

Permitting system for CO₂ sequestration in sub-seabed geological formations and Related trend on CCS in Japan

April 18, 2024

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The London Protocol and Objective

- To protect and preserve the marine environment from all sources of pollution and take effective measures to prevent, reduce and eliminate pollution caused by dumping or incineration at sea of wastes or other matter.
- In the protocol, Contracting Parties shall prohibit the dumping of any wastes or other matter with the exception of those listed in Annex 1.

55 Contracting Parties (as of March 2024)

Amendment of the Protocol (CCS)

2006	CO2 sequestration in sub-seabed geological formations is listed in Annex 1.
2009	The London Protocol was amended to allow for cross border transportation of CO2 for sub-seabed storage. (The amendment must be ratified by two thirds of contracting parties to enter into force.)



Contracting Parties that have declared a provisional application can export CO2.

Act on Prevention of Marine Pollution and Maritime Disaster

Japan has been implementing the provisions of the Protocol domestically mainly through the Act on Prevention of Marine Pollution and Maritime Disaster.

- The disposal of wastes at sea is **prohibited in principle**.
- **Only when a permit is issued by the Minister of the Environment**, the limited exceptional types of “wastes” can be disposed at sea.
- “Wastes” mean things unnecessary for humankind in Japanese Law.

Permit for the disposal of CO₂ for CCS

The Act is covering the disposal of CO₂ for CCS.

Prohibition of disposal of oils, noxious liquid substances and wastes under the seabed.

Except for

1. Oily matter resulting from exploration of mineral resources in the seabed and sub-seabed
2. Gases consisting overwhelmingly of CO₂

 **Permit issued by Minister of the Environment is required.**

The permitting criteria and process for CCS

Permitting criteria for CCS

- ◆ Geological structure should prevent negative impact on the marine environment.
- ◆ The situation should be monitored to identify pollutions.
- ◆ No possibilities to affect the environment in the disposal area.
- ◆ No alternative appropriate disposal ways other than disposal under the seabed.
- ◆ An applicant should have technical and financial capability to implement disposal and monitoring continuously.

Permitting process

1. Submission of Application Documents

Public comment for 1 month

2. Issuance of a Disposal Permit

3. Disposal and Storage of CO₂, and Monitoring

4. Renewal of a Disposal Permit

※Permit is for a maximum of **5 years**

Three monitoring phases

Phase 1 : Regular monitoring

Exceed the threshold

Phase 2 : Precautionary Monitoring

Exceed the threshold

Monitoring to judge whether negative effect occurred/would occur.

Phase 3 : Contingency monitoring

Continuous monitoring until no negative effect is confirmed.

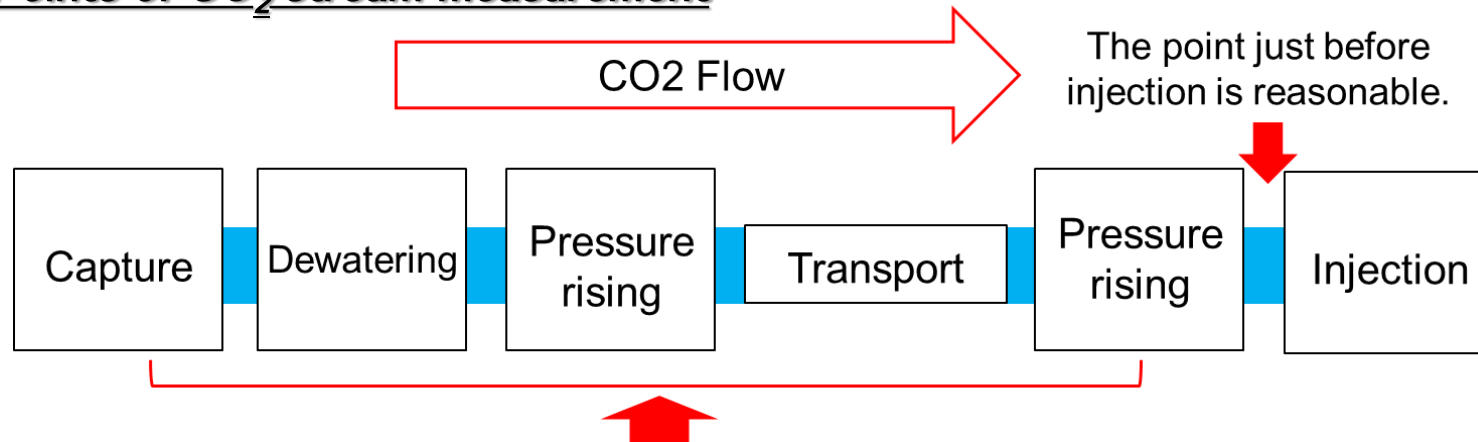
Provisions of CO₂ stream in the current Act

- The concentration of CO₂ > 99.99%
- Only chemical absorption using amines is permitted
- Measuring the impurities (H₂, O₂, N₂, CO and hydrocarbon)
- Other oils rather than CO₂ should not be included.

Impurities

- ◆ Expected impurities in CO₂ stream need to be listed by the applicant.
- ◆ Impurities which won't have any impacts on the marine environment doesn't need to be measured and reported.

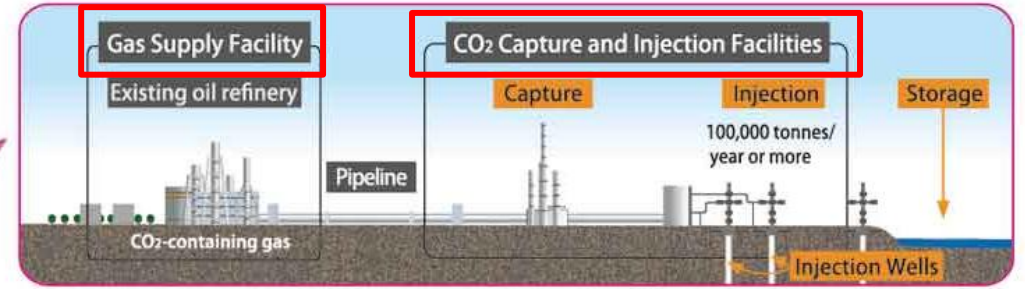
Points of CO₂ stream measurement



The applicant can select any points for measuring CO₂ if it is vailed that CO₂ concentration does not change throughout the transportation process. (*multiple sources of CO₂ gas is a future consideration)

Tomakomai CCS demonstration project

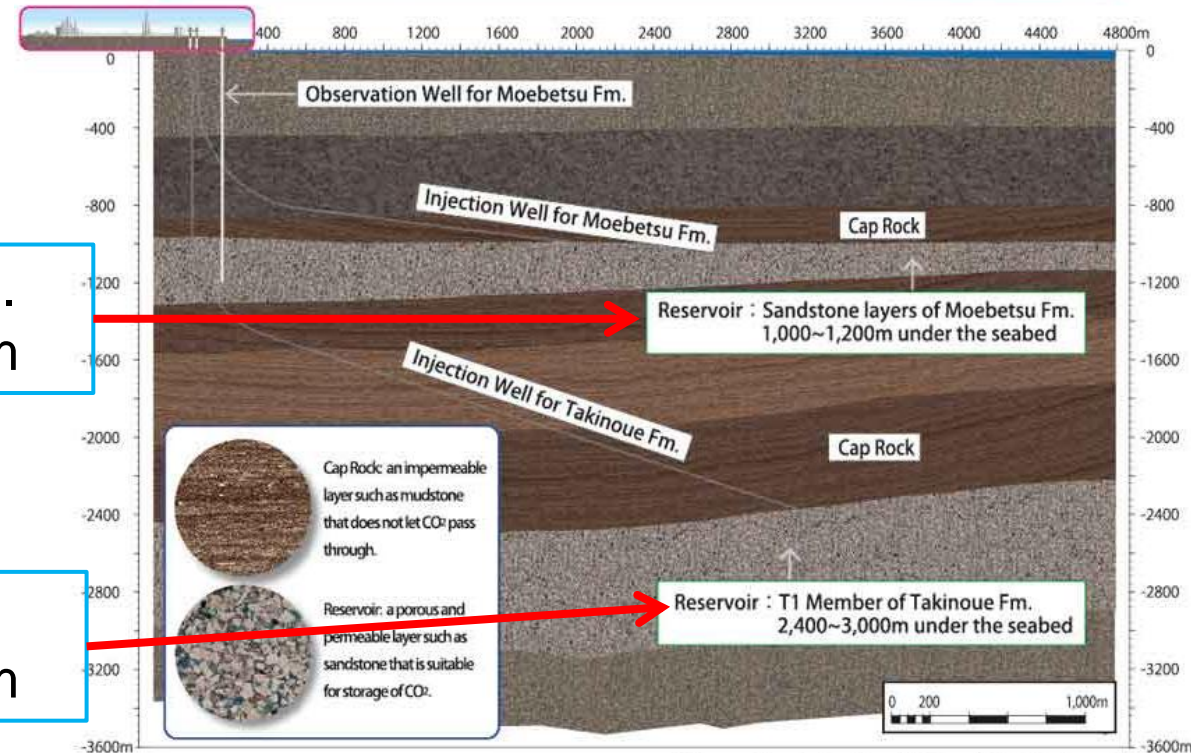
Applicant	Ministry of Economy, Trade and Industry
Permitted period	(1) 2016.4 - 2021.3, (2) 2021.4 - 2026.3
Injection period	2016.4 - 2019.3 (3 years)
Total amount	300,000 tonne (100,000 tonne/year)
CO2 Source	Petroleum refining plant



Reservoir
(aquifer)

Moebetsu Fm.
1,000~1,200m

Takinoue Fm.
2,400~3,000m

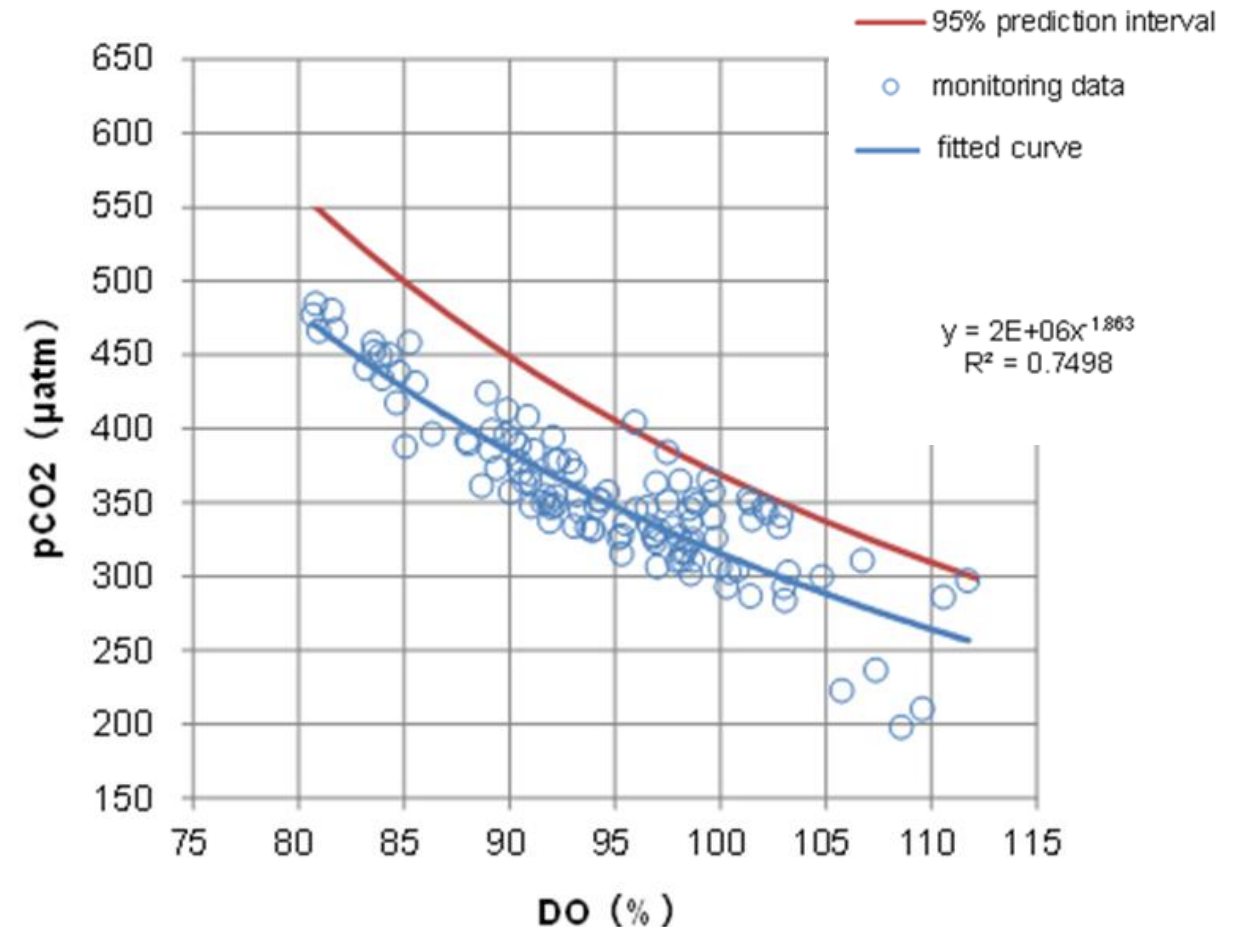


※ Cross-sectional view along the trace of the injection wells.
(Aspect Ratio = 1 : 1)

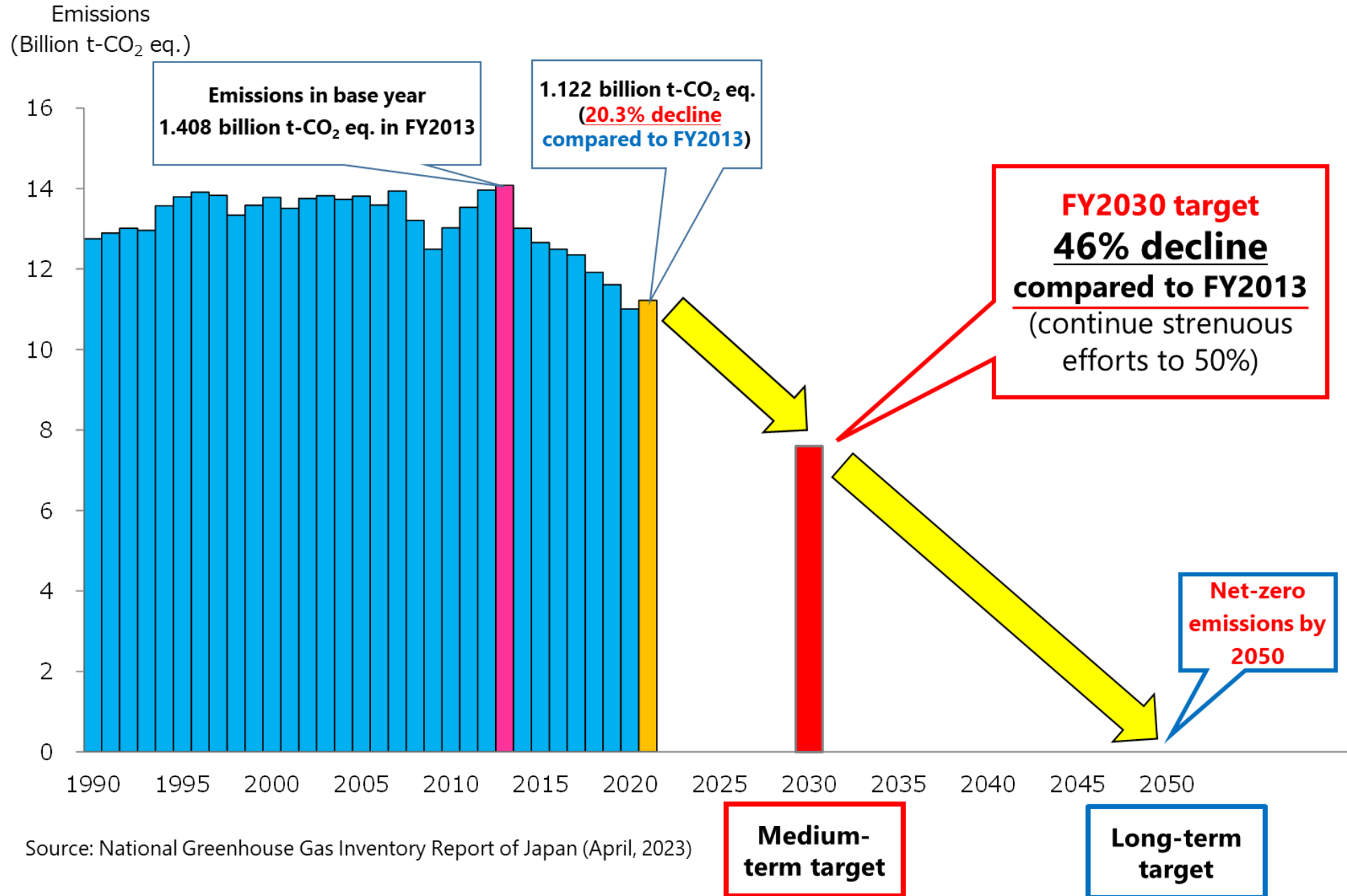
Parameters measured in Tomakomai

- Relationship between $p\text{CO}_2$ and DO was considered as valid for the threshold.
- The method of setting the threshold for water column sampling in Tomakomai area was considered.

- Relationship between $p\text{CO}_2$ and DO (dissolved oxygen saturation[%])
 - $p\text{CO}_2$ is inversely correlated with DO .
 - Stable throughout a year
- DIC (Dissolved Inorganic Carbon)
 - Increased linearly with the amount of leaked CO_2
 - Strongly affected by air-sea exchange
 - Differed from year to year even in the same season
- $p\text{CO}_2$ (carbon dioxide partial pressure)
 - Fluctuated due to respiration and photosynthesis of marine organism
 - Increased non-linearly with the amount of leak CO_2



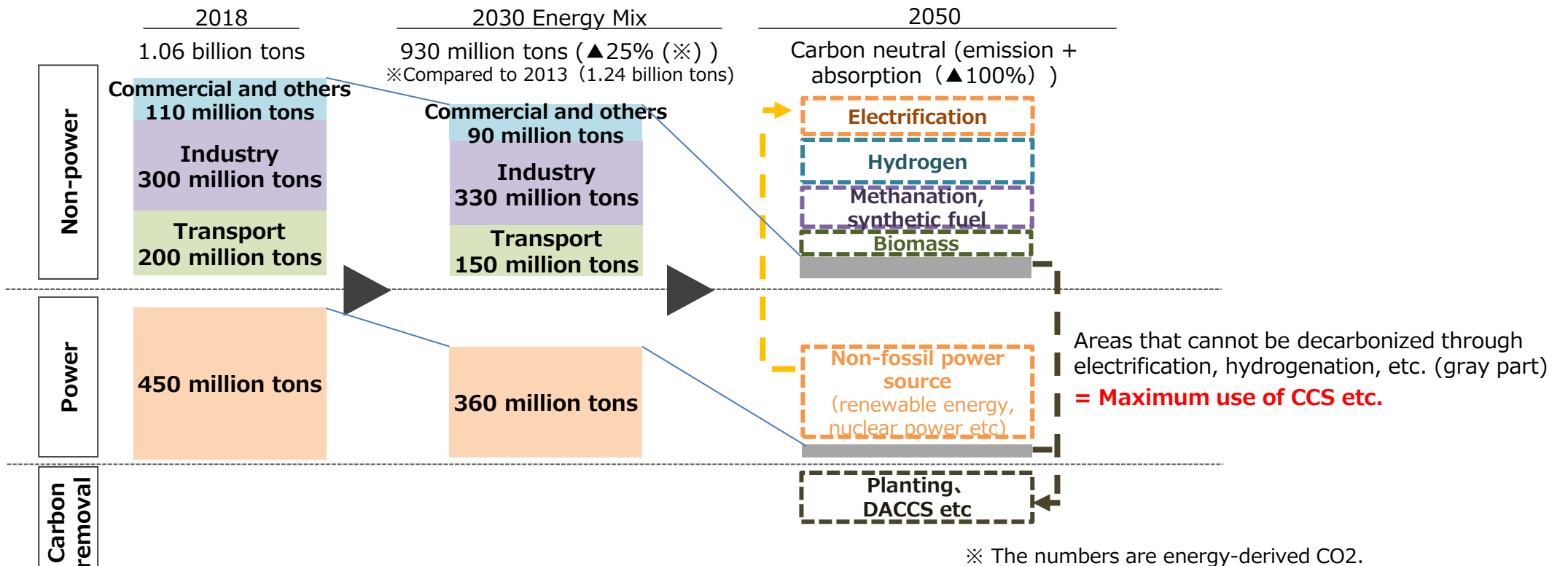
Japan's Medium- and Long-term Targets for GHG Reduction



CCS policy for Carbon Neutrality in Japan

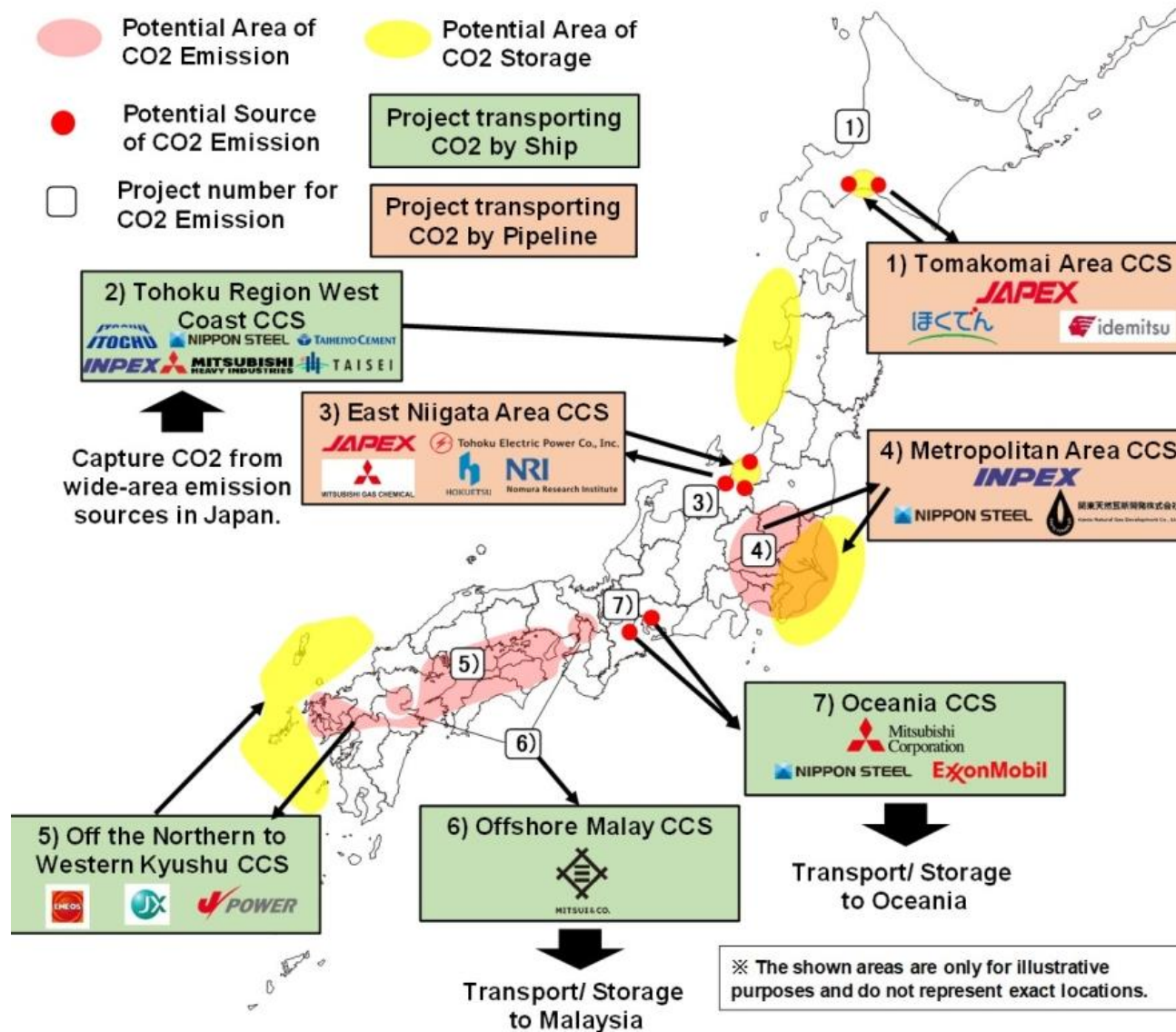
- To achieve carbon neutrality in 2050, **CCS is necessary to abate emissions in areas where CO₂ emissions are unavoidable.**
- The CO₂ capture amount volume of Japan in 2050 is expected **about 120 to 240 million tons**, based on the IEA report and the goals of each country.
- GX Promotion Strategy (Cabinet decision: July 2023) states that **to develop business environment for starting CCS by 2030**, advanced CCS Projects will be supported and discussions on **developing relevant legal frameworks will be accelerated** to have systemic measures in place.

Before allocation of power and heat



Potential CCS Projects in Japan

7 role model projects selected by JOGMEC (Japan Organization for Metals and Energy Security)



Overview of the draft Act on Carbon Dioxide Storage Businesses

(13th February 2024, Cabinet Decision)

- Japan plans to create **a business environment for private businesses to start CCS business by 2030** (GX Promotion Strategy, Cabinet decision in July 2023), **establishing a permit system for storage projects** while **maintaining public safety and conserving marine environment**.
- The **current permission system** under the Act on Prevention of Marine Pollution and Maritime Disaster **will be integrated into the new Act**.
- **The Minister of the Environment will jointly manage necessary measures with the Minister of the Economy, Trade and Industry** from the viewpoint of the marine environment conservation.

1. Permit system for exploratory excavation and storage business, business regulations related to storage business

1. Permit system for exploratory excavation and storage business (2) Regulations for storage business operators

The Minister of Economy, Trade and Industry

- **Designates the area** where the reservoir may exist as a "specific area"
- Announce an **open call for exploratory excavation and CO2 storage** projects in the specific area,
- **Grants permission** to the most appropriate applicants.
- **Need agreement with the Minister of the Environment** in designation of specific area and permit of a storage. .

The Minister of Economy, Trade and Industry

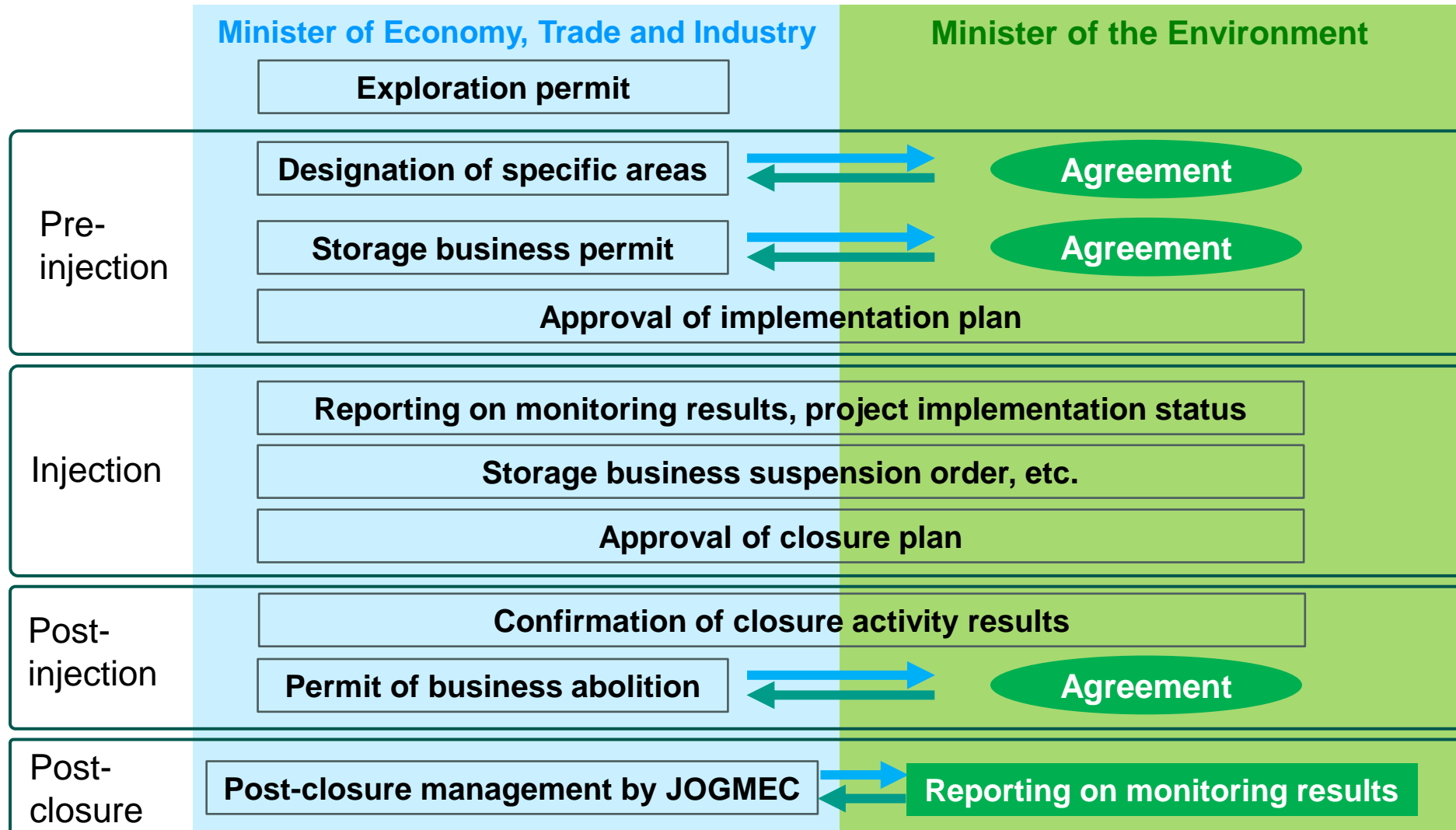
- **Approves** the specific "**implementation plan**" for exploratory excavation and storage projects
- In the case that **storage is in the sea** area, **approval by the Minister of the Environment** is required.
- Impose the **obligation to monitor** the temperature and pressure of the storage reservoir so that leakage of stored CO2 can be identified. .

2. Authorization of closure plan, post-closure management by JOGMEC

- After business abolition is permit, **projects will be taken over and managed by JOGMEC**

Conservation of the marine environment under a new act on CCS

- In February 2024, Cabinet Approval was made on **the Act on Carbon Dioxide Storage Businesses**. The Minister of the Environment will be jointly responsible for taking necessary measures for conservation of the marine environment under this Act.
- **Acceptance of Article 6 amendment** will be also consulted with the Diet.



Schedule

- The act on Carbon Dioxide Storage Businesses is under the domestic diet consideration. After the approval by the diet, the Act will be fully operated in 2 years.
- The ratification of 2009 amendment of the London Protocol is also under the discussion.

Future consideration (in terms of marine environment protection)

- Develop the detailed permit criteria and process for project closures.
- Methodology of environmental impact assessments in designation of specific area.
- Promote public consensus around project sites.