

Carbon-Recycling and Carbon dioxide Capture, Utilization and Storage

Introduction of R&D Overview in NEDO

Japan Asia CCUS Forum 2021

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Eiji UEHARA

Director General, Environment Department

New Energy and Industrial Technology Development Organization (NEDO)

- 1. About us**
- 2. Capture**
- 3. Storage**
- 4. Recycling (utilization)**
- 5. Relevant Activities**



1. 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



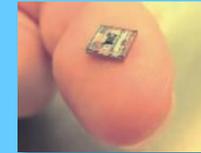
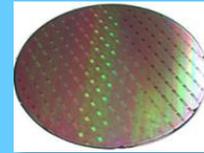
Rechargeable batteries and energy systems



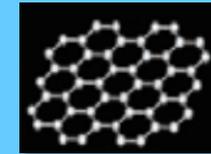
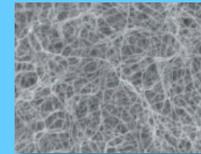
Environment and resource conservation

Industrial Field

Electronics, information and telecommunication



Materials and nanotechnology



Crossover and peripheral fields



Robot technology



New Manufacturing technology



1. NEDO : Environment fields activities



Water Recycling Technology



Following a shift from fluorocarbons, emissions of hydrofluorocarbons (HFCs) are anticipated to increase sharply in the refrigerator and air conditioner.



Reduce, Reuse and Recycle system



CO2 Utilization Project



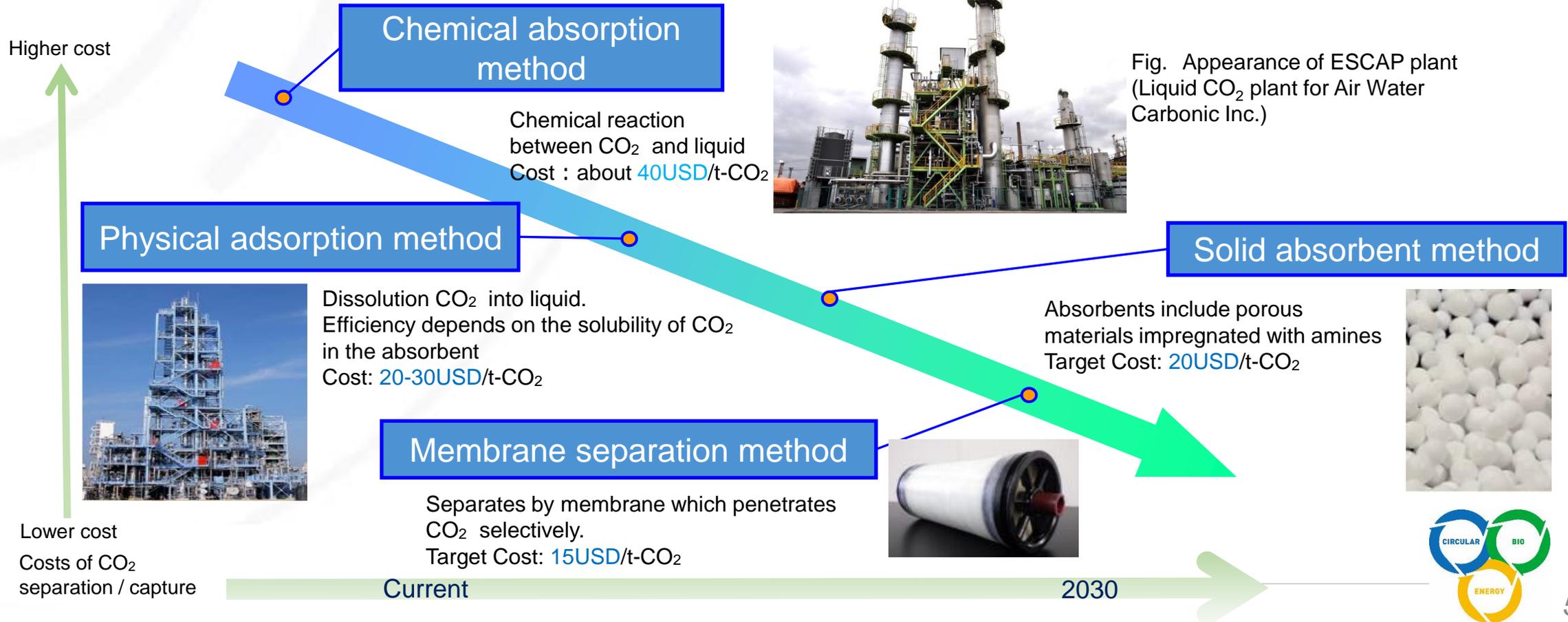
full-chain CCS system

Carbon Recycling and CCUS Technology



2.Capture (concept, target)

- ◆ 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.



2. Capture (projects)

1. Solid absorbent (FY 2020-2024)

- ◆ CO₂ capturing with solid absorbent is one of highly expected method to halve the cost of CO₂ capture.
- ◆ Based on our past RD activity, Kawasaki Heavy Industry and RITE are constructing pilot scale testing facility (tens of tons-CO₂ per day) at one of coal-fired power plant, since 2020.
- ◆ Through this demonstration project, we aim to develop the solid absorbent method for coal-fired flue gas.

2. Membrane separation

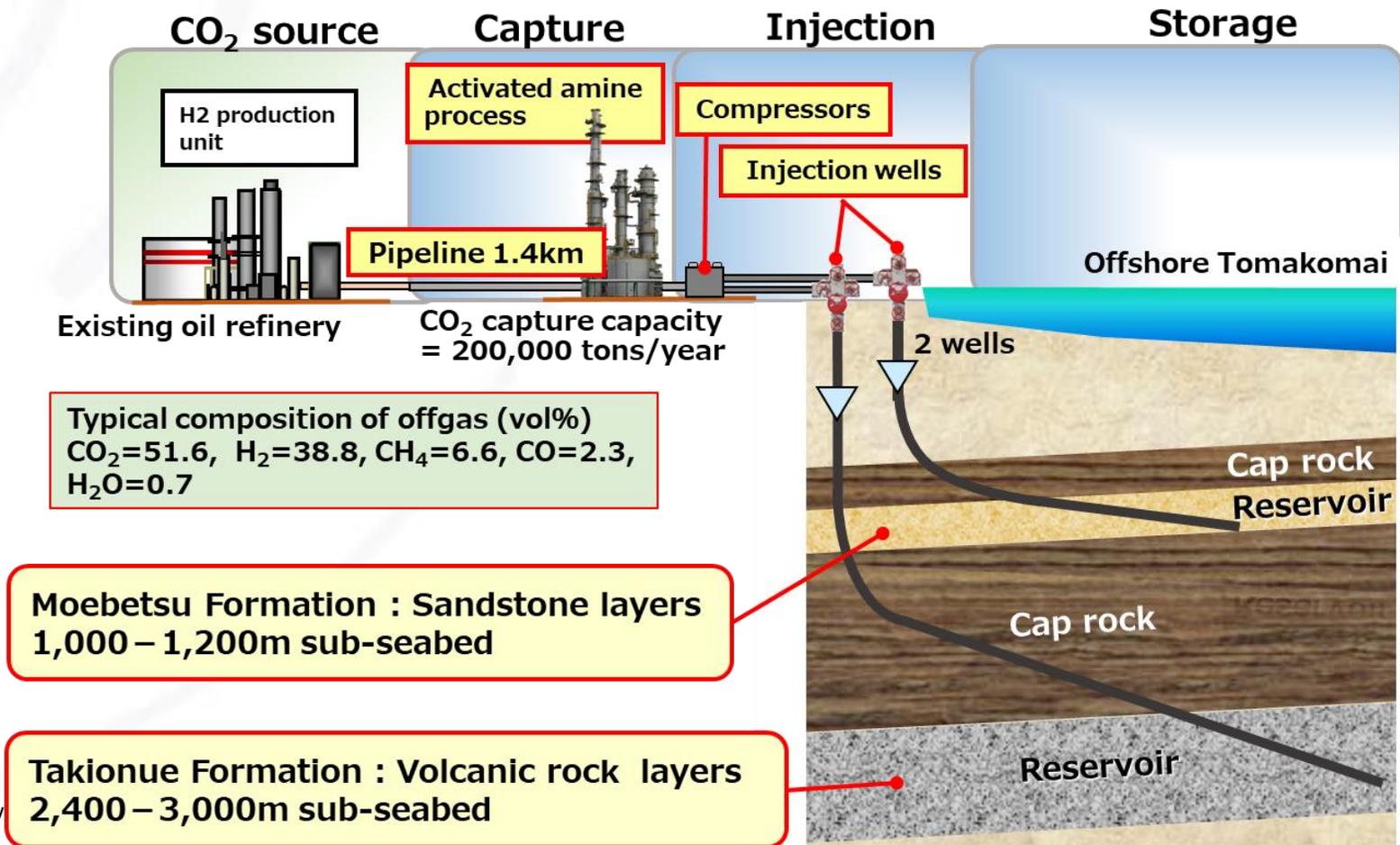
- ◆ Separation method which expects further cost reduction compared to solid absorbent.
- ◆ Requires development in materials of membrane, its module component and optimization with a plant.
- ◆ We are preparing an open call targeting membrane technology development, considering upgrading selectivity, permeability and durability of membrane, and process optimization.

3. Lower CO₂ gas concentration

- ◆ Direct Air Capturing technology is one of NEDO's portfolio. We started related project since 2020.

3. Storage (Demonstration including capture)

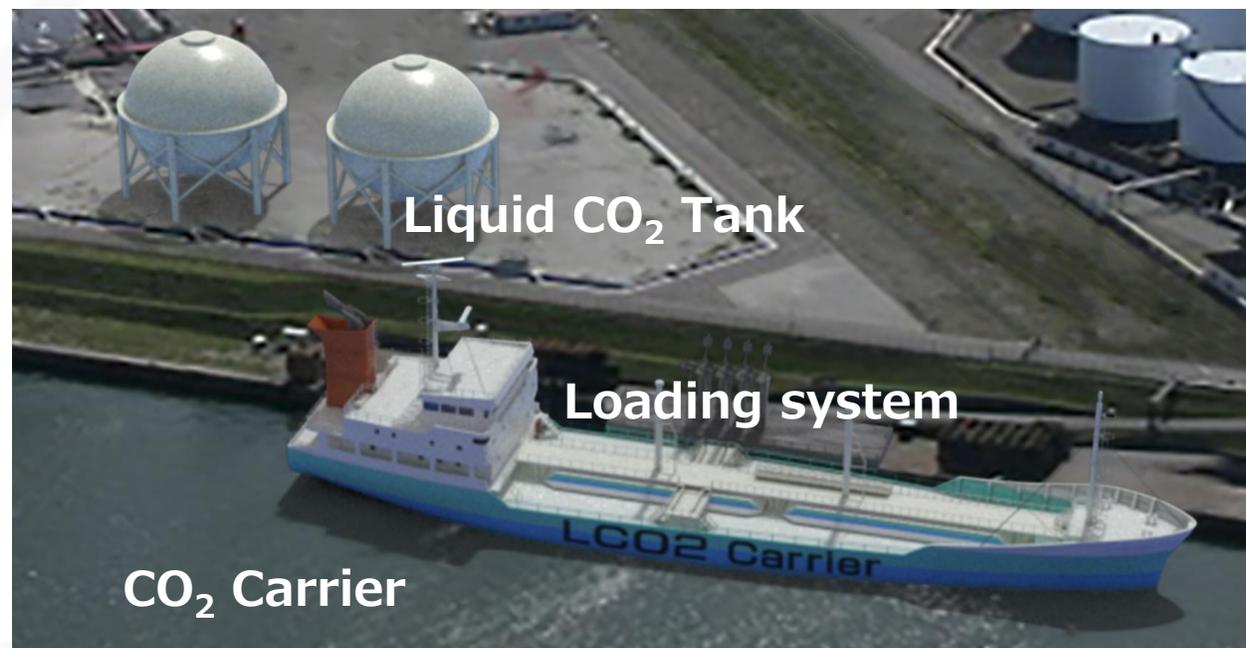
- ◆ To demonstrate the viability of a full-chain CCS system, from CO₂ capture to injection and storage.
- ◆ 300,000 tons of CO₂ was injected offshore reservoir in Tomakomai, one of large port city in Hokkaido.
- ◆ Environmental surveys and monitoring are on going to comply with relevant regulations.



Source : Japan CCS Co., Ltd.

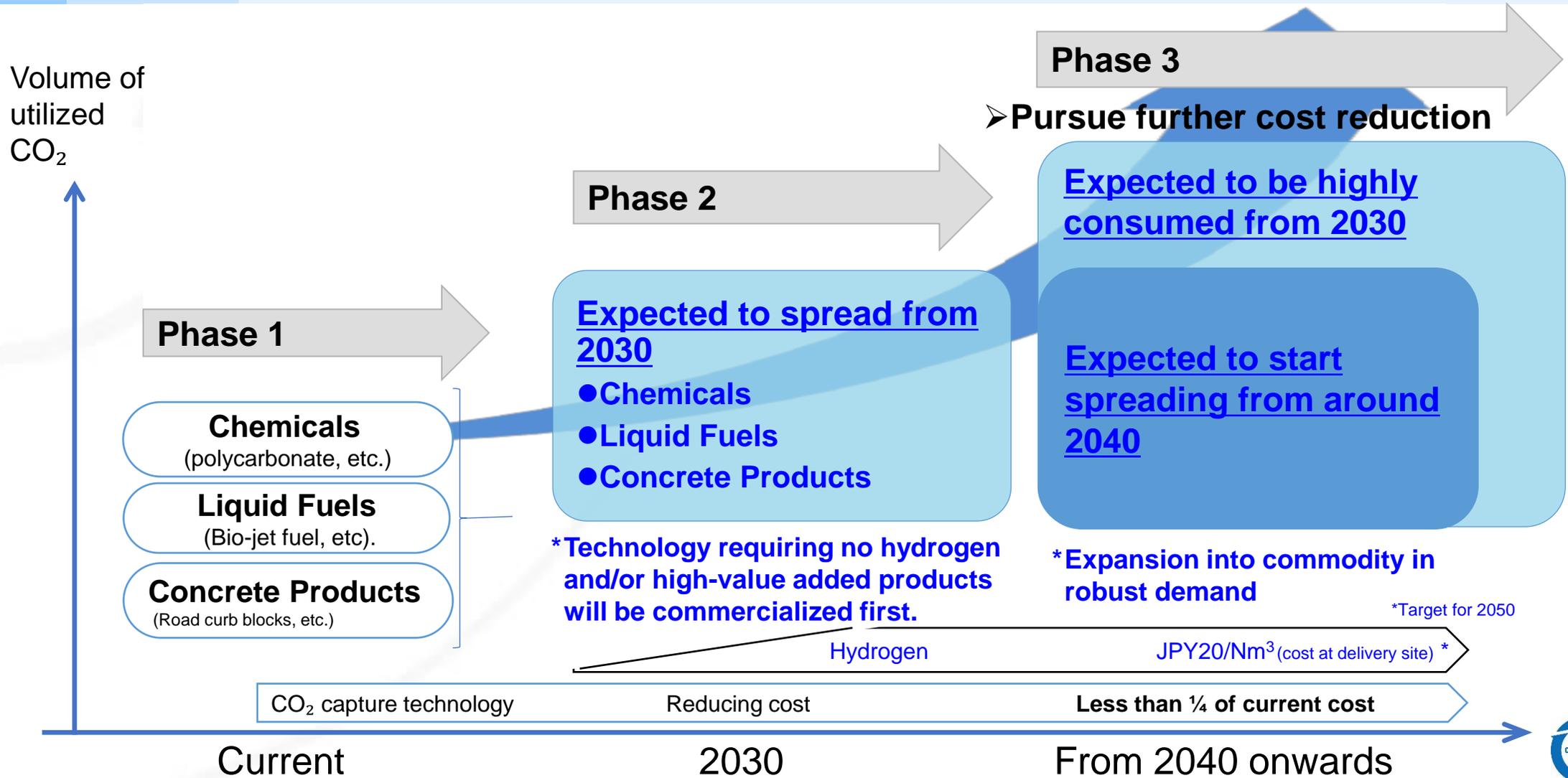
3. Storage (carrying)

- ◆ To connect CO₂ emitting location and storing location, it is necessary to secure an option of transportation.
- ◆ To develop an integrated system, from CO₂ liquefaction, ship transportation to tank storage, NEDO started a demonstration project since 2021.



The integrated transportation system Image

4. Recycling (road map)



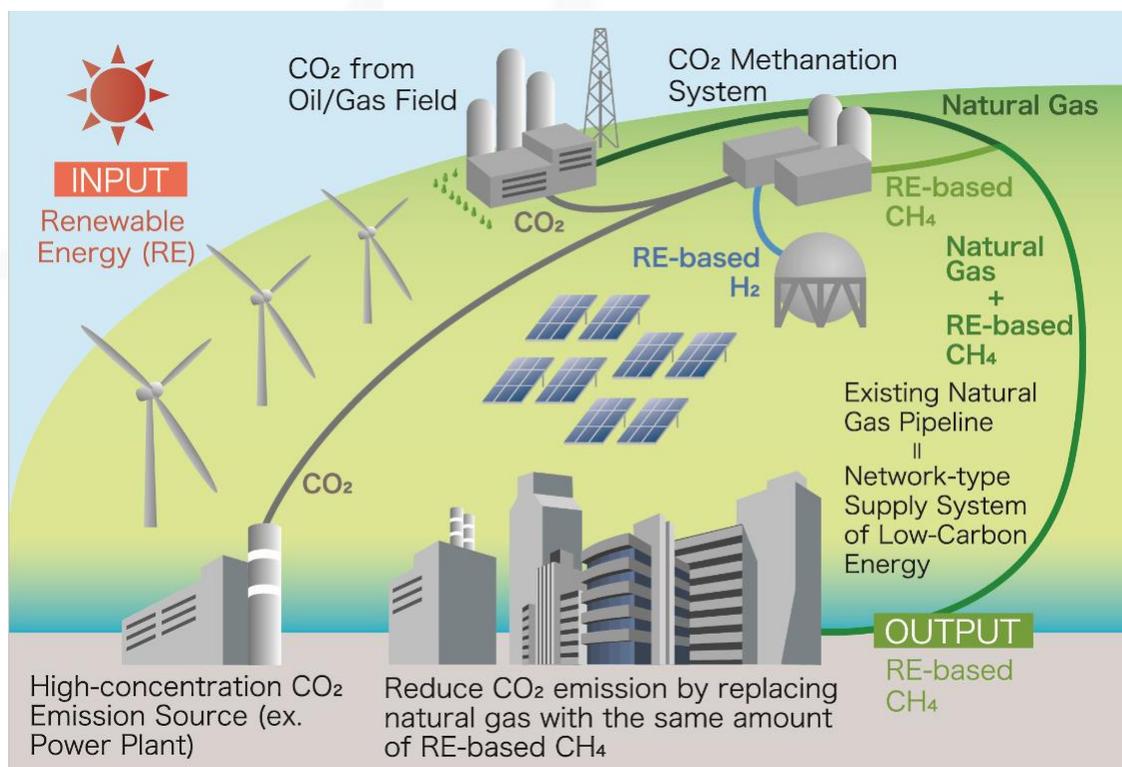
4. Recycling (projects)

- ◆ NEDO has been supporting several Carbon Recycling technologies.
- ◆ To push more its RDD activities, 13 projects are on-going, areas from chemicals, fuels and minerals.

Chemical	RD of Lower olefin production by direct synthetic reaction from CO ₂	RD of system for methanol synthesis from CO ₂	RD of paraxylene production from CO ₂	
Fuel	Large demonstration of CO ₂ methanation and mixture to gas supply line	RD of Liquid synthetic fuel from CO ₂		
Mineralization	RD of CO ₂ fixation using calcium in steelmaking slag	RD of CO ₂ fixation technology : high speed and large amount carbonization of steelmaking slag	RD of production technology of carbon material by CO ₂ chemical decomposition	RD of capturing CO ₂ emission with fine mist technology for the production of carbonates
	RD of CO ₂ fixation technology that co-produce valuables, using seawater and desalination brine	RD of CO ₂ -absorbing sintered material by microwave	RD of an accelerated mineral carbonation process using calcium in industrial wastes	RD of CO ₂ fixation process using cement-based waste materials and technology for using by-products in the construction field

4. Recycling (methanation project)

- ◆ Pilot-scale methanation project (8 Nm³-CH₄/h) was successfully concluded in 2021 and large scale demonstration (targeting 400 Nm³-CH₄/h) will start shortly.
- ◆ Methane produced by this project will be supplied through existing gas pipeline.



Reduction of CO₂ by substituting natural gas with carbon-neutral methane

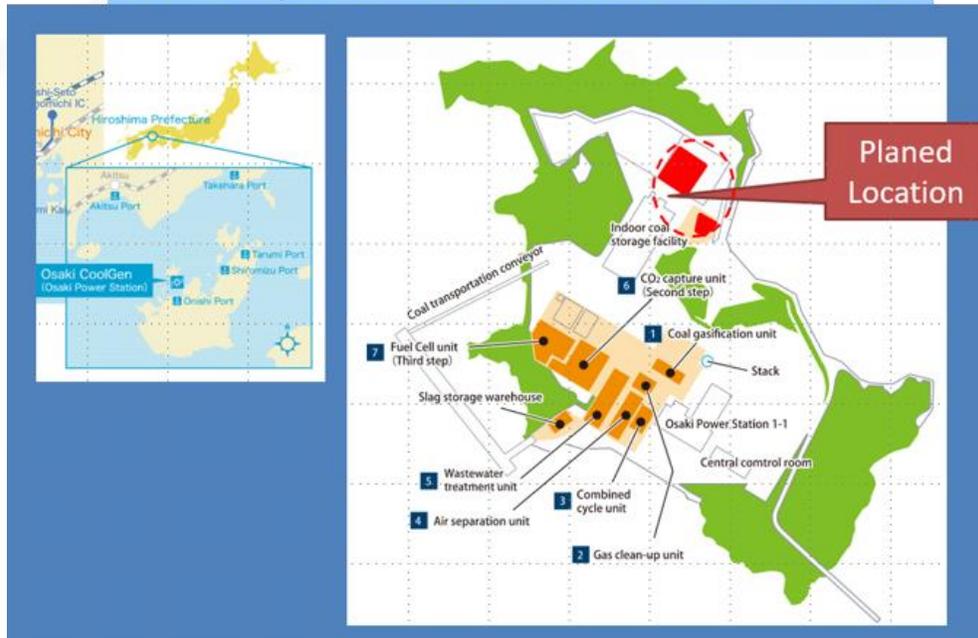


Methanation test facility
(Pilot-scale: 8 Nm³-CH₄/h, at Nagaoka, Niigata)

4. Recycling (RDD base)

- ◆ To further enhance development and demonstration of CR technologies, we provide supporting environment which will supply CO₂ gas emitted from IGCC.
- ◆ Site is under construction and NEDO is planning to have an open call shortly.

Location plan of Research Base at Osaki CoolGen



Source: Osaki CoolGen WEB site (<https://www.osaki-coolgen.jp/en/>)



Osaki CoolGen (OCG) 166MW IGCC

5. Relevant activities :



1. Sector coupling that enhance CR

- ◆ It is important to develop individual technologies and process for carbon recycling.
- ◆ Sector coupling is effective for “local or regional” cooperation or alignment especially in industrial complexes, that enables effective use of energy or CO₂ for further cost down.
- ◆ NEDO currently supports 4 feasibility studies.

2. International conference

- ◆ In order to widely spread the idea of “carbon recycling” both domestically and internationally, METI and NEDO co-organize international event every October.
- ◆ This year, we virtually held “The 3rd International Conference on Carbon Recycling 2021”.
- ◆ Speeches and panel discussions by policy makers and experts were made.
- ◆ You can watch stored contents with registration.

<https://carbon-recycling2021.go.jp/en/#home>



Thank you!