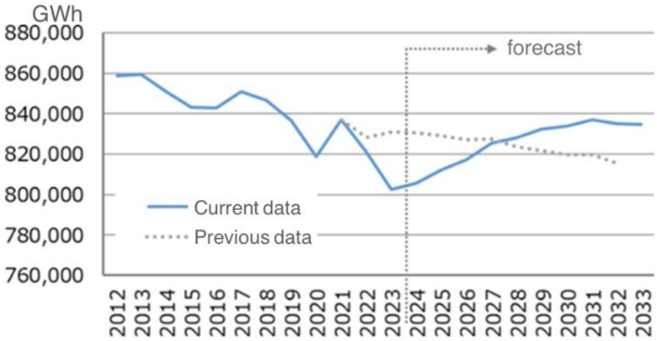
6-1. Future initiatives to contribute to the promotion of port decarbonization

6-1-1. Study on how to supply green power from offshore wind power generation starting from the waterfront area of Yokohama

(1) Forecast of future electricity demand

According to the Organization for Cross-regional Coordination of Transmission Operators (OCCTO) demand forecasts for FY2024, electricity demand in the residential sector is on a downward trend due to population decline, power saving, energy conservation, and other factors. However, overall electricity demand is on an upward trend due to a significant increase in electricity demand in the industrial sector resulting from the construction of new data centers and semiconductor factories.

Demand forecasts for each supply area include a particular increase in demand in the Tokyo, Hokkaido, and Chugoku regions due to the individual incorporation of new data centers and semiconductor factories.



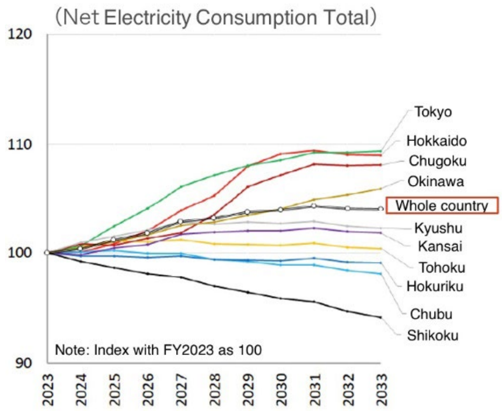


Figure 37: (left) National total of power requirements (net consumption)
Figure 38: (right) Electricity demand by service area (net consumption)

https://www.occto.or.jp/juyousoutei/2023/240124_juyousoutei_2024.html

(2) Expectations for Battery Tankers

Battery Tankers are the world's first means of transmitting electricity by sea, where electricity is stored in storage batteries on board the ship. While studies are underway to extend offshore wind power generation to the exclusive economic zone (EEZ), Japan's waters are deep, and strengthening the means of power transmission is just one challenge we face. Battery tankers are expected to be a potential solution to these issues.

Therefore, in conjunction with the response to increased electricity demand, in April 2024, the City of Yokohama concluded the "Memorandum of Understanding (MOU) on the establishment of a green power supply base to meet the increasing demand for electricity in the Yokohama waterfront area and the realization of onshore power supply for cruise ships" with TEPCO Power Grid, Inc. and Ocean Power Grid, Inc. (100% subsidiary of Power-X).

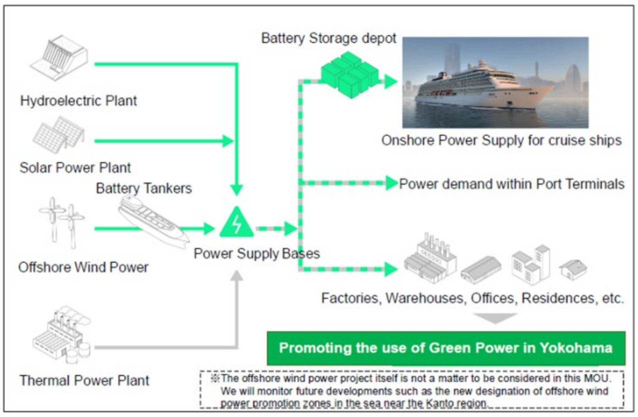


Figure 39: From the press release of the Memorandum of Understanding between the City of Yokohama, TEPCO Power Grid, Incorporated, and Ocean Power Grid, Inc. (April 24, 2024)

(3) Expectations for Floating Offshore Wind Power

The City of Yokohama concluded the memorandum of understanding (MOU) on the preceding page as an extension of the MOU concluded in May 2023 with PowerX, Inc. to study the utilization of battery tankers. One of the aims of the MOU is to supply green power to the Tokyo metropolitan area, including Yokohama, not through certificates but through actual power supply.

It is said that it is difficult to lay submarine cables to supply electricity to the Tokyo metropolitan area in Sagami Bay and Sagami Sea, where the water depth exceeds 1,500m. Furthermore, the Japanese government is developing a system that will allow offshore wind power generation to be deployed in the exclusive economic zone (EEZ). These factors suggest that the Yokohama area would be the most advantageous area for receiving electric power if electric power transport by battery tankers were to become a reality.

However, in order to realize this concept, it is necessary to collaborate with businesses that are involved in the development, installation, and operation of floating offshore wind power, which can be installed even in EEZ waters.

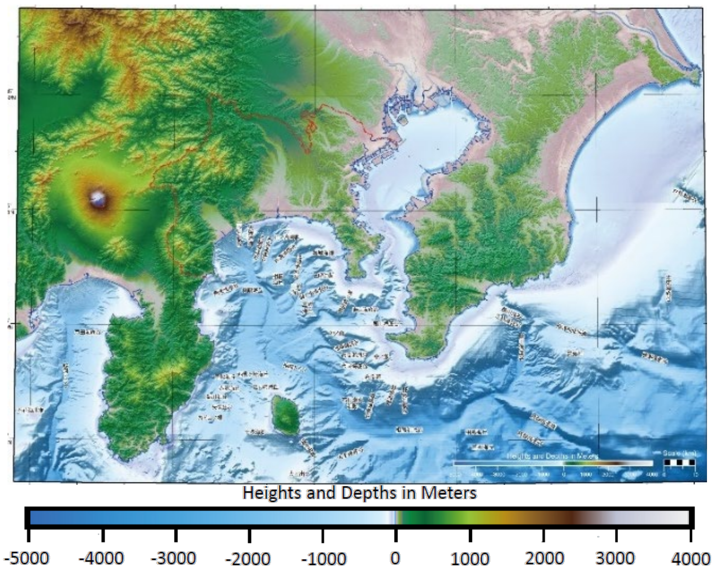


Figure 40: Topographic map of Sagami Bay and Sagaminada seafloor

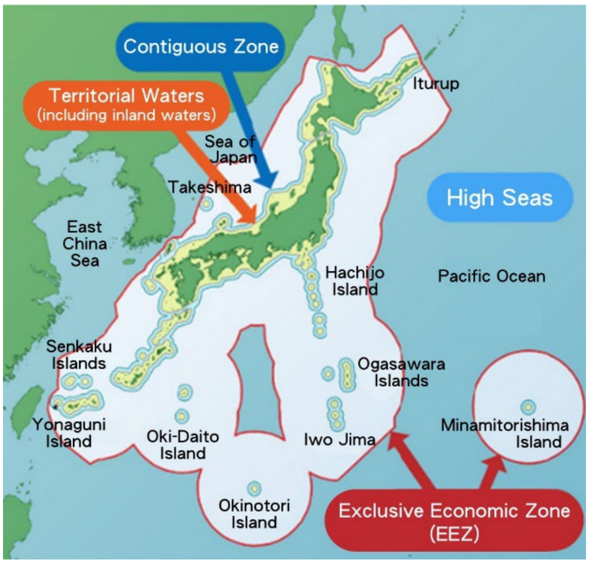


Figure 41: Exclusive Economic Zone (EEZ)

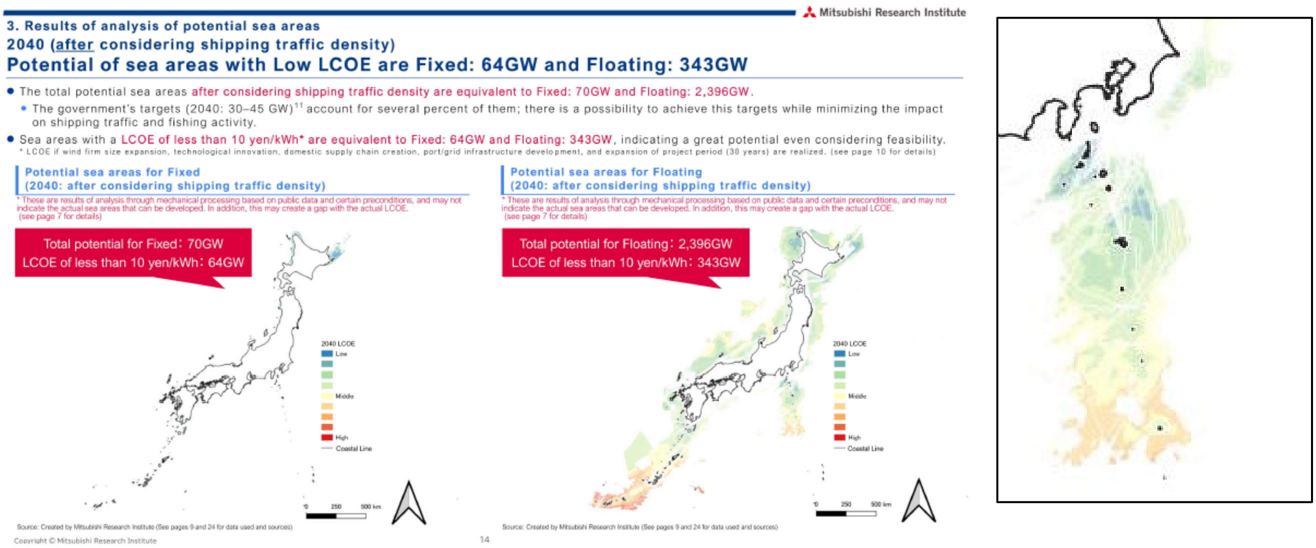


Figure 42: Results of analysis of potential sea areas
(from Mitsubishi Research Institute, Inc. report)

(4) Study on how to supply green power from offshore wind power generation starting from the waterfront area of the City of Yokohama

In January 2025, the City of Yokohama signed a memorandum of understanding with TEPCO Power Grid, Inc., Ocean Power Grid, Inc, TODA CORPORATION, and MUFG Bank, Ltd. to investigate ways to supply green power through offshore wind power generated in the Yokohama waterfront area.

Based on the proposal to fully introduce renewable energy as the main power source as indicated in the next Basic Energy Plan, all parties will work together to turn the Port of Yokohama into a carbon-neutral port.

Moreover, we will strive to supply renewable energy to a wide area and will study ways to supply electricity derived from offshore wind power generation from the Yokohama waterfront area, as well as the regional co-creation of industries related to offshore wind power generation projects.

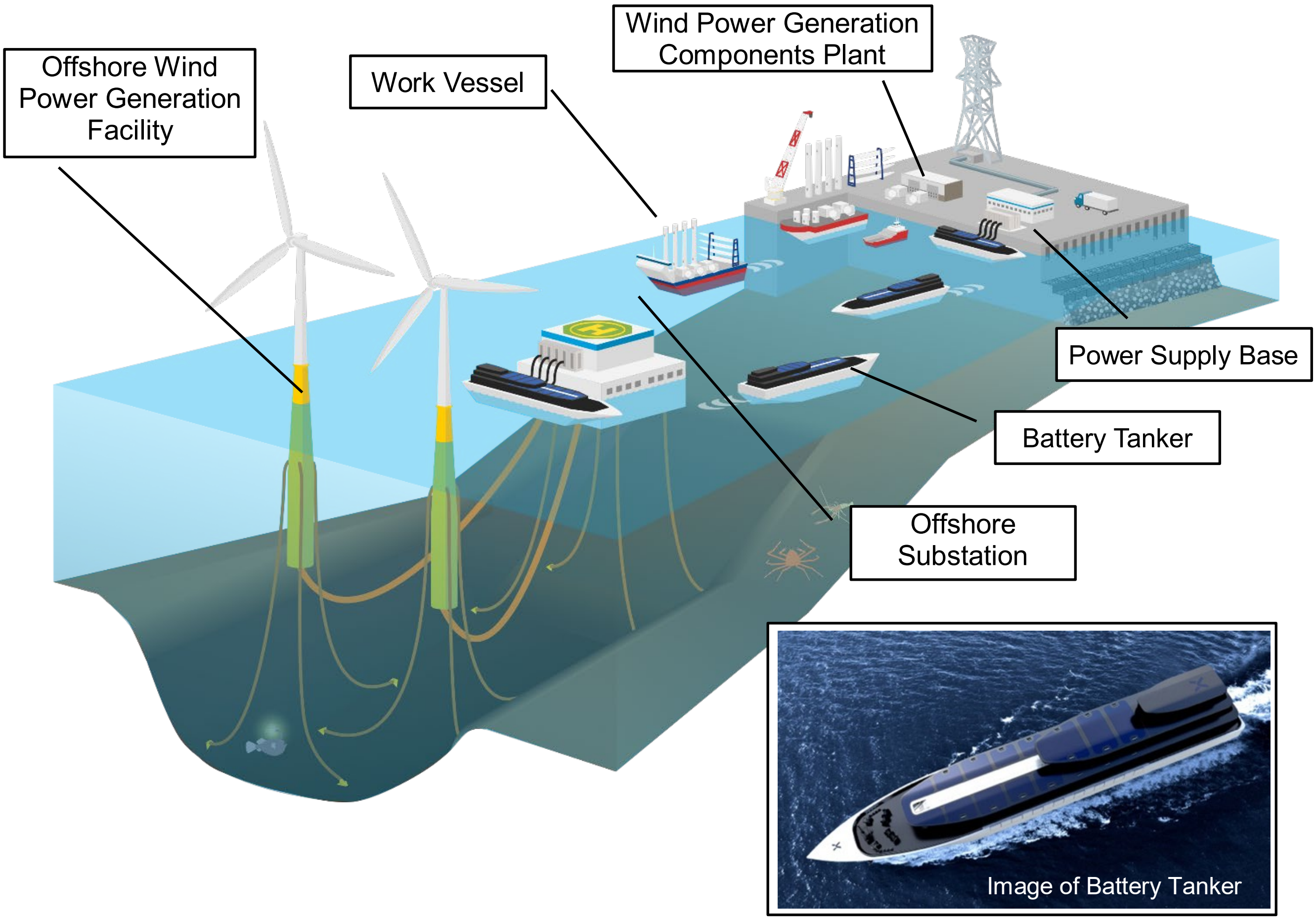


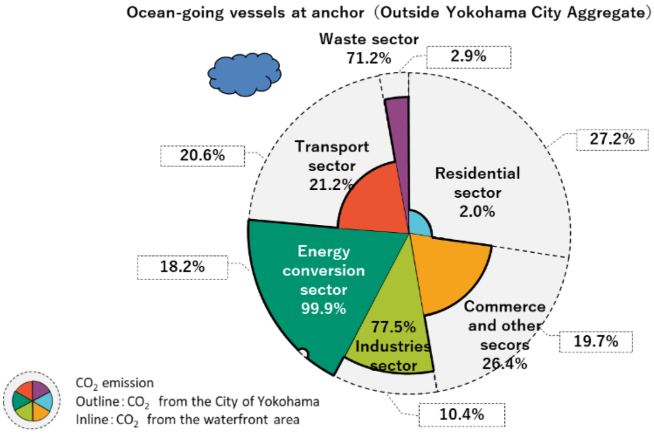
Figure 43: Floating offshore wind farm utilizing a battery tanker (image)

6-1-2. Status of Power Generation Projects in the Yokohama Waterfront Area

The following is a summary of the status of power generation projects in the Yokohama waterfront area based on publicly available data. In most cases, when aggregating CO_2 emissions, CO_2 emissions from power generation projects are organized as "indirect emissions." Hence, CO_2 emissions from power generation projects in the energy conversion sector are aggregated with emissions from self-consumption of electricity and transmission losses in power plants. Therefore, there is little focus on the CO_2 emissions figures directly emitted by power generation projects.

However, in the case of a plan like this one, which focuses on decarbonizing the waterfront area where energy companies are concentrated, we believe that it is necessary to attempt to grasp the "direct emissions" of CO_2 emissions from power generation projects.

Therefore, we have endeavored to convert indirect emissions to direct emissions by using the published document "Greenhouse Gas Emissions Calculation, Reporting and Publication System" by the Ministry of the Environment (hereinafter referred to as "Ministry of the Environment SHK System"). As a result, CO_2 emissions from the Yokohama city area increased by a factor of 1.6, while CO_2 emissions from the Yokohama waterfront area increased by a factor of 3.3. Thus, when considering CO_2 emissions by focusing on individual points, we expect each power producer to make efforts in the energy conversion sector, since power producers account for an overwhelming share of the total.



■ CO_2 emissions from Yokohama Waterfront area【Indirect】 (Unit: 10,000t)

2022[Based on preliminary figures]	Waterfront area		Yokohama City		Water front area /City
	Emissions	Proportion	Emissions	Proportion	
Energy conversion sector	294.4	46.0%	294.8	18.2%	99.9%
Industries sector	130.7	20.4%	168.6	10.4%	77.5%
Commercial and other sectors	84.1	13.2%	318.8	19.7%	26.4%
Transport sector	70.8	11.1%	334.2	20.6%	21.2%
Waste sector	33.7	5.3%	47.4	2.9%	71.2%
Residential sector	9.0	1.4%	440.4	27.2%	2.0%
Ocean-going vessels at anchor	16.7	2.6%	16.7	1.0%	100%
Total	639.4	100.0%	1620.9	100.0%	41.2%

Figure 44: Carbon dioxide emissions from Yokohama waterfront area (indirect emissions)

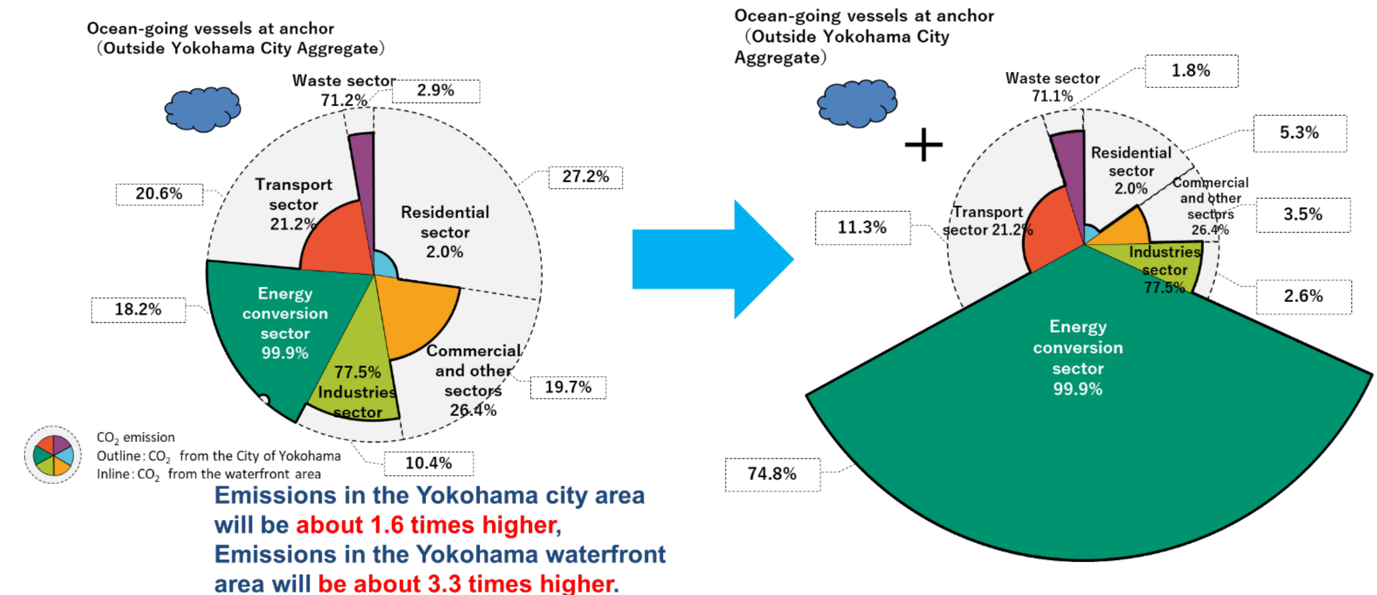


Figure 45: Carbon dioxide emissions from the Yokohama waterfront area (direct emissions)

Table 37: CO_2 Emissions from Power Plants in the City of Yokohama
(from publicly available data on the Ministry of the Environment's SHK program)

■2019-2021　3-year average CO_2 emissions（Unit：t）

		Energy-derived CO_2	Energy-derived CO_2 (Before power plant allocation)
Ohgishima power	Ohgishima power station	68,116	2,620,343
J-POWER	Isogo thermal power plant	361,120	6,235,148
JERA	Yokohama thermal power plant	135,897	6,875,186
JERA	Minami-Yokohama thermal power plant	76,648	1,282,933
		641,781	17,013,610 → 16,371,829 Amount returned before distribution: Table 38 in red box

*ENEOS Corporation also operates power generation facilities at each of its business sites, which emit CO_2 in the same way as the power plants mentioned above. However, the Negishi Refinery is not included in this estimation because it does not disclose its figures in the Ministry of Environment's SHK system. (Figures for Kashima Refinery, Sendai Refinery, etc. are disclosed.)

Table 38 CO_2 Emissions from Yokohama Waterfront Area Converted from Indirect to Direct Emissions

FY2022 [Based on preliminary figures]	City Indirect Emissions	Electricity-derived	City Indirect Emissions-Electricity-derived		Power plant-derived	City Direct Emissions		Waterfront area		Waterfront area/Yokohama City
	Emissions	Emissions	Emissions	Proportion	Emissions	Emissions	Proportion	Emissions	Proportion	Proportion
Energy conversion sector	294.8	6.9	287.9	30.7%	1637.2	1925.1	74.8%	1922.5	91.0%	99.9%
Industries sector	168.6	100.9	67.7	7.2%	0.0	67.7	2.6%	52.5	2.5%	77.5%
Commercial and other sectors	318.8	229.4	89.4	9.5%	0.0	89.4	3.5%	23.6	1.1%	26.4%
Transport sector	334.2	42.3	291.9	31.1%	0.0	291.9	11.3%	61.8	2.9%	21.2%
Waste sector	47.4	0	47.4	5.1%	0.0	47.4	1.8%	33.7	1.6%	71.1%
Residential sector	440.4	303.7	136.7	14.6%	0.0	136.7	5.3%	2.8	0.1%	2.0%
Ocean-going vessels at anchor	16.7	0.0	16.7	1.8%	0.0	16.7	0.6%	16.7	0.8%	100%
Total	[1620.9]	683.3	937.6	100%	1637.2	[2,574.8]	100.0%	[2,113.5]	100%	82.1%

Figure 46: Location of energy-related infrastructure facilities around the Port of Yokohama

6-2. Direction for land use with a view to utilizing the decarbonization promotion district system, etc.

There are no plans to utilize this system at this time. We will continue to study the issue.

6-3. Initiatives related to decarbonization that contribute to strengthening the competitiveness of the port and industry

Specific efforts to achieve a carbon-neutral port, including efforts that overlap with the Port Decarbonization Promotion Project, will be presented.

(1) Promoting the use of next-generation marine fuels

In order to contribute to the decarbonization of marine transportation and to create an internationally competitive port, the City of Yokohama will work to promote the use of various types of next-generation marine fuels.

① Methanol Bunkering

In December 2023, Maersk AS and Mitsubishi Gas Chemical Company, Inc. signed a memorandum of understanding to promote the use of green methanol as a marine fuel. In September 2024, a methanol bunkering simulation was conducted with Idemitsu Kosan Co.,Ltd. Efforts are underway to realize methanol bunkering in collaboration with private companies.

Figure 47: Naming Ceremony for Green Methanol Container Ship / Methanol Bunkering Simulation

② Ammonia Bunkering

In July 2024, a consortium led by Nippon Yusen Kabushiki Kaisha (NYK Line) realized the world's first Truck to Ship method of ammonia bunkering at Honmoku Pier in the Port of Yokohama. In the City of Yokohama, the Port and Harbor Bureau coordinates the use of the pier, and the Fire Bureau and other related departments provide support for the consortium's efforts.

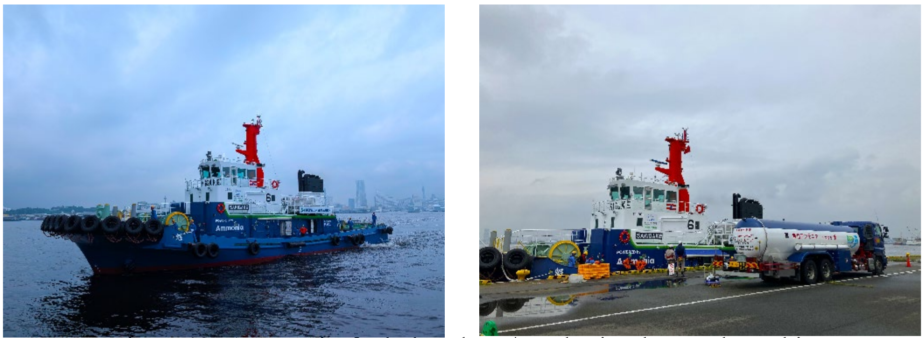


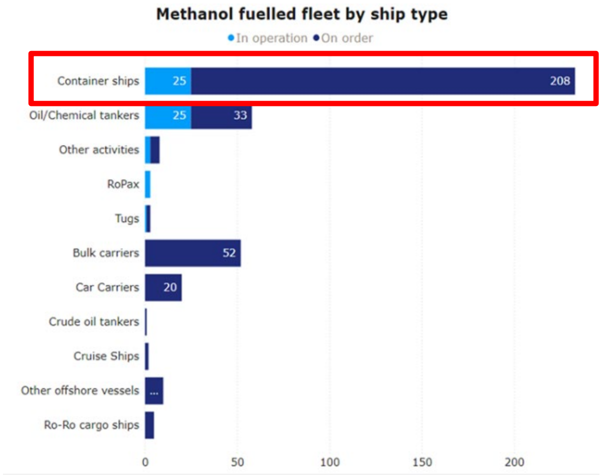
Figure48: Ammonia-fueled tugboat/Bunkering by truck to ship

③ LNG Bunkering

Eco Bunker Shipping Corporation, in which Yokohama Kawasaki International Port Corporation and others have invested, has been building an LNG bunkering vessel.

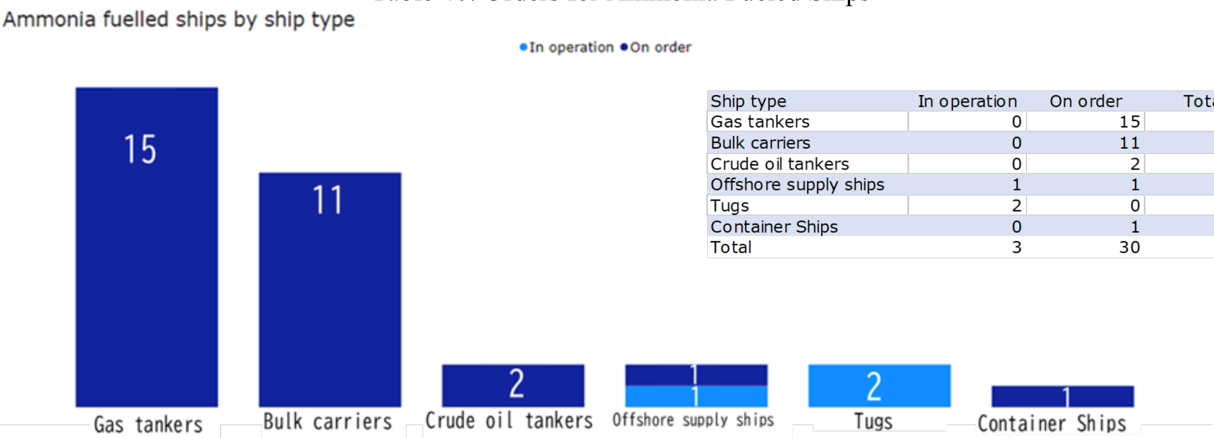
Table 39: Orders for methanol-fueled vessels

Ship type	In operation	On order	Total
Container Ships	25	208	233
Oil/Chemical tankers	25	33	58
Other activities	3	5	8
RoPax	3	0	3
Tugs	1	2	3
Bulk carriers	0	52	52
Car carriers	0	20	20
Crude oil tankers	0	1	1
Cruise ships	0	2	2
Other offshore vesseles	0	10	10
Ro-Ro cargo ships	0	5	5
Total	57	338	395



Source: DNV "Alternative Fuels Insight" https://afi.dnv.com/statistics/ (Reading date:2025.3.1)

Table 40: Orders for Ammonia Fueled Ships

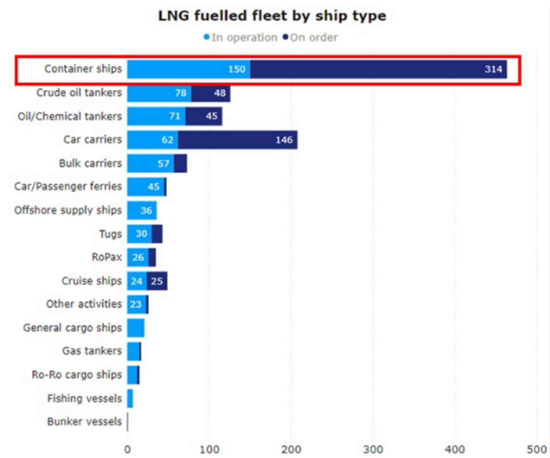


Ship type	In operation	On order	Total
Gas tankers	0	15	15
Bulk carriers	0	11	11
Crude oil tankers	0	2	2
Offshore supply ships	1	1	2
Tugs	2	0	2
Container Ships	0	1	1
Total	3	30	33

Source: DNV "Alternative Fuels Insight" https://afi.dnv.com/statistics/ (Reading date:2025.3.1)

Table 41: Orders for LNG Fuel Carriers

Ship type	In operation	On order	Total
Container Ships	150	314	464
Cruide oil tankers	78	48	126
Oil/Chemical tankers	71	45	116
Car carriers	62	146	208
Bulk carriers	57	16	73
Car/Passenger ferries	45	3	48
Offshore supply ships	36	0	36
Tugs	30	13	43
RoPax	26	9	35
Cruise ships	24	25	49
Other activities	23	3	26
General cargo ships	21	0	21
Gas tankers	15	2	17
Ro-Ro cargo ships	12	3	15
Fishing vessels	7	0	7
Bunker vessels	0	1	1
Total	657	628	1285



Source: DNV "Alternative Fuels Insight" https://afi.dnv.com/statistics/ (Reading date:2025.3.1)

(2) Incentive programs for environmentally friendly vessels

With the aim of promoting the use of environmentally friendly vessels, since 2017 we have been participating in the Environmental Ship Index (ESI) system operated by the International Association of Ports and Harbors (IAPH) and the Green Award Foundation's system. The City of Yokohama offers reduced entry fees for ocean-going vessels with an ESI index above a certain level, or those certified by the Green Award Foundation.

In addition, in order to promote LNG-fueled vessels and encourage them to call at ports, the port entry fees for LNG-fueled vessels and LNG bunkering vessels are reduced or exempted, and the quay fees for LNG bunkering vessels are reduced or exempted.

Table 42: Incentives for Environmentally Friendly Vessels

（Unit：counter for ships (large boats)）

	ESI (Environmental Ship Index）					GA*
	Container ships	Car Carriers	LNG Carriers	Other	Total	LNG Carriers Oil tankers
FY2023	542	93	30	12	677	16（0）
FY2022	375	112	39	13	539	1（1）
FY2021	437	102	51	9	599	10（3）
FY2020	528	124	43	12	707	6（0）
FY2019	746	302	52	36	1136	12（7）
FY2018	722	294	53	23	1092	4（0）
FY2017	561	203	37	11	812	1（0）

*Number of vessels covered by both Green Award Foundation (GA) and ESI in parentheses

(3) Green Logistics Initiatives

The Port of Yokohama is working to expand its domestic marine container transportation network through coastal shipping, container barge transportation, and rail transportation. The use of these transportation methods is expected to expand as a means of reducing road congestion and as green logistics with energy-saving effects.

① Coastal transportation

Domestic vessel transportation is an energy-efficient and environmentally-friendly mode of transportation because it can transport a large number of marine containers at one time, resulting in lower CO_2 emissions per ton transported compared to trucks. Currently, transport by coastal vessels is networked with the Pacific coasts of Hokkaido, Tohoku, Tokai, and Kansai.

② Container Barge Transportation

A container barge (a dedicated container barge) connecting Yokohama to Tokyo and Chiba by sea can transport a large volume of ocean containers, equivalent to more than 80 trucks at a time. In addition to reducing CO_2 emissions per ton of transport through energy savings, it is expected to reduce congestion on roads in the metropolitan area and around ports.

③ Transport by Rail

At the Port of Yokohama, rail transportation is based at Yokohama Honmoku Station. In October 2024, a major automaker and Nippon Express Co., Ltd. launched an initiative to regularly transport 40-foot marine containers by rail between Yokohama Honmoku Station and the Utsunomiya Cargo Terminal. The ability to transport cargo in ocean containers without having to reload them into dedicated rail containers is expected to decarbonize the industry and make logistics more efficient.

source：https://www.city.yokohama.lg.jp/city-info/yokohamashi/yokohamako/kkihon/kankyo/green2.html

Figure 49: Departure ceremony held at Yokohama Honmoku Station
/Regular rail transportation of 40-foot ocean containers

(4) Introduction of handling equipment (RTG) that can be converted to a future hydrogen fuel cell system

The Ports and Harbours Bureau of the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) announced that it will conduct a field demonstration for hydrogen-fueled handling equipment at the Minami Honmoku Pier MC-2 at the Port of Yokohama in February 2024. The demonstration project will be implemented from FY2022 to FY2025. In order to introduce hydrogen safely and smoothly at port terminals, the technical standards for port facilities are being revised, and efforts are being made to improve the environment for the increased introduction of hydrogen-fueled handling equipment.

source：https://www.mlit.go.jp/report/press/content/001721956.pdf

In addition, the Ports and Harbours Bureau of the Ministry of Land, Infrastructure, Transport and Tourism established a “Study Group for the Introduction of Hydrogen-fueled Handling Equipment” in November 2024 to discuss the safe and smooth introduction and spread of hydrogen-fueled handling equipment at port terminals. The City of Yokohama has been participating in this study group along with the Tokyo Metropolitan Government Bureau of Port and Harbor and the Kobe City Port Authority.

source：https://www.mlit.go.jp/report/press/content/001843003.pdf

(5) Promotion of onshore power supply

In addition to the energy required by the vessels themselves, vessels in port consume large amounts of electricity for refrigerated/freezer containers on container ships, and for cabins and service facilities on cruise ships. This power is generated by engines using fuel oil and other fuels, which emit greenhouse gases. Therefore, as the first step of an onshore power supply facility to supply necessary power while at anchor, the City of Yokohama has established an onshore power supply facility for coastal cargo ships at the A4 public wharf in Honmoku Pier in FY2024.

In July 2023, we joined the “Zero Emission Charger Promotion Council for Ships,” which aims to promote general-purpose onshore power supply facilities, because there is a lack of unified standards for onshore power supply facilities for domestic vessels.

In addition, we believe it is necessary to install onshore power supply facilities at the Osanbashi International Passenger Terminal in preparation for the Asuka III's launch in 2025, and we are considering various maintenance methods.

As for private-sector initiatives, Tokyo Kisen Co., Ltd. launched the tugboat “Taiga” in FY2022, powered by an electric propulsion system that combines large-capacity lithium-ion batteries and a diesel generator. The vessel is the first in Japan to combine a large-capacity lithium-ion battery to further improve efficiency compared to conventional electric propulsion systems.

(6) Terminal operations using electricity derived from renewable energy sources

Starting in FY2022, Yokohama Kawasaki International Port Corporation (YKIP) and Yokohama Port Corporation (YPC) have both transitioned the power supply for their terminals and other facilities to electricity derived from renewable energy sources. By combining non-fossil certificates, YKIP supplies electricity that is virtually CO_2-free. YPC supplies real renewable energy electricity using renewable energy certificates from renewable energy power plants located in municipalities that the City of Yokohama has concluded partnership agreements with under the “Demonstration Project for the Use of Electricity Derived from Renewable Energy to Revitalize the Tohoku Region (e.CYCLE)” promoted by the City of Yokohama. We will continue to work with the private sector to procure CO_2-free electricity.

source：https://www.yokohamaport.co.jp/wp/wp-content/uploads/2022/03/recycle-energy..pdf

(7) Green Shipping Corridor (GSC) Initiatives

Yokohama has concluded GSC MOUs with the Ports of Los Angeles, Oakland, Long Beach, the Singapore Maritime Port Authority, and the Port of Hueneme, and has been considering a GSC together with its sister ports and other ports participating in C40. As an example of one initiative, a survey was conducted to overseas ports on how to determine greenhouse gas emissions, which is a prerequisite for the formation of GSCs, and the involved parties have been exchanging information on their approaches.

(8) Collaboration with international NGOs such as IAPH and C40

The City of Yokohama participates in the activities of international NGOs such as IAPH (International Association of Ports and Harbors) and C40 (Global Metropolitan Climate Leadership Group) and works to enhance the presence of the Port of Yokohama through collaboration and dialogue with them.

Figure 50: Session of the City of Yokohama at the C40 Green Ports Forum (Barcelona, November 2024)

6-4. Plan for strengthening the supply chain for hydrogen and other next-generation energies

Currently, the national government has released the results of the public solicitation for the Hydrogen Supply Infrastructure Development Project, and the adoption of the FS project has been underway in various parts of Japan. The City of Yokohama continues to discuss initiatives with business operators.

6-5. Roadmap

The roadmap will be reviewed based on regularly scheduled council meetings and trends in technological development by companies and other organizations. In addition, efforts will be made to understand the issues and measures to be taken, which will be reflected when the roadmap is reviewed.

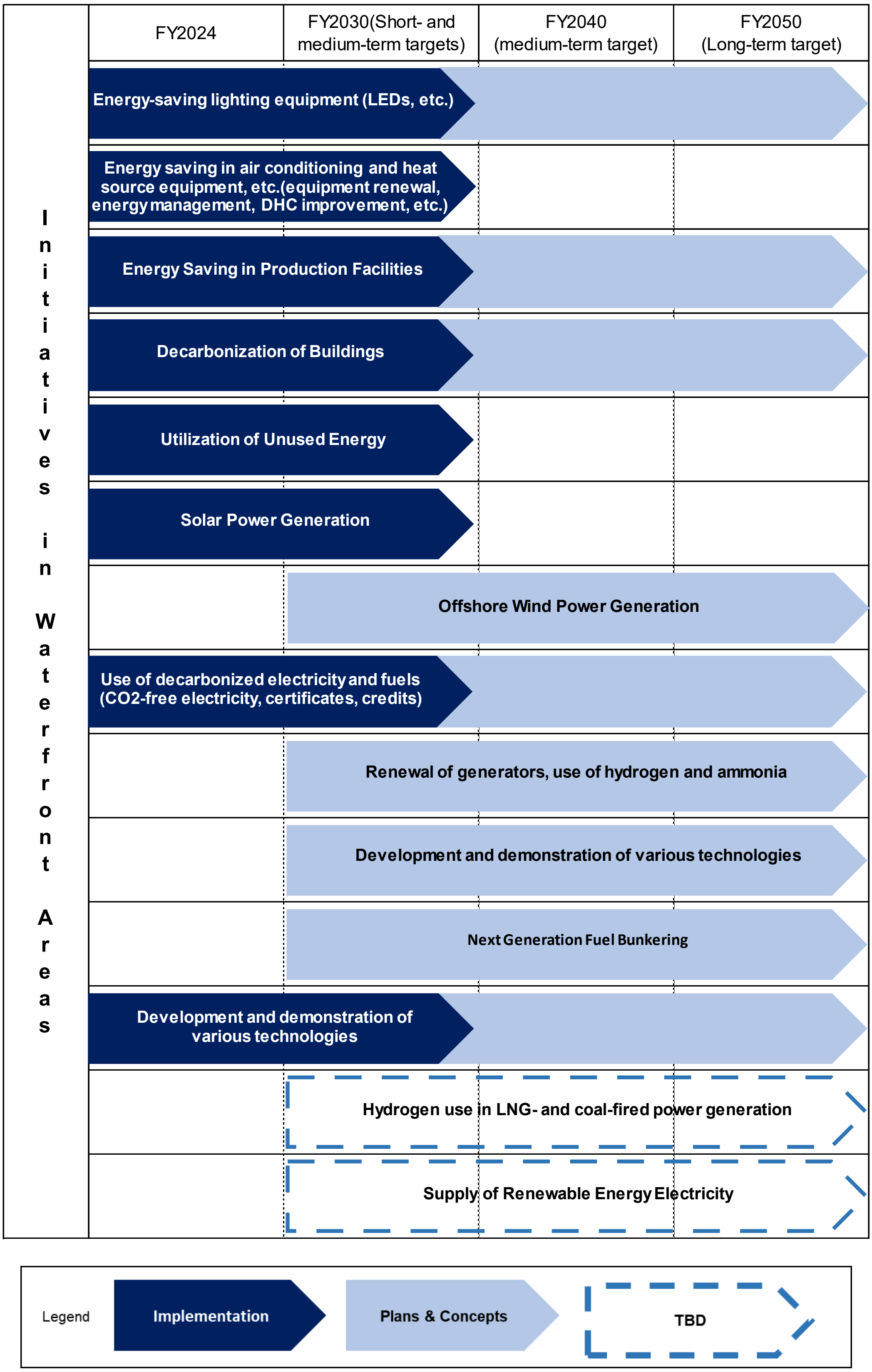


Figure 48 Roadmap for achieving the goals of Port and Harbor Decarbonization Plan for the Port of Yokohama (initiatives in the waterfront area))

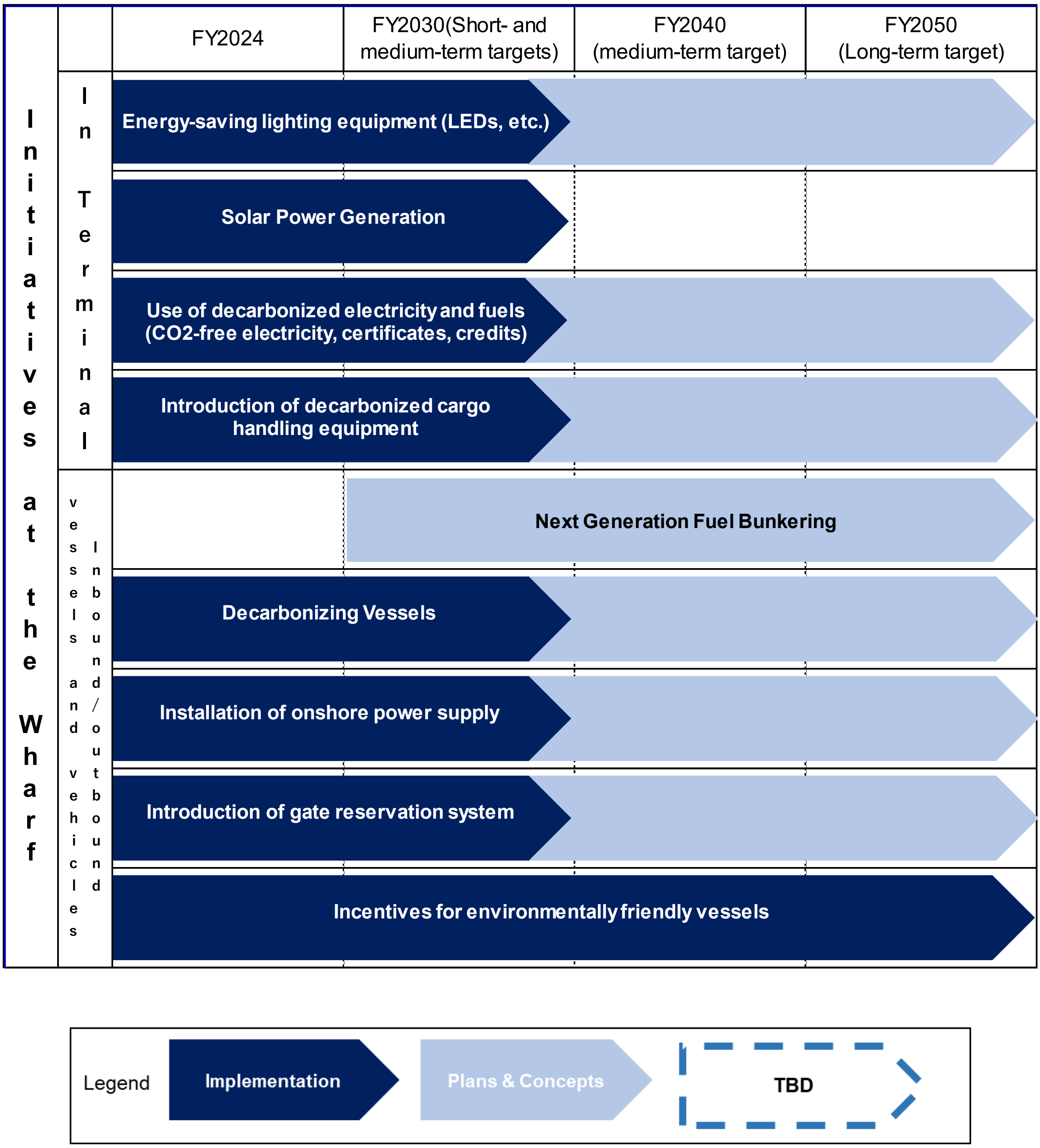


Figure 49: Roadmap for achieving the goals of the Yokohama Port Decarbonization Promotion Plan (initiatives at wharves)

Carbon-Neutral Port Initiatives of the Port of Yokohama

Japanese

English

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