

# 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



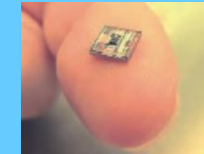
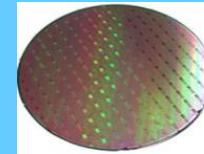
Rechargeable batteries and energy systems



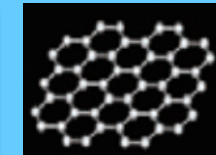
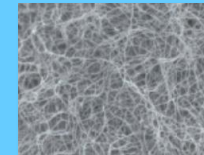
Environment and resource conservation

### Industrial Field

Electronics, information and telecommunication



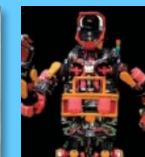
Materials and nanotechnology



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

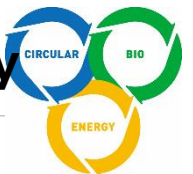


CO2 Utilization Project



full-chain CCS system

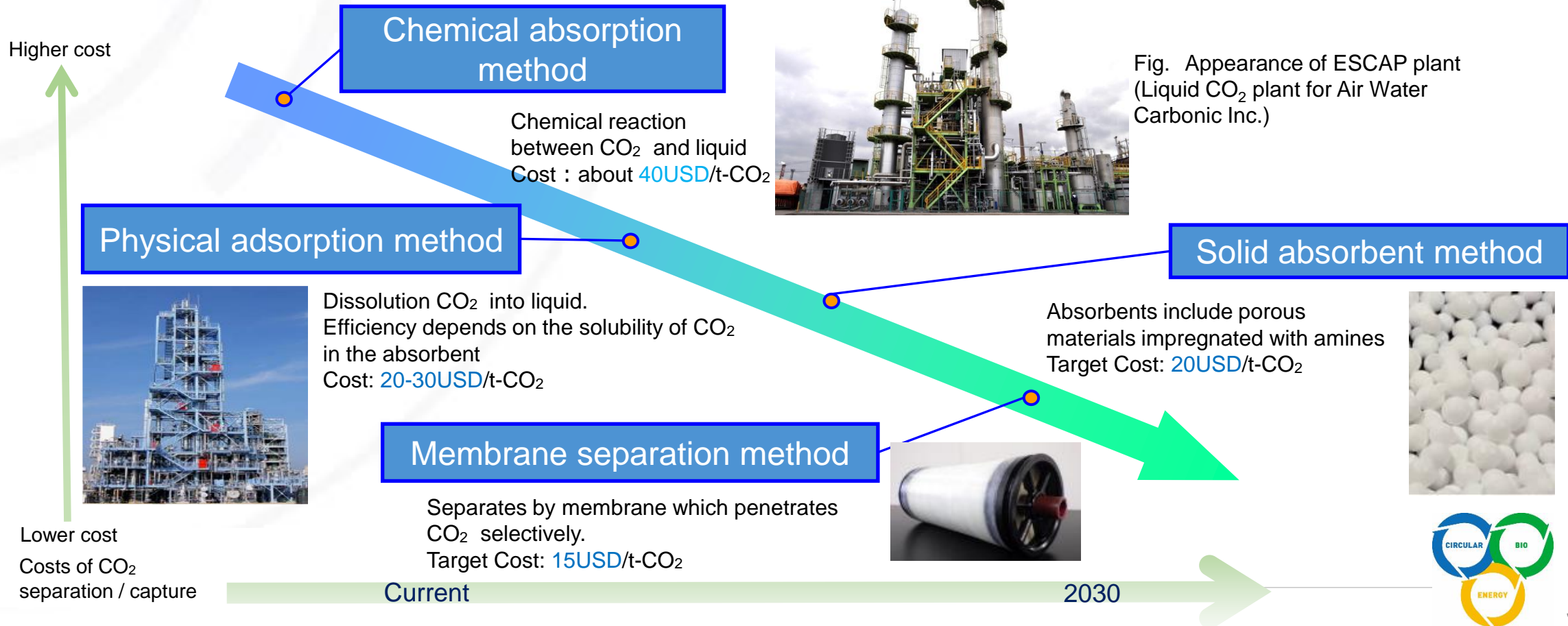
## Carbon Recycling and CCUS Technology





# 2.Capture (concept, target)

- ◆ CO<sub>2</sub> 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)

- ◆ CO<sub>2</sub> capturing with solid absorbent is one of highly expected method to halve the cost of CO<sub>2</sub> capture.
- ◆ Based on our past RD activity, Kawasaki Heavy Industry and RITE are constructing pilot scale testing facility (tens of tons-CO<sub>2</sub> 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

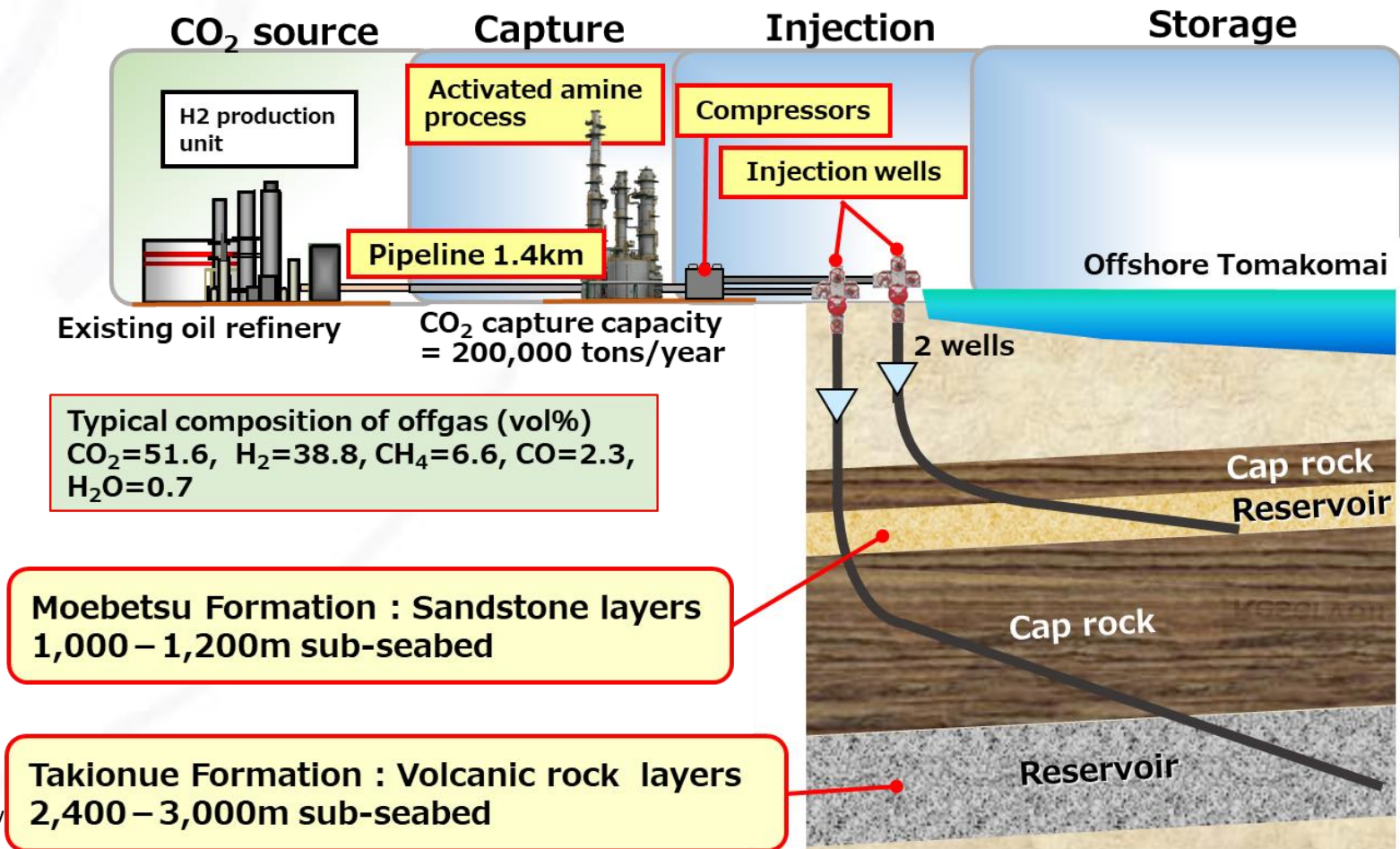
- ◆ Separation method which expects further cost reduction compared to solid absorbent.
- ◆ Requires development in materials of membrane, its module component and optimization with a plant.
- ◆ We are preparing an open call targeting membrane technology development, considering upgrading selectivity,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

### 3. Lower CO<sub>2</sub> gas concentration

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

# 3. Storage (Demonstration including capture)

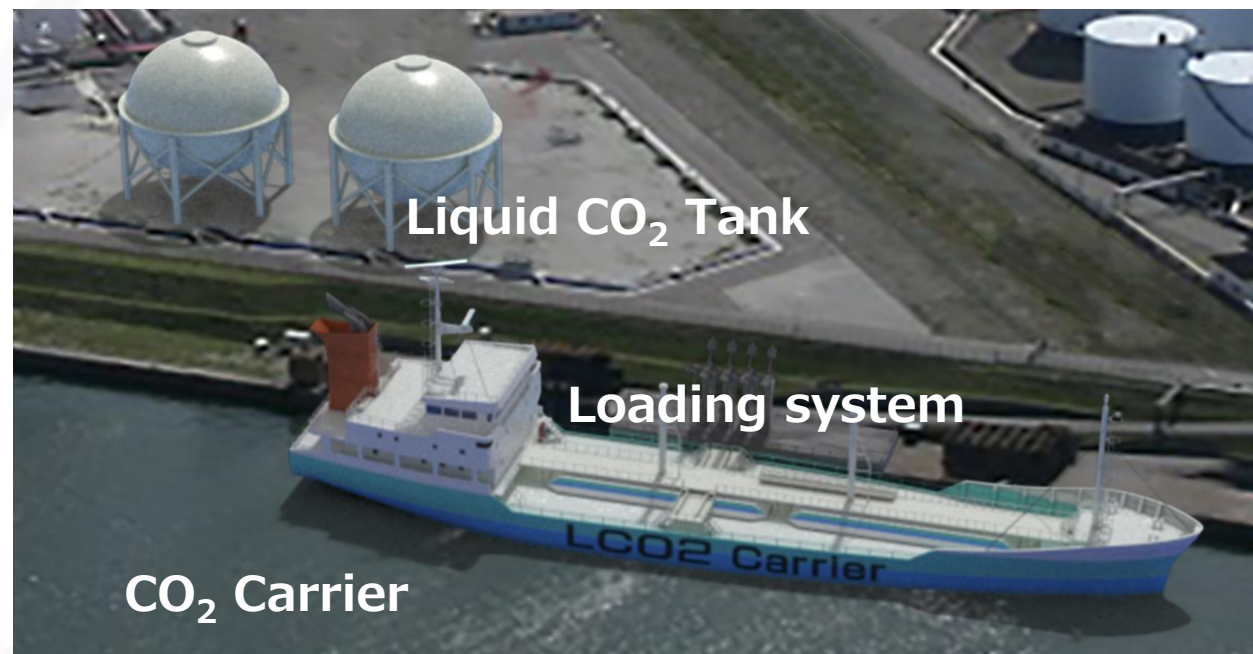
- ◆ To demonstrate the viability of a full-chain CCS system, from CO<sub>2</sub> capture to injection and storage.
- ◆ 300,000 tons of CO<sub>2</sub> was injected offshore reservoir in Tomakomai, one of large port city in Hokkaido.
- ◆ Environmental surveys and monitoring are on going to comply with relevant regulations.



Source : Japan CCS Co., Ltd.

### 3. Storage (carrying)

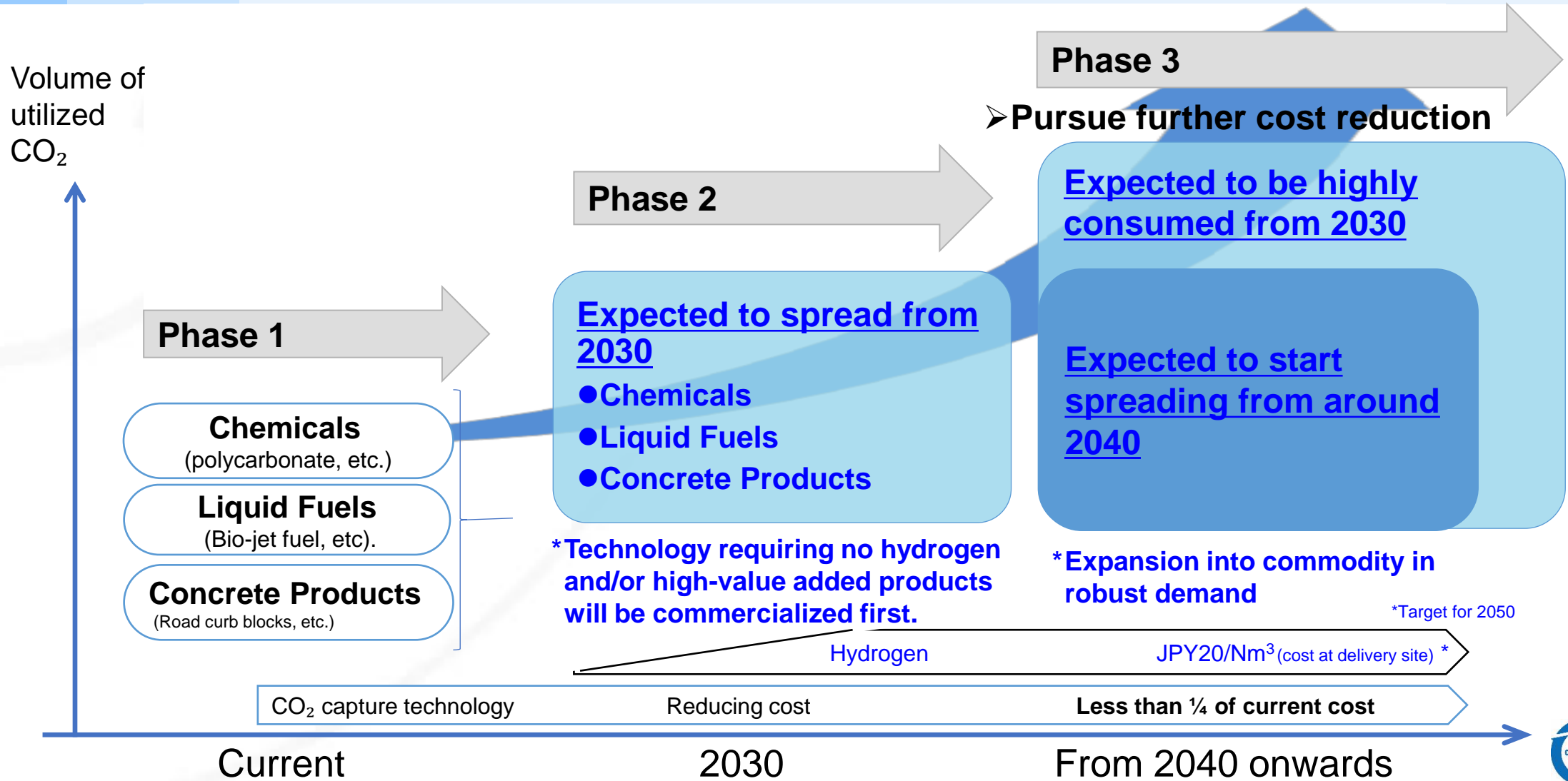
- ◆ To connect CO<sub>2</sub> emitting location and storing location, it is necessary to secure an option of transportation.
- ◆ To develop an integrated system, from CO<sub>2</sub> liquefaction, ship transportation to tank storage, NEDO started a demonstration project since 2021.



**The integrated transportation system Image**



# 4. Recycling (road map)



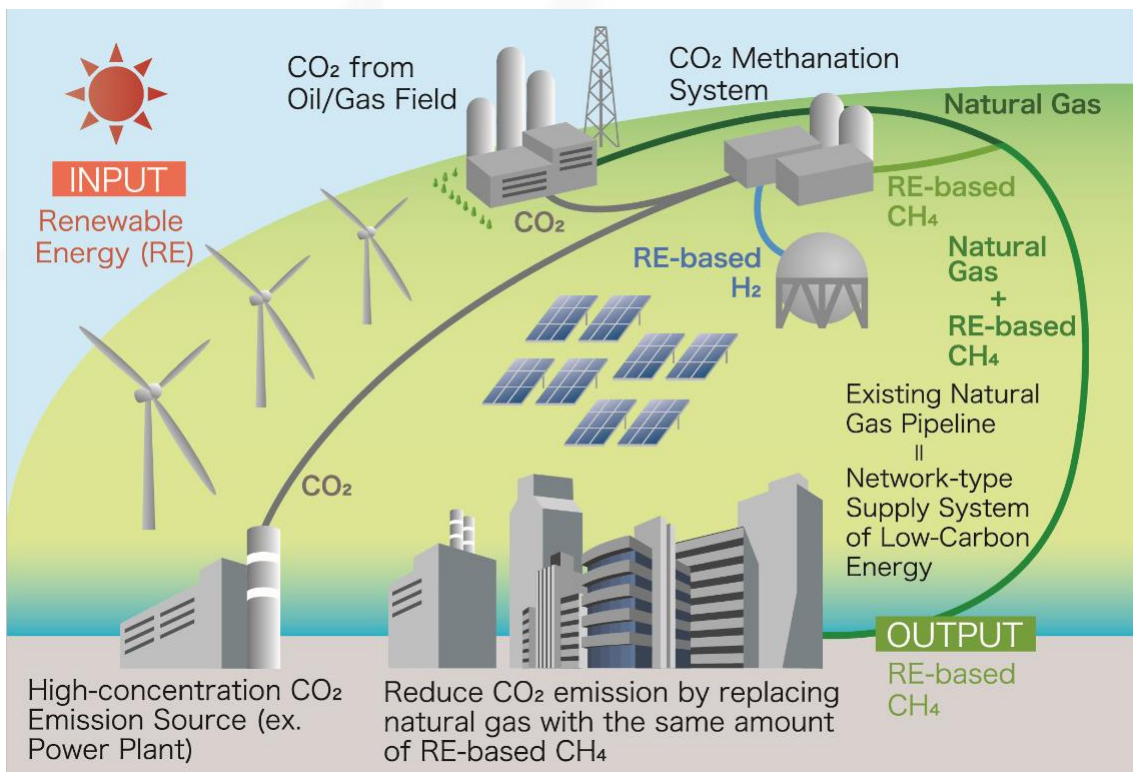
## 4. Recycling (projects)

- ◆ 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 <sub>2</sub>	RD of system for methanol synthesis from CO <sub>2</sub>	RD of paraxylene production from CO <sub>2</sub>	
Fuel	Large demonstration of CO <sub>2</sub> methanation and mixture to gas supply line	RD of Liquid synthetic fuel from CO <sub>2</sub>		
Mineralization	RD of CO <sub>2</sub> fixation using calcium in steelmaking slag	RD of CO <sub>2</sub> fixation technology : high speed and large amount carbonization of steelmaking slag	RD of production technology of carbon material by CO <sub>2</sub> chemical decomposition	RD of capturing CO <sub>2</sub> emission with fine mist technology for the production of carbonates
	RD of CO <sub>2</sub> fixation technology that co-produce valuables, using seawater and desalination brine	RD of CO <sub>2</sub> -absorbing sintered material by microwave	RD of an accelerated mineral carbonation process using calcium in industrial wastes	RD of CO <sub>2</sub> 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 Nm<sup>3</sup>-CH<sub>4</sub>/h) was successfully concluded in 2021 and large scale demonstration (targeting 400 Nm<sup>3</sup>-CH<sub>4</sub>/h) will start shortly.
- ◆ Methane produced by this project will be supplied through existing gas pipeline.



**Reduction of CO<sub>2</sub> by substituting natural gas with carbon-neutral methane**

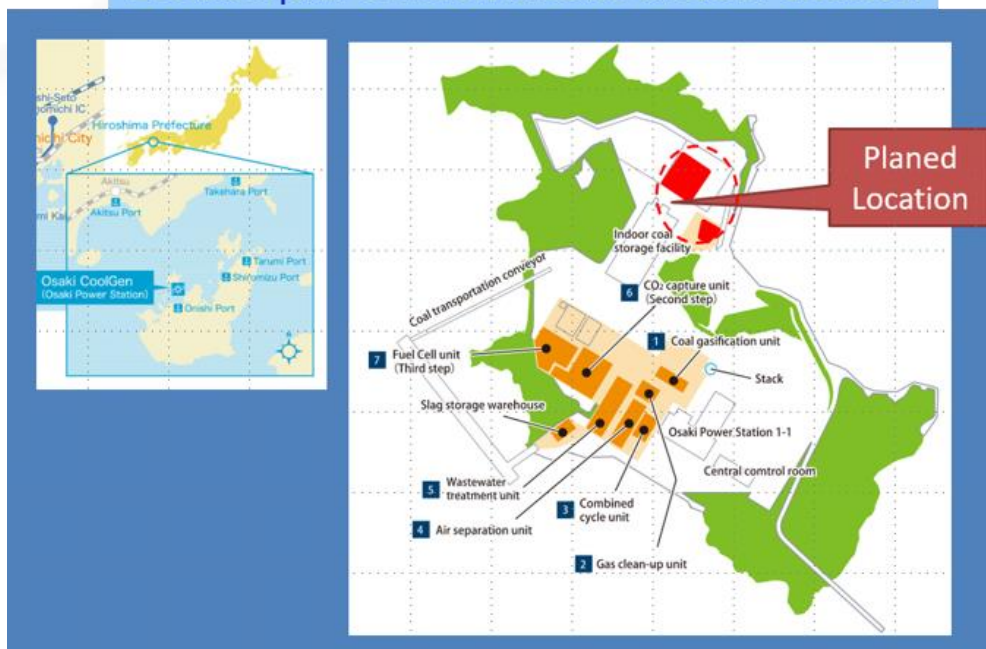


**Methanation test facility**  
(Pilot-scale: 8 Nm<sup>3</sup>-CH<sub>4</sub>/h, at Nagaoka, Niigata)

## 4. Recycling (RDD base)

- ◆ To further enhance development and demonstration of CR technologies, we provide supporting environment which will supply CO<sub>2</sub> 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 CO<sub>2</sub> 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!