Offshore CO$_2$ Storage in Korea: Progress, Future Plans and Needs

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### Functions of Ministries and R&Ds in CCS

- **Four ministries involved in CCS (including R&Ds)**

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<tr>
<th>Ministry</th>
<th>Description</th>
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<tr>
<td>Ministry of Trade, Industry and Energy</td>
<td><strong>CO₂ capture and transportation/storage (land)</strong>&lt;br&gt;CO₂ capture Tech. Project (2011): 0.1 Mt CO₂ capture (2014, completion); 1 Mt CO₂ capture (2017/18)</td>
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<tr>
<td>Ministry of Oceans &amp; Fisheries</td>
<td><strong>Offshore CO₂ storage, transportation &amp; environmental management</strong>&lt;br&gt;R&amp;D Project for preparing offshore CO₂ storage, transportation &amp; environment management (2010-2016)</td>
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<td>Ministry of Environment</td>
<td><strong>Environmental management (land)</strong>&lt;br&gt;CO₂ Environmental Management Project (2014)</td>
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Difficult to store large amount of CO₂ in land because of bad geological conditions, high population density and less public acceptance.
Major coal-used power plants in the western and southern coastal area of Korea

0.1 Mt CO₂ capture facilities at Boryoung (wet-style) and Hadong (dry-style) power plants (2014)

1 Mt CO₂ capture (wet-style?) demonstration project (from 2018)

- One (Boryoung or Hadong?) of major coal-used power plants
- Funding: Korean Government (major) with some industrial companies (minor)
• Prepare for core technologies to transport and store CO$_2$ captured from large-scale (1 Mt/year) sources (coal-used power plants) into the subsurface geological formations

• Budget : about US$40M
Framework of R&D Project

Project Management, Policy & Regulation

Offshore geologic storage of 1Mt CO₂

Site Selection & Characterization

Transport: Design & Safety Analysis

Subsurface CO₂ Monitoring & Modeling

Marine Environmental Risk Assessment & Management

Task 1

Task 2

Task 3

Task 4

Task 5

KRISO

KNOCS

KIOST
• SE continental shelf of Korea based on the regional-scale studies for potential CO₂ storage sites using previous oil/gas exploration data by KNOC

• 9 prospects (oil & gas targets in previous exploration stages) for CO₂ storage

• 2 prospects (depleted gas fields): Priority sites for large-scale (1 Mt/year) CO₂ storage demonstration project for ca. 20-30 years
Status of Offshore Geologic Storage Assessment

- Monitoring strategy in subsurface and sea-water column for large-scale (1 Mt CO₂) storage demonstration project: nearly set up
- Risk assessment for large-scale (1 Mt CO₂) storage demonstration project: less in the subsurface, more in sea-water column
• Major coal-used power plants for large-scale CO₂ source in the western and southern coastal areas: long distance to promising storage sites

• Less public acceptance about CO₂ transportation/storage in land

• Onshore pipeline transportation: expensive cost and less public acceptance

• Ship transportation from CO₂ sources to Hub terminal

• Offshore pipeline transportation from Hub terminal to storage sites
Status of Transportation Assessment

- PreFEED Package (transportation) for Offshore CO$_2$ (1 Mt/year) Storage

Contents (Draft)
- Ch1. Executive summary
- Ch2. Project design
  - 2.1 Integrated project design basis
  - 2.2 Value chain interface design
  - 2.3 Base and alternative scenarios
- Ch3. Technical design
  - 3.1 Technical analysis/design of Carrier
  - 3.2 Technical analysis/design of Hub storage
  - 3.3 Technical analysis/design of Offshore pipeline
  - 3.4 Technical analysis/design of Platform
- Ch4. Engineering document
  - 4.1 Process Flow Diagram (PFD)
  - 4.2 Heat and Mass Balances (HMB)
  - 4.3 Piping and Instrumentation Diagrams (P&ID)
  - 4.4 Layout (Plot Plan)
  - 4.5 Major Equipment List and Specification
  - 4.6 Process data sheet
  - 4.7 Subsurface Engineering Report
National Policy and Status of Large-Scale CCS Projects

- Increase in CO$_2$ emission rate because of Korean economic system dependent on export-industry structure
- CCS: one of the national strategies to reduce CO$_2$ → National plan in 2015: ca. 8 million Mt CO$_2$ reduction by CCS until 2030

CO$_2$ emission (IEA, 2014)
• Korean Government examines all aspects (cost, value, etc.) of CO₂ reduction projects including large-scale CCS projects in 2016

• Korean Government will decide whether large-scale CCS will be started or stopped in 2017

• Make a plan for large-scale CCS projects in 2017–2018

• Try to conduct large-scale offshore CO₂ storage demonstration projects (1 Mt/year) as soon as possible (from 2018)

• Draft of regulation for (large-scale) CCS: prepared by MOF, ME and MTIE since 2015
Public Knowledge and Acceptance

• Reduction of CO₂ (emission): very important issue in Koreans because of rapid climate change and environmental issues (e.g., yellow dust, fine dust, etc.)

• About 60%–70% of Koreans were willing to pay for CO₂ reduction

• Large-scale CCS: public project

• Less public acceptance for onshore large-scale CO₂ storage & transportation, but better public acceptance for offshore large-scale CO₂ storage & transportation in Korea
Other Important National Conditions and Needs

- Pilot-scale (10,000 tons/year) CO$_2$ injection and storage in land: start December 2016.
- Major power-plant (e.g., KEPCO) and oil/gas companies (e.g., KNOC & KOGAS) in Korea: mostly funded by Korean Government.
- Large-scale CCS projects in Korea: mostly funded by Korean Government; can be highly dependent on the policy of Korean Government, especially in the area of CO$_2$ storage.
- Less experience, less data and small-sized research team for offshore large-scale CO$_2$ storage and subsurface risk assessment (or evaluation) in major oil/gas companies, research institutes, universities in Korea: need collaboration with foreign community (major oil/gas companies, research institutes, university, etc.).
Thank you very much.