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# **Large-scale demonstration project of CCS in Japan**

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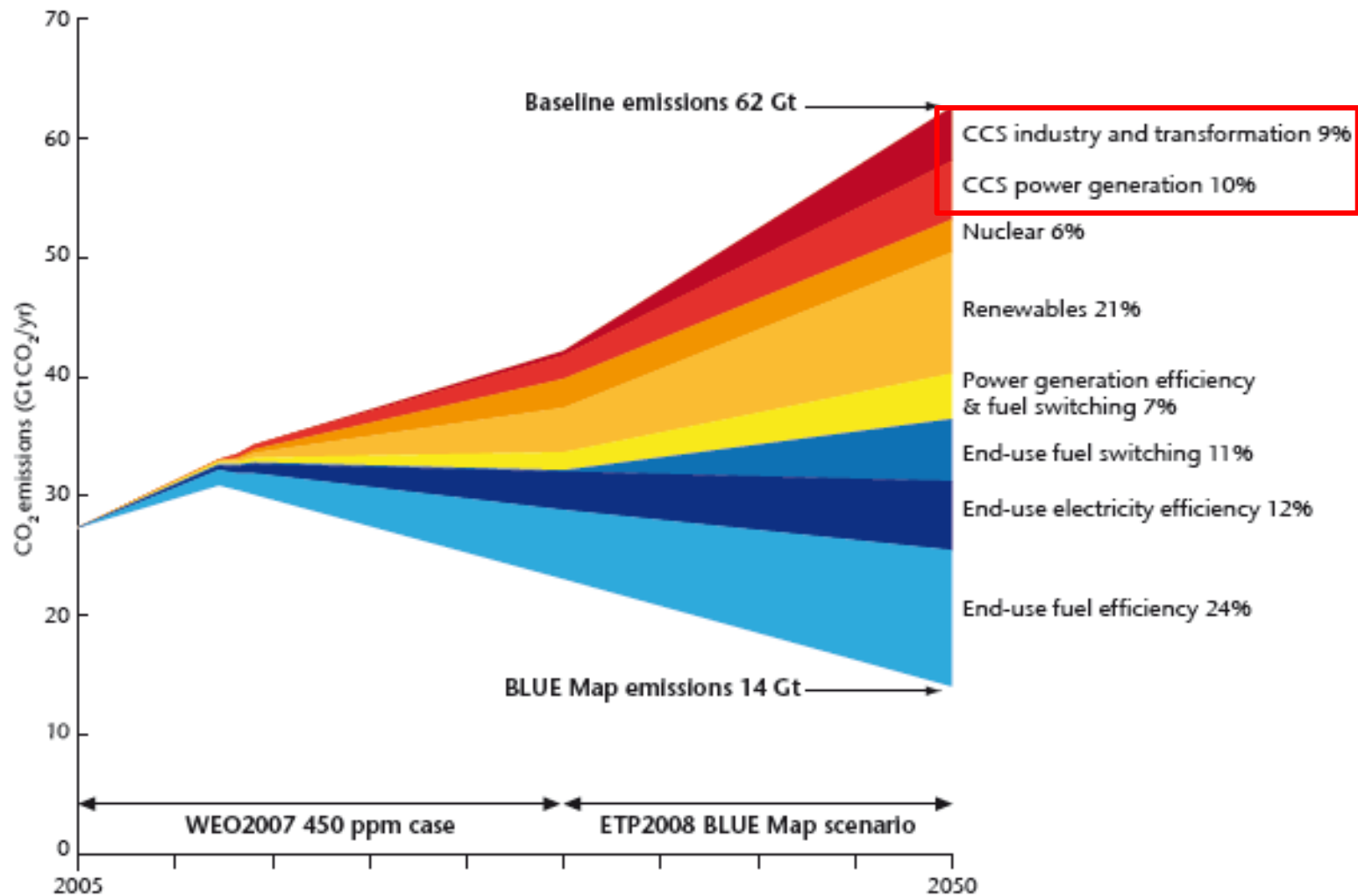
**Masanori Abe**  
**Japan CCS Co., Ltd. (JCCS)**

**CCS Workshop in Jakarta**  
**February 22, 2011**

- 1. Progress update**
- 2. Project update**
- 3. Laws and regulations**
- 4. Public outreach**
- 5. Summary**

# CCS is a key technology (1)

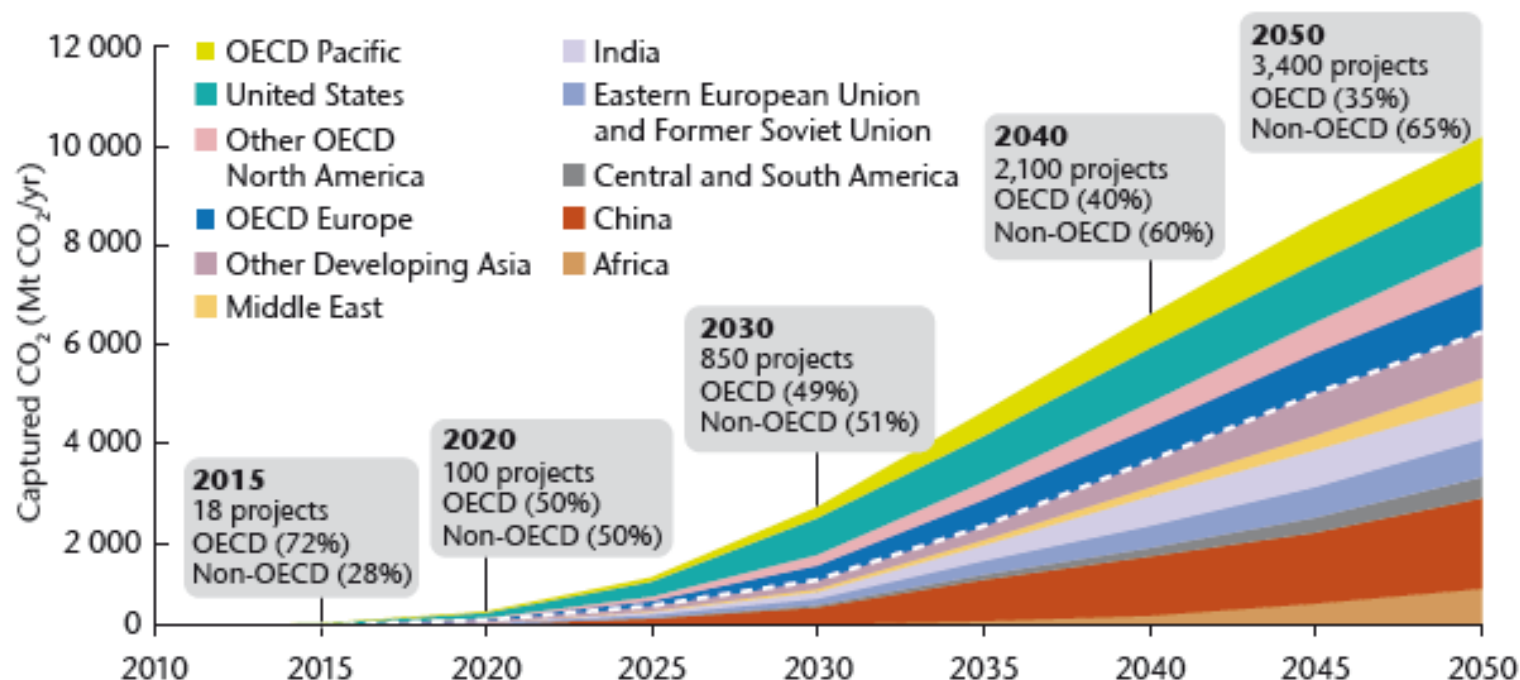
Figure 1: CCS delivers one-fifth of the lowest-cost GHG reduction solution in 2050



Source: IEA, *Energy Technology Perspectives* (2008a).

# CCS is a key technology (2)

Figure 6: Global deployment of CCS 2010–50 by region (MtCO<sub>2</sub> captured/year)



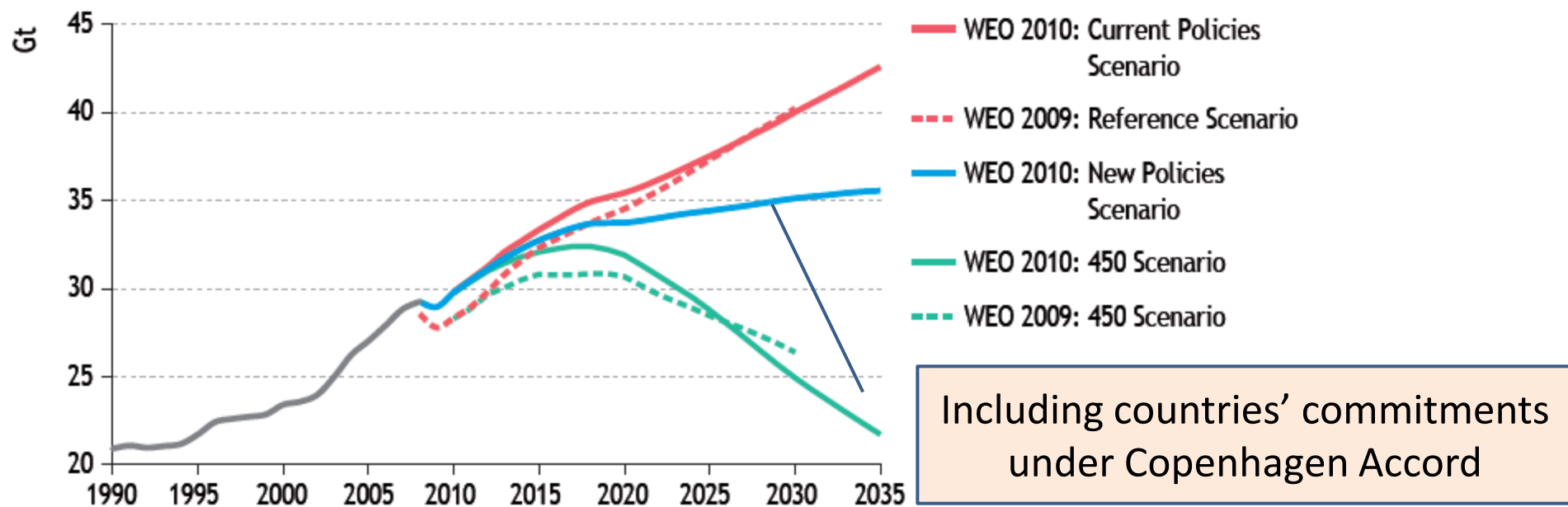
Note: The dashed line indicates separation of OECD/non-OECD groupings.

**KEY POINT:** To achieve the BLUE Map targets, OECD regions must lead in the demonstration phase but then CCS technology must spread rapidly to the rest of the world.

# Copenhagen Accord

- **Taken by the Conference of Parties of UNFCCC of December 18, 2009**
- **Agree that deep cuts in global emissions are required so as to hold the increase in global temperature no more than 2 °C, and take action to meet this objective**

**Figure 13.2** ● World energy-related CO<sub>2</sub> emissions by scenario



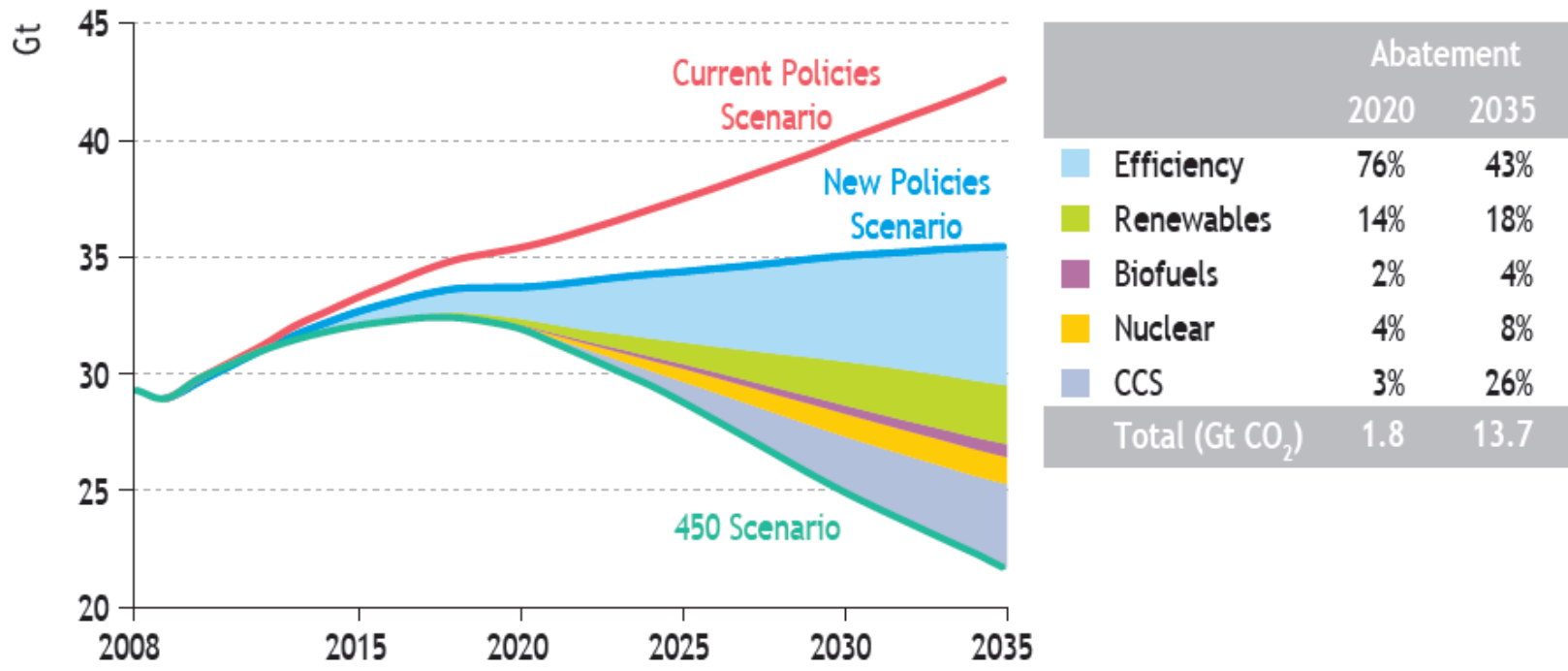
## ➤ **New Policies Scenario**

- Implementation of the policy commitments and plans announced by countries including Copenhagen Accord
- Increase of the world energy demand **1.2% per year** between 2008 and 2035
- Concentration of GHG: **650 ppm**
- Long term temperature rise: **3.5 °C**

## ➤ **450ppm Scenario**

- Long term temperature rise: **2.0°C**
- Increase of the world energy demand **0.7% per year** between 2008 and 2035
- Require far –reaching transformation of the global energy system and **\$13.5 trillion** more than in the New Policies Scenario

**Figure 13.18** • World energy-related CO<sub>2</sub> emission savings by policy measure in the 450 Scenario compared with the New Policies Scenario



Source: World Energy Outlook 2010, IEA

➤ **“In Japan, CCS becomes much more important, accounting for some 75 Mt CO<sub>2</sub>, or nearly a quarter, of abatement in 2035.”**

# G8 Hokkaido Toyako Summit Leaders Declaration

8 July 2008

- **We will establish an international initiative with the support of the IEA to develop roadmaps for innovative technologies and cooperate upon existing and new partnerships, including **carbon capture and storage (CCS)** and advanced energy technologies.**
- **We strongly support the launching of **20 large-scale CCS demonstration projects globally by 2010**, taking into account various national circumstances, with a view to beginning broad deployment of **CCS by 2020**.**



# CCS Projects Status in the World

by IEA/CSLF/GCCSI to the Muskoka 2010 G8 Summit

1. **By April 2010, active collaboration between government and industry has led to:**
  - 80** large-scale integrated projects at various stages
  - 9 operating** large-scale projects and **2** projects under construction
  - Over **US\$26 billion** world-wide in proposed government support for large-scale CCS projects.
2. **All nine operating projects and the two under construction have linkages to the oil and gas sector.**
3. **The Gorgon Project** in Australia has received a green classification for all seven G8 criteria.

## Outline of the Criteria for the large-scale CCS demonstration projects

1. **Large enough** to demonstrate the technical and operational viability
  - 1 Mtpa for coal-fired power station
  - 0.5Mtpa for gas-fired power station, an industrial or natural gas processing
2. **Full integration** of CO<sub>2</sub> capture, transport and storage
3. **Begin full-scale operation before 2020**
4. **Identification of storage site**
  - Identification of primary site with site characterization underway
  - Identification of preferred CO<sub>2</sub> transport route
5. **Providing a monitoring, measurement and verification plan**
6. **Appropriate strategies to engage the public**
7. **Adequate funding** to advance the project operation

- **Enacted in 2003, revised in 2007 and 2010 by Japanese Government**
- **Show the direction of the Japanese energy policy by the government based on the 3E principles, **Energy security, Environment, and Economy****

## Placement of CCS

- **Efficient and stable energy supply consisting with the countermeasures of climate change, and the utilization of non-fossil fuel energies, such as nuclear power and renewable energy, should be promoted. From the viewpoint of supply capability, economy, and convenience, **the utilization of fossil fuel will be still required.** It is necessary to use fossil fuel efficiently and environmentally, therefore, **the development of innovative technologies, such as CCS, is indispensable.****

**Date of Incorporation:**

**May 26, 2008**

**Business Description:**

**A comprehensive investigation for CCS Projects in Japan**

**Capital:**

**243 mm yen (ca. US\$3.0mm)**

**Shareholders:**

**36 companies**

**11 electric power, 4 petroleum, 5 engineering, 4 petroleum resource developing, 4 general trading, 2 iron and steel, 2 city gas, 1 chemical, 1 non-ferrous metal and cement, 1 steel pipe, 1 special trading**

**President:**

**Shoichi Ishii, MD for JAPEX**

**Directors:**

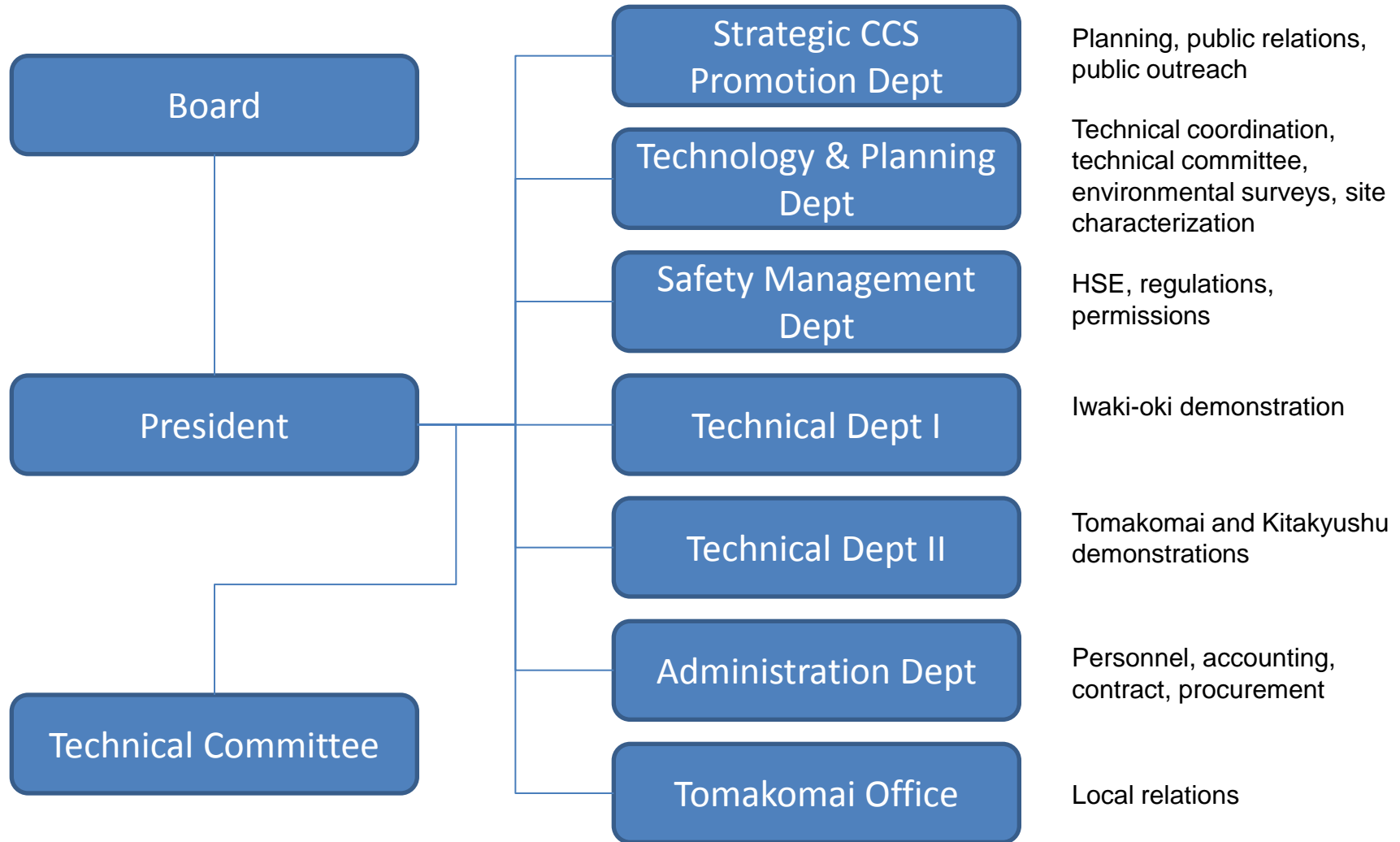
**8 representing the shareholders' industries**

**Auditor:**

**Takashi Honjo, Senior MD for RITE**

**No of Staff:**

**ca. 80**

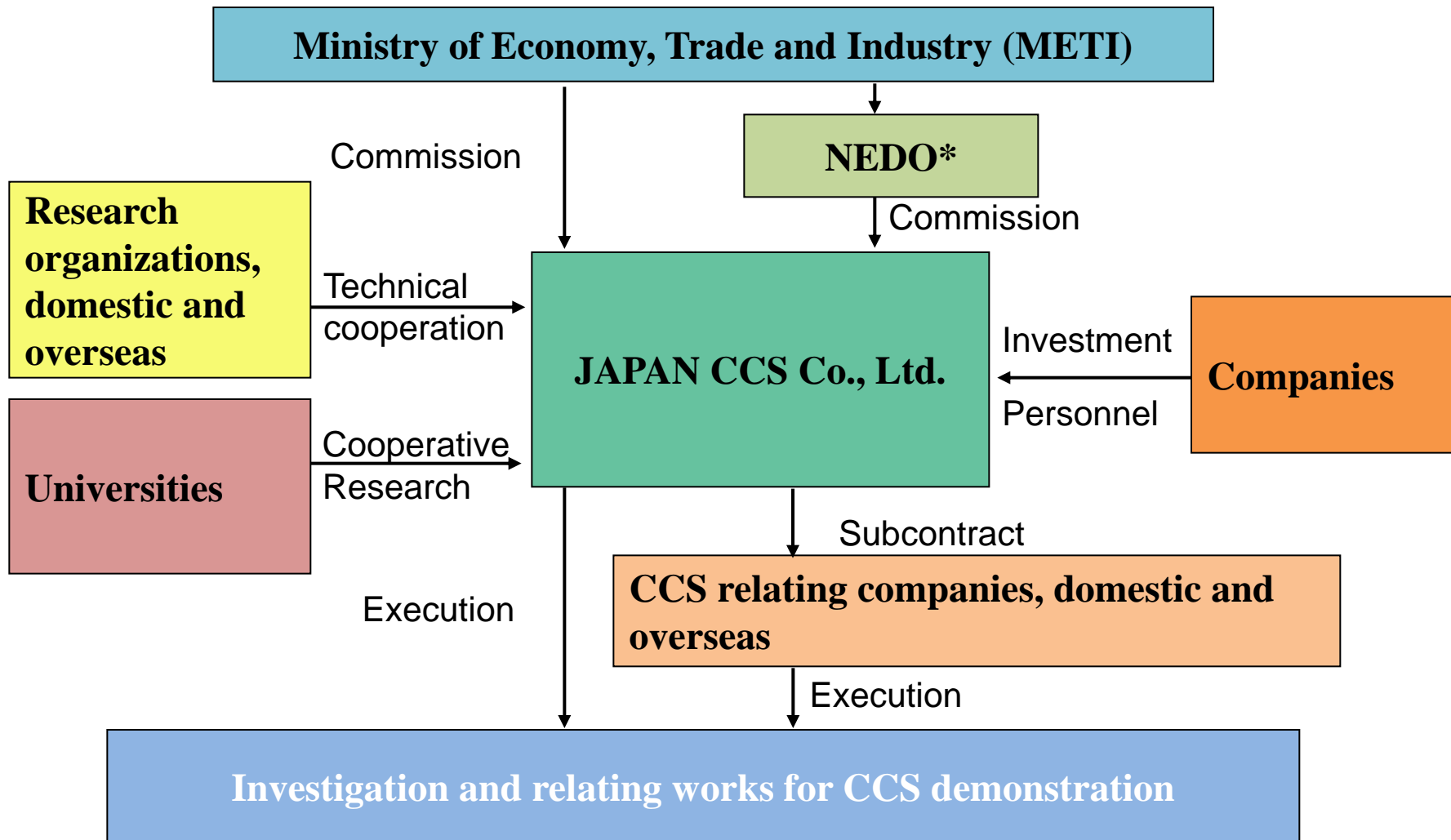


# List of Shareholders

Hokkaido Electric Power Co., Inc.  
 Tohoku Electric Power Co., Inc.  
 The Tokyo Electric Power Co., Inc.  
 Chubu Electric Power Co., Inc.  
 Hokuriku Electric Power Co., Inc.  
 The Kansai Electric Power Co., Inc.  
 The Chugoku Electric Power Co., Inc.  
 Shikoku Electric Power Co., Inc.  
 Kyushu Electric Power Co., Inc.  
 The Okinawa Electric Power Co., Ltd.  
 Electric Power Development Co., Ltd.  
 COSMO OIL CO., LTD.  
 Idemitsu Kosan Co., Ltd.  
 Japan Energy Corporation  
 JX Nippon Oil and Energy Corporation  
 Showa Shell Sekiyu K. K.  
 Chiyoda Corporation  
 JGC Corporation  
 JFE Engineering Corporation

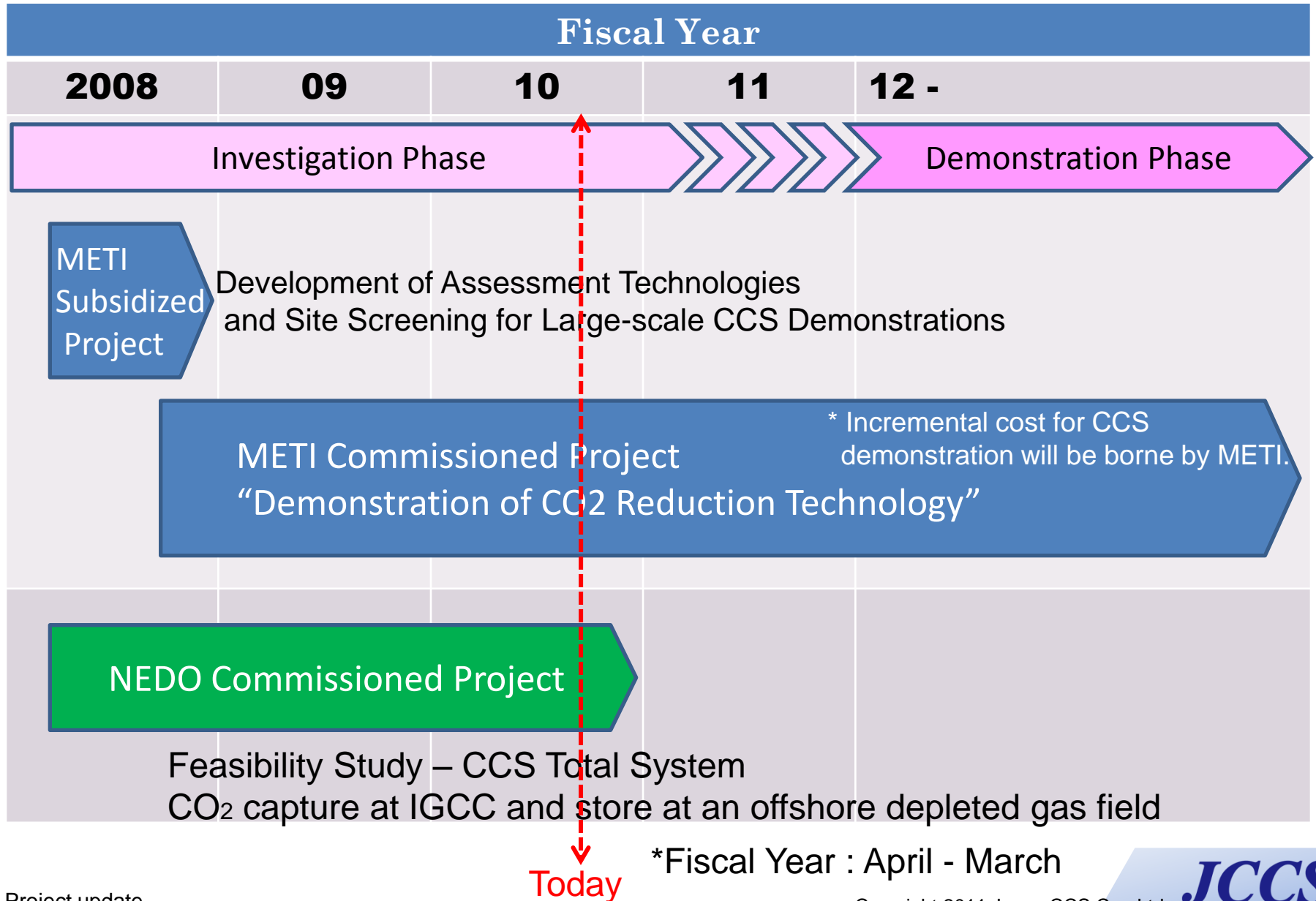
Nippon Steel Engineering Co., Ltd.  
 Toyo Engineering Corporation  
 Arabian Oil Company Ltd.  
 INPEX CORPORATION  
 Japan Petroleum Exploration Co., Ltd.  
 Mitsui Oil Exploration Co., LTD.  
 JFE Steel Corporation  
 Sumitomo Metal Industries, Ltd.  
 Tenaris NKK Tubes  
 ITOCHU Corporation  
 Marubeni Corporation  
 Mitsubishi Corporation  
 Sumitomo Corporation  
 Marubeni-Itochu Steel Inc.  
 Tokyo Gas Co., Ltd.  
 Osaka Gas Co., Ltd.  
 MITSUBISHI GAS CHEMICAL CO., INC.  
 Mitsubishi Materials Corporation

# PROJECT FRAMEWORK - FUNCTIONS OF JCCS -



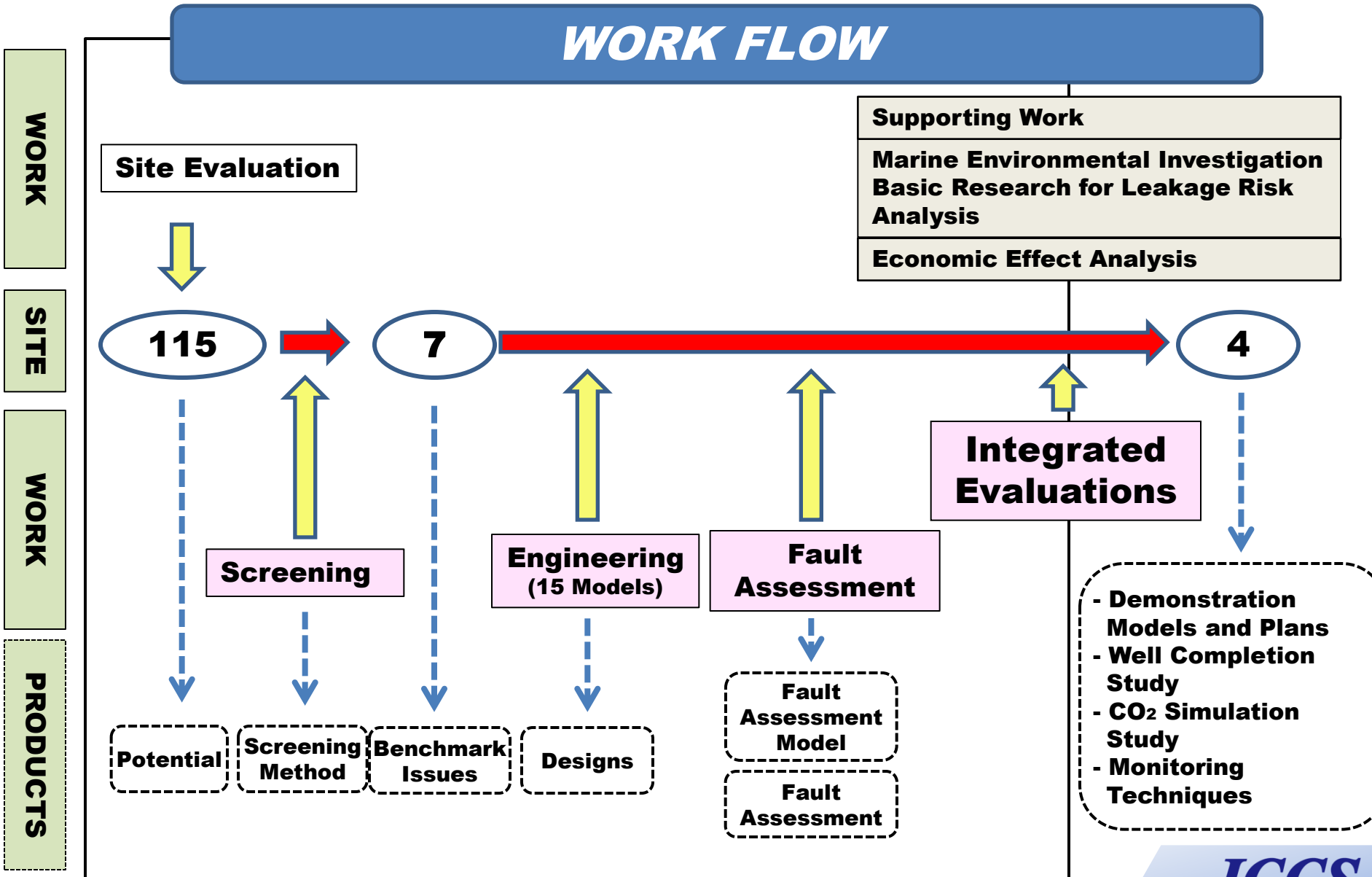
\*New Energy and Industrial Technology Development Organization

# CCS Demonstration Project Phase



\*Fiscal Year : April - March

# METI Subsidized Project in FY 2008





## **Screening Criteria for Demonstration Candidate Site**

- 1. Potential**  
supply and store
- 2. Reservoir Type**  
depleted oil/gas reservoir, Neogene aquifer with closure, Neogene aquifer without closure, Paleogene aquifer without closure
- 3. Existing Data Volume**  
to start injection as early as possible
- 4. Effect to the Environment**  
fault assessment, marine environmental investigation
- 5. Capture Technology**  
to start injection as early as possible
- 6. Scale-up Possibility**  
for future usage
- 7. Variety of Technological Issues**  
to demonstrate as many issues as possible

## METI Subsidized Project in FY 2008

### 15 models of CCS total systems for engineering and reservoir study

Source	Capture	Transport	Injection	Store
<b>IGCC</b>	<b>Physical Absorption</b>	<b>Land Pipeline (gas)</b>	<b>ERD (Extended Reach Drilling) Well</b>	<b>Depleted Gas Field</b>
<b>Coal Pulverized Power Plants</b>				
<b>Oil refineries</b>		<b>Offshore Pipeline (gas)</b>	<b>Directional Drilling Well</b>	<b>Aquifer with Closure</b>
<b>Chemical Plants</b>		<b>Lorry (liquid)</b>	<b>Subsea Completion</b>	<b>Neogene Aquifer without Closure</b>
<b>Gas Field</b>		<b>Ship (liquid)</b>	<b>Platform</b>	<b>Palaeogene Aquifer without Closure</b>
<b>Paper Mill Plant</b>				
<b>Cement Plant</b>				
<b>Ironworks</b>				

# Candidate sites for CCS demonstrations

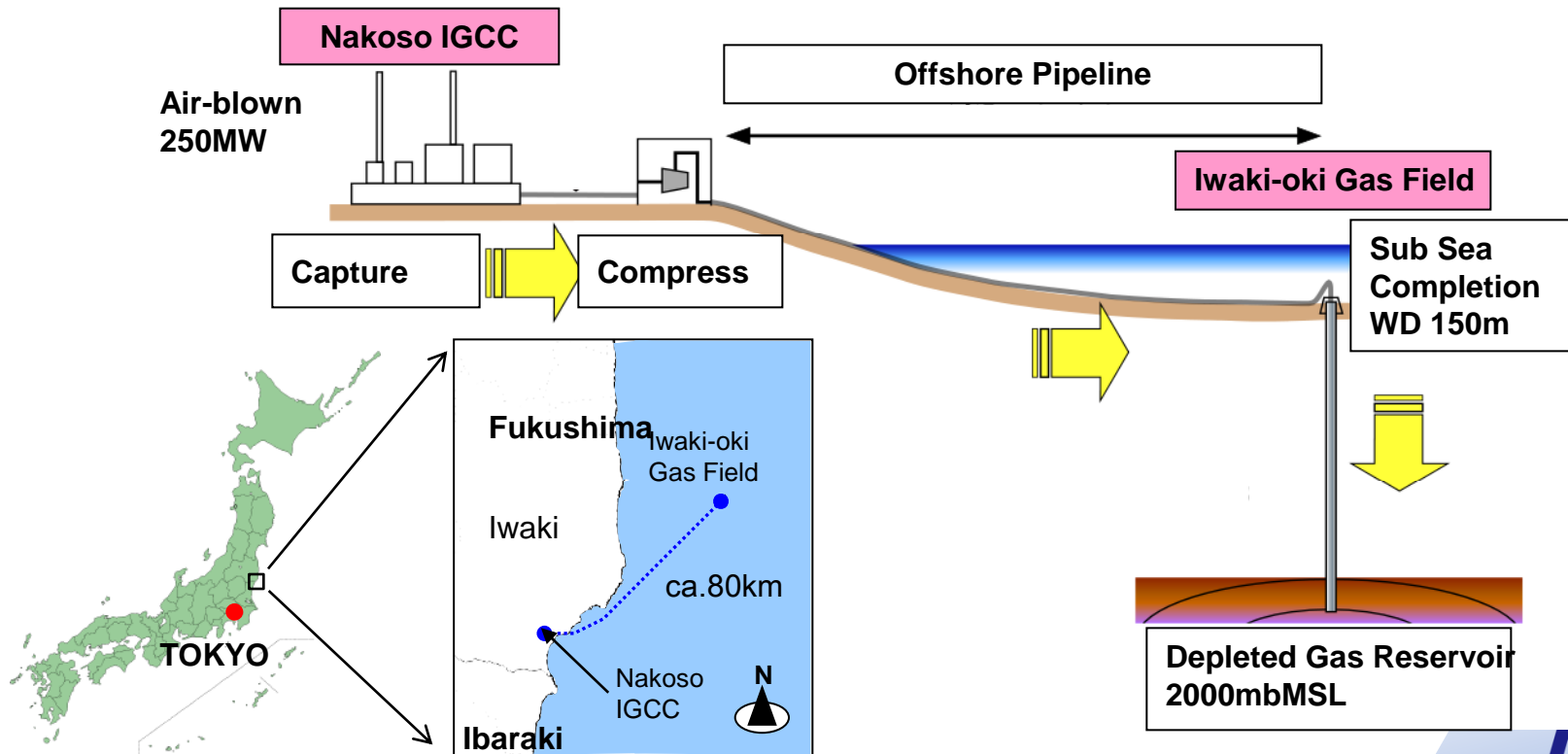
JCCS is conducting surveys and studies on three candidate sites for CCS demonstrations.

Candidate Sites	Reservoir Types	CO <sub>2</sub> Source	Transportation	Current status
<b>Iwaki-oki</b>	Depleted gas reservoir	IGCC	Offshore pipeline	1) Geological modeling and simulation
<b>Tomakomai</b>	Saline aquifer with closure	Plants	Onshore pipeline and lorries	1) Seismic survey 2) Survey well 3) Geological modeling and simulation
	Saline aquifer without closure (Neogene)			
<b>Kitakyushu</b>	Saline aquifer without closure (Palaeogene)	Preliminary survey well		

As of Feb. 2011

# NEDO Commissioned Project

- CO<sub>2</sub> is assumed to be captured at the Nakoso IGCC demonstration plant, transported through pipeline and stored in depleted gas reservoir at the Iwaki-oki Gas Field .
  - IGCC (Integrated coal Gasification Combined Cycle) demonstration plant is owned and being operated by Clean Coal Power R&D Co., Ltd. (CCP).
  - Iwaki-oki gas field was operated by Inpex.
- Term: July 2008 – 2010



# Offshore pipeline route survey at Iwaki-oki candidate site

## Purpose

Acquire basic marine data to select the route of and to design an offshore pipeline from Nakoso to Iwaki-oki depleted gas field

## Area

- 80 km x 400 m

## Items

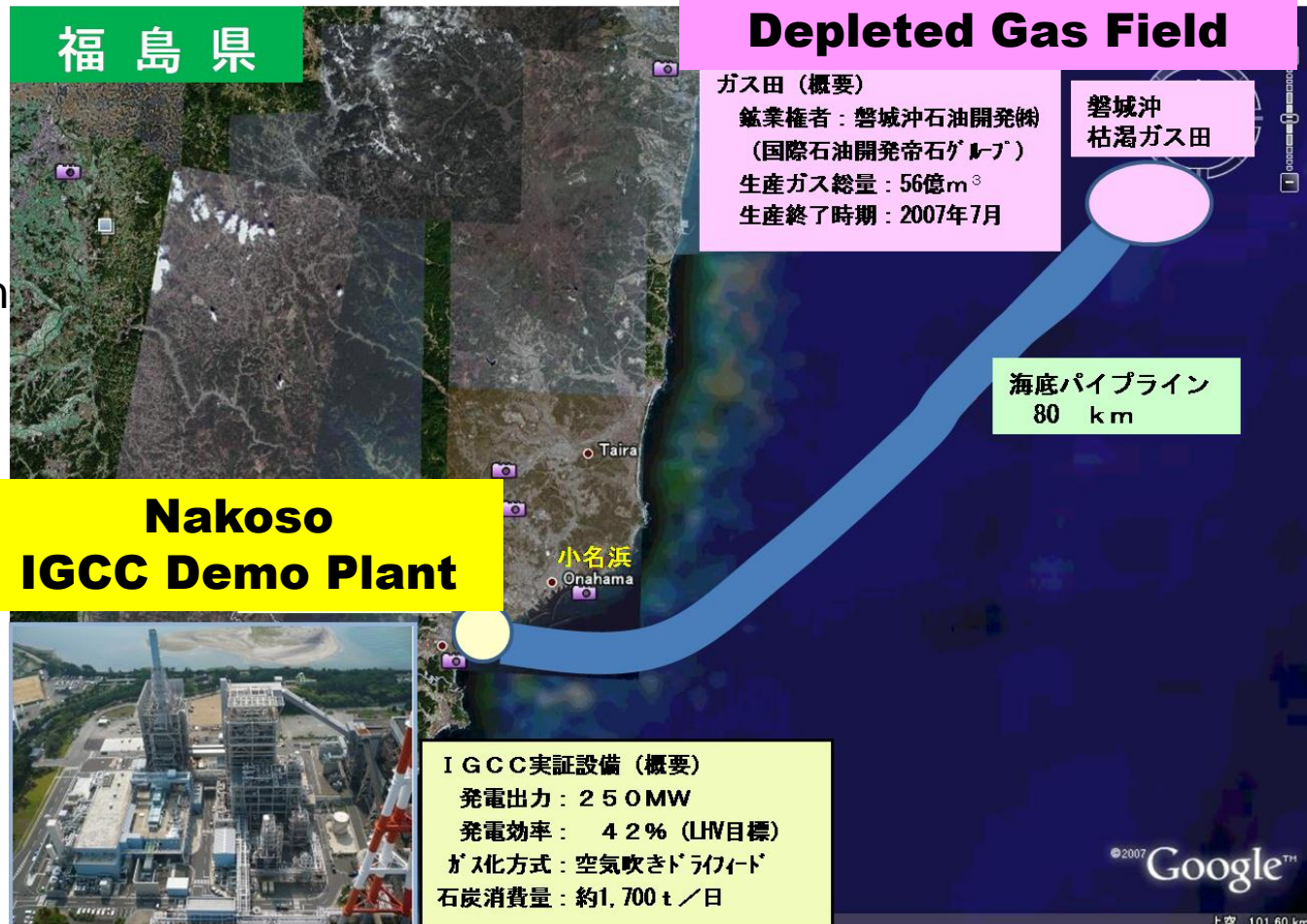
- sea bottom condition
- depth
- sea bed geology

## Term

July – August 2009



2. Project update

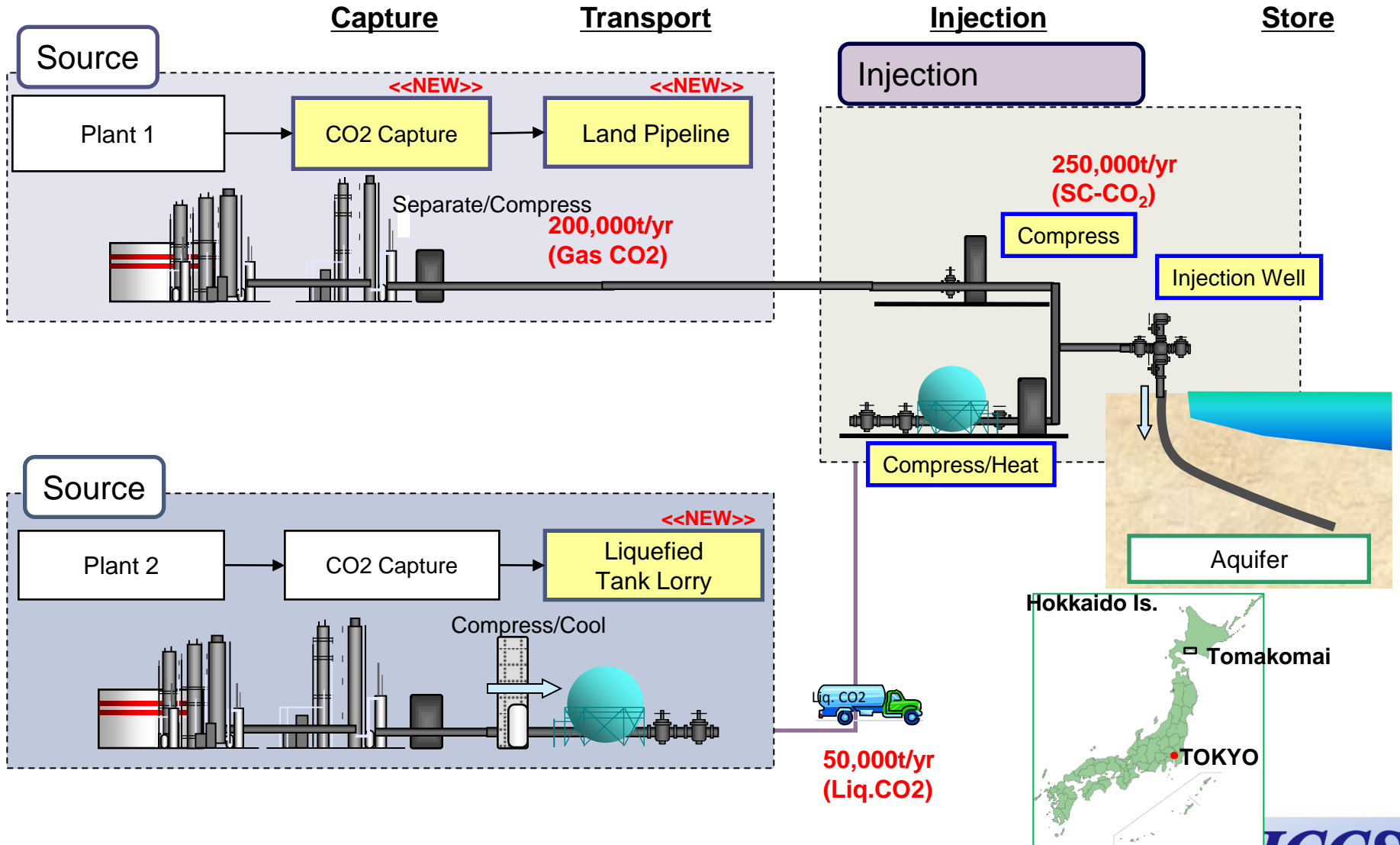


From HP of Clean Coal Power R & D Co., Ltd.  
[http://www.ccpower.co.jp/topics/sekitan\\_02.pdf](http://www.ccpower.co.jp/topics/sekitan_02.pdf)

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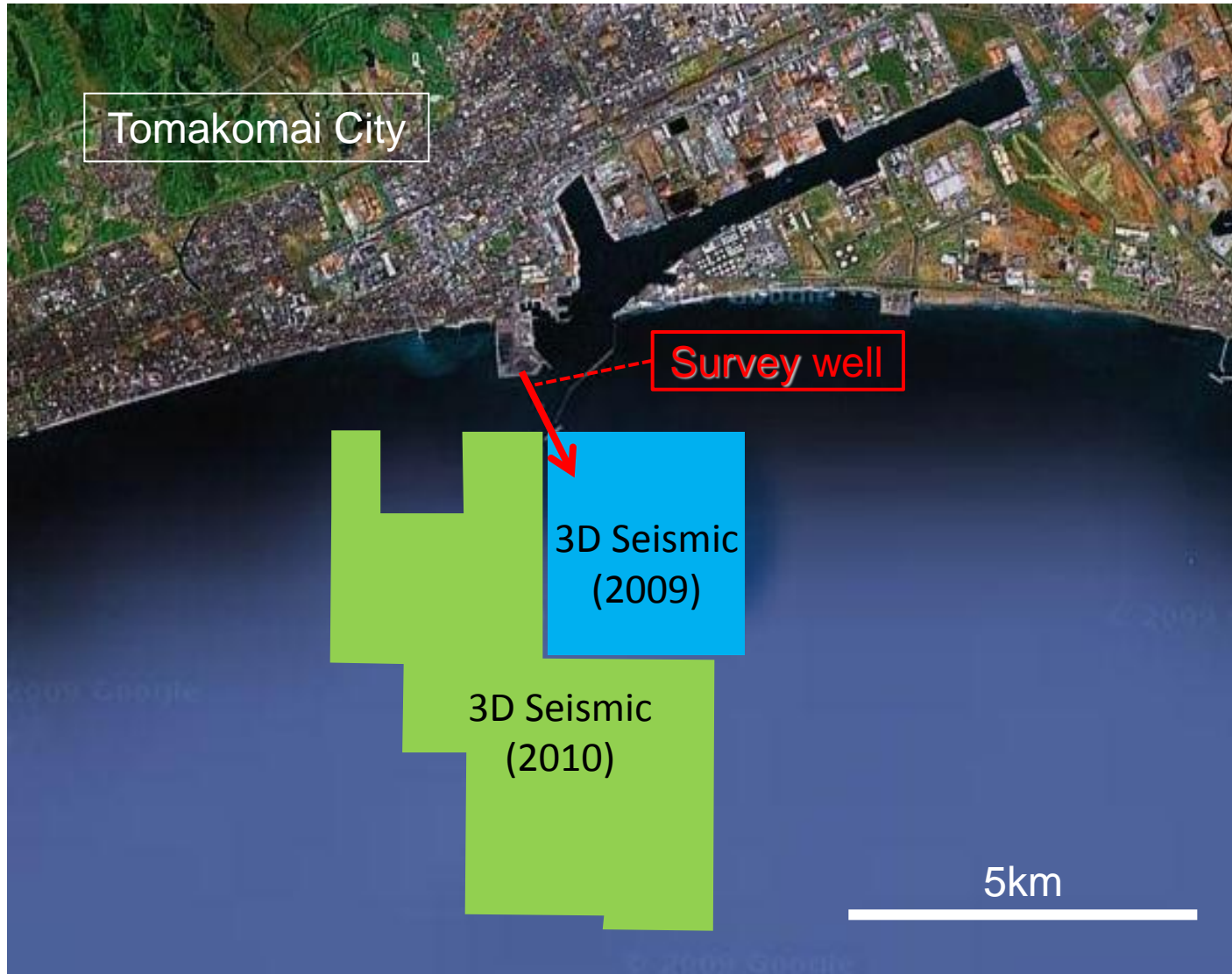
JCCS

# Assumed flow at Tomakomai candidate site

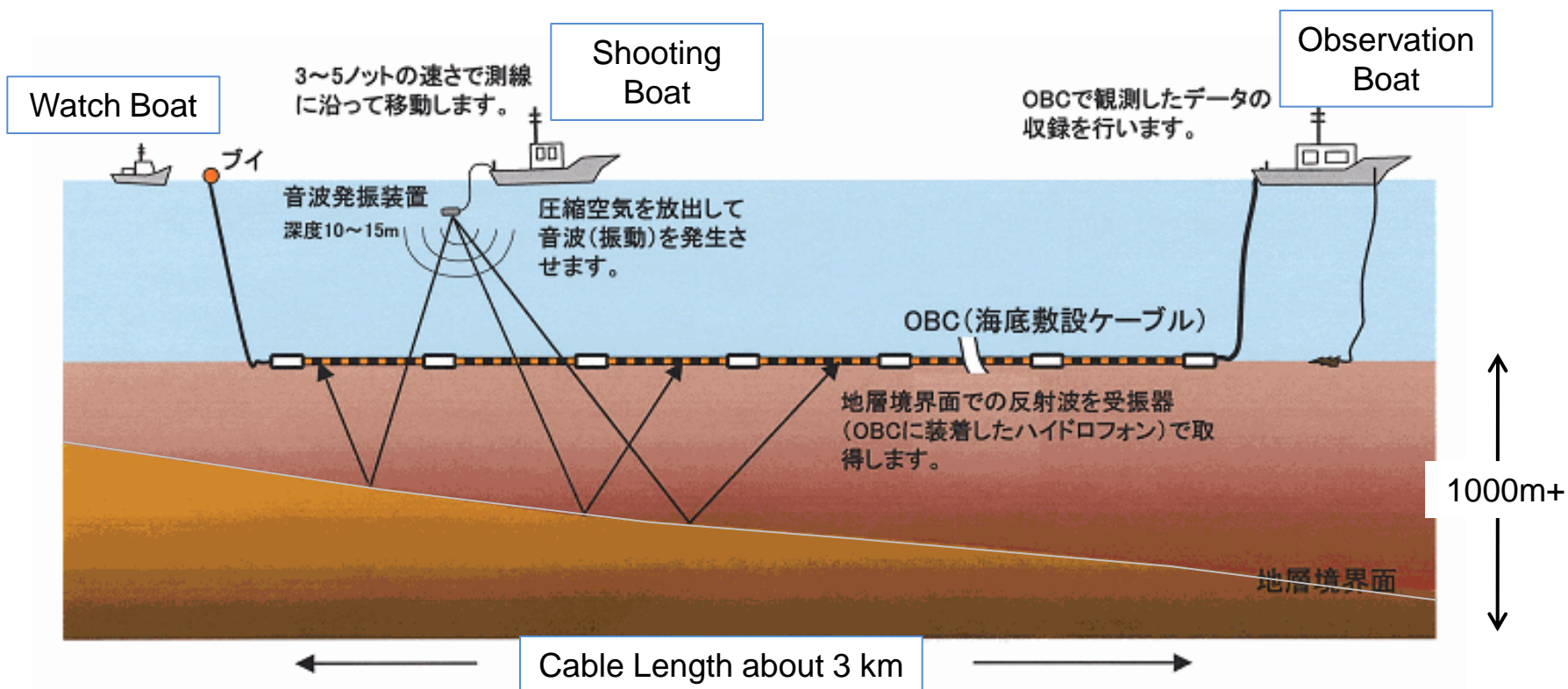


# Field Location Map

## Tomakomai Candidate Site

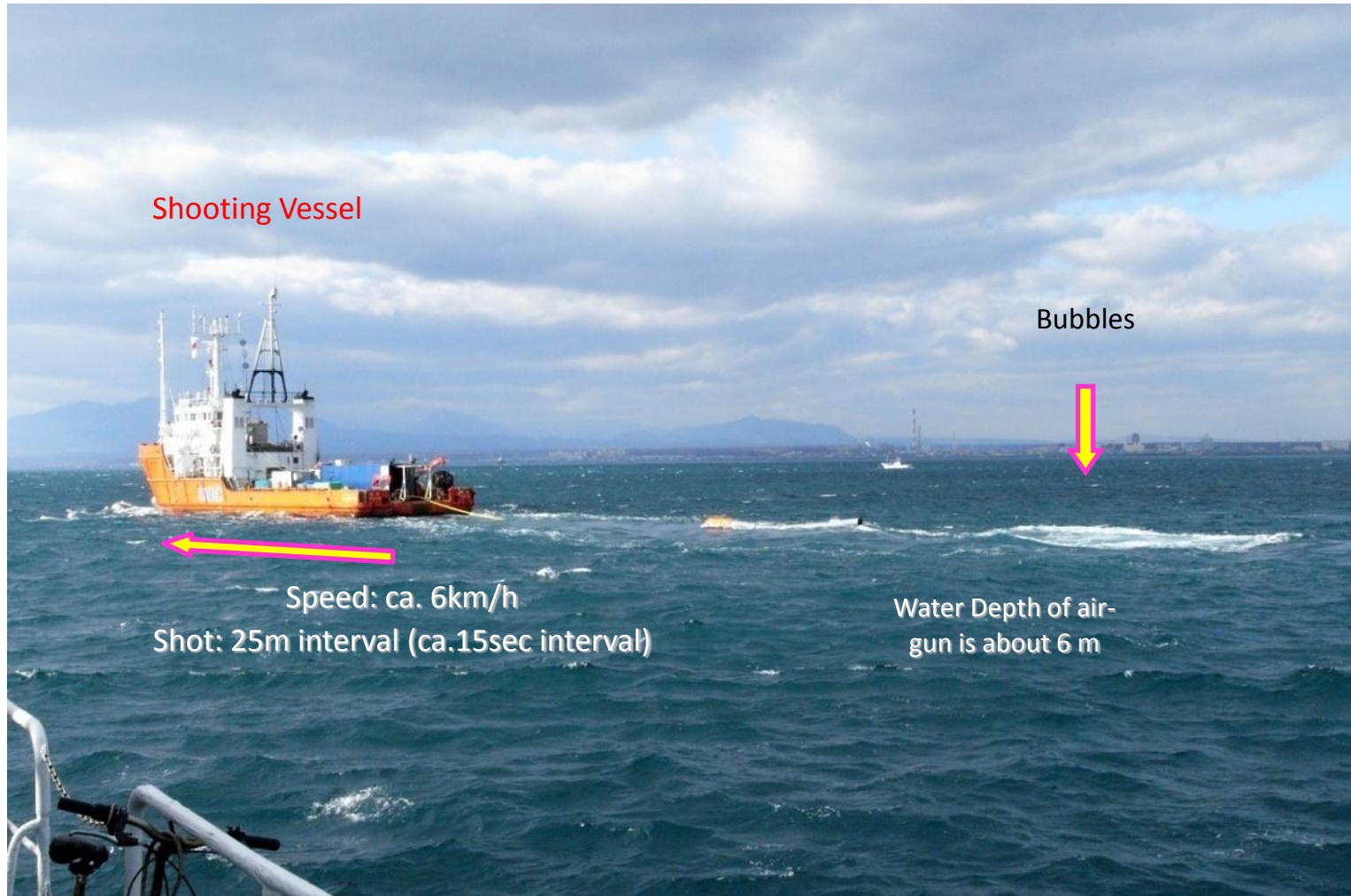


# Shallow Marine 3D Seismic Survey Ocean Bottom Cable System



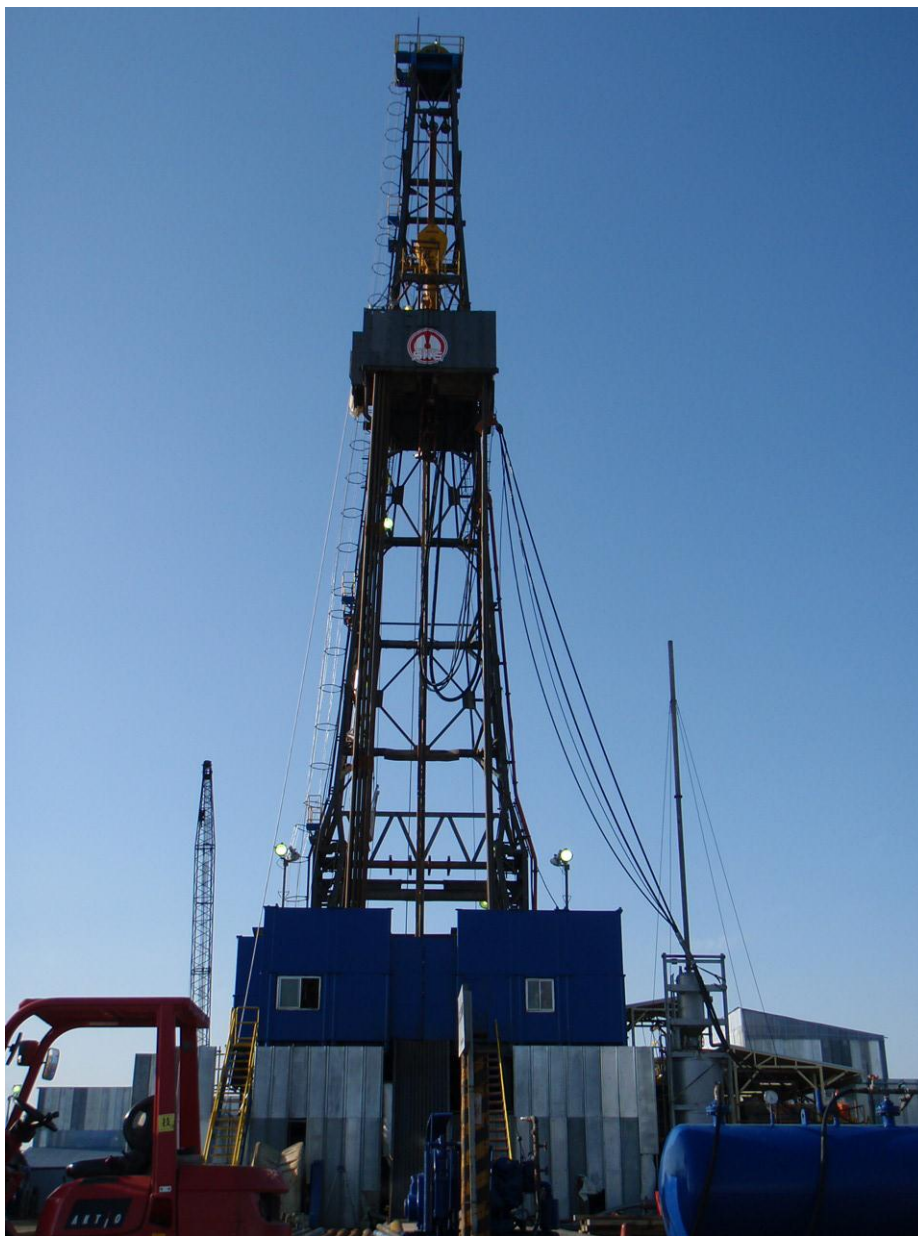


# 3D Seismic Survey in 2009



Shooting on 22 Oct. 2009

# Drilling Rig for Tomakomai Survey Well



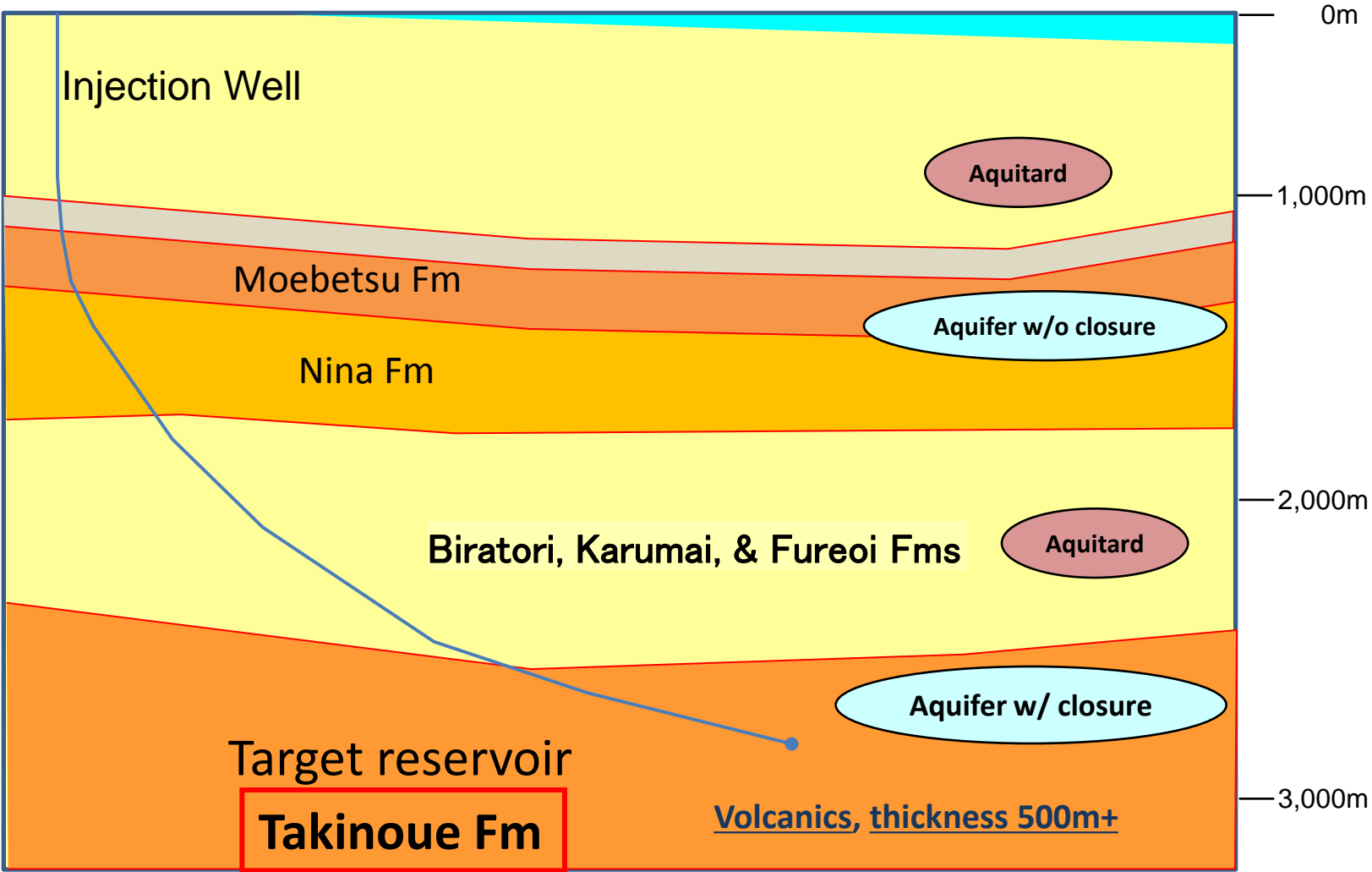
Name: 1320-M  
(owned by SKE)  
Height: 48.8m  
Max. Drilling Depth:  
6100m (vertical well)

\* The land is being rented from the Ministry of Land, Infrastructure, Transportation and Tourism.

# Schematic cross section Tomakomai candidate site

Landward

Seaward



# Boring Survey at Kitakyushu Candidate Site

Objective is to evaluate geological potential of Palaeogene formations at Kitakyushu candidate site



Drilling Rig



Spindle



BOP

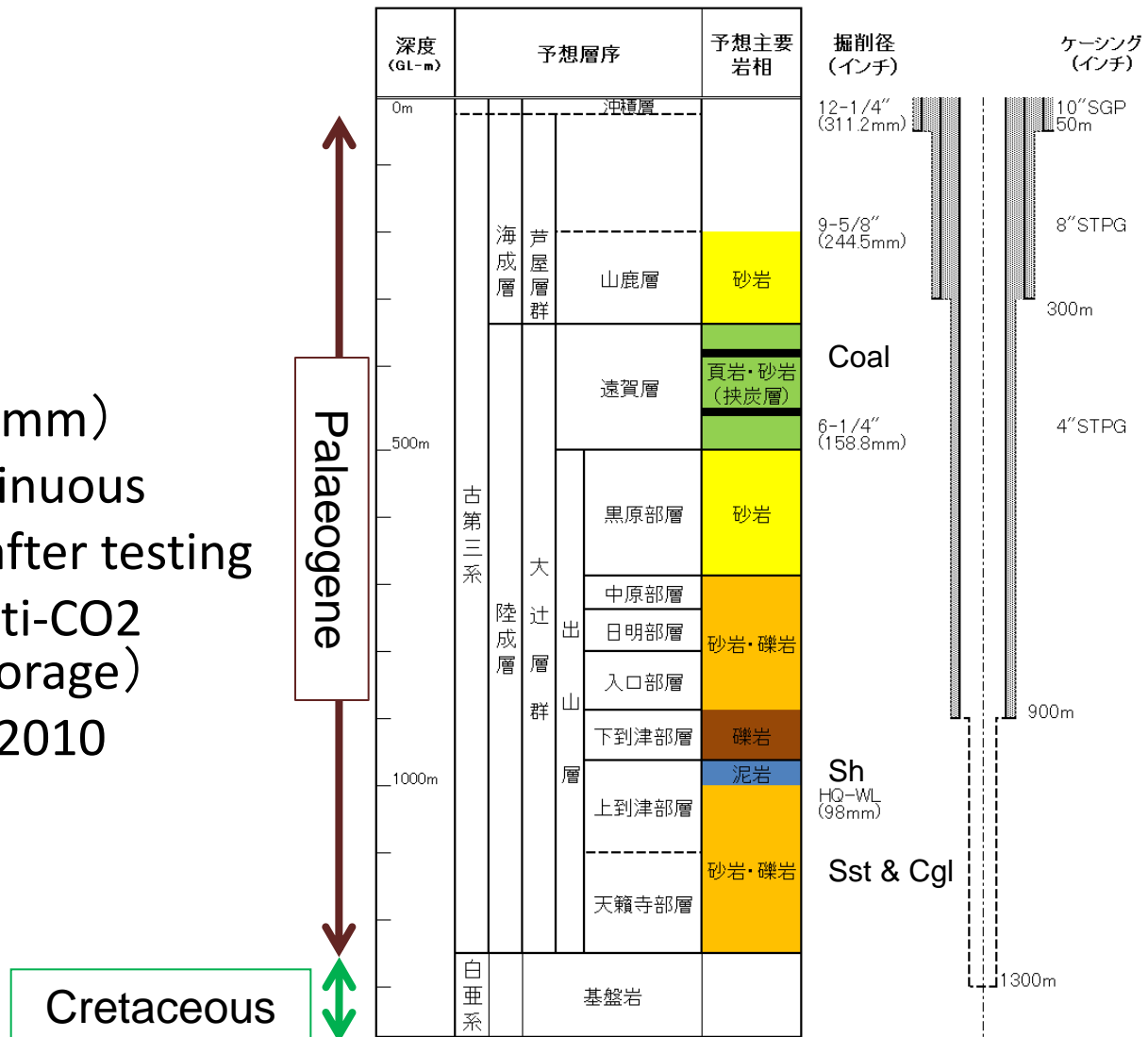


Core and Coring Bit

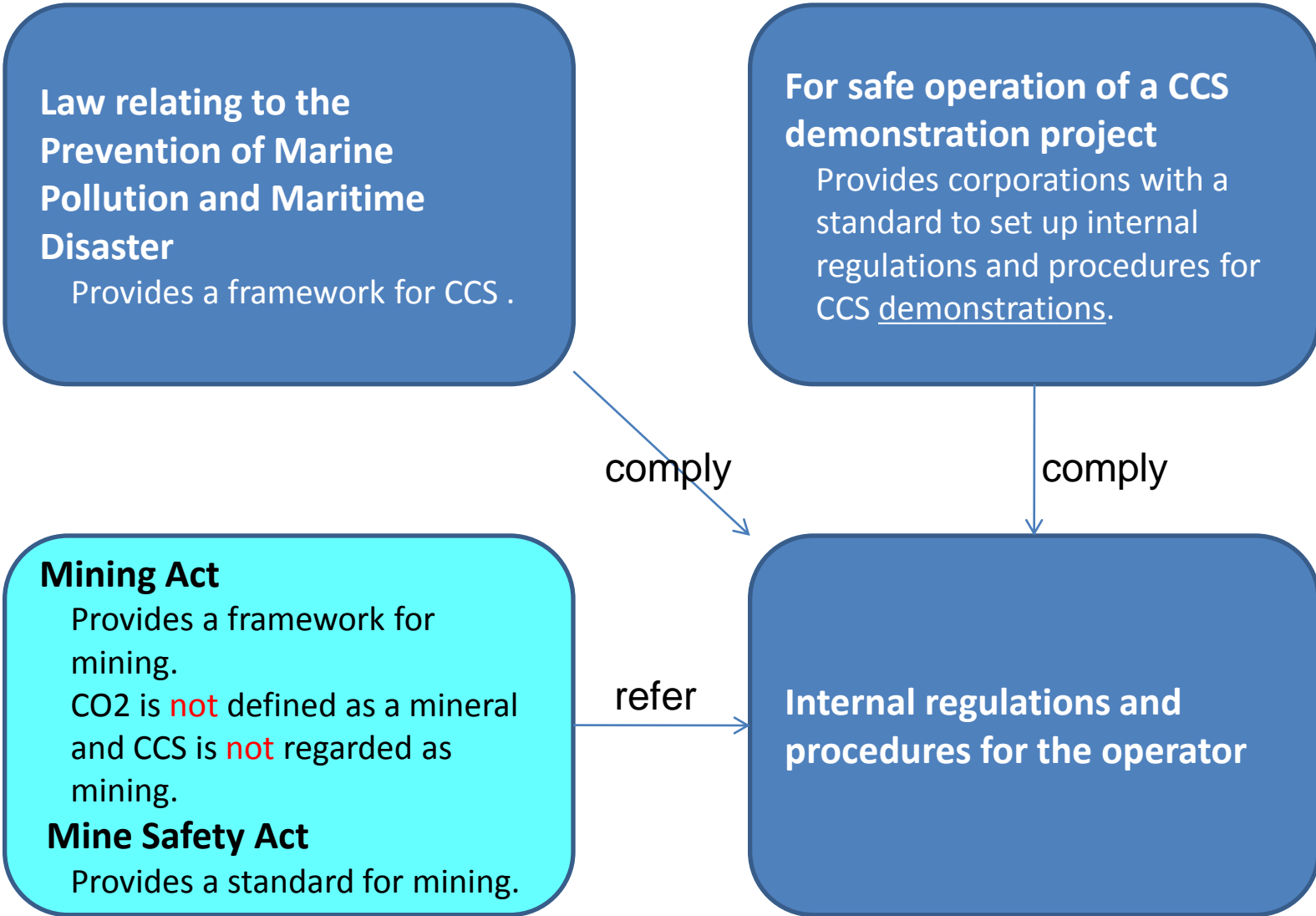
Kitakyushu TOKYO

# Well Specs at Kitakyushu Site

- PTD: 1,300m  
(to see Cretaceous)
- Well Type: Vertical Well
- Drilling System: Spindle
- Final Diameter: HQ (Φ98mm)
- Coring: 300-1300m Continuous
- Completion: To be P&A after testing  
(Bore hole will be anti-CO<sub>2</sub> cemented for future storage)
- Term: June – November 2010



# Laws and Regulations for CCS in Japan - 1



## Law relating to the Prevention of Marine Pollution and Maritime Disaster (amended May, 2007)

Only law to provide a framework for CCS in Japan.

Purpose is to prevent marine environment.

To regulate offshore CCS.

The Minister of the Environment grants a permit for five years.

The following report and plans are required for an application;

- Environment Impact Assessment Report

- Monitoring Plan to confirm no pollution

- Mitigation Plan in the case of seepage

Applicable to demonstration projects.

### Issues

Applicant must apply **every five years** as long as CO<sub>2</sub> stays sub-sea bed and must keep monitoring.

Purity of CO<sub>2</sub> must be more than **99%** (98% from H<sub>2</sub> plants in oil refinery) and be captured by **amine** chemical absorption.

**Seepage scenario** must be made although site was selected where seepage would not occur.

No law for onshore CCS.

## For safe operation of a CCS demonstration project

(operational guidelines set forth by METI in August, 2009)

1. Things to be assessed for CO2 storage from geological aspects
2. Transportation Standard
3. Safety consideration for placing CCS-related facilities
4. Environmental Impact Assessment (EIA)
5. Safety consideration for the drilling, completion and P&A (plugging and abandonment) for CO2 injection and storage wells
6. Safety considerations for CO2 injection and operation
7. Concentration standard of CO2 to be injected
8. Monitoring
9. Measures to be taken when abnormalities occur



To enter Demonstration Phase (may not be permits)

- Completion of site characterization and assessment

- Completion of demonstration planning

- Consent by stakeholders in the area

To start construction

- Permit from the various authorities to construct plants, facilities, pipelines and to drill well by the various applicable laws and regulations

  - e.g.) High Pressure Gas Safety Law, Industrial Health and Safety Law, etc.*

To start injection of CO<sub>2</sub>

- Permit from the Minister of the Environment by the Law relating to the Prevention of Marine Pollution and Maritime Disaster

- an example -

Tomakomai City has two ports and one air port. There are Japan's largest paper industry, and large industrial complex including oil refineries, coal-fired power plants, and auto-assembly plants.

<i>Location:</i>	South-Western Hokkaido (ca. 800km N of Tokyo)		
<i>Area:</i>	561 Km <sup>2</sup>		
<i>Population:</i>	174,069		(2010)
<i>Climate (Temp):</i>	Average	11.9 deg C	(2008)
	Lowest	-13.8 deg C	(2008)
	Highest	28.0 deg C	(2008)
<i>Economy:</i>	Manufacturing	1,169 billion yen	
		(US\$14B)	(2008)
	Agriculture	1.6 billion yen	(2008)
	Fishery	2.7 billion yen	(2008)
<i>CO<sub>2</sub> Emission:</i>		2.8 million t/y	(2007)

# Stakeholders in TOMAKOMAI Area

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- Government of Hokkaido
  - Hokkaido Legislative Assembly
  - Municipality (Tomakomai City )
  - Fisheries union
  - Politicians
  - Tomakomai Chamber of Commerce
  - Tomakomai CCS Promotion Association (\*)
  - Local residents close to the work site
  - Port management
  - Ferry companies
  - Local media
  - NPOs (to be involved at a start-up of a demonstration project)
- (\*) CCS Promotion Association was established in Apr/2010 by Tomakomai City . Members are Tomakomai City, Tomakomai Fishery Union, Tomakomai Chamber of Committee, local industries, NPO's and representatives from academia.

## *Surveys:*

- Oct. 2009/ 3D seismic survey in narrow area
- Jul.- Sep. 2010/ 3D seismic survey in additional area
- Nov. 2010 – Feb. 2011/ survey well

## *Public outreach:*

- 2009/ Frequent meetings with local fisheries union.
- 2010/ Frequent invitations to stakeholders to the work sites (3D seismic survey, a survey well), and meetings with the local residents.
- CCS surveys in the region are well received by stakeholders (local government, municipality, fisheries union, etc.).
- Municipality's desire to leverage CCS for industrial and subsequent economic growth in the region.

- CCS is expected to play an important role to reduce CO<sub>2</sub> emissions. The government and industries are working in concert to launch a large-scale CCS demonstration project in Japan.
- Site screening and engineering studies were carried out for CCS demonstrations in FY 2008, and field surveys have been conducted in FY 2009 and 2010.
- One law provides a framework for CCS and one standard provides general guidelines for CCS demonstration.
- Careful and earnest communication led us reliable relationship with stakeholders for field surveys.

***Terima kasih!***  
***Thank you for your attention.***

**Let's save the Earth!**

Any comment and inquiry to  
[masanori.abe@japanccs.com](mailto:masanori.abe@japanccs.com)