

Notable Developments on Clean Fossil Energy in Japan

APEC Expert Group on Clean Fossil Energy (EGCFE) 2023 Meeting

20 April 2023

Agency for Natural Resources and Energy
Ministry of Economy, Trade and Industry, Japan

2050 Carbon-Neutral Declaration and 2030 Climate Goal

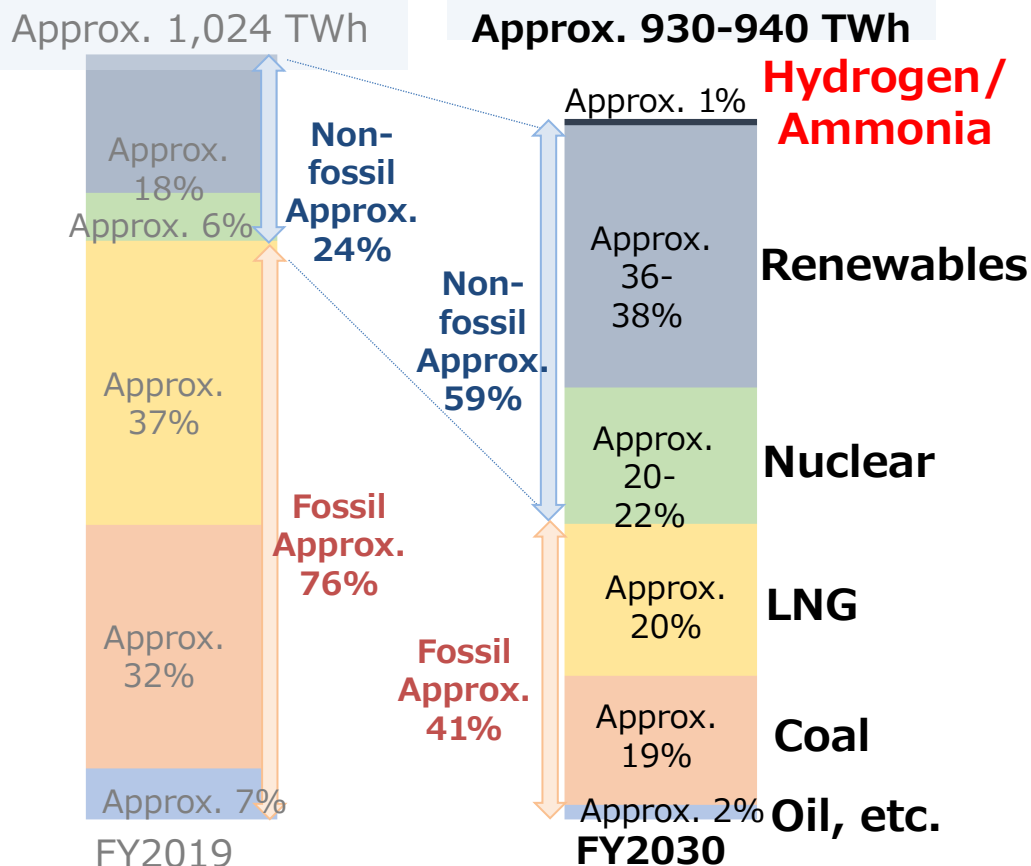
- In October 2020, Prime Minister Suga declared that **Japan aim to reduce greenhouse gas emissions to net-zero by 2050**, that is, to realise a carbon-neutral, decarbonised society.
- At the Leaders Summit on Climate in April 2021, Prime Minister Suga announced that **Japan aims to reduce its GHG emissions by 46 percent in FY 2030 from its FY 2013 levels**.

Remarks at Leaders Summit on COP26 (Nov. 2021)

Japan aims to reduce its greenhouse gas emissions by **46 percent** in the fiscal year **2030** from its fiscal year 2013 levels, and that Japan will continue strenuous efforts in its challenge to meet the lofty goal of cutting its emissions by **50 percent** in the fiscal year **2030**.



Electricity mix

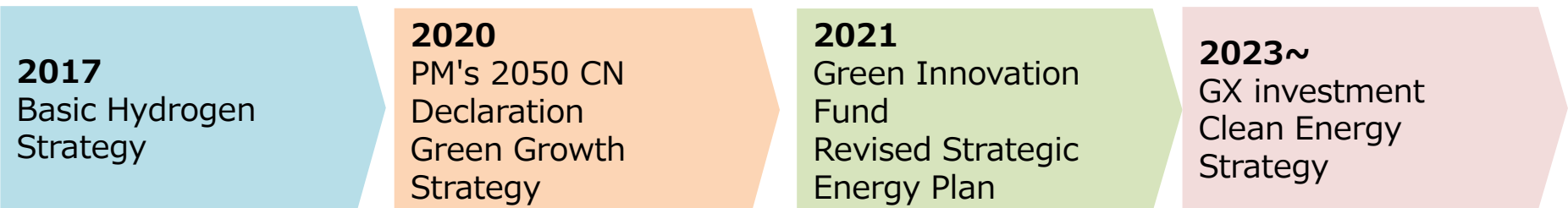


- Maximum introduction of renewables as primary power sources.
- Further pursuit of thorough energy efficiency
- Restart of nuclear power plants with safety as a top priority.
- On the major premise of ensuring energy security, thermal power in the electricity mix will be lowered as much as possible.
- Innovation in the thermal power by means of hydrogen /ammonia - fired power generation and CCUS/Carbon Recycling will be pursued.

Japan's Strategies & Policies towards Hydrogen Economy

- The first country to have formulated a national hydrogen strategy.
- The Prime Minister set "2050 carbon neutral" declaration.
- Positioned hydrogen as one of the priority areas in the Green Growth Strategy.
- Aim to expand the volume of hydrogen introduction and to achieve cost reduction through the governmental support including Green Innovation fund projects and investments towards green transformation (GX).

Situation and status of strategy formulation



Targets (Set in the Basic Hydrogen Strategy on Dec. 26, 2017)

▣ Supply & Demand volume:

Current (Approx. 2Mt) → 2030 (Approx. 3Mt) → 2050 (Approx. 20Mt)

▣ Hydrogen cost:

Current (JPY100/Nm3) station retail price → 2030 (JPY30/Nm3) (=2.6 \$/kg-H₂*) → 2050 (Less than JPY20/Nm3) (=1.7 \$/kg-H₂*)

* 1\$=130yen

Hydrogen Use in the Power Sector

- Japan has been a world leader in hydrogen power generation technology. Both large and small turbines projects are underway.

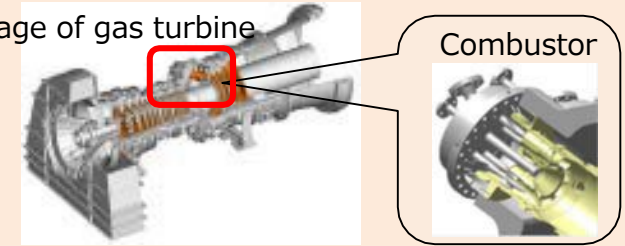
500 MW class

Achieving hydrogen co-firing rate of 20% in 2018.



Single fuel power generation is under progress.

The image of gas turbine



1MW class

Achieving combined heat and power supply to urban areas using hydrogen exclusively in 2018.



High-efficiency dedicated hydrogen single fuel power generation is under progress.



Hydrogen power generation facility (hydrogen CGS) constructed on Port Island in Kobe City

Netherland

Mitsubishi Heavy Industries, Ltd. is participating in a project to convert the Magnum power plant in the Netherlands from natural gas-fired to hydrogen-fired, with plans to start commercial operation of the world's first large-scale hydrogen-fired power plant around 2025.

The United States

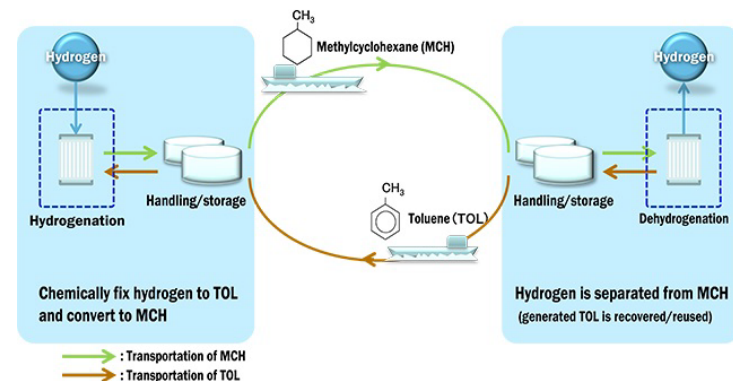
Mitsubishi Heavy Industries, Ltd. has received an order for a GT for a large-scale hydrogen power generation project planned in Utah, the United States. The project aims to start operation by 2025 with a hydrogen co-firing rate of 30% and achieve 100% by 2045.

Global Hydrogen Supply Chain

- **“Suiso Frontier”**, the first liquefied hydrogen carrier, **successfully completed its maritime transport** in February 2022 - **a world first**.
- An international hydrogen supply chain **using MCH as the hydrogen carrier** in the demonstration project was **completed in June 2020. (Brunei - Japan)**
- Aim to establish a **commercial large-scale supply chain by FY2030** in both carriers.



MCH Hydrogenation and Dehydrogenation Plant completed



“Suiso Frontier” (left) and a ceremony to mark the completion of the maritime transport of liquefied hydrogen (right)
(Iwatani, Kawasaki Heavy Industries, Shell Japan, J-POWER, Marubeni, ENEOS, Kawasaki Kisen Kaisha)

Fuel Ammonia: Production and utilization processes

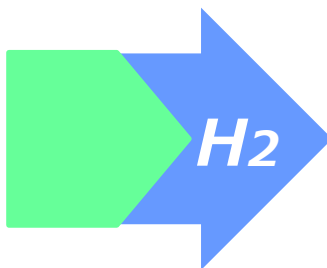
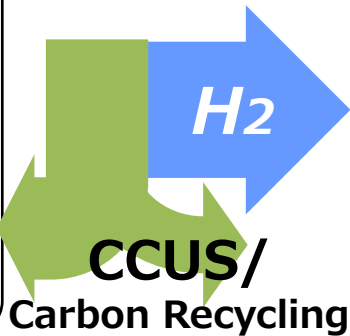
- Ammonia does not emit CO2 during combustion and becomes one of the effective fuels for combating global warming. It can be produced from natural gas (fossil fuels) with CO2 offset, or renewable energy.
- Ammonia is not only positioned as one of the hydrogen carriers in the "Hydrogen Basic Strategy" (2017) in Japan, but also be used directly for electricity generation as a zero emission fuel.

Production

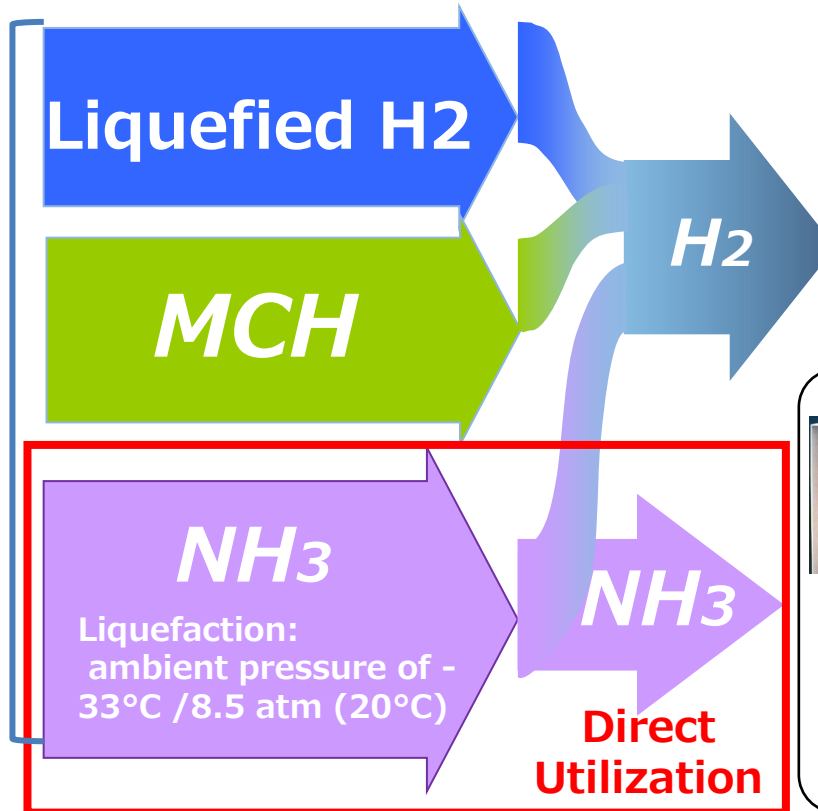
Natural Gas
Oil
Coal



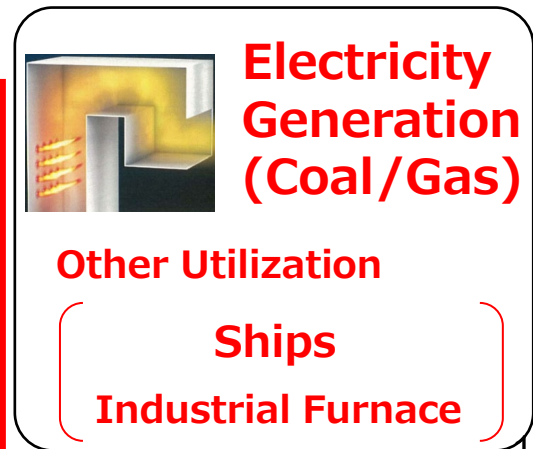
Renewable energy



Marine Transportation

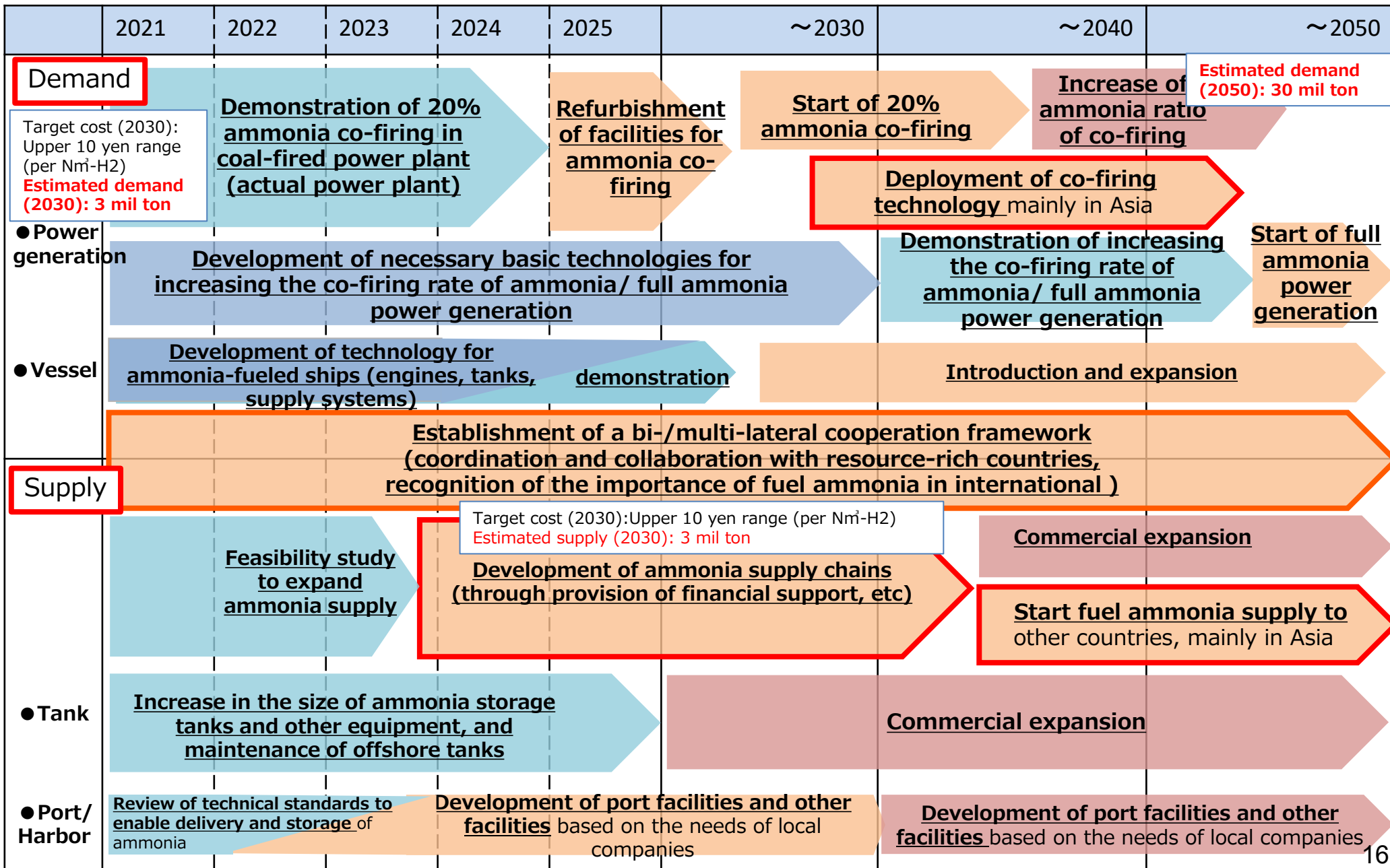


Utilization



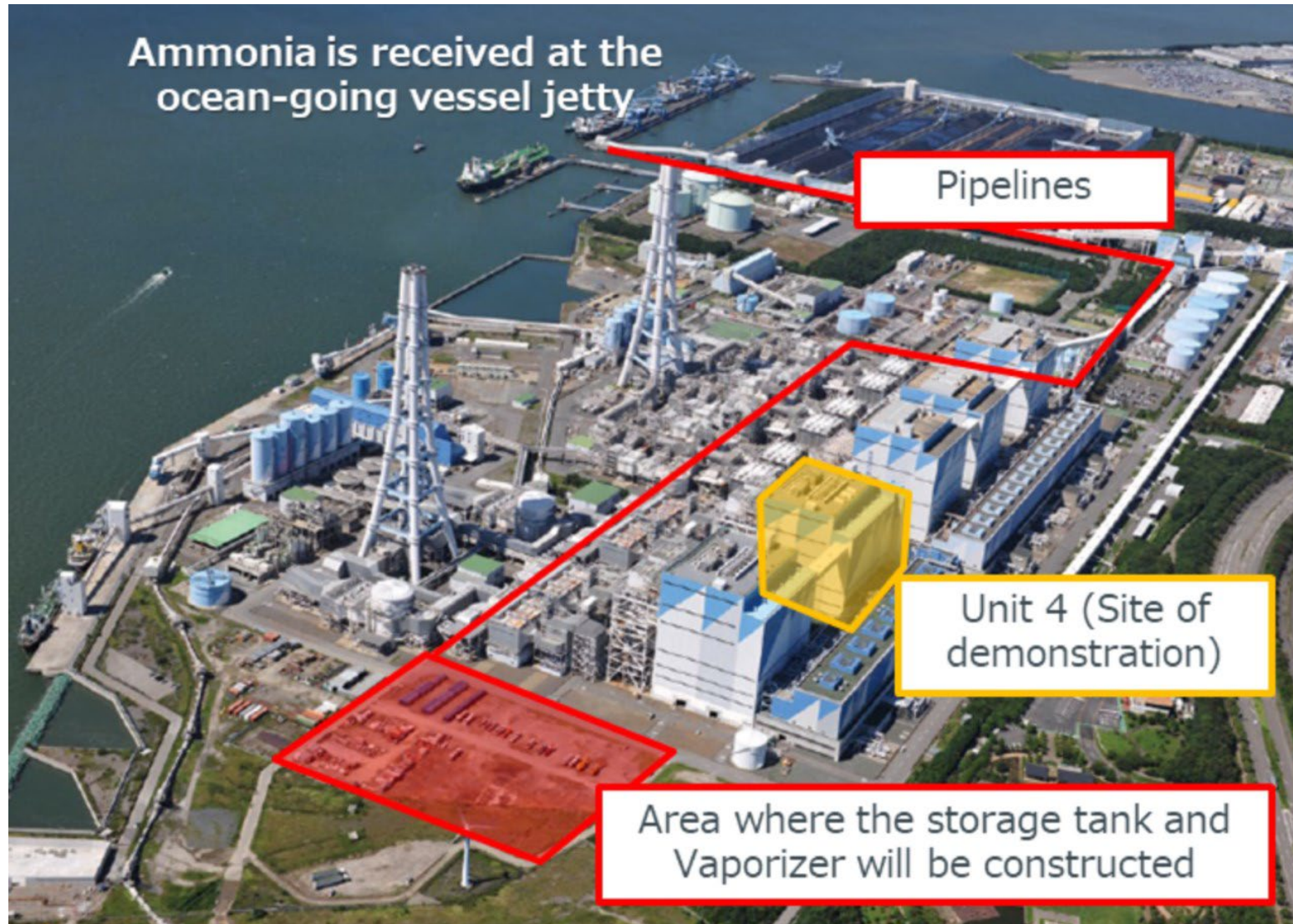
Japan's Road Map for introduction/expansion of Fuel Ammonia

(Japan's Green Growth Strategy: Revised in June 2021)



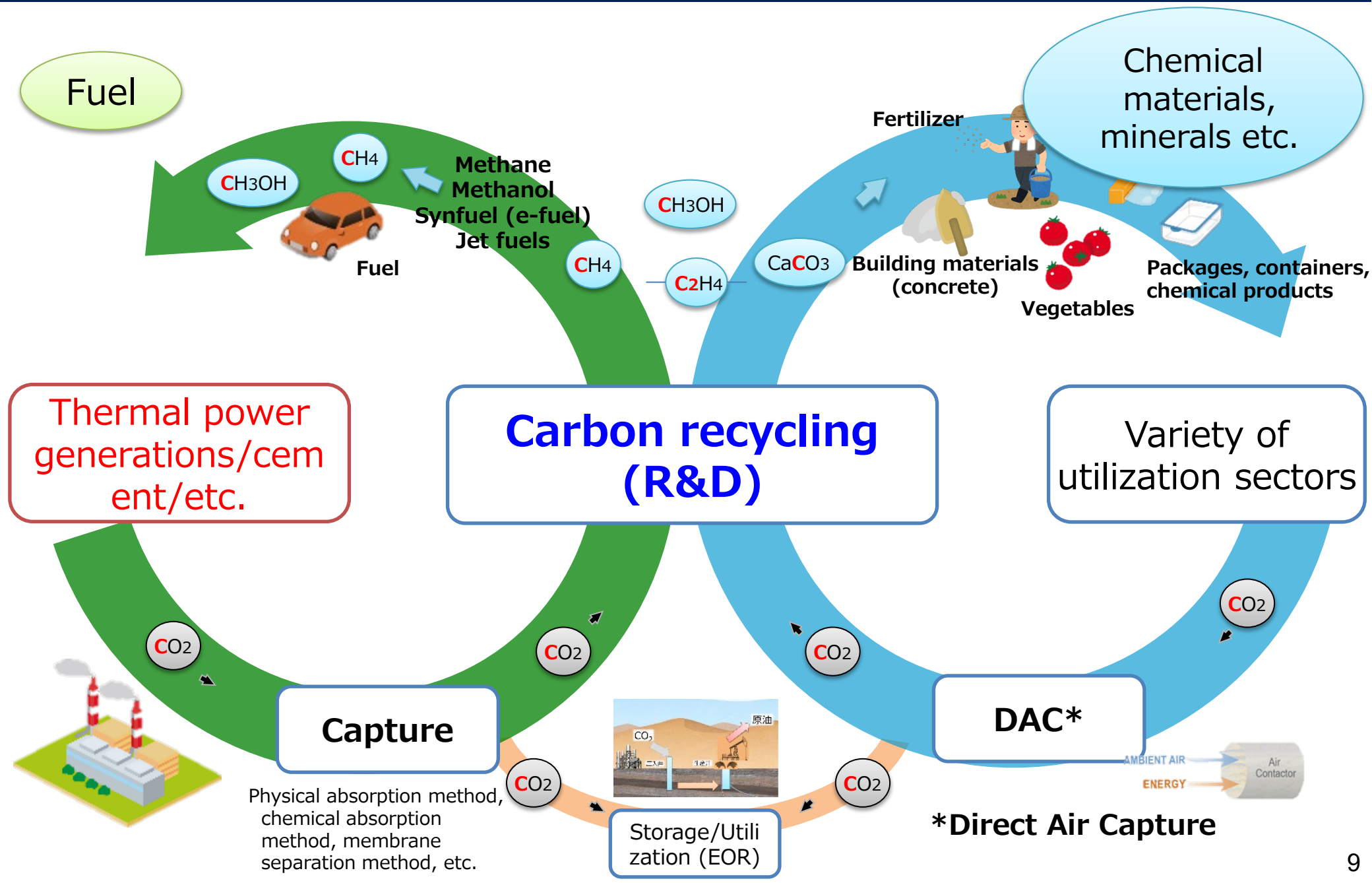
Ammonia - Co-firing Project by JERA and IHI

Hekinan Thermal Power Station (Aichi, Japan)



https://www.jera.co.jp/english/information/20210524_677

Concept of Carbon Recycling



Thank you!