International cooperation in the field of CCS - Approaches and implementation

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Deployment of CCS – Why is there a need for policy and regulation?

Carbon Capture and Storage:

- fulfills primarily climate policy objectives
- faces multiple market failures
- requires financial and policy incentives
- requires regulation regarding the technology deployment
Exploring the idea of CCS

Cesare Marchetti publishes „On Geoengineering and the CO₂ Problem“ (1976)

- “This is not the place to think of each consumer filling his own little balloons with CO₂ to be processed by his municipality. The problem has to be tackled upstream.”
- “[…] one of the numerous (a dozen) processes of stripping CO₂ from other gases […] which are currently used in industry could be employed.”
- “CO₂ can be easily compressed […]. It can be transported in pipelines that are essentially the same as those for methane.”
- “[CO₂ disposal] could be done in the form of a permanent underground storage, e.g. by using exhausted gas fields.”

Source: Marchetti, C. (1976): On Geoengineering and the CO₂ Problem
International networks and organizations

IPCC
- 1990-2000: Scoping meeting, Regina
- 2002: Scoping meeting, Regina
- 2005: Special report
- 2006: Inventory guidelines
- 2005: “welcomes” IPCC Special Report
- 2006: Workshops CCS and CCS & CDM
- 2010: CCS eligible in CDM

UNFCCC
- 1992: UNFCCC launched
- 1997: Kyoto protocol finalized
- 2005: “welcomes” IPCC Special Report
- 2006: Workshops CCS and CCS & CDM
- 2010: CCS eligible in CDM
- 2005: Gleneagles Plan of Action
- 2008: Commitment to 20 large-scale demo projects by 2010

G8
- 2002: Scoping meeting, Regina
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CEM
- 2009: 1st CEM
- 2010: CCUS recommendations established
- 2011: CCUS recommendations established

CCLF
- 2003: Inaugural meeting
- 2006-07 Early opportunities workshops
- 2010: CCS Roadmap
- 2008: GCCSI announcement
- 2012: last update on global status of CCS

GCCSI
- 2011: CCUS recommendations established
- 2012: last update on global status of CCS

IEAGHG
- 2007: Capture-ready report
- 2012: GHGT-11

Source: de Coninck, Bäckstrand 2011 with modifications
IPCC - Recognition of CCS as a climate change mitigation option

IPCC - Special Report on CCS (2005)

Technical findings:
For geological storage, 99% of the CO$_2$ is very likely to be retained over 100 years, and 99% of the CO$_2$ is likely to be retained over 1,000 years.

Policy findings:
- CCS is an important option available to reduce the impacts of climate change
- There is a need to increase public awareness of CCS
- There is a need for the development of suitable regulatory frameworks

Source: IPCC SR on CCS
Incentivizing the worldwide deployment of CCS

- Inclusion of CCS into the clean development mechanism project activities (CDM) of the Kyoto Protocol

- G8
  - 2005: Gleneagles Plan of Action – enhancing international cooperation on CCS
  - 2008: Target of launching 20 large-scale CCS demonstration projects globally by 2010

- CSLF
  - CCS demonstration project recognition
  - Early opportunity workshops for stakeholders
  - CCS Roadmap 2010

- GCCSI
  - Database on the status of CCS projects
International collaboration on CCS R&D and demonstration

CSLF, IEAGHG, IEA Clean Coal Centre

- Knowledge-sharing (R&D, pilot and demonstration projects)
- Networking
- Identification of international best practice
- Concept definition (e.g. „capture-ready“), development of guidelines for regulatory purposes
## Worldwide deployment of CCS

<table>
<thead>
<tr>
<th>Project</th>
<th>Location</th>
<th>Project phase</th>
<th>Capture</th>
<th>Transport</th>
<th>Storage</th>
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<tr>
<td>Enhance Energy EOR Project</td>
<td>Canada, Alberta</td>
<td>execute</td>
<td>pre-combustion</td>
<td>Pipeline</td>
<td>EOR</td>
</tr>
<tr>
<td>Great Plains Synfuel Plant and Weyburn-Midale Project</td>
<td>Canada, Saskatchewan</td>
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<td>pre-combustion</td>
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<tr>
<td>Boundary Dam Integrated Carbon Capture and Sequestration Demonstration Project</td>
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</tr>
<tr>
<td>Shute Creek Natural Gas Processing</td>
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<td>pre-combustion</td>
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</tr>
<tr>
<td>Lost Cabin Gas Plant</td>
<td>USA, Wyoming</td>
<td>execute</td>
<td>pre-combustion</td>
<td>Pipeline</td>
<td>EOR</td>
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<tr>
<td>Occidental Gas Processing Plant</td>
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<td>Pipeline</td>
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<tr>
<td>Enid Fertilizer Plant</td>
<td>USA, Oklahoma</td>
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<td>Pipeline</td>
<td>EOR</td>
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<tr>
<td>Val Verde Natural Gas Plants</td>
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<td>operate</td>
<td>pre-combustion</td>
<td>Pipeline</td>
<td>EOR</td>
</tr>
<tr>
<td>Kemper County IGCC Project</td>
<td>USA, Mississippi</td>
<td>execute</td>
<td>IGCC</td>
<td>Pipeline</td>
<td>EOR</td>
</tr>
<tr>
<td>ADM Illinois Industrial Carbon Capture and Sequestration Project</td>
<td>USA, Illinois</td>
<td>execute</td>
<td>CO₂-capture in the industry</td>
<td>Pipeline</td>
<td>deep saline formations</td>
</tr>
<tr>
<td>In Salah CO₂ Injection</td>
<td>Algeria, Ouargla Wilaya</td>
<td>operate</td>
<td>pre-combustion</td>
<td>Pipeline</td>
<td>deep saline formations</td>
</tr>
<tr>
<td>Sleipner CO₂ injection</td>
<td>Norway, Nordsee</td>
<td>operate</td>
<td>pre-combustion</td>
<td>on-site</td>
<td>deep saline formations</td>
</tr>
<tr>
<td>Snøhvit CO₂ injection</td>
<td>Norway, Barentssee,</td>
<td>operate</td>
<td>pre-combustion</td>
<td>Pipeline</td>
<td>deep saline formations</td>
</tr>
<tr>
<td>Gorgon Carbon Dioxide Injection Project</td>
<td>Australia, Western Australia</td>
<td>execute</td>
<td>pre-combustion</td>
<td>Pipeline</td>
<td>deep saline formations</td>
</tr>
</tbody>
</table>

Source: GCCSI project database – as of July 2012
CCS and Local Resistance in Germany

Storage areas

Local resistance

Potential pipelines

CCS power plant (on hold)

Demo plant Jänschwalde by Vattenfall, part of the EU EEPR funding – cancelled due to the lack of the regulatory framework

Summary on international cooperation in the field of CCS

- The key actors of international cooperation are governments, industry and academia that cooperate in the framework of international organizations, scientific organizations, and R&D networks.

- CCS was recognized as a climate change mitigation option after the release of the IPCC SR on CCS.

- The international organizations address the deployment of CCS by means of goal-setting, roadmapping activities, and inclusion of CCS in the existing mechanisms of international climate change mitigation.

- The international R&D networks focus on knowledge sharing and contribute to technical concepts’ definition for regulatory purposes.
References

IPCC:
- IPCC SR on CCS (2005): https://docs.google.com/file/d/0B1gFp6Ioo3akWFVJRmdxRU5xU1E/edit?pli=1

Roadmaps:

Policy and regulation:

CCS in CDM:

CCS global status updates:

International cooperation in the field of CCS:
- HAGEMANN, M., MOLTMANN, S., PALENBERG, A., DE VISSER, E., HÖHN, N., JUNG, M. & BAKKER, S. (2011) CATO-2 Deliverable WP 2.3-D03, Background paper on “Role of CCS in the international climate regime”.
Thank you for the attention!

Questions?

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