



# **ECCO** **European value Chain for CO<sub>2</sub>**

**Contract N° 218868**

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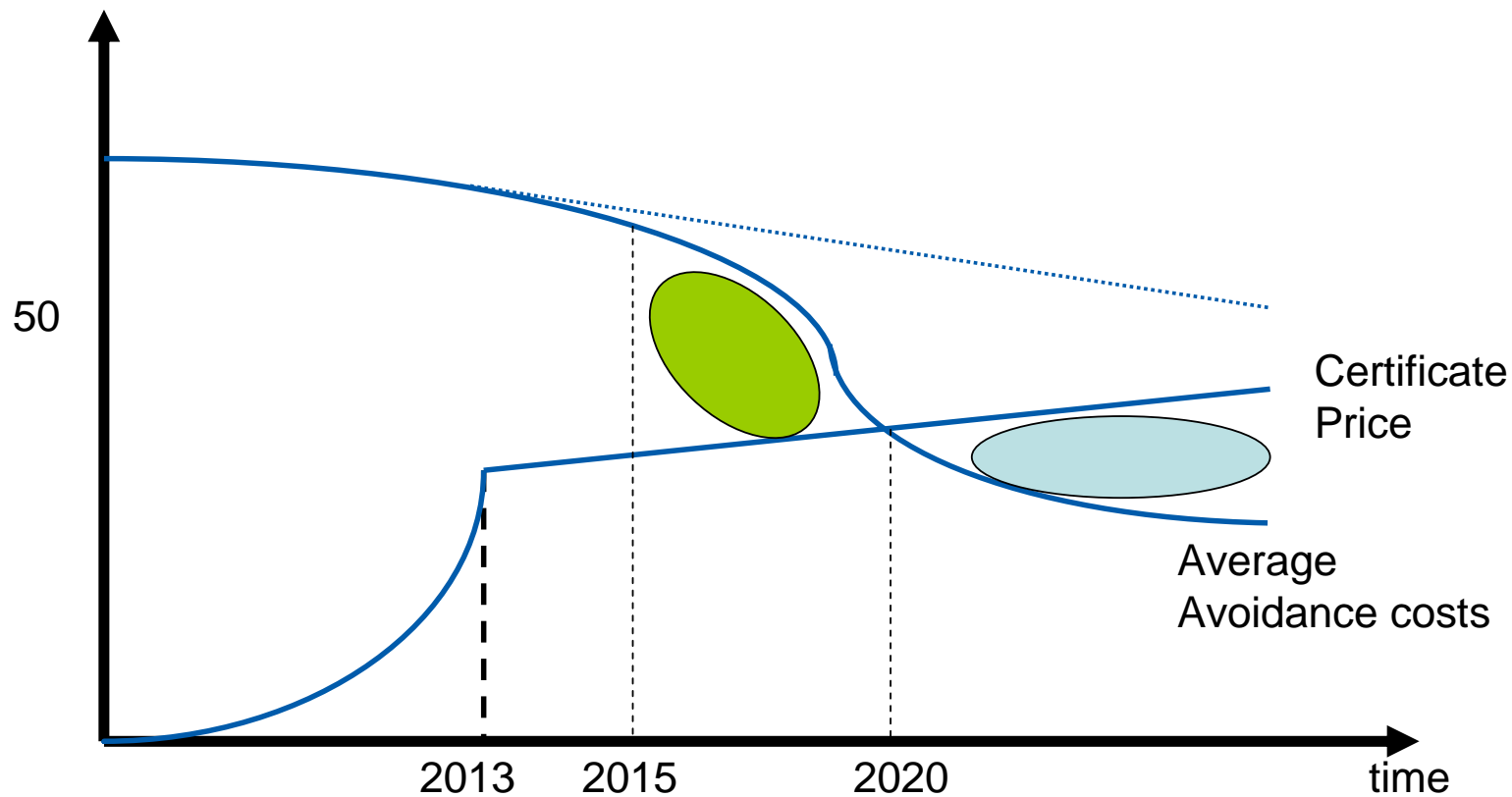
# Outline

- ECCO background, objectives and expected impact
- ECCO metrics and structure
- ECCOs approach towards fulfilling the expected impact
  - Scenarios
  - Case studies
  - Modelling
- ECCOs main results and expected industry uptake

# ECCO – European Value Chain for CO<sub>2</sub>

## The challenge... as stated by EU

Additional Cost for  
CCS, per ton CO<sub>2</sub>



Directorate-General  
for Energy  
and Transport

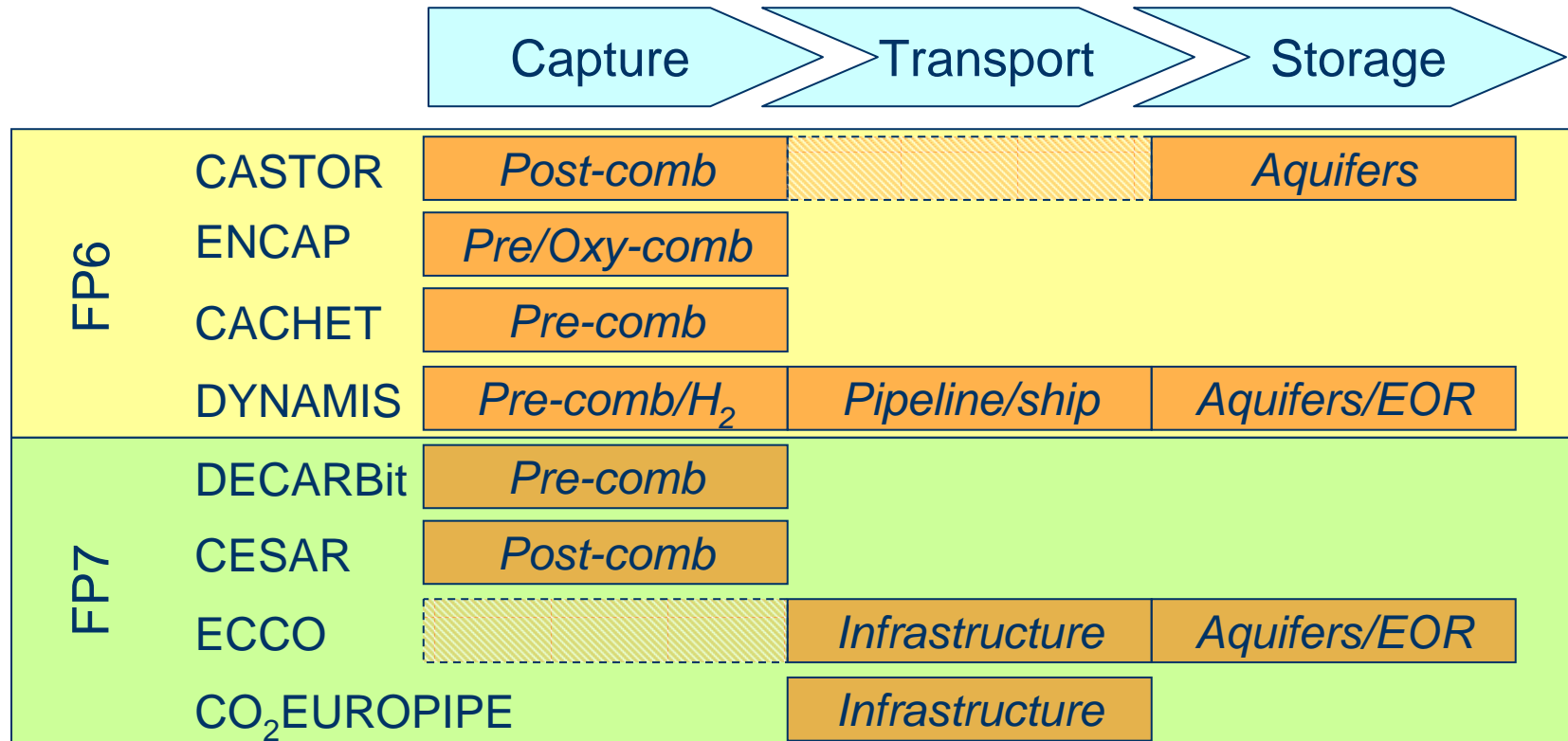


Illustration; K. Tullius, EU



# ECCO – European Value Chain for CO<sub>2</sub>

## EUs project portfolio (some of it...)



+ several storage projects!

# ECCO – European Value Chain for CO<sub>2</sub>

## Project objectives

The main objective of ECCO is to facilitate robust strategic decision making regarding early and future implementation of CO<sub>2</sub> value chains in the face of uncertainty.

### *IMPACT:*

- *The knowledge, methods, and tools developed in ECCO shall influence future CCS initiatives by enabling the industrial players and the authorities to analyse, understand, and make sound decisions.*

# ECCO – European Value Chain for CO<sub>2</sub>

## Project objectives (cont.)

- 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 CO<sub>2</sub> value chain analysis tool
- Quantify the potential for enhanced hydrocarbon recovery (EOR/EGR) and CO<sub>2</sub> storage in European petroleum reservoirs and evaluate technological challenges

# ECCO – European Value Chain for CO<sub>2</sub>

## Project expected impacts

- **Underpin the realisation of CO<sub>2</sub> value chains** for captured CO<sub>2</sub> from large point sources for CO<sub>2</sub> injection in petroleum reservoirs (EOR/EGR) and CO<sub>2</sub> 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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# ECCO – European Value Chain for CO<sub>2</sub>

## Project metrics

- Duration : 3 yrs – started 1<sup>st</sup> September 2008
- Budget: 5.355 M€ ~3.853 M€ in grant
- Partners: 18 legal entities;
  - 7 energy providers (oil & gas companies and utilities)
  - 2 engineering companies
  - 1 NGO
  - 8 highly ranked RTD providers
- Coordinator: SINTEF Energy Research
  
- Application evaluation; 14/15 points!
  
- It's not a shoe – it's an EU-project!



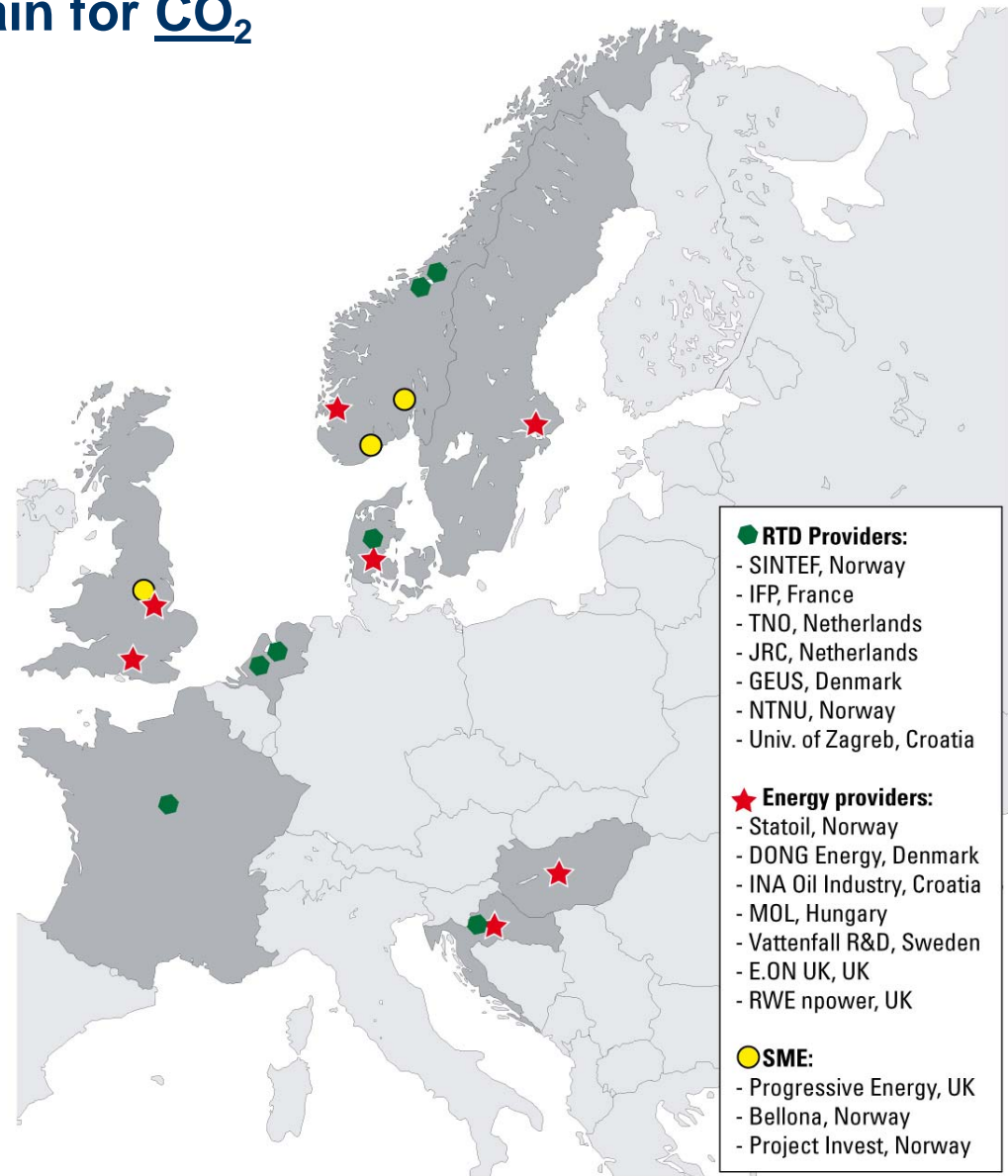
# The ECCO Consortium



# ECCO – European Value Chain for CO<sub>2</sub>

## Project partners

- Partners representing bordering countries around the North Sea basin and in Central and Eastern Europe



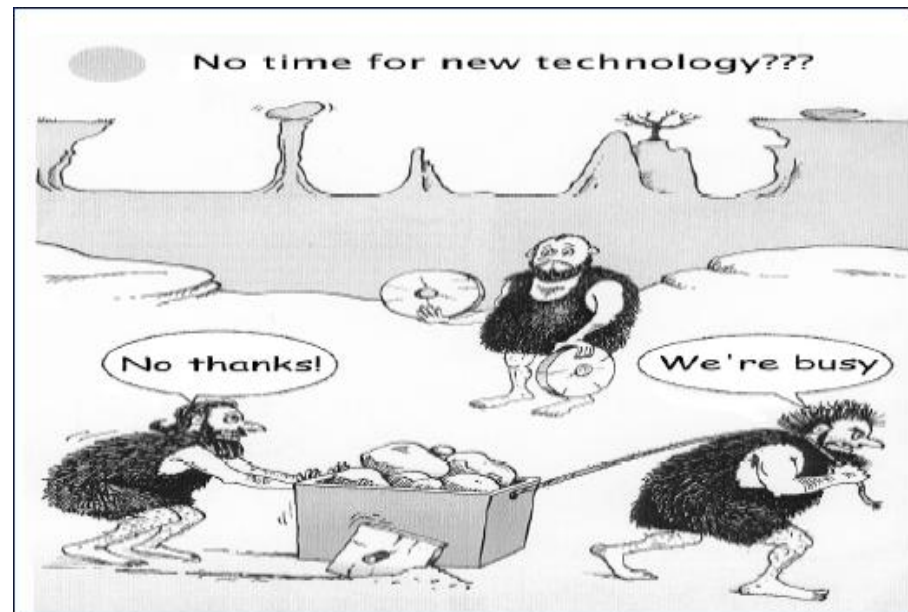
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# ECCO – European Value Chain for CO<sub>2</sub>

## Obstacles for realization of CCS

- Legislative Hurdles
- Non legislative Hurdles
  - Long term economic viability
  - Industrial Scale CCS Demo Projects (all main technology routes (Pre-, Post-, Oxyfuel-Combustion))
  - General and Industry Awareness
  - Public Acceptance



# ECCO – European Value Chain for CO<sub>2</sub> Strategy – key questions

ECCO should provide **methodology and tool** for evaluation of various CO<sub>2</sub> chain options and so **enabling making qualified decisions**.

- What might be the future “CO<sub>2</sub> world”?
- How to identify feasible CO<sub>2</sub> chain options?
- How to evaluate the CO<sub>2</sub> chain options and choose the most promising solutions for CCS?



# ECCO – European Value Chain for CO<sub>2</sub> Strategy – key questions

## ■ What might be the future CO<sub>2</sub> 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 CO<sub>2</sub> 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 CO<sub>2</sub> chain options and choose the most promising solutions for CCS?

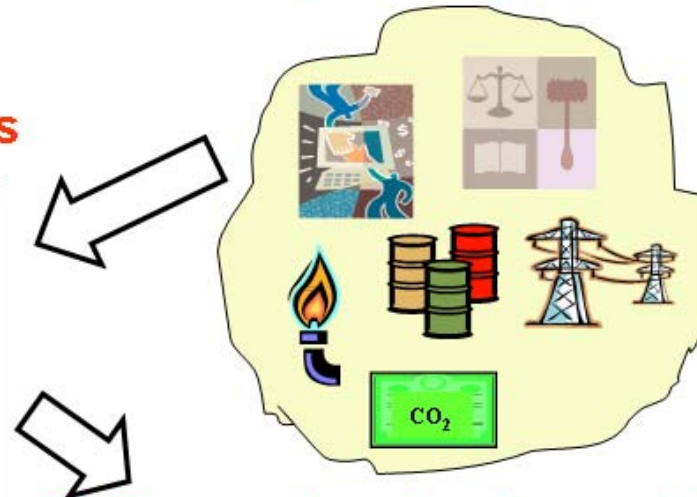
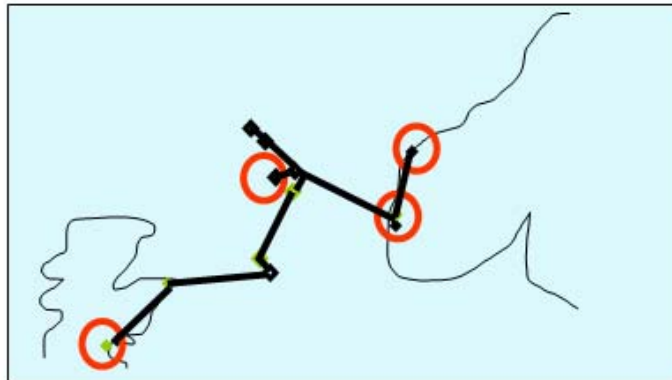
- Tool for economic analysis of CO<sub>2</sub> chain

→ **IMPORTANT** – simple BUT high quality input data & consistent implementation

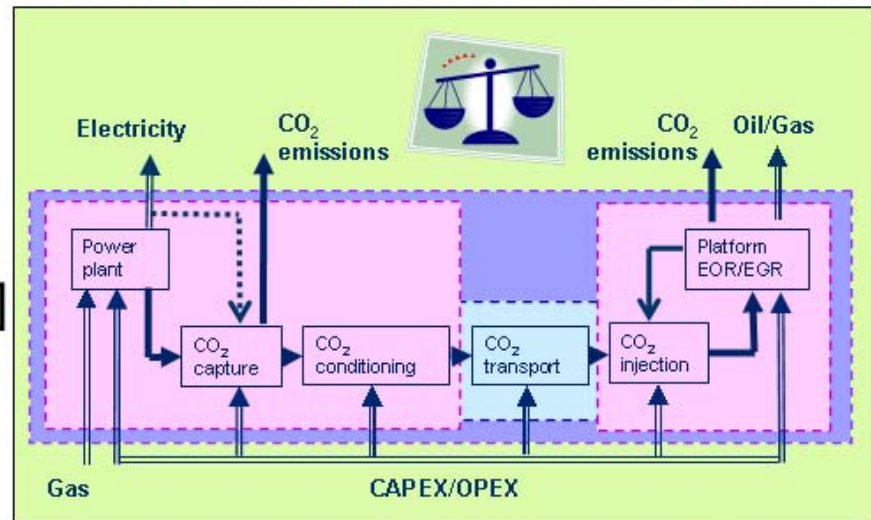


# 1. Scenario – “predicting” future CO<sub>2</sub> world

## 2. Case study – defining options



## 3. Economic analysis – profit vs. costs



## 4. Case study – evaluating options & recommendations

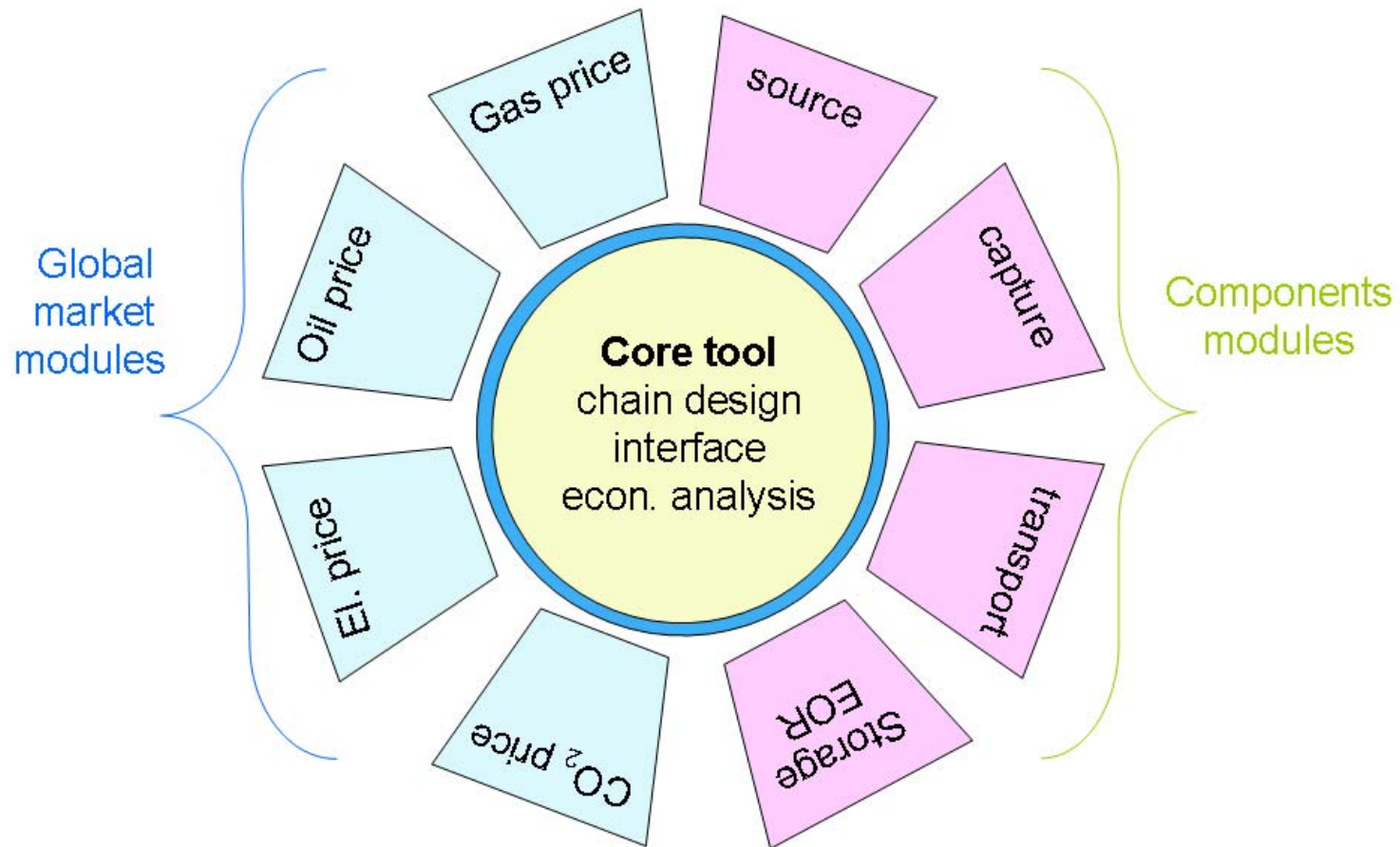


J. P. Jakobsen  SINTEF



# ECCO – European Value Chain for CO<sub>2</sub>

## Object oriented code



J. P. Jakobsen  SINTEF

## Tool design

### Overall structure

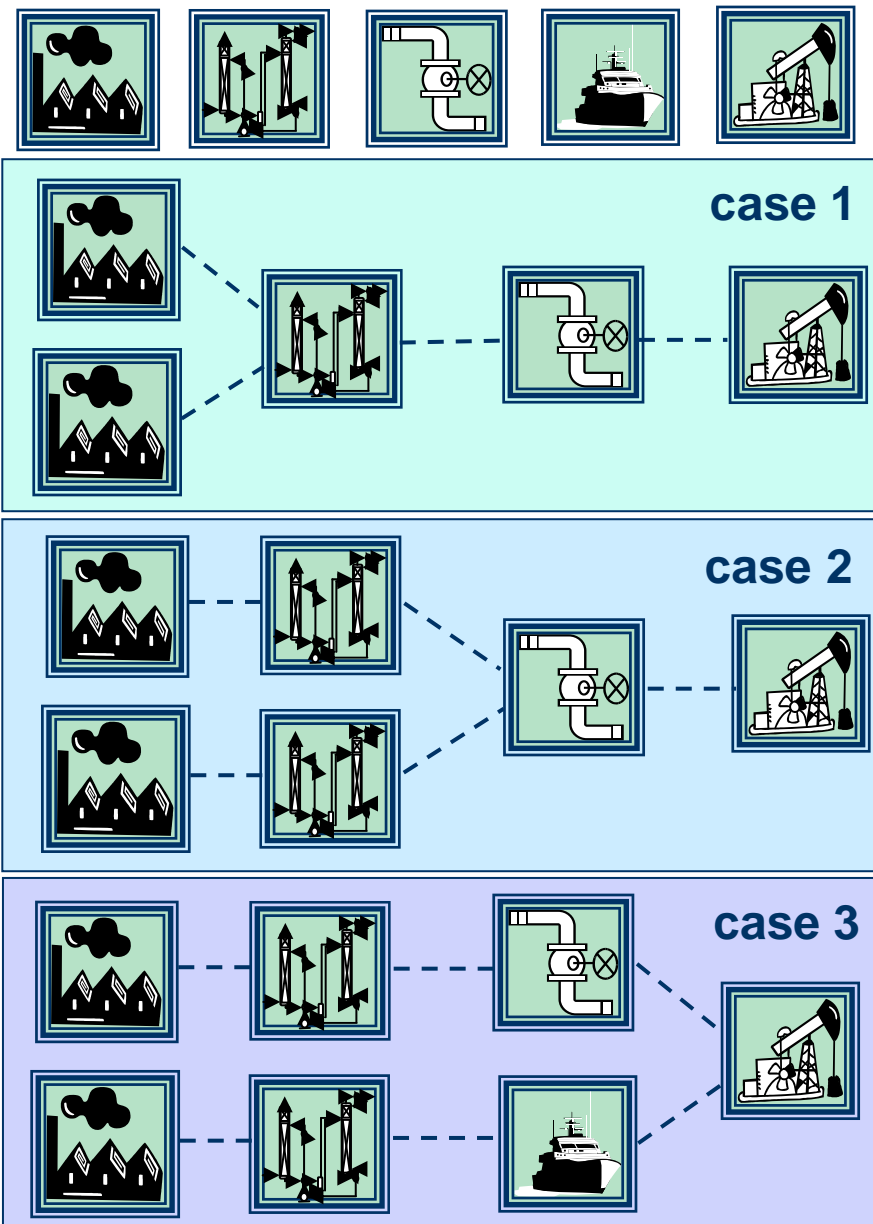
- Modular –multiple modules chain (Drag and drop)

### Global parameters

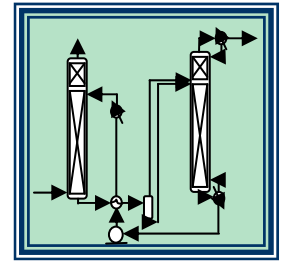
- Oil price
- Gas price
- El price
- CO<sub>2</sub> quote price

### Local parameters

- CO<sub>2</sub> capture efficiency
- Characteristic costs for capture
- Pipe length
- Infrastructure
- ...



# ECCO – European Value Chain for CO<sub>2</sub> CO<sub>2</sub> capture module



- Outlet:
  - CAPEX/OPEX
  - CO<sub>2</sub> quality?
  - CO<sub>2</sub> emissions?
- Variable:
  - CO<sub>2</sub> volume / flow rate
- Parameters:
  - Process efficiency (capture rate)
  - Costs per kg CO<sub>2</sub>
  - ...

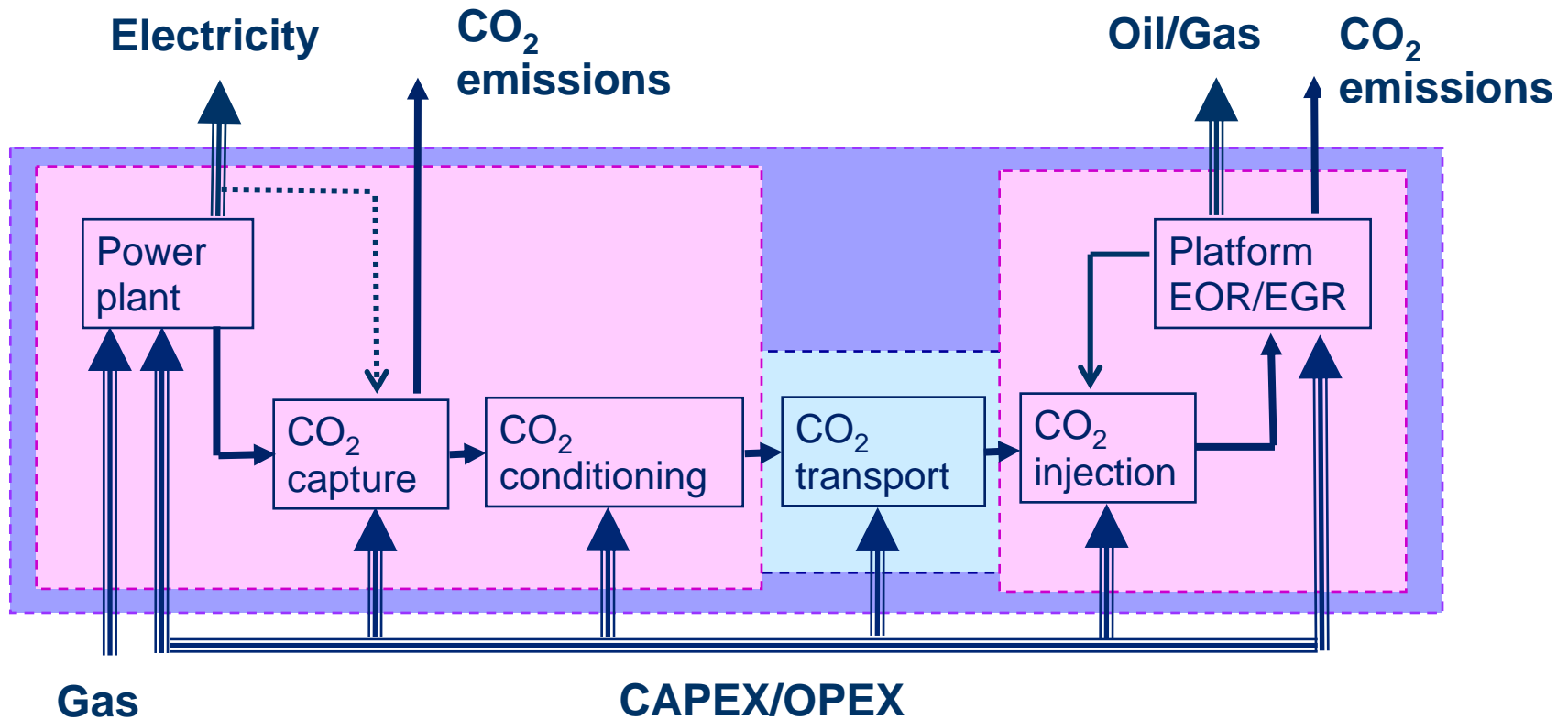


**These will characterize  
the capture technology**

# ECCO – European Value Chain for CO<sub>2</sub> Economic analysis

**COSTS**

**PROFIT**



Important to evaluate systems with multiple sources/sinks  
Infrastructure modelling – large scale CCS systems

# Strategy - Most important moments

- Standardized framework
- Transparent & consistent analysis
  - Assumptions
  - Parameter values
  - Implementation
- Careful definition of base case
- Relevant sensitivity analysis
- Qualified interpretation of results



**INCREASED UNDERSTANDING OF CCS !**

# ECCO - European value Chain for CO<sub>2</sub>

## 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 CO<sub>2</sub> value chains

## SP3 CO<sub>2</sub> value chain methodology and tool development

CO<sub>2</sub> value chain  
assessment tool

Implementation and  
simulation of CCS cases

Global parameters and market models

Techno-economic models for CO<sub>2</sub>  
chain components

## SP4 Reservoir technology for EOR/EGR

Techno-economic strategies  
for optimal CO<sub>2</sub> injection

EOR/EGR potential with CO<sub>2</sub> injection

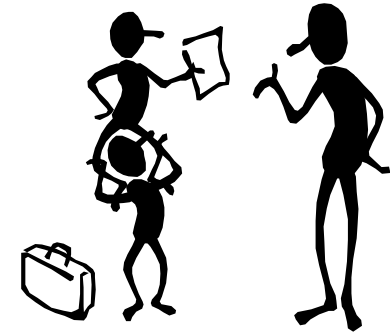
Integration of aquifers  
into CO<sub>2</sub> infrastructure

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# ECCO – European Value Chain for CO<sub>2</sub>

## Main results



- ECCO is focused towards the complete CO<sub>2</sub> value chain, and will generate results and cause progress beyond state of the art within the following topics;
  - Strategies and recommendations for deployment of CO<sub>2</sub> value chain: Main report: “**ECCO Strategies for CO<sub>2</sub> value chain deployment**”.
  - **CO<sub>2</sub> value chain assessment tool** that enables transparent and robust analysis of CO<sub>2</sub> value chains.
  - **Reservoir technology for EOR and EGR** increasing the ability to predict EOR and EGR profiles and potentials for CO<sub>2</sub> injection into European oil and gas reservoirs.
  - **Methodology for CO<sub>2</sub> value chain assessment** by means of establishing scenarios as input for formulation of CCS cases, which further are used in the CCS case analysis.



# ECCO – European Value Chain for CO<sub>2</sub> **Users of results**

The main users of ECCO-results

- **CO<sub>2</sub> Producers**
  - **EC and other supranational bodies**
  - **National authorities**
  - **CO<sub>2</sub> Transporters and sellers**
  - **CO<sub>2</sub> 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.



Schwarze Pumpe, P.Røkke



***Thank you for your attention!***  
***Questions...?***

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