

# Japan's CCS long-term roadmap

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# Japan's Long-Term Roadmap

## [Basic principles]

To implement CCS systematically and rationally to promote the sound development of CCS business in Japan with minimal social costs, thereby contributing to the development of Japan's economy and industry, securing a stable energy supply, and the achievement of carbon neutrality.

## [Objectives]

**A business environment for commencement shall be prepared by 2030**, involving cost reduction, public understanding, overseas CCS promotion, and CCS Business Act legislation, **based on the rough estimation of enabling CO<sub>2</sub> storage of about 120 to 240 million tons as of 2050**, and **full-scale CCS business shall deploy after 2030**.



## [Specific actions]

- (1) Government support for CCS business
- (2) Efforts for reducing CCS costs
- (3) Promotion of public understanding of CCS business
- (4) Promotion of overseas CCS business
- (5) Examination for the development of the CCS Business Act (tentative name)
- (6) Formulation and review of the CCS Action Plan

# Purpose of advanced CCS program

- To secure annual storage of 120-240 million tons of CO<sub>2</sub> by 2050, A business model for CCS that can cross-sectoral should be established at an early stage. Thus, Japanese government selected “Advanced CCS projects” led by operators and will actively support them.
- This supporting program will establish various CCS business models by supporting projects with different combinations of CO<sub>2</sub> source, transportation methods and CO<sub>2</sub> storage areas. Furthermore, it aims to secure 6-12 million tons of CO<sub>2</sub> storage per year by 2030.
- This year, this program will provide support for the analysis of this geologic data and feasibility study.

## Possible types of CO<sub>2</sub> source, transport methods, and CO<sub>2</sub> storage areas

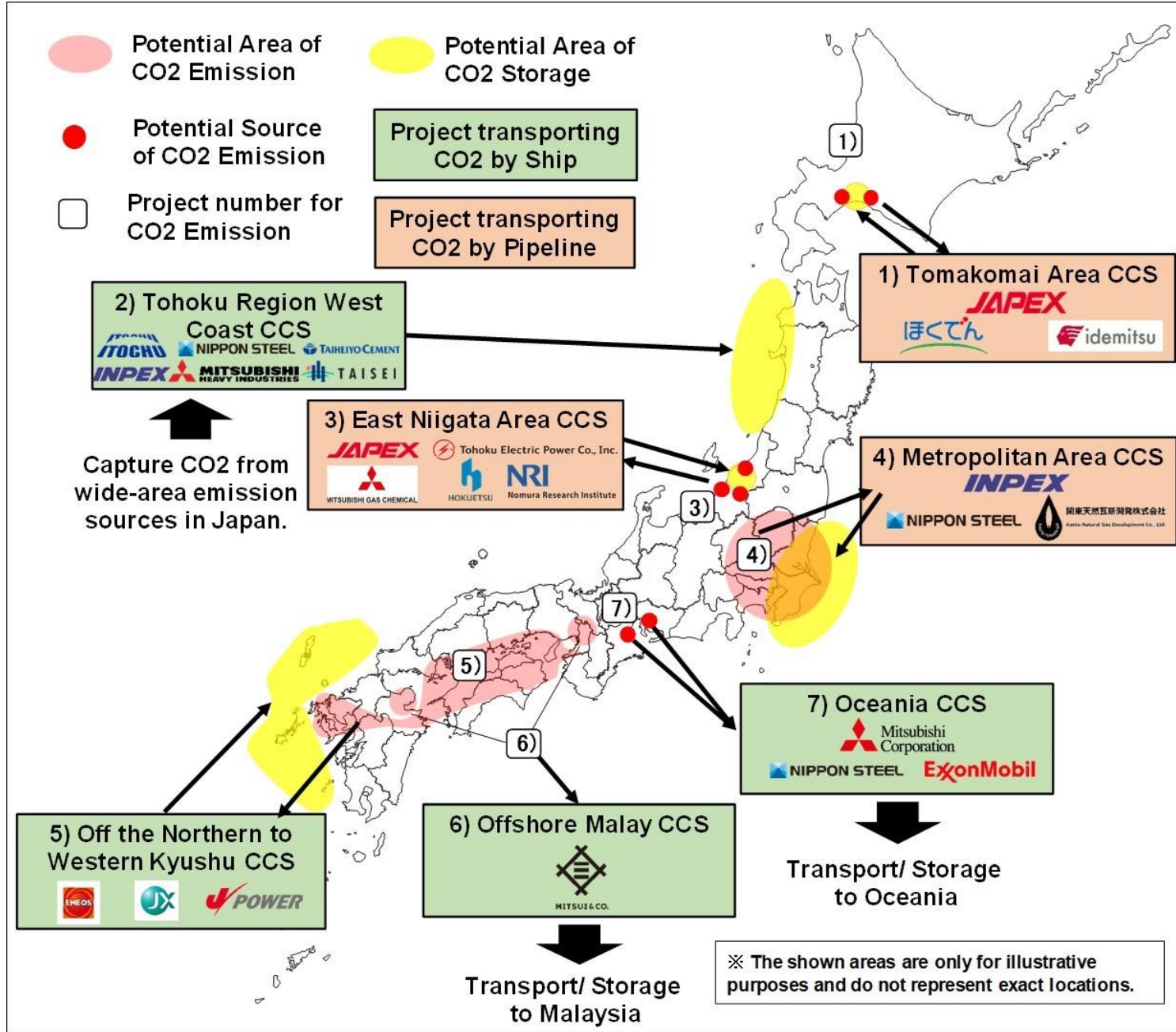
CO <sub>2</sub> sources	Transport methods	CO <sub>2</sub> storage areas
Thermal power plant	Pipeline	Onshore
Steel plant		Ship
Chemical plant	Offshore	
Cement plant		
Paper plant		
Hydrogen plant etc.		

# Overviews of Selected Advanced CCS Projects

- On June 6, Seven CCS projects was selected as Advanced CCS project (including two oversea export projects) which was considered CO2 source, transportation methods, storage areas.
- Selected project target a wide range of industries such as electric pawner, oil refineries, steel, chemical, pulp/paper, and cement, and capture CO2 emitted from various regions in Japan.
- The total estimated annual storage of CO2 in 2030 is about 13 million tons (including 30% exported overseas).

Storage areas	CO2 Sources	Transportation methods	Types of storage site
①Tomakomai Area CCS JAPEX, Idemitsu Kosan, Hokkaido Electric power	Oil refinery, electric power plant	Pipeline	Onshore depleted gas fields and/or Near shore
②Tohoku region west coast CCS ITOCHU Corp., Nippon Steel, Taiheiyo Cement, Mitsubishi Heavy Industries, ITOCHU Oil Exploration, INPEX, Taisei Corp.	Steel plant, Cement plant	Ship, Pipeline	Near shore
③East Niigata Aria CCS JAPEX, Tohoku electric power, Mitsubishi Gas Chemical Company, Hokuetsu Co, Nomura Research Institute.	Chemical plant, Paper plant, electric power plant	Pipeline	Onshore depleted gas fields ~ Near Shore
④Metropolitan Aria CCS INPEX, Nippon Steel, Kanto Natural Gas Development	Steel plant, others	Pipeline	Near Shore
⑤Northern to Western Offshore CCS ENEOS、 JX Nippon Oil & Gas Exploration、 J-Power	Oil refinery, electric power plant	Ship, Pipeline	Offshore
⑥Offshore Malay CCS Mitsui & Co.	Oil refinery, Chemical plant, others	Ship, Pipeline	Oversea project (Malaysia)
⑦Oceania Mitsubishi Corp., Nippon Steel, ExxonMobil	Steel plant, others	Ship, Pipeline	Oversea project (Oceania)

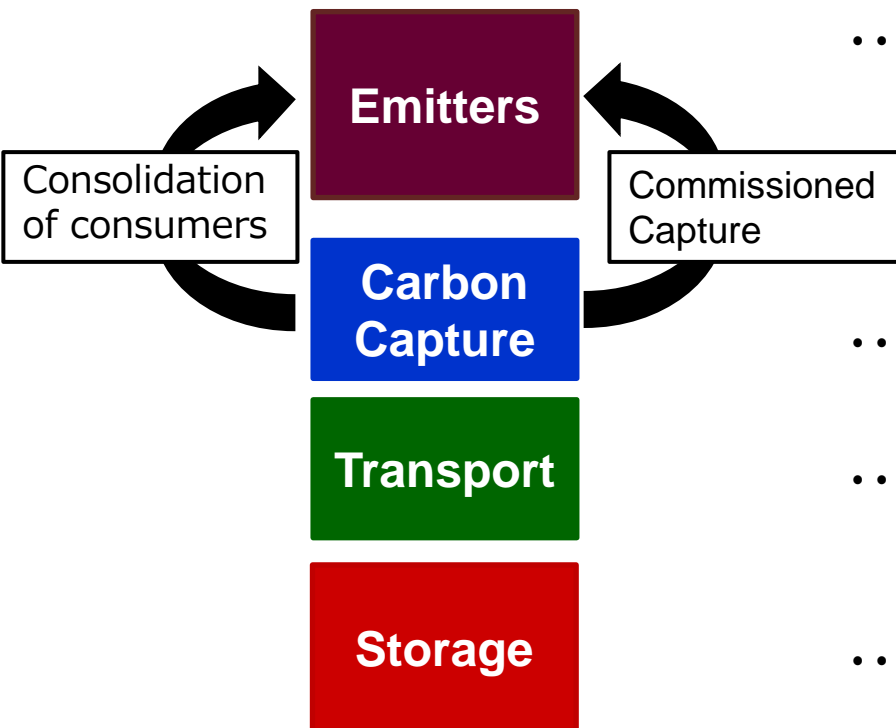
# Locations of the selected projects and companies



# Lessons from Advanced CCS Program

- T & S companies requires several hundreds million dollars and high technologies to install. The number of potential entrants would be limited.
- In order to install Carbon Capture process and transportation, “Aggregator” for emitters is necessary to foster by promoting outsourcing. Some public utilities companies to think to enter.
- In CCS, quantities of CO2 to transport would be more than 100 times. Primary transport would be pipelines and shipping would fill the regional gap.

## CCS System and its challenges



- In Japan there are around 7,500 factories to consume more than energy equivalent to 3,000kl annually
  - Large class facilities : couples of 100k – million ton
  - Middle class facilities : couples of 10k – 100k ton
  - Small class facilities : ~ couples of 10 K ton
- “Aggregation business” to covers Carbon Capture needs
  - Covering potential users and accept outsourcing of capture
- Smooth installation of pipelines and liquified shipping
  - Pipelines are required to cover the general requirement
- Expansion of its capacity and sustainable discovery of potential



# Liquefied CO2 Shipping Demonstration Project

- A demonstration project for long-haul transportation from emission sources to places suitable for storage will be carried out to establish liquefied CO2 shipping techniques. **Specifically, demonstration transportation, including a 1,000 km long-haul transportation route of from Maizuru to Tomakomai, will start in 2024, with the aim of achieving the world's first results.**

## Outline

- Establishment of CO2 liquefaction and storage systems and marine transportation technology for long-haul and large-scale transportation
- Demonstration test of 10,000 tons of CO2 transport by ship per year
- Feasibility Study on Vessel Transportation for CCUS



## Background of the study

CCS has not been commercialized until now: the reasons from legal viewpoints are as follows:

- (1) The application of laws and regulations (e.g., Mining Act, Mine Safety Act) to the CCS business and **the rules to be complied with on the operators' side and the national supervision system were unclear.**

Note) Mining Act and Mine Safety Act apply to oil and natural gas production increases, which are technically common to CCS projects; however, it is unclear whether they apply to CCS projects.

- (2) **There were no rules for arranging gas composition, and measuring, transporting, and providing the data** in the CCS value chain of CO<sub>2</sub> capture, transportation, and storage.
- (3) **There was no mechanism to eliminate or prevent interference from third parties** to secure the stability of a long-term project.
- (4) The development of CCS shall proceed while obtaining the understanding of residents; however, **there was no compliance with safety regulations, no mechanism for compensation for damage, and no clear explanation of what the operator should explain to residents.**

Note) In Japan's mining legislation, impacts on the surrounding environment are discussed in the preservation issues.

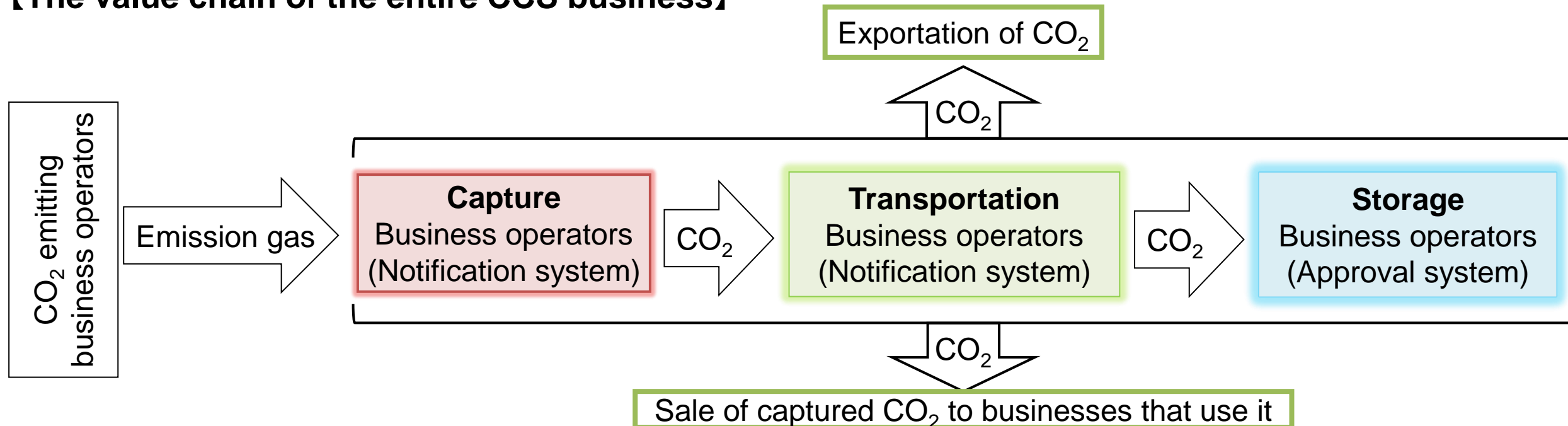
- (5) In particular, **the safety and monitoring responsibilities of storage operators were unclear.** Also, **business viability could not be guaranteed** unless responsibility was extinguished.



# Details of the measures

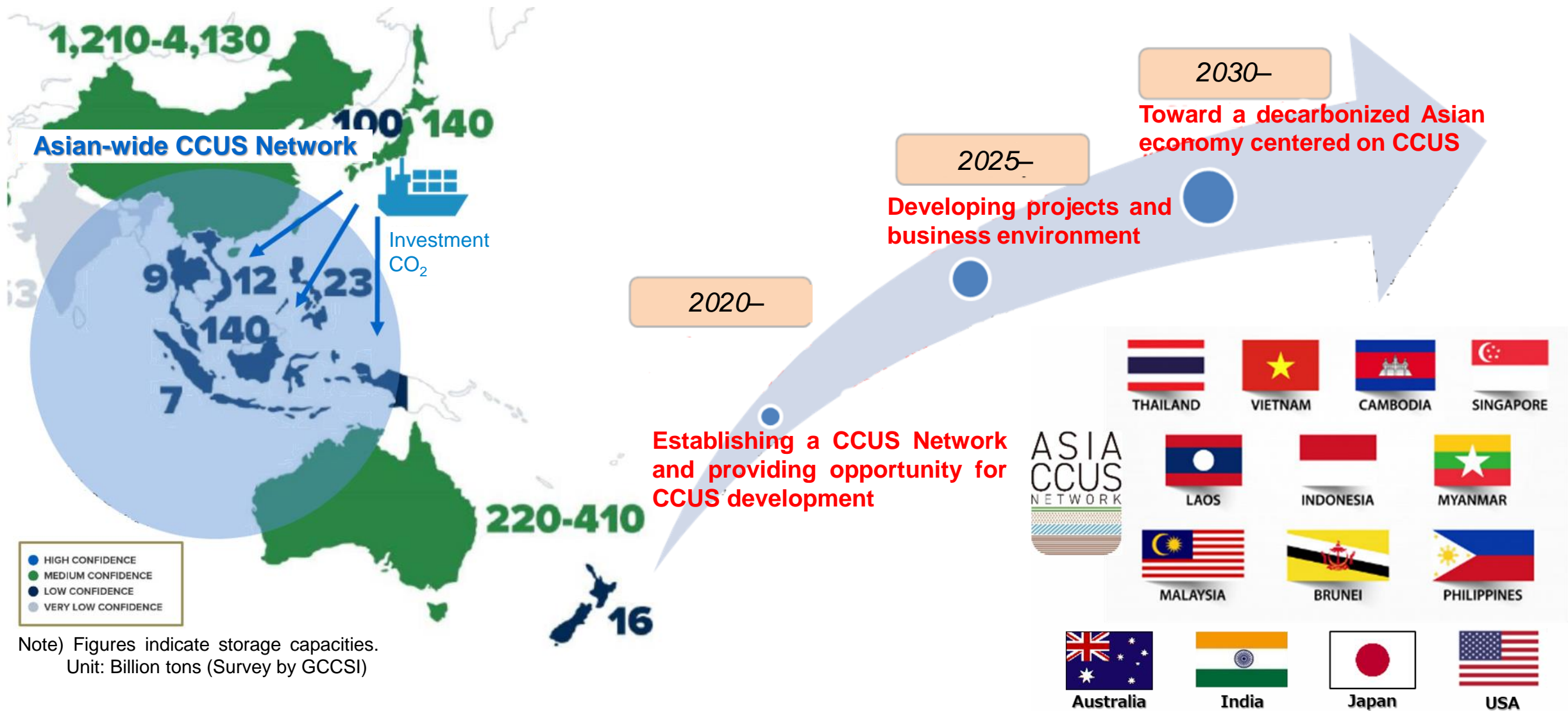
- **(1) Developing the CCS Business Act (new law) is urgent.**
- Based on the CCS value chain, **(2) the Act** should cover **capture, transportation, and storage.**
- In particular, **the storage business has many points in common with the oil and natural gas business.** Thus, measures, such as **(2) the institutionalization common to land and sea, (3) new establishment of storage business rights, (4) the establishment of a security system and clarification of liability for compensation (no fault liability), and (5) limitations of monitoring responsibilities** shall be taken, referring to mining legislations.
- **A legal framework for CO<sub>2</sub> exports aimed at promoting overseas CCS** should be determined.
- **Captured CO<sub>2</sub> should be able to be sold to promote CCU/carbon recycling.**

## 【The value chain of the entire CCS business】



# Building Asian-wide CCUS Network

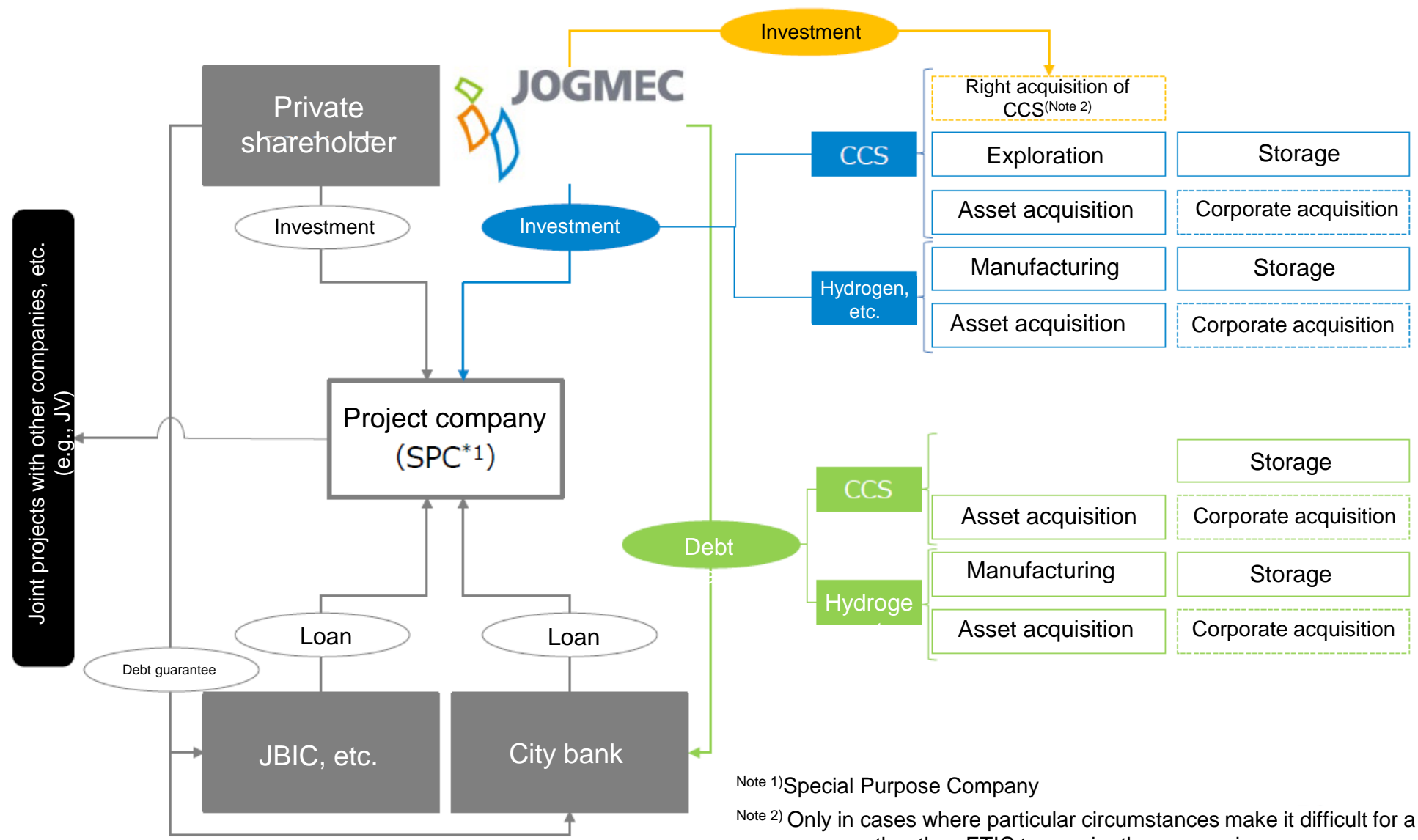
In June 2021, the Asia CCUS Network (ACN), an international industry-academia-government platform, was established as part of AETI. It aims to share knowledge and develop a business environment for CCUS utilization throughout Asia where large-scale CO<sub>2</sub> storage potential is expected.



Note) Figures indicate storage capacities.  
Unit: Billion tons (Survey by GCCSI)

# Support through risk money supply by JOGMEC

Example of the scheme for risk money supply and related support tools



Note 1) Special Purpose Company  
 Note 2) Only in cases where particular circumstances make it difficult for a person other than ETIC to acquire the concession

# Japan's contribution toward CCS value chain

- Japan is the only economy that has various technology related to the CCS value chain, such as CO2 capture, transport and storage.

CO2 capture



[Engineering]



Global No.1 Provider for exhausted gases (70% of global market) and Provided for Petra Nova



Provided for Steel Makers and Coal-fired power plants.



Delivered PCC facility as EPC contractor, New technology development under NEDO project

Liquefied CO2 transport ship



[Engineering]



Low Temperature Low Pressure First mover in the world

[Shipping Company]



Invested in Larvik Shipping



Provides for Northern Lights

CO2 pipeline



[Manufacturing]



Provides Seamless Pipe for CO2 Injection well of Northern Lights

[Engineering]



Storage/Total engineering



[Engineering]



Designed "Tomakomai" Demonstration PJ



Delivered CCS facilities for LNG plants in Qatar