Carbon Capture & Storage in Korea

March 25, 2014

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Korea Carbon Capture and Storage Association (KCCSA)
South Korea: 8th Most GHG Emitting Country (2009)

Emission Reduction Target:
BAU 30% Reduction of CO2 Emission by 2020 (Nov. 2009)

2009.11 Cabinet Meeting:
(BAU 30% Reduction)
MOTIE’s The 6th Electricity Supply and Demand Program (Feb. 2013)

- 2012: 81,806 MW (60.6% Fossil fuels)
  - Nuclear: 2,768 MW (3.4%)
  - Coal: 4,700 MW (5.7%)
  - Anthracite: 4,888 MW (6.0%)
  - LNG: 20,116 MW (24.6%)
  - Oil: 23,409 MW (28.6%)
  - Renewables: 1,125 MW (1.4%)
  - H&P: 1,249 MW (0.8%)

- 2027: 158,502 MW (49.6% Fossil fuels)
  - Nuclear: 4,700 MW (3.0%)
  - Coal: 32,014 MW (20.2%)
  - Anthracite: 7,434 MW (4.7%)
  - LNG: 31,794 MW (20.1%)
  - Oil: 44,669 MW (28.2%)
  - Renewables: 7,25 MW (0.5%)
  - H&P: 1,249 MW (0.8%)
Major Carbon Gas Emission Sources in Korea

Cement
40 million tons/yr

Power Plants
KEPCO 158 million tons/yr

Iron & Steelmaking
POSCO Kwangyang
3.2 million tons/yr

Petrochemical
40 million tons/yr
## Korean National Roadmap for CCS (2009)

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### Policy Direction

**Capture Ready based on continuous monitoring of global GHG regulations**
Demo Sites of CO₂ Capture Plants

- **Taean:** IGCC + CCS, Solid Sorbent
  - (‘18, 1-10 MW)
  - (‘18~, 300 MW)

- **Boryeong:** Adv. Amine
  - (‘10, 0.1 MW) (‘14, 10 MW)
  - (‘18, 500 MW)

- **Hadong:** Solid Sorbent
  - (‘11, 0.5 MW) (‘14, 10 MW)

- **Youngdong:** Oxy-Fuel
  - (‘15, 100 MW)

- **Samcheok:** Solid Sorbent
  - (‘18, 300 MW)
Ongoing CCS Projects in Korea

- **Advanced Amine Solvent : KoSol (Korea Solvent)**
  - 0.1MW Test Bed Constructed (2010. 12) → 10MW Pilot Plant (2014)
  - 100~300MW Demonstration Plant (2018)
Ongoing CCS Projects in Korea

**Dry Re-generable Solvent**

- 0.5MW Test Bed Constructed (2010. 3)
- → 10MW Pilot Plant (2014)
- → 100~300MW Demonstration Plant (2018)

- 2005
  - Improvement of CO₂ removal % (above 65%)
- 2006
  - Improvement of regeneration
    *Removal > 80%.*
    *Regeneration > 90%*
- 2007
  - Basic Process Design for 2000Nm3/h
- 2010.3
  - 0.5MW Demonstration

100 Nm3/h 50h Continuous process
CO₂ Removal : 30~60%

2000 Nm3/h 50h Continuous process
CO₂ Removal : 70~85%

KCCSA
Potential CO₂ Storage Sites in Korea

**Underground Storage**
(1.8 billion ton estimated)

- Kyoungsang Basin
  - 680 million ton
  - Priority Rank 1
- Taebaek Basin
  - 180 million ton
  - Priority Rank 2
- 3: Chungnam Basin
- 4: Moonkyung Basin
- 5: Honam Basin
  - Priority Rank 3

**Undersea Storage**
(Expected to have great storage potential)

- Ulleung Basin
  - (Dolgorae Gas field)
  - Priority Rank 1
- Pohang Basin
  - Priority Rank 2
- C: Chuju Basin
- D: Haenam Basin
- E: Kyukpo Basin
- F: Koonsan Basin
  - Priority Rank 3

*Junmo Kim, Seoul National Univ.*
### Industrial Applications of CCS in Korea

#### CO2 capture in Steel industry (POSCO)

[27 million(USD), 2009~2014]

- Capture CO2 from blast furnace using ammonia liquid (10 ton/day, 0.5MW equiv)
- Purification/liquefaction process integrated with capture facility
- Production of liquid CO2 using the capture facility (3 ton/day)

#### CO2 conversion using microalgae (Korea District Heating Co.)

[11 million(USD), 2012~2017]

- CO2 fixation through microalgae photosynthesis
- Conversion of CO2 into high value-added products (astaxanthin)
- Developing photo-culture process (1 ton)

#### Green Polymer (SK)

- Convert CO2 into polymerized compound and produce plastic
- Aims for commercialization in 2014

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As alternatives for storage,
National CCS Master Plan  
(July 2010)

Goal and Roles (KCCSA)

Korea CCS Association (KCCSA)

KCCSA  
Ministry of Knowledge Economy

Presidential Committee on Green Growth

KCRC  
MEST

CCS Environmental Center  
ME & MMLTA

Regulatory /Incentive System

International Collaboration

Demonstration & Commercialization

Sharing & Networking

Promotion & Expansion
Members of KCCSA:
All Major Players in Korea

* Newsletter recipients (bimonthly): 62,000
Active Participation in International CCS Networks

*IEA-GHG: International Energy Agency GreenHouse Gas R&D Program  
*CSLF: Carbon Sequestration Leadership Forum  
*CO2CRC: CO2 Cooperative Research Center  
*CCPP: Climate Change Policy Partnership, Duke University  
*GCCSI: Global CCS Institute  
*CCSA: Carbon Capture Storage Association  
*NETL: National Energy Technology Laboratory  
*MIT CSI: MIT Carbon Sequestration Initiative
Summary

- CCS will play an important role in CO2 emission reduction.
- Large scale integration projects (LSIP) may be postponed until international regulation on CO2 emission is to be effective.
- Capture-Ready may be required for new power plants in the future.
- Korea will keep investing in CCUS R&D.
- Korea needs international collaboration in CCS in general, and Storage in particular.
Thank you

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