ECCO
European value Chain for CO$_2$

Contract N° 218868

Project coordinator: SINTEF Energy Research
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CCS-conference, Oslo, 10th February 2009
Outline

- ECCO background, objectives and expected impact
- ECCO metrics and structure
- ECCOs approach towards fulfilling the expected impact
  - Scenarios
  - Case studies
  - Modelling
- Some initial work in ECCO (after 5 months…)
- ECCOs main results and expected industry uptake
ECCO – European Value Chain for CO₂
The challenge… as stated by EU

Additional Cost for CCS, per ton CO₂

…for all CCS projects!

Certificate Price

Average Avoidance costs

Illustration; K. Tullius, EU
ECCO – European Value Chain for CO₂ CCS project portfolio (some of it...)
ECCO – European Value Chain for $\text{CO}_2$

Project objectives

The main objective of ECCO is to facilitate robust strategic decision making regarding early and future implementation of $\text{CO}_2$ value chains in the face of uncertainty.

- Provide the basis for, and the recommendations leading to implementation of the most promising EOR and EGR alternatives
- Prepare for analyses and recommendations through the development of a $\text{CO}_2$ value chain analysis tool
- Quantify the potential for enhanced hydrocarbon recovery (EOR/EGR) and $\text{CO}_2$ storage in European petroleum reservoirs and evaluate technological challenges
ECCO – European Value Chain for CO₂
Project expected impacts

- **Underpin the realisation of CO₂ value chains** for captured CO₂ from large point sources for CO₂ injection in petroleum reservoirs (EOR/EGR) and CO₂ storage.

- Improve security of supply by enabling **sustainable use of fossil fuels**, protracting increases in fuel imports by making **better use of existing resources** and **shortening time to market** for promising CCS related technologies.

- **Strengthen the competitiveness of the European economy** by maintaining and reinforcing the leading position in CCS technologies and by sharing and building on the existing EOR experience in Central and Eastern Europe and on-going activities in the North Sea.
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Project metrics

- Duration: 3 yrs – started 1\textsuperscript{st} September 2008
- Budget: 5.355 M€ ~3.853 M€ in grant
- Partners: 18 legal entities (+1);
  - 7 (+1) energy providers (oil & gas companies and utilities)
  - 2 engineering companies
  - 1 NGO
  - 8 highly ranked RTD providers
- Coordinator: SINTEF Energy Research

- It’s not a shoe – it’s an EU-project!
ECCO – European Value Chain for CO₂
The Consortium

RTD Providers:
- SINTEF, Norway
- IFP, France
- TNO, Netherlands
- JRC, Netherlands
- GEUS, Denmark
- NTNU, Norway
- Univ. of Zagreb, Croatia

Energy providers:
- Statoil, Norway
- DONG Energy, Denmark
- INA Oil Industry, Croatia
- MOL, Hungary
- Vattenfall R&D, Sweden
- E.ON UK, UK
- RWE npower, UK
- Fortum Oyj

SME:
- Progressive Energ, UK
- Bellinna, Norway
- Project Inerex, Norway
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Strategy – key questions

ECCO should provide **methodology and tool** for evaluation of various CO$_2$ chain options and so **enabling making qualified decisions**.

- What might be the future “CO$_2$ world”?

- How to identify feasible CO$_2$ chain options?

- How to evaluate the CO$_2$ chain options and choose the most promising solutions for CCS?
ECCO – European Value Chain for CO₂ Strategy – key questions

- What might be the future CO₂ world?
  - Scenario analysis –> 2-3 scenarios
    - Exist infrastructure?
    - Who owns infrastructure?
    - How will parameters affecting oil/gas/el market develop?
    - What are the incentives/regulations for CCS?
  ➔ IMPORTANT – best guess - qualified experts opinion

- How to identify feasible CO₂ chain options?
  - Formulation & analysis of cases
    - Relevant questions/problem formulation
    - Cases reflecting the scenarios
    - Cases illustrating the effect and importance of various parameters – sensitivity analysis
    - Integrated multiple source/sink systems
  ➔ IMPORTANT – relevant cases - “smart use of tool”

- How to evaluate the CO₂ chain options and choose the most promising solutions for CCS?
  - Tool for economic analysis of CO₂ chain
  ➔ IMPORTANT – simple BUT high quality input data & consistent implementation
The iteration process...

1. Scenario – “predicting” future CO$_2$ world

2. Case study – defining options

3. Economic analysis – profit vs. costs

4. Case study – evaluating options & recommendations

J. P. Jakobsen  SINTEF
ECCO – European Value Chain for CO₂
Object oriented code
ECCO – European Value Chain for CO₂

Tool design

- Overall structure
  - Modular – multiple modules chain (Drag and drop)

- Global parameters
  - Oil price
  - Gas price
  - EI price
  - CO₂ quote price

- Local parameters
  - CO₂ capture efficiency
  - Characteristic costs for capture
  - Pipe length
  - Infrastructure
  - …
ECCO – European value Chain for CO₂ Implementation

SP1 ECCO dissemination and training

SP2 CCS analysis and recommendations
- Envisaging CCS in Europe by 2020
- Formulation of CCS case studies
- Strategies for implementation of CO₂ value chains

SP3 CO₂ value chain methodology and tool development
- CO₂ value chain assessment tool
- Implementation and simulation of CCS cases
- Global parameters and market models
- Techno-economic models for CO₂ chain components

SP4 Reservoir technology for EOR/EGR
- Techno-economic strategies for optimal CO₂ injection
- EOR/EGR potential with CO₂ injection
- Integration of aquifers into CO₂ infrastructure
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Some initial work (after 5 months…)

- Scenario work → what will it be like in 2020? CCS considered?
  - ECCO seeks to identify the early opportunities
  - Need to identify the main factors and actors affecting realization of CCS value chains in Europe (both short and long term perspective need to be considered)
  - Workshops… group sessions… post-it notes…

- Value chain tool – supporting tool for decision makers
  - Design and structure
  - Focus on input and output parameters, issues that are modelled and objective of tools – industrial relevance and importance emphasized
  - Based on ECCO partners’ internal tools and available literature on other tools

- EOR/EGR as a part of the value chain
  - European experience in Hungary and Croatia (15 years!) – information shared by the relevant partners (next slide as example)
  - Main source for CO?
    - Natural reservoirs!!
EOR/IOR applications in Hungary

30 years Experience in EOR/IOR technologies

Demjén:
- in-situ combustion,
- water flooding,
- steam injection,
- in-situ combustion - air injection
- microbiological EOR (MEOR) experiment.

Pusztaföldvár:
- pressure maintenance by non-miscible CO₂ and water injection,
- water flooding.

Kiskunhalas:
- HC gas injection,
- water flooding
- partially miscible CO₂ flooding
- WAG silicate gel injection
- in-fill wells.

Algyő:
- water flooding,
- polymer flooding experiment
- polymer/silicate gel treatment
- lean gas injection and vaporization
- Ethan reach gas injection.

Lovászi:
- HC gas injection,
- water flooding,
- partially miscible CO₂ flooding
- WAG, silicate gel injection
- in-fill wells.

Nagylengyel:
- artificial gas cap by CO₂ injection,
- chemical flooding experiment (ammonia).

Budafa:
- HC gas injection,
- water flooding,
- partially miscible CO₂ flooding
- WAG silicate gel injection,
- in-fill wells.

Újfalú:
- MEOR experiment.

Szank:
- partially miscible CO₂ flooding/injection

MOL GROUP
Source: P. Kubus, MOL
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Main results

- ECCO is focused towards the complete CO₂ value chain, and will generate results and cause progress beyond state of the art within the following topics;
  - Strategies and recommendations for deployment of CO₂ value chain: Main report: “ECCO Strategies for CO₂ value chain deployment”.
  - CO₂ value chain assessment tool that enables transparent and robust analysis of CO₂ value chains.
  - Reservoir technology for EOR and EGR increasing the ability to predict EOR and EGR profiles and potentials for CO₂ injection into European oil and gas reservoirs.
  - Methodology for CO₂ value chain assessment by means of establishing scenarios as input for formulation of CCS cases, which further are used in the CCS case analysis.
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Users of results

The main users of ECCO-results

- CO$_2$ Producers
- EC and other supranational bodies
- National authorities
- CO$_2$ Transporters and sellers
- CO$_2$ Storage operators
- R&D providers and universities

Finally, the increased knowledge of EOR and EGR potential and challenges provided by ECCO might provide the basis for further industrial activities in this front.
Thank you for your attention!

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