Where We Are, and Current Challenges:

Large Scale Projects

Regulation

UNFCCC

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IEA GHG Members

Capturing the Learning from Large-scale Operational Projects (2008)

Criteria:

- Indicative criteria defined for ‘large-scale operational projects’
- Was, or had been, operational by the end of 2008, and either:-
  - Captures over 10,000 tCO_2 per year from a flue gas
  - Injects over 10,000 tCO_2 per year with the purpose of geological storage with monitoring
  - Captures over 100,000 tCO_2 per year from any source
  - Coal-bed storage of over 10,000 tCO_2 per year
- *Commercial CO_2 EOR is excluded unless there is a monitoring programme to provide learning.*
- *Does not need to be fully integrated*

Projects identified

Bellingham Cogeneration Facility	IFFCO CO2 Recovery Plant – Aonla
CASTOR Project	Prosint Methanol Plant
Great Plains Synfuel Plant	Rangely CO2 Project
IMC Global Soda Plant	Schwarze Pumpe
In Salah	SECARB - Cranfield II
K12-B	Shady Point Power Plant
Ketzin Project	Sleipner
MRCSP - Michigan Basin	Snohvit LNG Project
Nagaoka	SRCSP - Aneth EOR-Paradox Basin
Otway Basin Project	SRCSP - San Juan Basin
Pembina Cardium Project	Sumitomo Chemicals Plant
Petronas Fertilizer Plant	Warrior Run Power Plant
IFFCO CO2 Recovery Plant - Phulpur	Weyburn
Chemical Co. “A” CO2 Recovery Plant	Zama EOR Project

- Capture over 100ktCO_2
- Injection over 10ktCO_2 for storage
- Monitored EOR over 10ktCO_2
- Capture over 10ktCO_2 from flue gas
- Coal bed storage over 10ktCO_2

Extent of coverage vs ZEP project matrix

Archetype 1	• Lignite/co-firing with Biomass	• Pre-combustion, variant A	• Cross-border pipeline	• Offshore depleted oil & gas field
Archetype 2	• Gas	• Post-combustion, variant A	• Pipeline	• Onshore structural deep saline aquifer
Archetype 3	• Hard Coal	• Oxy-fuel, variant A	• Ship	• Offshore open deep saline aquifer
Archetype 4	• Hard Coal	• Post-combustion, variant A	• Pipeline	• Onshore depleted oil & gas field
Archetype 5	• Lignite	• Oxy-fuel, variant B	• Pipeline	• Onshore structural deep saline aquifer
Archetype 6	• Hard Coal	• Pre-combustion, variant B	• Pipeline	• Offshore depleted oil & gas field
Archetype 7	• Hard Coal	• Post-combustion, variant B	• Pipeline	• Onshore open deep saline aquifer

Demonstrated in operational large projects

Not demonstrated in operational large projects

Project matrix courtesy of EU Technology Platform for Zero Emission Fossil Fuel Power Plants - ZEP (2008)

Conclusions from Large-Scale Operational Projects

- Elements of CCS are operating at large scale
- Integrated CCS is operating at large scale, just not from power plant

Challenges:

- Integrated CCS with power plant
- There is a lot that has been learnt from existing projects, but more can be done to share the learning
- CCS industry can build on existing projects' experience
- Increasing IPR issues will affect sharing learning

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- Research Networks
  - Storage (Monitoring, Risk Assessment, Well Integrity, Social Science)
  - Capture (Post combustion, Oxyfuel)
- GHGT 10 Conference
- Workshops
- Studies
- Large Scale Operational Projects – GCCSI

Legal and Regulatory Developments

International:

- 2006 IPCC Guidelines for GHG Inventories – methodology for CCS (site characterisation + modelling, + monitoring = zero leakage)
- Marine Conventions - London Protocol (2006), OSPAR (2007)

Regional/national regulation:

- EU Storage Directive, ETS Directive (2008)
- Australia – Offshore and Onshore GHG Storage Acts (2008-9)
- US EPA Draft Rule (2008)
- Japan, Canada

Regulatory lessons learnt

Regulatory principles for CCS to ensure environmental integrity:

- Site-by-site assessment
- Risk assessment
- Site characterisation and simulation, supported by monitoring
- CO2 stream impurities determined by impacts on integrity

Development of regulation:

- Use the technical and scientific evidence base
- Learn from existing regulatory developments
- Benefit of having real projects to drive and test regulations

Legal and Regulatory Developments

Challenges:

- Regulation development within countries
- Regulation detail, and implementation
- Long-term liability – principle, and detail for transfer criteria

IEA GHG providing technical information to inform regulatory development

UNFCCC - CDM (Kyoto 1st Period)

- Considering CCS since COP/MOP1 Montreal (2005)
  - 2 synthesis reports on Submissions
  - Decision due at COP/MOP4 Poznan (Dec08) – nearly but blocked
- CMP4 – Poznan (Dec08) tasked CDM EB to consider implications of CCS in CDM, to report to CMP5 (Copenhagen) - EB commissioned report – IEA GHG studies are key inputs
- SBSTA – CDM and CCS - ongoing, further submissions 28 Sep, continue at SBSTA31 (Copenhagen), waiting for EB report (due end Aug).

UNFCCC Post 2012

- AWG LCA (UNFCCC Parties)
- AWG KP (KP Parties) – Considering future CDM :- Chairs text options CCS excluded or included [2 proj per region]. No progress in August meeting (next 28 Sep Bangkok, then 2 Nov Barcelona). COP15 – 7 Dec.
- Both discussing new mechanisms: - Sectoral mechanisms and NAMAs for developing countries.

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Challenges:

- Resolving CCS in CDM, without prejudicing other post 2012 mechanisms

- Recognition and inclusion of CCS in other post 2012 mechanisms and initiatives – for developing countries

IEA GHG providing information into UNFCCC to encourage evidence-based decisions, eg CDM Reports

IEA Greenhouse Gas R&D Programme

- General - www.ieagreen.org.uk
- CCS - www.co2captureandstorage.info