

Yokohama's "Hydrogen Society" Initiatives

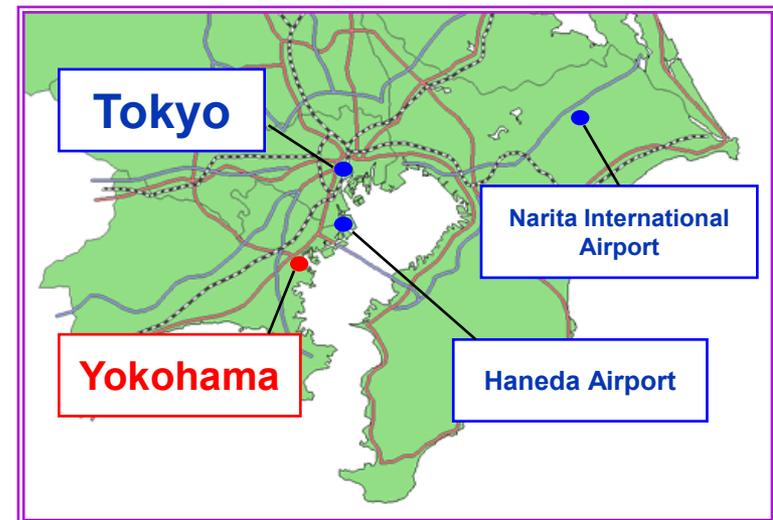
An aerial photograph of Yokohama, Japan, showing a dense urban landscape with numerous skyscrapers and buildings. The city is situated along a large body of water, with a prominent harbor area in the foreground. Several large ships, including a cruise ship, are docked at the piers. The sky is clear and blue, and the overall scene depicts a modern, developed city.

Climate Change Policy Headquarters, City of Yokohama

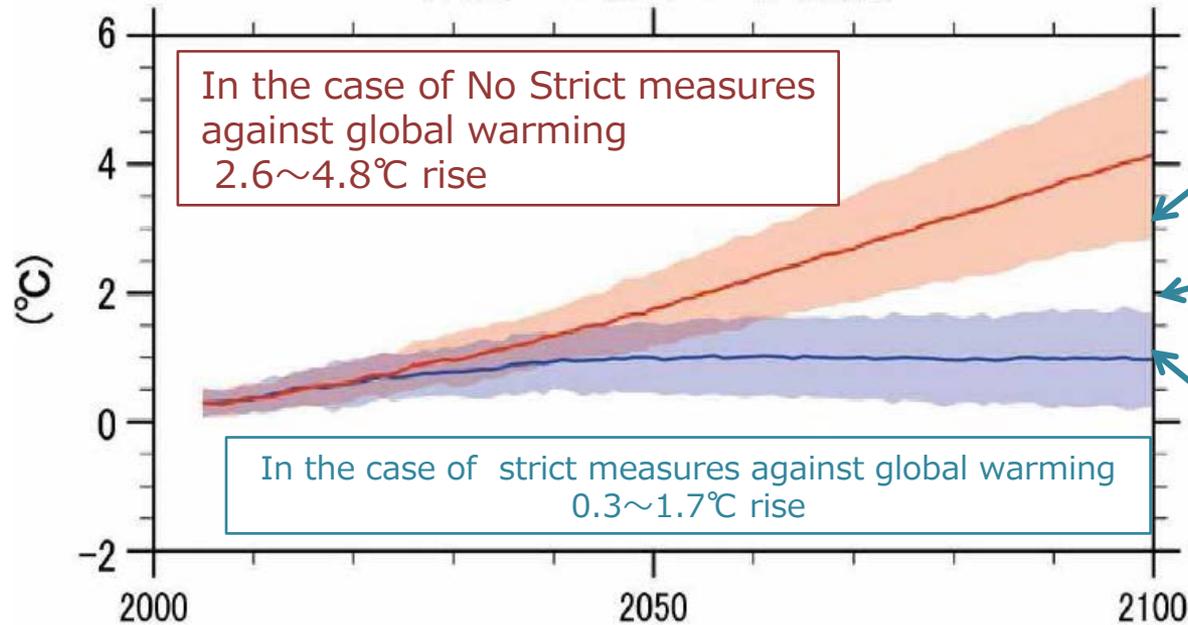
Overview of Yokohama



- An international port city
 - Port opened in 1859
- Population: approx. 3.73 million
 - Largest municipality in Japan
- Gross production: approx. ¥12.5 trillion (approx. \$115 billion USD)
- 21 minutes from Haneda Airport (Tokyo)



Future prediction and risk of average world temperature



(Source) IPCC Fifth Assessment Report AR5

3 °C rising : Risks such as sea level rise due to large scale irreversible loss of ice sheet

2 °C rising : Extremely high risk to the Arctic Ocean and coral reefs

1 °C rising : Risks of extreme phenomena (thermal waves, extreme precipitation, coastal flooding, etc.)



Flood adjustment by Tsurumi River multipurpose water reservoir

(Oct 6th 2014)

1. Energy saving / Low carbon

- Because high energy efficiency is realized by utilizing fuel cell, we can significantly save energy. Since carbon dioxide is not discharged at the utilization stage, it can be energy that does not emit carbon dioxide by utilizing hydrogen derived from renewable energy or by combining CCS* at the time of production.

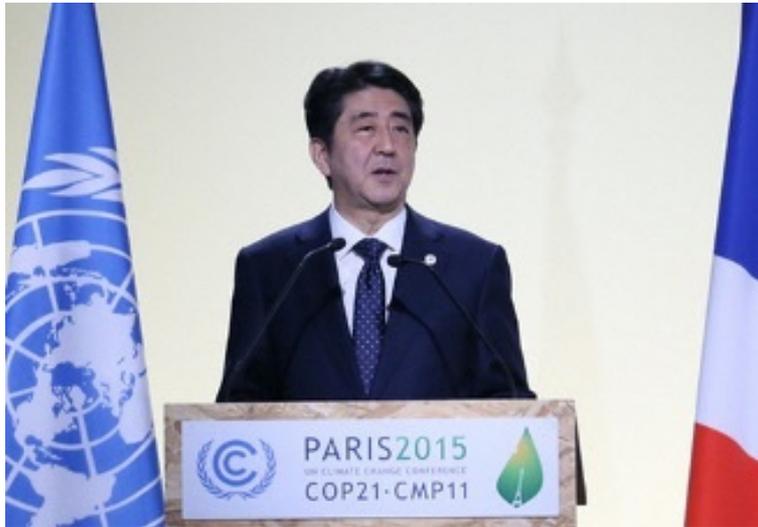
*CCS: Recovery and storage of carbon dioxide

2. Disaster-resistant town development · Diversification of energy supply sources

- Stationary fuel cells and fuel cell vehicles / buses can be used as emergency power supplies
- It can be manufactured from various primary energy sources such as unused energy such as by-product hydrogen and crude oil-associated gas, renewable energy, etc. There is a possibility that it will be added to the choice of energy other than fossil fuel in the future.

3. Industry Promotion / Regional Revitalization

- The base of fuel cell related industry is wide and Japan has strong competitiveness
- In hydrogen production, it is also possible to utilize regional resources such as renewable energy. Therefore, there is a possibility that it will lead to local areas.



Source: Department of Foreign Affairs

Remark of Prime Minister Abe

【 COP21 Summit Meeting (November 30th 2015) 】

- The key to achieving both climate change countermeasures and economic growth is to develop innovative technologies
- To realize a **carbon neutral society** we will work on the development of **hydrogen production, storage and transport technology**.

New Yokohama Mid-term 4-year plan 2018~2021 (Under development)

In Yokohama City, "Yokohama City Basic Concept (Long-Term Vision)" was formulated in June 2006 as the guiding principle which is the basis of the city administration looking at the next 20 years (about Year 2025 AD) of Yokohama.

The " New Yokohama Mid-term plan " is a four-year plan that embodies policies and processes aimed at realizing the urban image aimed at by the basic concept and is currently being studied for formulation in the autumn of 2018.

Hydrogen utilization is positioned in Strategy 2 "Environmentally advanced city full of flowers and greenery" and Basic policy 10 "Realization of a large city model of measures against global warming and energy policies.

- "As part of efforts to introduce and expand renewable energy, hydrogen energy, etc., we will investigate fuel production of sewage sludge and hydrogen production by biomass. "
- "In order to promote the spread of next-generation vehicles, we will introduce vehicles such as EV and FCV and promote the installation of infrastructure equipment such as hydrogen stations."

Yokohama city Action Plan for Global Warming Countermeasures

This is a plan to determine policies on the suppression of greenhouse gas emissions in the entire Yokohama area.

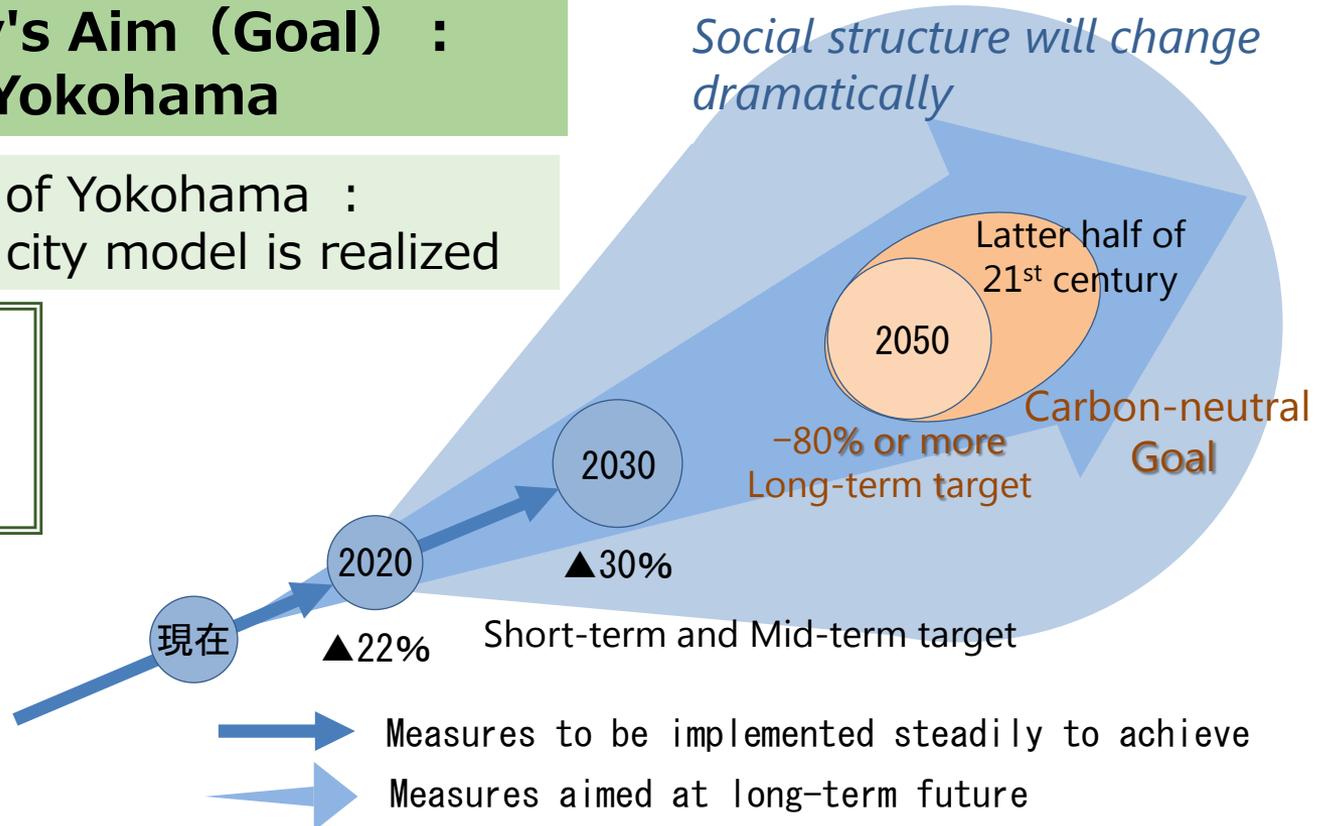
Today, based on the trends of the world after the adoption of the Paris Agreement and SDGs, revision work is in progress while working closely with the "New Mid-Term Four Year Plan 2018 - 2021" under formulation.

Yokohama City's Aim (Goal) :
Zero Carbon Yokohama

The future image of Yokohama :
Sustainable big city model is realized

Three Powers

- ①【Choice】
- ②【Creation】
- ③【Collaboration】



Yokohama city Action Plan for Global Warming Countermeasures

- Positioning the future image "town that is skillfully using renewable energy" and promote the utilization of hydrogen energy to realize a hydrogen society with a view to the future.
- Major measures
 - Examination of digestion gas increase using MBT (Mechanical Biological Treatment) system
 - Accept the city's biomass to sewage facilities and increase digestion gas as a raw material of hydrogen by methane fermentation utilizing the existing digestion tank
 - Promoting of surface use of hydrogen etc.,
 - Promoting of construction of hydrogen stations
 - Promoting of diffusion of fuel cell vehicles (FCV)
 - Promoting of diffusion of fuel cell bus



Efforts of Yokohama

(Promoting of introduction of fuel cell vehicles)

Fuel cell vehicles

- Introduced 10 fuel cell vehicles in total for public vehicles
Planning to introduce three vehicles in fiscal 2018.
- Implemented subsidies for purchasing FCV for citizens and business operators.
(Budget in 2018 : 2.5million yen (2,300 USD) per car × 60
- About 90 fuel cell vehicles spread in the city (at Dec.2017)

Fuel cell bus

- With the "Rugby World Cup 2019TM*" as the opportunity, we will work on introducing the FC bus to the Yokohama municipal bus.
* Seven games including the final game will be held in Yokohama



Public vehicle (FCV)



FC-Bus
"SORA (Concept model) "
(Source: TOYOTA)

Efforts of Yokohama (Promoting construction of hydrogen stations)

Hydrogen stations

- Six* commercial hydrogen stations are developed and operated.
(Fixed type is 4, mobile type is 2 and simple type is 1.)
* This number is the highest in municipalities.
- Implementation of construction cost for promotion
(Budget in 2018 : Fixed type 40million yen (373,000 USD), mobile type 1.2million yen (11,200USD), simple type 10million yen (93,300USD)

Yokohama's Hydrogen Stations

<Fixed type>

- ① Asahi Ward (opened Feb 2015)
- ② Izumi Ward (opened Feb 2015)
- ③ Minami Ward (opened Mar 2016)
- ④ Kohoku Ward (opened Mar 2017)

<mobile type>

- ⑤ Naka Ward (opened Nov 2015)
- ⑥ Tsuzuki Ward (opened Feb 2016)

<simple type>

- Tsurumi Ward (opened Mar 2018)

- ◆ Hydrogen production shipping center (Naka Ward)
※ Hydrogen is supplied to stations inside and outside the city

- ★ City Hall



Fixed type :
Tsunashima
Hydrogen Station

Source:
JXTG Energy Co., Ltd.

Mobile type :
Oosanbashi
Hydrogen Station



Mobile type :
Renewable Energy
Hydrogen Station
(Kanagawa Prefecture)

Efforts of Yokohama

(Promoting dissemination of stationary fuel cells)



Home fuel cells (Ene-Farm)

- Approximately 13,000 house fuel cells (Ene-Farm) are using in the city (at the end of Mar 2018)
- Implemented subsidies for purchasing house fuel cells for citizens. (Budget in 2018 : 30,000yen(280USD) per unit ×300)



Home fuel cells (Ene-Farm)
(Source: Tokyo Gas Co., Ltd.)

Fuel cells of industrial or commercial use

- Commercial fuel cells (250Kw) will be introduced in the new city hall building to be used from 2020
- Self-contained hydrogen fuel cell system was installed at Yokohama Port Distribution Center located in Yokohama Port, one of Japan's largest comprehensive logistics facilities. Demonstration experiments such as power peak cutting and utilization of emergency power supply are carried out there.
- Implemented subsidies for purchasing fuel cells for business. (Budget in 2018 : 100,000yen(930USD) per 1KW, total is up to 2.5million yen per unit)



New City Hall



Self-supporting hydrogen
fuel cell system

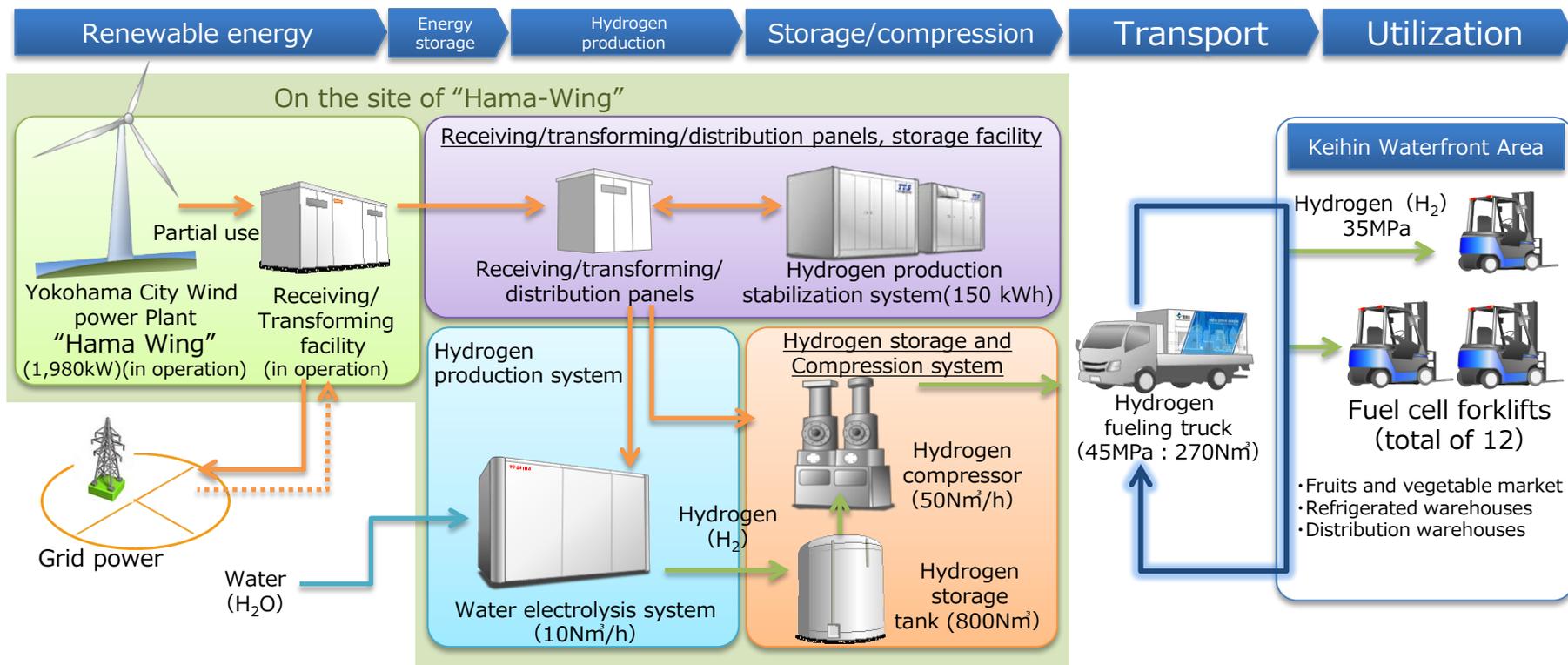
(Source : Toshiba Energy Systems Co., Ltd.)

Efforts of Yokohama

(Demonstration project of building a Community-Integrated Low-carbon Hydrogen Supply Chain in Keihin Waterfront area)



In collaboration with private enterprises and related municipalities, a demonstration project is under way to build a low-carbon hydrogen supply chain model utilizing renewable energy in the Keihin Waterfront area.
【 Ministry of the Environment commissioned project 】



Efforts of Yokohama

(Demonstration project of building a Community-Integrated Low-carbon Hydrogen Supply Chain in Keihin Waterfront area)

Yokohama City Wind power Plant
"Hama Wing"



In this project, part of the renewable energy power of "Hama Wing" is utilized

Water electrolysis system



Water is electrolyzed by the power of "Hama Wing" to produce carbon dioxide-free hydrogen. (Flexible hydrogen production is possible according to the changing wind power generation) amount)

Hydrogen production stabilization system
(Storage battery system)



A rechargeable battery system reusing used batteries of hybrid cars is installed. Even when wind power is not enough, stable hydrogen production and supply are possible.

Hydrogen storage tank



Hydrogen for 2 days is stored for stable supply of hydrogen. The tank's hydrogen is pressurized by the compressor and loaded into the fueling truck.

Hydrogen fueling truck



A simplified hydrogen-filled car was first introduced in Japan. Hydrogen compressed to 45 MPa is brought to the customer and fueled in the site.

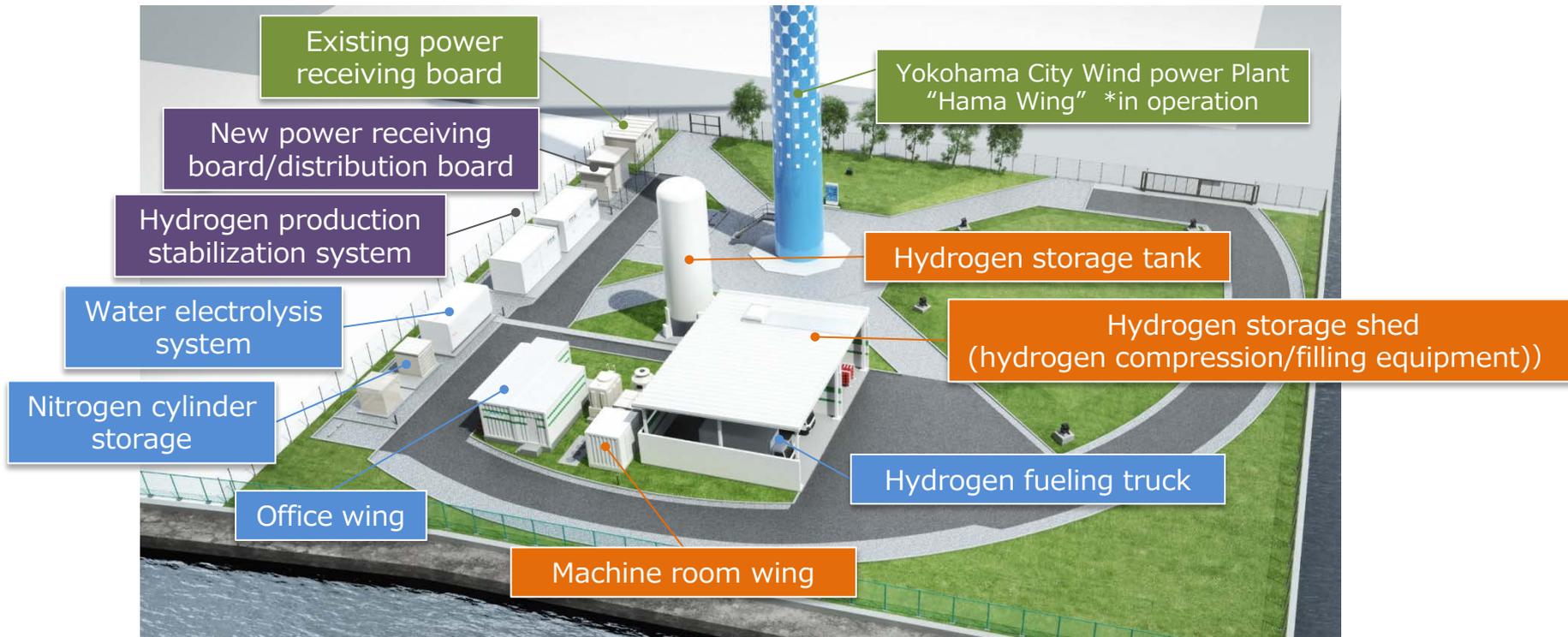
Fuel cell forklifts



Fuel cell forklift trucks were introduced in 4 places such as the Yokohama central wholesale market authentic fruit part. Carbon dioxide emissions of zero are realized when using.

Efforts of Yokohama

(Demonstration project of building a Community-Integrated Low-carbon Hydrogen Supply Chain in Keihin Waterfront area)



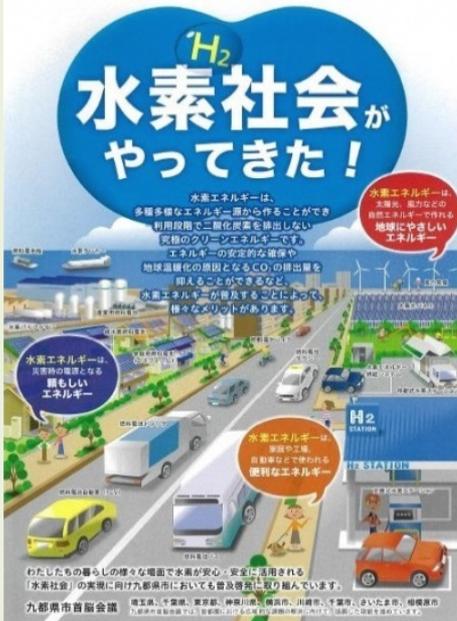
【 Verification and examination contents through demonstration (excerpt) 】

- Verification of reduction of carbon dioxide by construction of low-carbon hydrogen supply chain by this demonstration project (Estimated that it is possible to reduce carbon dioxide by 80% or more as compared with the past)
- Estimation of allowable cost in consideration of environmental value in addition to existing operation cost at the place where fuel cell forklift is installed.
- Verification of the current high cost can be lowered through economies of scale, deregulation etc
- Study of a feasible deployment model that developed the model of this demonstration project

Efforts of Yokohama (Public awareness)



In cooperation with neighboring municipalities etc., we conducted test drive and exhibition of fuel cell vehicles at various events such as public awareness event of next-generation automobile etc.



Creation of a leaflet for easy understanding of hydrogen energy



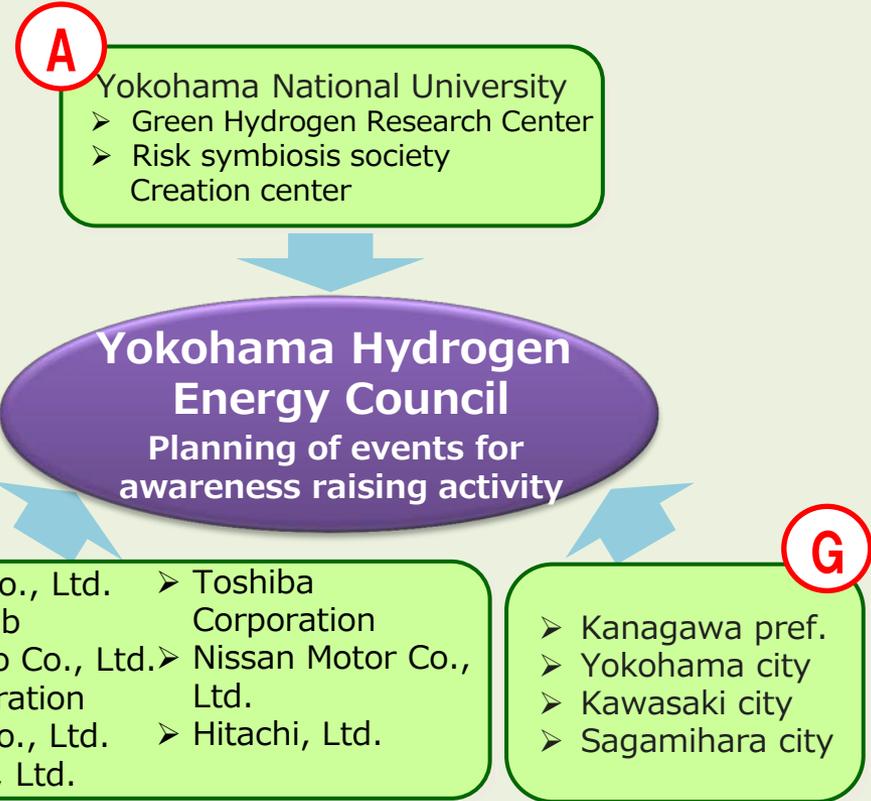
Participation in the planning of portal site on hydrogen energy

Yokohama Hydrogen Energy Council

Participate in industry-academia-government collaborative organization "Yokohama Hydrogen Energy Council" which aim to create "Kanagawa model for safe hydrogen energy" by returning research results on reliability, safety and usefulness of hydrogen energy to society



Yokohama Hydrogen Energy Council Establishment Commemoration Seminar

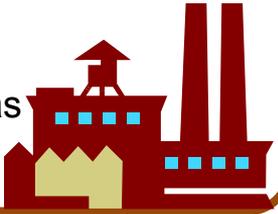


Spread of Hydrogen Use

The technology of companies and expertise of universities in Yokohama possess great potential for each of the stages in manufacturing, transporting/storing and using hydrogen
In cooperation with all of you, such as the country, related groups, etc., we will proceed efforts to realize a hydrogen society.

Spread of Hydrogen Use

Reforming from fossil fuels such as natural gas



Reforming from fossil fuels such as natural gas



Sources of renewable energy
➤ Water electrolysis
➤ Reforming from methane gas



Liquefied hydrogen
Organic hydride



Overseas

Hydrogen

FCV, etc.

From personal vehicles to public transportation and commercial/industrial vehicles

FCV

FC Scooters

FC Bus

FCFL



(Source: TOYOTA)



(Source: HONDA)



(Source: SUZUKI)

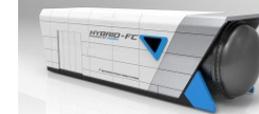


(Source: TOYOTA)



Fuel Cell

From home to business and industry



(Source: Mitsubishi Hitachi Power Systems)



(Source: Panasonic)

Hydrogen power generation, etc.

Toward a new, two-dimensional energy structure adding hydrogen to the current heat and electricity





Chinatown



Minato Mirai



**Yokohama Port Opening
Memorial Hall**

Thank you for your attention.



**Yamate Diplomat's
House**



Sankeien Garden



Zoorasia Yokohama