

Technology Development of CCUS toward Carbon Neutral by NEDO

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**Project Manager,
Environment Department**

**New Energy and Industrial Technology
Development Organization (NEDO)**

- 1. About NEDO**
- 2. CCS Necessity**
- 3. NEDO's Effort on CCUS**
- 4. NEDO R&D and Demonstration Base**
- 5. Green Innovation Fund**

1. About NEDO



Positioning of NEDO

In order to contribute to the resolution of social issues, NEDO formulates technology strategies and project plans and, as part of its project management, establishes project implementation frameworks by combining the capabilities of industry, academia, and government. NEDO also promotes technology development by carrying out, evaluating, and allocating funding to promising projects to accelerate the practical application of project results.

NEDO's Mission

Addressing energy and global environmental problems

Enhancing industrial technology



1. About NEDO < Funding agency supports energy and industrial technology >



Covers a wide range of technology fields, necessary for the future

Energy and Environmental Fields

New energy



Clean coal technologies



Energy conservation



Global warming mitigation



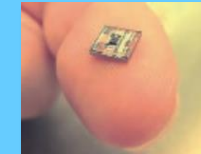
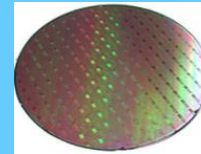
Rechargeable batteries and energy systems



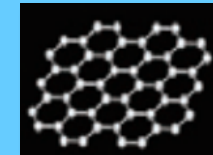
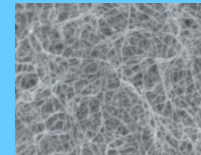
Environment and resource conservation

Industrial Field

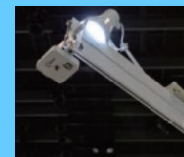
Electronics, information and telecommunication



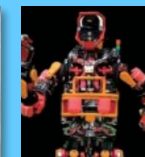
Materials and nanotechnology



Crossover and peripheral fields



Robot technology



New Manufacturing technology

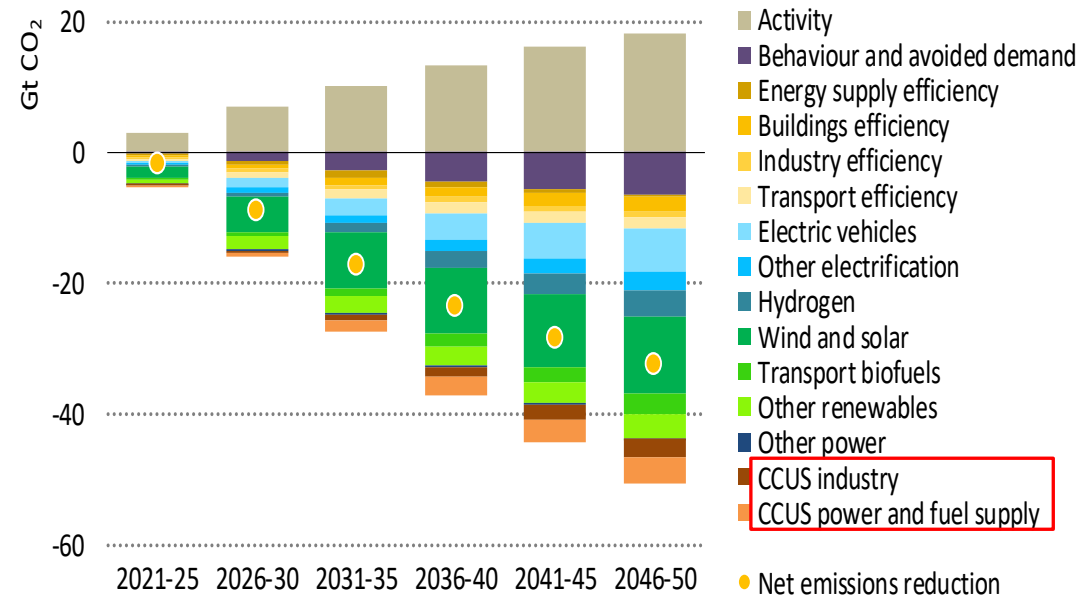
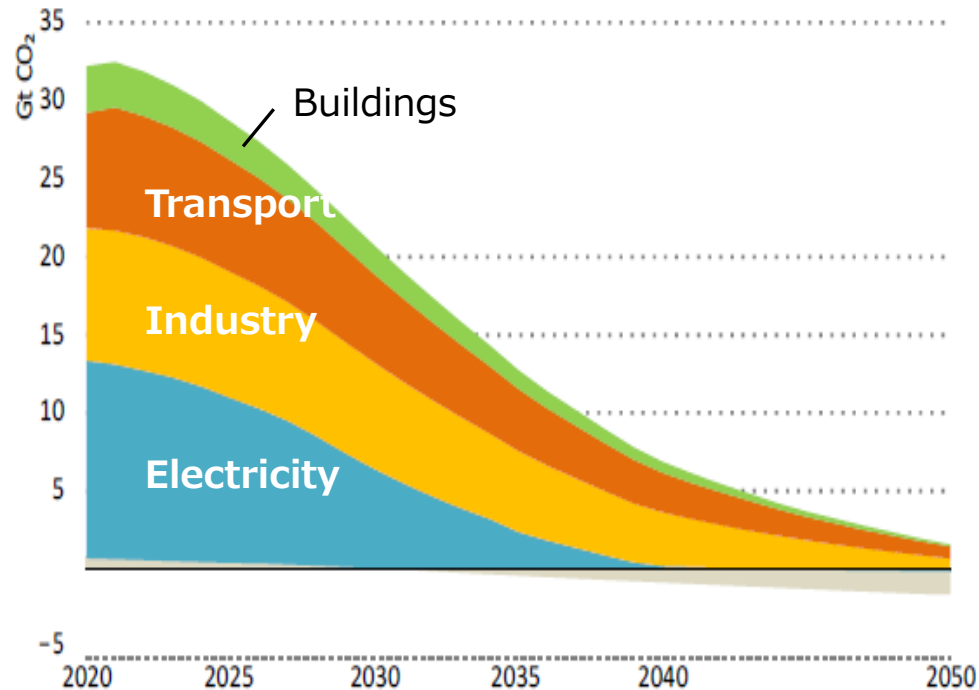


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2. CCS Necessity (1/2)

The IEA says that net-zero targets must quickly turn into real-world action. To reach our long-term climate goals, governments need to move fast to implement policies that can put global emissions into sustained decline in the coming years.

➡ CCUS/Carbon recycling is one of the solutions to reduce GHG emissions.

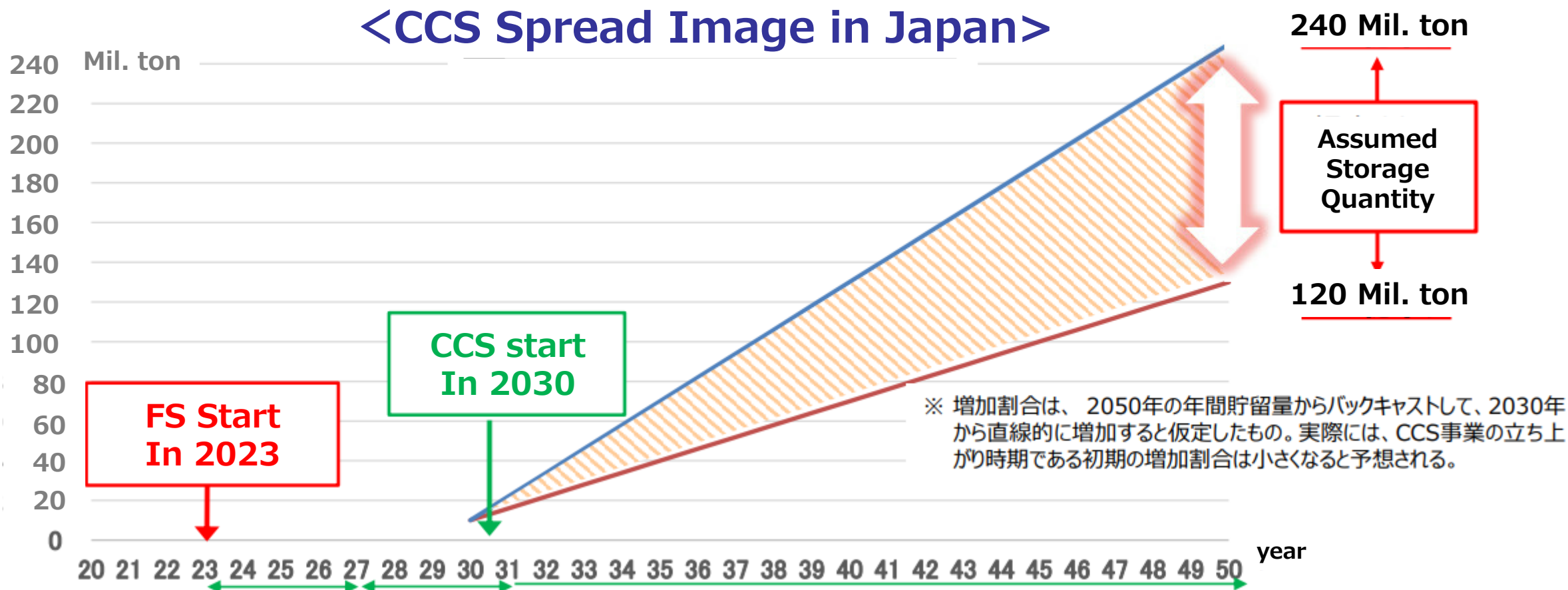


Source: NET ZERO by 2050, IEA

2. CCS necessity (2/2)

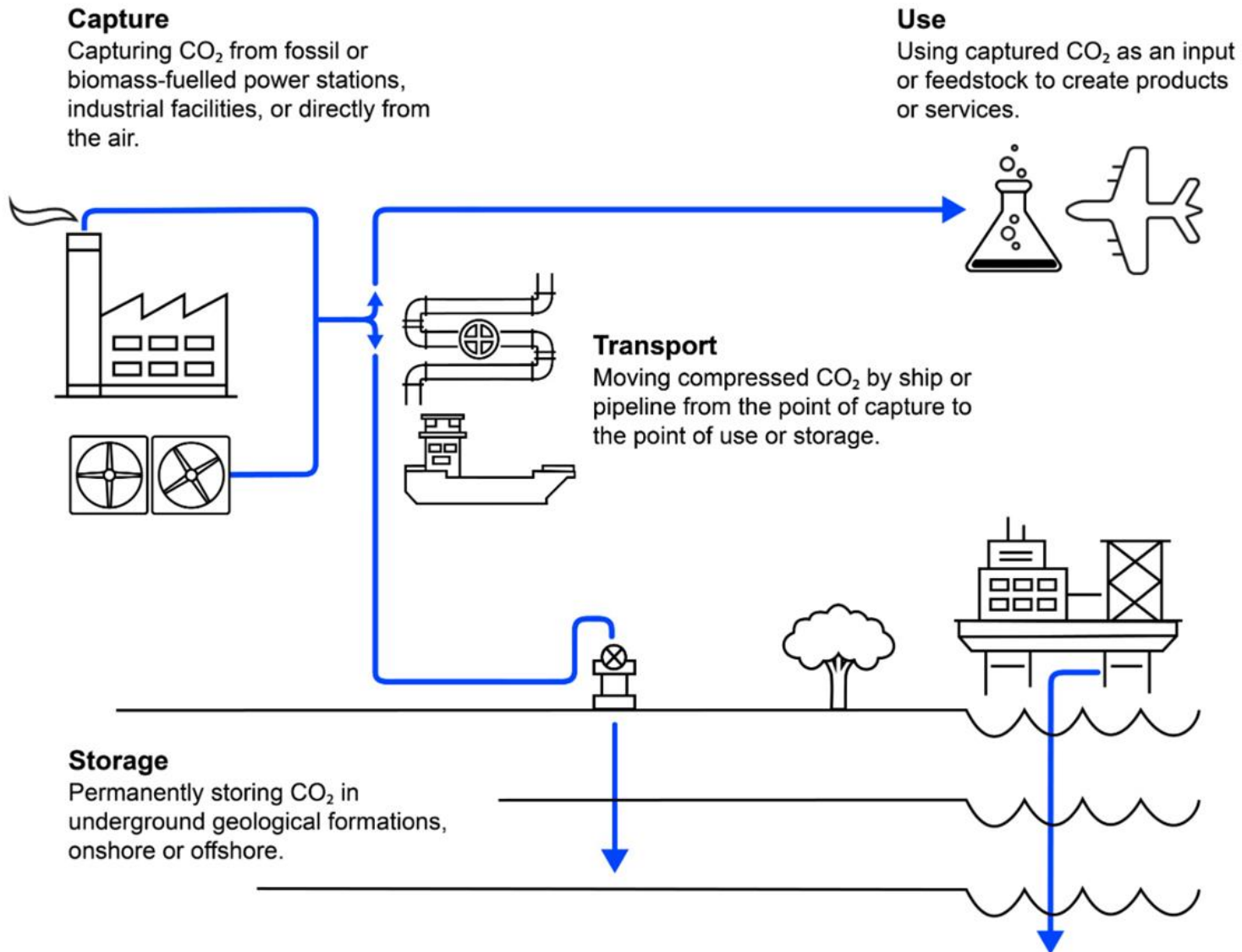
- CCS is a necessity based on IEA estimation.
- In 2050, CCS quantity is assumed as 120 ~ 240 million ton in Japan.
- In order to start CCS in 2030, FS will be started in 2023, and FID will be a necessary in 2026.

<CCS Spread Image in Japan>



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3. NEDO's Effort on CCUS CCUS Overview



3. NEDO's Effort on CCUS



3.1 CO₂ Capture - Technical Load Map -

- ◆ CO₂ capture is a first step for Carbon Recycling system and reduction of its cost is critical for CR implementation.
- ◆ Finding cost and energy efficient method better than chemical absorption is the way of RDD in this field.

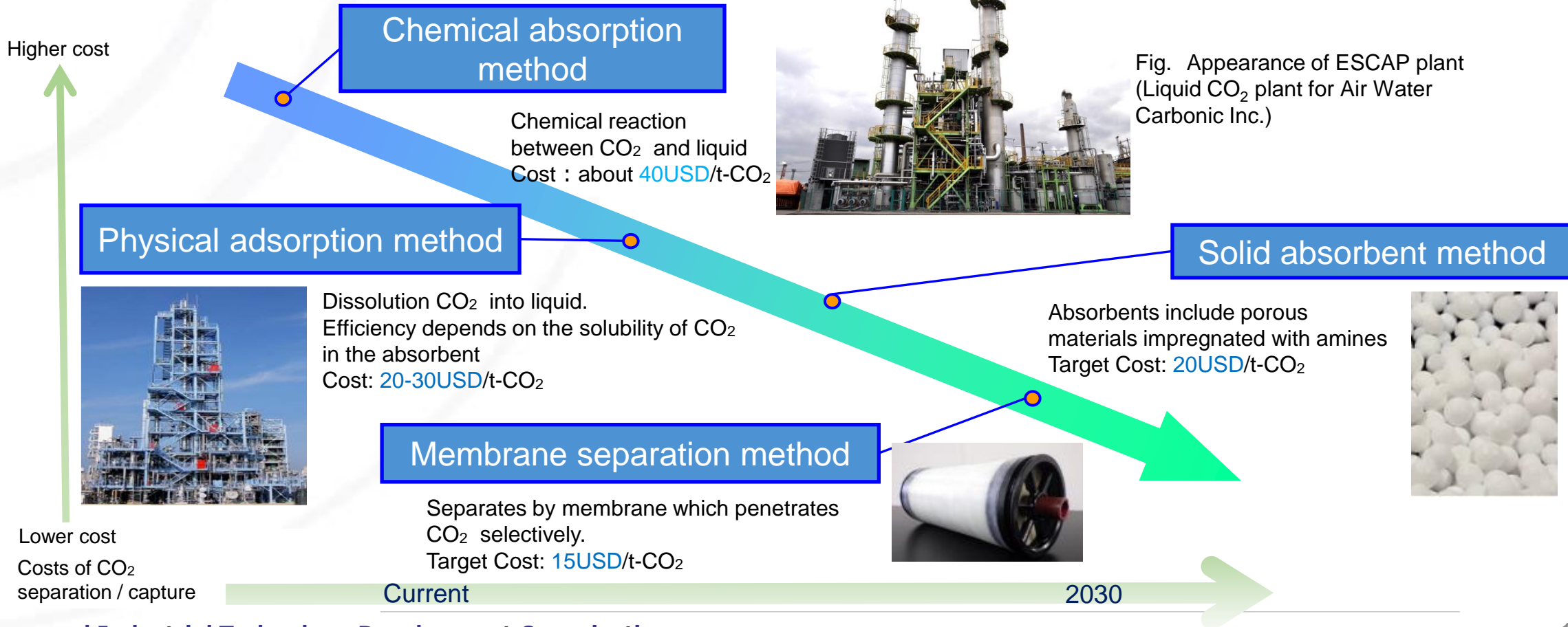


Fig. Appearance of ESCAP plant (Liquid CO₂ plant for Air Water Carbonic Inc.)

3. NEDO's Effort on CCUS

3.1 CO₂ Capture

- ◆ NEDO aimed to lower costs and expand scale by developing a massive synthesis method for materials and conducting a bench-scale test using a moving-bed system since FY2018.
- ◆ Through a pilot-scale test at Kansai Electric Power Co., Inc's Maizuru Power Plant, which is scheduled to start up in 2023, NEDO aims to put technology for capturing CO₂ with solid sorbents into practical use.

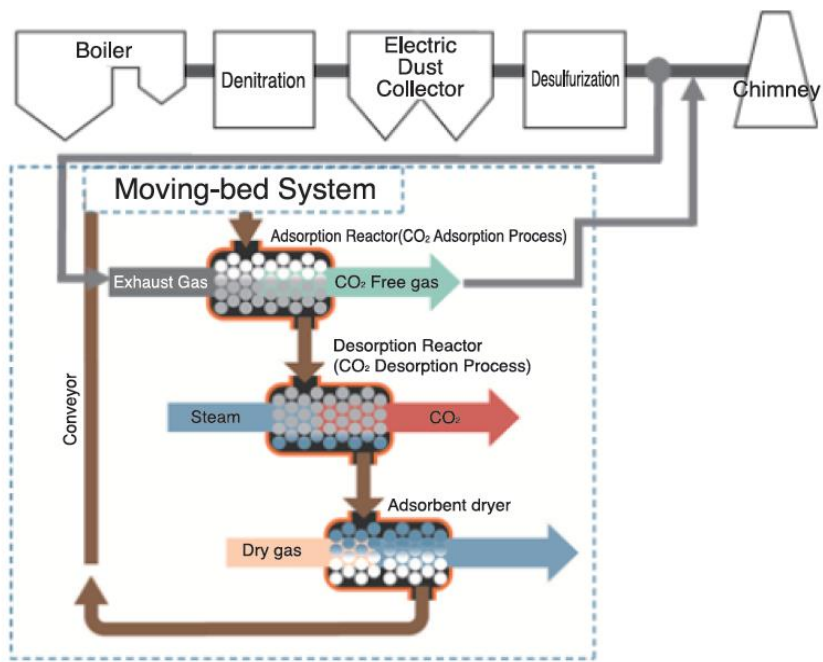


Image of the solid absorbent method (moving-bed) for coal thermal power



The Kansai Electric Power Company, Inc.
Maizuru power station
(Source: The Kansai Electric Power Company, Inc.)

< Period > 2018-2024

< Contractors > Kawasaki Heavy Industries, RITE

3. NEDO's Effort on CCUS

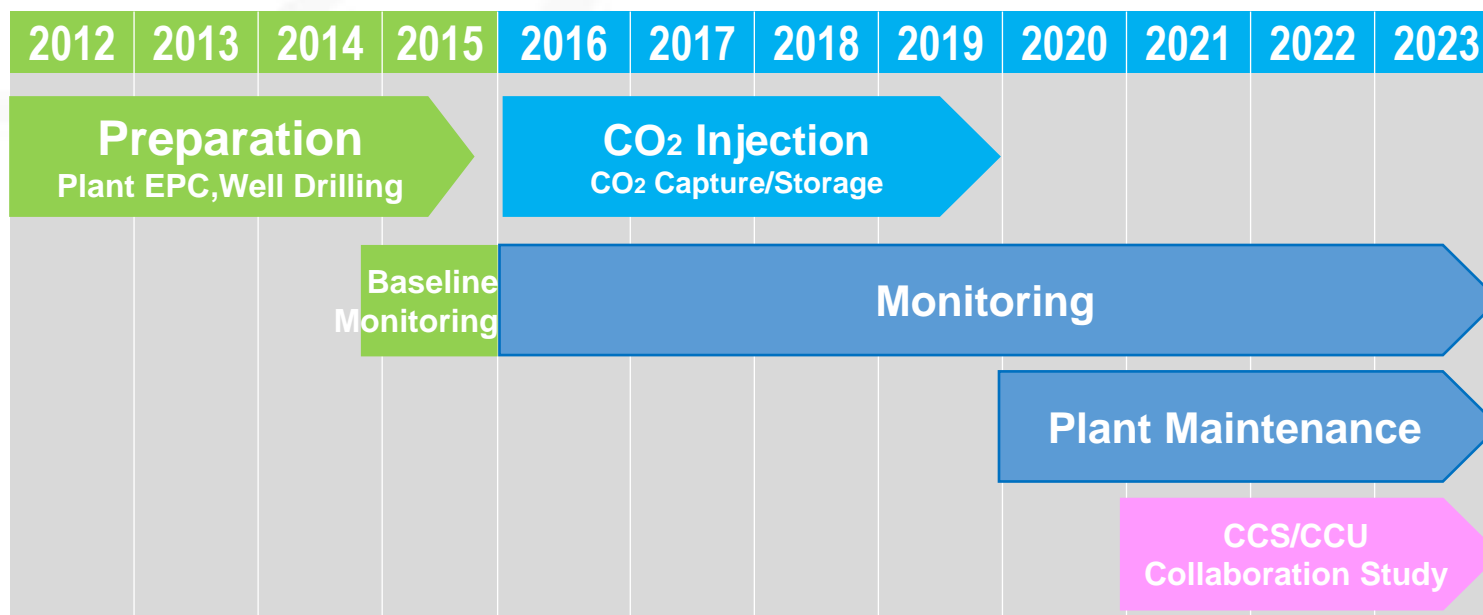
3.2 CO₂ Storage



苫小牧CCS設備の外観



- ◆ To demonstrate the viability of a full-chain CCS system, from CO₂ capture to injection and storage in Hokkaido.
- ◆ The demonstration was started from 2012, and CO₂ was injected from 2016 to 2019.
- ◆ Environmental surveys and monitoring are on going to comply with relevant regulations.



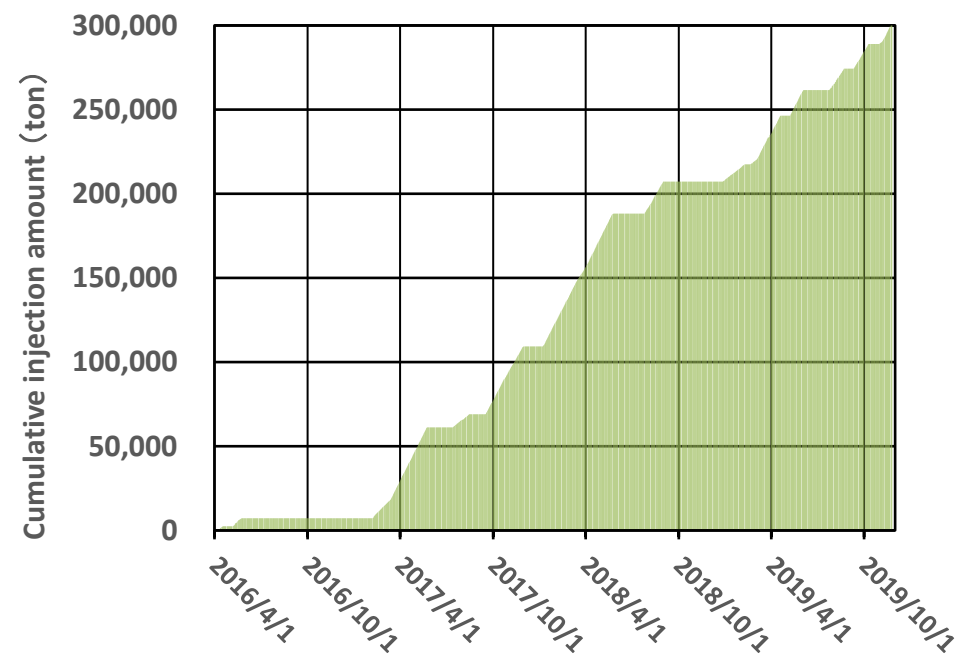
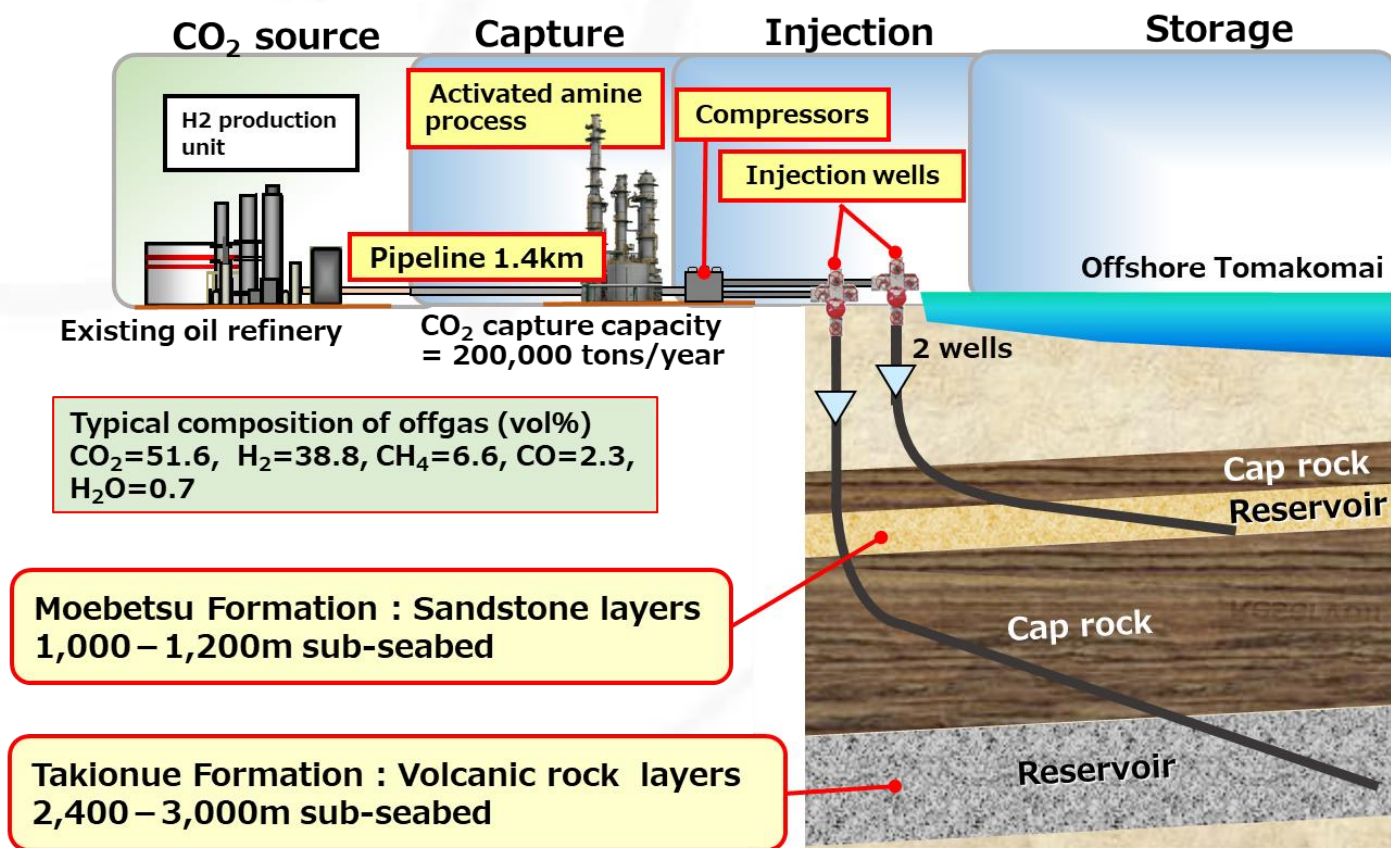
<Investigation period> April 2018 ~ March 2027

<Contractors> Japan CCS Co., Ltd.

3. NEDO's Effort on CCUS

3.2 CO₂ Storage

- ◆ CO₂ was captured from Exhaust gas of Existing Oil Refinery.
- ◆ CO₂ was injected to two reservoirs, Moebetsu formation(1000-1200m), Takionue formation(2400-3000m).
- ◆ 300,000 tons of CO₂ was injected offshore reservoir in Tomakomai, one of large port city in Hokkaido.

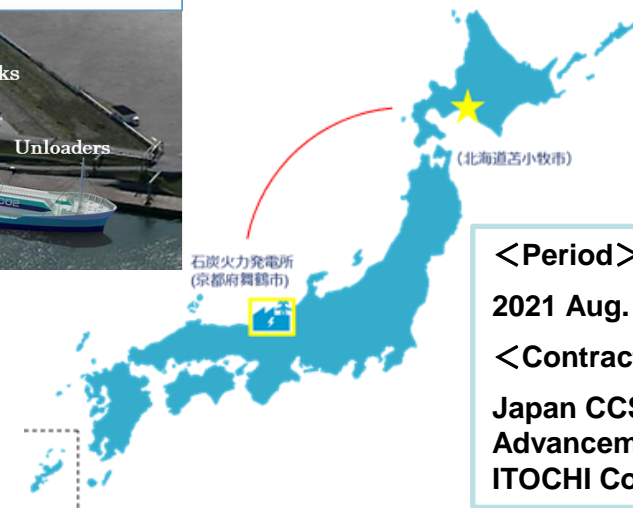
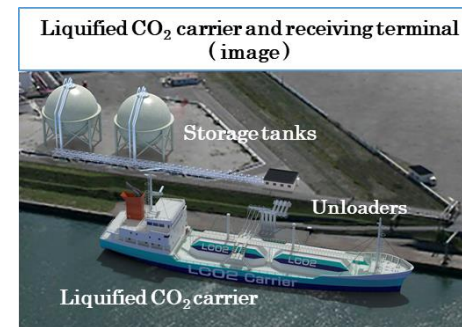
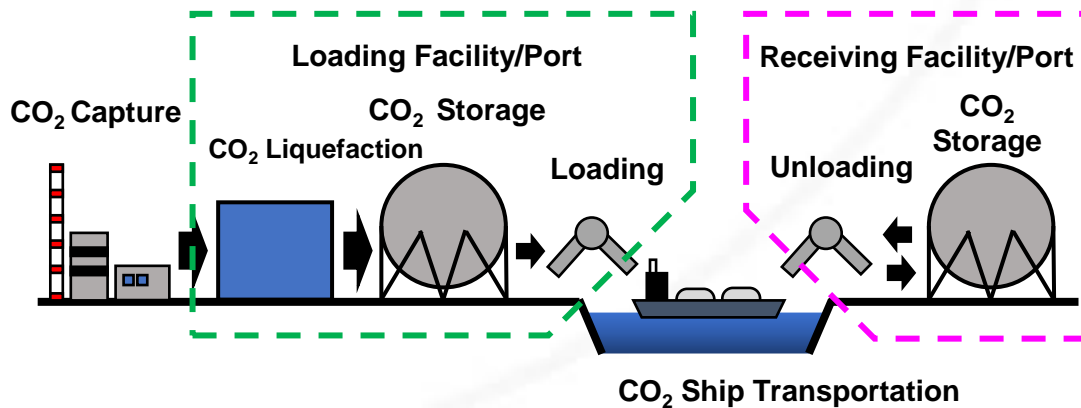


CCS Demo. Plant CO₂ Injection Result

3. NEDO's Effort on CCUS

3.3 CO₂ Transportation

- ◆ For the purpose of the safe and efficient transportation of CO₂ emitted from factories and thermal power plants for carbon recycle or CCS, NEDO will develop the integrated transportation system (CO₂ liquefaction, ship, transportation and tank storage) under optimal temperature and pressure conditions.
- ◆ 1,000 tons of liquified CO₂ vessel will be constructed and verifies above technical aspects.

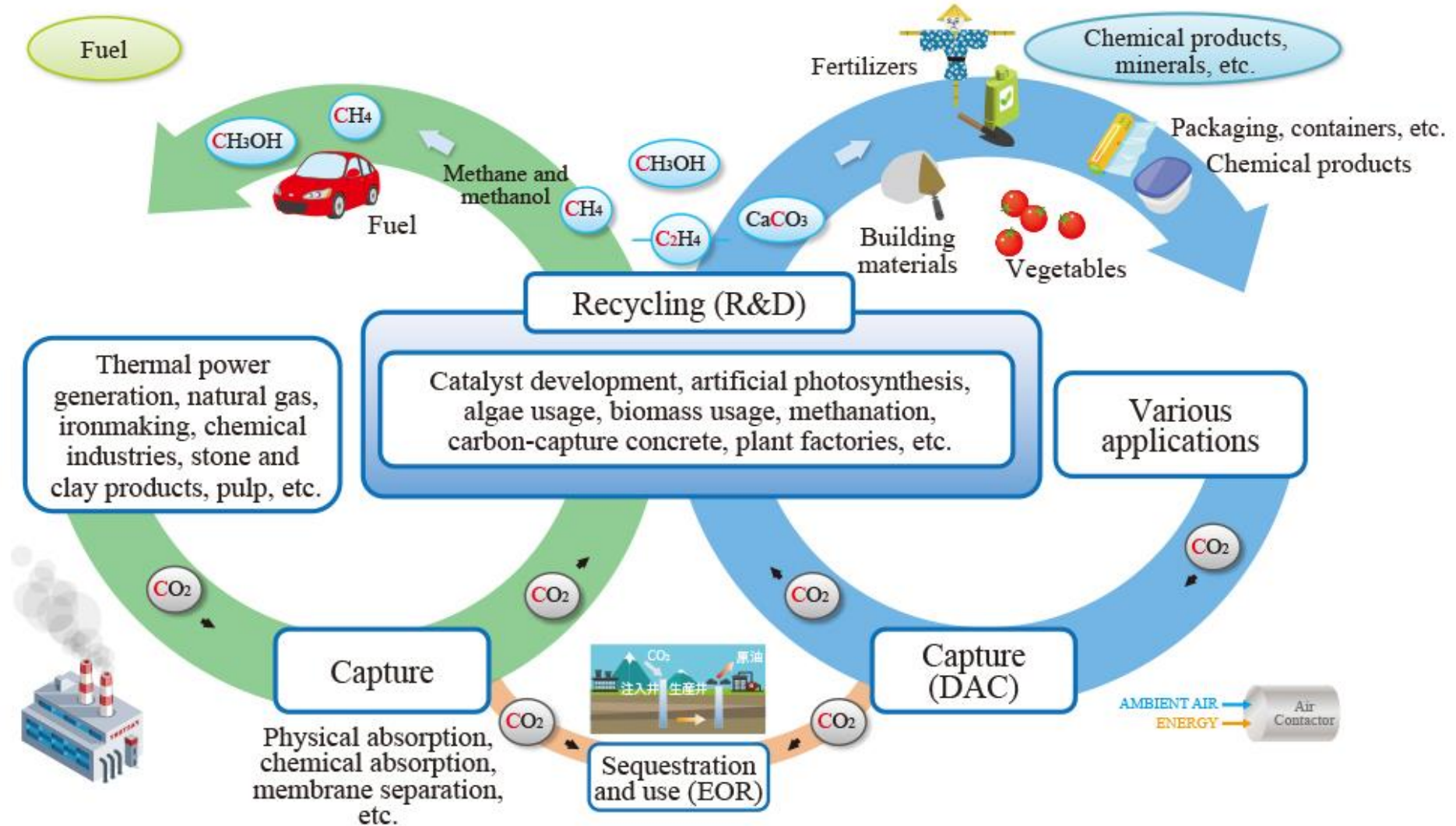


<Period>
2021 Aug. – 2027 Feb.

<Contractors>
Japan CCS Co.,Ltd., Engineering
Advancement Association of Japan,
ITOCHI Corp., Nippon Steel Corp.

3. NEDO's Effort on CCUS

3.4 CO₂ Utilization Overview



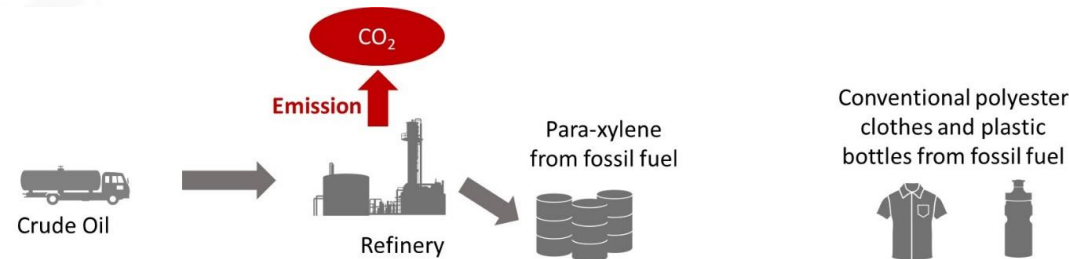
3. NEDO's Effort on CCUS

3.4 CO₂ Utilization - Para-xylene Production from CO₂ -

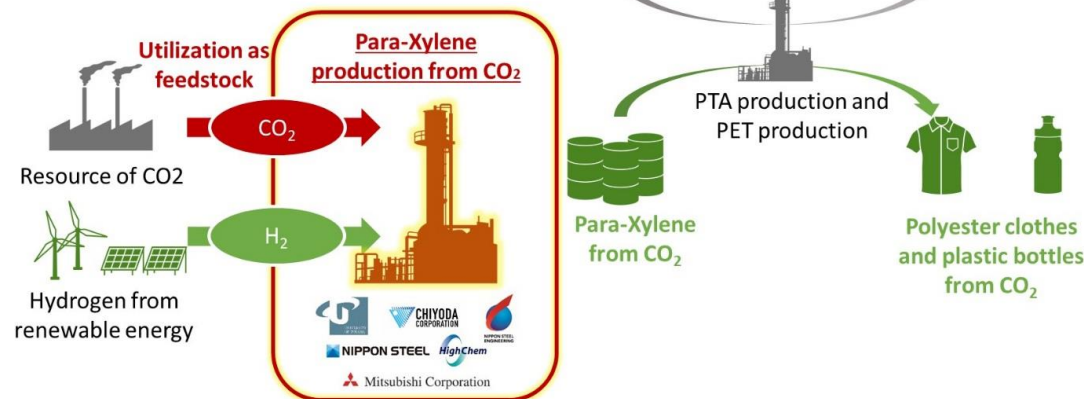


- ◆ Potential CO₂ reduction will be theoretically 160 mil tons, in case the 49mil ton world para-xylene demand is replaced by this technology.
- ◆ In this project, the consortium will improve the innovative catalyst for the production of para-xylene from CO₂, develop a way to mass-produce the catalyst, and finally develop the process while studying its feasibility including its overall economics and CO₂ reduction effect in order to pave the way to a demonstration.

Existing Technology



Current Study Concept



<Period> FY2020~FY2023

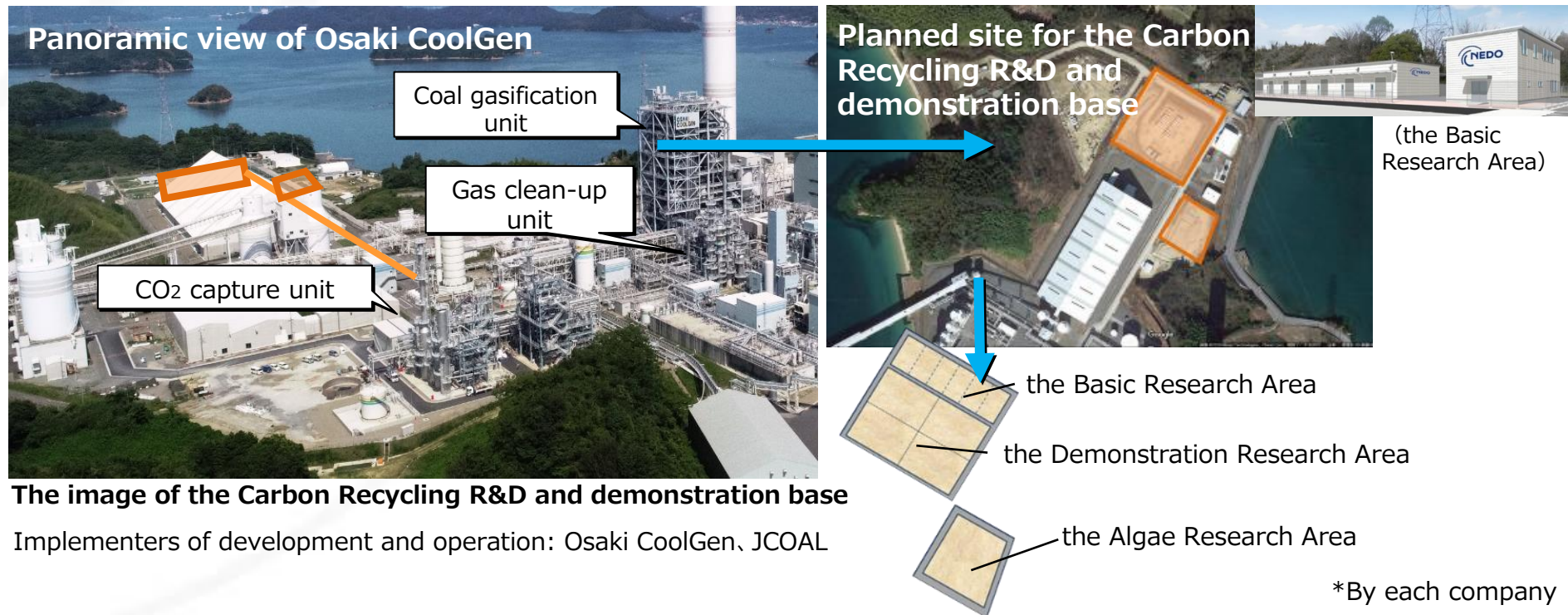
<Contractors> University of Toyama, Chiyoda Corporation, Nippon Steel Engineering Co., Ltd., Nippon Steel Corporation, HighChem Company Limited, Mitsubishi Corporation

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4. NEDO R&D and Demonstration Base <Carbon Recycling : Osaki CoolGen Project>



- ◆ In order to bring innovations in CR technologies, it is necessary to keep an easy access to certain amount of CO₂ as a research resource.
- ◆ Coordinating with other NEDO project; Osaki Cool Gen (IGCC demonstration plant), captured CO₂ has been supplied to CR research and demonstration facilities via pipeline.



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- In October 2020, the Government of Japan declared that it aims to **achieve carbon neutrality by 2050**.
- The Ministry of Economy, Trade and Industry in collaboration with other ministries and agencies, **formulated the “Green Growth Strategy through Achieving Carbon Neutrality in 2050”**.
- This strategy specifies 14 promising fields that are expected to grow and provides action plans for them from the viewpoints of both industrial and energy policies.

14 growth sectors



“The Green Innovation Fund ”

Creation of 2.0 trillion yen

**Continuous
Support for
Up to 10 years**

**From
Ambitious R&D
to social
implementation**

**Management
Commitment**



Offshore wind Power



Perovskite Solar Cell



Hydrogen Supply Chain



Hydrogen Production



Green Steel



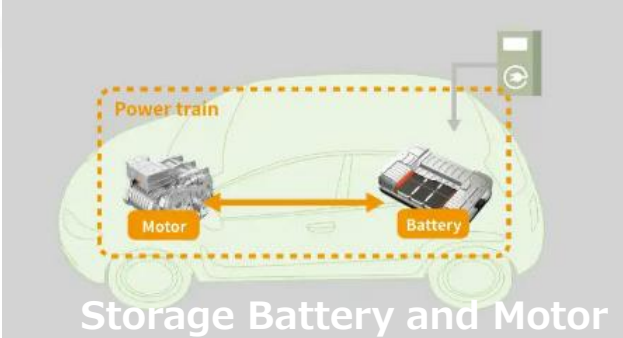
Fuel Ammonia Supply Chain



Carbon Recycling(Chemical)



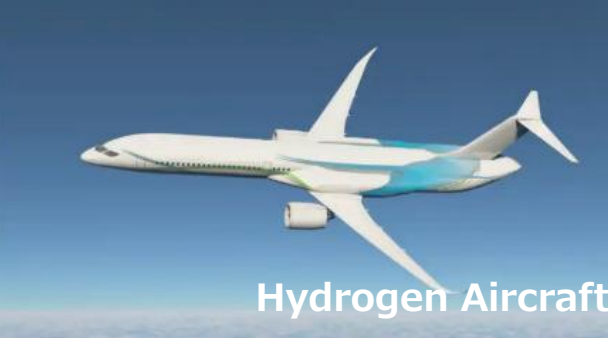
Carbon Recycling (Concrete and Cement)



Storage Battery and Motor



Digital Infrastructure



Hydrogen Aircraft



Zero-Emission Ship



Synthetic fuels

SAF



Synthetic methane

LPG

Carbon Recycling (Fuel)



CO2 Separation and Capture

Already formulated **16** Projects,
allocated **1.8** trillion yen

And more coming soon



Thank you for your attention.