

# Clean Energy Ministerial CCUS Initiative Webinar: Carbon Capture, Utilization and Storage in Japan

*Thursday 24 June 2020*  
*07:00 EDT | 13:00 CET | 20:00 JST*

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<https://www.youtube.com/user/cleanenergypolicy>

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# AGENDA

1

## Welcome & Introductory Remarks

- **Brian Allison**  
*CEM CCUS Initiative Co-Lead*  
UK Department for Business,  
Energy and Industrial Strategy

2

## Presentation

- **Yoshihiro Sawada**  
*General Manager,*  
*International Affairs Dept.*  
Japan CCS Co., Ltd.
- **Jiro Tanaka**  
*Associate General Manager,*  
*International Affairs Dept.*  
Japan CCS Co., Ltd.
- **Yukihiro Kawaguchi**  
*Director, Global Environmental*  
*Affairs Office*  
Ministry of Economy, Trade and  
Industry

3

## Question and Answer Session



## **Brian Allison**

*CEM CCUS Initiative Co-Lead*

Department for Business, Energy, and Industrial Strategy  
UK Government

Brian has developed UK energy policy since 2002; he joined the BEIS CCUS Policy Team in 2010 and leads on CCUS R&D, innovation and international collaboration. Brian represents the UK on the Technical Group of the Carbon Sequestration Leadership Forum (CSLF), IEA Greenhouse Gas R&D Programme (IEAGHG) and co-leads the CCUS CEM Initiative where he is pursuing, in line with the BEIS Clean Growth Strategy, opportunities to encourage the development of CCUS R&D internationally.

Brian is the UK lead for the CCUS "ACT" (Accelerating CCUS Technologies) grant programme where he works with a number of international consortium partners. He is the co-lead for the Mission Innovation Carbon Capture and Storage Challenge.

Brian is also an Associate Lecturer with The Open University, where he tutors on their Renewable Energy and Communication and Information Technology courses.



**Yoshihiro Sawada**  
*Corporate Adviser  
General Manager,  
International Affairs Dept.  
Japan CCS Co., Ltd.*

Joining Japan CCS in 2010, Mr. Yoshihiro Sawada has served as Executive Managing Director and President of the Plant Division between 2015 and 2017, and Corporate Adviser and General Manager of the International Affairs Dept. since 2017.

Between 2004 and 2009, he was with Japan Continental Shelf Survey Corp., with the mission to extend the outer limits of the continental shelf of Japan, serving as president between 2007 and 2009.

Prior to this, he was involved in research, engineering and construction of offshore structures and pipelines at Nippon Steel Corp., which he joined in 1977.

Mr. Sawada holds a M.S. (Civil Engineering), from the University of Tokyo and University of New York, and a Bachelor (Civil Engineering) from the University of Tokyo, and is a certified Professional Engineer of Japan.



**Jiro Tanaka**  
*Associate General Manager,  
International Affairs Dept.  
Japan CCS Co., Ltd.*

Jiro Tanaka has over 35 years' experience in the oil and gas industry. Mr. Tanaka joined the International Affairs Dept. of Japan CCS in June 2016, which was newly established to engage in international activities such as information sharing and collaboration.

Prior to this, he was General Manager - Business Development in the Asia-Oceania and International Oil & Gas Divisions of Japan Petroleum Exploration Co. Ltd. (JAPEX), a leading Japanese oil & gas exploration and production company.

Mr. Tanaka joined JAPEX in April 1980 after receiving a B.S. degree in geophysics from the University of Tokyo.



## **Yukihiro Kawaguchi**

*Director, Global Environmental Affairs Office*  
Ministry of Economy, Trade and Industry

Yukihiro Kawaguchi is the Director of the Global Environmental Affairs Office – in charge of international relations on climate change issues in the Ministry of Economy, Trade and Industry (METI) of Japan. Mr. Kawaguchi is also in charge of CCUS policy and technology development.

Mr. Kawaguchi previously served as the Director of the Global Environment Partnership Office and as the Deputy Director of the Environmental Policy Division and the Environmental Economy Office in METI. Mr. Kawaguchi was also the Secretary General of the Japan Business Council in Europe.

Mr. Kawaguchi obtained a Bachelor of Arts in economics from Waseda University and a Master of Arts in public affairs from the School of International and Public Affairs at Columbia University.



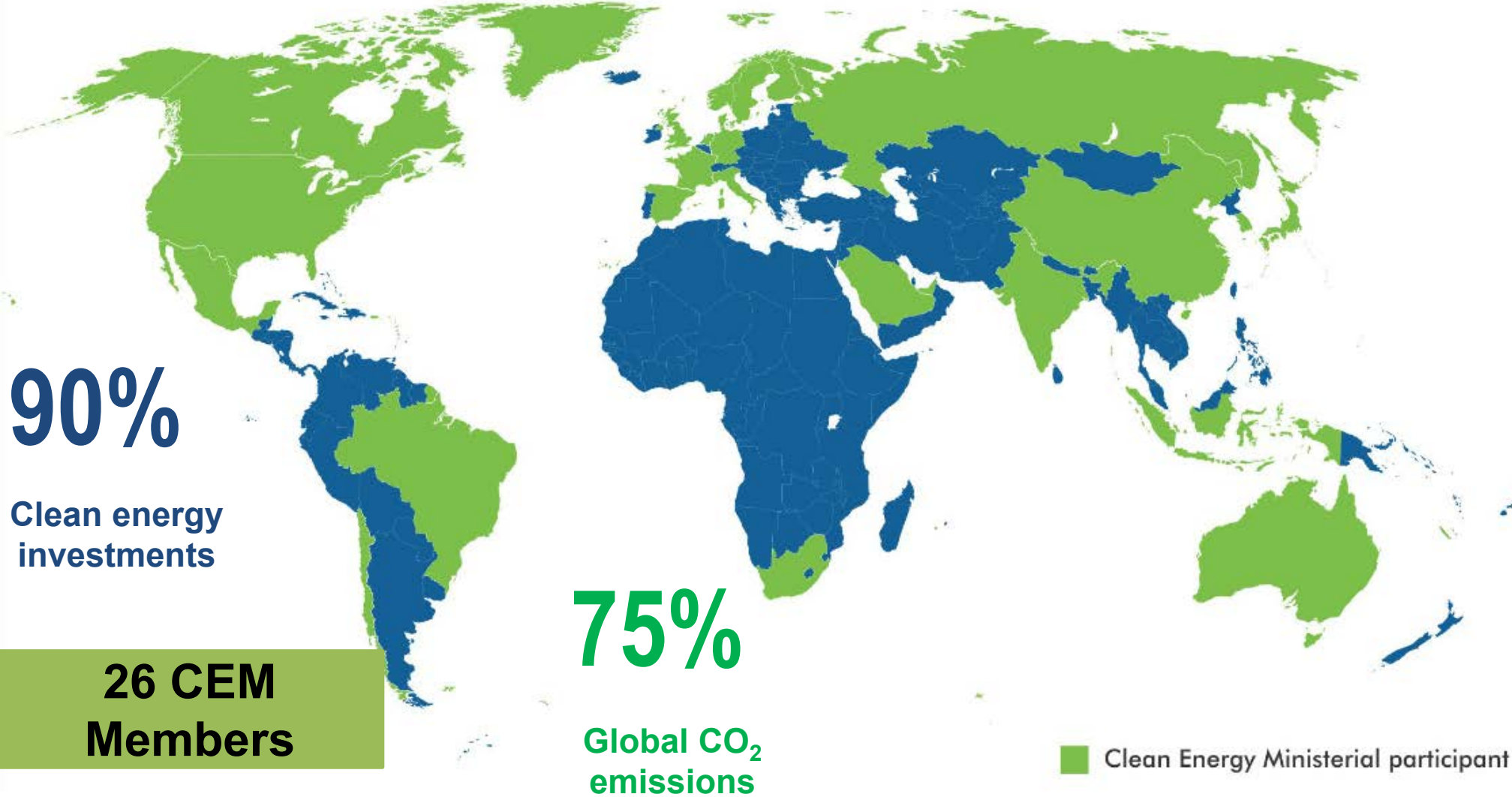


# CARBON CAPTURE, UTILIZATION & STORAGE

ACCELERATING CCUS TOGETHER

AN INITIATIVE OF THE CLEAN ENERGY MINISTERIAL

# Clean Energy Ministerial: global process to accelerate clean energy



[www.cleanenergyministerial.org](http://www.cleanenergyministerial.org)



# CEM CCUS Initiative Member Governments



Saudi Arabia



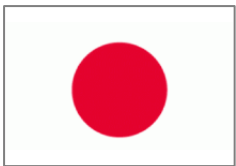
United States



South Africa



Norway



Japan



United Kingdom



United Arab Emirates



Mexico

Observer:



China



Canada



Netherlands

# Accelerating CCUS Together by:

1. Actively **including** CCUS within global clean energy agenda
2. Bringing **together** the private sector, governments and the investment community
3. Facilitating identification of both near and longer-term **investment opportunities**
4. Disseminating **best practice** in CCUS policy, regulation and investment

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<https://www.youtube.com/playlist?list=PLKRmGa9s99JVssP8Gb5buwLg3Bl1lls>

## CONTACT US:



[cemccus@outlook.com](mailto:cemccus@outlook.com)

A low-angle photograph of the Tomakomai CCS Demonstration Project industrial facility. The image shows several tall, silver-colored cylindrical towers and complex piping systems against a clear blue sky. The towers are equipped with yellow safety railings and ladders. The overall scene is industrial and modern.

# Tomakomai CCS Demonstration Project at 300 thousand tonnes cumulative injection

CEM CCUS Initiative Webinar: CCUS in Japan, June 25<sup>th</sup>, 2020

**Yoshihiro Sawada, Jiro Tanaka**

International Affairs Department, Japan CCS Co., Ltd.

**JCCS**

*Japan CCS Co., Ltd.*

# Tomakomai CCS Demonstration Project Summary Report - Background

- The Tomakomai CCS Demonstration Project commenced CO<sub>2</sub> injection into deep saline aquifers in April 2016.
- On Nov. 22, 2019, the project achieved the target of 300 thousand tonnes cumulative CO<sub>2</sub> injection.
- METI<sup>(1)</sup>, NEDO<sup>(2)</sup> and JCCS<sup>(3)</sup> convened expert review meetings to discuss and summarize the issues of the project, compiled the results and released a Summary Report.

(1) **METI**: Ministry of Economy, Trade and Industry

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

(3) **JCCS**: Japan CCS Co., Ltd.

*This presentation is based on the Summary Report and relevant material.*

# Tomakomai CCS Demonstration Project at 300 thousand tonnes cumulative injection

CEM CCUS Initiative Webinar: CCUS in Japan, June 25<sup>th</sup>, 2020

Part I Yoshihiro Sawada

**Overview of Tomakomai CCS Demonstration Project**

**Key Results of Tomakomai Project**

Part II Jiro Tanaka

**Public Engagement and Issues**

**Summary**

16





# Tomakomai CCS Demonstration Project at 300 thousand tonnes cumulative injection

CEM CCUS Initiative Webinar: CCUS in Japan, June 25<sup>th</sup>, 2020

Part I Yoshihiro Sawada

**Overview of Tomakomai CCS Demonstration Project**

**Key Results of Tomakomai Project**

17





## Overview of Tomakomai CCS Demonstration Project

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**JCCS**  
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# Project Overview

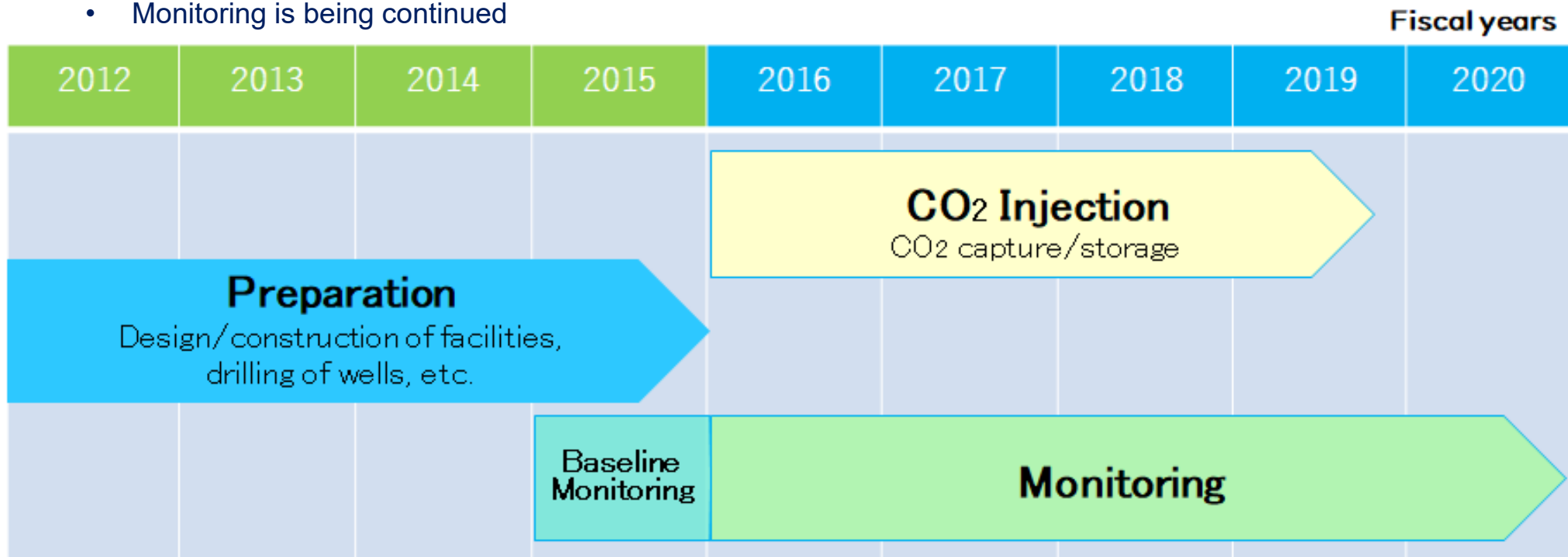
- **First large-scale CCS demonstration project in Japan**
- **Location: Tomakomai City, Hokkaido Prefecture**
- **Commissioned by: METI, NEDO**
- **Contractor: JCCS**



Tomakomai CCS Demonstration Center, Tomakomai City, Hokkaido

# Project Schedule

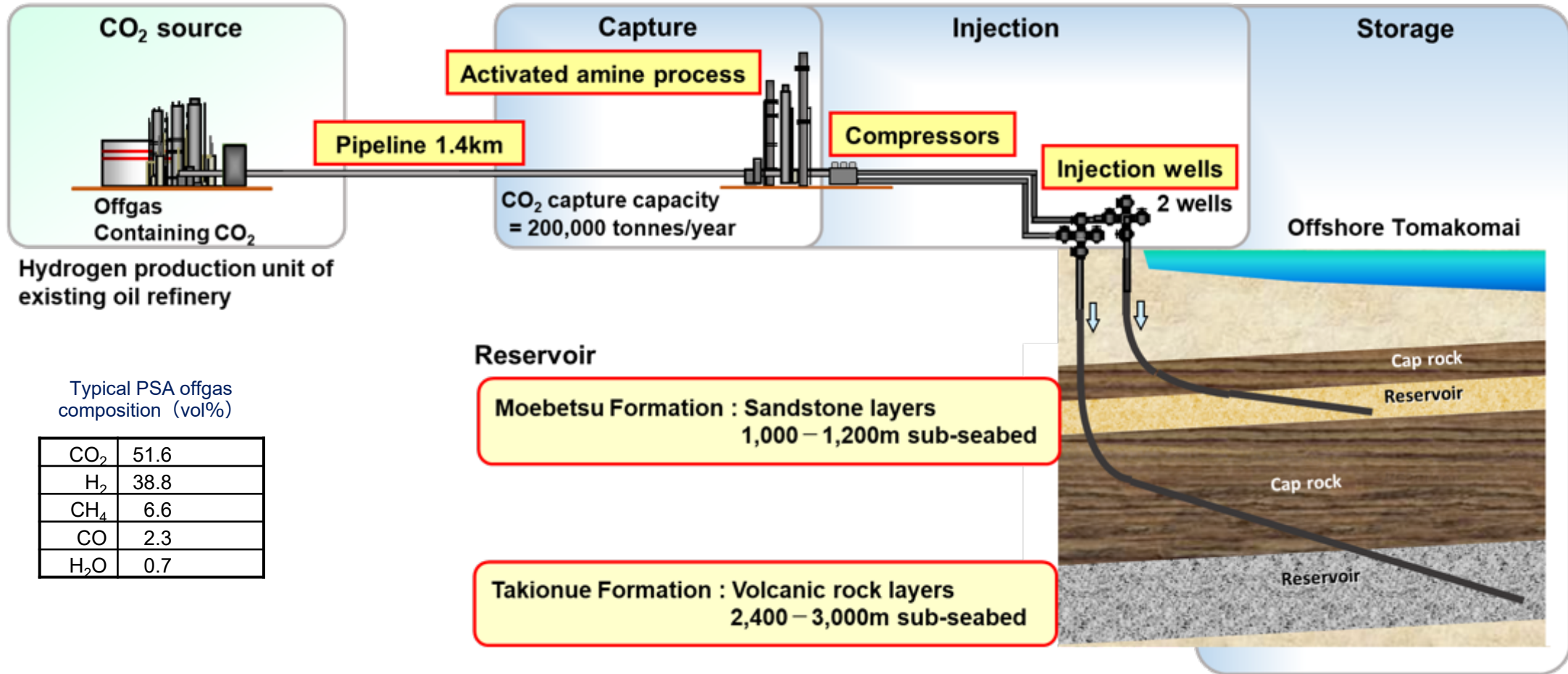
- Constructed demonstration facilities **from FY2012 to 2015**
- Started injection **at scale of 100 thousand tonnes** per annum **from April 2016**
- Achieved initial target of **300 thousand tonnes cumulative injection on November 22, 2019**
- Monitoring is being continued



20

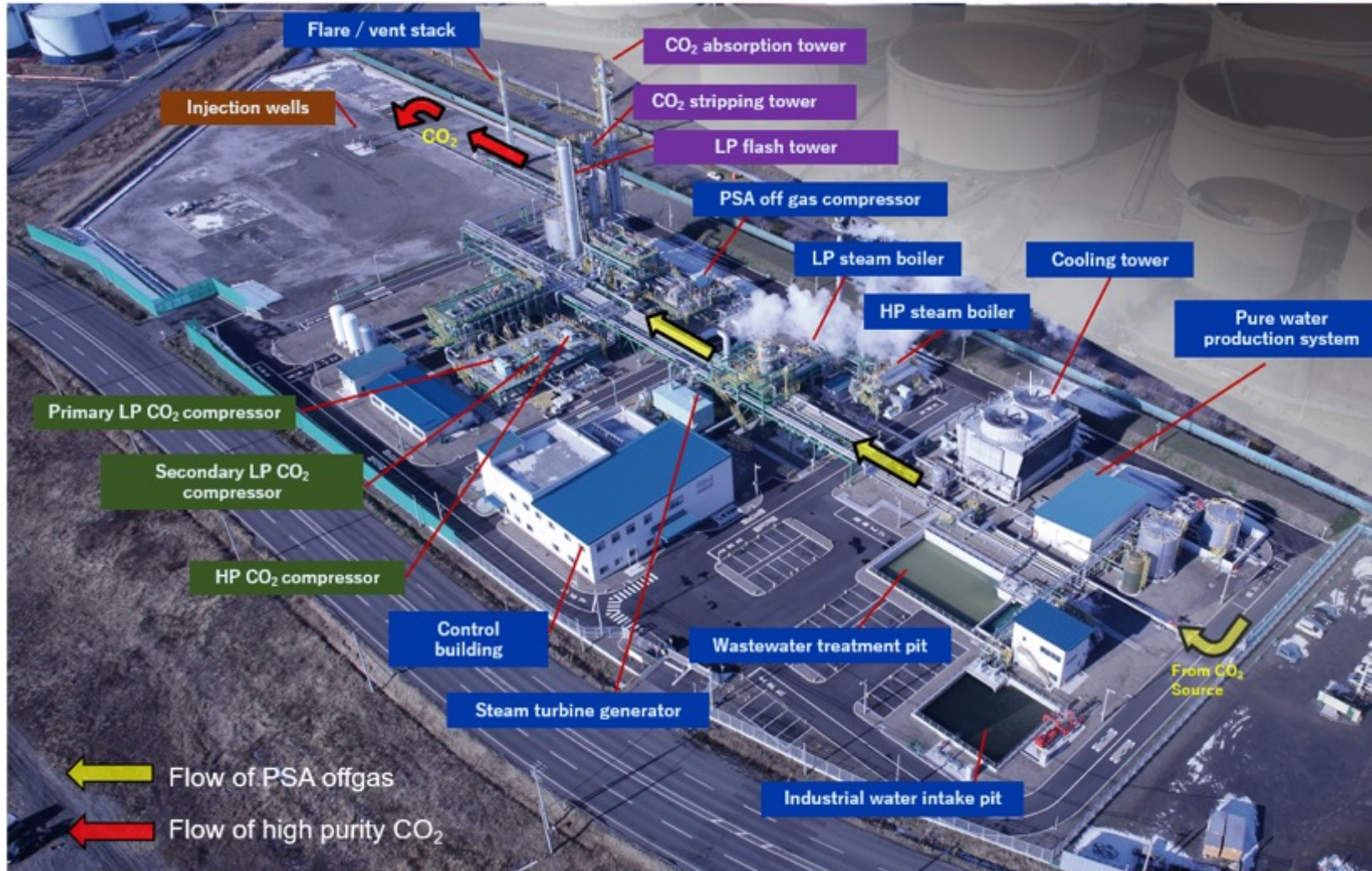
# Project Scheme

- A portion of PSA (Pressure Swing Adsorption) offgas containing approximately 52% CO<sub>2</sub> generated by a hydrogen production unit in adjacent refinery is transported by 1.4km pipeline to Tomakomai Project capture facilities.





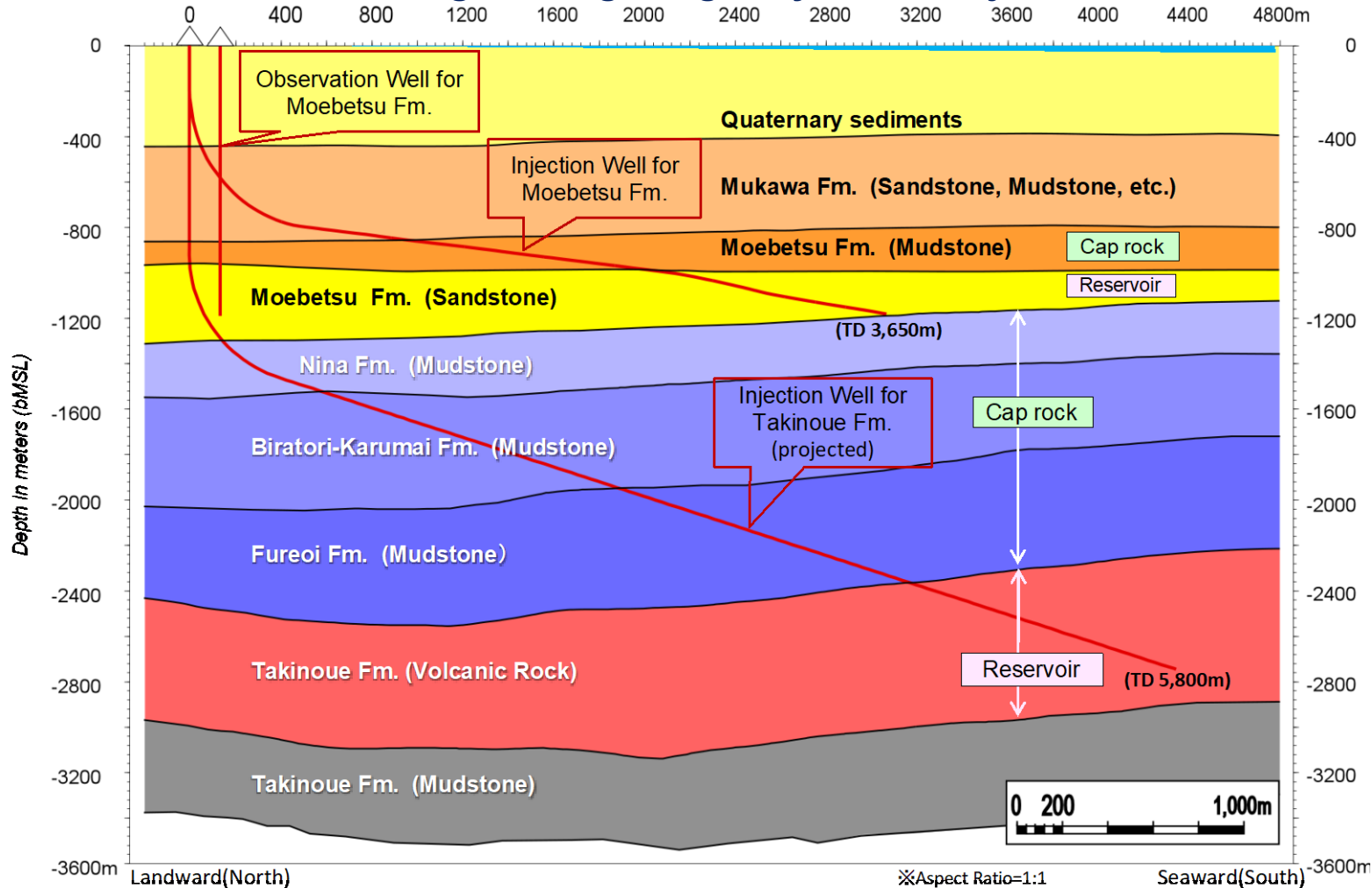
# Bird's Eye View of Tomakomai Capture/Injection Facilities



- CO<sub>2</sub> rich gas from refinery is sent to the CO<sub>2</sub> absorption tower
- Captured CO<sub>2</sub> is compressed and sent to injection wells

# CO<sub>2</sub> Injection and Storage

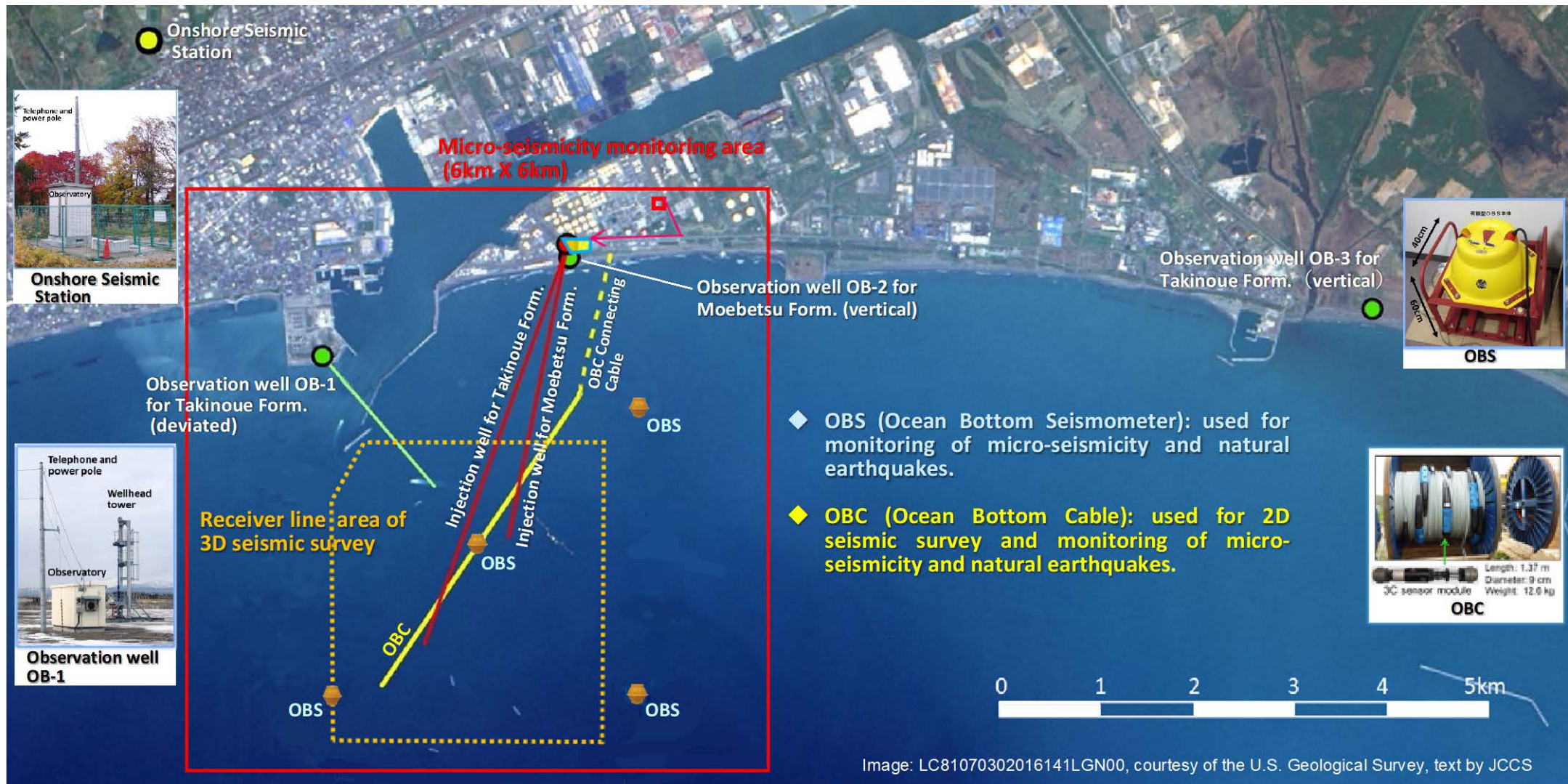
**Schematic diagram of geologic layers and injection wells**



- The captured CO<sub>2</sub> is compressed and stored 3-4km offshore in two sub-seabed reservoirs at different depths – Moebetsu and Takinoue formations by two independent injection wells.
- Deviated CO<sub>2</sub> injection wells drilled from onshore to offshore sub-seabed
  - Cost reduction of drilling, operation and maintenance
  - No disturbance on marine environment and harbor operation



# Location of Monitoring Facilities



- ◆ **OBS (Ocean Bottom Seismometer):** used for monitoring of micro-seismicity and natural earthquakes.
- ◆ **OBC (Ocean Bottom Cable):** used for 2D seismic survey and monitoring of micro-seismicity and natural earthquakes.

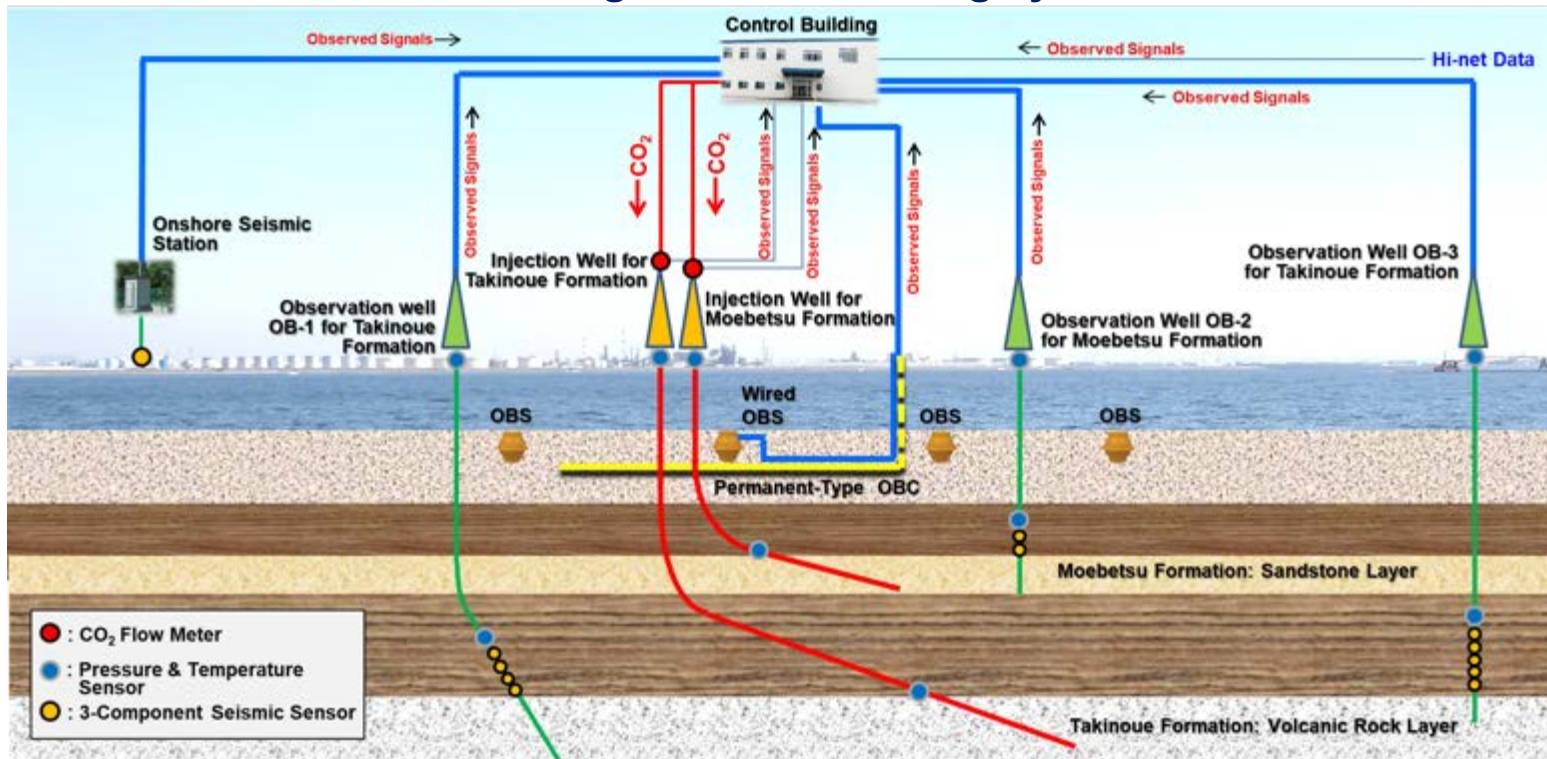
Image: LC81070302016141LGN00, courtesy of the U.S. Geological Survey, text by JCCS



# Schematic Diagram of Monitoring System / Monitored Items

- Offshore CO<sub>2</sub> storage in Japan is conducted in accordance with Act on Prevention of Marine Pollution and Maritime Disaster, with a storage permit issued by Minister of Environment. Permit holder (METI in this project) is required to conduct monitoring in accordance with “Monitoring Plan” submitted in permit application and confirm CCS is being conducted safely as planned.
- In accordance with Tomakomai Project “Monitoring Plan”, observation of reservoir temperature and pressure, and seismic surveys to grasp CO<sub>2</sub> distribution, quarterly (seasonal) marine environmental surveys are being conducted.

**Schematic diagram of monitoring system**

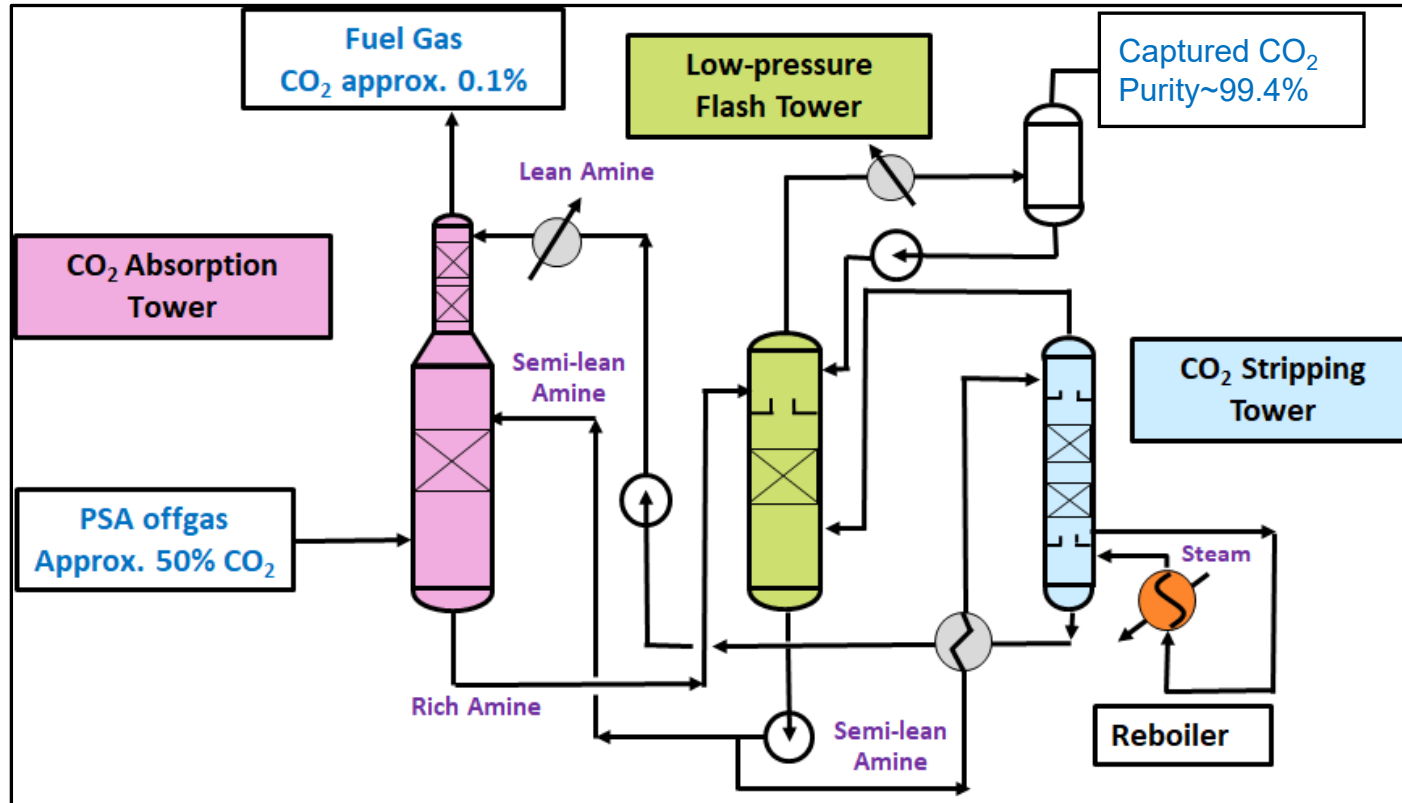


**Monitored Items**

Equipment/Work	Monitored Items
Injection wells, facilities	Downhole: temperature, pressure Wellhead: injection temperature, pressure, CO <sub>2</sub> injection amount
Observation wells	Downhole: temperature, pressure, micro-seismicity, natural earthquakes
Ocean Bottom Cable (OBC)	Micro-seismicity, natural earthquakes, recording of 2D seismic surveys
Ocean Bottom Seismometers (OBS)	Micro-seismicity, natural earthquakes
Onshore seismometer	Micro-seismicity, natural earthquakes
2D seismic survey	Distribution of CO <sub>2</sub> in reservoir
3D seismic survey	Distribution of CO <sub>2</sub> in reservoir
Marine environmental survey	Marine data (physical, chemical properties, biological habitat, etc.)

# CO<sub>2</sub> Capture

## Two-stage absorption process



CO<sub>2</sub> Capture facilities



## Key Results of Tomakomai Project

# CO<sub>2</sub> Capture Results

- Achieved following results in capture/injection facilities demonstration:
  - ① Designated capture amount (25.3t/h), recovery rate ( $\geq 99.9\%$ ), purity ( $\geq 99\%$ ), capture energy ( $\leq 1.22\text{GJ/t-CO}_2$ )
  - ② Complete automation of CO<sub>2</sub> compressor control system (simultaneous injection into two different reservoir types).
- Adopted two-stage absorption process employing activated amine for capture process. Achieved capture energy (consumption) target of less than 1.22GJ/t-CO<sub>2</sub>**

• **Capture energy = reboiler duty/boiler efficiency  
 + pump electricity x heat conversion coefficient/power efficiency;**  
**Example for FY2016:  $0.923/0.9 + 19.8 \times 0.0036/0.42 = 1.20 \text{ GJ/t-CO}_2$**

28

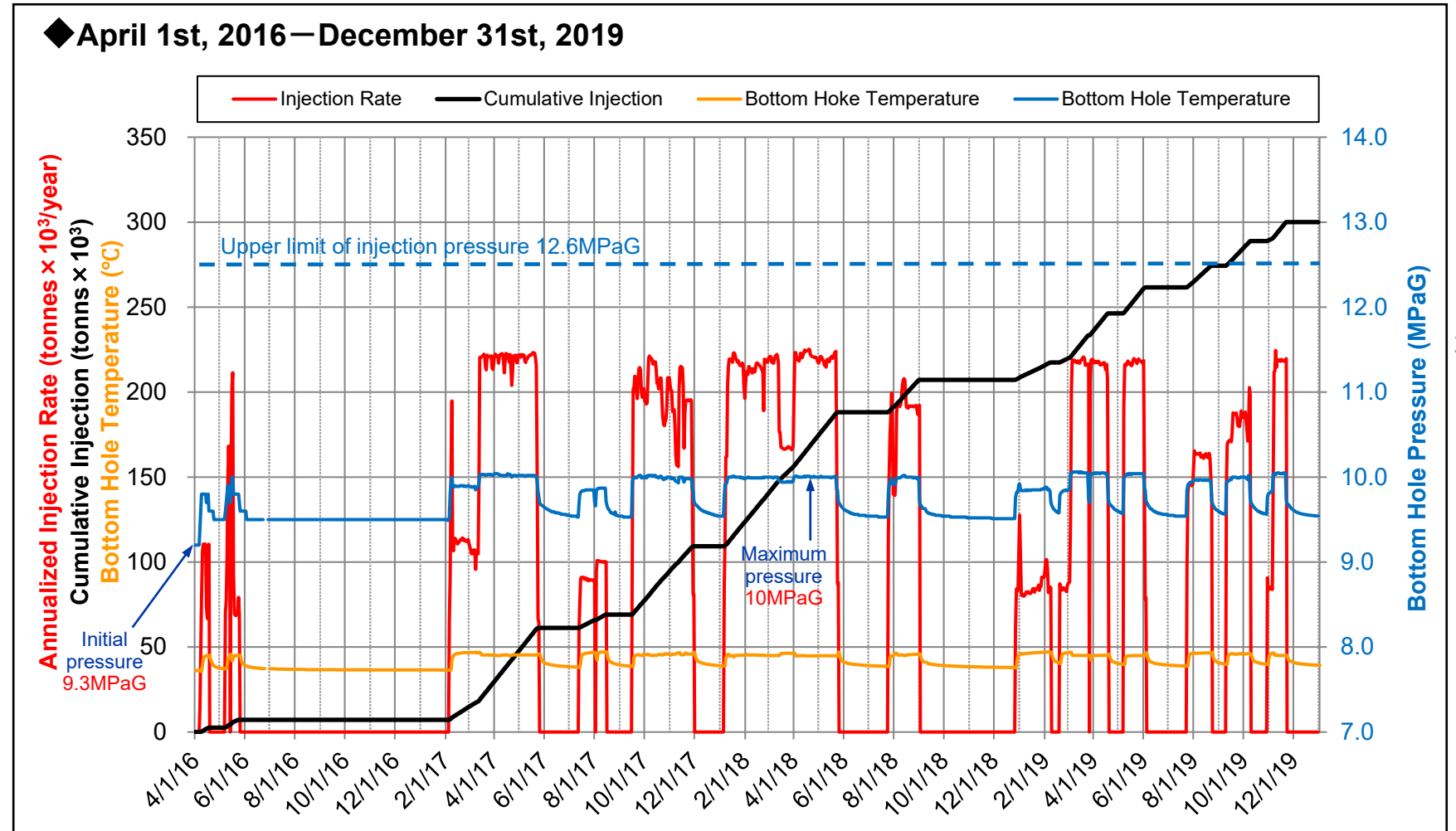
		FY2016	FY2017	FY2019	Designated Value
CO <sub>2</sub> recovery	t/h	25.3	24.3	26.4	25.3
Reboiler duty	GJ/t-CO <sub>2</sub>	0.923	0.882	0.915	0.949
Pump electricity	kWh/t	19.8	21.0	18.8	19.2
Capture energy	GJ/t-CO <sub>2</sub>	1.20	1.16	1.18	Target:1.22



# Results of CO<sub>2</sub> Injection

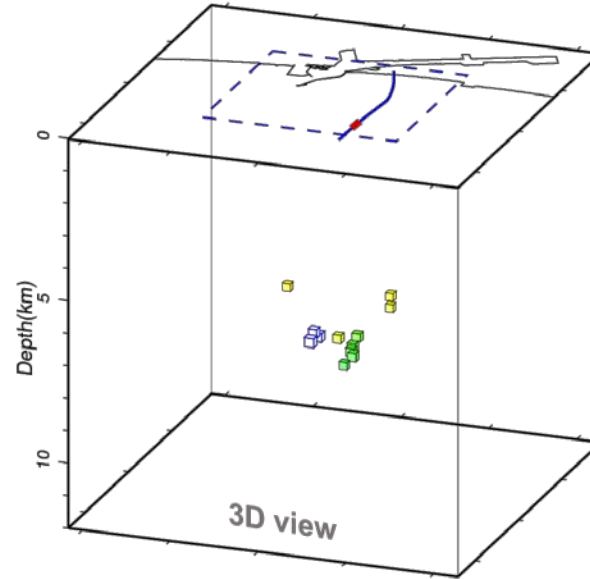
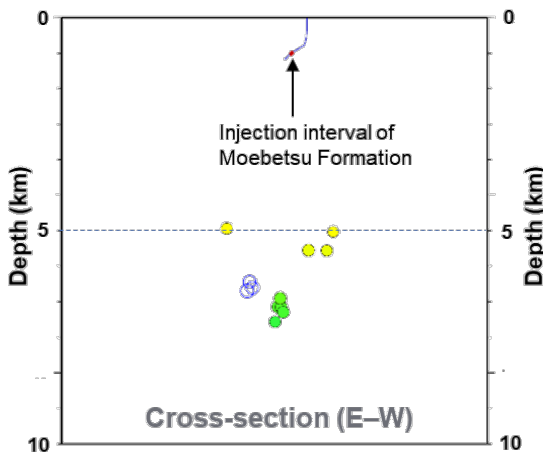
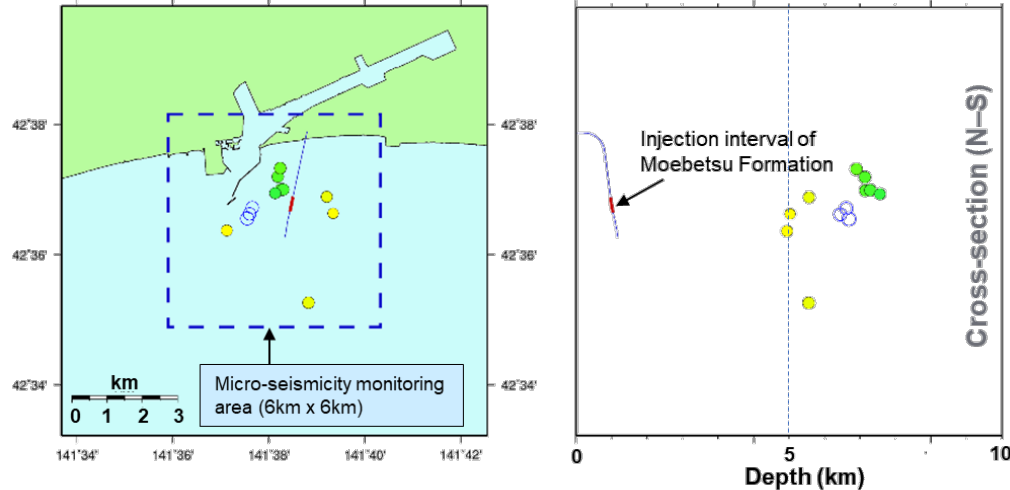
- Achieved 300,110 tonnes cumulative CO<sub>2</sub> injection into 2 reservoirs at different depths (Moebetsu Formation – 300,012 tonnes, Takinoue Formation – 98 tonnes).
- Maximum values recorded by PT sensors (pressure, temperature sensors set close to reservoir) during injection were sufficiently lower than the upper limits set to avoid destruction of cap rock of each reservoir.

## Injection record of Moebetsu Formation



# Results of Micro-seismicity Monitoring

## Events detected in micro-seismicity monitoring area

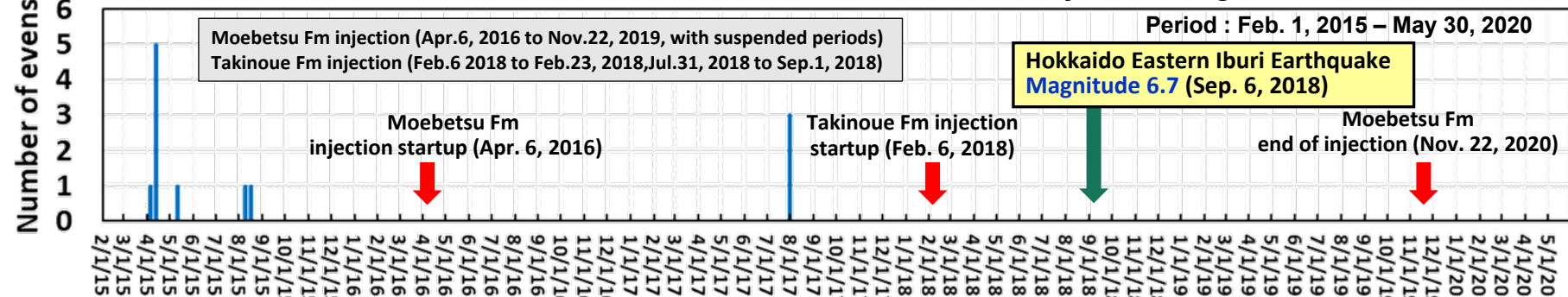


- No micro-seismicity or natural earthquakes attributable to CO<sub>2</sub> injection were detected in vicinity of injection area between startup of injection and December 2019, including before and after 2018 Hokkaido Eastern Iburu Earthquake.

※ Detectability:  $M_w > -0.5$

30

## Micro-seismic events detected in the micro-seismicity monitoring area

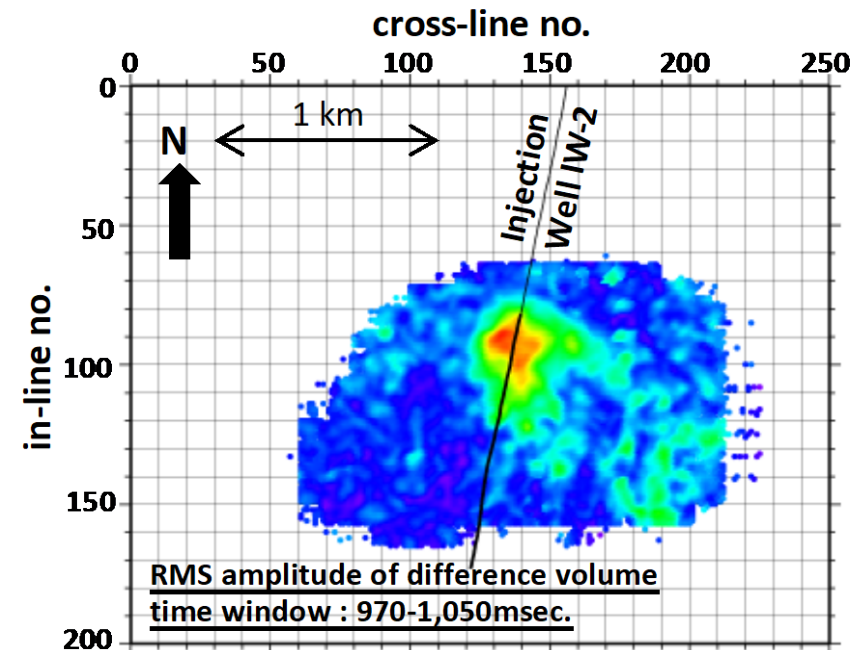
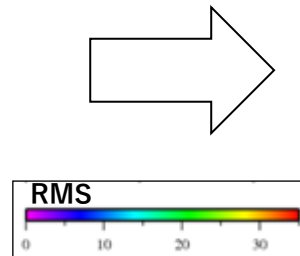
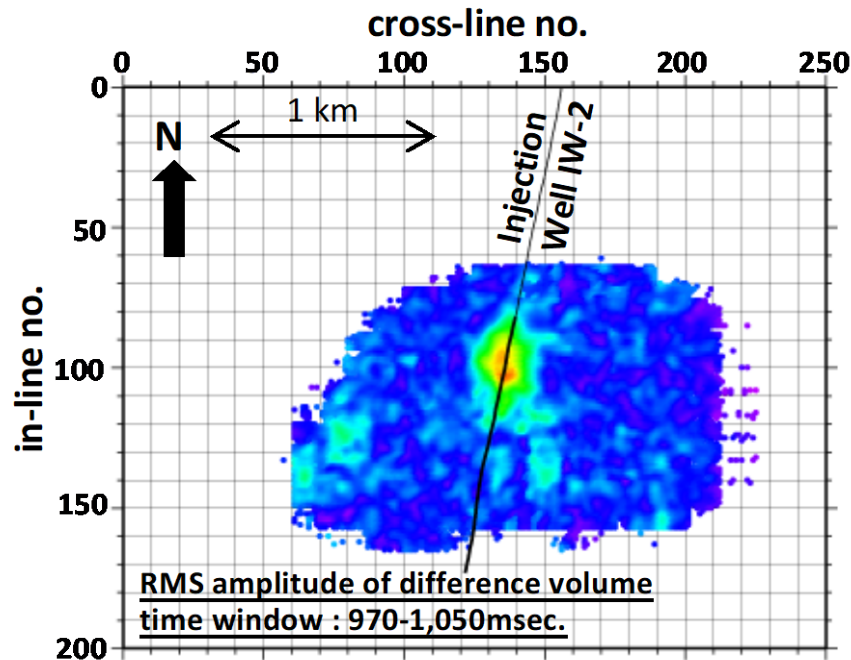


# Seismic Survey Results - 2nd & 3rd Monitor Surveys -

- Distribution of CO<sub>2</sub> in Moebetsu Formation confirmed by seismic surveys since FY2017. Injected CO<sub>2</sub> is limited to upper portion of reservoir in correspondence with predictions made in advance, and not believed to have behaved abnormally.

2<sup>nd</sup> monitor survey (61,239 - 69,070 tonnes; JFY2017 )

3<sup>rd</sup> monitor survey (207,209 tonnes; JFY2018 )

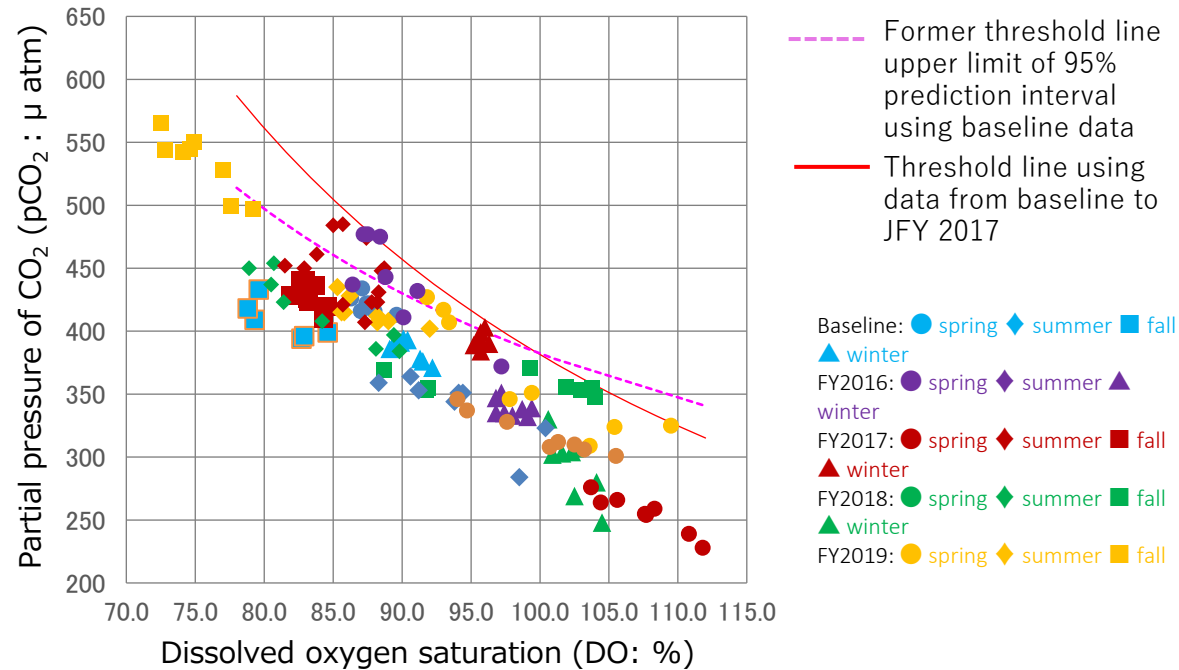


※ S/N ratio and accuracy of difference calculation is low due to the limited area of the data utilized for calculation.

# Results of Marine Environmental Surveys

- Quarterly (seasonal) marine environmental surveys are required in accordance with the domestic “Act on Prevention of Marine Pollution and Maritime Disaster”.

## Threshold of monitoring stage shift and observed values



- FY2016 spring and FY2017 summer, winter surveys recorded data exceeding former threshold (derived from baseline survey conducted from FY2013 summer - FY2014 spring). Based on results including confirmation surveys, MOE expressed view that “phenomena indicating CO<sub>2</sub> leakage or the risk thereof were not confirmed” (former threshold curve was derived from only 1 years’ data and insufficient in reflecting natural variations; multiple years’ data is needed).
- Threshold was revised in summer of FY2018; thereafter, no data exceeding threshold has been observed.

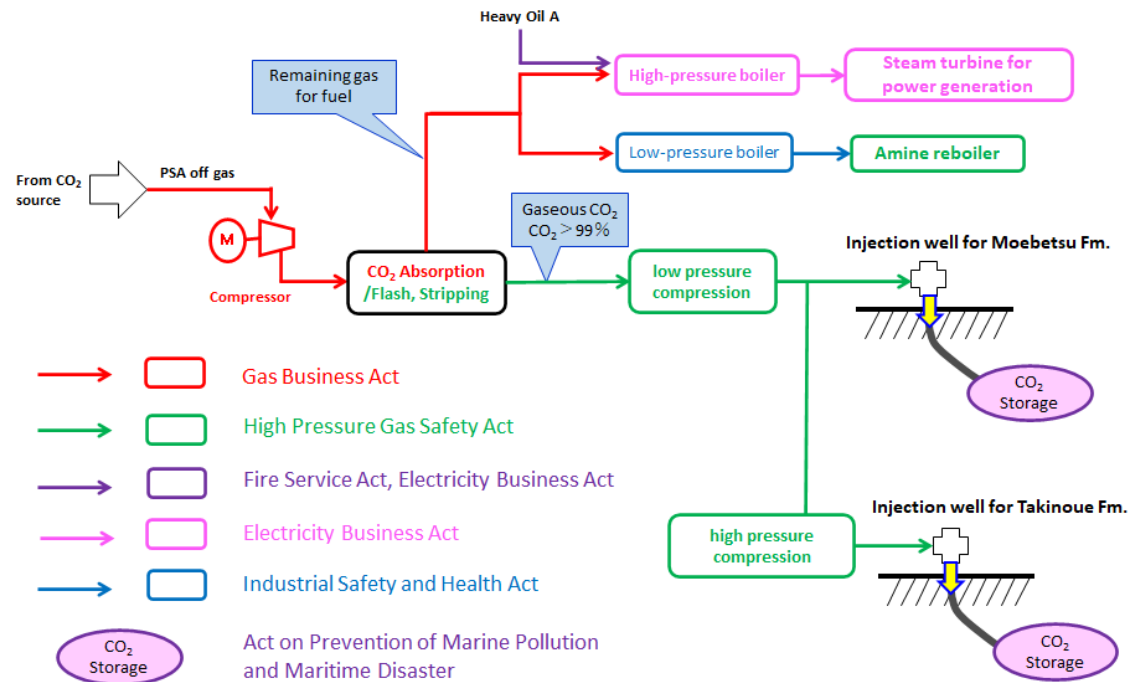


# Compliance with Laws and Regulations & Issues (1)

## Laws applied to conduct project

- As Japan has no CCS specific laws (excluding sub-seabed CO<sub>2</sub> storage), existing laws and regulations were applied to govern operation of project facilities.
  - ✓ CO<sub>2</sub> capture facilities: High Pressure Gas Safety Act, Industrial Safety and Health Act, Gas Business Act
  - ✓ Safety standards of injection/storage facilities and injection operations: Mining Act, Mining Safety Act
  - ✓ Sub-seabed dumping (geologic storage) of CO<sub>2</sub>: Act on Prevention of Marine Pollution and Maritime Disaster (“Monitoring Plan” pursuant to Act was followed)

## Laws applied to surface facilities, CO<sub>2</sub> storage



# Compliance with Laws and Regulations & Issues (2)

## Marine environmental surveys

- Following issues have become apparent in the implementation of marine environmental surveys in accordance with “Monitoring Plan” pursuant to Act on Prevention of Marine Pollution and Maritime Disaster
  - ✓ Possibility that index currently used to detect possible CO<sub>2</sub> leakage into sea could generate false positives caused by natural variations rather than actual leakage
  - ✓ Effectiveness of surveying the sea-bottom soil and condition of marine organisms as a method of detecting CO<sub>2</sub> leakage believed to be low
  - ✓ Issues should be taken into account in application procedure for next period of CO<sub>2</sub> storage permit (FY2021~2025), with a view to reduce current number of survey points, survey frequency, survey items

34

## CO<sub>2</sub> Storage

- Long term liability regarding storage location and stored CO<sub>2</sub>
  - ✓ Provisions for long term liability and the transfer of such liability not yet established in Japan; only mention in Act on Prevention of Marine Pollution and Maritime Disaster that as long as there is storage (dumping) of CO<sub>2</sub> in subsurface, implementer shall continue monitoring

⇒ **Legal and regulatory framework for CCS is needed**

# Cost Estimation of Commercial Model

- Based on Tomakomai demonstration data, conducted cost estimation of 200-thousand tonnes/yr commercial model, and 1-million-tonnes/yr commercial model under similar conditions and certain assumptions.

(JPY/t-CO<sub>2</sub>)

CCS Cost	200-thousand-ton commercial model	1-million-ton commercial model
1) Capture / Injection		
CAPEX	852	590
OPEX	4,720	4,079
Total	5,572	4,669
2) Injection wells / Storage		
CAPEX	922	369
OPEX	4,635	1,148
Total	5,557	1,517
3) Grand Total		
Captured	11,129 (=103 USD/t-CO <sub>2</sub> )	6,186 (=57 USD/t-CO <sub>2</sub> )
Avoided	13,328 (=123 USD/t-CO <sub>2</sub> )	7,261 (=67 USD/t-CO <sub>2</sub> )
4) CO <sub>2</sub> emission factor (t-CO <sub>2</sub> emitted from capture/injection facilities) ÷ (t-CO <sub>2</sub> captured/injected)		
t-CO <sub>2</sub> /t-CO <sub>2</sub>	0.165	0.148

(1USD=108JPY)

- CO<sub>2</sub> source gas is separated from PSA upstream; treated off-gas is returned to PSA upstream.
- CO<sub>2</sub> transportation cost not included; facility housing, operator labor costs assumed to be provided by refinery and not included.
- Fuel gas unit cost: JPY1,205/GJ (equivalent to JPY48.2/Nm<sup>3</sup>), electricity unit cost: JPY10.84/kWh (excluding consumption tax).
- Captured cost: CCS cost/injected CO<sub>2</sub> amount; Avoided cost: CCS cost/(injected CO<sub>2</sub> amount — CO<sub>2</sub> generated by CCS)

# Tomakomai CCS Demonstration Project at 300 thousand tonnes cumulative injection

CEM CCUS Initiative Webinar: CCUS in Japan, June 25<sup>th</sup>, 2020

Part II Jiro Tanaka

**Public Engagement and Issues**

**Summary**

36





## Public Engagement and Issues

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# Public Outreach Activities

## Voice of Tomakomai Citizens

### 1. Information Disclosure

Thorough disclosure should be made

### 2. Safety/CO<sub>2</sub> leakage

Want more detailed information on risk of CO<sub>2</sub> leakage

Monitoring & Disclosure Plan

### 3. Dissemination to Young Generation

Should consider efforts to involve young generation

## Outreach Activities

- ① Panel Exhibitions
- ② Forum for Tomakomai Citizens
- ③ Site Tours
- ④ Information Disclosure System

- ⑤ Mini seminars for students
- ⑥ Kids' lab classes/site tours

## Outreach Activities (JFY2019)

Site Visitors: 2168 people  
(401 from overseas)

Mini seminars: 27 times

Panel Exhibitions: 8 times

Kids' lab classes: 3 times

Booth in Environmental exhibitions: 11 times

CCS Forum: 600 people

### Outreach Activities:



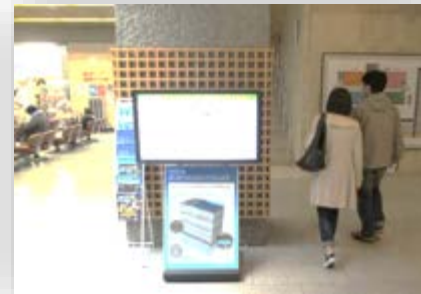
Panel Exhibition in Tomakomai



Kids' lab class



Site Tours



Information disclosure system in Tomakomai City Hall

*Project being conducted with understanding and support of local community*

# Public Outreach - Issues

- Public awareness of CCS in Japan still very low - knowledge enhancement activities should be continued
- When carrying out CCS in a new area, important to have local community know that government is responsibly advancing project, implement activities that suit the region, then build a trusting relationship with local community



Site Tours



Forum for Tomakomai Citizens

# International Activities and Future Steps

- Tomakomai CCS Demonstration Project is a rare project in the world in which government, private sector, local community joined efforts to steadily achieve results, experienced world's first occurrence of a major earthquake near injection area, and continued onwards
- Demonstration site has received over 1,400 international visitors comprising government officials, national companies, embassies, private companies, CCS research organizations, thinktanks, consortiums, universities, academia, banks and financial organizations, media
- Key future objective will be to increase opportunities to gain experience through collaboration, cooperation with international undertakings and deepen knowledge, accumulate know-how to overcome issues common to Japan and abroad, alleviate various barriers to CCS through international cooperation
- Present situation is that discussions regarding legal framework for CCS and conceptual design of business models are more advanced overseas. Important as well as an effective approach that Japan actively participate in international discussion, obtain information from various matters such as role of public and private sector

40



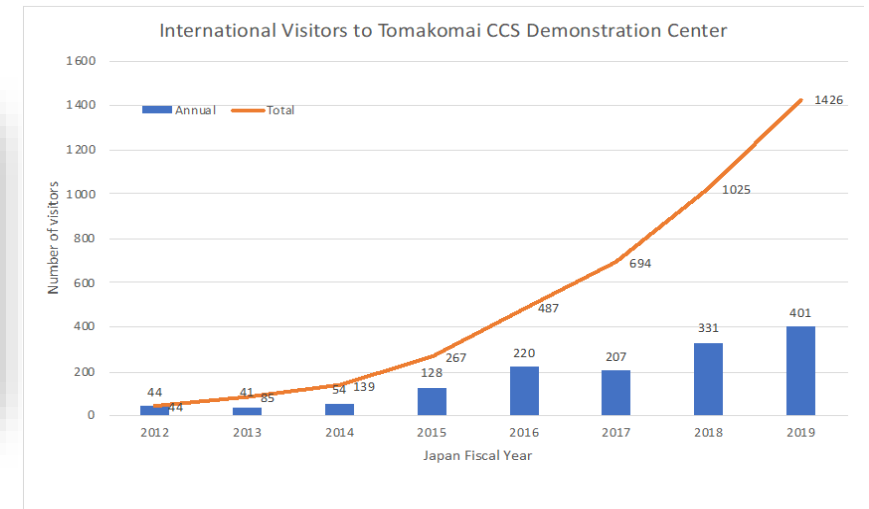
Signing of MOU by International CCS Knowledge Centre and JCCS



CSLF Recognition of Tomakomai CCS Demonstration Project



Visit of CEO of Global CCS Institute

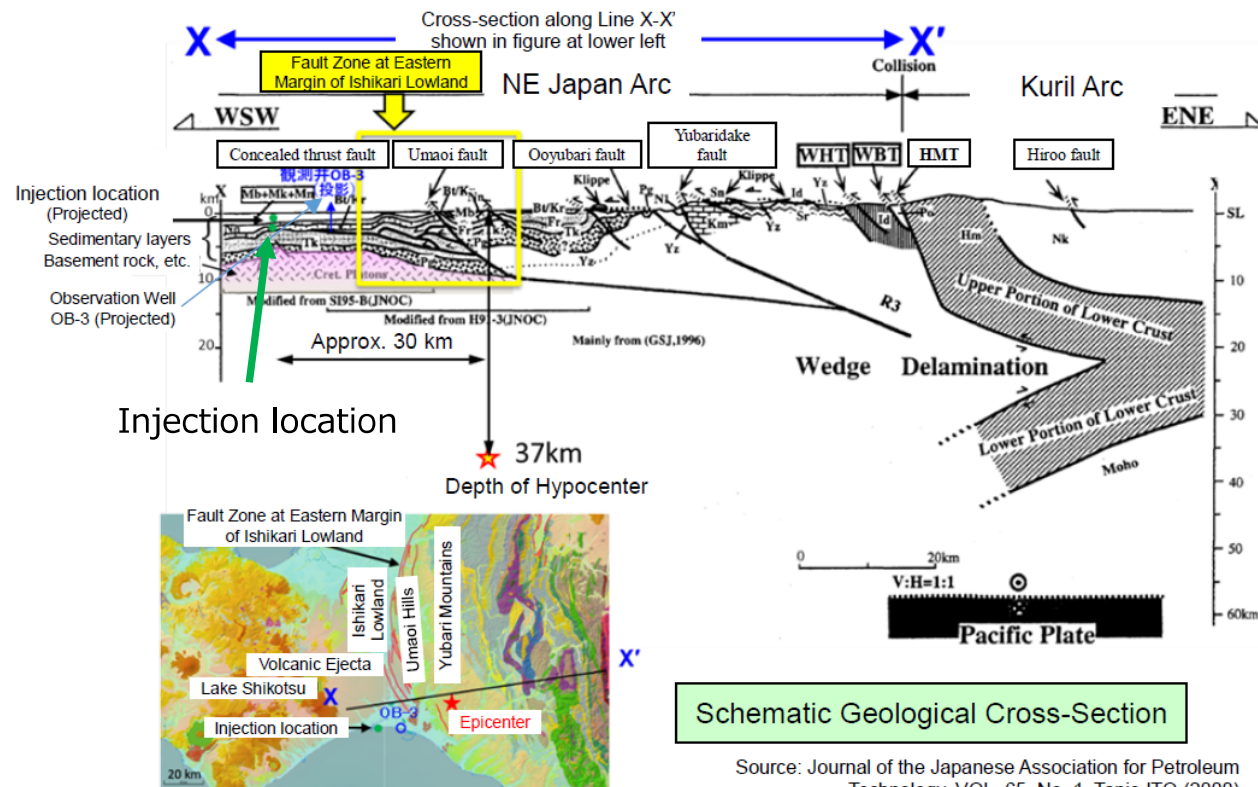




# 2018 Hokkaido Eastern Iburi Earthquake

- At 3:07am Sept. 6, 2018, a magnitude 6.7 earthquake at 37km depth occurred in central eastern part of Iburi region of Hokkaido. Tomakomai CCS demonstration site recorded seismic intensity of lower 5.

## Schematic cross section of hypocenter and injection location



Source: National Institute of Advanced Industrial Science and Technology; additions made by JCCS

Source: Journal of the Japanese Association for Petroleum Technology, VOL. 65, No. 1, Tanio ITO (2000)

## Positional relationship between injection area and epicenter

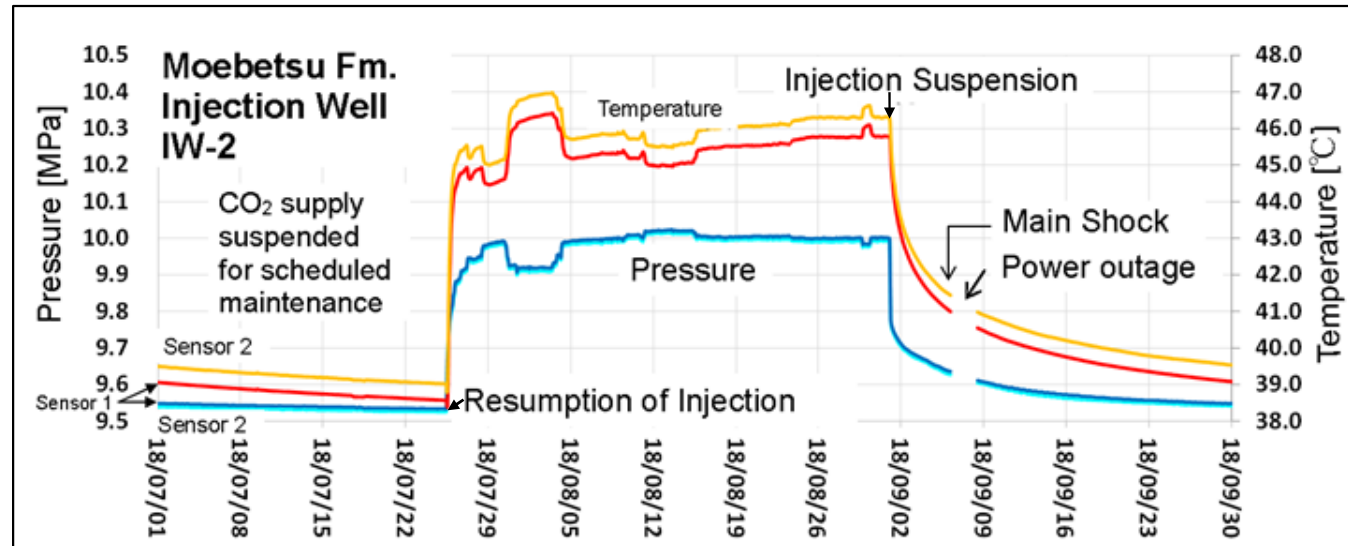


# 2018 Hokkaido Eastern Iburi Earthquake

- No indication of CO<sub>2</sub> leakage was confirmed in the reservoir pressure and temperature data. No detection of events by micro-seismic monitoring conducted continuously in injection area.
- Stress variation caused by CO<sub>2</sub> injection at hypocenter of Eastern Iburi Earthquake was found to be about 1/1,000th of pressure change in earth's crust caused by earth's tidal force.
- On Oct. 19, 2018, review meeting including experts in seismology reached common understanding: 1) No CO<sub>2</sub> leakage caused by the earthquake, 2) No data suggesting a connection between CO<sub>2</sub> storage and earthquake. Report summarizing conclusions was posted on JCCS homepage ([https://www.japanccs.com/wp/wp-content/uploads/2019/09/Research-Report-on-Impacts-of-Hokkaido-Eastern-Iburi-Earthquake-on-CO2-Reservoir\\_2nd-edition.pdf](https://www.japanccs.com/wp/wp-content/uploads/2019/09/Research-Report-on-Impacts-of-Hokkaido-Eastern-Iburi-Earthquake-on-CO2-Reservoir_2nd-edition.pdf))

## Bottom hole pressures, temperatures of Moebetsu Formation injection well before/after earthquake

(measured by downhole pressure and temperature sensors set close to the reservoir)



# Measures taken by JCCS after the Hokkaido Eastern Iburi Earthquake

- 6<sup>th</sup> Sept. 2018: Magnitude 6.7 earthquake occurred
- 12<sup>th</sup> Sept 2018: Posted JCCS's views on JCCS on HP
- 19<sup>th</sup> Oct. 2018: Convened an expert review meeting
- 21<sup>st</sup> Nov. 2018: Posted summary of review meeting on HP
- 21<sup>st</sup> Feb. 2019: Magnitude 5.8 aftershock occurred
- 26<sup>th</sup> Feb. 2019: Posted JCCS's views on HP

## Key points on JCCS HP:

1. No relationship between CO<sub>2</sub> injection and earthquake
2. No CO<sub>2</sub> leakage

43

## Key principles to minimize concerns of local community and general public:

- *Respond quickly*
- *Include technical explanation*



# Summary

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**JCCS**  
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# Summary

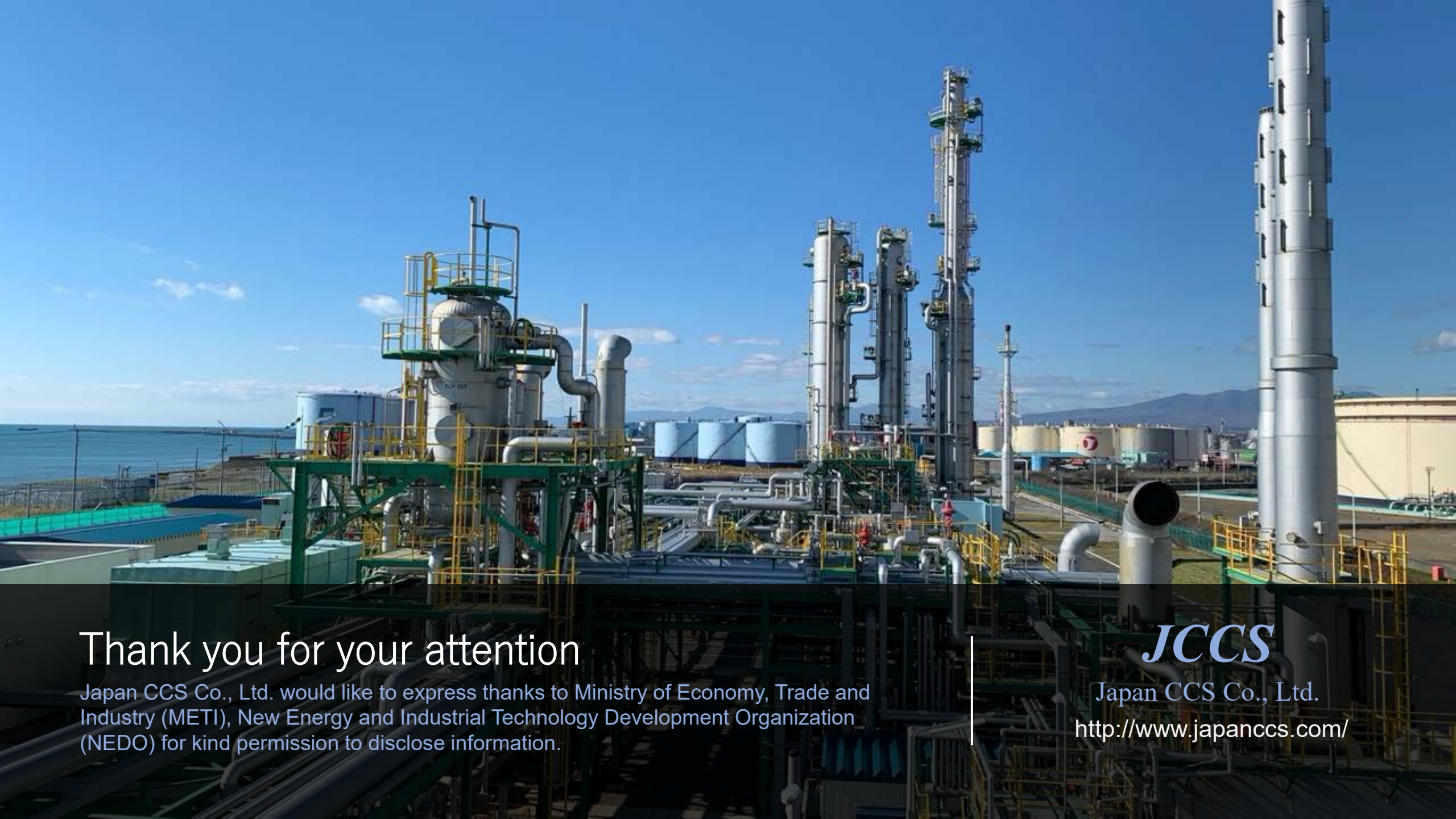
## Key Results

- Operation of **full chain CCS system from capture to storage conducted successfully, target of 300,000 tonnes of CO<sub>2</sub> injection achieved**. Monitoring operations being continued.
- CO<sub>2</sub> capture process comprising a two-stage absorption system with low pressure flash tower achieved **significantly lower capture energy than conventional system**
- Deviated injection wells from onshore site into offshore reservoirs saved drilling cost, avoided disturbance of marine environment and harbor operation
- Safety and reliability of CCS system demonstrated
- Concerns about **earthquakes and induced seismicity** addressed
  - Natural earthquakes have not caused damage to reservoirs
  - No seismicity (Mw > -0.5) detected in/around depth range of reservoirs before/during injection
- Project being conducted with **understanding and support of local community**

45

## Remaining Issues

- **Legal and regulatory framework for CCS is needed**
- **Public awareness of CCS is still low**



Thank you for your attention

Japan CCS Co., Ltd. would like to express thanks to Ministry of Economy, Trade and Industry (METI), New Energy and Industrial Technology Development Organization (NEDO) for kind permission to disclose information.

*JCCS*

Japan CCS Co., Ltd.

<http://www.japanccs.com/>



METI  
Ministry of Economy,  
Trade and Industry

# **CCUS in Japan**

## ***Present and future***

**Kawaguchi Yukihiro**

Director

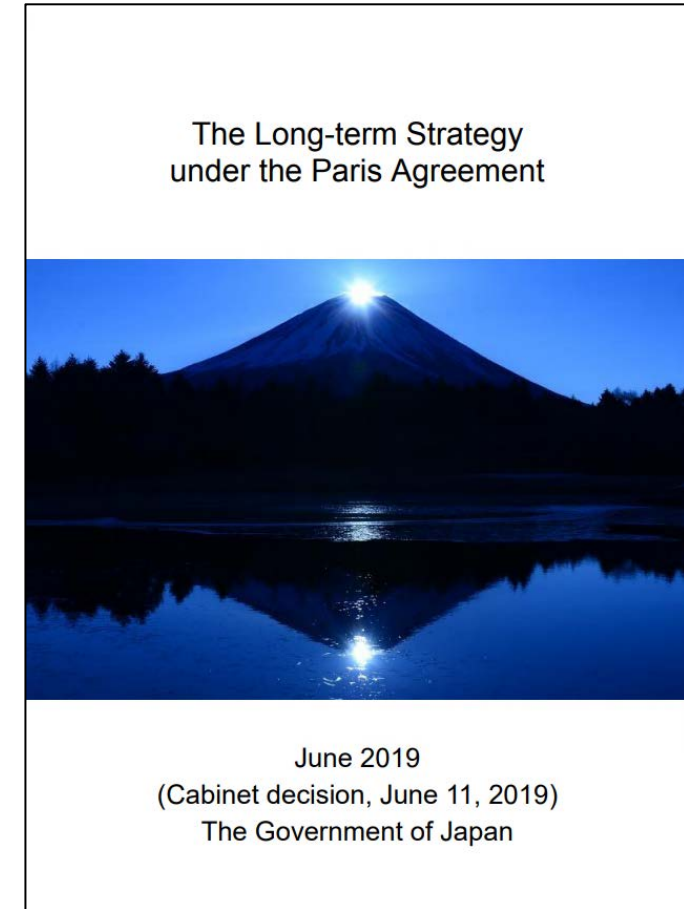
Global Environmental Affairs Office

METI, Japan

# Japan's Long-term Strategy under the Paris Agreement

## ■ Basic Concept

- ✓ Accomplish "decarbonized society" as early as possible in the second half of this century
- ✓ Take measures towards the reduction of GHGs emissions by 80% by 2050
- ✓ Realize "a virtuous cycle of environment and growth"

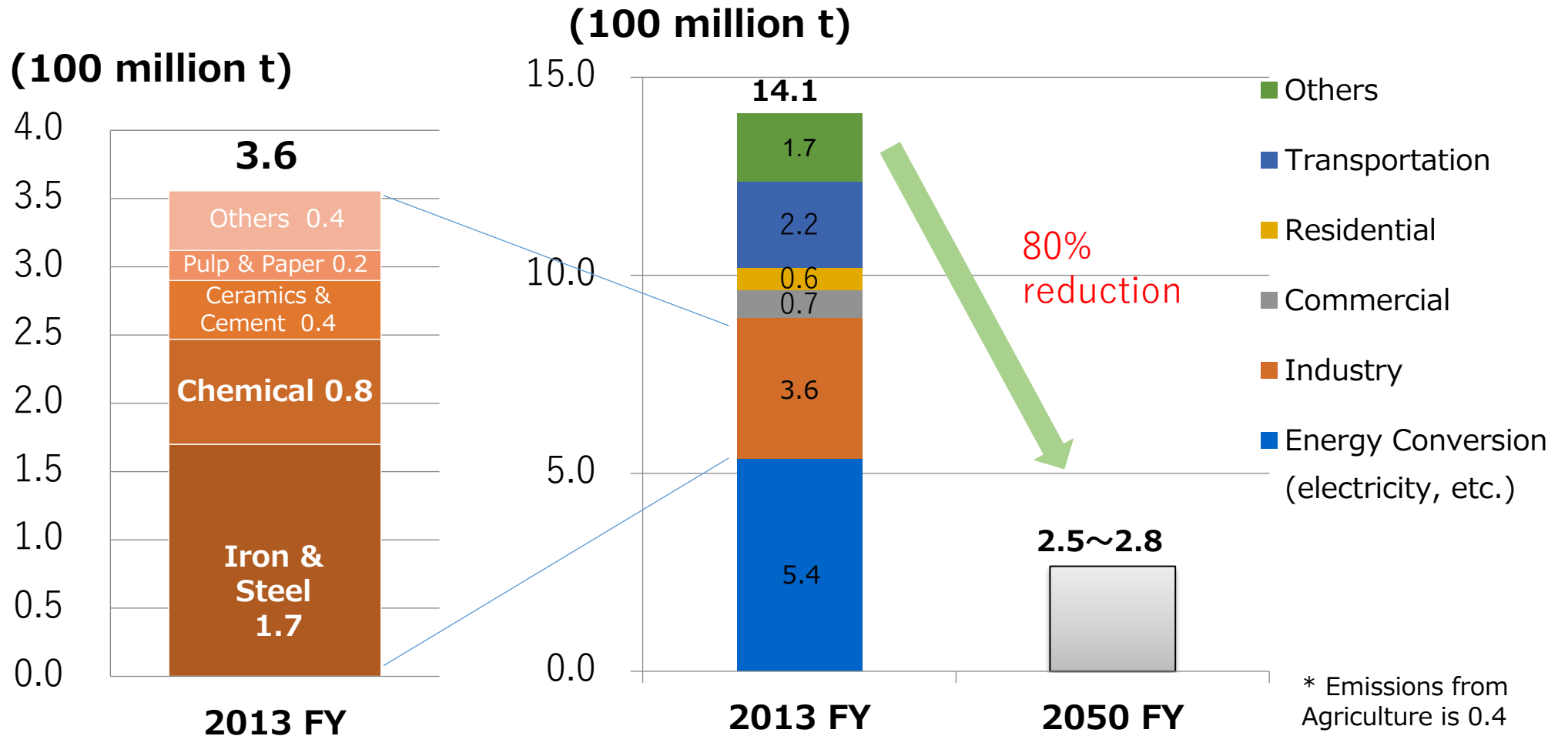


Japan's Long-term Strategy specifies  
**CCUS as one of the key technologies**  
for accomplishing "decarbonized society"



# Implications of 80% reduction for Japan

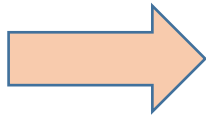
## <GHG Emissions>



## Two milestones for CCS in Japan

- [R]esearch and development will be conducted with a view to **practical use of the CCUS technology around 2020**

The 5th Strategic Energy Plan (July 2018)



Achievement of 300,000 tonnes cumulative CO<sub>2</sub> injection of Tomakomai CCS demonstration project proved CCS is a safe and secure system in Japan.

- **[I]ntroduction of the CCS by 2030** in the coal-fired power generation will be considered, with a view to **commercialization**.

The Long-term Strategy  
under the Paris Agreement (June 2019)

# Study for introduction of CCS (Oct.2019-Mar.2020)

## ➤ Participation from industries

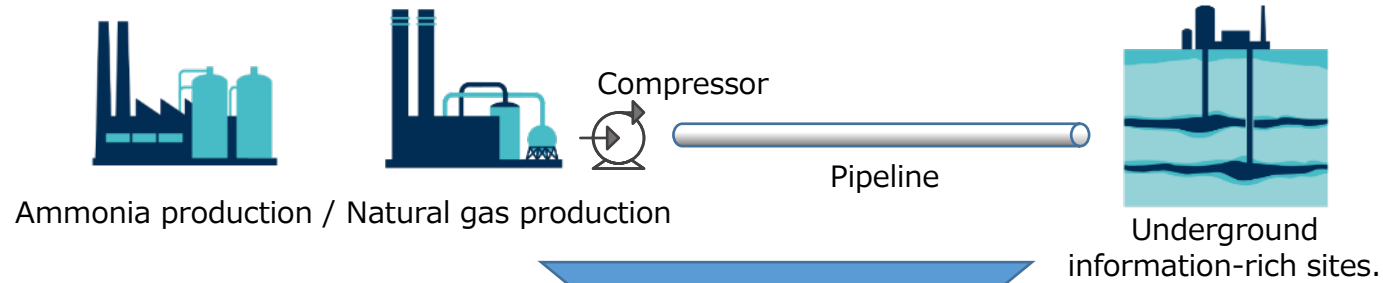
- ✓ Electric Power, steel and chemical industries acknowledged **CCS as indispensable technology** for their decarbonization.

## ➤ Integrated model analysis

- ✓ The availability of **CCS will help to reduce the cost of emission reductions** after 2030 under any scenarios.
- ✓ In the case of 80% GHG emission reduction in Japan, **no feasible solution could be obtained in the case where CCS is not utilized.**
- ✓ CO<sub>2</sub> storage in 2050 is estimated to be about **92MtCO<sub>2</sub>/year** in the standard case and **182MtCO<sub>2</sub>/year** in the expansion case.

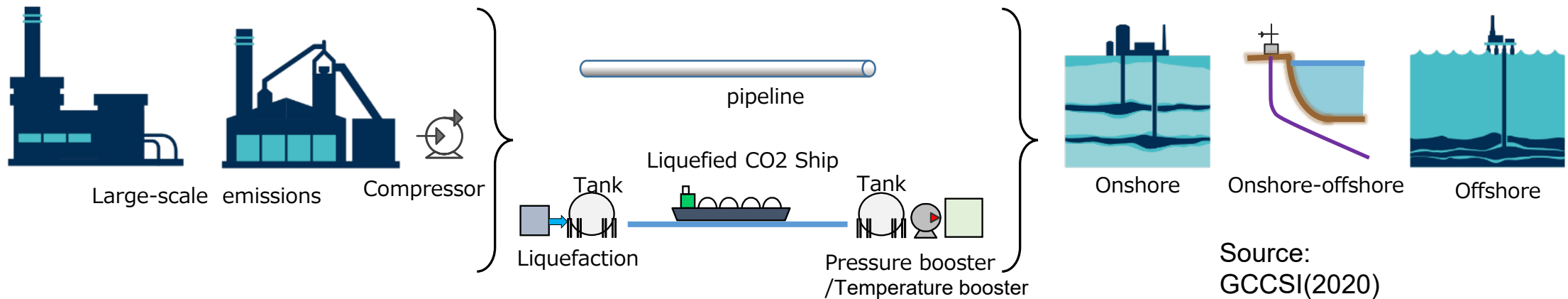
# Business models

## 【initial stage】



Reduce costs, Reduce uncertainty, Improve social acceptance, and Enhance the business environment, etc.

## 【growth stage】



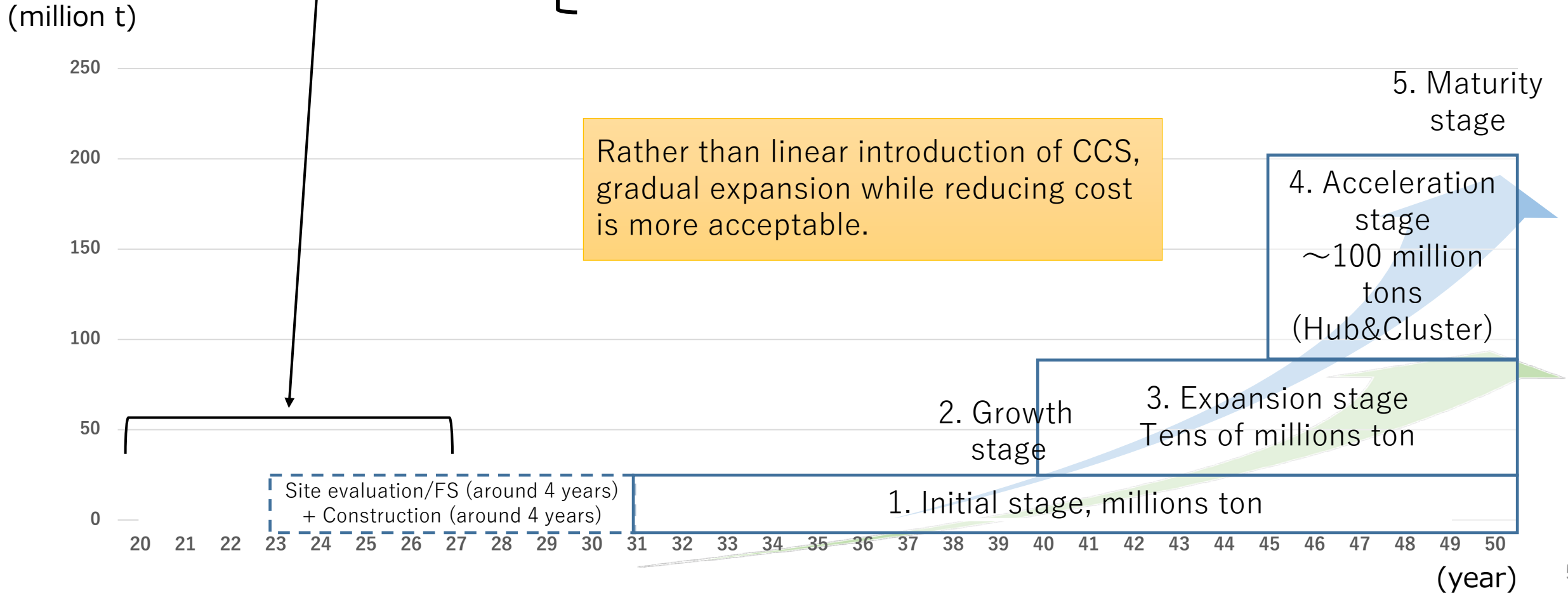
Source: GCCSI(2020)



# Challenges & time-frame image

Need to enhance **business environment** for commercialization

- Cost reduction
- Incentives
- Legal framework (incl. long-term liability)
- Site survey for large-scale (>0.1 billion-ton) storage
- Public Acceptance



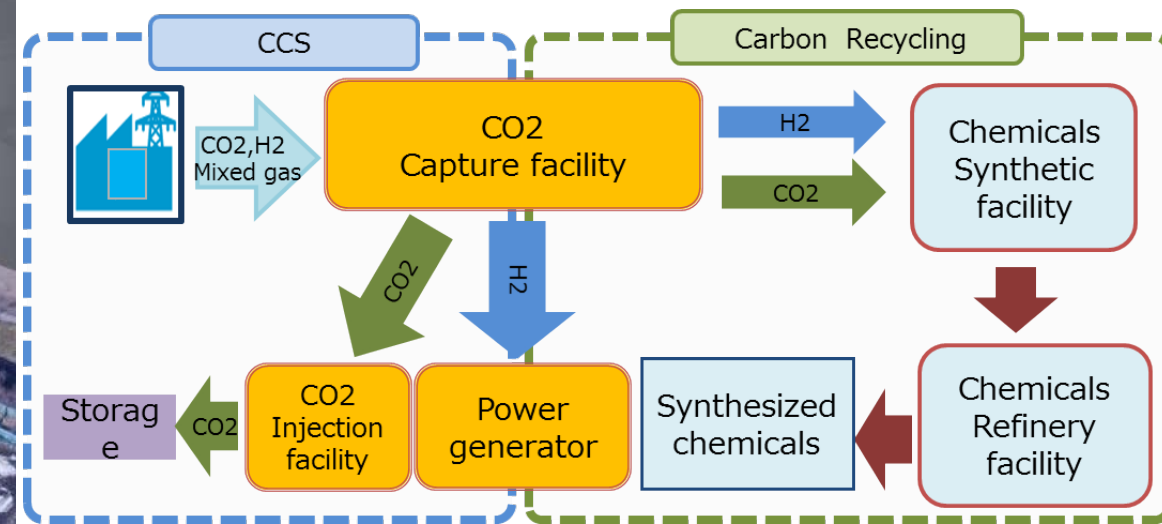
# Tomakomai CCS Demonstration Project and Carbon Recycling

- Achieved initial target of approximately 300,000 tonnes cumulative injection in November 2019.
- Utilize the Tomakomai CCS facility effectively and promote the development of “**Carbon Recycling**”.

\***Carbon recycling:** Considering CO<sub>2</sub> as source for Carbon, capture CO<sub>2</sub> then utilize and recycle it as Carbon compounds.



The image of the new facility for Carbon Recycling



<The image of Carbon Recycling demonstration at Tomakomai>

# CCS demonstration projects

## - Hub & Cluster model in Japan at initial stage (2023-)?



**IGCC with CO2 capture and carbon recycling\* facility**

Capture started from Dec.2019.



**CO2 transport ship**

Study started from 2020.



**Tomakomai CCS with Carbon Recycling\***



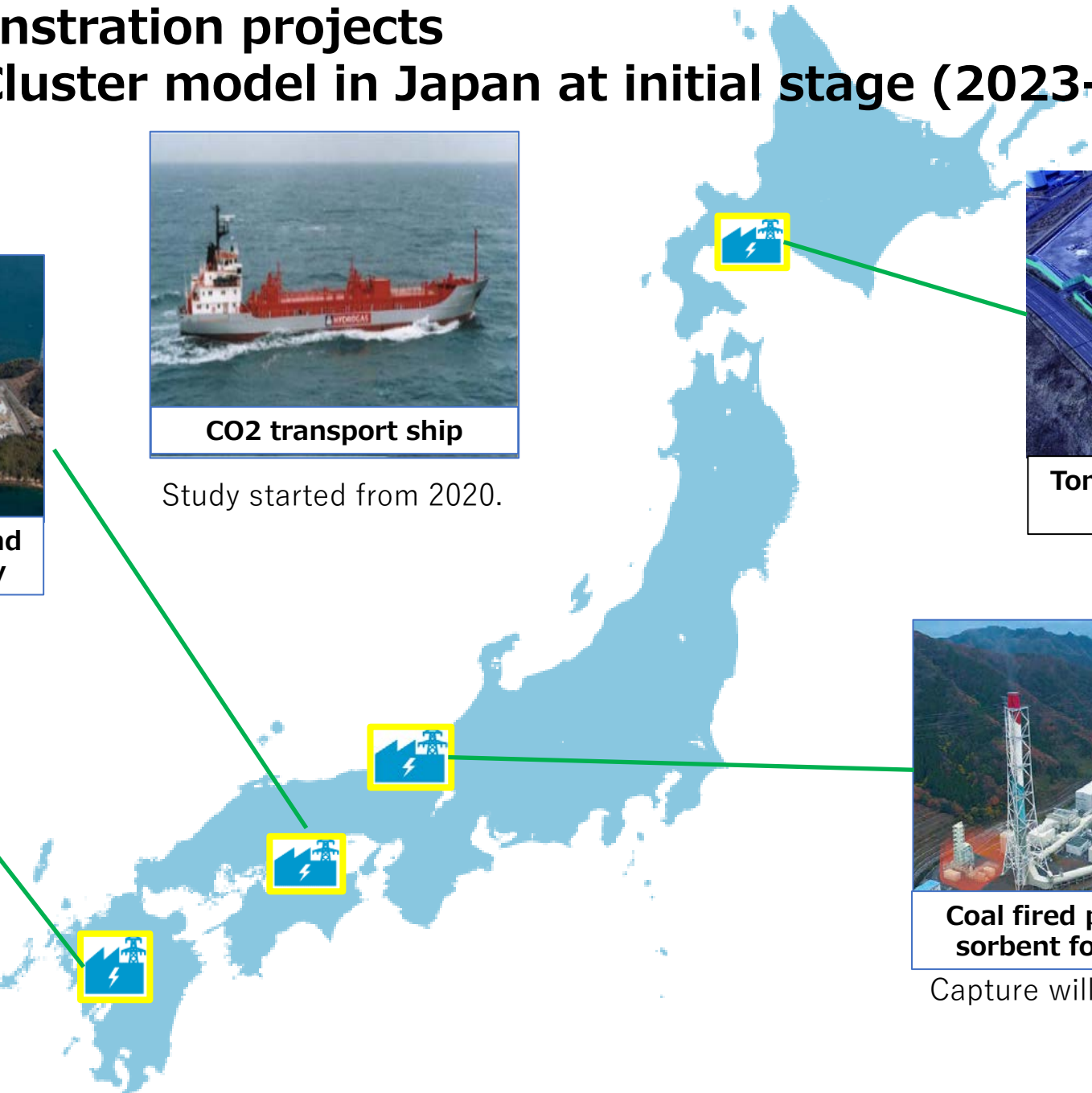
**Biomass power plant with CO2 capture**

Capture will start from 2020.



**Coal fired plant with solid sorbent for CO2 capture**

Capture will start 2023.





# Japan's worldwide cooperation for CCUS development & deployment

## EU:

- ✓ Joint Press Statement including CCUS at G20 Karuizawa



## Canada:

- ✓ MOC including CCUS at G20 Karuizawa
- ✓ MOC between JCCS and International CCS Knowledge Centre (Saskatchewan)



## UK:

- ✓ MoC between METI-BEIS including CCUS
- ✓ METI-BEIS CCUS Workshop



## USA:

- ✓ MOC on the CCS collaboration
- ✓ Research cooperation on microbubbles and optical fibers at North Dakota
- ✓ Petra Nova CO2EOR project



## Saudi Arabia :

- ✓ Saudi-Japan vision 2030 2.0
- ✓ FS for CO2 free-ammonia supply with CCUS



## Australia:

- ✓ MOC including CCUS at G20Karuizawa
- ✓ Hydrogen Energy Supply Chain Project



## Indonesia :

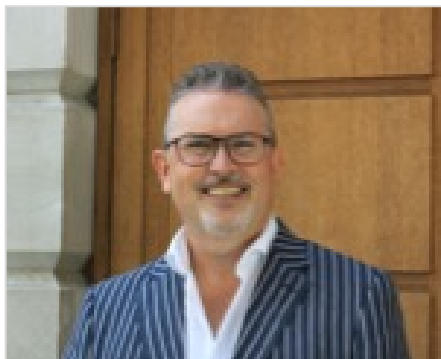
- ✓ MOC including CCUS at G20 Karuizawa
- ✓ FS for applying CCUS to JCM



**Multilateral Collaboration**  
(CEM, CSLF, IEA, IEAGHG, GCCSI...)



# QUESTION AND ANSWER SESSION



**Brian Allison**

*CEM CCUS Initiative Co-Lead*  
Department for Business,  
Energy, and Industrial  
Strategy  
UK Government



**Yoshihiro Sawada**

*Corporate Adviser,  
General Manager*  
International Affairs  
Dept.  
Japan CCS Co., Ltd.



**Jiro Tanaka**

*Associate General  
Manager*  
International Affairs  
Dept.  
Japan CCS Co., Ltd.



**Yukihiro Kawaguchi**

*Director*  
Global Environmental  
Affairs Office  
Ministry of Economy,  
Trade and Industry

Webinar recordings provided on  
YouTube

<https://www.youtube.com/user/cleanenergypolicy>

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@ccuscem



<https://www.youtube.com/playlist?list=PLKRmGa9s99JVssP8Gb5buwLg3Bl1lls>

## CONTACT US:



[cemccus@outlook.com](mailto:cemccus@outlook.com)

## CEM CCUS Initiative Members:

Lead countries:



Norway



Saudi Arabia



United Kingdom



United States

Members:



Canada



China



Japan



Mexico



Netherlands



South Africa



United Arab Emirates

Observer:





# CARBON CAPTURE, UTILIZATION & STORAGE

ACCELERATING CCUS TOGETHER

AN INITIATIVE OF THE CLEAN ENERGY MINISTERIAL