A Norwegian Perspective on Ongoing CCS Projects

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IEA GHG – Expert meeting on financing CCS projects
London 31 May – 1 June 2007
CO2-emissions by country
Maps are re-sized to reflect emissions in each country

Source: www.worldmapper.org
Statoil’s climate challenge
Increasing and more CO2 intensive production

- International production
- NCS production

Build international growth platforms
Maximise NCS value creation

CO₂ emissions
Kg / tonne product

- EPN
- Global prod. avg.
- Re-fin. LNG
- EHO
- EHO incl. upgr
- GTL

GTL
....and Norway’s climate gas challenge
Statoil’s CO₂ projects
An industrial approach to climate change

CO₂ injection capacity
million tonnes/year

1. Sleipner
2. In Salah
3. Snøhvit LNG
4. Halten CO₂
5. Mongstad

1996-
2004-
2007-
2011/12-
2014-
The Sleipner experience – our starting point

- Started in 1996 (10 year anniversary in October 2006)
- Statoil with license partners (Exxon, Total, Hydro)
- Source: CO2 from natural gas (removed to reach sales gas spec of 2.5%)
- Separating and injecting approx. 1 mill. tons CO2 annually
- Storing in saline aquifer above natural gas reservoir
- **Driver**: CO2-tax (340 NOK/ton – 40€/ton)
- Learning and confidence building through a series of large EU-wide R&D programmes – especially on storage monitoring
In Salah and Snøhvit LNG – taking the next CCS steps

- Started in 2004
- BP with Sonatrach & Statoil
- Source: CO2 from natural gas (feed to LNG plant)
- Separating and injecting 1,2 mill. tons CO2 annually
- Injection into reservoir aquifer
- **Driver:** BP internal quota system?

- Starts in late 2007
- Statoil with license partners
- Source: CO2 from natural gas (feed to LNG plant)
- Separating, piping and injecting 0,7 mill. tons CO2 annually
- Injection below reservoir
- **Driver:** CO2 tax
The Halten CO2 project

- Starts 2011/2012 if sanctioned
- Statoil/Shell JV
- Source: CO2 from gas power plant
- Separating, transporting and injecting/EOR up to 2.5 mill. tons CO2 annually
- Injection into producing oil reservoir
- **Driver**: EOR and electrification

- Current results shows challenging economics and additional incentives are necessary
Mongstad CO2 test centre and full scale capture project

**Capture test centre**
- Starts late 2010
- Statoil, partners and authorities
- Source: CO2 from gas power plant and refinery cracker gas
- Separating, transporting and storing 0.1 mill. tons CO2 annually
- Transportation and injection site not yet identified
- **Driver:** Technology development, qualification and cost reduction. Authorities to bear cost of transport and storage.

**Full scale capture**
- Starts 2014
- Statoil on behalf of authorities
- Source: CO2 from gas power plant and refinery cracker gas
- Separating, transporting and storing up to 2.5 mill. tons CO2 annually
- Injection site not yet identified
- **Driver:** Fully covered CCS cost by authorities
The Kårstø CCS project

- Starts 2011/2012 if sanctioned
- Authorities through project dev. group
- Source: CO2 from gas power plant
- Separating, transporting and injecting 1,0 mill. tons CO2 annually
- Injection site not yet identified – Sleipner/Utsira studied
- **Driver**: Environment (environmental politics)

Feasibility report available for public:
What does it take?
Simple economic rules will decide speed and volume of CCS roll-out

- Direct subsidies
- Technology development
- EOR

- Environmental taxes
- Under-supply of credits

Nothing material will happen within CCS until we get here.

Year

Cost per ton CO2

emitting

removing
Incentive toolkit

• State direct investment

• Tax and depreciation

• Volume allowance EOR oil

• Credit of socio-economic benefits

• Gas-to-electricity pricing mechanisms

• Introduce/increase CO2 tax
CO2 capture cost/kWh vs. electricity price

- System price Nordpool
- Consumer price Norway

Cost of CO2 capture
How to begin the CCS industry

• Sort out the regulations
  — Int’l conventions
  — Local tax regimes
  — Authority involvement

• O&G companies are keys in developing CCS
  — Obvious similarities to natural gas infrastructure development
  — No lack of money

• Pick the low-hanging fruits first

• Public acceptance
Summary and conclusions

- CCS technically proven
- Enormous potential – public acceptance necessary
- Value chain approach (EOR) can support pioneering projects
- Financial mechanisms key to initiate projects
- Key element in meeting the global climate challenge
Thanks for the attention!
20 Year Anniversary for Our Common Future

“The Brundtland Report”, 1987

Norway’s Prime Minister
Gro Harlem Brundtland in Rio in 1992*

The Kyoto Protocol, 1997

The Kyoto Protocol ratified, 2005

* Gro Harlem Brundtland introduced a CO2-tax of about 45 US$/ton in Norway in 1992
World energy-related CO2-emissions by sector 2004

Source: IEA WEO 2006, table page 80
Announced projects are not sanctioned before developers see an economic driver in realising them.

Other large CCS-projects internationally*

**Power plants with CO2-capture:**
- Proposed full-scale projects

**CO2-storage projects:**
- Commercial and demonstration

15 projects
7 projects

*Based on list compiled by IEA Greenhouse Gas R&D Programme*