Yokohama Port Decarbonization Promotion Plan

(Draft)

December 2024

City of Yokohama (Yokohama Port and Harbor Manager)

＜eye　order＞

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 Yokohama Port

(1) Characteristics of the Port of Yokohama

Since its opening in 1859, the Port of Yokohama has always been Japan's leading international trading port and a driving force of the Japanese economy. While developing as a commercial port representing Japan's vast consumption area of Tokyo and its vast hinterland, it has also played an important role as an industrial port based in the Keihin Industrial Zone and other industrial zones on the waterfront. In addition, until the advent of the aircraft age, the port was a busy gateway not only for goods but also for people, and has grown as a comprehensive port. The number of ocean-going vessels calling at the port has been the highest in Japan since 1964, making it a port that is open to the world and representative of Japan.

The Yokohama Port and Harbor Bureau, the port administrator of the Port of Yokohama, is "an internationally competitive port" and "a port of tourism and liveliness,

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 "a safe, secure, and environmentally friendly port," and is working to create a carbon neutral port that develops and deepens the "safe, secure, and environmentally friendly port" initiative.

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

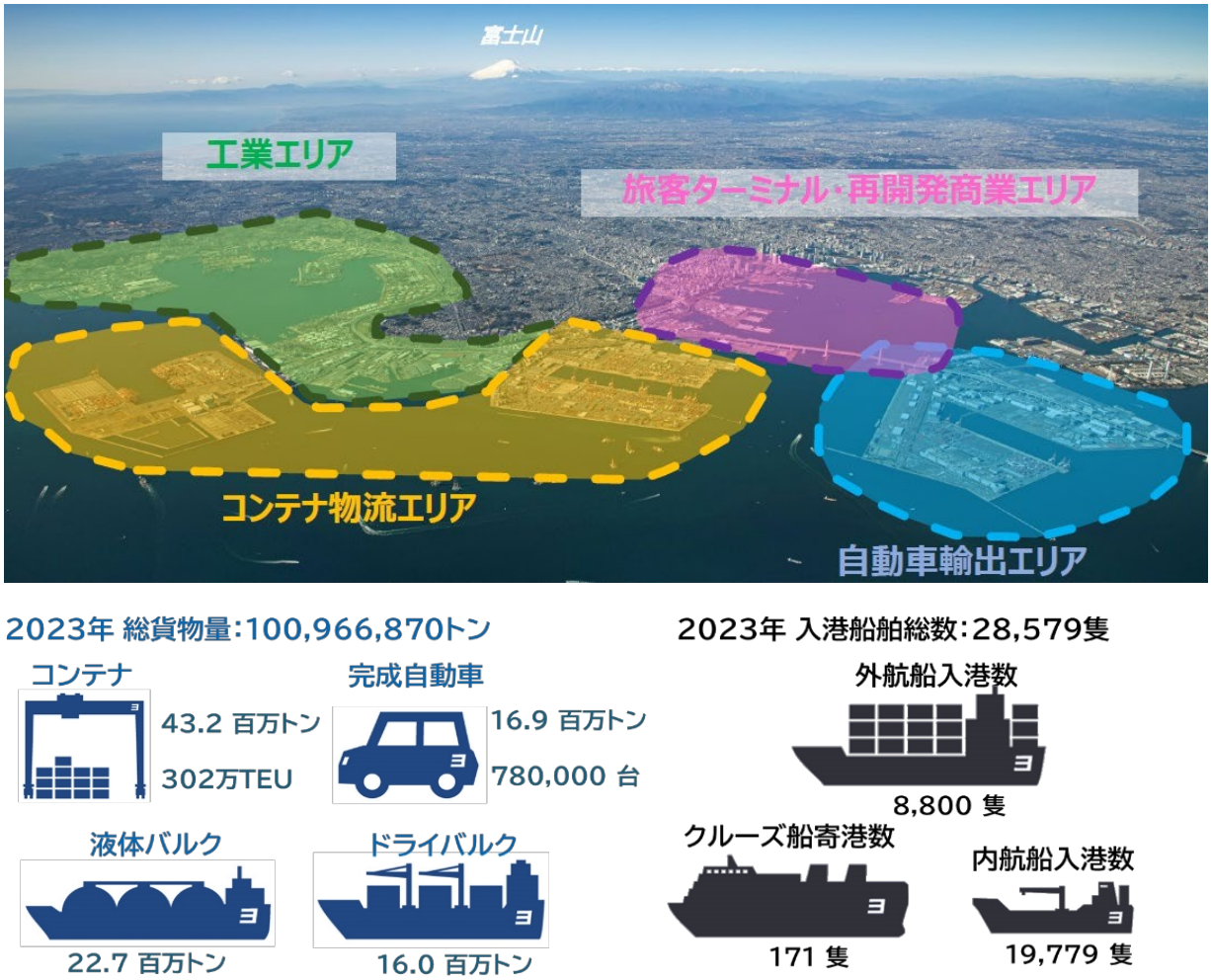


Figure 1. Overview of the Port of Yokohama, number of vessels entering the port, and cargo handled

(2) Status of Public Terminals

As an international container strategic 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 the New Honmoku Wharf, the integrated operation of the Minami Honmoku Wharf, and the redevelopment of the Honmoku Wharf.

In addition, the Daikoku Wharf is being enhanced as the largest automobile handling base in eastern Japan.

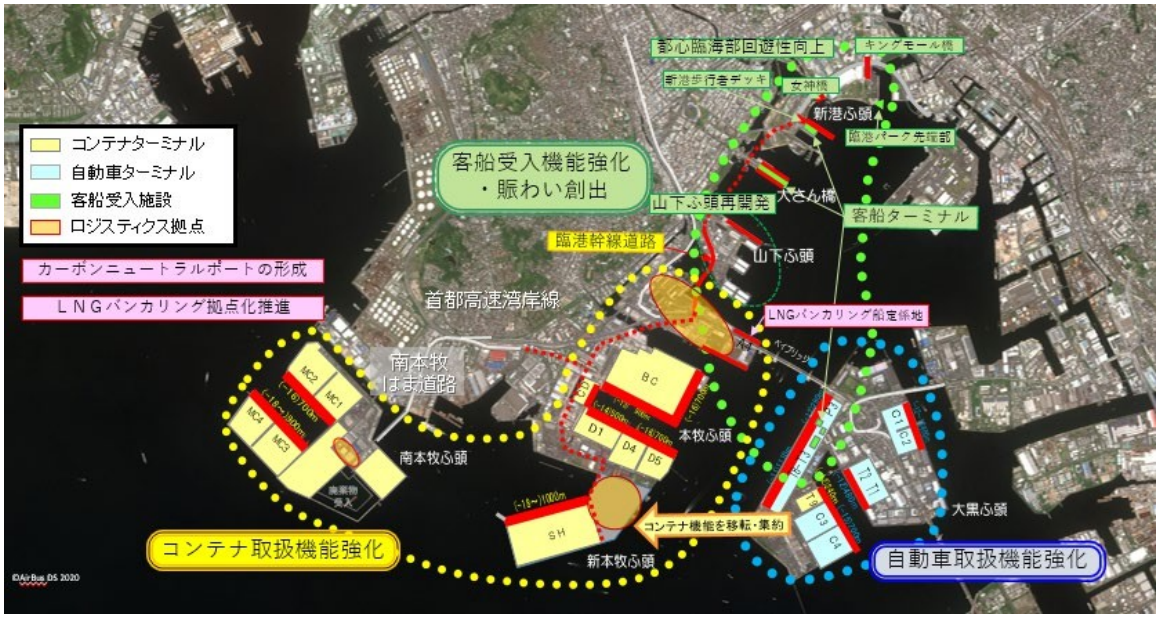


Figure 2. Main Public Terminals

(iii) Location of energy infrastructure

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

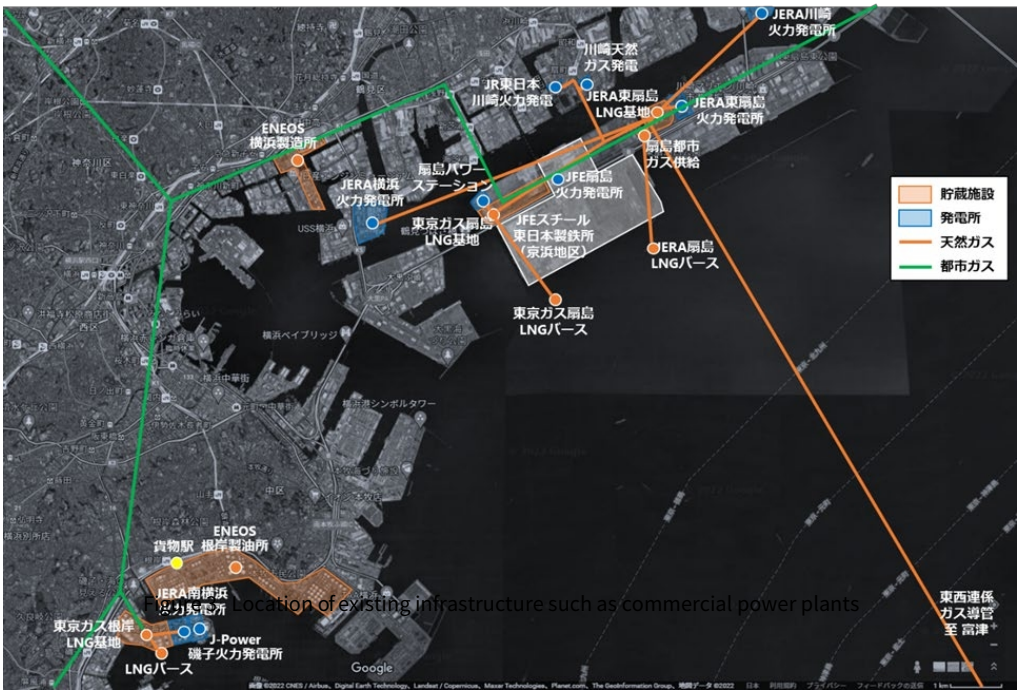


Figure 3. Location of existing infrastructure such as commercial power plants

(4) Trends in Ocean Freight In/Out and Import/Export Freight

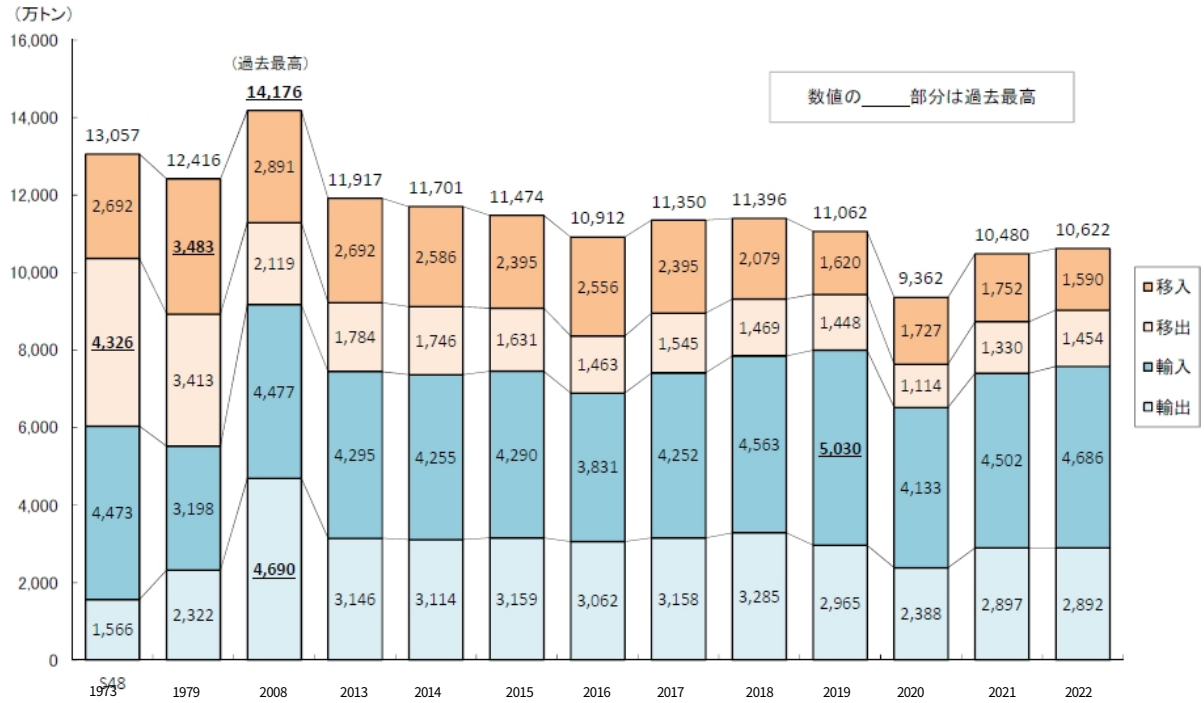


Figure 4. Changes in Ocean Freight Inbound and Outbound Cargoes

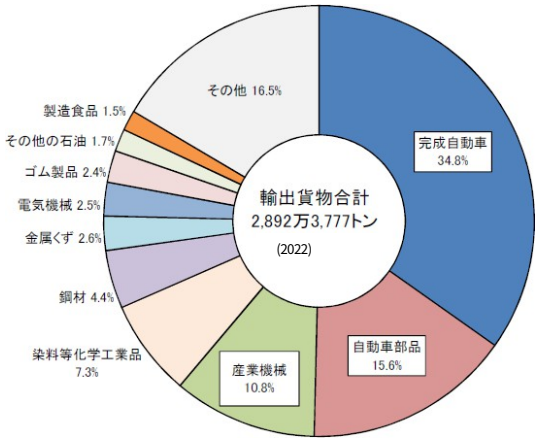


Figure 5. Export Cargo (by major product type)

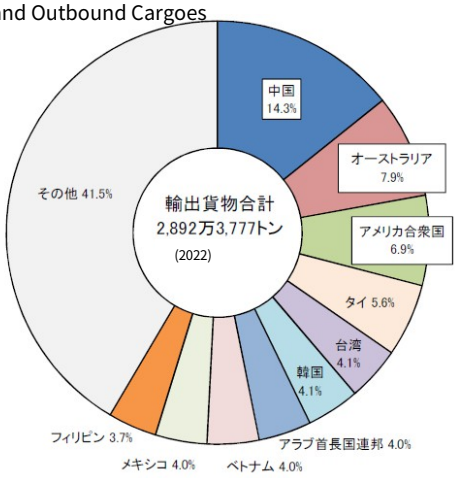


Figure 6. Export Cargo (by major countries)

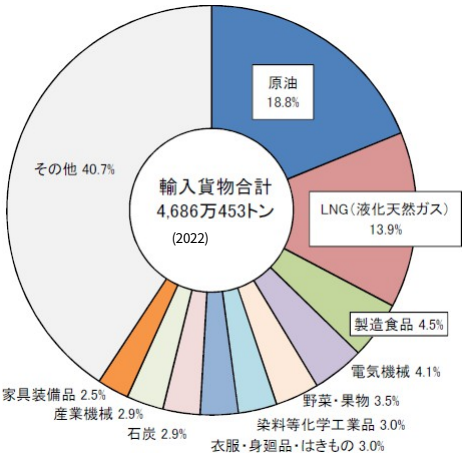


Figure 7. Imported Cargo (by major product type)

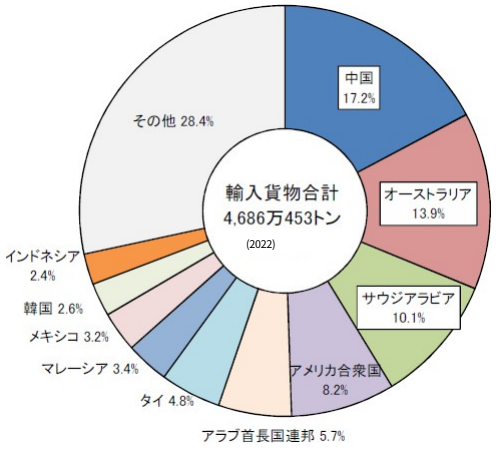


Figure 8. Imported Freight (by major countries)

Source: 2022 Yokohama Port Statistical Yearbook

(5) Volume of Crude Oil, Coal, and Liquefied Natural Gas Handled* Status

In crude oil, there was a decrease due to the discontinuation of some equipment at the Negishi Refinery of ENEOS Corporation in October 2022. Coal handling volumes not change during the period when only the Isogo Thermal Power Station of JENPEN DEVELOPMENT CORPORATION was in operation, but are on an increasing trend with the start of operation of Unit 1 in June 2023 and Unit 2 in December 2023 at JERA Corporation's Yokosuka Thermal Power Station. Liquefied natural gas (LNG) imports from the Negishi and Ogishima terminals of Tokyo Gas Co.

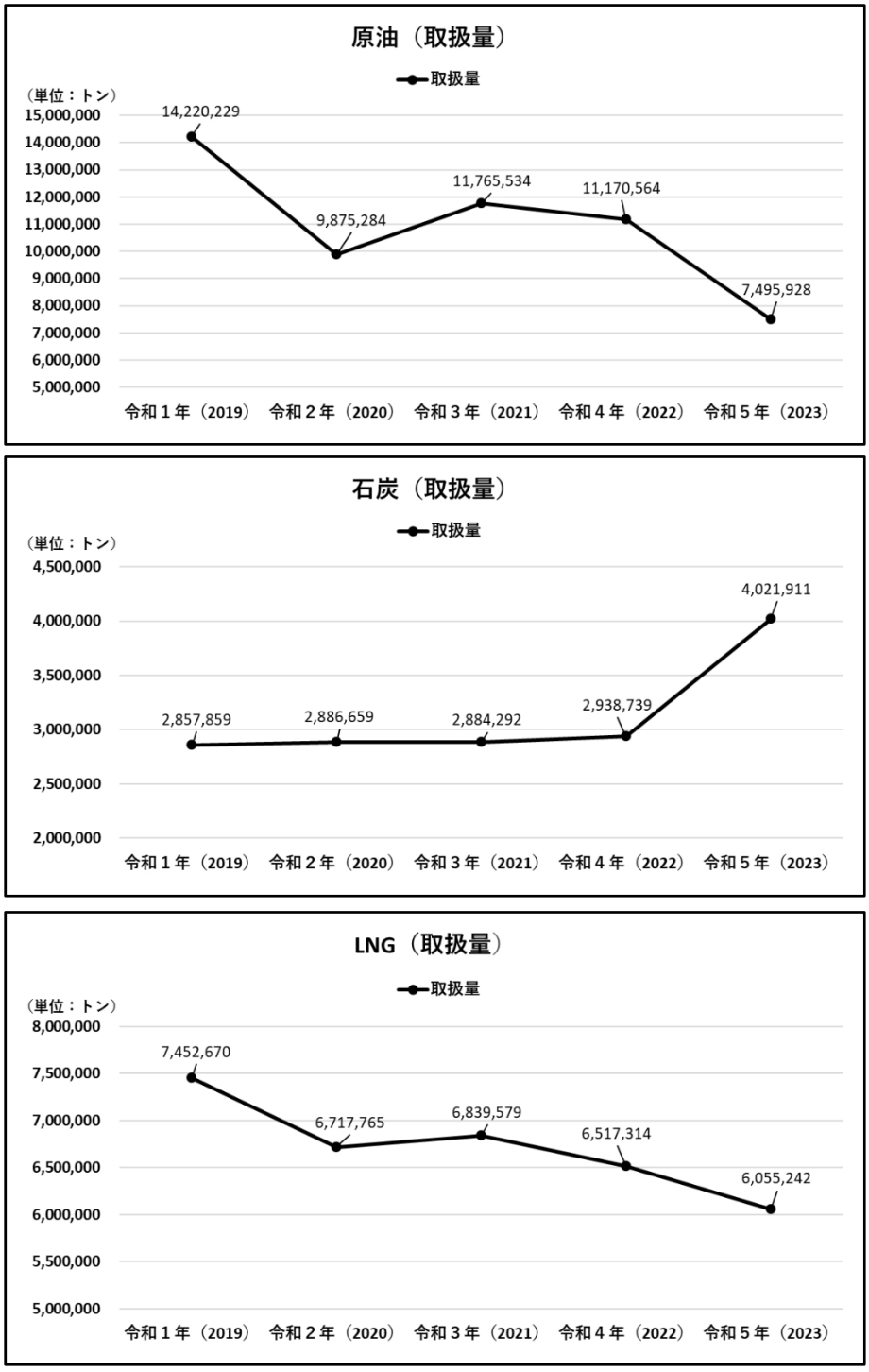


Figure 9. Crude oil, coal, and LNG volumes handled

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

(2) Positioning of this plan and related plans

① Positioning of this plan

This Plan is the "Port Decarbonization Promotion Plan", a plan to promote the effective use of ports that contributes to the promotion of decarbonization through public-private partnership, in accordance with the provisions of Article 50-2-1 of the Port Law.

(2) Positioning in the port plan

The future vision of the Yokohama Port and Harbor Plan, revised in November 2014, is to be an "internationally competitive The three pillars of the plan are "a port," "a port where citizens can gather and relax," and "a safe, secure, and environmentally friendly port," aiming to create a comprehensive port that will revitalize Yokohama's economy and enrich the lives of its citizens.

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 Port Development, Utilization and Preservation and Development of Development and Preservation Passages" and "Comprehensive Plan for Keihin Port (Yokohama Port Long-term Concept)" and other related policies.

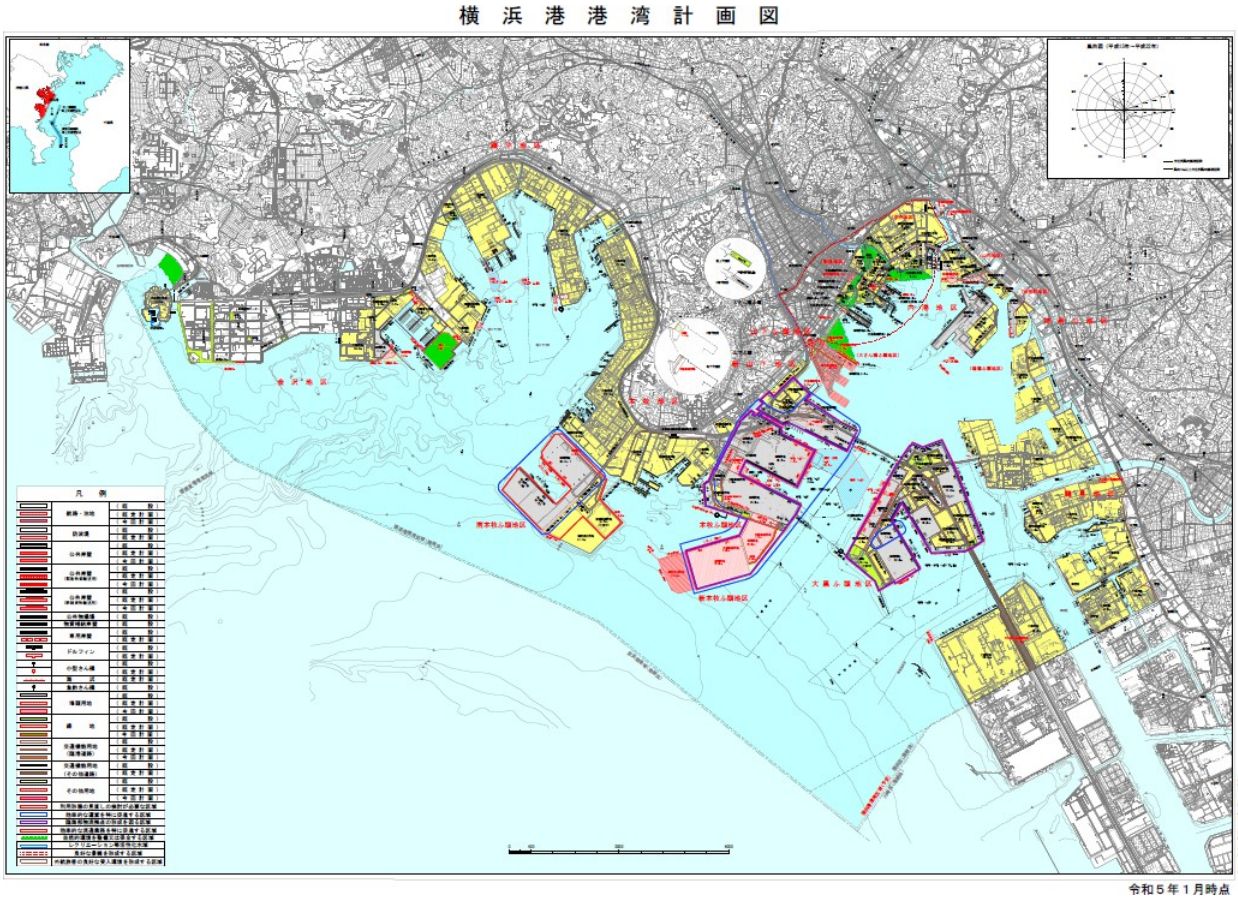


Figure 10. Yokohama Port Plan

(3) Positioning in Yokohama City Mid-Term Plan

In the Yokohama City Mid-Term Plan 2022-2025 (December 2022), Strategy 3 "Realization of Zero Carbon Yokohama" > Policy 18 "Promotion of a Decarbonized Society", Strategy 9 "Urban Development Supporting Citizens' Lives and Economic Activities" > Policy 37 "Development of an Integrated Port with International Competitiveness" にカーボンニュートラルポートの形成が位置付けられている。

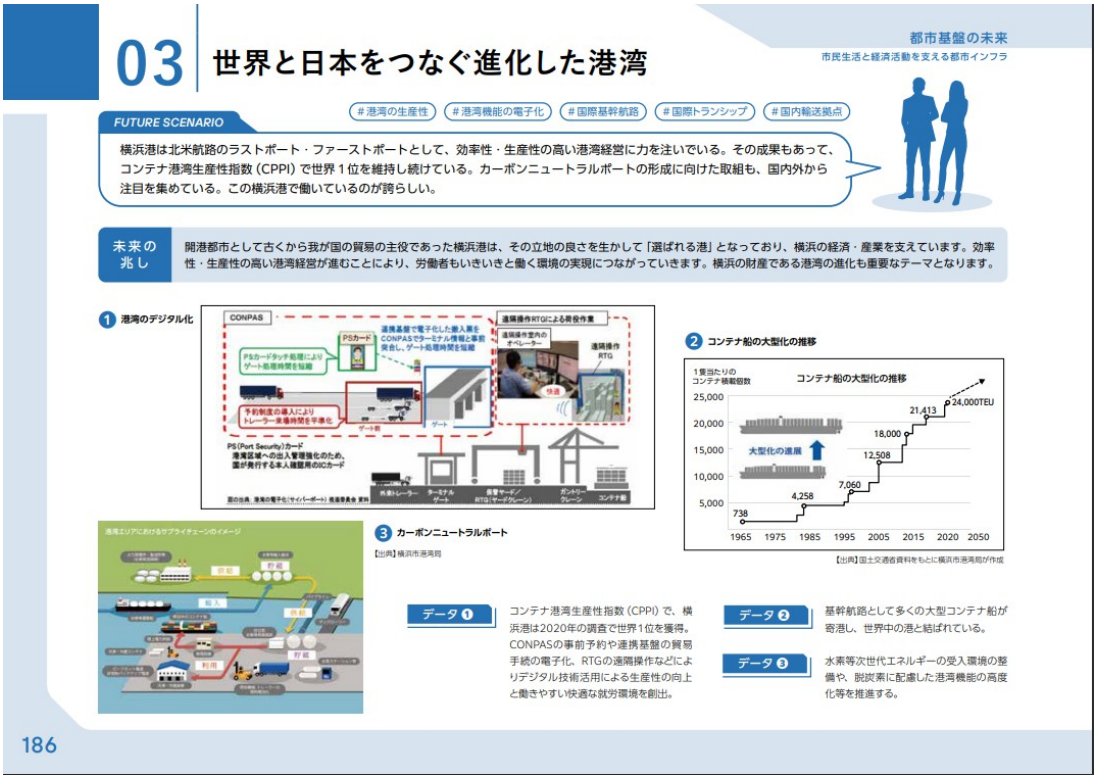


Figure 11. Yokohama City Medium-Term Plan 2022-2025 From "The Future of Urban Infrastructure

(4) Positioning in the action plans of local governments based on the Law Concerning the Measures to Cope with Global Warming (Area Policy Section)

The Yokohama Action Plan for Global Warming Countermeasures (revised on January 27, 2023) calls for a 50% reduction of greenhouse gas emissions in Yokohama City in FY2030 compared to the FY 2013 level, and for virtually zero greenhouse gas emissions from the city by 2050.

In addition, as one of the measures in Basic Policy 1, "Creation of a Virtuous Circle between the Environment and the Economy," the city has set forth "(Priority Action 1) Creation of decarbonization innovation in the Yokohama waterfront area in collaboration with the government and industry," and the direction of this initiative is "Taking advantage of the potential of the city, especially in the waterfront area,水 promote initiatives to create new decarbonization innovation in the areas of element, ammonia, synthetic methane, liquid The city will also promote the formation of a carbon-neutral port in collaboration with the waterfront industry, which is concentrated in the city center. The formation of carbon neutral ports is positioned as an important measure to combat global warming.

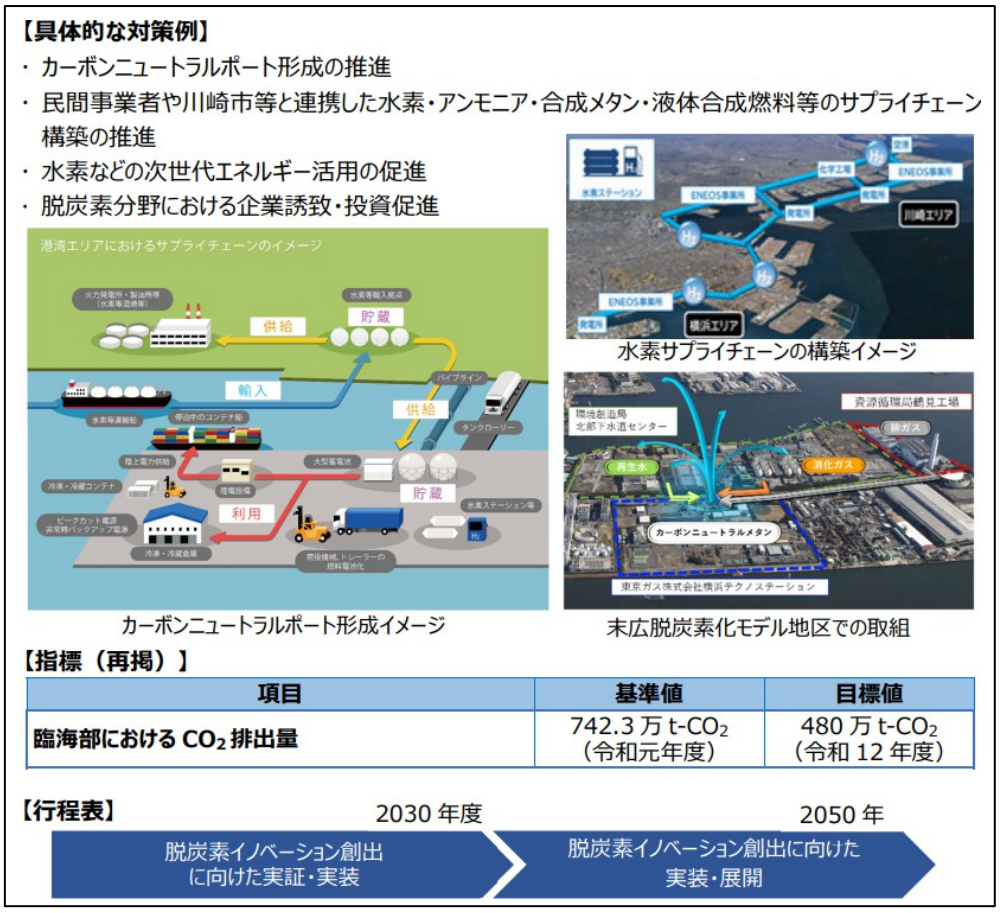
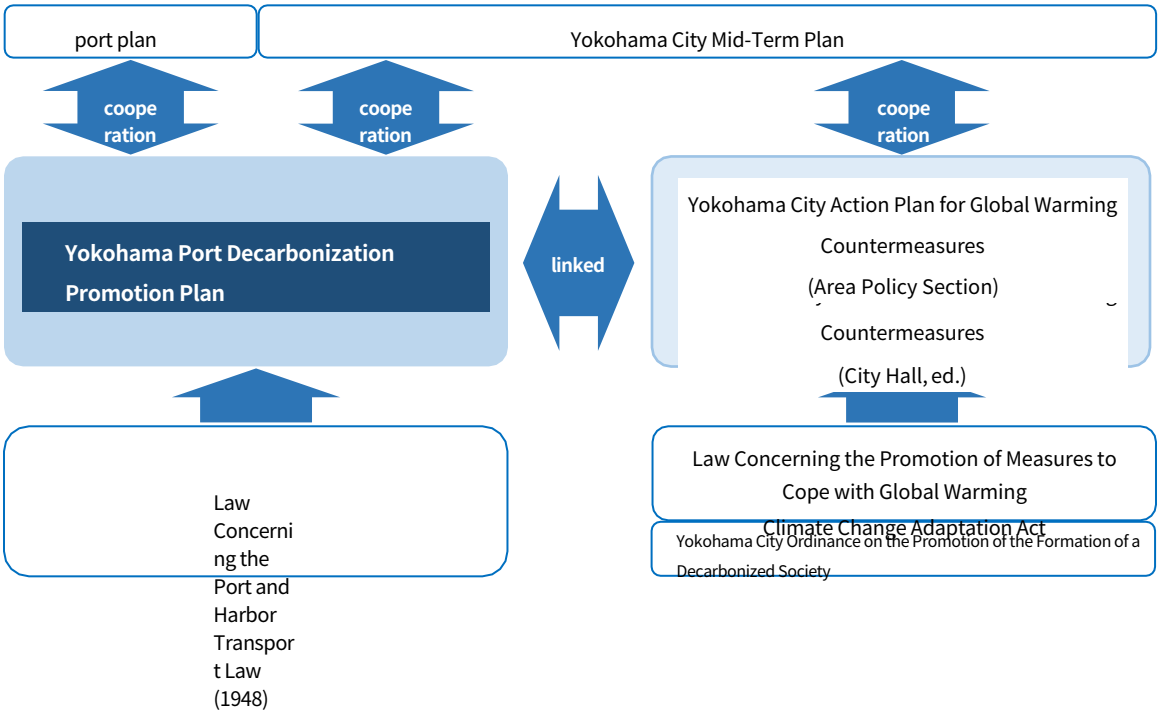


Figure 12. Yokohama City Action Plan for Global Warming Countermeasures (Area Policies), page 55

(5) Positioning in the Action Plan of Local Governments under the Law Concerning the Measures to Cope with Global Warming

In the Yokohama City Action Plan for Global Warming Countermeasures (City Hall version), which was revised at the same time as the Yokohama City Action Plan for Global Warming Countermeasures (Area Policy version), the initiatives of the port administrator (Yokohama Port Authority) categorized as "government buildings, etc." and include the introduction of LEDs in public facilities and renewable energy facilities such as solar power generation. The measures taken by the port manager (Yokohama City Port Authority) in the action plan (City Hall version) are categorized as "government buildings, etc.

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



1-2 . Scope of the Yokohama Port Decarbonization Promotion Plan

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

In addition to logistics functions at the wharf, the Port of Yokohama has production functions in the Keihin Waterfront Area and Negishi District, and tourism and cultural functions in the Tokyo Waterfront Area, etc. Since these functions cover business activities in the Waterfront Area and adjacent areas, the geographical coverage of this plan is shown in the table below. The geographic scope of this plan is the estimated scope of greenhouse gas emissions from the Port of Yokohama and the economic ripple effects of the Port of Yokohama.

Table 1 Scope of the plan (town/street)

district	name of a town or street
Tsurumi Ward	Anzen-cho, Ogishima, Ono-cho, Suehiro-cho, Daikoku-cho, Daikoku-futo, Kansei-cho, Namamugi 1-chome, Namamugi 2-chome, Benten-cho
Kanagawa Ward	Deida-cho, Ebisu-cho, Kanagawa 1-chome, Sakae-cho, Suzushige-cho, Takara-cho, and Senwaka-cho, Hashimoto-cho, Hoshino-cho, Mizuho-cho, Yamauchi-machi, Ono-cho, Shin-Urashima-machi, Moriya-machi, Kinko-cho
western district	Takashima 1-chome, Takashima 2-chome, Minatomirai 1-chome, Minatomirai 2-chome, Minatomirai 3-chome, Minatomirai 4-chome, Minatomirai 5-chome, Minato Mirai 6-chome
central district	Kaigan Dori, Kamome-cho, Shinko 1-chome, Shinko 2-chome, and Shinyamashita 1-chome, Shinyamashita 2-chome, Shinyamashita 3-chome, Toyoura-cho, Nishiki-cho, Honmoku-futo, Minami Honmoku, Yamashita-cho, Chidori-cho, Honmoku Juniten, Kitanaka-dori, Nihon-odori, Honmachi, Minaminaka-dori, Motohama-cho, Motomachi, Yamate-cho
Isogo Ward	Isogo 1-chome, Hori-machi, Shin-Isogo-machi, Shin-Sugita-machi, Shin-Nakahara-machi, Sugita 1-chome, Sugita 5-chome, Haramachi, Shin-Morimachi
Kanazawa Ward	Sachiura 1-chome, Sachiura 2-chome, Showa-cho, Shiraho, Torihama-cho, Hakkeijima Shibamachi, Fukuura 1-chome, Fukuura 2-chome, Fukuura 3-chome

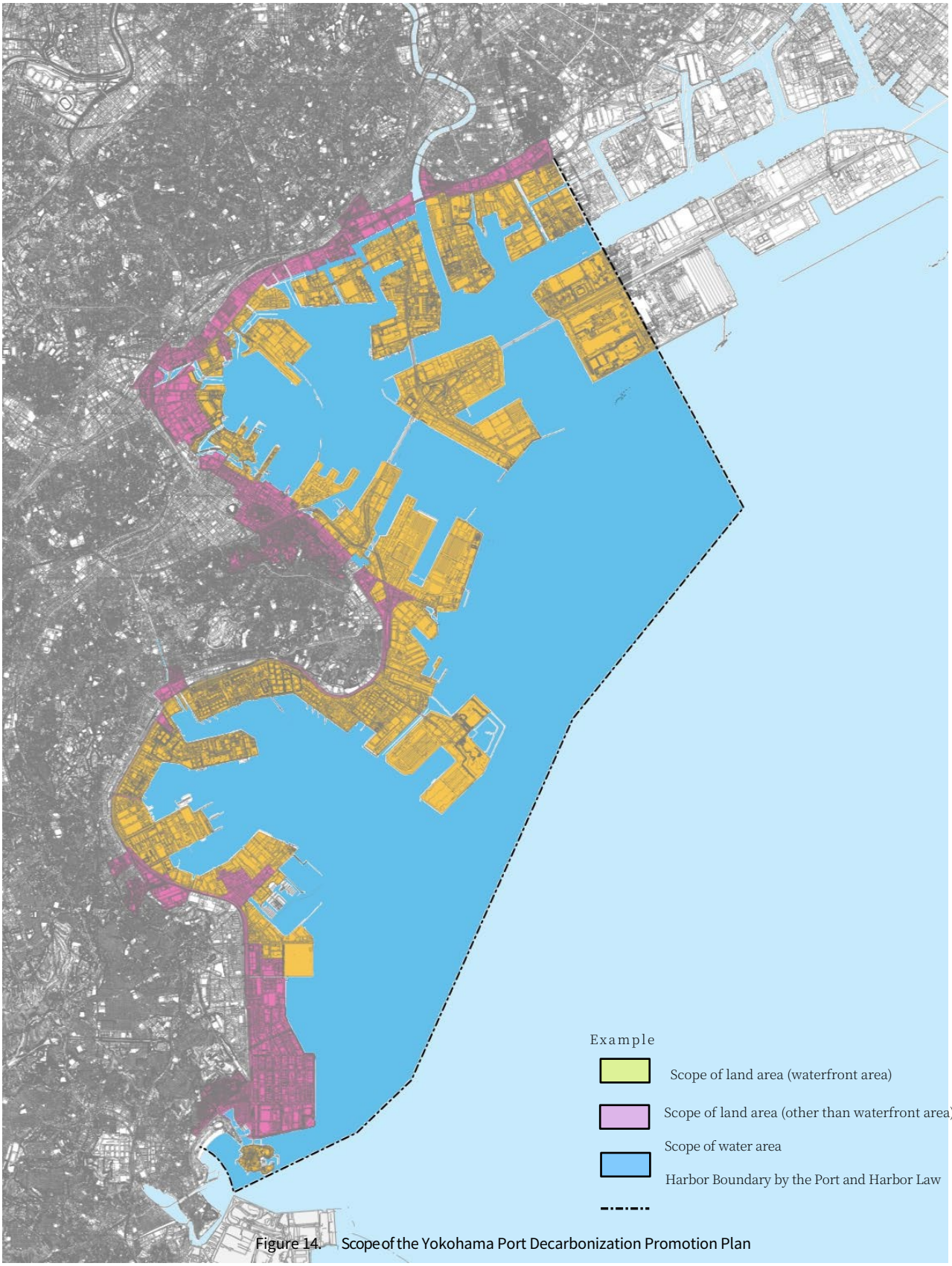


Figure 14. Scope of the Yokohama Port Decarbonization Promotion Plan

(Note: The above chart shows the approximate scope of the initiatives in the Yokohama Port Decarbonization Promotion Plan (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

Classification.	Target District	Main target facilities, etc.		Owner/manager
container terminal	(nomadic) head of a family Minami Honmoku Wharf Daikoku Pier	stevedoring equipment	transfer crane straddle carrier Top Lifter reach stacker forklift Container tractors	Terminal Lessee, etc.
			gantry crane	City of Yokohama Yokohama Port Terminal Co. Yokohama Kawasaki International Port Co. Port of Yokohama Mega Terminal Co.
		Administration building, lighting facilities, reefer power supply		City of Yokohama Yokohama Port Terminal Co. Yokohama Kawasaki International Port Co.
Others Terminal Conventional Freight Vehicles, etc.	Honmoku Wharf Daikoku Wharf	Administration building, lighting facilities, inspection building, sheds, other facilities, etc.		City of Yokohama Yokohama Port Terminal Co.
Vessels and vehicles entering and leaving the terminal	Honmoku Wharf Minami Honmoku Wharf Daikoku Wharf	Vessels at anchor		Unspecified (shipping company)
		Tractors and trucks for containers		Unspecified (freight forwarder)

Figure 15. Major Public Terminals at the Port of Yokohama

1-3. Policy for the Promotion of Effective Use of Ports and Harbors that Contribute to the Promotion of Decarbonization through Public-Private Partnerships

(1) Policy for Efforts to Create a Carbon Neutral Port

Following the government's decarbonization declaration in October 2020, the Port of Yokohama was selected by the Ministry of Land, Infrastructure, Transport and Tourism in December of the same year as a port that should aim to become a carbon neutral port and began studies. The Port of Yokohama will continue to consider this issue in light of technological progress and changes in social conditions related to decarbonization, but the following chart shows the initiatives expected of the Port of Yokohama at this time. 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 decarbonizing 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 equipment, and development of new technologies.

(2) Policies for decarbonization initiatives at the wharf

As an International Container Strategic Port, the Port will promote decarbonization of public terminals such as container terminals in order to become a port of choice. Specifically, we will work to reduce and decarbonize cargo handling machinery, use LEDs in the administration building, upper building, and lighting equipment, and utilize electricity derived from renewable energy sources. For vessels, bunkering to next-generation fuel vessels will be realized and onshore power supply facilities will be improved, and for vehicles, electrification and modal shift will be promoted.

(3) Policy for efforts toward the creation of a rich ocean

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

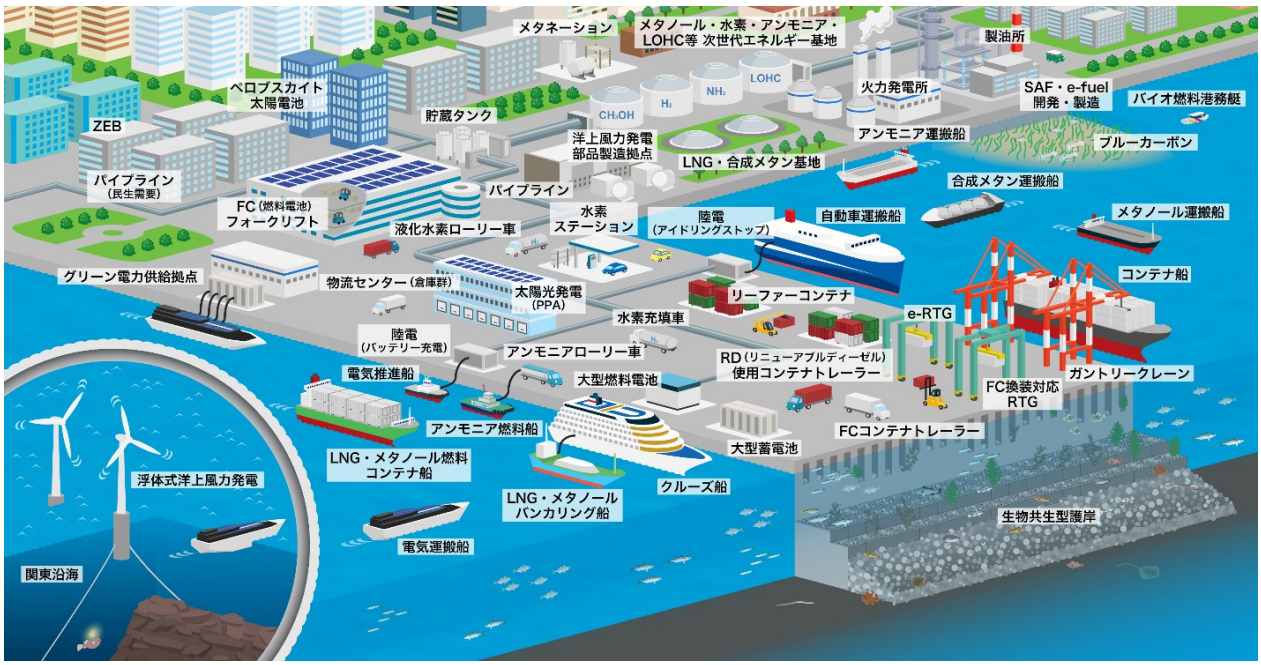


Figure 16. Port of Yokohama's carbon neutral port concept

(2) Wide-area collaboration on next-generation energy

In July 2022, the City of Yokohama will go carbon neutral in the waterfront area, which plays a central role in the local economy. In order to maintain and strengthen the competitiveness of the industry, the company concluded a collaboration agreement with Kawasaki City, which is promoting the Kawasaki Carbon Neutral Industrial Complex concept for hydrogen and other next-generation energies.

Then, 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.

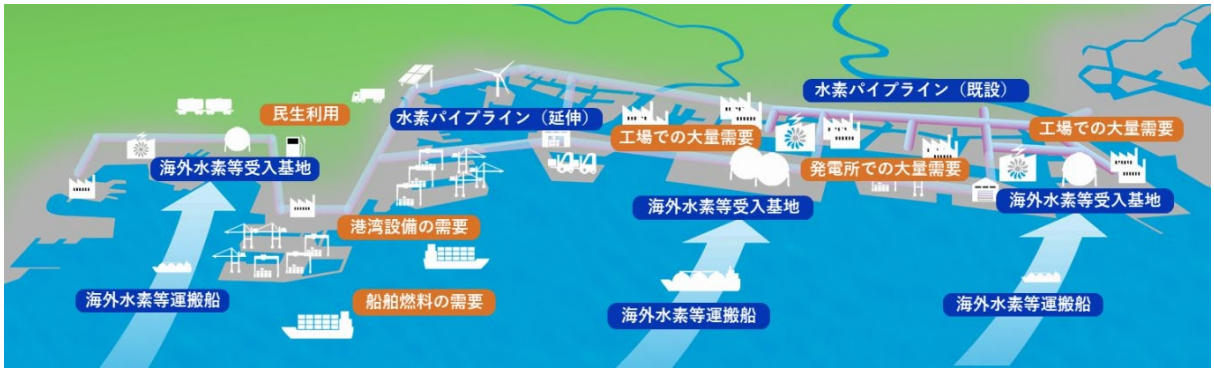


Figure 17. Image of Wide-Area Cooperation between the Ports of Yokohama and Kawasaki

(3) Efforts to form green shipping corridors

Green Shipping Corridor is a newly proposed concept for decarbonizing shipping and port management that is gaining popularity worldwide. It is an initiative to promote the reduction of greenhouse gas emissions from shipping and port activities by introducing new technologies into the shipping routes connecting ports and harbors, and through public-private partnerships and policies.

Figure 18. Image of Green Shipping Corridor formation

(4) Support for CNP certification (container terminal)

The Port Authority of the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) is studying the establishment of 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.

Therefore, terminals within the Port of Yokohama also need to closely monitor the CNP certification efforts of the Ministry of Land, Infrastructure, Transport and Tourism.

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

	区分	評価項目	登録	認証				備考
				Certified	Silver	Gold	Platinum	
登録	計画作成	認証取得可能な計画の作成	○					「登録」により「認証」申請資格取得
認証	（1） ターミナル内・境界部の脱炭素化の取組							
		CO2排出量原単位の公表		○	○	○	○	
		電力・燃料のカーボンニュートラル化					○	
		ガントリークレーンの脱炭素化				○ 8割以上	※	※Platinumでは、荷役機械の性能によらず、電力・燃料のCN化が必要であるが、省エネ機械等の導入が望ましい。
		トランスファークレーン等の脱炭素化		○ 5割以上	○ 8割以上	○ 8割以上	※	
		ヤード照明のLED化		○ 5割以上	○ 8割以上	○ 8割以上	※	
		停泊中船舶からのCO2削減の取組（陸電供給等）				○	○	
		ゲート待ち車両の渋滞緩和の取組（予約システム等）			○	○	○	
	（2）ターミナルを出入りする船舶・車両の脱炭素化を支える取組							
		低炭素燃料（LNG等）の供給機能の導入			○	○	○	
		低炭素燃料船舶に対する入港インセンティブの導入			○	○	○	例：ESIプログラム

(5) Blue carbon formation

In the highly urbanized city of Yokohama, it is difficult to create new large-scale forests. Therefore, the city is promoting the formation of seaweed beds and shallow areas to expand "blue carbon," in which seaweed and seagrasses such as eelgrass and wakame absorb $CO_{(2)}$.

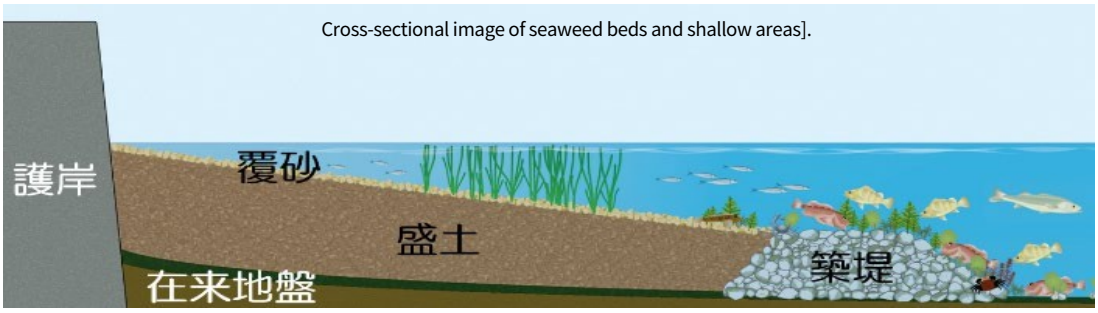


Figure 19. Formation of Blue Carbon

2. planning period

The planning period for this plan shall be through the year 2050. The target years are 2030 for the short-, 2040 for the medium-, and 2050 for the long-term.

This plan shall be reviewed in a timely and appropriate manner in light of the government's greenhouse gas reduction targets and progress in technologies that contribute to decarbonization. Furthermore, the period of the plan and the timing of the review shall be addressed after taking into consideration the review status of related plans such as the Port Plan and the Yokohama City Action Plan for Global Warming Countermeasures based on the Law Concerning the Promotion of the Measures to Cope with Global Warming.

3. Goals of the Yokohama Port Decarbonization Promotion Plan

3-1 . Targets of the Yokohama Port Decarbonization Promotion Plan

The target fiscal years in this plan are FY2030 for the short-, mid-, and long-term targets, FY2040 for the mid-term target, and FY2050 for the long-term target. In setting the fiscal year for the mid-term target, we set the target as FY2040, which is discussed in the Seventh Basic Energy Plan and other documents. Key Performance Indicators (KPI) were set for each target year to serve as indicators for each area of action.

The 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 target will not be reached by accumulating reductions in carbon dioxide emissions from the Port Decarbonization Promotion Project, it will be positioned in the plan sequentially, starting with those ready for decarbonization efforts by the private sector, etc., with the aim of achieving the target.

Conservation, restoration, 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 value		
		short- to medium-term (Fiscal year 2030)	medium-term (FY2040)	long term (FY2050)
1	Carbon dioxide emissions from the Yokohama waterfront area	4.8 million t-CO_2/year (47% decrease from FY2013)	2.4 million t-CO_2 per year* (million t-CO_2 per year) (74% decrease from FY2013)	Real 0 t-CO_2/year
2	Preservation, rehabilitation, and creation of blue infrastructure (carbon dioxide absorption)	Approx. 150 t-CO_2/year	Approx. 200 t-CO_2/year	Approx. 250 t-CO_2/year

The above is subject to change based on the status of the 7th Basic Energy Plan and other considerations.

[Ref. 1

The Outcome of the First Global Stocktake, adopted at the 28th Conference of the Parties (COP28) to the United Nations Framework Convention on Climate Change (UNFCCC) 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.

◯ FY2030 4.23 million t-CO_2/year (43% reduction from FY2019)

◯ FY2035 2.96 million t-CO_2/year (60% reduction from FY2019)

[Reference 2

Japan's next national reduction target (NDC) level was proposed at the joint meeting of the Central Environment Council and the Industrial Structure Council (6th meeting, November 25, 2024) as 60% reduction in FY2035 and 73% reduction in FY2040 (compared to FY 2013). Therefore, reference values are shown as in Reference 1.

3.64 million t-CO_2/year in FY2035 (60% reduction from FY13)

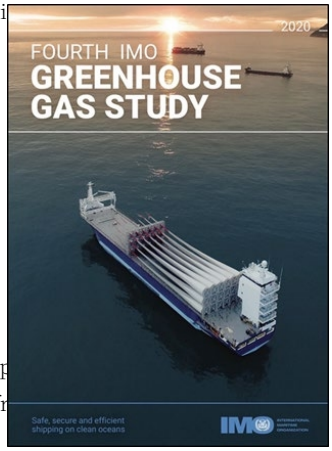
2.46 million t-CO_2/year in FY2040 (73% reduction from FY13)

3-2 . Estimation of Greenhouse Gas Emissions

(1) Summary of Estimation Methodology

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

First, emissions from the land area are based on the "Greenhouse Gas Emissions from Yokohama City Area," which is estimated annually by the Yokohama City Office of Decarbonization and GREENxEXPO Promoti



The estimates for the unique group of companies, mainly in the manufacturing industry, were made using data from the "Yokohama City Global Warming Action Plan System" implemented by the Yokohama City Office of Decarbonization and GREEN×EXPO Promotion.

Next, for emissions from ocean-going vessels at anchor, statistical data on vessels entering port held by the Yokohama Port and Harbor Bureau and the IMO (International Maritime Organization) REDUCTION OF GHG EMISSIONS FROM SHIPS Fourth IMO GHG Study

Estimates were made using 2020, etc.

By adopting Yokohama City's own estimation method, the estimates obtained based on this p obtained by Yokohama City's environmental department for the land area, and for emissions fr can be based on the IMO's required level.

In addition, the city uses the Maritime Emissions Portal of RIGHTSHIP (headquartered in Melbourne) to obtain estimates of greenhouse gas emissions (CO_2, CH_4, N_2O, PM, and other greenhouse gases regulated by the IMO) from ships operating in the Port of Yokohama area. However, if these figures are also included, there will be a discrepancy with other ports in Japan, so they are presented here for reference only.

The details of the estimation method are described in detail 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 Terminal Corporation). The report is available on the NEDO Achievement Report Database.

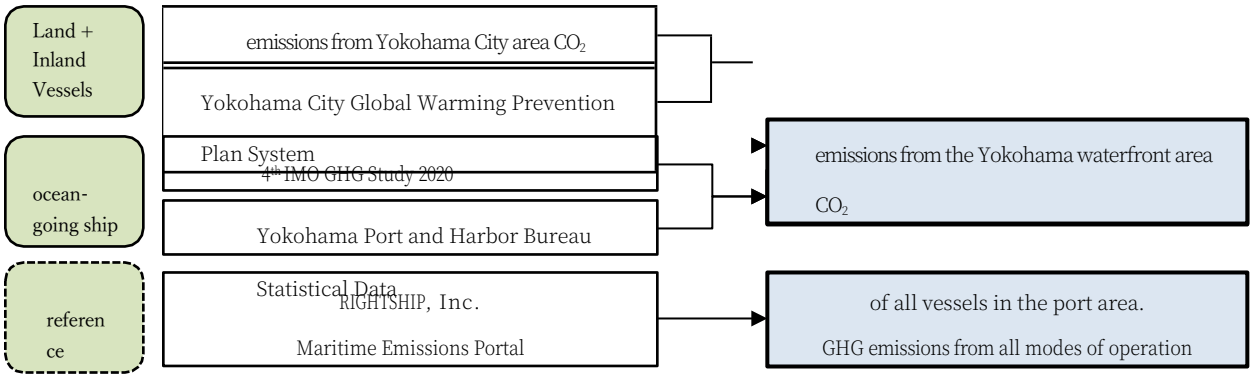
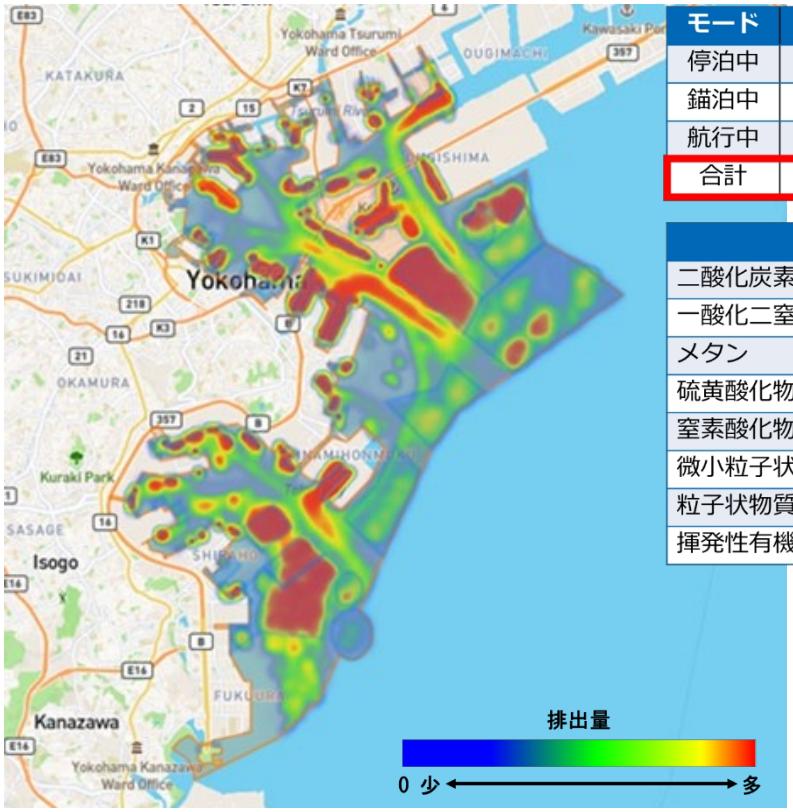


Figure 20. Overall flow of emissions estimation

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 determine 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). emissions.



モード	CO_2排出量(t)	CO_2換算排出量(t)
停泊中	218,959	222,889
錨泊中	53,080	53,808
航行中	229,518	232,648
合計	501,557	509,345

物質名		数量（t/年）
二酸化炭素	CO_2	501,557
一酸化二窒素	N_2O	25
メタン	CH_4	42
硫黄酸化物	SOx	1,030
窒素酸化物	NOx	6,438
微小粒子状物質	PM2.5	196
粒子状物質	PM10	208
揮発性有機化合物	VOCs	258

VOCs is a generic term for organic compounds that are volatile and become gaseous in the atmosphere. Paints and adhesives, Widely used as solvents in ink, etc.
The company has been in the process of developing a new business model.

Figure 21. Greenhouse gas emissions in the Port of Yokohama port area according to MEP (actual results for 2023)

Initiative 2: Participation in the Blue Visby Consortium (https://bluevisby.com/)

The first Japanese port to participate in the Blue Visby Consortium, which aims to reduce greenhouse gas emissions from ships by optimizing ship navigation through the use of digital technology.

In the shipping industry, it is customary to "Sail Fast, then Wait", which means to sail fast and wait near the destination, resulting in more greenhouse gas emissions. According to the analysis and empirical studies conducted by the Consortium, if a fleet of vessels jointly adjust their sailing speed and arrival time using the Blue Visby Solution, it is possible to reduce greenhouse gas emissions by 15% or more.

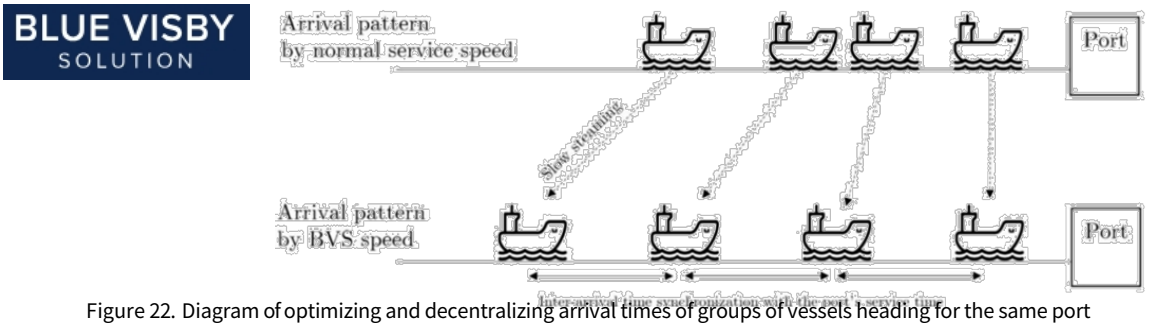


Figure 22. Diagram of optimizing and decentralizing arrival times of groups of vessels heading for the same port

(2) Carbon Dioxide Emissions from the Waterfront Area of Yokohama City

In FY2013, CO_2 emissions were 9,093,000 t-CO_2, accounting for 42.4% of the total emissions from the Yokohama city area. The breakdown of CO_2 emissions from the city's waterfront area shows that the energy conversion sector accounted for approximately 50% of the total, followed by the industrial sector and the business sector. Of these, emissions from the public wharf complex, which is the port administrator's primary business area, are estimated to be mainly part of the business sector.

emissions in FY 2019 and FY 2022 were 7,423,000 t-CO_2 and 6,394,000 t-CO_2, respectively, showing a downward trend compared to FY 2013, and accounting for 39.5% of the total emissions from the Yokohama city area in FY 2022. The breakdown of CO_2 emissions from the city's waterfront area is the same as in FY2013, 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 (2013)

		Yokohama City Waterfront		Yokohama City Area		City waterfront area /City area (%)
		amount of discharge (10,000 t-CO_2)	Composition ratio (%)	amount of discharge (10,000 t-CO_2)	Composition ratio (%)	
Emissions from land		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 department	121.7	13.4	486.7	22.7	25.0
	Transportation	82.6	9.1	389.5	18.2	21.2
	Waste Division	40.0	4.4	52.5	2.4	76.2
	household sector	10.1	1.1	500.9	23.4	2.0
Emissions from anchored ocean-going vessels		18.7	2.1	18.7	0.9	100.0
total amount		909.3	100.0	2144.2	100.0	42.4

(Note 1) Although the Green Expo Promotion Office includes CH_4 and N_2O emissions in its GHG estimates, the estimates for the Lingang area for these gases are subject to future improvement, so only CO_2 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 CO_2 emissions from ocean-going vessels are outside the scope of the Japanese inventory and are not included in the calculations of the Office for Promotion of Decarbonization and GREENxEXPO.

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

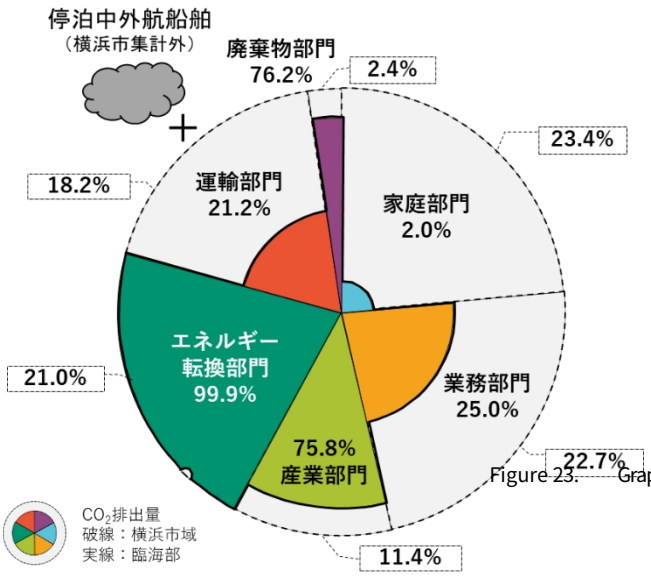


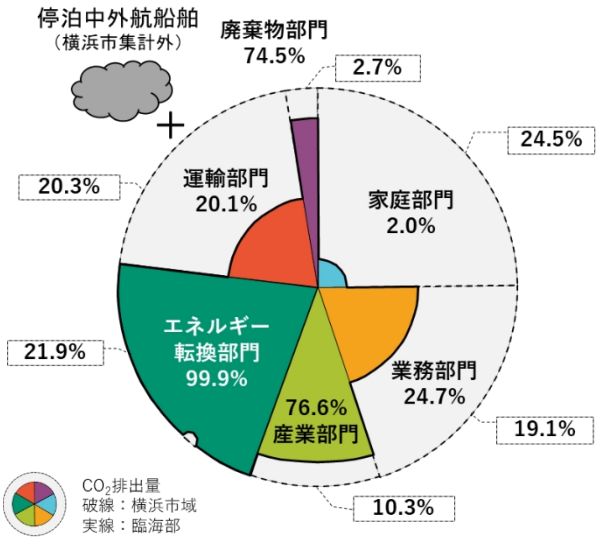
Figure 23. Graph of estimated CO_2 emissions in 2013

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

		Yokohama City Waterfront		Yokohama City Area		City waterfront area /City area (%)
		amount of discharge (10,000 t-CO_2)	Composition ratio (%)	amount of discharge (10,000 t-CO_2)	Composition ratio (%)	
Emissions from land		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 department	83.1	11.2	336.4	19.1	24.7
	Transportation	71.5	9.6	356.0	20.3	20.1
	Waste Division	35.9	4.8	48.2	2.7	74.5
	household sector	8.7	1.2	431.1	24.5	2.0
Emissions from anchored ocean-going vessels		19.0	2.6	19.0	1.1	100.0
total amount		742.3	100.0	1,757.7	100.0	42.2

Table 7. Estimated CO_2 emissions from the Yokohama waterfront area (FY2022)

		Yokohama City Waterfront		Yokohama City Area		City waterfront area /City area (%)
		amount of discharge (10,000 t-CO_2)	Composition ratio (%)	amount of discharge (10,000 t-CO_2)	Composition ratio (%)	
Emissions from land		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 department	84.1	13.2	318.8	19.7	26.4
	Transportation	70.8	11.1	334.2	20.6	21.2
	Waste Division	33.7	5.3	47.4	2.9	71.2
	household sector	9.0	1.4	440.4	27.2	2.0
Emissions from anchored ocean-going vessels		16.7	2.6	16.7	1.0	100.0
total amount		639.4	100.0	1620.9	100.0	39.5



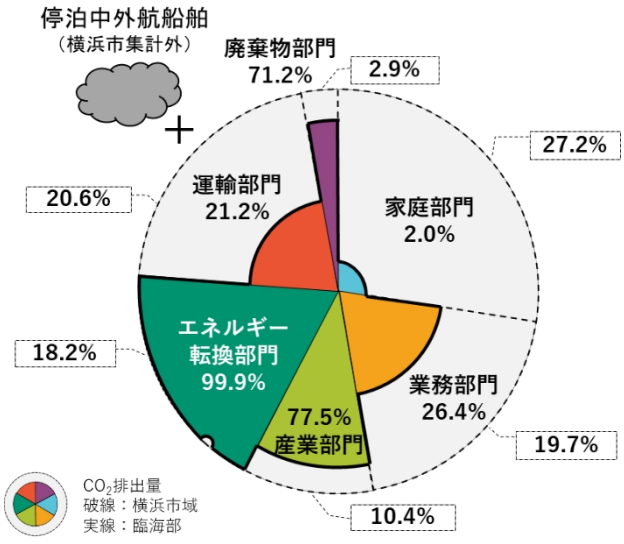


Figure 24. Graph of estimated CO_2 emissions in 2019 Figure 25. Graph of estimated CO_2 emissions in FY2022

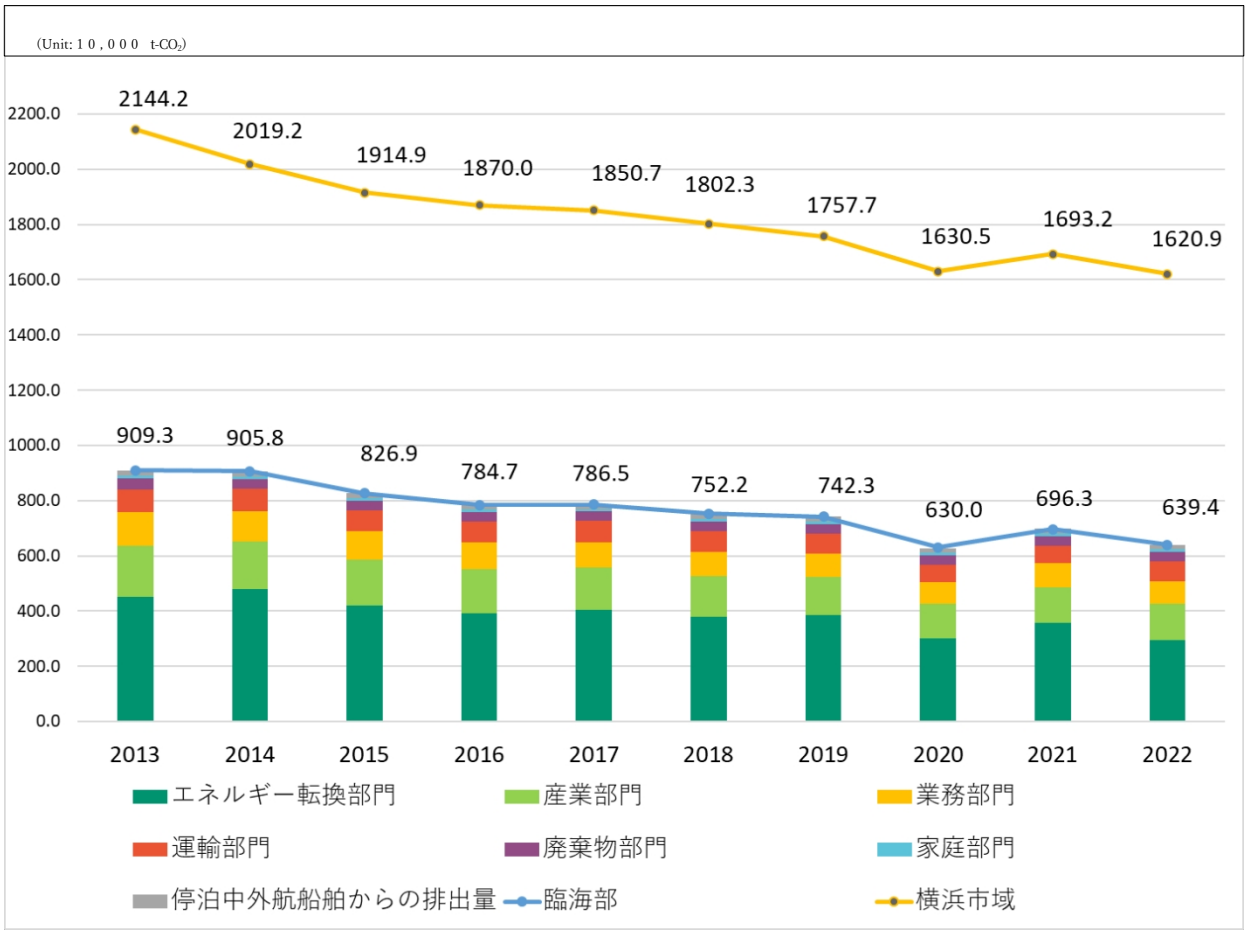


Figure 26. CO_2 Emissions in Yokohama City Area and Yokohama Waterfront Area

(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's name	2013			2019			Year 2022		
	ocean-going ship	coastal vessel	total	ocean-going ship	coastal vessel	total	ocean-going ship	coastal vessel	total
LNG Ship	19,934	–	19,934	10,560	–	10,560	13,571	–	13,571
LPG Ship	2,373	11,785	14,158	2,721	12,701	15,422	6,530	17,447	23,977
RORO Ship	14,509	1,165	15,674	3,654	458	4,112	4,521	yakuza	5,414
semi-container ship	571	10	581	972	100	1,072	1,321	18	1,339
cement ship	216	1,271	1,487	105	1,273	1,378	104	1,462	1,566
Other Thangkas tanker	625	3,341	3,966	40	4,208	4,248	108	2,825	2,932
Other Dedicated 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 ship	–	–	–	–	1	1	–	–	–
barge	–	297	297	–	179	179	–	–	–
patrol boat	–	2,684	2,684	34	3,069	3,103	243	3,305	3,549
Full container ship	47,168	6,266	53,434	46,163	7,842	54,005	42,914	12,226	55,140
product oiltanker	1,465	–	1,465	739	359	1,097	500	950	1,450
General cargo ship	32,095	4,170	36,265	25,149	3,466	28,615	19,612	3,378	22,990
Towing and pushing boats	168	615	783	6	632	639	31	432	463
combined cargo and passenger ship	–	–	–	–	36	36	–	–	–
ocean-going chemical ship	7,696	–	7,696	10,173	–	10,173	11,967	183	12,149
passenger boat	5,808	5,706	11,513	13,322	5,504	18,827	159	15,717	15,877
fishing boat	–	–	–	–	2	2	–	2	2
training ship	73	1,320	1,394	8	1,168	1,177	–	1,313	1,313
warship	409	40	449	3,847	55	3,903	6,963	422	7,385
ore ship	448	95	543	–	71	71	22	59	81
steel ship	745	2,743	3,488	61	1,889	1,949	35	1,485	1,519
grain ship	2,464	15	2,480	138	15	153	–	27	27
Gravel, sand and stone ship	–	5,056	5,056	–	4,874	4,874	–	4,896	4,896
work(ing) ship	1,248	48	1,296	2,533	131	2,664	2,033	107	2,141
Car Carrier	23,803	5,302	29,105	18,197	2,804	21,001	15,878	2,306	18,185
coal ship	798	751	1,548	73	567	641	44	500	544

Inland chemical ship	–	5,388	5,388	–	3,905	3,905	–	9,149	9,149
an oil tanker	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			Year 2022		
	ocean-going ship	coastal vessel	total	ocean-going ship	coastal vessel	total	ocean-going ship	coastal vessel	total
(nomadic) head of a family	29,578	4,626	34,203	32,384	3,125	35,509	31,194	4,405	35,599
Minami Honmoku Wharf	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
Deida-cho Wharf	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 Wharf	98	285	382	410	404	814	109	326	436
Kanazawa Lumber Wharf	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 Pier)	–	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 (Government and municipal offices)	–	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

Supplemental explanation of CO2 emissions from ships is provided since multiple estimation methods are combined.

specified by the Ministry of the Environment, the theoretical estimates include emissions while at anchor and while sailing.

CO2 emissions from ocean-going vessels are not included in Japan's inventory, i.e., not covered by the Action Plan on Climate Change, so estimates from 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 estimating CO_2 emissions from the Yokohama City waterfront area.

	coastal vessel	ocean-going ship
Estimates based on the Action Plan for Global Warming Countermeasures	adoption	Not subject to estimation
Estimates from Fourth IMO GHG Study 2020	rejection (of an application) (Priority is given to the implementation plan)	adoption

Table 11. CO_2 emissions from ships (breakdown of domestic and international shipping)

(Unit: 10,000 t-CO_2)

	Fiscal Year 2013	Fiscal Year 2019	Fiscal Year 2022	remarks
coastal vessel	15.0	15.4	15.9	Estimated as within the transportation sector in Tables 5, 6, and 7.
ocean-going ship	18.7	19.0	16.7	Estimated as total for ocean-going vessels in Tables 8 and 9
total amount	33.7	34.4	32.6	

(4) Carbon Dioxide Emissions from Container Terminals

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

Table 12. Estimation Methodology for CO_2 Emissions at Container Terminals

classification	Main Facilities	CO_2 emission sources	Emissions Estimation Method
(inside a) terminal	loading and unloading machinery	Electricity use and light oil use for cargo handling machinery	Diesel oil consumption x CO_2 emission factor + Electricity consumption x CO_2 emission factor
	Container terminal facilities, administration building, etc.	Electricity use for administration building, 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 compared to FY2013)
	Fiscal Year 2013	Fiscal Year 2019	Fiscal Year 2022	
In the Port of Yokohama Total Container Terminals	37,930	37,980	26,112	11,818 (down 31.2%)

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 of electricity and fuel in each year and the introduction status of cargo handling machinery such as hybrid RTGs.

emissions per TEU multiplied by the number of containers handled (TEU) by wharf for each fiscal year.

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

3-3 . Estimation of Greenhouse Gas Absorption

Blue carbon ecosystems with the ability to absorb and fix CO_2 include seagrasses and seaweeds, wetlands and tidal flats, and mangroves. Here, the amount of blue carbon absorbed and fixed by seagrasses and seaweeds living in port areas of Yokohama City was estimated 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, conservation, and restoration of blue carbon ecosystems, and the amount of CO_2 absorption was estimated by multiplying this by a CO_2 absorption coefficient.

Table 14. Estimated carbon dioxide absorption

classification	Target District	Target Facilities, etc.	Owner/Manager	CO_2 absorption Fiscal Year 2024
Non-Terminal	Port area, etc.	Seaweeds and seaweeds inhabiting seawalls, etc. Location: Seawalls, vanishing wave blocks, Shallow water, etc.	City of Yokohama, etc.	Approx. 100t-CO_2/year

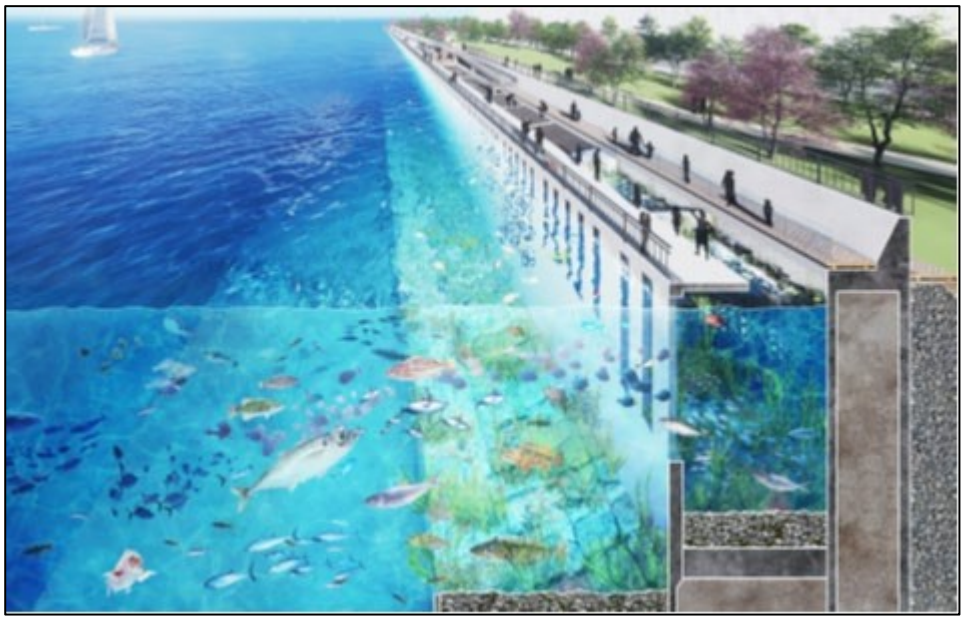


Figure 27. Image of a biosymbiotic revetment

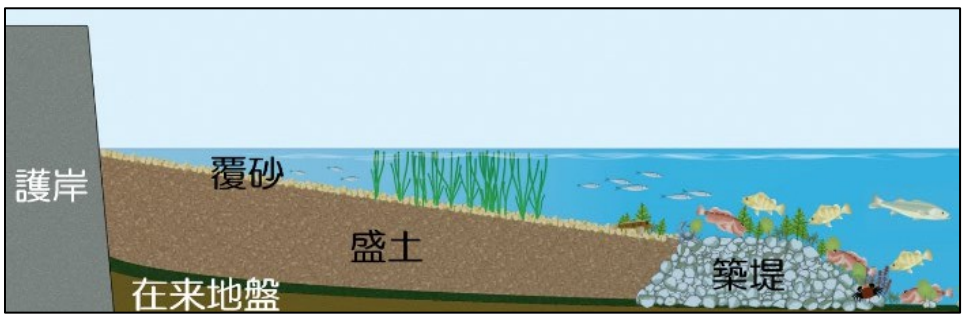


Figure 28. Image of seaweeds, etc. inhabiting shallow areas, etc.

3-4 . Study of greenhouse gas emission reduction targets

3-4-1. Carbon Dioxide Emissions from the Waterfront Area of Yokohama City

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

(1-1) Targets for FY2030

Based on the reduction rate by sector in the Yokohama City Action Plan for Global Warming Countermeasures, a CO_2 reduction target was set for the Yokohama waterfront area: CO_2 emissions are to be reduced from 9.09 million t-$CO_{(2)\,in}$ FY2013 to 4.8 million t-$CO_{(2)\,in}$ FY2030.

(The goal is to achieve a 47% reduction from the fiscal 2013 level.

Table 15. CO_2 Reduction Targets for FY2030 Emitted from Yokohama Waterfront Area (Unit: 10,000 t-CO_2)

department	department	Fiscal Year 2013 Amount of Emission	Fiscal year 2030 target value	Compared to FY2013 Reduction rate
Emissions from land		891	467	▲48% (-48%)
	Energy Conversion Sector	450	252	▲44% (-44%)
	Industrial Sector	186	87	▲53% (-)
	Operations Division	122	41	▲66% (-66%)
	Transportation	83	56	▲32% (-32%)
	Waste Division	40	26	▲36% (-36%)
	household sector	10	5	▲55% (-55%)
Emissions from anchored ocean-going vessels		19	13	▲32% (-32%)
total amount		909	480	▲47% (-47%)

(1-2) Reference values for FY2030 and FY2035 considering COP28 global stocktaking results

Although not listed as a KPI, reference values for CO_2 emissions are given, taking into account the results of the global stocktake adopted at COP28 in 2023. In this case, CO_2 emissions would be 4.23 million t-$CO_{(2)\,in}$ FY2030 (43% reduction from FY2019) and 2.96 million t-$CO_{(2)\,in}$ FY2035 (60% reduction from FY2019).

Table 16. CO_2 Reduction Targets for FY2035 Emitted from Yokohama Waterfront Area (Unit: 10,000 t-CO_2)

department	department	Fiscal Year 2019 amount of discharge	Emissions in FY2030 (Reference value)	Compared to FY 2019 Reduction rate	Emissions in FY2035 (Reference value)	Compared to FY 2019 Reduction rate
Emissions from land		723	412	▲43% (-)	289	60%▲60
Emissions from anchored ocean-going vessels		19	11	▲43% (-)	7	60%▲60
total amount		742	423	▲43% (-)	296	60%▲60

(1-3) Reference values for FY2035 and FY2040 considering Japan's next NDC (National Reduction Target) level

As in (1-2), reference values for CO_2 emissions based on Japan's next NDC (National Reduction Target) levels as presented at the joint meeting of the Central Environment Council and the Industrial Structure Council (6th meeting, November 25, 2024) are shown below. In this case, CO_2 emissions would be 3.64 million t-$CO_{(2)\,in}$ FY2035 (60% reduction from FY13) and 2.46 million t-$CO_{(2)\,in}$ FY2040 (73% reduction from FY13).

Table 17. CO_2 Reduction Targets for FY2040 Emitted from the Waterfront Area of Yokohama (Unit: 10,000 t-CO_2)

department department	Fiscal Year 2019 amount of discharge	Emissions in FY2035 (Reference value)	Compared to FY2013 Reduction rate	Emissions in FY2040 (Reference value)	Compared to FY2013 Reduction rate
Emissions from land	891	356	▲60% (60%)	241	▲73% (-)
Emissions from anchored ocean-going vessels	19	8	▲60% (60%)	5	▲73% (-)
total amount	909	364	▲60% (60%)	246	▲73% (-)

(2) Targets for FY2040

As for the target for FY2040, the 7th Basic Energy Plan, etc., is still under discussion for formulation, and target values have not yet been determined. Therefore, a target value was 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 target of reducing CO_2 emissions to 2.4 million t-CO_2 (74% reduction from FY 2013).

The above is subject to change based on the status of the 7th Basic Energy Plan and other considerations.

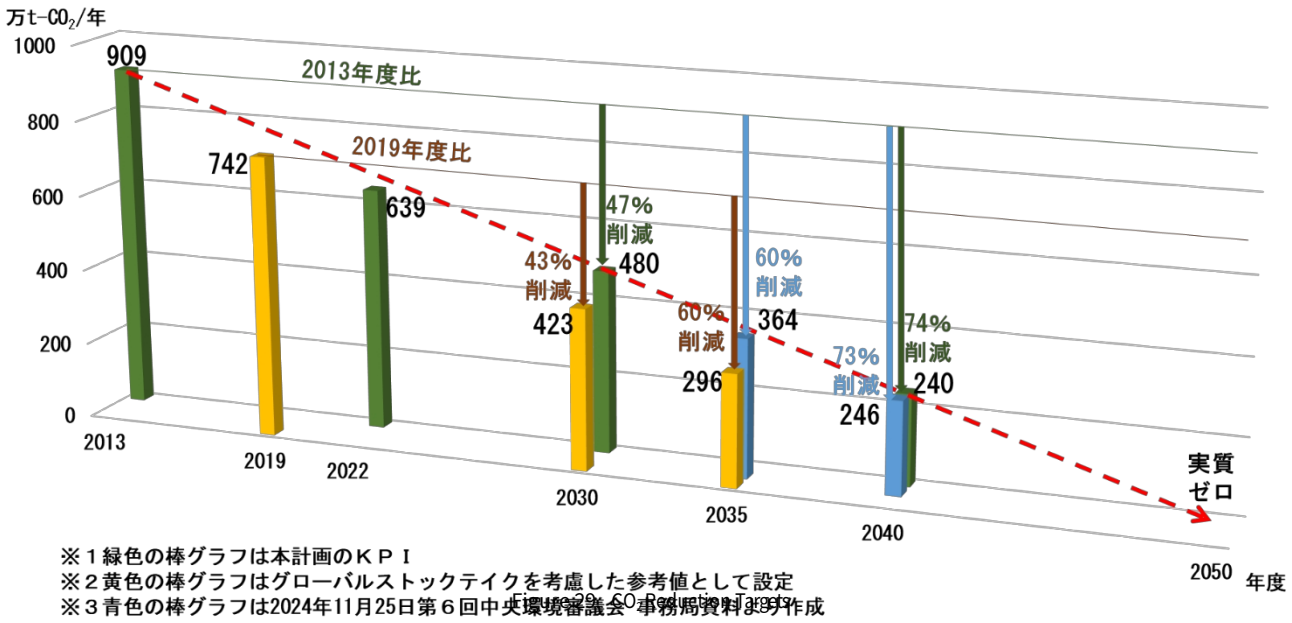


Figure 29 CO_2 Reduction Targets

(3) Targets for FY2050

The entire scope of this plan will be carbon neutral, and CO_2 emissions will be effectively reduced to zero (9.09 million t-CO_2 less than in FY2013).

Table 18: Carbon Dioxide Emissions Targets

KPI (Key Performance Indicators)		Specific numerical targets		
		short- to medium-term (Fiscal year 2030)	medium-term (FY2040)	long term (FY2050)
1	Carbon dioxide emissions from the Yokohama waterfront area	4.8 million t-CO_2/year (47% decrease from FY2013)	2.4 million t-CO_2/year (74% decrease from FY2013)	Real 0 t-CO_2/year

3-4-2. Carbon Dioxide Emissions from Container Terminals

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

(1) Targets for FY2030

Same reduction target as the reduction target for carbon dioxide emissions from the waterfront area of Yokohama City set in 3-4-1.

(47% reduction in $CO_{(2)}$ emissions compared to FY2013) from container terminals as a target for reducing $CO_{(2)}$ emissions.

(2) Targets for FY2040

The target value was calculated using the same method as in 3-4-1. 74% reduction of CO_2 emissions from container terminals compared to FY2013 is set as the CO_2 reduction target.

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 for the entire scope of the plan, which means that CO_2 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 value		target value (Reduction target compared to FY2013)		
	Fiscal Year 2013	Fiscal Year 2019	FY2030 (47% reduction)	Fiscal year 2040 (74% reduction)	Fiscal Year 2050 (100% reduction)
In the Port of Yokohama Container Terminal Total Total	37,930	37,980	20,102 (47% reduction)	9,862 (74% reduction)	0 (100% reduction)

3-4-3. carbon dioxide absorption through conservation, rehabilitation, and creation of blue infrastructure

The objectives in this plan listed in KPI-2 are as follows. The details of the initiatives are described in 4-1-3.

Table 20: Targets for carbon dioxide absorption

KPI (Key Performance Indicators)		Specific numerical targets		
		short- to medium-term (Fiscal year 2030)	medium-term (FY2040)	long term (FY2050)
2	Preservation, rehabilitation and creation of blue infrastructure (carbon dioxide absorption)	Approx. 150t-CO_2/year	Approx. 200t-CO_2/year	Approx. 250t-CO_2/year

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

The estimation of hydrogen demand in the Yokohama waterfront area was conducted as a NEDO-commissioned survey (March 2023) in the form of a questionnaire to companies located in the area, but the survey items varied depending on how they were set up, and in many cases, companies did not respond to the questionnaire about future estimates for individual areas. In addition, there were many cases in which the respondents did not provide future estimates for individual regions.

Therefore, in the same study, the primary energy supply forecast for 2050 from the perspective of primary energy supply (Hereafter referred to as the "2050 Primary Energy Supply Outlook Estimates" or "Hydrogen Utilization Pathway"). The City has compiled its own "Hydrogen Utilization Pathway" (hereafter referred to as the "2050 Primary Energy Supply Projection" or "Hydrogen Utilization Pathway"), and will use this pathway in this plan.

In its Sixth Basic Energy Plan (October 2021), the government has presented a primary energy supply outlook for the year 2030, but has not presented a primary energy supply outlook for the year 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 (work) agency	document-name	scenario classification	Publication Destination
National Institute of Advanced Industrial Science and Technology (AIST)*1	Japan's pathways to achieve carbon neutrality by 2050 - Scenario analysis using an energy modeling methodology (announced in 2022)	Base Case	Renewable and Sustainable Energy Reviews
The Institute of Energy Economics, Japan (IEEJ)*2	Model estimates of carbon neutrality in 2050 (published in 2021)	Base Case	General Resources and Energy Investigation Committee Basic Policy Subcommittee (44th)
McKinsey & Company (McK)*3	Decarbonization in Japan - Prospects for 2050 (Announced in 2021)	Main Scenarios	
Mitsubishi Research Institute, Inc. (MRI)*4	Carbon neutral society in 2050 Economic Impact (announced in 2022)	Demand Reduction technological innovation	MRI econoMic re. view
National Institute for Environmental Studies (NIES)*5	One Analysis of Scenarios for Achieving a Decarbonized Society in 2050 (presented in 2021)	+Social Transformation	General Resources and Energy Investigation Committee Basic Policy Subcommittee (44th)
Research Institute of Innovative Technology for the Earth (RITE)*6	Scenario analysis of carbon neutrality in 2050 (interim report) (published in 2021)	Reference value case	General Resources and Energy Investigation Committee Basic Policy Subcommittee (43rd)
Institute for Global Environmental Strategies (IGES)*7	IGES 1.5°C roadmap (announced 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

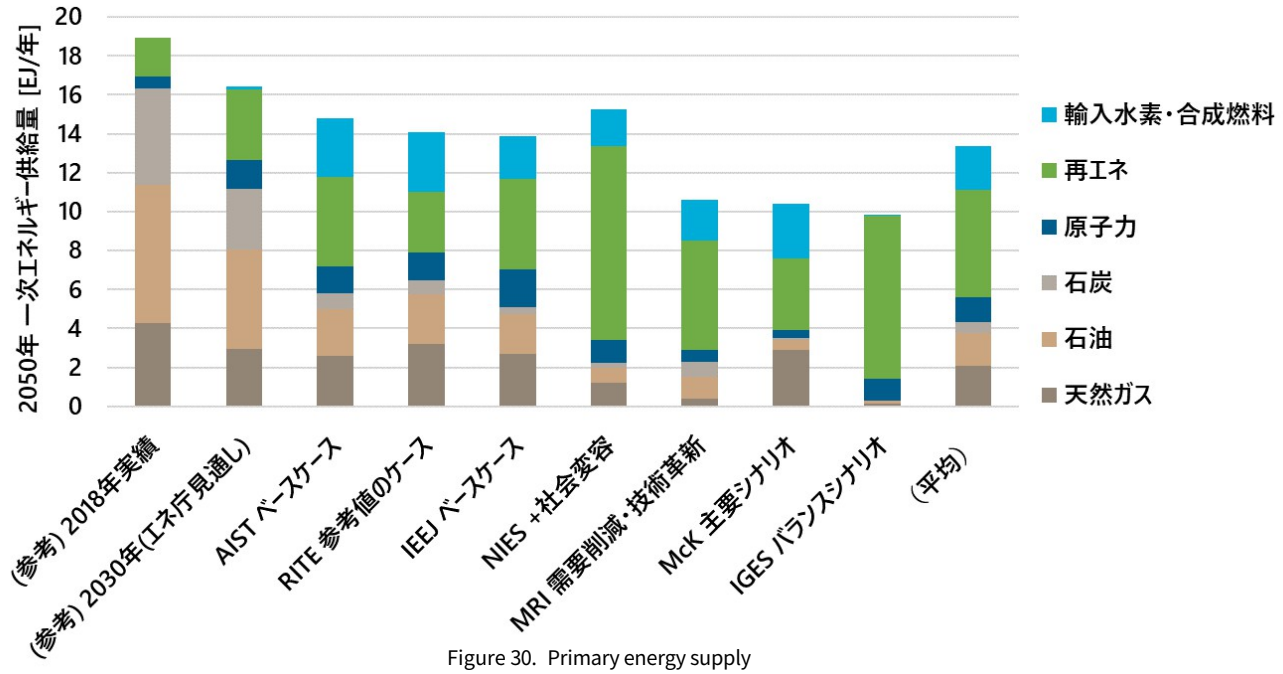


Figure 30. Primary energy supply

(2) Final energy consumption

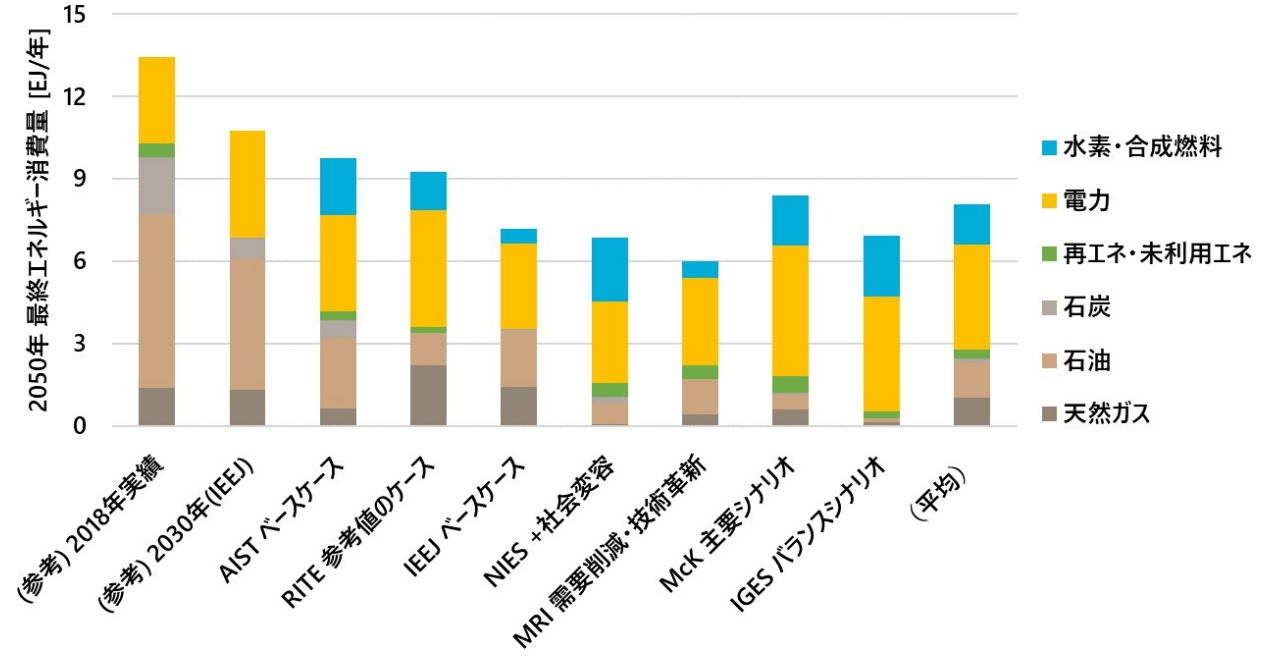


Figure 31. Final energy consumption

3-5-3. 2050 Primary Energy Supply Outlook Estimates (Pathways for 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.

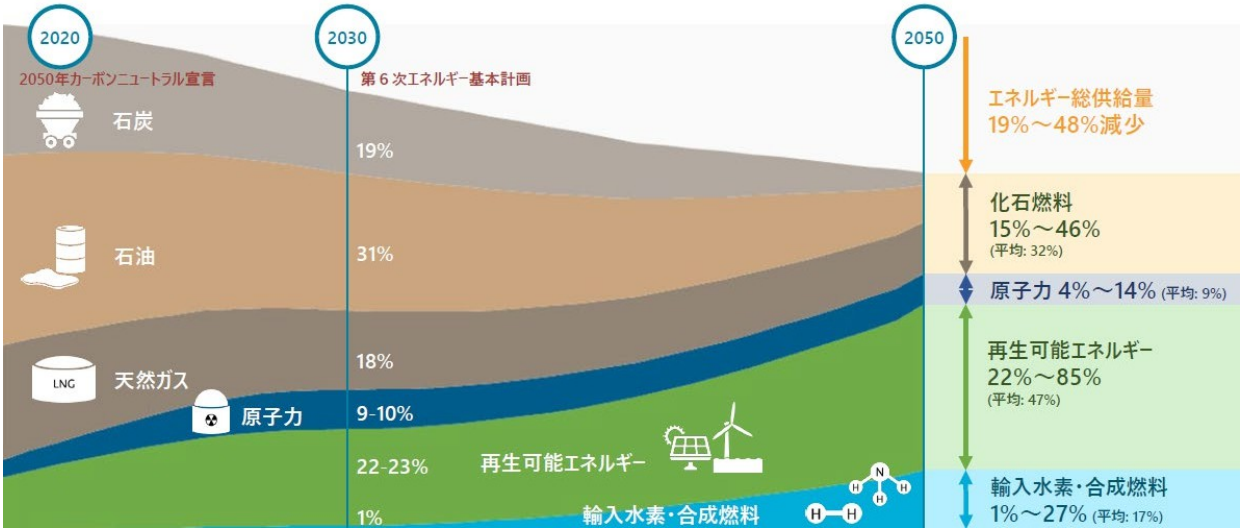


Figure 32. Estimated Primary Energy Supply Outlook (Pathways for Hydrogen Utilization)

(Prepared by Yokohama Port and Harbor Bureau and Hiroaki Onodera, Department of Technology and Social Systems, Graduate School of Engineering, Tohoku University)

[Annotation

The energy supply structure includes primary energy supply and hydrogen and synthetic fuel imports.
The energy supply structure in 2030 is based on the "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 current status to 2030 and 2050 is supplemented by time series scenarios from McK, AIST, and IEEJ.
Each scenario is calculated according to the conditions assumed by each research institute, 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 Yokohama Port Authority does not necessarily consider the use of hydrogen as the primary means of next-generation energy conversion in the waterfront area, but rather believes that next-generation fuels should be selected to suit each type of use and equipment. However, the Manual for the Port Decarbonization Promotion Plan by the Ministry of Land, Infrastructure, Transport and Tourism stipulates that the volume of hydrogen demand should be calculated, so here we present the volume when the potential for hydrogen utilization is maximized, which was organized in a NEDO-commissioned study (March 2023).

The hydrogen potentials in (1) public terminals and (2) inbound and outbound vessels and vehicles at public terminals were estimated using the same conditions as in 2030. The estimated values for 2040 are the same as those for 2030. (3) Hydrogen potential outside terminals and in dedicated terminals was calculated using our own estimates of primary energy supply in 2030, 2040, and 2050.

(1) In terminal (public)

(1) Hydrogenation of cargo handling machinery, etc.

2030: 2 FC-RTGs installed

2040: Same as above

2050: Assumption that all cargo handling machinery at container terminals will be hydrogenated (except 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 2 FC-RTGs. (The amount of hydrogen demand overlaps with the "hydrogenation of cargo handling machinery, etc." in (1) (i) above.

2040: Same as above

2050: FC generators are expected to be installed at container terminals, and hydrogen produced by utilizing surplus electricity from wind power generation will be used along with externally procured hydrogen.

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

(1) Electric power supply to vessels at anchor

2030: Assuming installation of FC generators dedicated to land-based power generation at container terminals under consideration for land-based power generation facilities.

2040: Same as above

2050: Assumption of installation of FC generators dedicated to land-based power generation at all applicable terminals for ships to which land-based power will be applied in the future.

(2) Fuel supply to hydrogen-fueled vessels

2030: Assumed to be zero, assuming that hydrogen-fueled vessels will gradually become more common toward 2050, although the development of hydrogen-fueled vessels is progressing for smaller vessels.

2040: Same as above

2050: All pleasure boats and service vessels berthed at the Port of Yokohama are assumed to be converted from existing gasoline and diesel to hydrogen fuel.

(iii) Hydrogenation of overland transportation of marine containers

2030: Assumed to be zero because the 2030 introduction target for heavy-duty vehicles over 8 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. Automobile electrification targets in the "Green Growth Strategy" (June 18, 2021)

電動化の目標　※電動車＝EV（電気自動車）、FCV(燃料電池自動車）、PHEV(プラグインハイブリッド）、HV（ハイブリッド）

- ✓ 2035年までに、乗用車新車販売で電動車 100%を実現
- ✓ 商用車については、
  - ・8t以下の小型車について、2030年までに、新車販売で電動車20～30%、2040年までに新車販売で、電動車と合成燃料等の脱炭素燃料の利用に適した車両で合わせて100%を目指す
  - ・8t超の大型車については、2020年代に5,000台の先行導入を目指すとともに、2030年までに、2040年の電動車の普及目標を設定する

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

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 City. Specifically, hydrogen demand was estimated by multiplying (A) fuel and heat consumption by (B) the hydrogen conversion rate. (A) Fuel and heat consumption at waterfront business sites

＜Estimation Procedure

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

b) Calculate the ratio of electricity to primary energy use 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 the annual energy consumption of each municipality by energy type and industry.

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

Table 23. Primary Energy Consumption of Waterfront Businesses

Number of offices		Primary energy use (TJ/year)		
Facility Type	total amount	electric power	Fuel & Heat	total amount
Factory　46, Warehouse 17 Power generation facilities　4, Heat supply facilities　1 Other　68	136	22,056 (6%)	321,879 (94%)	343,935 (100%)

(B) Hydrogen conversion ratio

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 Primary Energy Supply Outlook in 2050 (Pathway 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: average percentage of adoption)

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

Table 24. Hydrogen Demand (FY2030, FY2040, and FY2050)

classification	(data) item	Hydrogen demand (t-H_2/year)		
		FY2030	Fiscal year 2040	Fiscal Year 2050
(inside a) terminal (Public)	Hydrogenation of cargo handling machinery, etc.	20	20	4,844
	Energy management at wharfs utilizing renewable energy, fuel cells, etc.	(24*)	(24*)	957
Inbound and outbound vessels and vehicles (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 (Dedicated)	Hydrogenation in industrial facilities such as port facilities, factories and industrial complexes	26,823	134,116	724,228
Total total		27,220	134,513	754,722

*The demand volume is excluded from the total because it overlaps with "Hydrogenation of cargo handling machinery, etc.".

The details of the estimation method are described in detail 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 Terminal Corporation). The report is available on the NEDO Achievement Report Database.

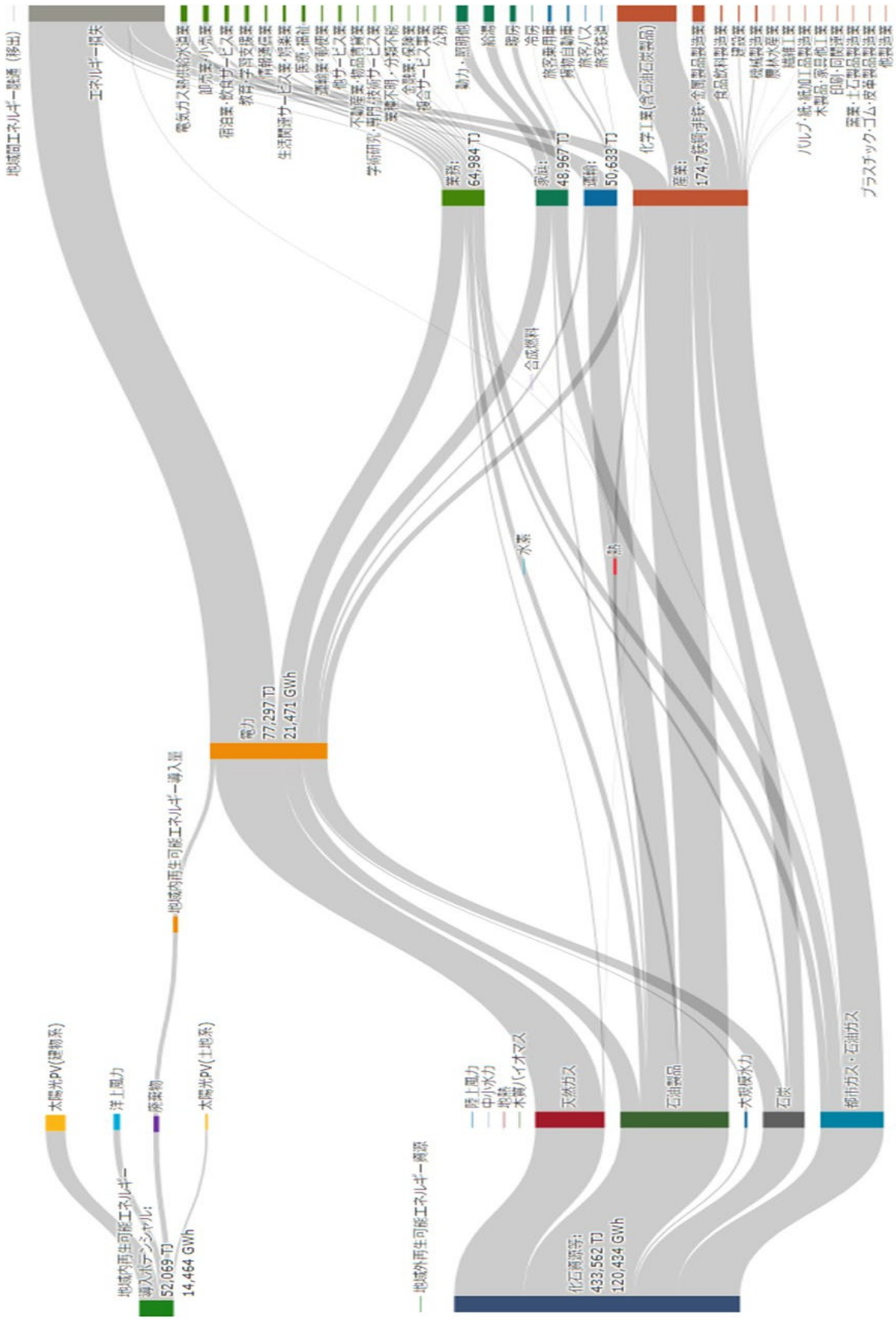


Figure 33. Energy Supply and Demand Flow Diagram for Yokohama City (2013)

(Source: Regional Energy Supply and Demand Database (Version 2.10) https://energy-sustainability.jp/)

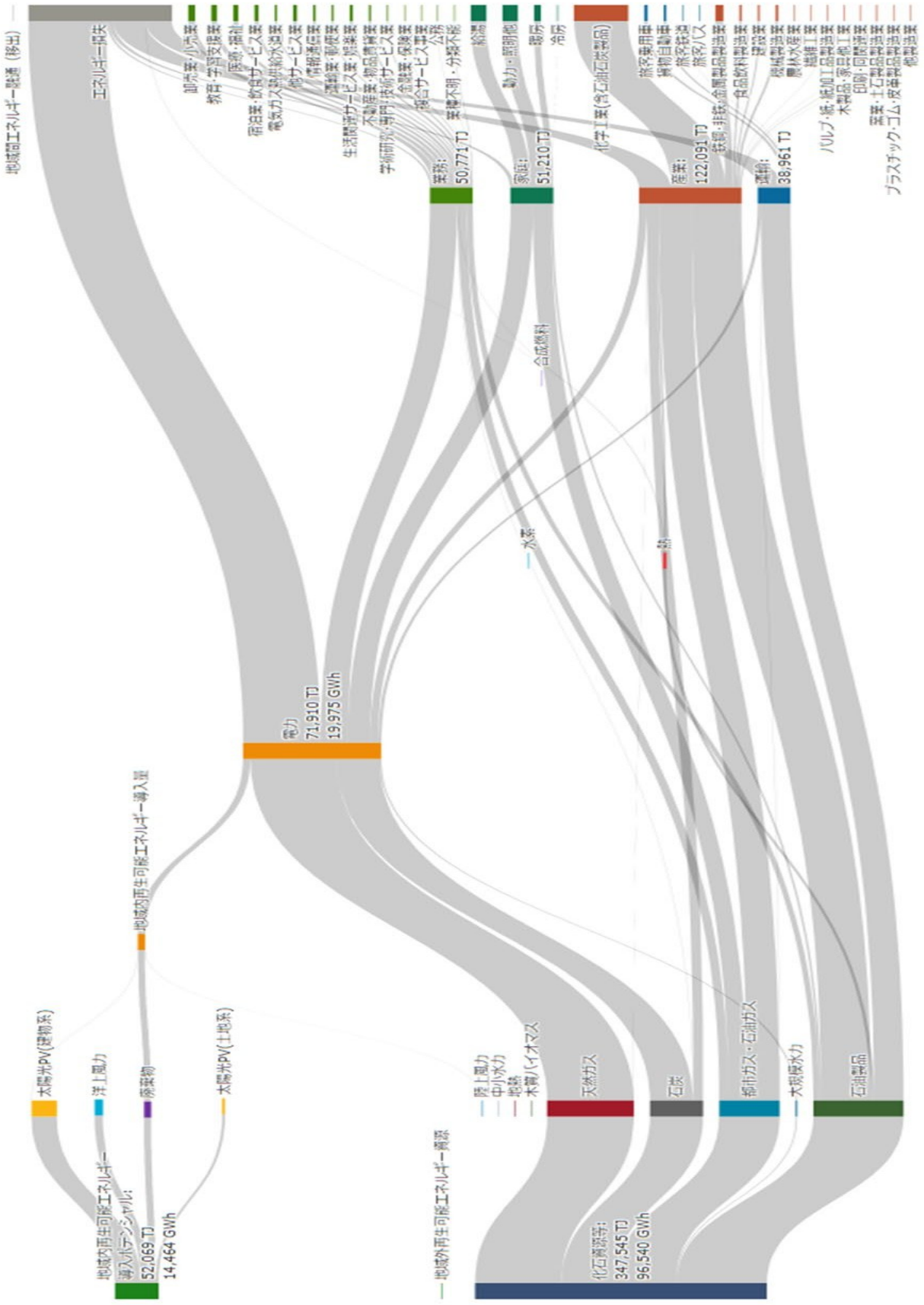


Figure 34. Energy Supply and Demand Flow Diagram for Yokohama City (2020)

(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. initiatives to decarbonize the waterfront area

The following is a list of projects to promote decarbonization of ports and harbors in the Yokohama waterfront area (initiatives for decarbonization of the waterfront area) and the entities responsible for implementing these projects. These are the current status of studies by each entity, and will be updated to reflect future studies by each entity based on the progress of technologies that contribute to decarbonization and changes in social conditions, as well as the progress of inter-company collaboration and participation of new entities.

(1) Short- to medium-term (FY2030)

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

Waterfront initiatives

Details of Initiatives	party carrying out (e.g. a policy)	Location	implementation period	Scale and Breakdown of Initiatives	Effects of the Project (CO2 reduction t/year)	remarks
Energy-saving lighting equipment (LEDs, etc.)	AGC Corporation	Yokohama Technical Center tahr (measure of land area)	2019-2021	1,200,000 kWh	-	
	ENEOS Corporation	Yokohama Works	Fiscal Year 2023～	FY 2011 110 l i g h t s 9.2 kW	58	
	Ogishima Power Co.	Ogishima Power Station	FY 2013 - FY 2023	everything	169	
			FY2024 - FY2025 (Plan)	everything	7	
	Tokyo Gas Co.	Tsurumi Ward	Introduced in FY2024	everything	2	
	Toshiba Energy Systems Corporation	Keihin Office	Fiscal Year 2024～	Installation rate 72	40	
	Public University Corporation Yokohama City University	All campuses	FY2021 - FY2026	58.3MWh	27	
	IHI Corporation	Yokohama Office	FY2021-2024	95% adoption rate	800	
	JFE Engineering Corporation	Yokohama Head Office	Implemented in FY2022	everything	350	
Energy conservation in air conditioning and heat source equipment, etc. (equipment renewal, energy management, DHC improvement, etc.)	AGC Corporation	Yokohama Technical Center tahr (measure of land area equal to or greater than one-tenth of a tsubo)	~2030 years	Energy Management in Development and Common Sector	5,400	Scope1,2 down 30% from 2019
	Toagosei Co.	Yokohama Plant	FY2020-2024 vs. Response, post-completion effect	Renewal of No. 1 turbo chiller	341	
	Public University Corporation Yokohama City University	Fukuura Campus and Hospital	FY2021 - FY2026 FY2021 - FY2027 FY2021-2024	(a) Renewal of power receiving and transforming equipment and high-efficiency transformers (b) Renewal of aging air-conditioning equipment c. Repair of steam piping (leak) and hospital vertical piping (south side)	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, CO2 emissions reductions will not be recorded.
		Tsurumi Campus	FY2022-2026 FY2022-2026 FY2023 - FY2026	a. Fin cleaning of PAC outdoor unit. b. Conversion of cooling water pump to INV. c. Renewal of cooling unit in low-temperature room	5	
	JFE Engineering Corporation	Yokohama Head Office	Operation to start in FY2023	Installation of storage batteries (2.5MW/5MWh)	-	
	Mitsubishi Heavy Industries, Ltd.	pasture land	FY2027 Plan	Electrification of hot water supply and cooking facilities	4	
			FY2027 Plan	Renewal of hot water supply, air conditioning, and substation facilities (High efficiency)	44	
Energy conservation in production facilities	ENEOS Corporation	Negishi Refinery	at any time	Energy-saving modification of existing facilities	-	
			Fiscal Year 2022～	One line of atmospheric distillation equipment was established	-	
			Fiscal Year 2023～	Introduction of large storage batteries	-	
		Yokohama Works	Fiscal Year 2022～	Removal of unnecessary piping (0.241 Ton/h)	310	
			Fiscal Year 2024～	Reduction of steam use during long vacations (GW) 10 days Obon 10 days)	33	

Waterfront initiatives

Details of Initiatives	party carrying out (e.g. a policy)	Location	implementation period	Scale and Breakdown of Initiatives	Effects of the Project (CO2 reduction t/year)	remarks
Building decarbonization (multiple initiatives)	NTT Communications Corporation	1 location in telecommunications building	2023-2030 (Partially - 2040)	Decarbonization of bases (energy conservation through equipment upgrades, purchase of non-fossil certificates, etc.)	1,200	
		4 office locations	2023 - 2030	Decarbonization of Group sites (energy conservation through equipment upgrades, purchase of non-fossil certificates, etc.)	300	
	Hitachi, Ltd.	System Plaza Yokohama	implementation	Upgrading to high-efficiency air conditioners Review the appropriate number of air conditioners and humidifiers in operation Purchase of non-fossil certificates	2,105	7.7% reduction from the previous year
	City of Yokohama	Minato Mirai 21 District	Fiscal Year 2022～ FY2030, in progress	region with a high decarbonization rate and a high unemployment rate (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, Yokohama Minato Mirai 21, Inc. Participating Businesses] 41 facilities in the district (R6) (As of July, 2010)
	The Bank of Mitsubishi UFJ, Ltd.	G□val Learning center	Fiscal Year 2024	Decarbonization of heat (10,199 GJ/year)	(680)	Included in reductions in decarbonization leading regions Therefore, these values are provided for reference only.
Utilization of unused energy	Toagosei Co.	Yokohama Plant	For fiscal years 2021-2024 Response, post-completion effect	Reduction of steam consumption through heat recovery	836	
			Corresponding to FY2022-2026, with effects occurring after completion.	Demonstration test of effective utilization of incinerated waste heat	6,349	FY2024 Subsidy for Carbon Dioxide Emission Reduction Project (Establishment of Regional Recycling and Symbiosis Blocs with Waste Treatment Facilities at the Core) (Construction Promotion Project)
solar power (generation)	IHI Corporation	Yokohama Office	FY2023-2030	1,000kW	100	
offshore wind power generation	Toshiba Energy Systems Corporation	Keihin Office	FY2028～	72 wind turbine nacelles manufactured annually 12.5MW/unit		(Reference value) CO2 reduction 1,241,000 t-CO2/year
Use of decarbonized electricity and fuels (CO2-free electricity, certificates, credits)	AGC Corporation	Yokohama Technical Center tahr (measure of land area, approx. one-tenth of a tsubo)	Year 2022～	Approx. 35,000,000 kWh/year	16,000	
	Tokyo Gas Co.	City of Yokohama	Fiscal Year 2023 introduction	everything	13,454	
	JFE Engineering Corporation	Yokohama Head Office	To be introduced sequentially from fiscal 2021	100% introduction in Yokohama area	5,000	
	The Bank of Mitsubishi UFJ, Ltd.	Branches and other facilities	Fiscal Year 2022	Installation rate 100%.	-	
Renewal of generators, hydrogen and ammonia utilization	The Nisshin Oillio Group, Ltd.	Isogo Isogo Office	Operating from FY2025	Renewal of gas turbine (8,000kW class)	1,200	
			From 2027 until 2030 one's turn to go out	Gas turbine 1% hydrogen co-firing per year	1,100	
Next Generation Fuel Bunkering	Mitsubishi Gas Chemical Company, Inc.	Port of Yokohama	Aiming for implementation in 2025	Supply and bunkering of fuel methanol to domestic and ocean-going vessels Implementation of	undecided	
Development and demonstration of various technologies	ENEOS Corporation	Central Research Institute of Technology	2025 Development of large electrolyzer and technological demonstration 2030s Social implementation have an eye on	Direct MCH®: Development of low-cost production technology for MCH, a type of hydrogen carrier	-	
			Scale-up at plant scale from FY2022 Started the demonstration of a new product line.	Development of synthetic fuel production technology	-	
			Starting from 2023	Demonstration of DAC technology	-	
			Starting from 2022	Chemical Lisa, which manufactures raw materials for tires from used tires. Ikle technology development	-	
	Tokyo Gas Co.	Tsurumi Ward	Demonstration from FY2022	Demonstration test of e-methane (synthetic methane) production	-	Preparing to acquire Clean Gas Certificate
Other	ENEOS Corporation	City of Yokohama	Fiscal Year 2014～	Operation of hydrogen stations (4 locations)	-	
	Mizuho Bank, Ltd.	Port of Yokohama	plan	New to support the formation of carbon neutral ports Creation of new financial support schemes	-	
	Mitsui E&S Co.	-	April 2024～	Widespread use of high-pressure, high-flow hydrogen compressors	-	
				Total Short- and Mid-term Initiatives	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 (mid-term)

Waterfront initiatives						
Details of Initiatives	Implementing Entity	Location	implementation period	Scale and Breakdown of Initiatives	Effects of the Project (CO2 reduction t/year)	remarks
Thermal decarbonization (Synthetic methane utilization, etc.)	The Nisshin Oillio Group, Ltd.	Isogo Isogo Office	FY2030～	Synthetic methane (e-methane) (minimum 1% of supply)	860	
Synthetic methane supply	Tokyo Gas Co.	City of Yokohama	Scheduled to be introduced gradually from FY2030 onward.	Supply of e-methane (synthetic methane)	undecided	The project is under consideration with the aim of introducing more than 1% of city gas in 2030. Effectiveness of the project will be examined in conjunction with future concretization.
				Total Mid-term Initiatives	860	

(3) Long-term (FY2050)

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

Waterfront initiatives						
Details of Initiatives	Implementing Entity	Location	implementation period	Scale and Breakdown of Initiatives	Effects of the Project (CO2 reduction t/year)	remarks
Energy-saving lighting equipment (LEDs) (flower) vase	Nissan Motor Co.	pasture land	plan	Conversion of factory lighting to LED	-	
Energy conservation in production facilities	JFE Steel Corporation	islets of Lantern Festival (Ogasawara)	plan	Energy saving by downsizing pumps, etc.	-	
Use of decarbonized electricity and fuels (CO2-free electricity, certificates, credits)	JFE Steel Corporation	islets of Lantern Festival (Ogasawara)	plan	From natural gas to carbon neutral fuels such as heating furnaces convert	-	
	The Nisshin Oillio Group, Ltd.	Isogo Isogo Office	plan	portion of a telegram received	600	
Renewal of generators, use of hydrogen and ammonia	The Nisshin Oillio Group, Ltd.	Isogo Isogo Office	plan	Gas turbine hydrogen co-firing GT: 60%, Firing: 100%.	15,700	
	IHI Corporation	Yokohama Office	plan	Gas engine power plant fuel conversion (City gas ⇒ ammonia) (4,000 kW)	undecided	
	City of Yokohama	Minato Mirai 21 District	Creation of ❑d map for 2050 in FY2023	Hydrogen utilization in district heating and cooling (Minatomirai Hydrogen Project) (boiler facilities, scale to be determined)	90,000	
Hydrogen use in LNG- and coal-fired power generation	JERA Corporation	-	undecided	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.
	Power Development Co.	Isogo Thermal Power Station	undecided	Transition of thermal power supply based on J-POWER BLUE MISSION 2050 (2 units)	-	J-POWER BLUE MISSION2050❑d In accordance with the map, high-efficiency coal-fired power plants will also select the most appropriate technology based on the characteristics of the location, and will contribute to the stable supply of electricity while reducing carbon emissions and decarbonization. *Although we presented the direction of transitions for our seven thermal power plants, including Isogo Thermal Power Plant, in May of this year, we may revise it according to the policy, power supply and demand situation, progress of industrial development, and other preconditions.

Waterfront initiatives							
	Details of Initiatives	party carrying out (e.g. a policy)	Location	implementation period	Scale and Breakdown of Initiatives	Effects of the Project (CO2 reduction t/year)	remarks
	Supply of renewable electricity	Power-X Corporation	Port of Yokohama	undecided	Introduction of renewable energy from offshore wind power by electric carriers	undecided	Yokohama City and TEPCO PG sign tripartite MOU (Apr. 24)
	Next Generation Fuel Bunkering	Idemitsu Kosan Co.	Honmoku and Minami Honmoku Wharf	plan	eMethanol fueling for container ships	undecided	eMethanol demand being calculated
	Development and demonstration of various technologies	ENEOS Corporation	Central Research Institute of Technology	implementation	MCH-FC Technology Development	-	
				implementation	Biofuel production technology development	-	
	Consideration of land use conversion	JFE Holdings, Inc.	islets of Lantern Festival (Ogasawara)	Fiscal Year 2023～	Land use shift to areas leading the way in carbon neutrality exchange	undecided	
					Total Long-term Initiatives	106,300	
					Total Promotion Project Initiatives	352,440	

(4) Reduction in CO_2 emissions

Table 28. CO2 Emissions Reduction Effects of Waterfront Decarbonization Initiatives

Item item	Total total
① CO_2 emissions in the base year (2013)	909,300 tons
(2) CO_2 emissions in the most recent year (2022)	6,394,000 tons
③ : Reduction of CO_2 emissions by port decarbonization promotion projects (2023-2050)	379,000 tons
④ ： Reduction of CO2 emissions from the base year (2050) ((1)-(2)+(3))	3,078,000 tons
⑤ ： Reduction ratio (④／①)	33.9% (in %)

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

4-1-2. initiatives for decarbonization at docks

The following table shows the Port of Yokohama's port decarbonization promotion projects (initiatives for decarbonization of wharves) and the entities responsible for implementing them. These are the current status of studies by each entity, and will be updated to reflect the future development of technologies that contribute to decarbonization, studies by each entity based on changes in social conditions, progress in inter-company cooperation, and participation by new entities.

(1) Short- to medium-term (FY2030)

Table 29. Efforts toward decarbonization at wharves (short- and medium-term)

Efforts at the wharf (in the terminal)						
Details of Initiatives	party carrying out (e.g. a policy)	Location	implementation period	Scale and Breakdown of Initiatives	Effects of the Project (CO2 reduction t/year)	remarks
Energy-saving lighting equipment (LEDs, etc.)	City of Yokohama	(inside a) terminal public facilities	~ FY2030	in the process of being adjusted	-	
	Yokohama Kawasaki International Port Co.	Minami Honmoku Wharf MC-4	Fiscal Year 2021	Six lighting towers, gantry crane lighting facilities, etc.	-	The effects of the project are accounted for in the introduction of renewable electricity.
		(nomadic) head of a family D-4	FY2025～	Six lighting towers, gantry crane lighting facilities, etc.	-	
		(nomadic) head of a family D-5	FY2025～	Four lighting towers, gantry crane lighting facilities, etc.	-	
	Yokohama Port Terminal Co.	Daikoku Pier C-1~4,L-1~8	FY 2014 - 2024	Installation rate 100%.	-	40%-50% of electricity consumption related to lighting curtailment
solar power (generation)	Yokohama Port Terminal Co.	Minami Honmoku Wharf MC-1,2	Fiscal Year 2014～	520kW	249	FIT
		Minami Honmoku Wharf MC-3	Fiscal Year 2015～	310 kW	184	FIT
	City of Yokohama	Daikoku Pier T-4	Fiscal Year 2014～	300kW	160	FIT
		Daikoku Pier Y-CC	Fiscal Year 2016～	24.5 kW	13	
Use of decarbonized electricity and fuels (CO2-free electricity, certificates, credits)	Yokohama Kawasaki International Port Co.	(nomadic) head of a family D-1	Fiscal Year 2022～	2,145 MWh/year	948	
		(nomadic) head of a family D-4	Fiscal Year 2022～	5,645 MWh/year	2,495	
		(nomadic) head of a family BC (before Christ)	Fiscal Year 2022～	9,459 MWh/year	4,181	
		Daikoku Pier T-9	Fiscal Year 2022～	675 MWh/year	299	
	Terminal lessee, etc.*	Minami Honmoku Wharf MC-1 to 4	~ FY2029 conceptual stage	27,000 kWh/year	10,176	
	Yokohama Port Terminal Co.	Daikoku Pier C-1	Fiscal Year 2022～	252 MWh/year	110	
		Daikoku Pier C-2	Fiscal Year 2022～	198 MWh/year	80	
		Daikoku Pier L-1-8	Fiscal Year 2022～	1,389 MWh/year	580	
		(nomadic) head of a family A-5,6	Fiscal Year 2022～	142 MWh/year	50	
		-	Fiscal Year 2023～	Use of J-credits (gasoline) (100% adoption rate)	16	
Introduction of decarbonized cargo handling machinery	Yokohama Kawasaki International Port Co.	(nomadic) head of a family 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.
		(nomadic) head of a family D-4	FY2024 - FY2027	Introduction of energy-saving gantry cranes (2 units)	-	
		Minami Honmoku Wharf MC-4	After 2026	Introduction of energy-saving gantry cranes (2 units)	-	
		(nomadic) head of a family BC (before Christ)	After 2026	Introduction of energy-saving gantry cranes (3 units)	-	
		(nomadic) head of a family MC-1,2	FY2020 - FY2024	Improvement of energy-saving gantry cranes (5 units)	-	
		(nomadic) head of a family BC (before Christ)	FY2021 - FY2023	Improvement of energy-saving gantry cranes (2 units)	-	
		(nomadic) head of a family BC (before Christ)	FY2025 - FY2026	Improvement of energy-saving gantry crane (1 unit)	-	
		(nomadic) head of a family D-5	After 2028	Improvement of energy-saving gantry cranes (3 units)	-	

Efforts at the wharf (in the terminal)

Details of Initiatives	party carrying out (e.g. a policy)	Location	implementation period	Breakdown of scale and initiatives	Effects of the Project (CO2 reduction t/year)	remarks
Introduction of decarbonized cargo handling machinery	Suzue Corporation, Sankyu Corporation, Sumitomo Warehouse Co, Tokyo International Terminal Corporation, Mitsubishi Logistics Corporation, Yokohama Port Mega Terminal Co.	Honmoku Pier BC	FY 2015 - FY 2023	Low-carbon RTGs 50% of total installed	501	
	Nippon Express Co. Kamihama Corporation	Honmoku Wharf D-1	~ FY2021	Low-carbon RTGs 87.5% adoption rate	374	
			FY2025 - FY2026	Low-carbon RTGs 100% of total RTGs installed	53	
	CMACGMJAPAN㈱	(nomadic) head of a family D-4	Fiscal Year 2013	Low-carbon RTGs 100% of total RTGs installed	701	
	APM Terminals Japan K.K.	Minami Honmoku Wharf MC-1~4	FY 2015 - FY 2023	Low-carbon RTGs 93% adoption rate	2,134	
			FY2025 - FY2026 conceptual stage	Low-carbon RTGs 100% of total RTGs installed	305	
	Terminal lessee, etc.*	Minami Honmoku Wharf MC-1~4	FY2027 - FY2029 conceptual stage	RTG 100% introduction rate	4,551	
			FY2027 - FY2029 conceptual stage	Reach Stacker 100% of installed base	2	
			FY2027 - FY2029 conceptual stage	Top Lifter 100% of total installed base	1,232	
			FY2027 - FY2029 conceptual stage	Forklift trucks: 100% of total forklift trucks installed	107	
			FY2027 - FY2029 conceptual stage	Trucks on premises 100% adoption rate	3,013	
	Mitsui E&S Co.	Port of Yokohama	FY2023 - FY2024	On-site demonstration of hydrogen-fueled cargo handling equipment (our company's NIAZE) One ❑ emission RTG to be fuel cell powered)	-	CO2 emissions are assumed to be ze❑.
				Total short- and medium-term in terminal	32,514	

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

Details of Initiatives	party carrying out (e.g. a policy)	Location	implementation period	Breakdown of scale and initiatives	Effects of the Project (CO2 reduction t/year)	remarks
Next Generation Fuel Bunkering	City of Yokohama	Port of Yokohama	-	Work with companies to implement initiatives	undecided	Assuming an increase in fuel types, listed for all periods.
Decarbonization of ships	Nippon Yusen Kabushiki Kaisha	Tokyo Bay	Fiscal Year 2024～	Ammonia Fueled Tugboats	-	New Energy and Industrial Technology Development Organization (NEDO) (NEDO) Green Innovation Fund Reference: GHG reduction rate of 60% or more compared to conventional vessels is planned.
		Port of Yokohama, etc.	Construction to be completed in 2025	(Asuka III) LNG Fueled Vessel / Onshore Power Support	-	Yusen Cruises Inc.
	City of Yokohama	Port of Yokohama	Fiscal Year 2024～	Participation in the Blue Visby Consortium	-	
			Fiscal Year 2023～	Use of Maritime Emissions Portal (Lightship)	-	
Installation of onshore power supply facilities	City of Yokohama	Honmoku Wharf A-4	Fiscal Year 2024～	Low-voltage onshore power supply facilities	5	Subsidy for International Strategic Port Rehabilitation Project (Yokohama Port Rehabilitation (International Strategic) Project)
		Daisan Bridge	April 2027～	High-voltage onshore power supply facility (for large cruise ships)	-	
	Yokohama Kawasaki International Port Co.	(nomadic) head of a family D-4,5	in planning conceptual stage	High-voltage onshore power supply facilities (for container ships)	-	
		Minami Honmoku Wharf MC-3,4	in 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 Wharf	Fiscal Year 2021～	everything	-	
		(nomadic) head of a family	From FY2025 onward	everything	-	
Incentives for environmentally friendly vessels	City of Yokohama	Port of Yokohama	Fiscal Year 2017～	Environmental Ship Index (ESI) System Programs by the Green Award Foundation LNG bunkering and LNG bunkering vessels	-	Assume that the increase in fuel types will lead to an increase in the number of types of . The following table shows the number of employees in the period.
				Inbound/Outbound Vehicles Vessels Medium/Short Term Total	5	

(2) Medium-term (FY2040)

Table 30. Efforts toward decarbonization at wharves (mid-term)

Efforts at the wharf (in the terminal)							
	Details of Initiatives	Implementing Entity	Location	implementation period	Breakdown of scale and initiatives	Effects of the Project (CO2 reduction t/year)	remarks
	Energy-saving lighting equipment (LEDs, etc.)	Terminal lessee, etc.*	Minami Honmoku Wharf MC-1 to 3	undecided conceptual stage	15 lighting towers, gantry crane lighting facilities, etc.	-	Effects of the project are accounted for in the introduction of renewable electricity.
			(nomadic) head of a family BC (before Christ)	undecided conceptual stage	13 lighting towers, gantry crane lighting facilities, etc.		
			(nomadic) head of a family D-1	undecided conceptual stage	Six lighting towers, gantry crane lighting facilities, etc.	-	
	Introduction of decarbonized cargo handling machinery	Yokohama Kawasaki International Port Co.	Minami Honmoku Wharf 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.
			(nomadic) head of a family BC (before Christ)	~FY2040 conceptual stage	Introduction of energy-saving gantry cranes (6 units)	-	
			New Honmoku Head Office	~FY2040 conceptual stage	Introduction of energy-saving gantry cranes (8 units)	-	
			Minami Honmoku Wharf MC-3	~FY2040 conceptual stage	Improvement of energy-saving gantry cranes (4 units)	-	
			Minami Honmoku Wharf MC-4	~FY2040 conceptual stage	Improvement of energy-saving gantry crane (1 unit)	-	
			(nomadic) head of a family BC (before Christ)	~FY2040 conceptual stage	Improvement of energy-saving gantry cranes (2 units)	-	
			(nomadic) head of a family D-1	~FY2040 conceptual stage	Improvement of energy-saving gantry cranes (3 units)	-	
		Terminal lessee, etc.*	Honmoku Wharf D-5	~FY2040 conceptual stage	RTG 100% introduction rate	925	
				~FY2040 conceptual stage	Top Lifter 100% of total installed base	227	
				~FY2040 conceptual stage	Forklift trucks: 100% of total forklift trucks installed	14	
				~FY2040 conceptual stage	Trucks on premises 100% adoption rate	549	
			Honmoku Wharf BC	~FY2040 conceptual stage	RTG 50% introduction rate	1,077	
				~FY2040 conceptual stage	Top Lifter Installation rate 13.3	113	
				~FY2040 conceptual stage	Trucks on premises: 22.9% of total	284	
	Total mid-term in terminal					3,189	

Efforts at the wharf (incoming/outgoing vessels and vehicles)						
Details of Initiatives	party carrying out (e.g. a policy)	Location	implementation period	Scale and Breakdown of Initiatives	Effects of the Project (CO2 reduction t/year)	remarks
Next Generation Fuel Bunkering	City of Yokohama	Port of Yokohama	-	Work with companies to implement initiatives	undecided	Assuming an increase in fuel types, for the entire period in
Decarbonization of ships	City of Yokohama	Port of Yokohama	Fiscal Year 2024~	Promotion and dissemination of the Blue Visby Consortium	-	
Incentives for environmentally friendly vessels	City of Yokohama	Port of Yokohama	Fiscal Year 2017~	Environmental Ship Index (ESI) System Programs by the Green Award Foundation LNG bunkering and LNG bunkering vessels	-	Assume that the increase in fuel types will lead to an increase in the number of types of . The following table shows the number of employees in the period.

(3) Long-term (FY2050)

Table 31. Efforts toward decarbonization at docks (long-term)

Efforts at the wharf (in the terminal)						
Details of Initiatives	Implementing Entity.	Location	implementation period	Scale and Breakdown of Initiatives	Effects of the Project (CO2 reduction t/year)	remarks
Introduction of decarbonized cargo handling machinery	Terminal lessee, etc.*	Honmoku Wharf BC	~FY2050 conceptual stage	RTG 100% introduction rate	1,077	
			~FY2050 conceptual stage	Top Lifter 100% of total installed base	735	
			~FY2050 conceptual stage	Reach Stacker 100% of installed base	122	
			~FY2050 conceptual stage	Trucks on premises 100% adoption rate	959	

Efforts at the wharf (in the terminal)							
	Details of Initiatives	party carrying out (e.g. a policy)	Location	implementation period	Scale and Breakdown of Initiatives	Effects of the Project (CO2 reduction t/year)	remarks
	Introduction of decarbonized cargo handling machinery	Terminal lessee, etc.*	Honmoku Wharf D-1	~FY2050 conceptual stage	RTG 100% introduction rate	990	
				~FY2050 conceptual stage	Top Lifter 100% of total installed base	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% of total forklift trucks installed	3	
				~FY2050 conceptual stage	Reach Stacker 100% of installed base	1	
	Total Long-term in terminal					4,398	

Efforts at the wharf (incoming/outgoing vessels and vehicles)							
	Details of Initiatives	party carrying out (e.g. a policy)	Location	implementation period	Scale and Breakdown of Initiatives	Effects of the Project (CO2 reduction t/year)	remarks
	Next Generation Fuel Bunkering	City of Yokohama	Port of Yokohama	-	Work with companies to implement initiatives	-	Assuming an increase in fuel types, for the entire period in
	Decarbonization of ships	Nissan Motor Co.	whole company	-	Adoption of Container Bio Fuel Vessels for Europe	-	
		City of Yokohama	Port of Yokohama	Fiscal Year 2024～	Promotion of the Blue Visby Consortium	-	
	Incentives for environmentally friendly vessels	City of Yokohama	Port of Yokohama	Fiscal Year 2017～	Environmental Ship Index (ESI) System Programs by the Green Award Foundation LNG bunkering and LNG bunkering vessels		Assume that the increase in fuel types will lead to an increase in the number of types of . The following table shows the number of employees in the 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
Only container terminal in	38,360	11,633	26,727
Total Initiatives for Inbound/Outbound Vehicle / Vessel Promotional Projects	5	0	5

The manual for preparing port decarbonization promotion plans (March 2023, Ministry of Land, Infrastructure, Transport and Tourism, Ports and Harbors Bureau, Industrial Ports Division) stipulates that the details of initiatives with "etc." added as an executing entity should be listed in 6-1. The plan, however, places emphasis on the list of port decarbonization promotion projects, which are described in section 4-1-2. We recognize that these initiatives do not currently fall under the category of port decarbonization promotion projects stipulated in Article 50-2-5 of the Port Law.

(4) Reduction in CO_2 emissions

Table 32. CO2 emission reduction benefits of decarbonization initiatives at wharves

Item item	In terminal*1	Inbound/outbound vessels/vehicles*2	Total total
(1) CO_2 emissions in the base year (2013)	37,000 tons	337,000 tons	374,000 tons
emissions in the most recent year (2022)	26,000 tons	326,000 tons	352,000 tons
③ : Reduction of CO_2 emissions through port decarbonization promotion projects (2023-2050)	26,000 tons	0 million tons	26,000 tons
④ : CO2 emissions from the base year Reduction (2050) ((1)-(2)+(3))	37,000 tons	11,000 tons	48,000 tons
⑤ : Reduction ratio (④/①)	100%.	3.3% (3.3%)	12.8% (in %)

1 Only figures for container terminals are reported.
2 CO2 emissions from vessels entering and leaving port are recorded as CO2 emissions from vessels at anchor (including anchorages). CO2 emissions from inbound and outbound vessels are not recorded because measures such as electrification and modal shift are qualitative at this point.

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 a rich ocean

The Port of Yokohama Port Decarbonization Promotion Project (Initiatives for Creating a Prosperous Sea) and its Implementing Entities

The following table defines the project and its implementing entities.

(1) Short- to medium-term (FY2030)

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

name (Business name)	position	scale	party carrying out (e.g. a policy)	implementation period	Effects of the Project (CO_2 absorption)	Remarks remarks
Preservation, rehabilitation and creation of blue infrastructure	Port area, etc.	Seawalls and wave dissipating blocks, Shallow water, etc.	City of Yokohama, etc.	~Fiscal year 2030	Approx. 150t-CO_2/year	

(2) Medium-term (FY2040)

Table 34. Efforts to create a rich ocean (mid-term)

name (Business name)	position	scale	party carrying out (e.g. a policy)	implementation period	Effects of the Project (CO_2 absorption)	Remarks remarks
Preservation, rehabilitation, and creation of blue infrastructure	Port area, etc.	Seawalls and wave dissipating blocks, Shallow water, etc.	City of Yokohama, etc.	~Fiscal year 2040	Approx. 200t-CO_2/year	

(3) Long-term (FY2050)

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

name (Business name)	position	scale	party carrying out (e.g. a policy)	implementation period	Effects of the Project (CO_2 absorption)	Remarks remarks
Preservation, rehabilitation and creation of blue infrastructure	Port area, etc.	Seawalls and wave dissipating blocks, Shallow water, etc.	City of Yokohama, etc.	～FY2050	Approx. 250t-CO_2/year	

(4) CO_2 Absorption Effect

Table 36. Effects of efforts to create a rich ocean on CO_2 absorption

	(1) ：CO_2 Absorption (FY2024)	② ： Accumulated amount of CO_2 absorption (Cumulative amount until FY2050)	③: Percentage increase (②/①)
total amount	Approx. 100t/year	Approx. 250t/year	2.5 times

4-2. the matters listed in Article 50 -2, paragraph 3 of the Port and Harbor Law

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

nashi (Pyrus pyrifolia, esp. var. culta)

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

nashi (Pyrus pyrifolia, esp. var. culta)

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

nashi (Pyrus pyrifolia, esp. var. culta)

(4) Matters related to the business of operating specified wharfs 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

nashi (Pyrus pyrifolia, esp. var. culta)

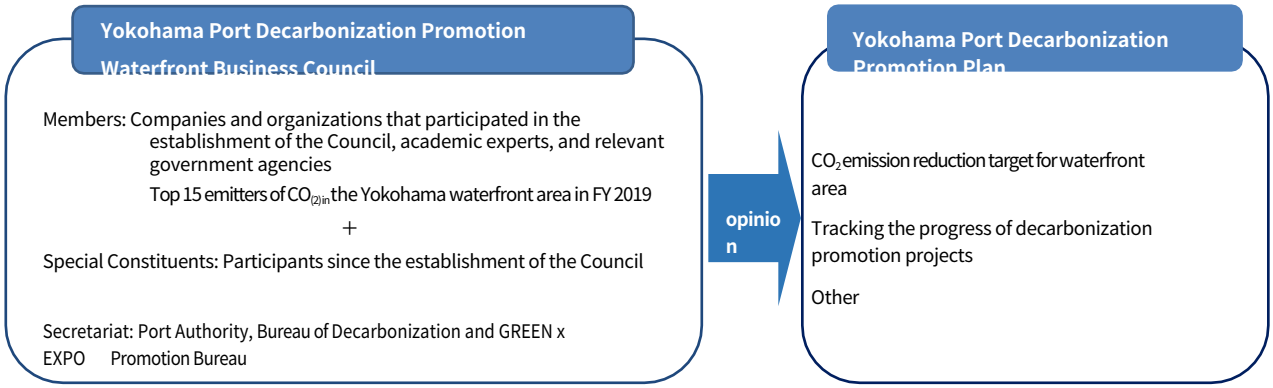
(5)Matters concerning the person who constructs or improves the port facilities for specified purposes provided for in Paragraph 2 of Article 55-7, Paragraph 1 of the Act with the loan of the port administrator provided for in Paragraph 1 of Article 55-7, Paragraph 2 of the Act.

nashi (Pyrus pyrifolia, esp. var. culta)

5. Matters related to the evaluation of the achievement status of the plan

5-1 . Implementation system for evaluation of plan achievement, etc.

This plan was developed by the City of Yokohama, the port administrator of the Port of Yokohama, based on the opinions of the Yokohama Port Decarbonization Council (hereinafter referred to as "the Council") and other organizations. The Plan will be developed by Yokohama City, the port administrator of the Port of Yokohama, based on the opinions of the Yokohama Port Decarbonization Promotion Council (hereinafter referred to as the "Council") and other relevant parties. The Council, etc. shall meet regularly to promote the Plan, and to confirm and evaluate the progress of the Plan. In addition, Yokohama City shall review the Plan in a timely and appropriate manner based on the results of the evaluation, the government's greenhouse gas reduction targets, and progress in technologies that contribute to decarbonization.



members

○ Company/Organization

AGC Corporation, NTT Communications Corporation, ENEOS Corporation, Ogishima Power Corporation, JFE Steel Corporation, JERA Corporation, Power Development Corporation, Toagosei Corporation, Tokyo Gas Co,

Toshiba Energy Systems Corporation, Nissan Motor Co,

(Hitachi, Ltd., City of Yokohama, Yokohama City University

○ Academic experts (titles omitted)

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

Akihisa Kuriyama, Research Manager, Research Institute for Global Environmental Strategies

○ Administrative Agencies

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

special member

pioneer in the field of business

(IHI Corporation, Idemitsu Kosan Corporation, JFE Engineering Corporation, and NYK Line, Ltd,

(Power-X Corporation, Mizuho Bank, Ltd., Mitsui E&S Corporation, Gas Chemical Company, Inc.

Figure 35. Implementation Structure of the Yokohama Port Decarbonization Promotion Waterfront Area Business Council

5-2 . Methodology for evaluating the achievement of the plan

The achievement status of the plan will be evaluated at regular meetings of the Council. In addition to the progress of the port decarbonization promotion project, the Council will also quantitatively assess the effects of decarbonization, including the reduction of carbon dioxide emissions through the aggregation of actual fuel and electricity consumption by the companies participating in the Council. The evaluation will compare specific numerical targets and actual performance for each target year, and for other years, it will assess whether or not the actual performance is achievable for the target year.

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

The main measurement (estimation) method is the method of extracting the coastal area from the estimates of the Bureau of Decarbonization and GREEN×EXPO Promotion. For GHG emissions from ships, we will use the estimates from the IMO GHG Study 2020, but we will also use the Maritime Emissions Portal of RIGHTSHIP (headquartered in Melbourne) to obtain estimates at a level closer to actual results and compare targets and estimates in the future. We will also consider using the Maritime Emissions Portal of RIGHTSHIP (headquartered in Melbourne) to obtain estimates that are closer to actual results and compare targets and estimates.

5-3 . efforts to promote the achievement 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 Yokohama waterfront area toward decarbonization, in the formation of a carbon neutral port at the Port of Yokohama.

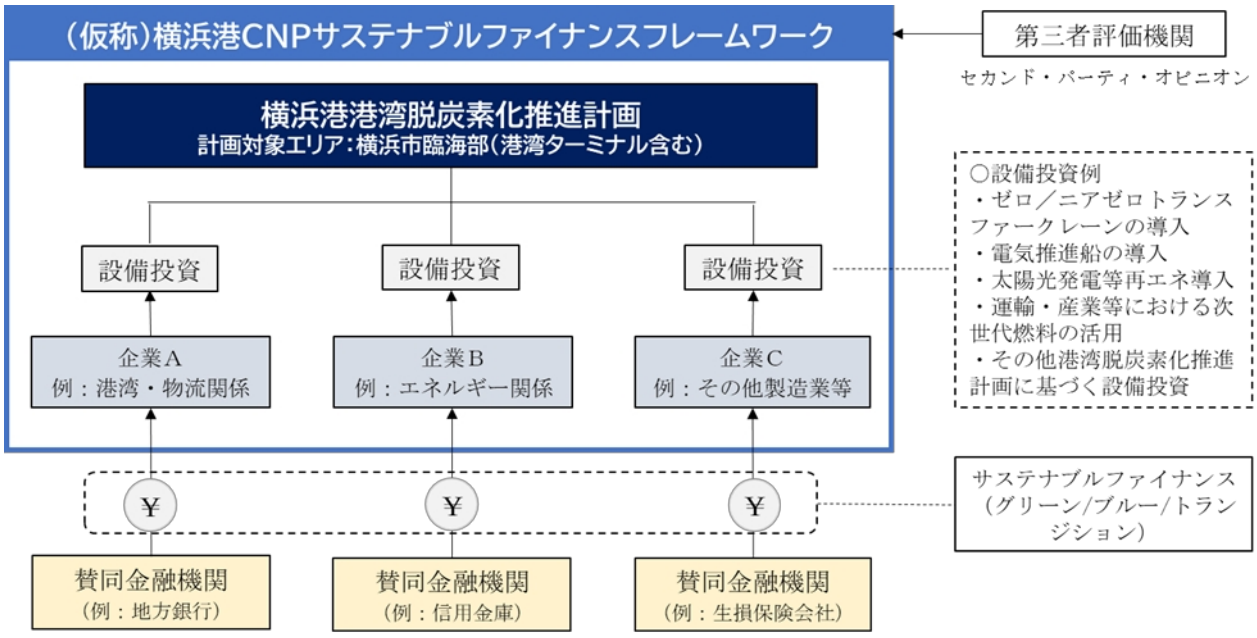


Figure 36. （Scheme Diagram of the Port of Yokohama CNP Sustainable Finance Framework (tentative name)

The size of the companies in 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 have originally made it difficult for them to engage in sustainable finance. Even if they were able to undertake the project, they may abandon it due to the cost of third-party evaluation, manpower, and other factors.

is considered to be a large number.

Therefore, Yokohama City will develop the "Port of Yokohama CNP Sustainable Finance Framework (tentative name)" 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 of a scale that would be difficult to address on their own, enable access to sustainable finance, and promote the carbon neutrality of the entire Port of Yokohama. This will also promote the carbon neutralization of the Port of Yokohama as a whole.

[Ref. 1

Of the 27 members of the Yokohama Port Decarbonization Council, 12 have developed a financial framework for sustainable finance (as of August 2024). (As of August 2024)

[Reference 2

Yokohama has selected DNV Business Assurance Japan K.K. as its third-party evaluation organization. The reasons for this selection include not only their track record as a certification body, but also their world-class market share in ship classification services and their track record in evaluating GX Economic Transition Bonds.

5-3-2. examples of sustainable finance applications

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

6. Matters deemed necessary by the port administrator with respect to the implementation of the port decarbonization promotion plan

6-1 . future initiatives to help promote decarbonization at ports.

6-1-1. Feasibility Study on Offshore Wind Power Generation and Green Power Procurement by Electric Carriers in the Kanto Coastal Area

(1) Responding to future increases in demand for electric power

In May 2024, the government began formulating the 7th Basic Energy Plan, and in a reversal from the previous outlook, electricity demand is expected to increase significantly in line with demand for data centers and other facilities.

Based on this background, in April 2024, the City of Yokohama, together with Tokyo Electric Power Grid Corporation and Maritime Power Grid Corporation (a wholly owned subsidiary of Power-X), concluded a "Memorandum of Understanding for the Establishment of a Green Power Supply Base in Response to Increased Electricity Demand in the Yokohama City Waterfront Area and the Realization of Land Power for Cruise Ships".

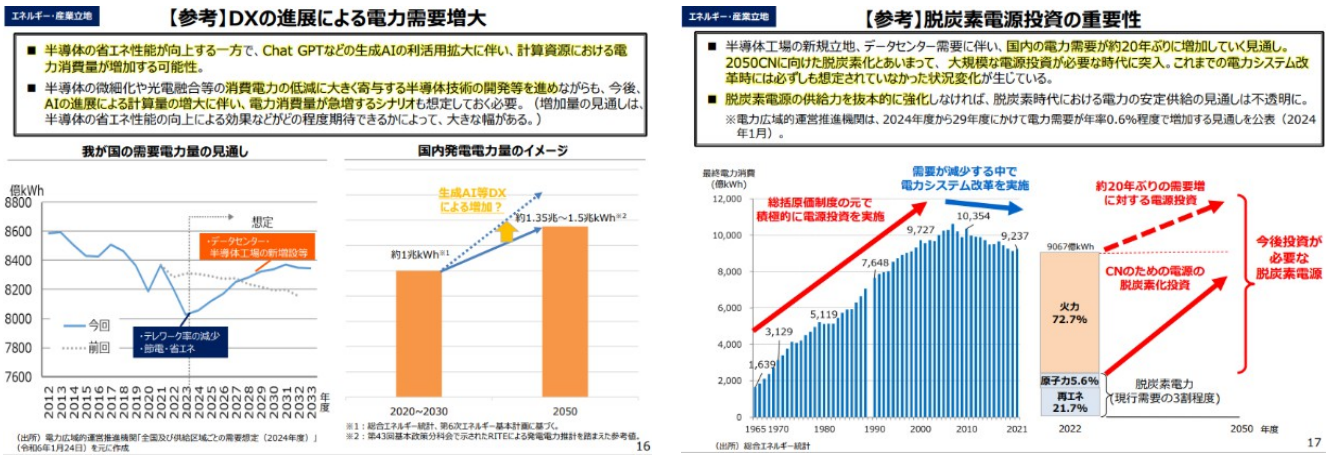


Figure 37. From the 11th GX Executive Meeting (May 13, 2024)

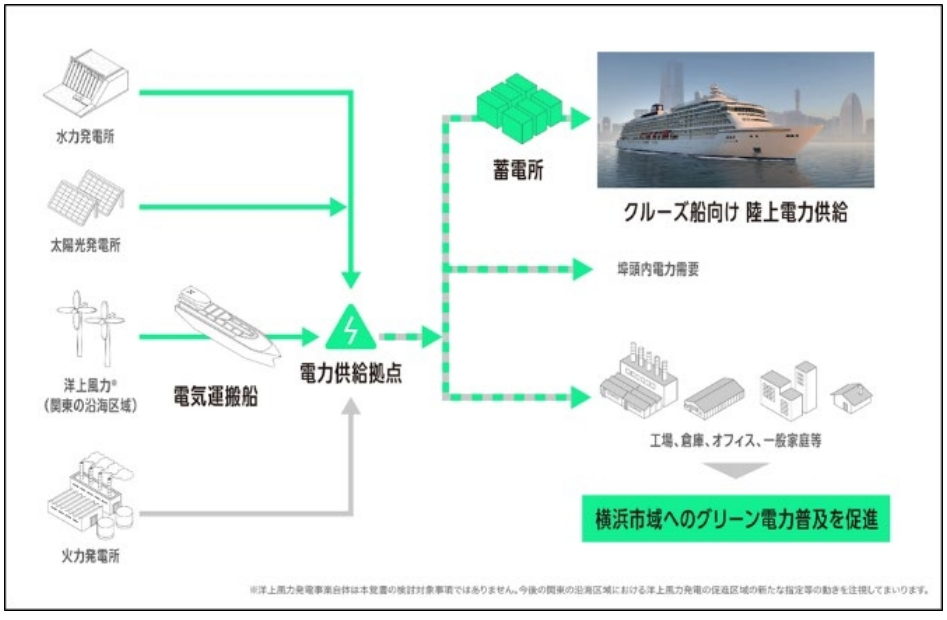


Figure 38. From Yokohama City, TEPCO PG, and MSI PG tripartite memorandum of understanding press release (April 24, 2024)

(2) Expectations for Floating Offshore Wind Power

The MOU on the previous page was signed in May 2023 as an extension of the MOU Yokohama City had signed with Power-X Corporation to study the utilization of electric carriers. One of the aims is to supply green power to the Tokyo metropolitan area, including Yokohama City, not through certificates but through actual power procurement.

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 is over 1,500 m. The government is developing a system to enable offshore wind power generation in the exclusive economic zone (EEZ). If the transportation of electricity by electric carriers becomes a reality, the Yokohama area will be the most advantageous as an area to receive electricity.

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

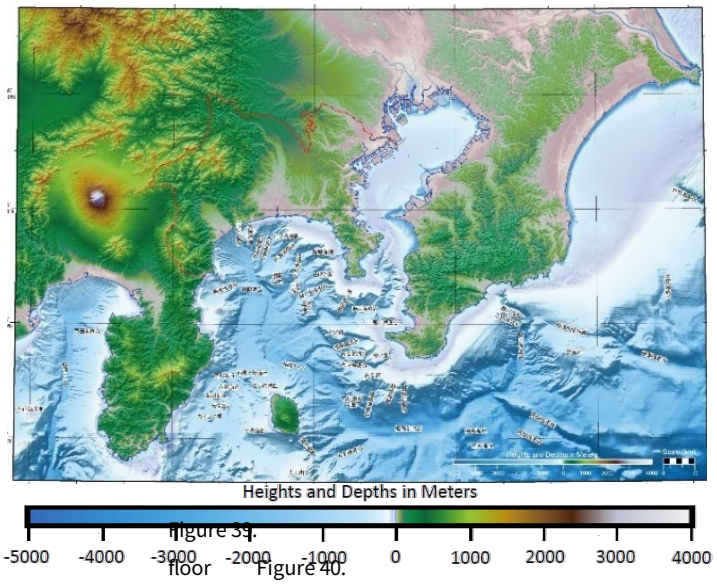


Figure 39. floor

Figure 40. Topographic map of Sagami Bay and Sagami-nada Sea Exclusive Economic Zone (EEZ)

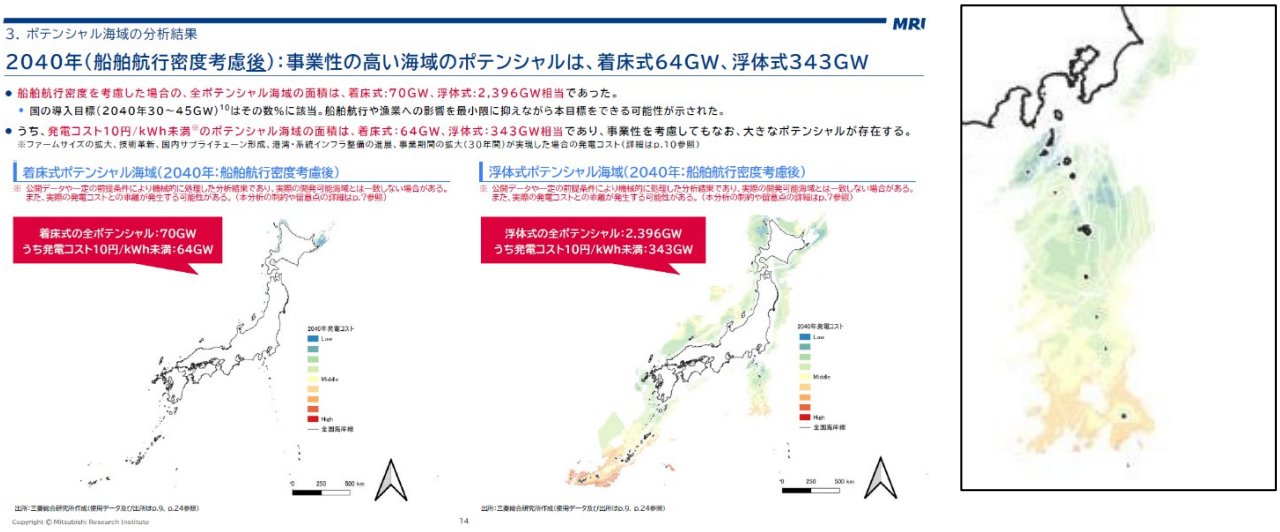


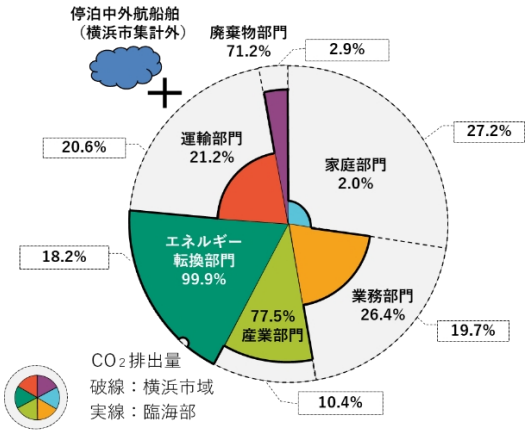
Figure 41. Offshore wind power potential sea area analysis (from Mitsubishi Research Institute, Inc. report)

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

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, $CO_{(2)}$ emissions from power generation projects are classified as "indirect emissions" when $CO_{(2)\ emissions}$ are compiled, so CO_2 emissions from power generation projects in the energy conversion sector are compiled from in-house power consumption and transmission losses within the power plant. 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 plan, which is dedicated to decarbonizing the waterfront area where energy companies are concentrated, we believe that it is necessary to attempt to determine the CO_2 emissions from power generation projects in terms of "direct emissions".

Therefore, the published document, "Greenhouse Gas Emissions Calculation, Reporting, and Publication System" by the Ministry of the Environment (hereafter, (referred to as the "Ministry of Environment SHK System.") We attempted to convert indirect emissions to direct emissions using the "Ministry of the Environment's SHK System". As a result, $CO_{(2)}$emissions from the Yokohama city area were about 1.6 times higher, and $CO_{(2)\ emissions}$ from the Yokohama waterfront area were about 3.3 times higher. Thus, when examining CO_2 emissions by focusing on individual points, the share of power generators in the energy conversion sector is overwhelming, and we expect each power generator to make efforts to address this issue.



■横浜市臨海部から排出される二酸化炭素排出量【間接】

（単位：万t）

2022年度[速報値]（令和4年度）	臨海部		横浜市域		臨海部/市域
	排出量	構成比	排出量	構成比	
エネルギー転換部門	294.4	46.0%	294.8	18.2%	99.9%
産業部門	130.7	20.4%	168.6	10.4%	77.5%
業務部門	84.1	13.2%	318.8	19.7%	26.4%
運輸部門	70.8	11.1%	334.2	20.6%	21.2%
廃棄物部門	33.7	5.3%	47.4	2.9%	71.2%
家庭部門	9.0	1.4%	440.4	27.2%	2.0%
停泊中外航船舶	16.7	2.6%	16.7	1.0%	100%
合　計	639.4	100.0%	1620.9	100.0%	41.2%

Figure 42. Carbon dioxide emissions from the Yokohama waterfront area (indirect emissions)

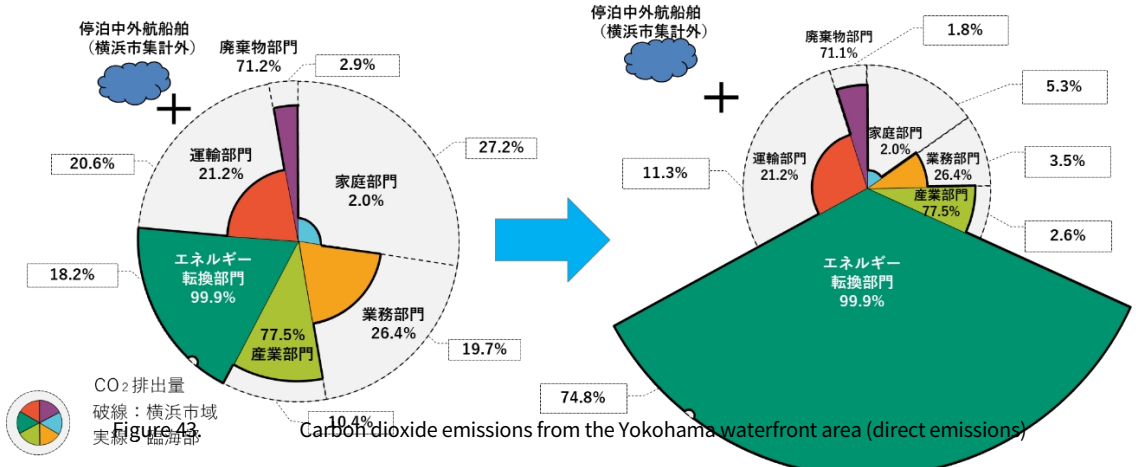


Figure 43. Carbon dioxide emissions from the Yokohama waterfront area (direct emissions)

横浜市域の排出量は約1．6倍になり、
横浜市臨海部の排出量は約3．3倍となる。

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

■ 2019-2021 Three-year average CO_2 emissions (unit: t)

		Energy-derived CO_2	Energy-Induced CO_2 (before power plant allocation)
Ogishima Power development of electrical power resources	Ogishima Power Station	68,116	2,620,343
	Isogo Thermal Power Station	361,120	6,235,148
JERA	Yokohama Thermal Power Station	135,897	6,875,186
JERA	Minami Yokohama Thermal Power Station	76,648	1,282,933
		641,781	17,013,610 →16,371,829 (Amount returned before allocation: Table 38, in red box)

However, the Negishi Refinery is not included in these calculations because the Ministry of the Environment does not publish figures for this refinery under its SHK system (figures for the Kashima Refinery, Sendai Refinery, etc. are publicly available).

Table 38. CO_2 emissions in the Yokohama waterfront area converted from indirect to direct emissions

（単位：万t）

2022年度［速報値ベース］	㋐ 市域間接排出量	電力由来	㋑ 市域間接排出-電力由来		発電所由来	㋒ 市域直接排出量		臨海部		臨海部/市域
	排出量	排出量	排出量	構成比	排出量	排出量	構成比	排出量	構成比	構成比
エネ転部門	294.8	6.9	287.9	30.7%	1637.2	1925.1	74.8%	1922.5	91.0%	99.9%
産業部門	168.6	100.9	67.7	7.2%	0.0	67.7	2.6%	52.5	2.5%	77.5%
業務部門	318.8	229.4	89.4	9.5%	0.0	89.4	3.5%	23.6	1.1%	26.4%
運輸部門	334.2	42.3	291.9	31.1%	0.0	291.9	11.3%	61.8	2.9%	21.2%
廃棄物部門	47.4	0	47.4	5.1%	0.0	47.4	1.8%	33.7	1.6%	71.1%
家庭部門	440.4	303.7	136.7	14.6%	0.0	136.7	5.3%	2.8	0.1%	2.0%
停泊中外航船舶	16.7	0.0	16.7	1.8%	0.0	16.7	0.6%	16.7	0.8%	100%
合　計	[1620.9]	683.3	937.6	100%	1637.2	[2,574.8]	100.0%	[2,113.5]	100%	82.1%

Figure 44. Location of energy-related infrastructure facilities around the Port of Yokohama

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

At this time, there are no plans to utilize this system. We will continue to consider the possibility.

6-3 . initiatives related to decarbonization that contribute to enhancing port and industry competitiveness.

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

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

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

(1) Methanol bunkering

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

Figure 45. Methanol Bunkering Simulation/Green Methanol Container Ship Nomenclature

(2) Ammonia bunkering

In July 2024, a consortium led by NYK Corporation realized the world's first Truck to Ship method of ammonia bunkering at Honmoku Wharf in the Port of Yokohama. The Port and Harbor Bureau of the City of Yokohama is coordinating the use of the wharf, and the Fire Department and other related departments are providing support for the consortium's efforts.

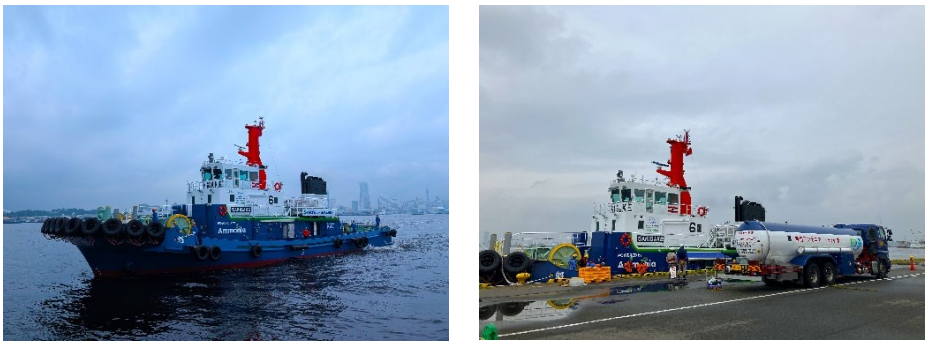


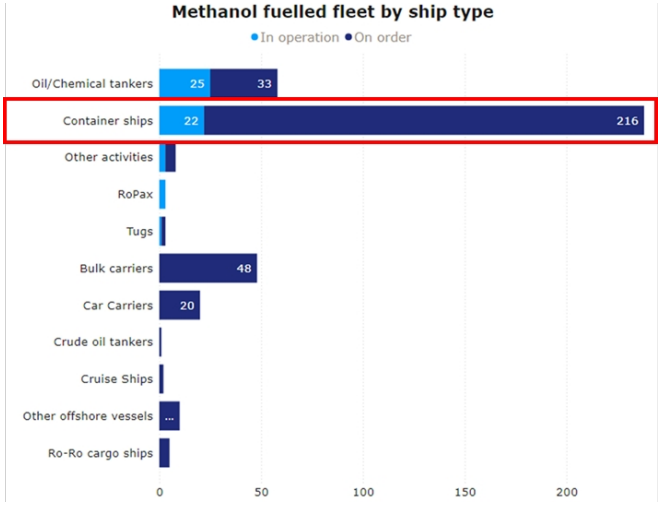
Figure 46. Bunkering by ammonia-fueled tugboat/Truck to Ship.

(iii) LNG bunkering

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

Table 39. Orders for Methanol Fueled Vessels

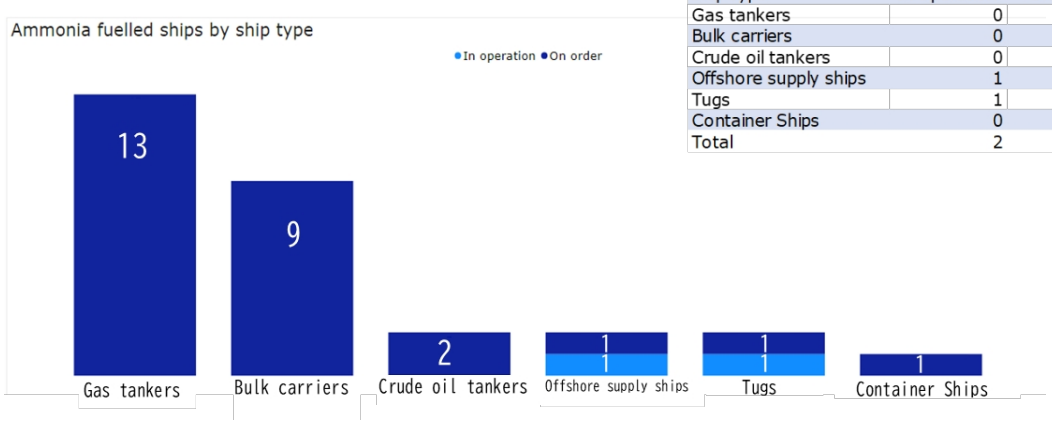
Ship type	In operation	On order	Total
Oil/Chemical tankers	25	33	58
Other activities	3	5	8
Container Ships	22	216	238
RoPax	3	0	3
Tugs	1	2	3
Bulk carriers	0	48	48
Car carriers	0	20	20
Crude oil tankers	0	1	1
Cruise ships	0	2	2
Other offshore vesseles	0	10	10
Ro-Ro cargo ships	0	5	5
Total	54	342	396



出典:DNV "Alternative Fuels Insight" https://afi.dnv.com/statistics/ (閲覧日2024.12.13)

Table 40. Orders for Ammonia Fueled Vessels

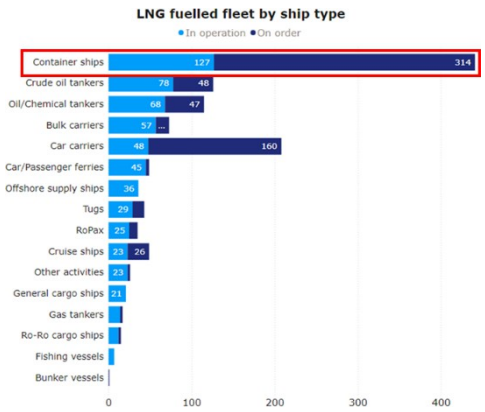
Ship type	In operation	On order	Total
Gas tankers	0	13	13
Bulk carriers	0	9	9
Crude oil tankers	0	2	2
Offshore supply ships	1	1	2
Tugs	1	1	2
Container Ships	0	1	1
Total	2	27	29



出典:DNV "Alternative Fuels Insight" https://afi.dnv.com/statistics/ (閲覧日2024.12.13)

Table 41. Orders for LNG Fuel Vessels

Ship type	In operation	On order	Total
Cruide oil tankers	78	48	126
Container Ships	127	314	441
Oil/Chemical tankers	68	47	115
Car/Passenger ferries	45	4	49
Bulk carriers	57	16	73
Offshore supply ships	36	0	36
Tugs	29	14	43
RoPax	25	10	35
Other activities	23	3	26
General cargo ships	21	0	21
Car carriers	48	160	208
Cruise ships	23	26	49
Ro-Ro cargo ships	12	3	15
Gas tankers	14	3	17
Fishing vessels	7	0	7
Bunker vessels	0	1	1
Total	613	649	1262



出典:DNV "Alternative Fuels Insight" https://afi.dnv.com/statistics/ (閲覧日2024.12.13)

(2) Incentive programs for environmentally friendly vessels

To promote the use of environmentally friendly vessels, the company has been participating in the Environmental Ship Index (ESI) program operated by the International Association of Ports and Harbors (IAPH) and the Green Award Foundation since 2017. The company participates in the ESI (Environmental Ship Index) program operated by the IAPH (International Association of Ports and Harbors) and the Green Award Foundation, and offers reduced entry fees for ocean-going vessels with an ESI index above a certain level or ocean-going vessels certified by the Green Award Foundation.

In addition, in order to promote and encourage LNG-fueled vessels 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. Actual Incentives for Environmentally Friendly Vessels

(Unit: Vessels)

	ESI (Environmental Ship Index)					GA*
	container ship	Car Carrier	LNG Carrier	Other	total amount	LNG Carrier oiltanker
Fiscal year 2023	542	93	30	12	677	16 (0)
Fiscal year 2022	375	112	39	13	539	1 (one)
Fiscal Year 2021	437	102	51	9	599	10 (3)
FY2020	528	124	43	12	707	6 (0)
Fiscal Year 2019	746	302	52	36	1136	12 (7)
Fiscal Year 2018	722	294	53	23	1092	4 (0)
Fiscal Year 2017	561	203	37	11	812	1 (0)

*Numbers in parentheses indicate the number of vessels covered by both the Green Award Foundation (GA) and ESI programs.

(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. These modes of transportation are expected to alleviate road congestion and expand their use as green logistics with energy-saving effects.

(1) Domestic transportation

Coastal shipping is an energy-efficient and environmentally friendly mode of transportation that can transport a large number of marine containers at one time, resulting in lower CO_2 emissions per ton transported compared to trucks. Currently, coastal shipping is used for transportation between the Pacific coasts of Hokkaido, Tohoku, Tokai, and Kansai.

(2) Container Barge Transportation

Container barges (dedicated container barges) connecting Yokohama to Tokyo and Chiba by sea can transport large volumes of marine containers, equivalent to more than 80 trucks at a time. In addition to reducing CO_2 emissions per ton transported through energy-saving effects, it is expected to reduce congestion in the Tokyo metropolitan area and on roads around ports.

(iii) Rail transportation

At the Port of Yokohama, rail transport is based at Yokohama Honmoku Station, and in October 2024, a major automaker and Nippon Express launched an initiative to regularly transport 40-foot marine containers by rail between Yokohama Honmoku Station and the Utsunomiya Cargo Terminal. Since the containers can be transported as they are in ocean containers without having to be transshipped into dedicated railroad containers, the initiative is expected to decarbonize the industry and improve logistics efficiency.

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

Figure 47. Departure ceremony held at Yokohama Honmoku Station/regular rail transport of 40-foot ocean containers

(4) Introduction of loading and unloading machinery (RTG) that can be converted to a future hydrogen fuel cell system

The Port and Harbor Bureau of the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) has announced that it will conduct a field demonstration of hydrogen-fueled cargo handling machinery at the Minami Honmoku Wharf MC-2 at the Port of Yokohama in February 2024. The project will be implemented from FY2022 to FY2025, and efforts are underway to improve the environment for the safe and smooth introduction of hydrogen-fueled cargo handling machinery at port terminals.

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

In addition, the Port and Harbor Bureau of the Ministry of Land, Infrastructure, Transport and Tourism established a "Study Group for the Introduction of Hydrogen-fueled Cargo Handling Machinery" in November 2024 to discuss the safe and smooth introduction and diffusion of hydrogen-fueled cargo handling machinery at port terminals. The City of Kobe is participating in this study group together with the Bureau of Port and Harbor of the Tokyo Metropolitan Government and the Kobe City Port and Harbor Bureau.

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 berthed in ports consume large amounts of electricity for refrigerated/freezer containers on container vessels and for cabins and service facilities on cruise ships. Therefore, as the first step of a land-based power supply facility to supply necessary power while the vessels are at anchor, Yokohama City constructed a land-based power supply facility for coastal cargo ships at the A4 public wharf in Honmoku Wharf in FY2024.

In July 2023, we joined the "Zero Emission Charger Promotion Council for Ships," which aims to promote general-purpose land-based power supply facilities for domestic vessels, since there is a problem that standards for land-based power supply facilities for domestic vessels are not standardized.

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

As a private-sector initiative, Tokyo Kisen Kaisha, Ltd. launched the tugboat "Taiga" in FY2022, powered by an electric propulsion system combining large-capacity lithium-ion batteries and a diesel generator. This is the first tugboat in Japan to be powered by a combination of large-capacity lithium-ion batteries and an electric propulsion system that is even more efficient than conventional electric propulsion systems.

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

Starting in fiscal 2022, Yokohama Kawasaki International Port Corporation (YKIP) and Yokohama Port Terminal Corporation (YPC) have switched the electricity they supply to their terminals and other facilities to electricity derived from renewable energy sources. YKIP supplies virtually CO_2-free electricity by combining non-fossil certificates, while YPC supplies electricity from renewable energy sources from power plants located in municipalities with which Yokohama City has concluded partnership agreements, as part of the "e.CYCLE" demonstration project promoted by Yokohama City to revitalize the Tohoku region through the use of electricity derived from renewable energy sources. The company is supplying real renewable energy power by utilizing renewable energy certificates from power plants located in municipalities with which Yokohama City has concluded cooperation agreements. Going forward, we will continue to procure CO_2-free electricity in cooperation with private companies.

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, Singapore Maritime Port Authority, and Wynnemieh, and is also considering how to form the GSC with its sister ports and other ports participating in the C40. As an example of one initiative, we have conducted a survey of overseas ports on how to determine greenhouse gas emissions, which is a prerequisite for the formation of the GSC, and are mutually exchanging information on approaches to GSC formation.

6-4 . Plan for Strengthening the Supply Chain for Hydrogen and Other Next-Generation Energies

Currently, the national government has released the results of publicly solicited applications for the Hydrogen Supply Infrastructure Development Project, and FS projects are being adopted in many parts of Japan. The city is continuing to discuss initiatives with business operators.

6-5. Roadmap

The roadmap will be reviewed based on the trends of technological development by companies, etc., as well as by periodic meetings of the Council. Efforts will also be made to understand the issues and measures to be taken, which will be reflected when the roadmap is reviewed.

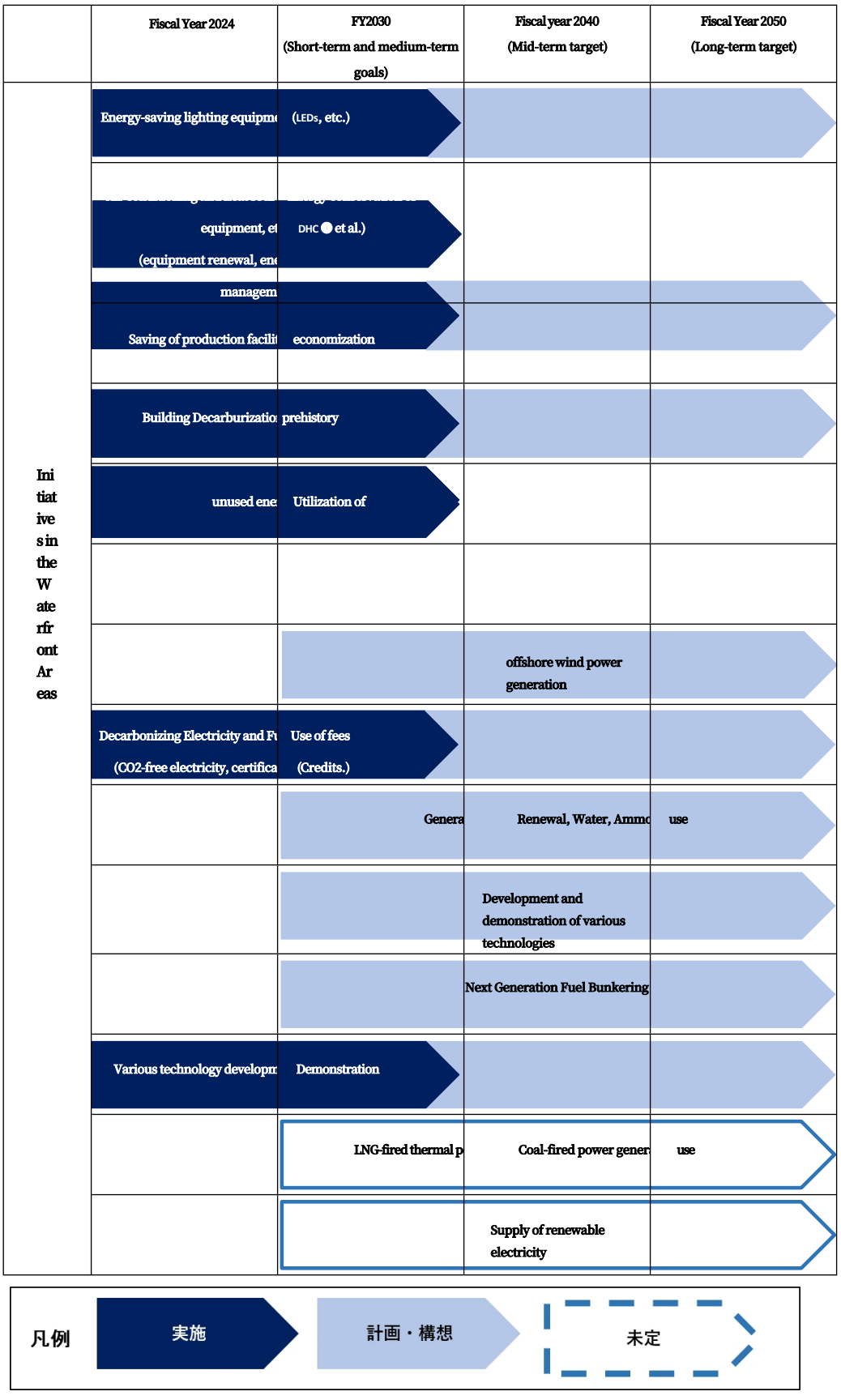


Figure 48. Roadmap for Achieving the Goals of the Yokohama Port Decarbonization Promotion Plan (Efforts in Critical Areas)

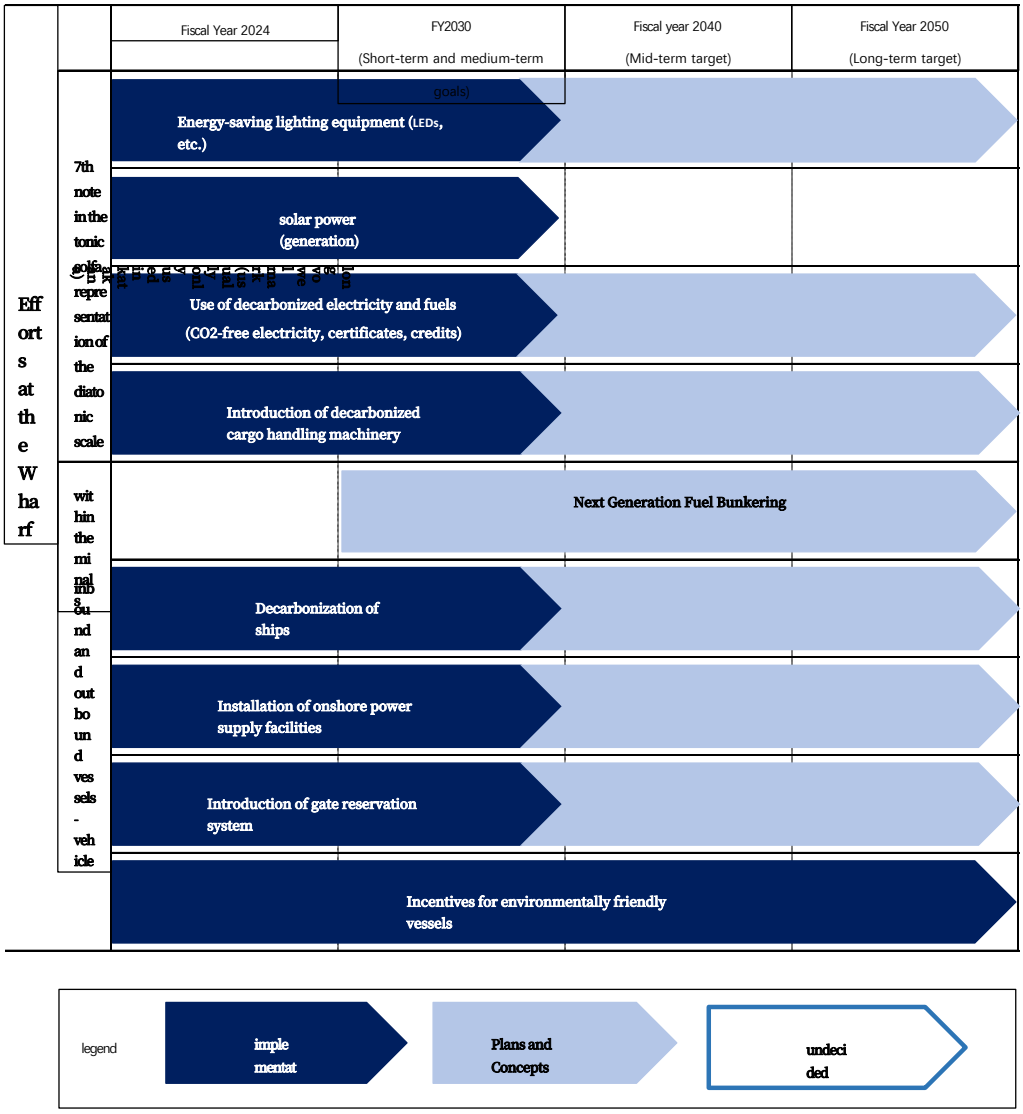


Figure 49. Roadmap for Achieving the Goals of the Yokohama Port Decarbonization Promotion Plan (Initiatives at the Wharf)

Carbon-Neutral Port Initiatives of Port of Yokohama

Japanese

Japanese

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