

11th March 2021



CCUS and Hydrogen in Japan — Overview of Policies and Project —

KATO Sei

Director, Climate Change Projects Office
Global Environment Bureau
Ministry of the Environment, Japan (MOEJ)



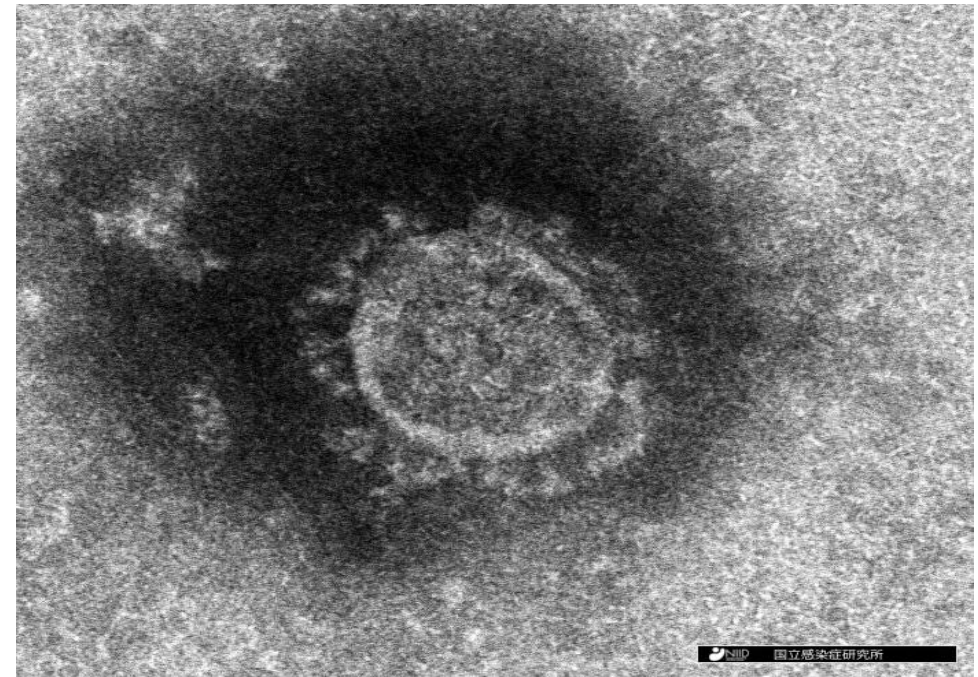
Policies in Japan

Facing Two Crises: "Climate Crisis" and " COVID-19 "

- Severe weather disasters occurred in Japan and abroad, which leads to increase the risk of weather disasters.
- On June 12, 2020, the Ministry of the Environment issued a "Climate Crisis Declaration".
- COVID-19 has had an enormous impact on the world's economy, society, and health.



▲ Damage caused by Typhoon Hagibis
in October 2019
<Chikuma River, Nagano City, Nagano Prefecture>



▲ Electron micrograph of 2019-nCoV
(Reference: National Institute of
Infectious Diseases)

Recent International Developments

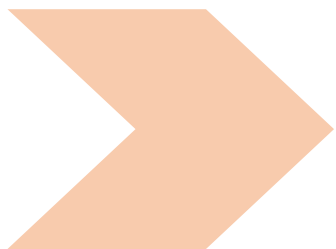


2020

- Sep.【China】 Announced its intention to achieve carbon neutrality by 2060 at the latest.
- Oct. 【Japan】 Announced its intention to achieve virtually zero greenhouse gas emissions by 2050.
- Oct. 【South Korea】 Declared its intention to become carbon neutral by 2050.
- Nov. 【U.S.】 Withdrew from the Paris Agreement
→ Mr. Biden was sworn in as President. (January 2021)

Mr. Biden's Climate Change Policy

- Virtually zero emissions by 2050 at the latest
- Return to the Paris Agreement
- put climate change as one of the four key issues for his administration
- Decarbonization of electricity such as \$2 trillion in infrastructure investment in green energy, etc. over 4 years



Global movements against climate change are accelerating

Realizing a Carbon-neutral, Decarbonized Society by 2050



- Prime Minister Suga declared **the goal of realizing a carbon-neutral, decarbonized society by 2050** in his speech at the 203rd Diet Session on October 26, 2020.
- At the Global Warming Prevention Headquarters held on the 30th of the same month, he stated that **"Japan is taking on the challenge of achieving carbon neutrality by 2050 as part of its new Growth Strategy"** and instructed to accelerate reviews on the Plan for Global Warming Countermeasures, the Strategic Energy Plan, and the Long-Term Strategy under the Paris Agreement.



Turning Global Warming Countermeasures into Japan's new Growth Strategy

◀ the Global Warming Prevention Headquarters
(https://japan.kantei.go.jp/99_suga/actions/202010/_00031.html) 4

3. **Realizing a green society**

My administration will devote itself to the greatest possible extent to bring about a green society, while focusing on **a virtuous cycle of the economy and the environment** as a pillar of our growth strategy.

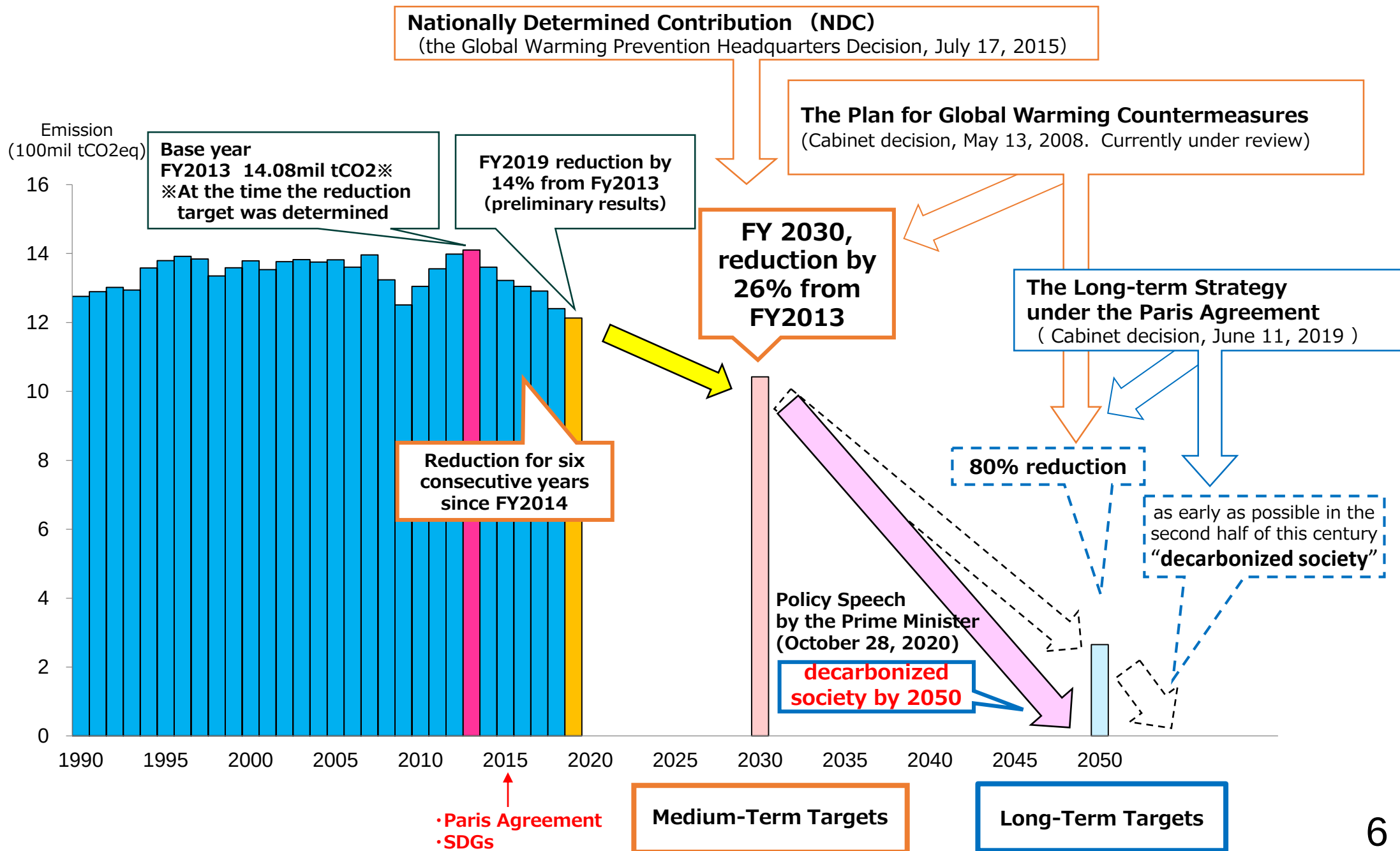
We hereby declare that **by 2050 Japan will aim to reduce greenhouse gas emissions to net-zero, that is, to realize a carbon-neutral, decarbonized society.**

Addressing climate change is no longer a constraint on economic growth. We need to adjust our mindset to a paradigm shift that proactive climate change measures bring transformation of industrial structures as well as our economy and society, leading to dynamic economic growth.

The key here is revolutionary innovations, such as next-generation solar cells and carbon recycling. We will accelerate research and development aimed at realizing utilization of such technologies in society. We will make our utmost efforts in this area, such as establishing a forum for the national and local governments to conduct a review towards realizing a decarbonized society, while making green investment more common through the full mobilization of regulatory reforms and other policy measures. Also, we will advance green transformation more efficiently and effectively through digital transformation in fields related to the environment. **We will lead the green industry globally and realize a virtuous cycle of the economy and the environment.**

We will establish a stable supply of energy by thoroughly conserving energy and introducing renewable energies to the greatest possible extent, as well as by advancing our nuclear energy policy with the highest priority on safety. We will also drastically change our longstanding policies on coal-fired power generation.

GHG emission and reduction target in Japan



Implementation Measures



- For 2050 carbon neutrality, **the decade from 2021 to 2030 is decisive.**
- We will trigger a regional decarbonization domino effect by implementing measures such as doubling the share of renewable energy consumption in regions.

“Zero carbon cities”: About 300 local governments (representing **more than 100 million** people)

Shift from “Declaration” to “Realization” (Budgeting)

- **Integrated support**, including support to the establishment of information infrastructure, planning, and to the introduction of renewable energy equipment
- Decarbonization measures will **foster a circular economy and increase the resilience of regions**

Council for National and Local Decarbonization

- ✓ Roadmap for decarbonization of all local governments by 2050
- ✓ Aim to realize model decarbonized regions by 2025

Carbon pricing

- ✓ Resume the examination of carbon pricing to promote the growth strategy in cooperation with the Ministry of Economy, Trade and Industry

Act on Promotion of Global Warming Countermeasures

- ✓ Examine the positioning of “2050 carbon neutrality” and the establishment of a system to foster the regional use of renewable energy

Plan for Global Warming Countermeasures and Long-Term Strategy

- ✓ Foster discussions to enhance measures to achieve the 2030 target
- ✓ Discuss the direction toward achieving the 2050 target

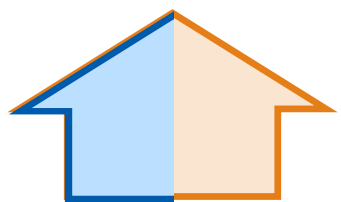
Increasing demand for decarbonization ①



- We have already started to **support the decarbonization of housing and the introduction of electric vehicles**, which are closely related to our lifestyle.
- Further acceleration of efforts will be required to realize a decarbonized lifestyle.

ZEH*/thermal insulation renovation

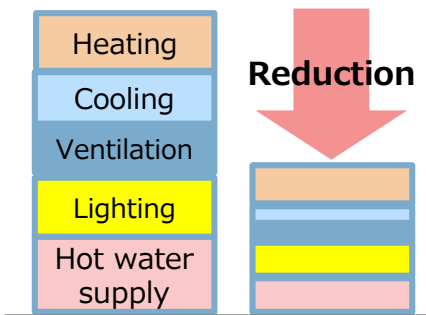
* ZEH (net zero energy house) : Housing with annual energy consumption of almost zero or less



Requires as little energy as possible.
(Cool in summer, warm in winter)



More efficient use of energy



Create Energy



Regional renewable energy + EVs as moving Storage Battery



< Odawara city, Kanagawa Pref. >
Support for the introduction of 100 EVs (planned) for car-sharing using local renewable energy sources (FY2020)



Power supply from EV

Electrification of "Last Mile Delivery"



Electric motorcycles with replaceable batteries



Supporting the electrification of Japan Post motorcycles for pickup and delivery (FY2020)

Increasing Demand for Decarbonization ②

- **Promote innovation** for the early realization of a decarbonized society **in the region**
- Promote social implementation of decarbonization technologies and use them to **create business and employment in the region**

<Moriya city, Ibaraki Pref. > Self sustained & decentralized hydrogen energy supply system



Image courtesy of Toshiba Energy Systems & Solutions Corp.

<Kanazawa city, Ishikawa Pref.> Self sustained & decentralized hydrogen energy supply system



Image courtesy of Shimizu Corp.

< Saga City, Saga Pref. > CO2 Capture and Utilization Project (CCU)



二酸化炭素生産量：10 t-CO₂/日
二酸化炭素濃度：99%以上
二酸化炭素成分規格：食品添加物の基準をクリア

Japan's first CO2 capture facility
in a **waste-to-energy facility**.



CO2 is sold to algae cultivators to be commercialized as cosmetics.

< Omuta City, Fukuoka Pref. > CO2 Capture Project

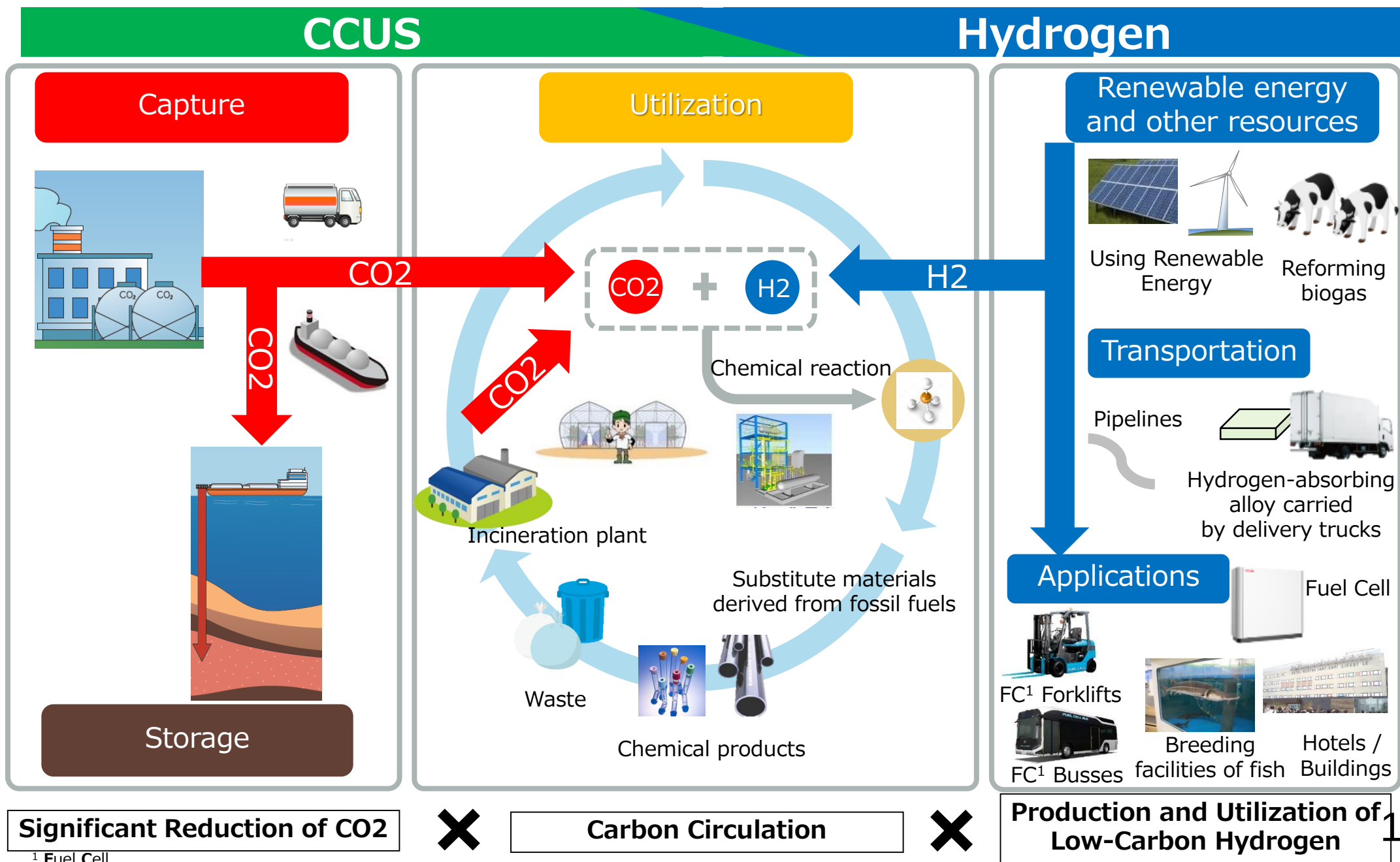


Japan's first commercial-scale capture technology demonstration, and **the world's first BECCS*** to be realized.

※Bio-energy Carbon Capture & Storage

MOE's Initiatives

Interconnection between CCUS and Hydrogen



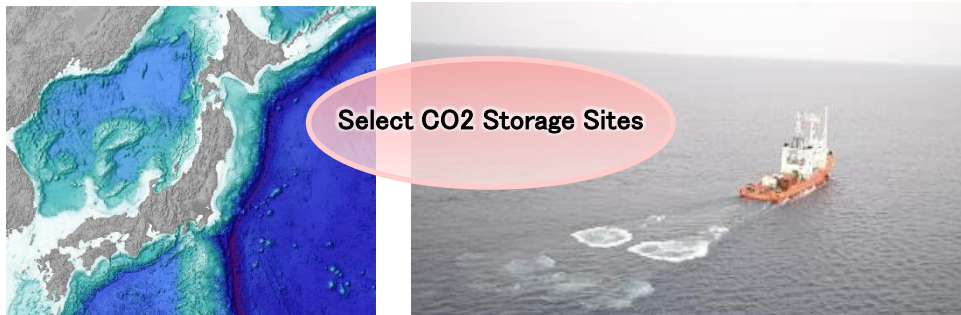
Movie

Transportation, Storage and Smooth Deployment of CCS

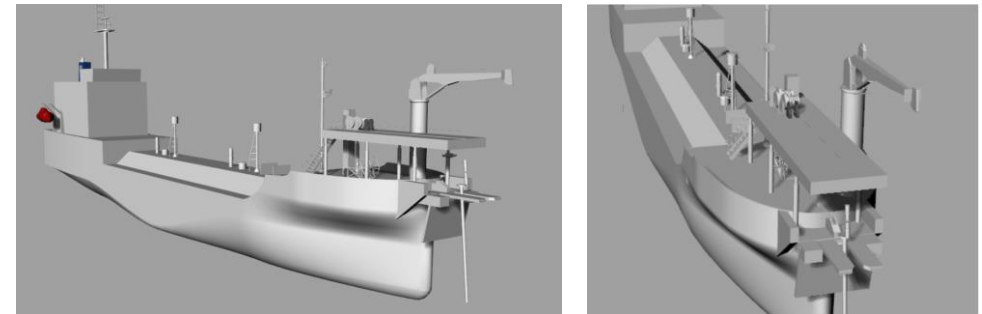


Potential CO2 Storage Sites investigated (with METI)

➤ Consideration of CO2 transportation methods suitable for Japan's conditions

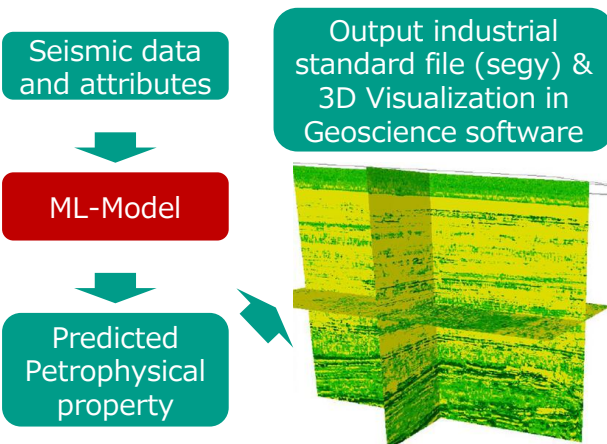


3D exploration with air gun

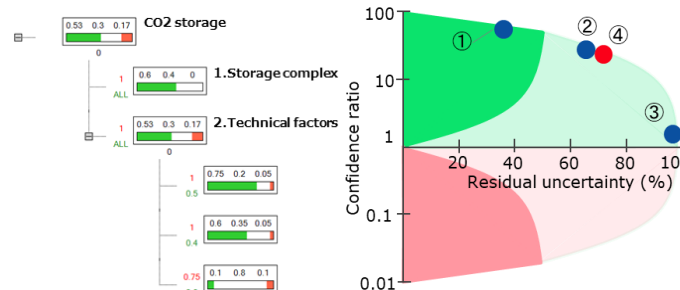


Approval in Principle (AiP) for ships transporting CO2 overseas

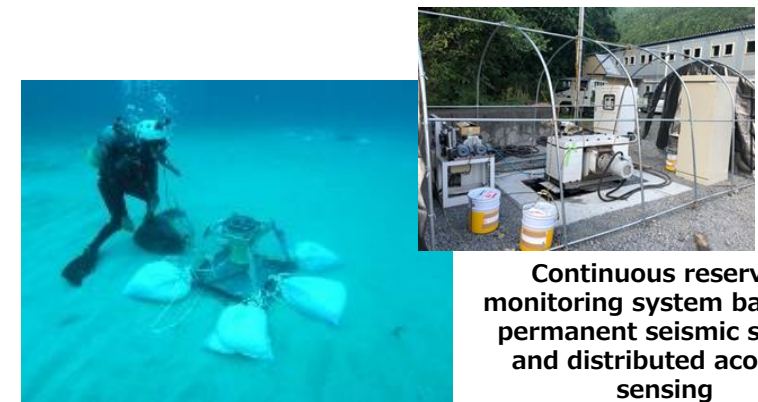
➤ Storage and Monitoring planning for the candidate sites



Machine learning model capable for nationwide storage assessment



Construction of storage risk assessment tool



Continuous reservoir monitoring system based on permanent seismic source and distributed acoustic sensing

Demonstration of underground and underwater CO2 monitoring technologies

Prospects of CCUS

2016~2020

Establishment
of technology

- **Verified operability, environmental impact, etc.** of CO2 capture facilities at a commercial-scale thermal power plant.
- Studied of **CO2 transportation and storage technology**
- Started **CCU technology demonstrations**
- Investigation of potential CO2 storage sites with METI

2021~2025

Practical
development

- Aiming to **establish first commercial scale CCU technology by 2023**
- Establishment of **an integrated verification base and supply chain**
- Feasibility study of CO2 transportation and storage, including overseas, international cooperation, etc.

2026~2030

Implementation

- In addition to the realization of the integrated CCUS demonstration, **full-scale social implementation will be pursued** based on the results of operation and evaluation and the study of environmental improvements.



Hydrogen Supply Chain Projects

Conducting supply chain demonstrations that produce, carry and use hydrogen by utilizing local resources for a construction of self-sustaining decentralized societies.

Shikakoi Town, Hokkaido

Demonstration using clean hydrogen (biogas from livestock excreta).
By Air Water INC

Muroran City, Hokkaido

Demonstration of low pressure hydrogen supply chain using wind power. By Taisei Corp.

Noshiro City, Akita Pref.

Demonstration mixing hydrogen produced from wind power with municipal natural gas. By NTT Data Institute of Management Consulting, Inc.

Namie Town, Fukushima Pref.

Demonstration constructing a low-cost renewable hydrogen supply chain. By Obayashi Corp.

Kitakyushu city, Fukuoka Pref.

Demonstration using green hydrogen from waste-to-energy and local renewable energy. By Kitakyushu Power Co., Ltd.

Shunan & Shimonoseki City, Yamaguchi Pref.

Demonstration using purity waste hydrogen supplied by Tokuyama's local caustic soda plant.
By Tokuyama Corp.

Shiranuka Town, Hokkaido

Demonstration using the clean hydrogen (small hydraulic power).
By Toshiba Corp.

Tomiya City, Miyagi Pref.

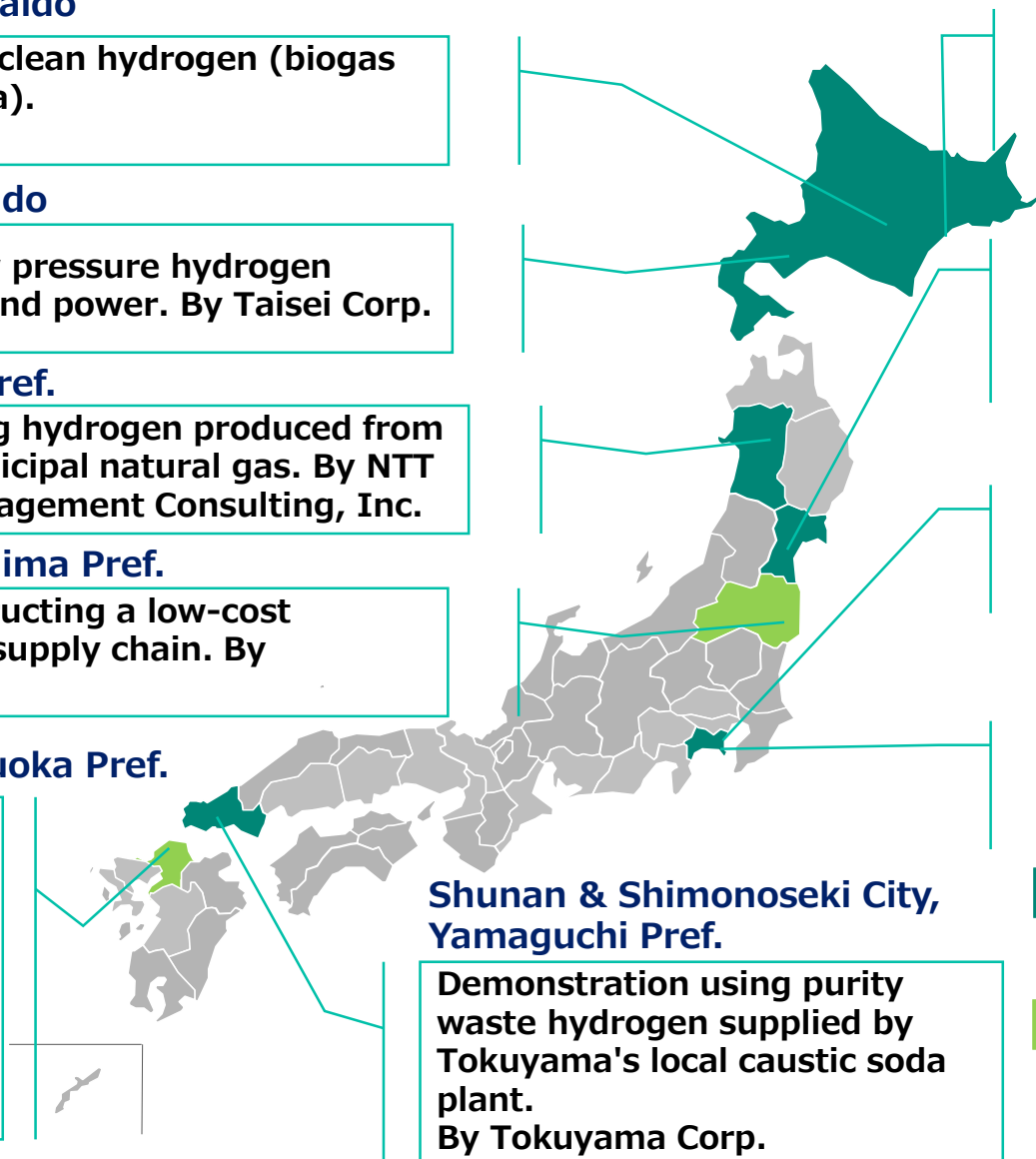
Demonstration of low carbon supply chain utilizing existing distribution network and pure hydrogen fuel cell. By Hitachi Ltd.

Kawasaki City, Kanagawa Pref.

Demonstration using waste plastics for hydrogen.
By Showa Denko K.K

Kawasaki & Yokohama City, Kanagawa Pref.

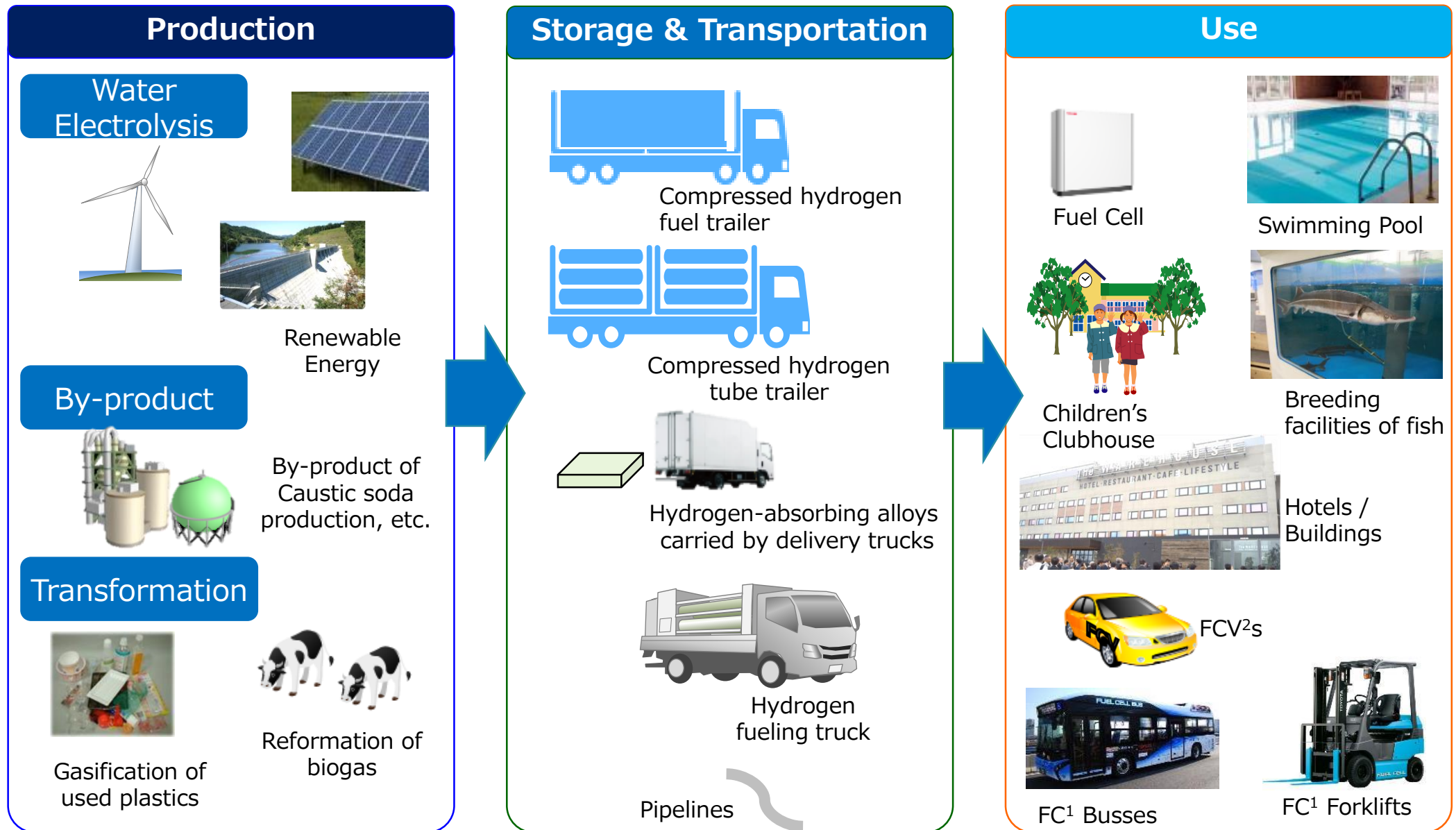
Demonstration using clean hydrogen (wind power).
By Toyota Motor Corp.



-  : Prefectures demonstrating a regional, low carbon hydrogen supply chain
 -  : Prefectures creating and demonstrating low-cost hydrogen models using existing facilities and infrastructures
- (As of March 2021)

Hydrogen Supply Chain Depends On Local Conditions

- 10 demonstration projects in Japan-



**CO2 Free Energy Sources /
Sources of H2**

Transportation of H2

Applications

¹ Fuel Cell
² Fuel Cell Vehicle

Development for Hydrogen Usage Technologies



FC Forklift



Courtesy of Toyota Industries Corp.

- R&D 2014-2016
- Released from 2016

FC Bus



Courtesy of Toyota Motor Corp.

- R&D 2013-2015
- Released from 2017

FC Power Supply Vehicle (2019-)



Courtesy of Denso Co., Ltd.

FC Truck (2016-2019)



Courtesy of Tokyo R&D Co., Ltd.

FC Vessel (2014-2015)



Courtesy of Toda Corp.

FC Garbage Truck (2015-2017)



Courtesy of Flat Field Co., Ltd.

Model Cases to Generate a Domino Effect

- Hydrogen from Renewable Power
- CCUS
- Floating wind turbine
- Local renewable energy, disaster prevention and mitigation

Saga City

Business development using CO2 from a waste-to-energy facility (Cosmetics, agricultural products)



Ishikari City

Zero-emission data center with 100% renewable energy



Yokohama City

Wide-area cooperation through purchase of renewable electricity from 12 municipalities in Tohoku

Kawasaki City

Hydrogen from used plastic to be used in nearby hotels



Kuji City

Ethanol production from CO2 in a waste treatment facility



Goto City

- Japan's First Commercial-Scale Floating Wind Turbine
- Regional development through fish reef effects



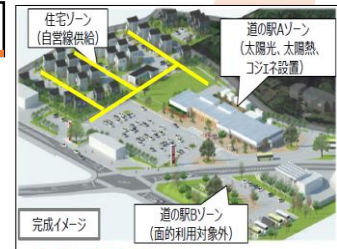
Namie Town

Utilization of hydrogen from Renewable Power, encouraging the realization of zero-carbon cities.



Mutsuzawa Town

Self-contained disaster prevention base area that operated even during typhoon power outages



Odawara City

- Car sharing using local renewable energy (EVs as moving Storage Battery)
- Methane production from CO2 in a waste treatment facility.



Omuta City

Japan's first commercial-scale capture technology demonstration, and the world's first BECCS* to be realized. *Bio-energy with CCS



Akashi City

DAC (Direct Air Capture) demonstration Project ※
(※) Negative emission technology

Challenges in introducing CCUS and Hydrogen future efforts



- In order to achieve a carbon-neutral society by 2050, **the decade from 2021 to 2030 is decisive**. We will achieve **a virtuous cycle of environment and growth** with disruptive innovation that is heretofore unconventional.
- It is necessary to promote the spread of renewable energy and **establish CCUS and Hydrogen technologies** as soon as possible to achieve a carbon-neutral society.
- CCU and Hydrogen technologies are interrelated, these technologies will contribute **to solving the plastic problem** and **achieving both a decarbonized society and a circular economy society**.
- **CCS could be a practical and quick solution** to achieve a carbon-neutral society in addition to other significant CO2 reductions.
- It is crucial not only to develop technologies but also to **implement them in society** as soon as possible, and we would like to work on providing **a model case that incorporates CCUS and hydrogen technologies that will lead to a regional decarbonization domino effect**.

Thank you

