Progress Report on Japan's CO$_2$ Geological Storage Technology

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Outline of Today’s presentation

- Reduction targets and Development schedule
- Some topics on R&D programs
Japan’s total greenhouse gas emission and reduction targets

Reduction targets
(20Fy -3.8%  30Fy -25%  50Fy -80%)

*Base period is 2005 Fy

Policy
Carbon Tax
16Fy  2.3B USD
Used for an energy-saving measure and renewable energy subsidies

Reduction Targets
Tentative schedule for CO$_2$ Geol. Storage Demo. Project in Japan

Governmental Initiative

2008

2010

2012

2014

2016

2020

Industrial Initiative

Pilot Demo. Plant
Nagaoka Project
by RITE

10,000 t
20-40 t/day

Large-scale Demonstration Plant Project by JAPAN CCS

100,000 t/year

Co.
Site selection

Well drilling Preparation

Injection

Commercial Plant

>1Mt
FY2016～
10,000ton/year CO₂ injection
2 injection wells into 2 reservoirs
(c. 1,000m and
c. 3,000m below sea bottom)

Layout of the CCS facilities and monitoring network
(JCCS, 2015)
Demonstration project
Implementation system

Project operator
(JCCS)

Supporting technology
(RITE /Oil co. ....)

Basic technology
(GSJ-AIST/RITE...)

Research Association
2016~
Site selection for future project

METI (Promotion)
MOE (Regulation)

2014
15
Re-Analysis of ex. Data
8
• 2D seismic survey

2016
5
• 3D seismic survey

2018
3
• Exploration well logging

2021
1

METI
Tomakomai Demonstration Proj.

MOE
Economically feasible capture technology for coal power plant
Mikawa Coal power plant:
CO2 are captured from exhaust gas

Off-shore Storage (FS)
Outline on Today’s presentation

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RITE: Optical Fiber Borehole Strain Gauge

New method can measure strain along well continuously

Field test in a deep borehole

Physical parameters (strain, temp., pressure) affect frequency shift of Scattering light but their effects can be separated by measuring both Brillouin scattering and Rayleigh scattering.
RITE:
Micro seismic management system

- Micro seismic observation system
  - OBC: 3 km
  - OBS: 4 sets
  - Observation well: 3 wells (2 vertical array, 1 bottom hole seismometer)
  - Surface seismometer: 1 set

Traffic light system
Monitoring stress state based on Micro-seismic observation and when seismic activity exceed the predetermined threshold level, the system raise an alarm operator To decrease injection rate or to stop injection
【Methods & Objectives】

- To provide proper geomechanic modeling method (to suitable numerical model)
- Modify THM simulator suitable for soft rock site
- Calibrate the modeling parameters from laboratory experiments and apply natural analog case study of Matsushiro earthquake swarm
Geomechanic modeling (Matsushiro-model)

Matsushiro Earthquake (1965~1967)
- Seismic swarm
- Water outflow
- Ground uplift
- Reactivated fault

Fluid (CO$_2$) from Magma

CO$_2$ injection model
- Ground deformation
- Strain ($\Delta \varepsilon$)
- Reservoir pressure ($\Delta P$)
- Effective stress ($\Delta \sigma$)

Risk of CO$_2$ leakage?
Permeability Changes in Fault/fracture

Max event M5.5
Total events 0.7 million

Total waterflow was $10^7$ m$^3$

Total waterflow was $10^7$ m$^3$
(4) Geomechanic modeling (cont.)

Simulation considering geomechanics

Collection of geomechanical parameters

Deformation-Permeability characterization for soft rocks

Evolution of Permeability during Fracturing Processes in Rocks under Conditions of Geological Storage of CO2
Thank you for your attention