

A low-angle photograph of the Tomakomai CCS Demonstration Project, showing several tall, silver industrial towers and a complex network of pipes and yellow safety railings against a clear blue sky. The sun is visible in the upper left corner, creating a lens flare effect.

# Tomakomai CCS Demonstration Project

- Achievements and Future Outlook

Shoichi Ishii, Japan CCS Co., Ltd.

**JCCS**

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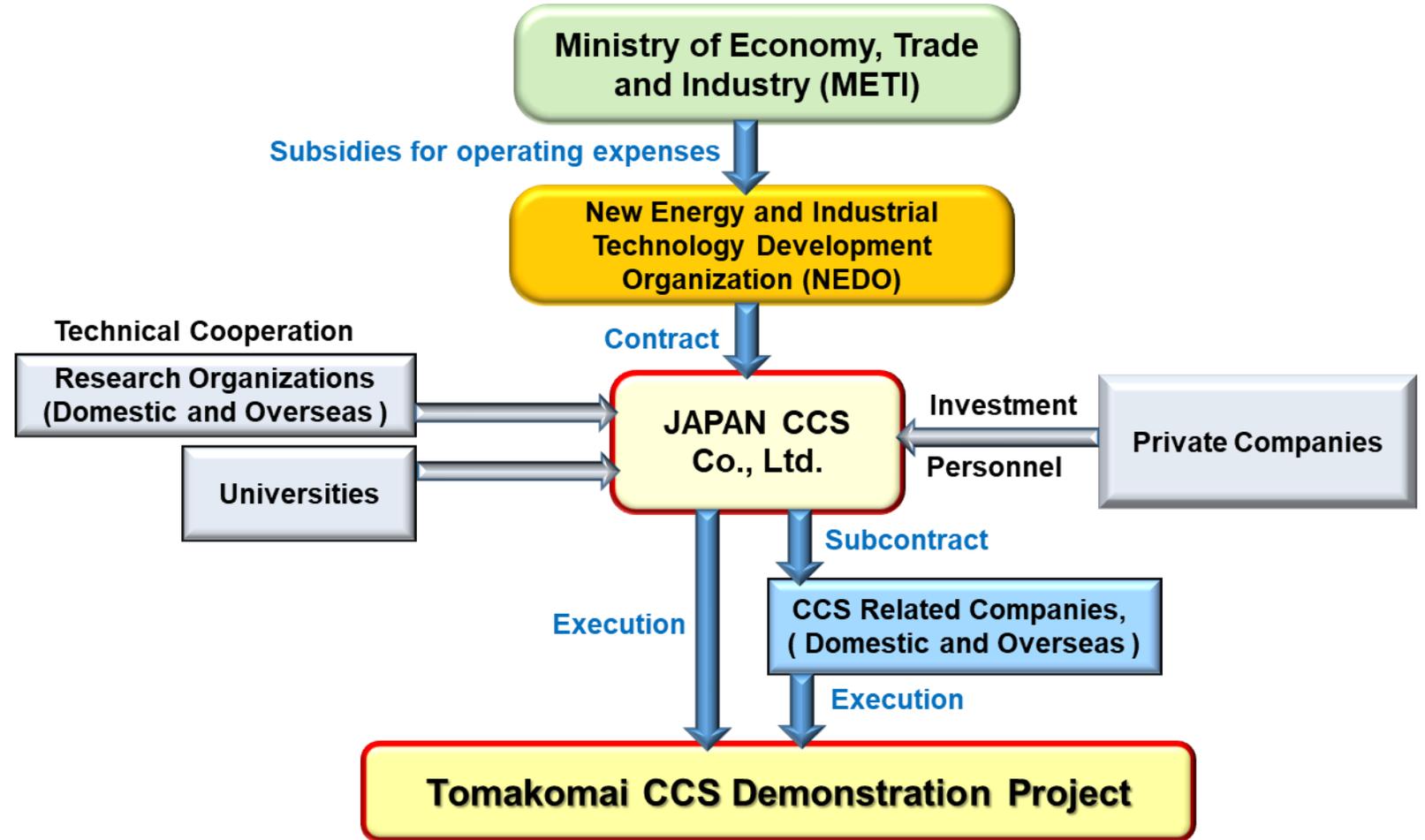
## Overview of Tomakomai CCS Demonstration Project

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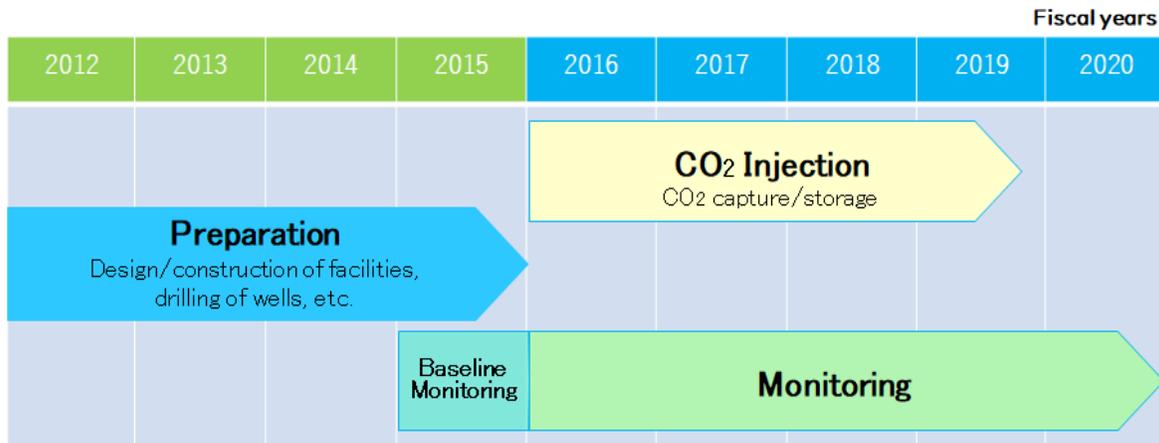
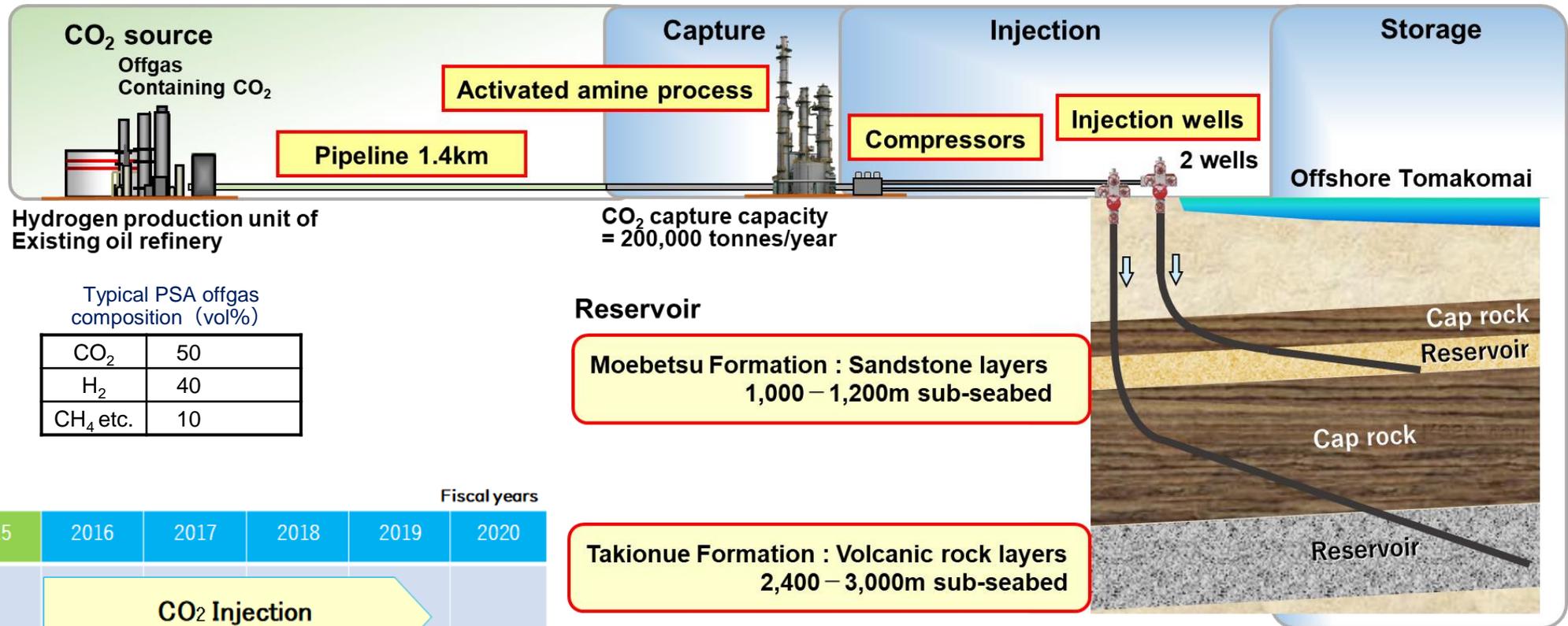
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# Project Overview and Organization

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

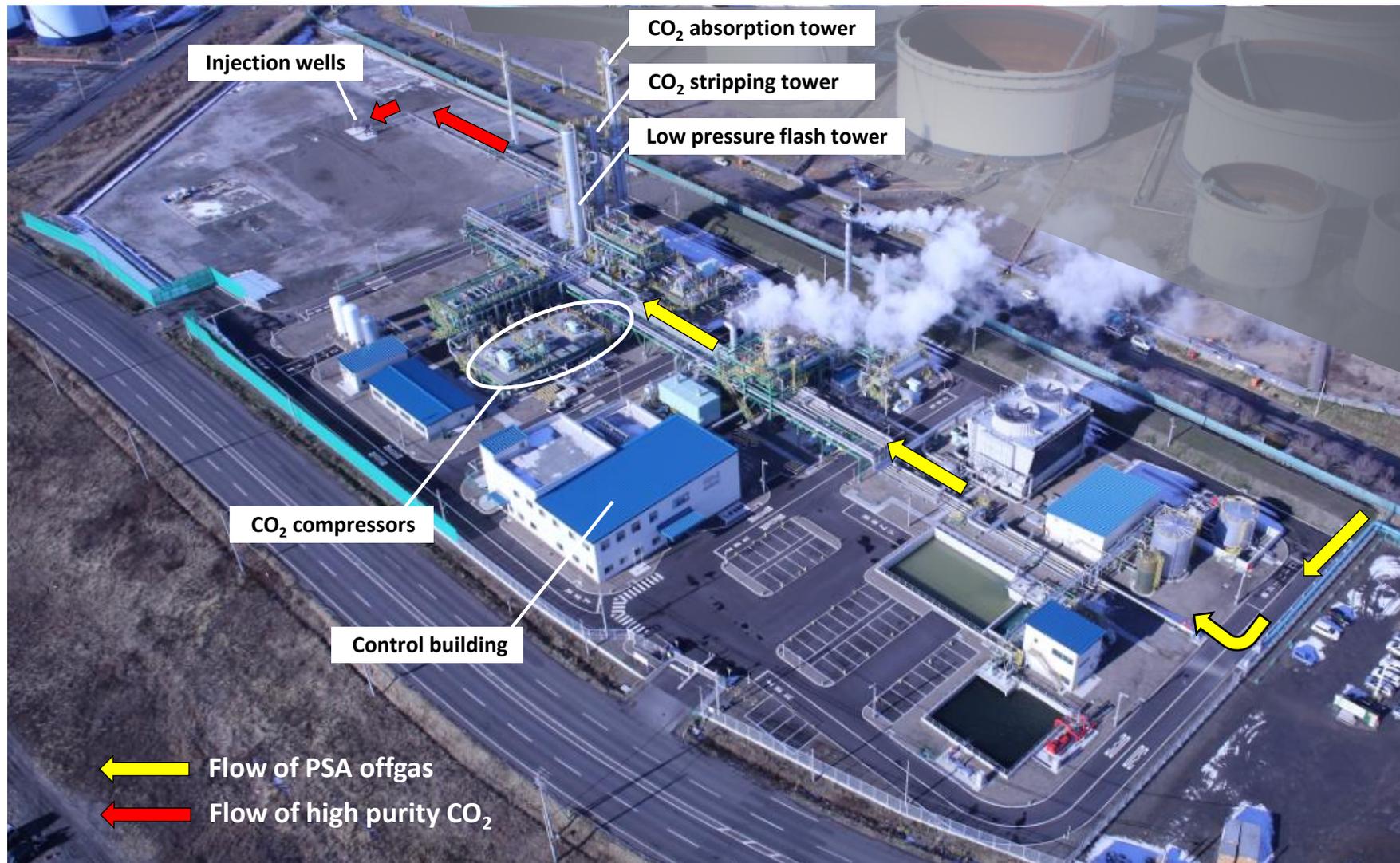


# Project Scheme and Schedule

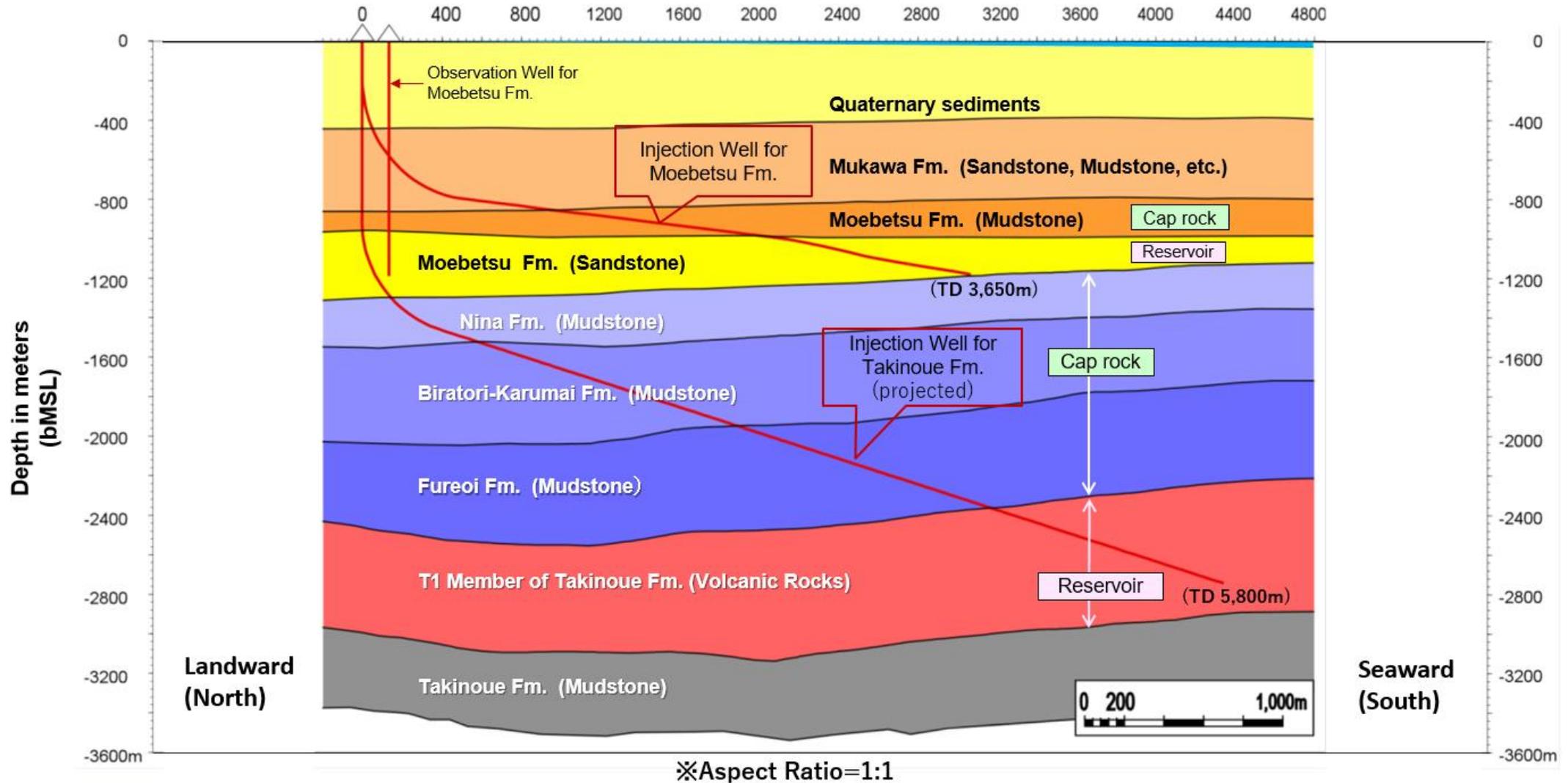


- Project executed on schedule except for external factors
- Project executed on budget
- No accident or disaster

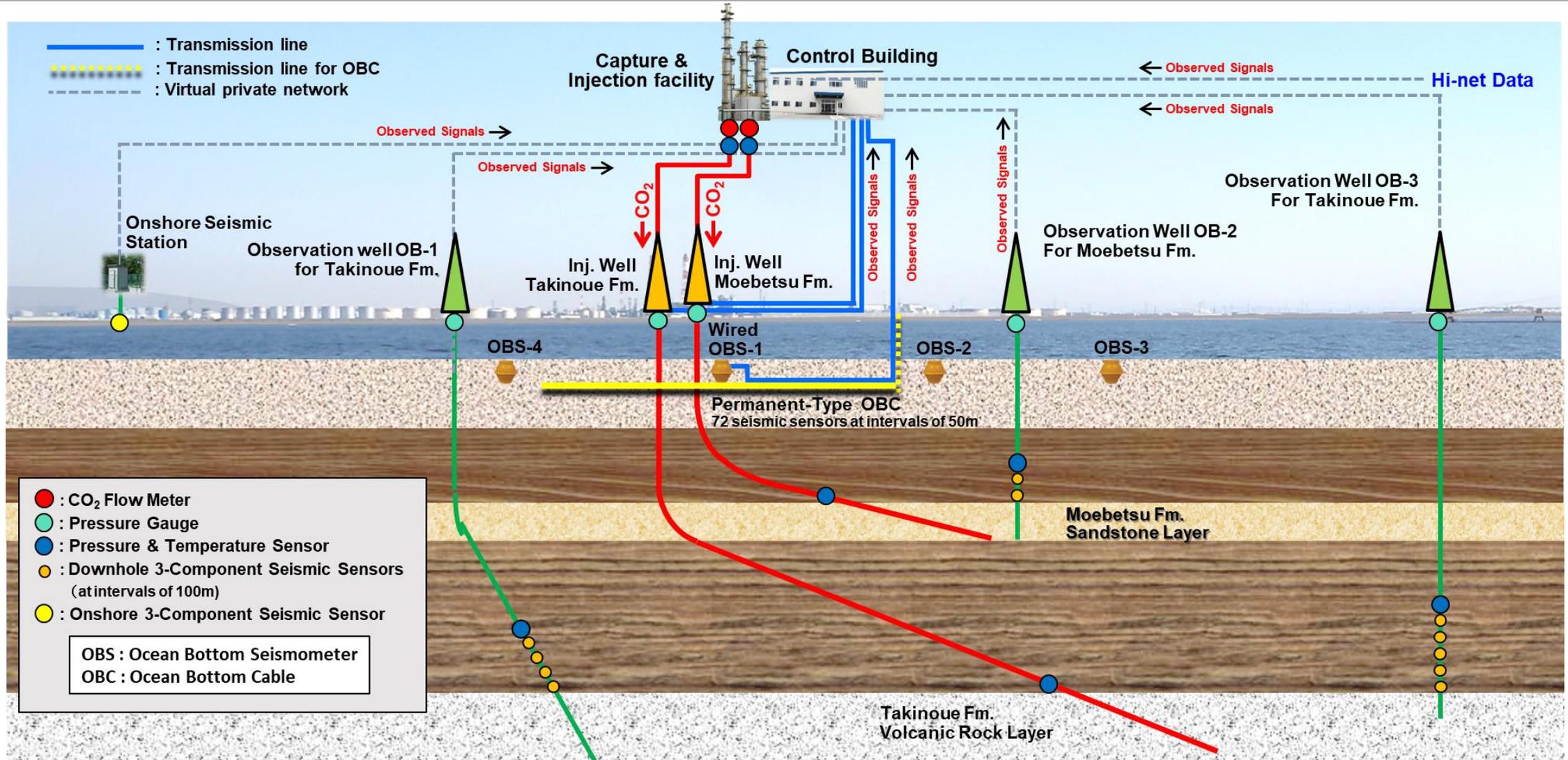
# Bird's Eye View of Tomakomai Capture/Injection Facilities



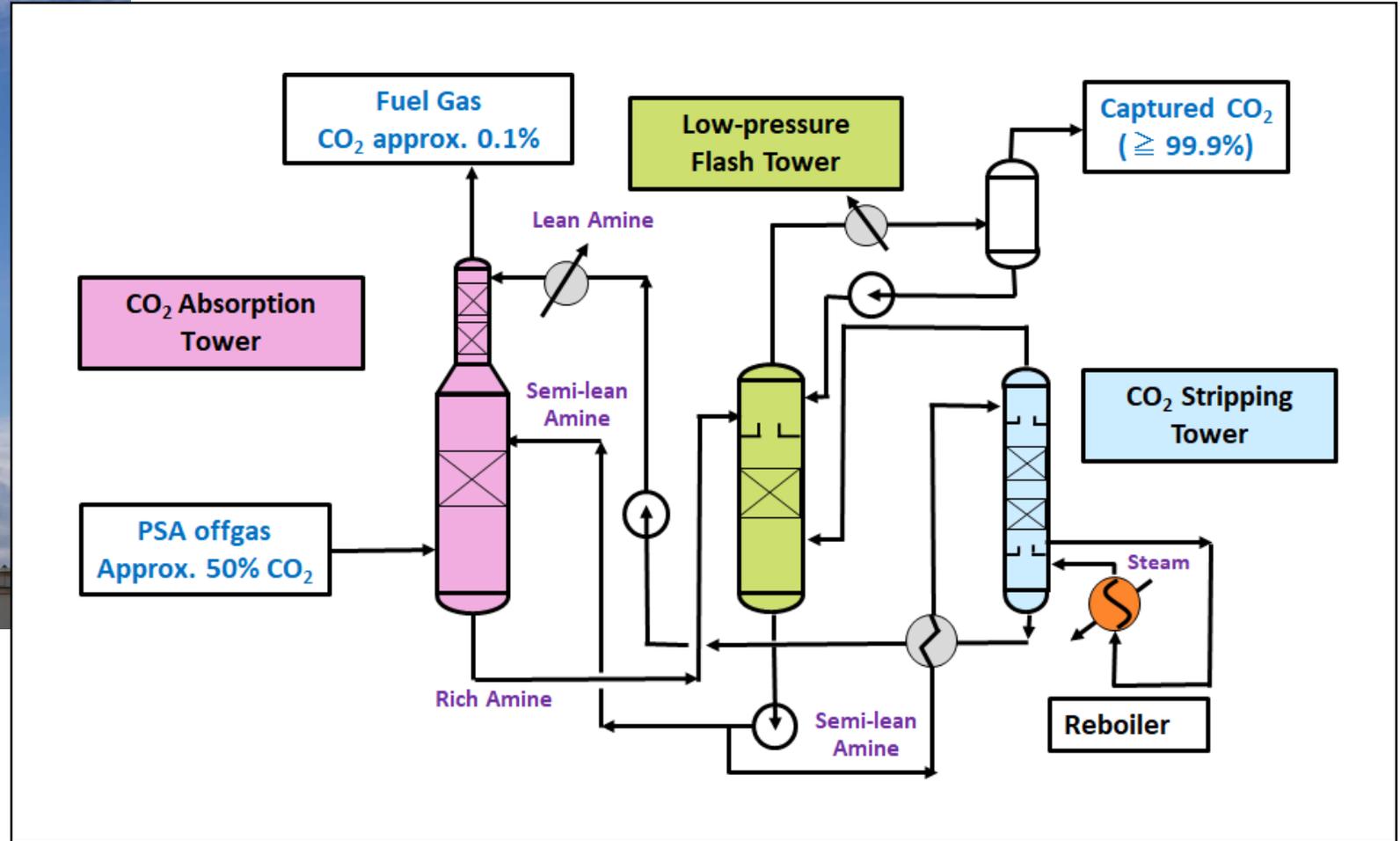
# Geological Section & CO<sub>2</sub> Injection Wells



# Schematic Diagram of Monitoring System



# CO<sub>2</sub> Capture Applying Two-Stage Absorption Process





## Key Results of Tomakomai Project

## CO<sub>2</sub> Capture Results by Two-stage Absorption Process

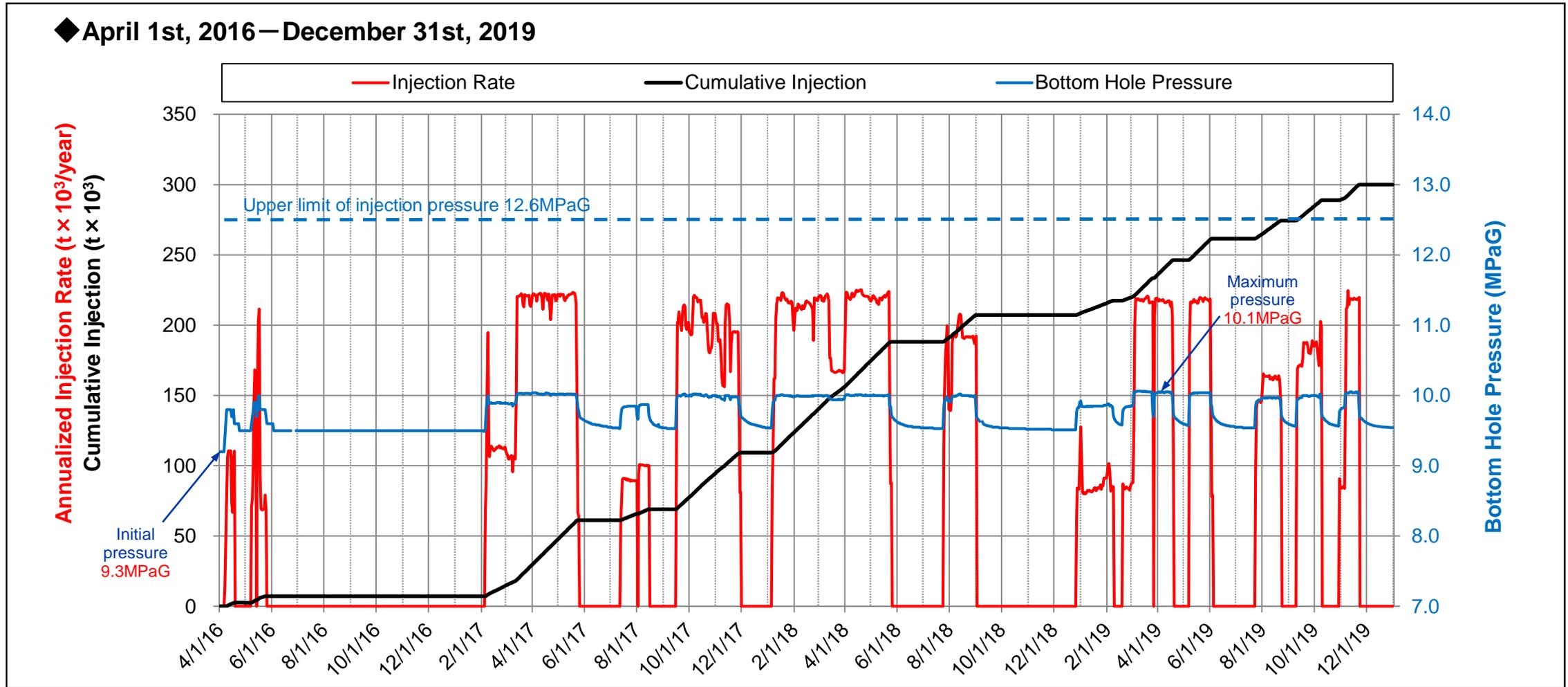
		FY2016	FY2017	FY2019
CO <sub>2</sub> recovery	t/h	25.3	24.3	26.4
Reboiler duty	GJ/t-CO <sub>2</sub>	0.923	0.882	0.915

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- Achieved reboiler duty of 0.882 to 0.923GJ/t-CO<sub>2</sub>; 1/2 to 1/3 of conventional one stage absorption process

# Results of CO<sub>2</sub> Injection (Moebetsu Formation)

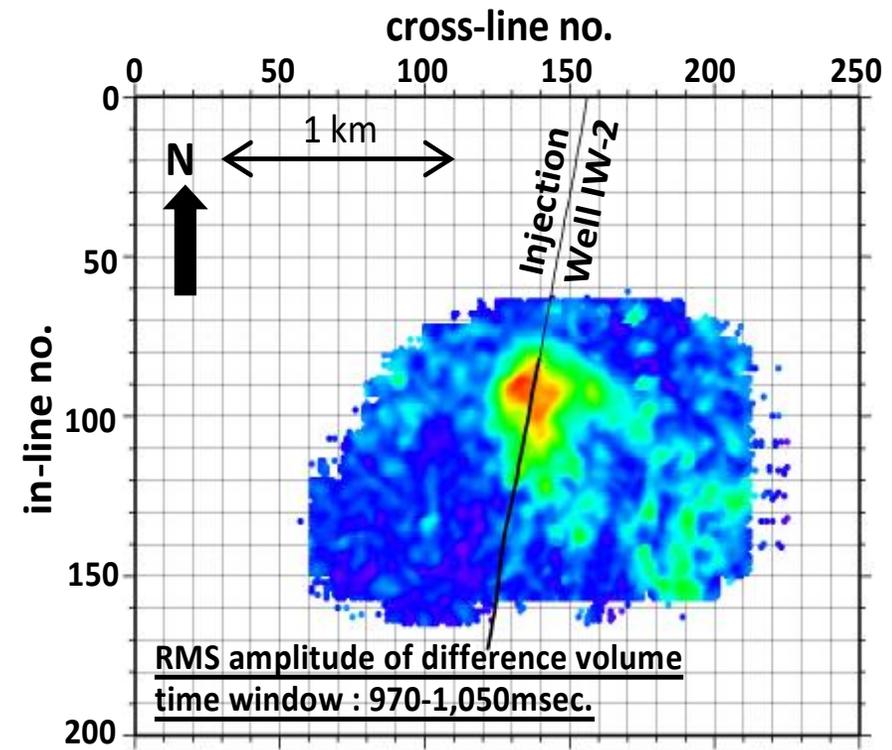
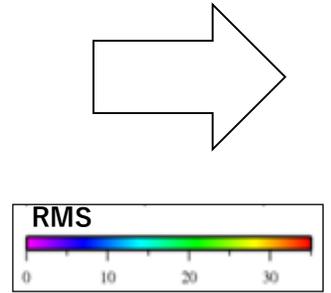
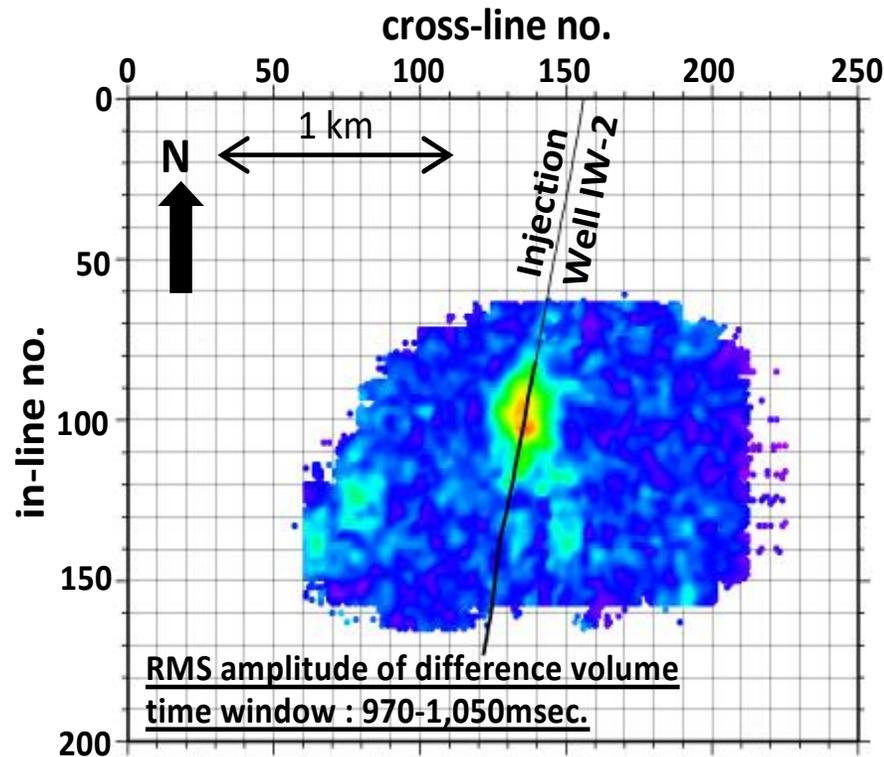
- Smooth injection with only slight pressure increase, well below upper limit of injection pressure



# 3D Seismic Survey Results

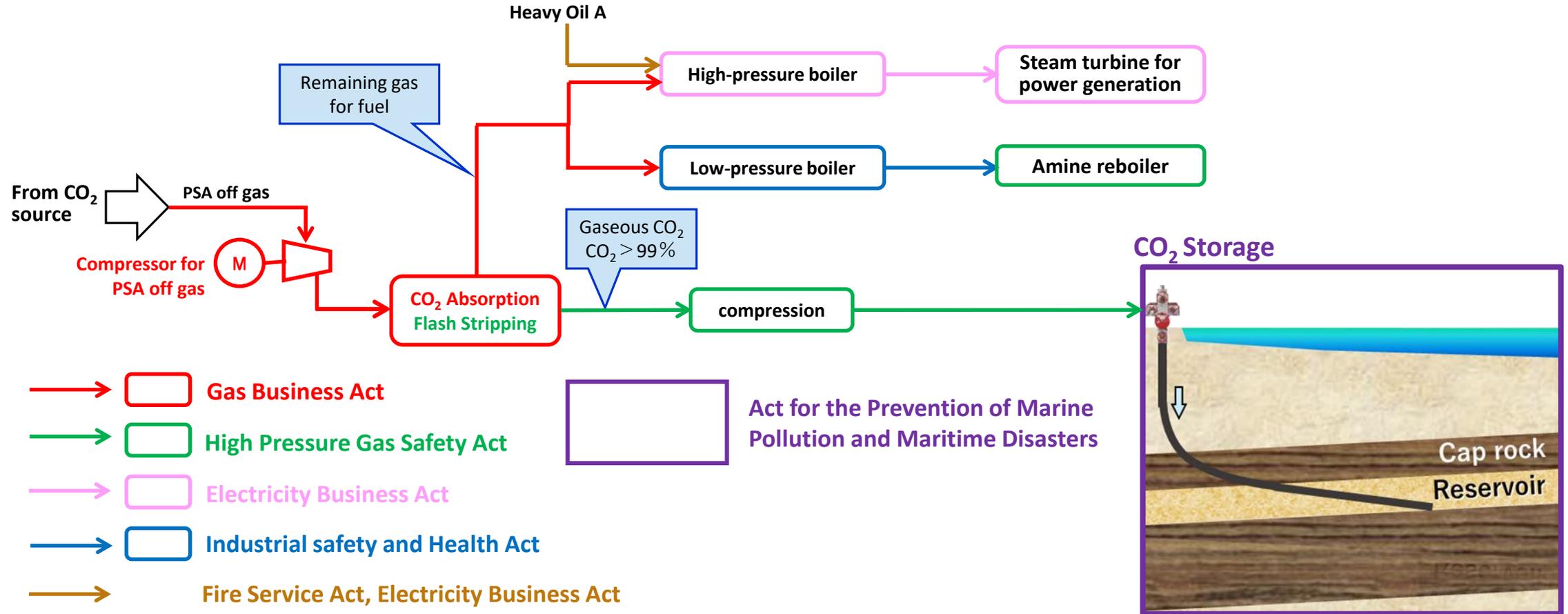
2<sup>nd</sup> monitor survey (61,239 - 69,070 tonnes; JFY2017 )

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



# Laws Applied to Conduct Project

- Existing laws were applied to facilities
- Though Tomakomai onshore to offshore injection scheme did not require application of London Protocol, domestic law reflecting London Protocol (Act on Prevention of Marine Pollution and Maritime Disaster) was applied



# Cost Estimation of Commercial Model

CCS Cost	1-million-ton commercial model JPY/t-CO <sub>2</sub>	
<b>1) Capture / Compression</b>		
CAPEX	590	
OPEX	4,079	
Total	4,669	
<b>2) Injection / Monitoring</b>		
CAPEX	369	
OPEX	1,148	
Total	1,517	
<b>3) Grand Total</b>		
Captured	6,186	(Approx. 57 USD/t-CO <sub>2</sub> )
Avoided	7,261	(Approx. 67 USD/t-CO <sub>2</sub> )
<b>4) CO<sub>2</sub> emission factor (t-CO<sub>2</sub>) emitted from capture/injection facilities ÷ (t-CO<sub>2</sub> captured/injected)</b>		
t-CO <sub>2</sub> /t-CO <sub>2</sub>	0.148	

(1USD=108JPY)

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## Public Engagement

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# Public Outreach Activities

## Voice of Tomakomai Citizens

### 1. Information Disclosure

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

Monitoring &  
Disclosure Plan

### 3. Dissemination to Young Generation

## Outreach Activities

- ➔ ① Forum for Tomakomai Citizens
- ➔ ② Site Tours
- ➔ ③ Panel Exhibitions
- ➔ ④ Information Disclosure System
- ➔ ⑤ Mini seminars for students
- ➔ ⑥ Kids' lab classes/site tours

Panel Exhibitions



Tomakomai City Hall  
Information Disclosure System



Mini seminars for students



Kid's lab classes



# Public Outreach Activities

**Keynote Speech by Mayor Iwakura  
at CCS Forum for Tomakomai Citizens**



**Site Tours for Tomakomai Citizens**



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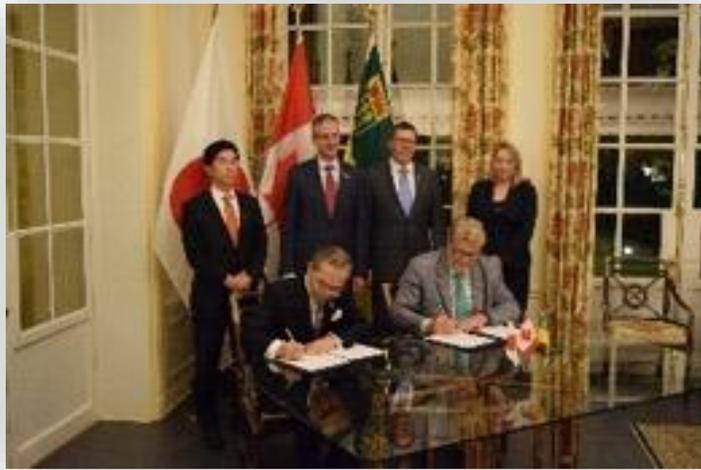
# International Activities



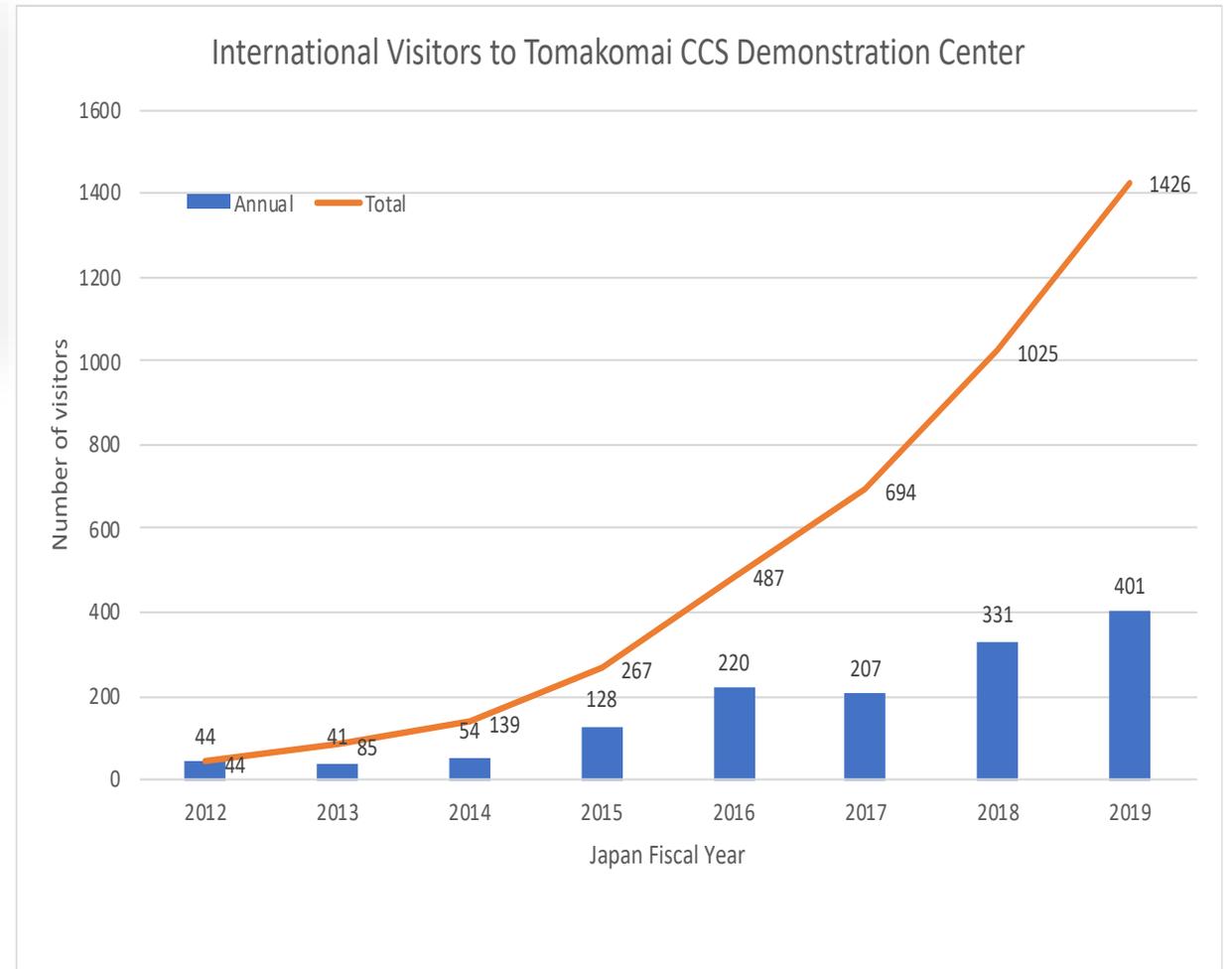
**CSLF Recognition of Tomakomai CCS Demonstration Project**



**Visit of CEO of Global CCS Institute**



**Signing of MOU by International CCS Knowledge Centre and JCCS**



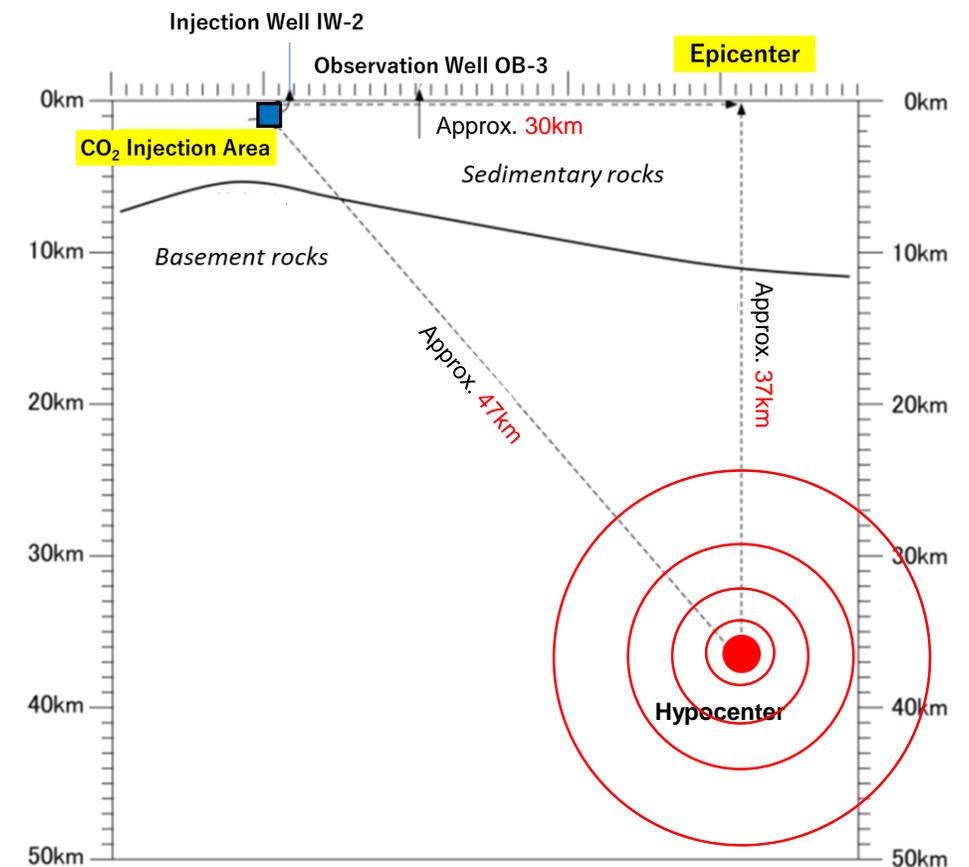
# 2018 Hokkaido Eastern Iburi Earthquake

- Date: Sept.6, 2018
- Magnitude: 6.7
- Distance from CO<sub>2</sub> injection area: 30km
- Depth: 37km



Plan view

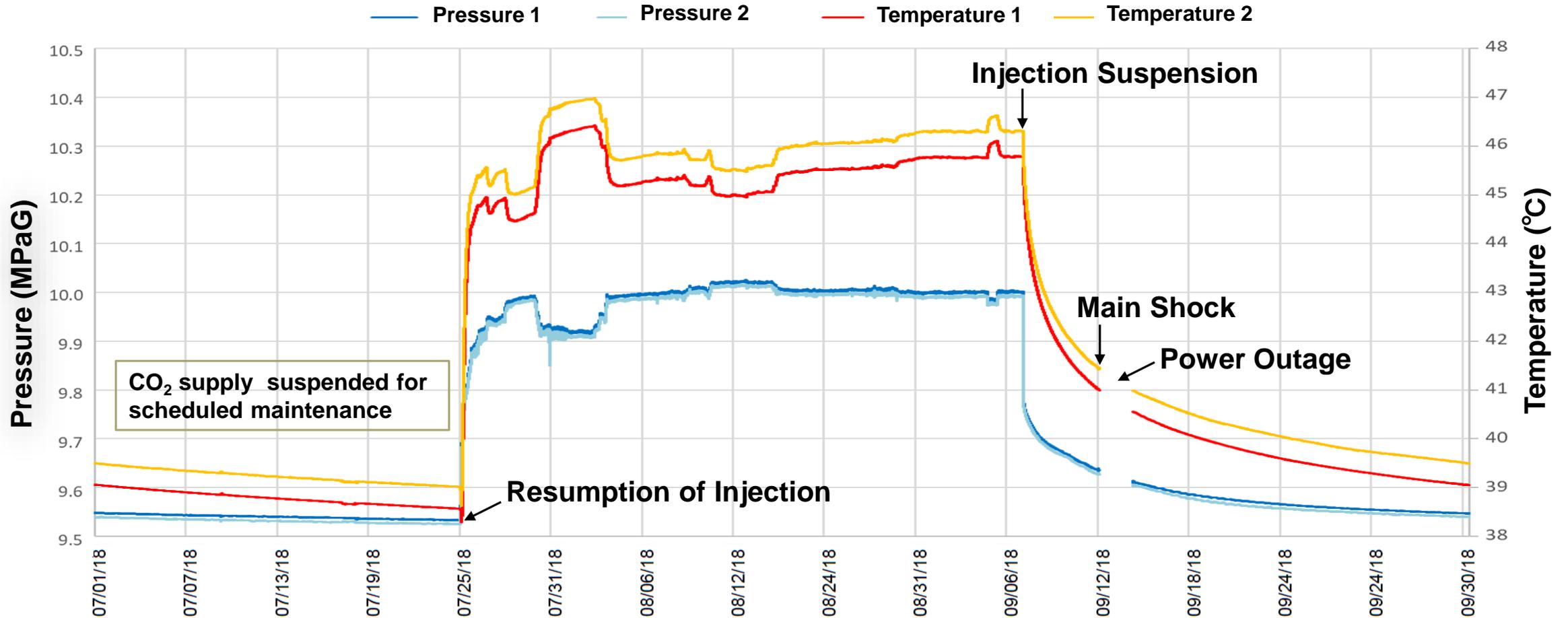
Source : LC81070302016141LGN00, courtesy of the U.S. Geological Survey; annotation added by JCCS



Cross section view

# 2018 Hokkaido Eastern Iburi Earthquake

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



# 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

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

- *Respond quickly*
- *Include technical explanation*

# Next Steps

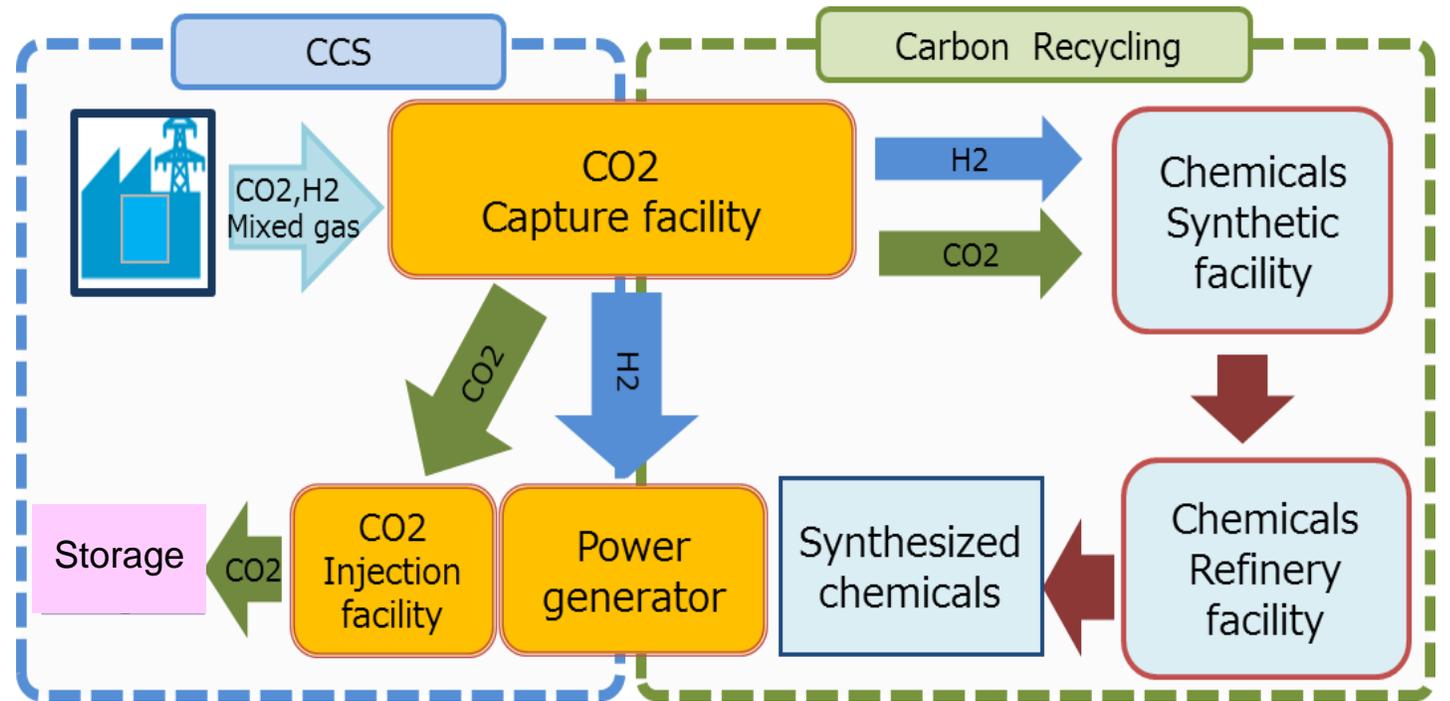
# Tomakomai CCS Demonstration Project and Carbon Recycling

- Utilize the Tomakomai CCS facility effectively and promote the development of **“Carbon Recycling”**.



The image of the new facility for Carbon Recycling

Courtesy of METI



<The image of Carbon Recycling demonstration at Tomakomai>



# Summary

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# Summary

## Key Results

- **Successful operation of full chain CCS system**
  - 300,000 tonnes of CO<sub>2</sub> injection
  - Energy efficient CO<sub>2</sub> capture process
  - Unique onshore to offshore injection scheme
  - Safety and reliability of CCS system demonstrated
  - Concerns about earthquakes addressed
  - Project being conducted with understanding and support of local community
- **Sharing the success of the 1 million-tonne-scale Tomakomai CCS project internationally will expand the feasibility of CCUS in countries with issues**
  - Frequent earthquakes and volcanic activity
  - Storage sites near densely populated areas
  - Public opposition

## Looking Ahead

- Carbon recycling
- CO<sub>2</sub> ship transport





# 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.

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