Kawasaki Carbon Neutral Industrial Complex Concept

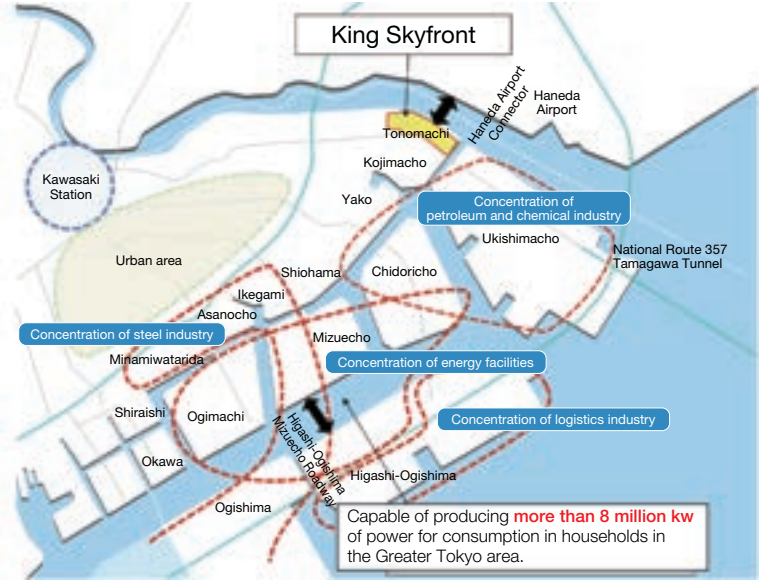
- A new form of industrial complex for a carbon neutral society -

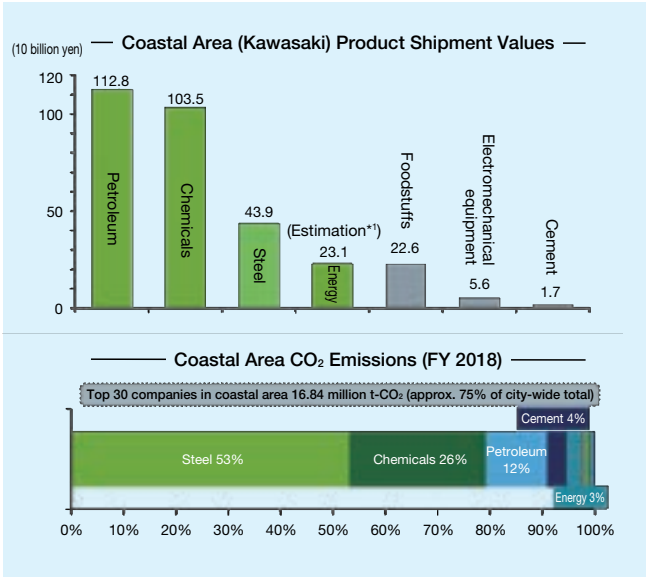
KAWASAKI CITY

Sate of the Kawasaki Coastal Area

The Kawasaki coastal area is an industrial zone with a high concentration of facilities such as petroleum refineries, chemical plants, steel manufacturers, and energy plants, which directly utilize massive quantities of non-renewable resources as fuel or raw materials.

High volumes of greenhouse gas emissions are produced to create steel, chemicals, petroleum, cement, and energy (in that order) at these coastal facilities, and the top 30 companies in this area account for approximately 70% of emissions for all of Kawasaki City.

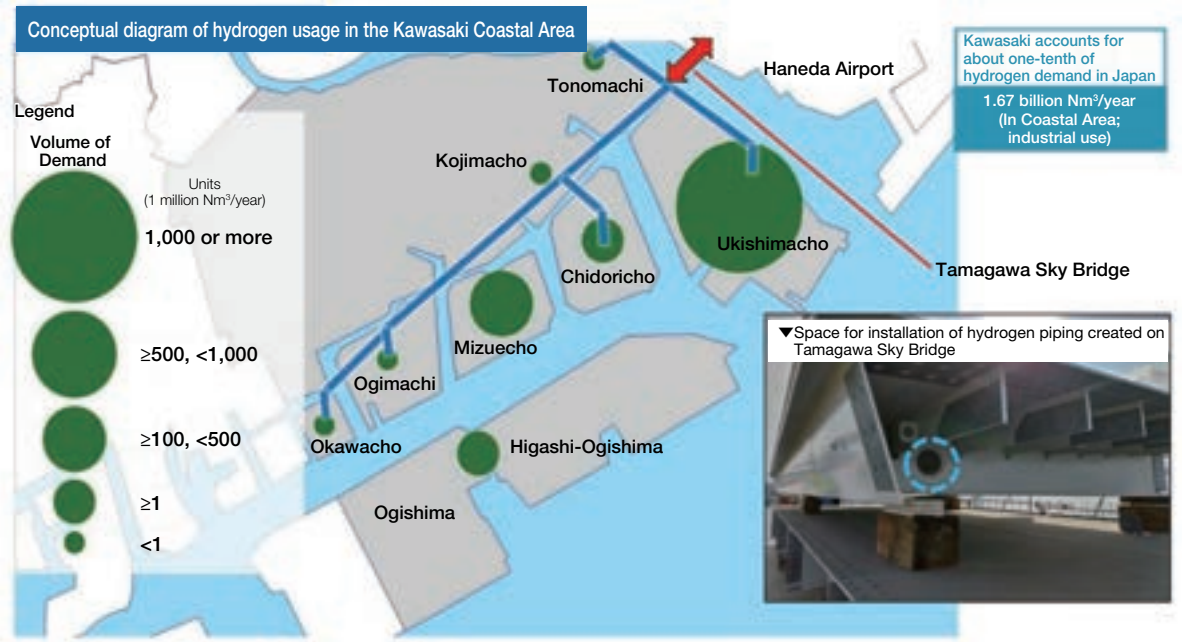




Features of Kawasaki Coastal Area

Features of industries contributing to energy and carbon neutral efforts in the Kawasaki Coastal Area

- Concentration of power generation facilities (power generation capacity of approx. more than 8 million kw) to provide an energy supply base for households in the Tokyo metropolitan area.
- Concentration of chemical companies to provide citizens with products and materials used in daily life.
- Concentration of recycling facilities for chemicals and plastics.
- Concentration of hydrogen-focused companies.
- Large demand and supply of hydrogen; about 10% of domestic market.
- Well equipped with hydrogen pipelines throughout the area.
- Pipelines and infrastructure for natural gas well developed; some lines are connected to Chiba to allow for interchange of energy and materials.



Blue line: Conceptual image of hydrogen pipeline

City Initiatives to Date

Low-carbon and decarbonization initiatives have been implemented thus far based on the **Coastal Area Vision** and the **Kawasaki Hydrogen Strategy**

Coastal Area Vision

- Kawasaki City developed a **"Coastal Area Vision"** in 2018.
- 13 leading projects are being promoted, including a **project to build a low-carbon industry area, a project to promote the use of hydrogenenergy,** and a project to promote asset utilization and investment.
- This vision **endeavors to strengthen the industrial competitiveness of the Kawasaki Coastal area,** including the establishment of an investment promotion system to encourage capital investment to improve the operation environment for manufacturers located in the area.

Kawasaki Hydrogen Strategy

- In 2015, the Kawasaki City **became the first in Japan to establish its Hydrogen Strategy.**
- This is promoted through three basic strategies: (1) Construct a hydrogen supply system, (2) Expand the use of hydrogen across multiple fields, and (3) Raise public awareness.
- Various projects are being implemented in collaboration with companies, the Japanese government, and other entities, centered on the **Kawasaki Coastal Area Hydrogen Network Counci** established in 2013.

Collaborative Projects

World's first demonstrated creation of an international hydrogen supply chain (by AHEAD)

The Advanced Hydrogen Energy chain Association for technology Development (AHEAD) transported hydrogen, converted into liquid methylcyclohexane, by sea from Brunei to be extracted for hydrogen power generation at a refinery in the Kawasaki Coastal Area in a demonstration in December 2020.

Dehydrogenation plant at Toa Oil Keihin Refinery

World's first demonstration of producing low carbon hydrogen from used plastic and using it as energy in a hotel (by RESONAC, formerly known as Showa Denko)

Hydrogen produced from used plastic at RESONAC's Kawasaki Works is transported by pipeline to the Kawasaki King Skyfront Tokyu REI Hotel in Tonomachi for use in electricity and heat via the hotel's fuel cells. (Ended in March 2022)

Kawasaki Works, RESONAC
(Gasification plant)

Kawasaki King Skyfront Tokyu REI Hotel
(Utilizes hydrogen fuel cells)

Many additional projects have also been implemented.

Concept Background

Acceleration of decarbonization

Government's "Carbon Neutral Declaration" (Oct. 2020)

Presenting a vision for the future of the Coastal area and working toward the realization of a carbon neutral society in 2050, we create a new industrial complex area that will lead Japan to carbon neutrality.

Industrial Complexes' Role in Shift to Carbon Neutrality

Due to the large volumes of non-renewable resources used in petroleum and chemical industrial complexes, significant reductions in CO_2 emissions are required in order to shift to a carbon neutral society. As such, industrial complexes have the potential to play the following roles moving forward.

(1) The role of acting as contributors to a carbon neutral society by developing businesses that further such efforts in a wide area

(2) The role of adapting complexes in an effort to reach carbon neutrality

Industrial complexes must take on both roles above and **make itself carbon neutral** in order for society at large to achieve carbon neutrality.

(1) Complexes which contribute to a carbon neutral society
Developing businesses that further such efforts in a wide area

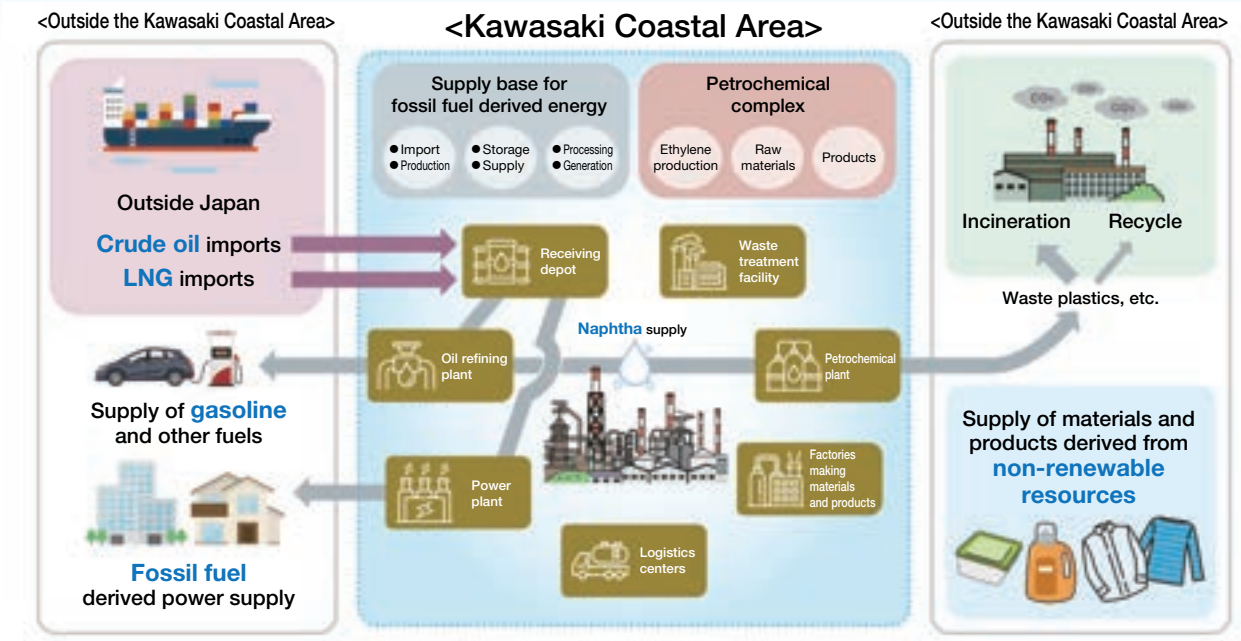
(2) Complexes which adapt to reach carbon neutrality
Adapting the complexes in a shift towards carbon neutrality

Mission Statement

As the world's frontier,
forge the path
towards a carbon neutral society;
form an industrial complex
that citizens can be proud of,
with concentration and continuous
development of industries that
are in-sync with the lives of citizens.

Concept Structure

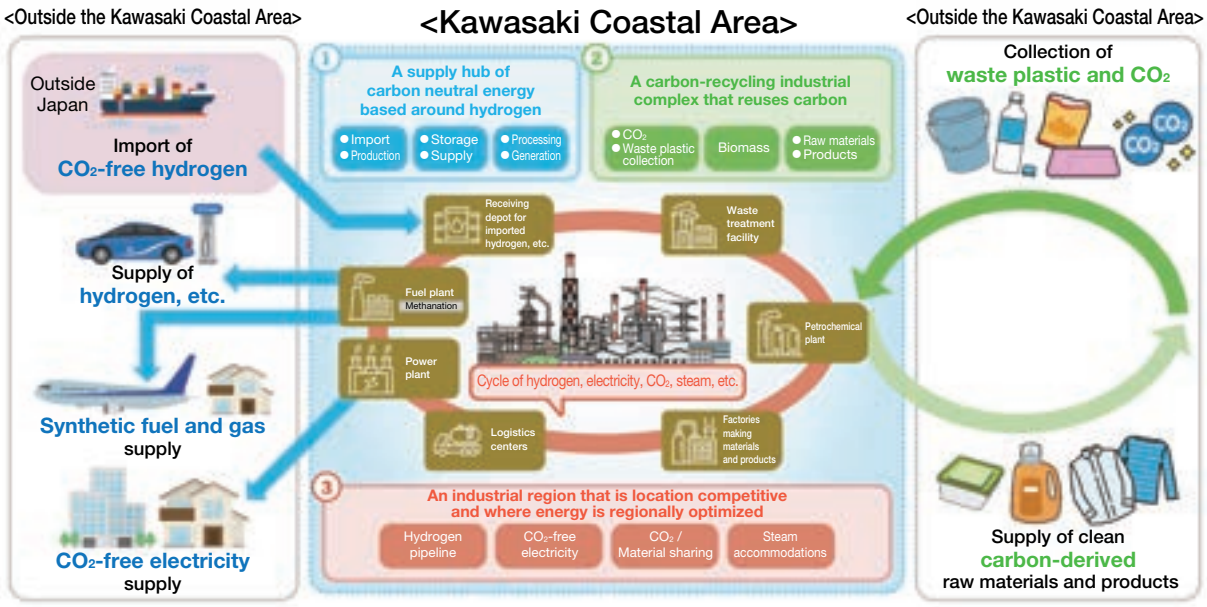
Diagram of the current Kawasaki Coastal Area



The area is a fossil fuel energy supply hub that imports and processes fossil fuels such as LNG and crude oil from outside Japan, and supplies them to the Greater Tokyo area in the form of gasoline, electricity, etc.

The area is a petrochemical complex that manufactures various materials and products from naphtha refined from crude oil (a certain percentage of waste plastics and other materials are incinerated).

Diagram of the Kawasaki Coastal Area industrial complex in 2050



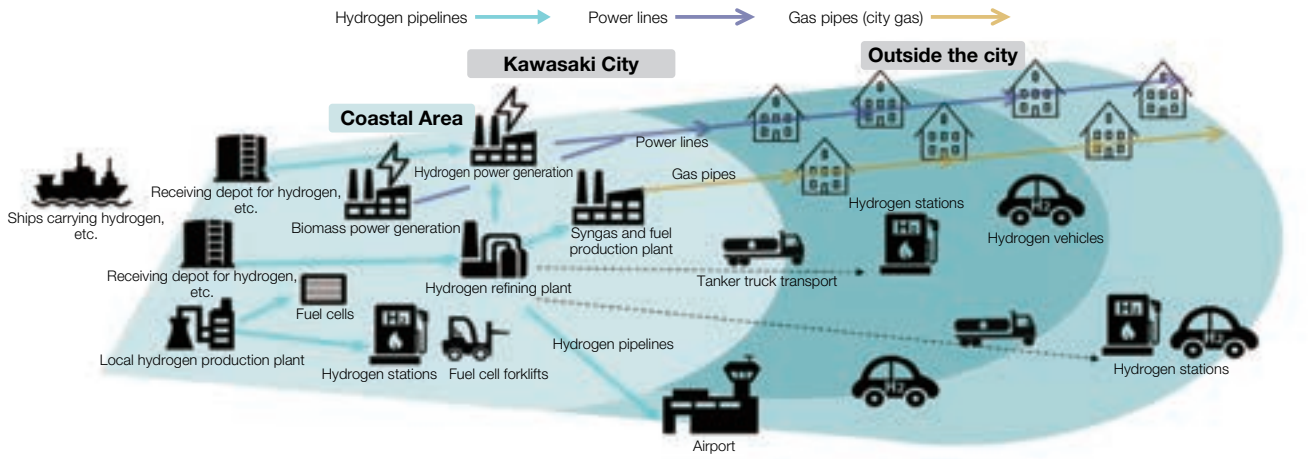
A carbon-neutral energy supply hub has been formed, producing mobility fuel, electricity, etc. from overseas and regional CO_2-free hydrogen and other resources and supplying them to the Tokyo metropolitan area.

A carbon-recycling industrial complex has been formed, manufacturing materials and products from recyclable carbon resources, such as waste plastic from the Tokyo metropolitan area and CO_2 from inside and outside the Coastal Area.

A location-competitive industrial region with a world-class, stable, resilient, and clean energy network has been formed, where electricity, gas, hydrogen, and other forms of energy and utilities are regionally optimized.

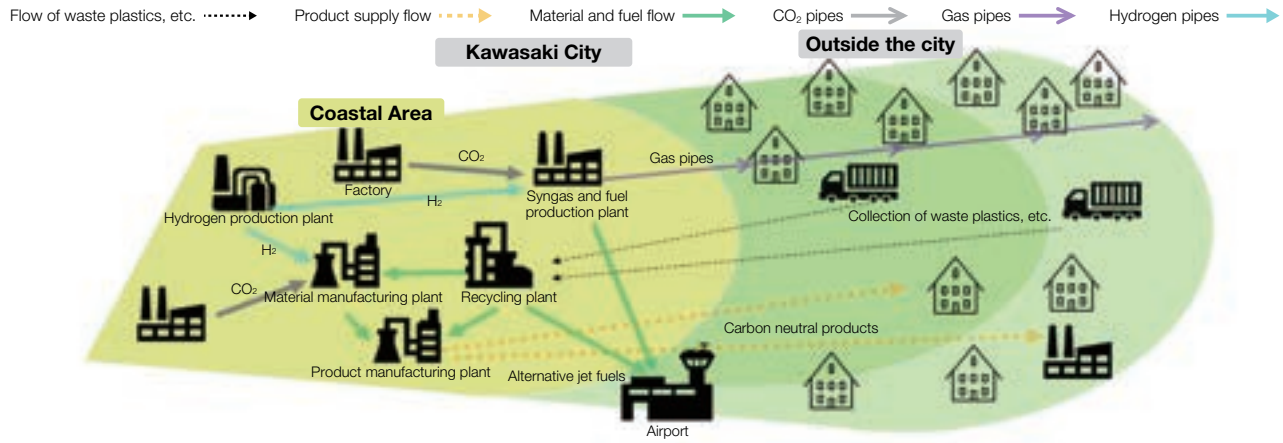
(1) Building a carbon-neutral energy supply hub centered around hydrogen

A carbon-neutral energy supply hub has been formed, producing mobility fuel, electricity, etc. from overseas and regional CO_2-free hydrogen and other resources and supplying them to the Tokyo metropolitan area.



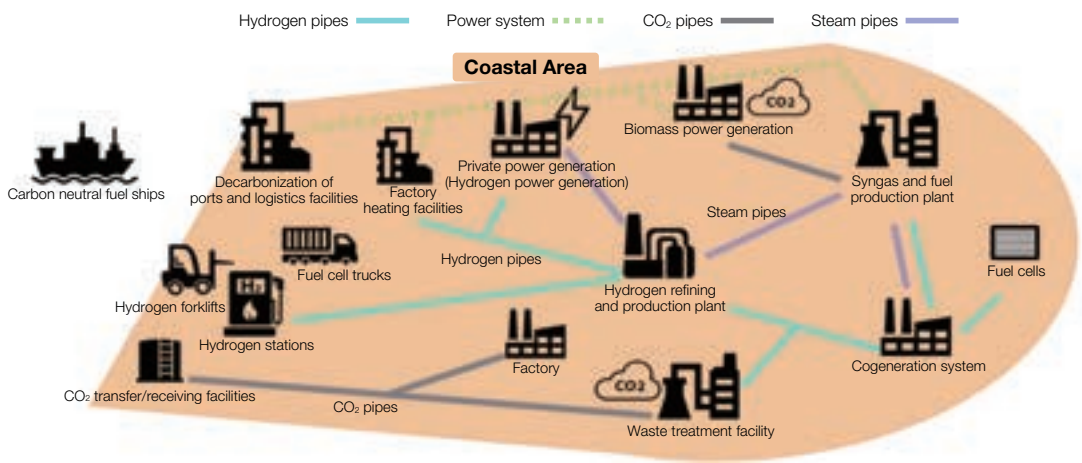
(2) Building a carbon-recycling industrial complex

A carbon-recycling industrial complex has been formed, manufacturing materials and products from recyclable carbon resources, such as waste plastic from the Tokyo metropolitan area and CO_2 from inside and outside the Coastal Area.



(3) Formation of an industrial region that is location-competitive and where energy is regionally optimized

A location-competitive industrial region with a world-class, stable, resilient, and clean energy network has been formed, where electricity, gas, hydrogen, and other forms of energy and utilities are regionally optimized.



Direction of Efforts

Kawasaki Hydrogen Strategy

(1) Building a supply system for CO_2-free hydrogen, etc.

- **Advance initiatives to build a supply system for CO_2-free hydrogen, etc.** which will bring in a cheap, stable supply of hydrogen from overseas for use in constructing an energy supply base for the Tokyo metropolitan area.
- Advance initiatives to build a regional supply system for CO_2-free hydrogen which utilizes locally produced and consumed hydrogen extracted from waste, as well as hydrogen, etc. produced from fossil fuels in processes which recover CO_2.

(2) Expanding demand for CO_2-free hydrogen, etc.

- Advance **initiatives to introduce hydrogen and alternative energy solutions for large-scale demand equipment such as generators and boilers** in local and neighboring industrial areas in anticipation of the large-scale demand from industrialization of hydrogen energy.
- Advance initiatives to **introduce hydrogen powered industrial vehicles, etc,** based on anticipated rise in demand due to the qualities and advantages of hydrogen-use.
- Advance initiatives to introduce carbon-recycled methane, synthetic fuels, etc. created in processes expected to utilize hydrogen.
- Advance initiatives to expand the number of hydrogen stations and FCVs (Fuel Cell Vehicles) in an effort to spread the use of hydrogen into the daily lives of citizens.

(3) Improvement of social acceptability

- Publish information to improve public and commercial awareness and carry out efforts to **promote understanding of the safety and effectiveness of hydrogen** in order to improve acceptance of CO_2-free hydrogen, etc. throughout society.

Carbon recycling strategy

(1) Expand recovery of carbon resources

- Promote further categorical separation of waste and advance efforts to **introduce new separation, collection, and processing technologies for recycling plastic waste** in the industrial complex in order to effectively utilize waste plastics which are not currently recycled.
- Expand utilization of recyclable CO_2 and separation and recovery of CO_2 produced from Coastal Area industries for effective use.

(2) Introduction of innovative recycling methods

- Advance the **introduction of new technologies and promote collaborative efforts among businesses** for the manufacturing of materials, products, aviation fuel, etc. from carbon resources such as waste plastics, bio-resources, CO_2, etc.

(3) Promoting understanding among citizens and businesses

- Implement **efforts to improve public and commercial understanding of carbon recycling** in order to obtain the cooperation of citizens and organizations in further waste separation and recycling of waste plastics, etc.

Strategy for regional optimization of energy

(1) Regional optimization of electricity use

- Advance the effective use of local power grids and carbon-neutral energy resources in order to **reduce energy consumption, strive for carbon-neutrality, and shift towards use of electricity** in local companies and port facilities.

(2) Regional optimization of heat utilization

- Advance efforts for **reduced power consumption and shift to carbon neutrality through the effective use of previously unused heat resources** in local companies and port facilities through planned utilization of local hydrogen pipe infrastructure and carbon-neutral energy resources such as hydrogen.

(3) Expand effective utilization of CO_2, raw materials, etc.

- Advance efforts to **expand the use of piping infrastructure designed for the area** since energy, CO_2, raw materials, water, wastewater, and more can be optimized between companies via such piping.

The City's Role in the Strategy

Promotion of business-to-business cooperation	● **Promote business-to-business collaboration projects** by establishing the **"Kawasaki Carbon Neutral Industrial Complex Formation Promotion Council"** (public-private sector council). ● **Conduct foundational research** into private power generation equipment and heat utilization **in order to optimize the area for carbon neutrality.**
Promotion of region-to-region cooperation	● Collaboration in the **Tokyo Bay area**, including the Keihin coastal region, focusing on hydrogen utilization. ● Share common issues such as regulatory compliance **throughout the complex** and work towards addressing said issues with government regulators. ⇒**Promote the spread of efforts in Kawasaki to other regions, as well as collaborative efforts with other regions**
System Proposals / Regulatory Responses	● Demand **proposals for systems, regulatory reforms**, and carbon neutral product/energy evaluation systems **based on the needs of local companies** ● Fully utilize national strategic special zones and special systems.
Providing guidance on locations	● **Attract carbon neutrality-focused facilities and research institutions** to low-use / underutilized land.

Form a model region
that will drive Japan's carbon neutrality

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