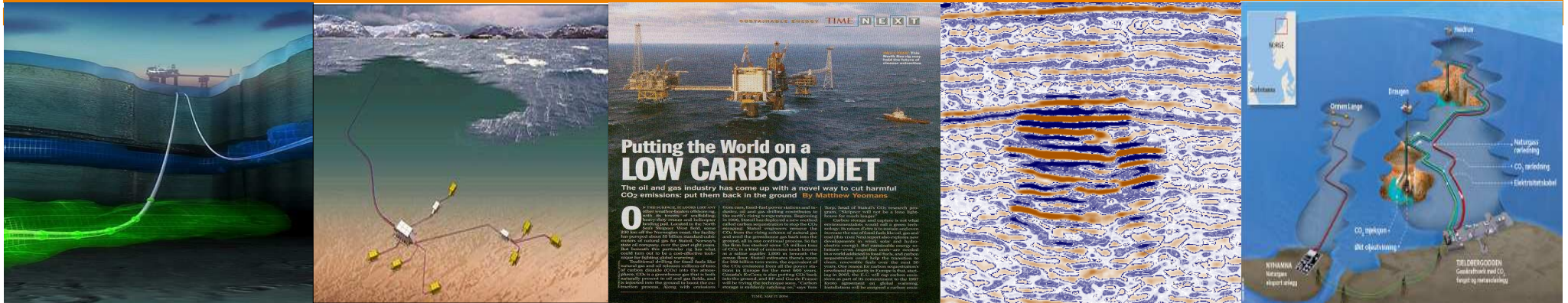


# A Norwegian Perspective on Ongoing CCS Projects

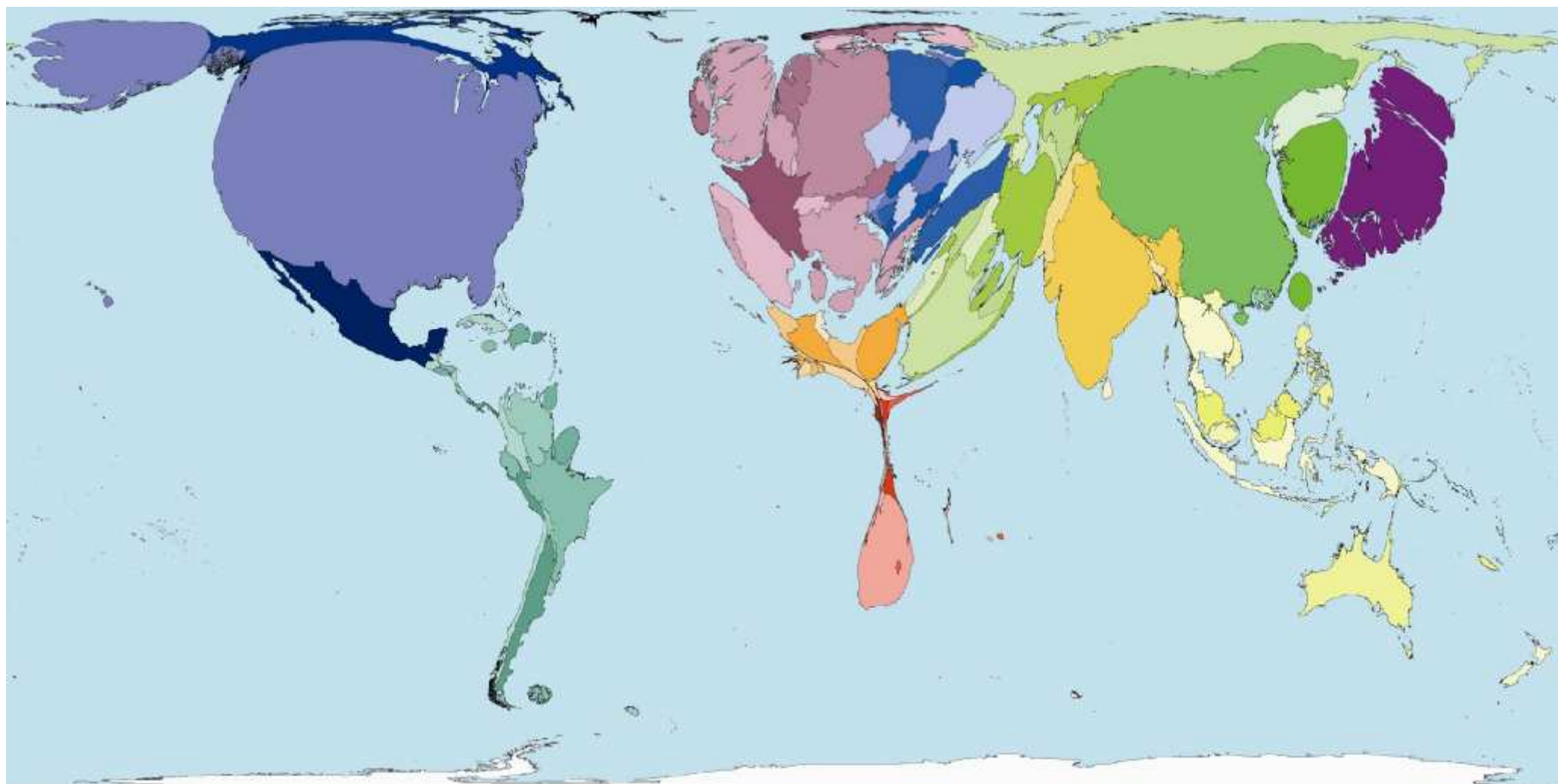


Michel Myhre-Nielsen  
BD Manager CO2  
Statoil New Energy

IEA GHG – Expert meeting on financing CCS projects  
London 31 May – 1 June 2007

# CO2-emissions by country

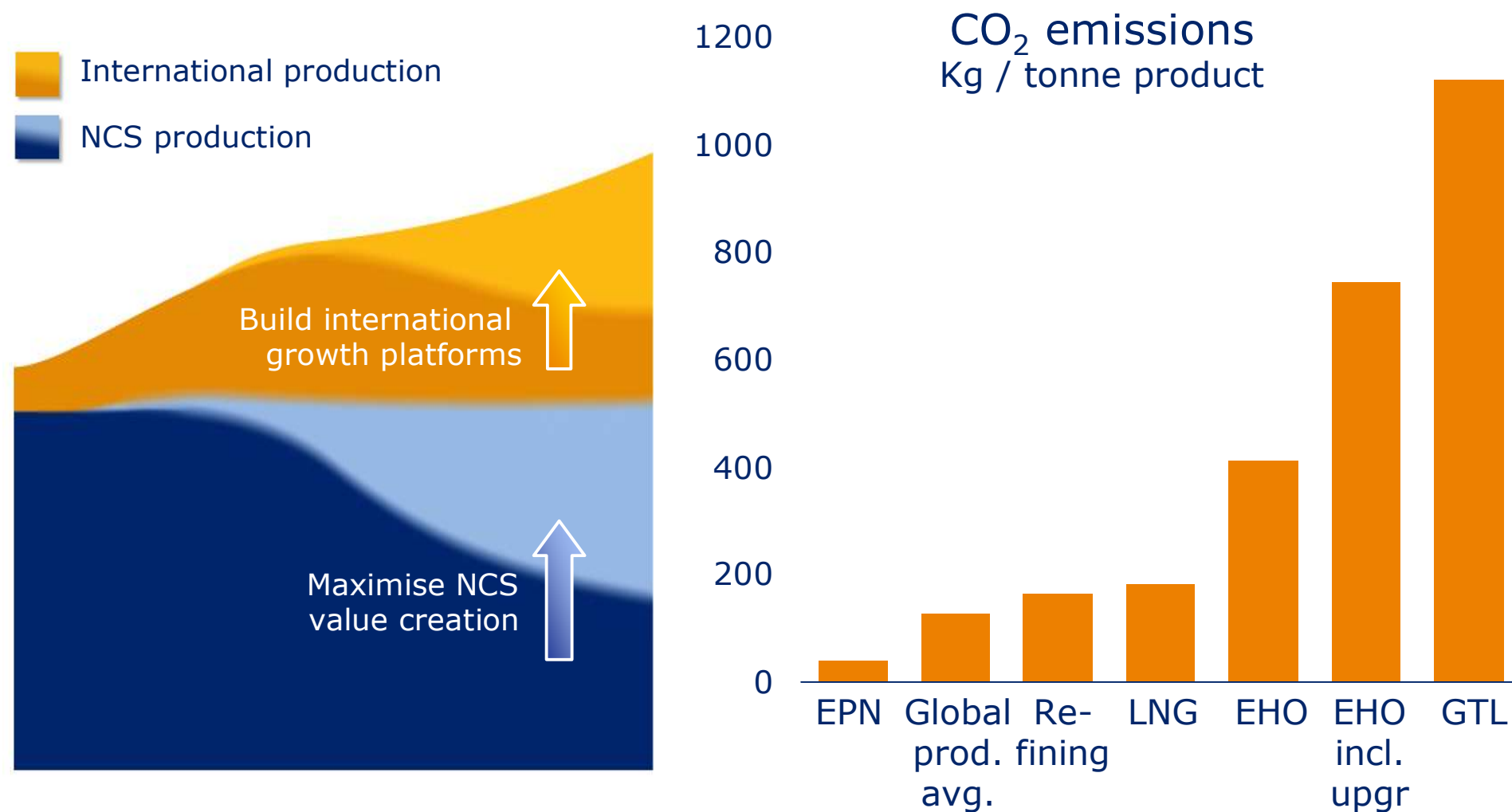
Maps are re-sized to reflect emissions in each country



Source: [www.worldmapper.org](http://www.worldmapper.org)

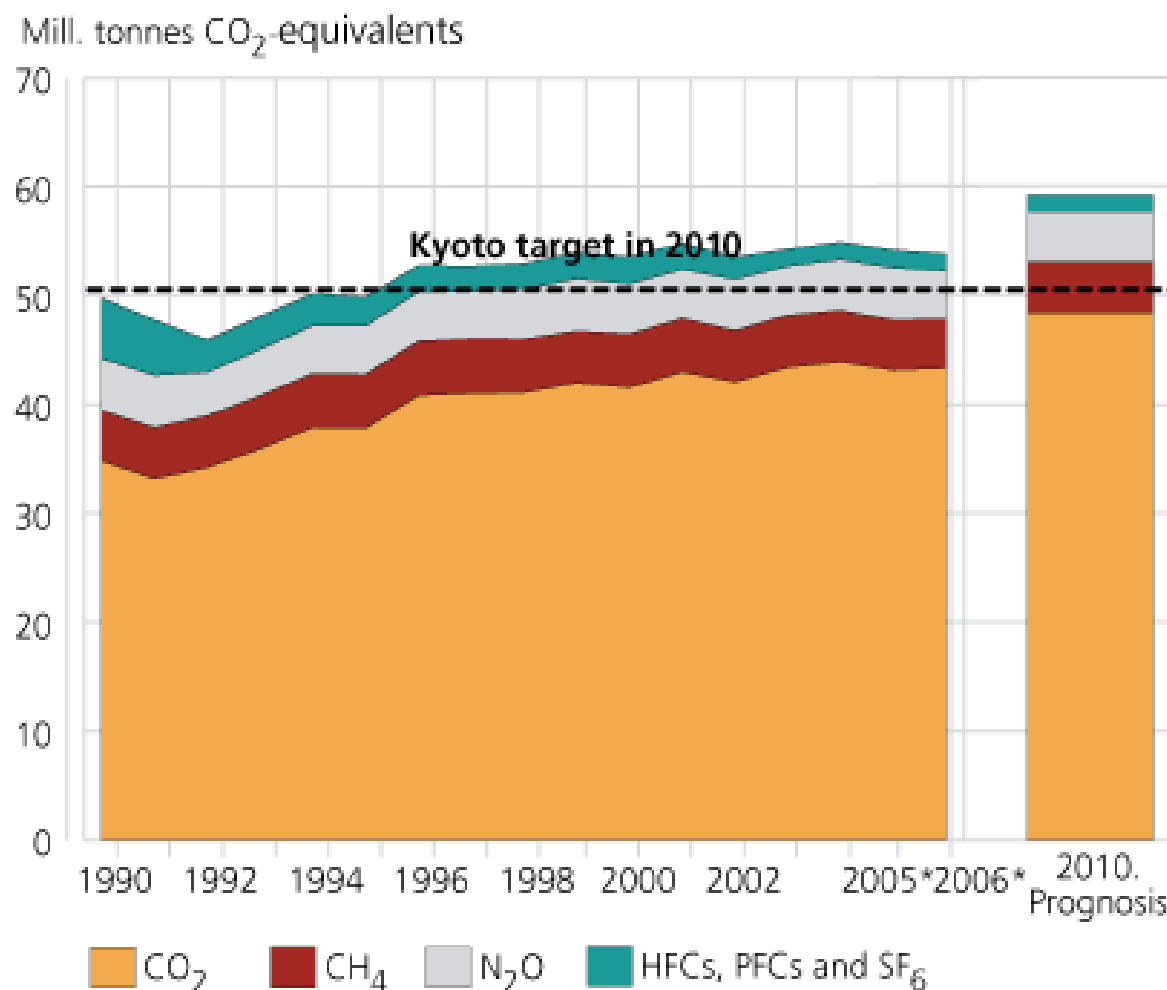
# Statoil's climate challenge

## Increasing and more CO<sub>2</sub> intensive production



# ....and Norway's climate gas challenge

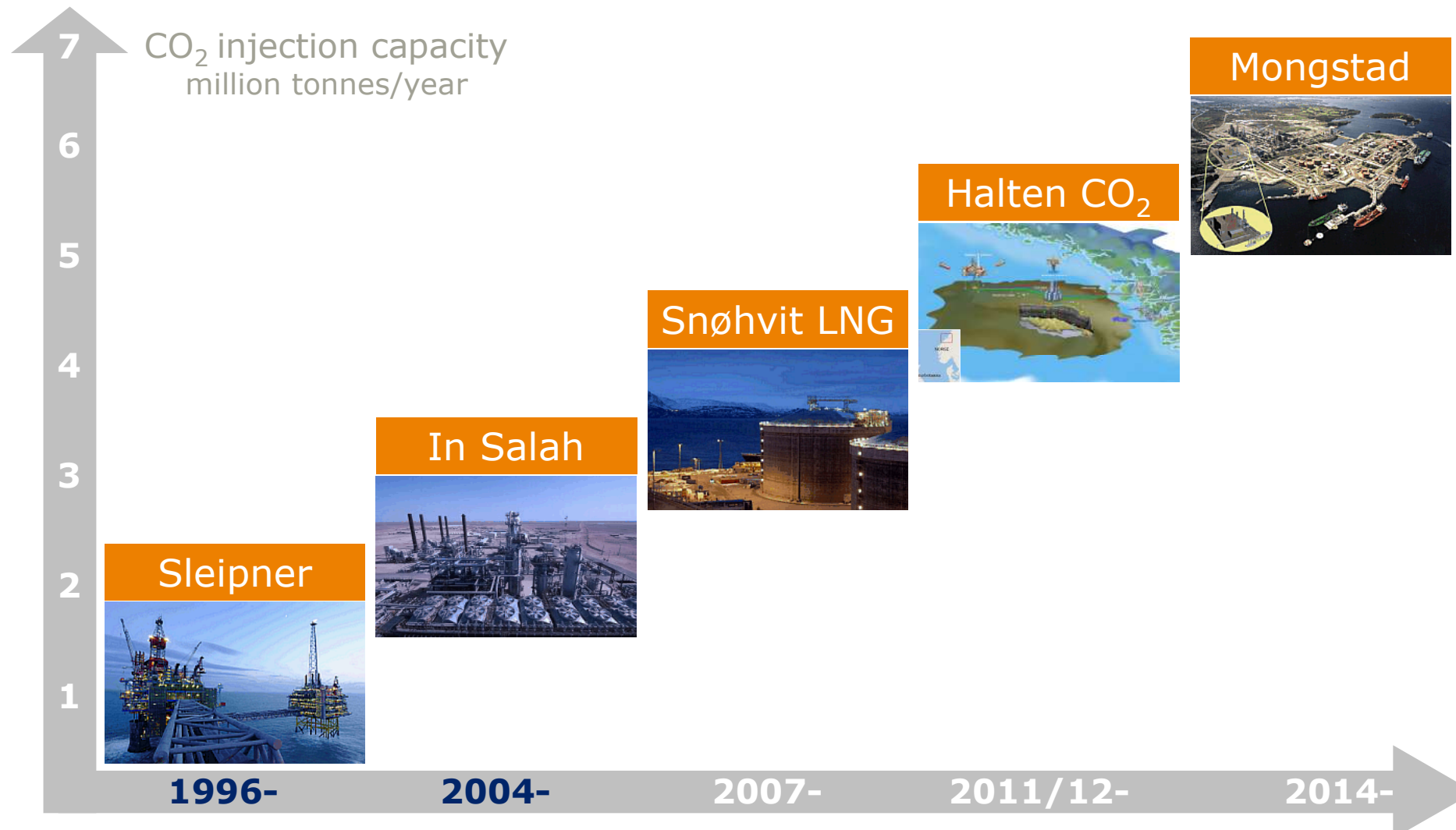
Emissions of greenhouse gases. 1990-2006\* and prognosis 2010.  
Million tonnes CO<sub>2</sub> equivalents



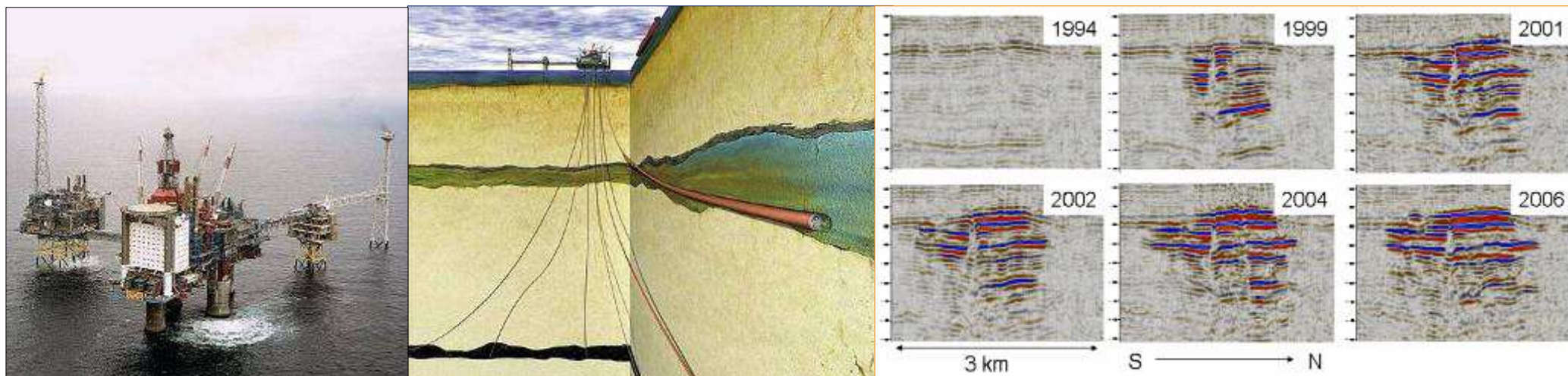
Source: Historical data: Emission inventory from Statistics Norway and Norwegian Pollution Control Authority; Prognosis: Report No. 1 (2006-2007) to the Storting: The National Budget 2007.

# Statoil's CO<sub>2</sub> projects

## An industrial approach to climate change



# 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: CO<sub>2</sub> from natural gas (feed to LNG plant)
  - Separating and injecting 1,2 mill. tons CO<sub>2</sub> annually
  - Injection into reservoir aquifer
  - **Driver:** BP internal quota system?
- Starts in late 2007
  - Statoil with license partners
  - Source: CO<sub>2</sub> from natural gas (feed to LNG plant)
  - Separating, piping and injecting 0,7 mill. tons CO<sub>2</sub> annually
  - Injection below reservoir
  - **Driver:** CO<sub>2</sub> 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



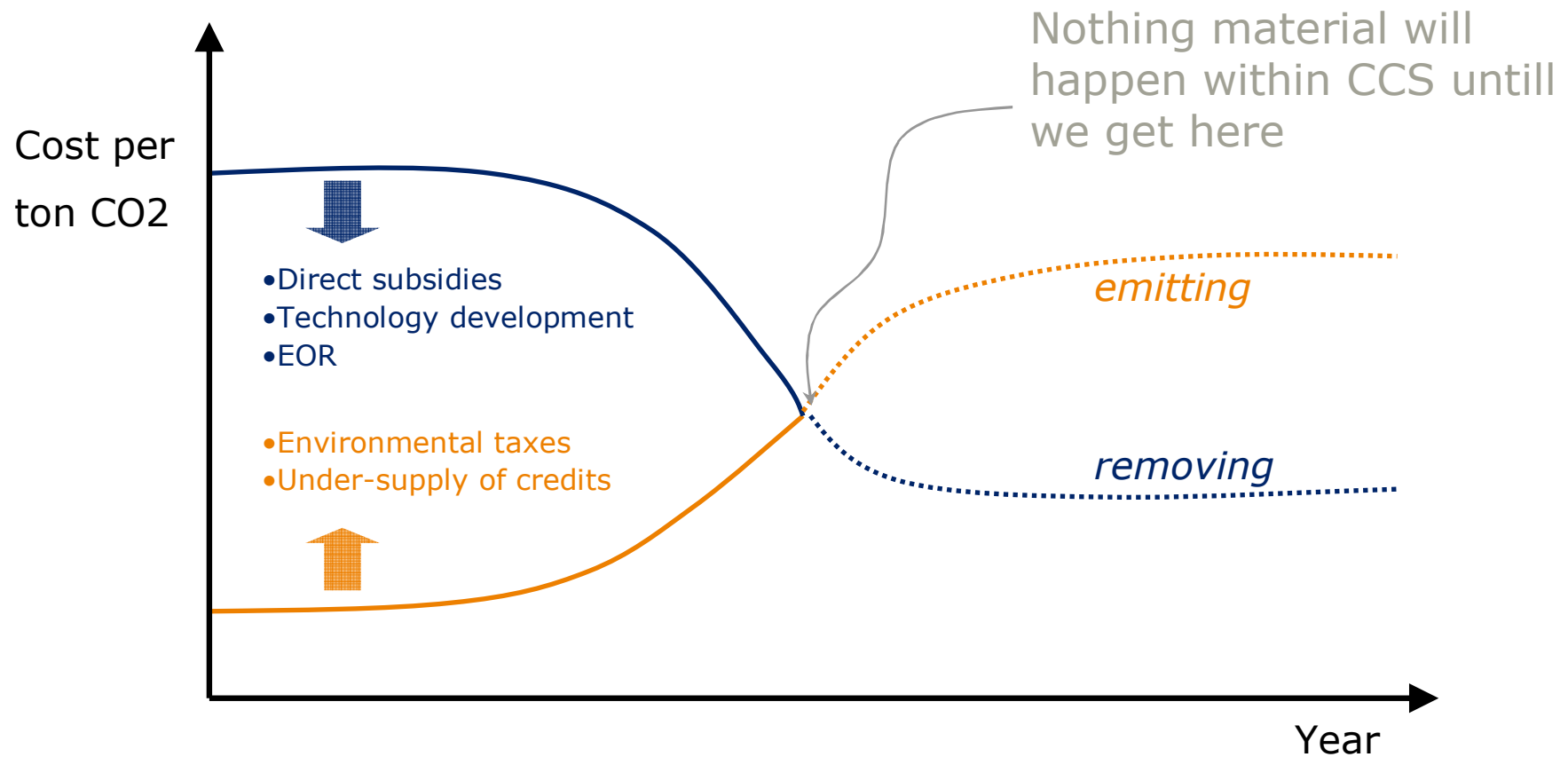
# The Kårstø CCS project

- Starts 2011/2012 if sanctioned
  - Authorities through project dev. group
  - Source: CO<sub>2</sub> from gas power plant
  - Separating, transporting and injecting 1,0 mill. tons CO<sub>2</sub> annually
  - Injection site not yet identified – Sleipner/Utsira studied
  - **Driver:** Environment (environmental politics)
- 
- Feasibility report available for public:  
<http://www.nve.no/FileArchive/447/NVE%20Report%202-07.pdf>



# What does it take?

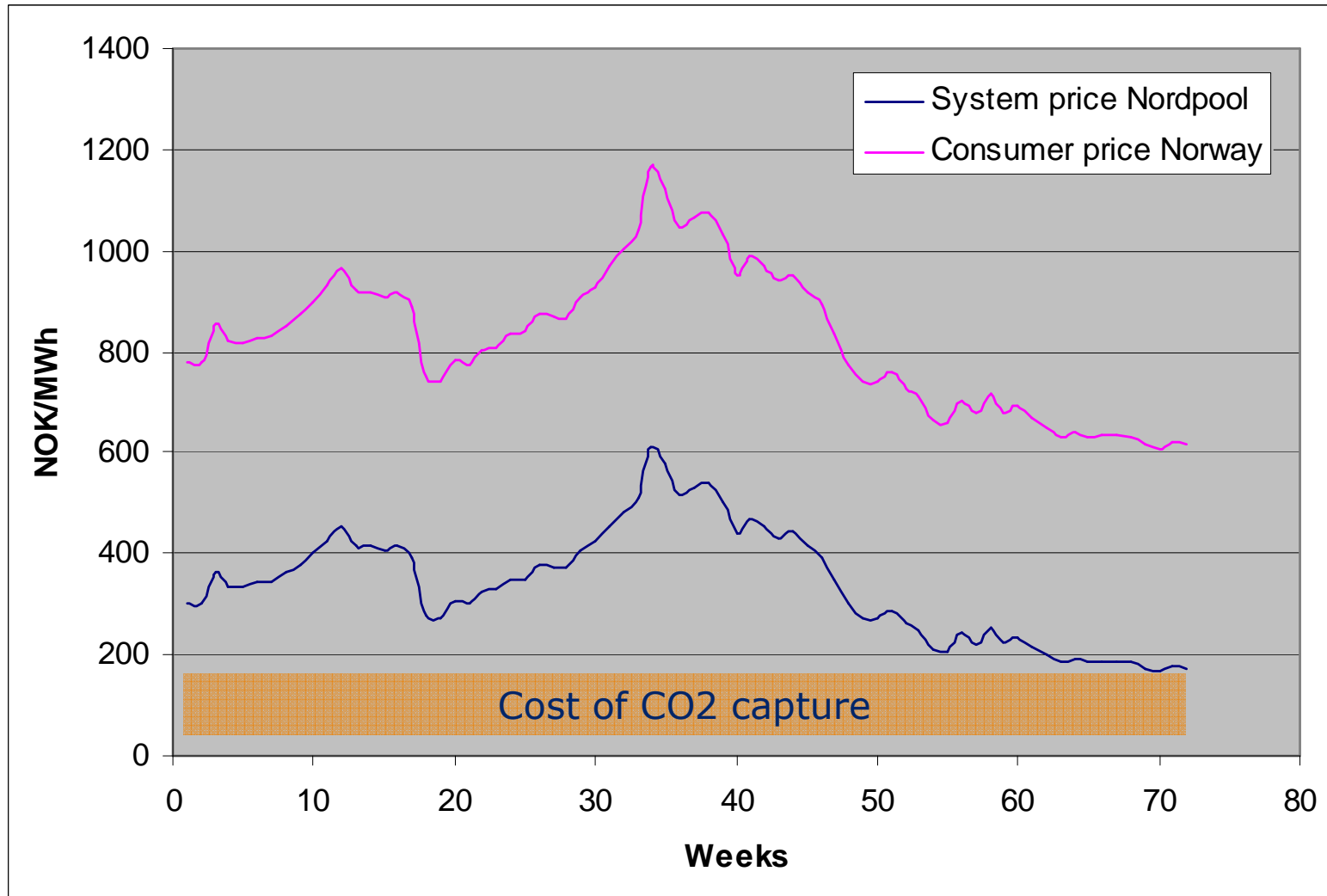
Simple economic rules will decide speed and volume of CCS roll-out



# Incentive toolkit

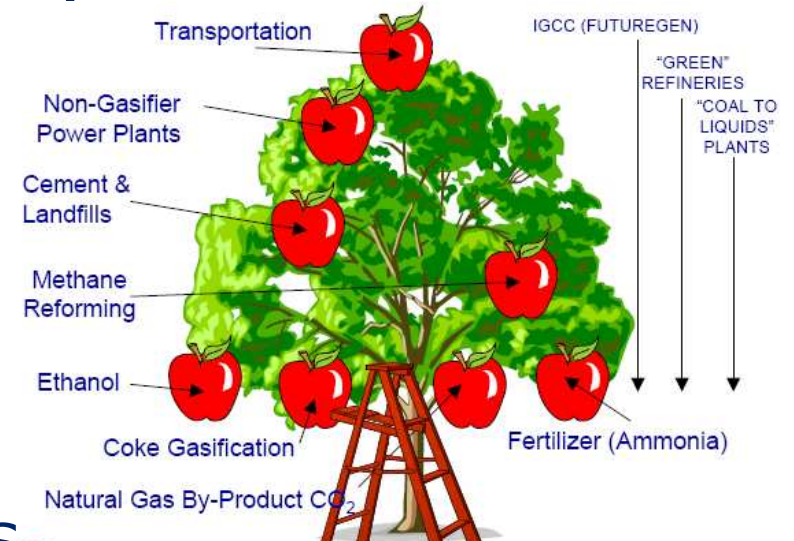
- State direct investment
- Tax and depreciation
- Volume allowance EOR oil
- Credit of socio-economic benefits
- Gas-to-electricity pricing mechanisms
- Introduce/increase CO2 tax

# CO2 capture cost/kWh vs. electricity price

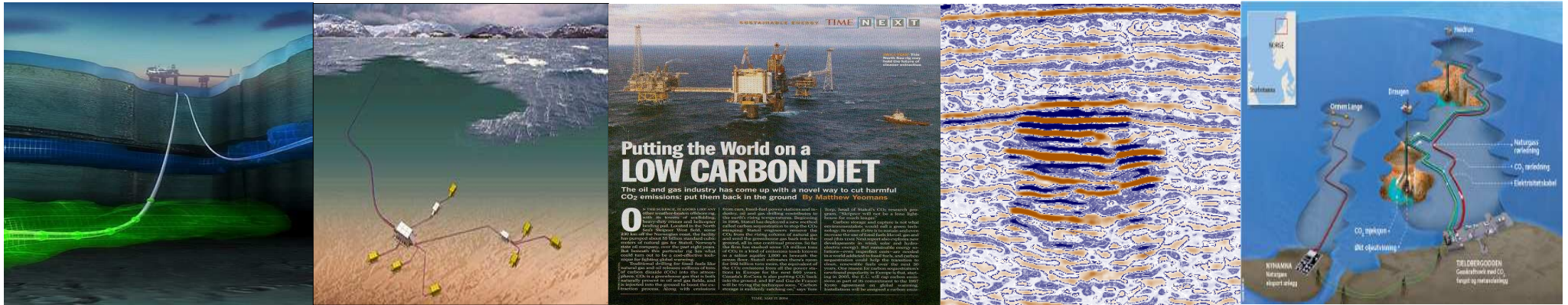


# How to begin the CCS industry

- 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



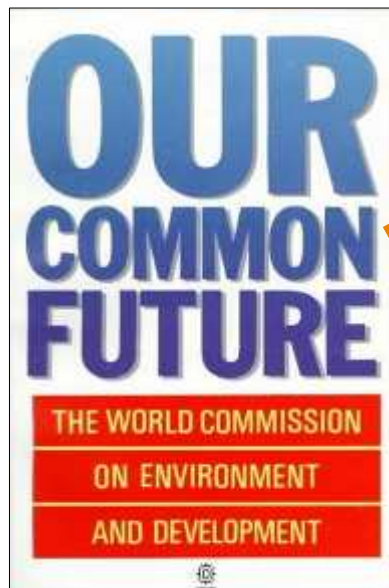
- CCS technically proven
- Enormous potential – public acceptance necessary
- Value chain approach (EOR) can support pioneering projects
- Financial mechanisms key to initiate projects
- Key element in meeting the global climate challenge

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Thanks for the attention!



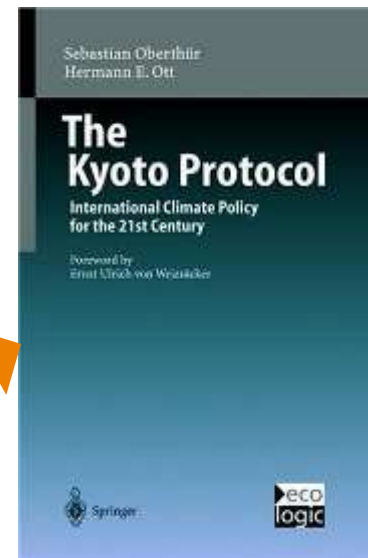
# 20 Year Anniversary for Our Common Future



**"The Brundtland Report", 1987**



**Norway's Prime Minister Gro Harlem Brundtland in Rio in 1992\***



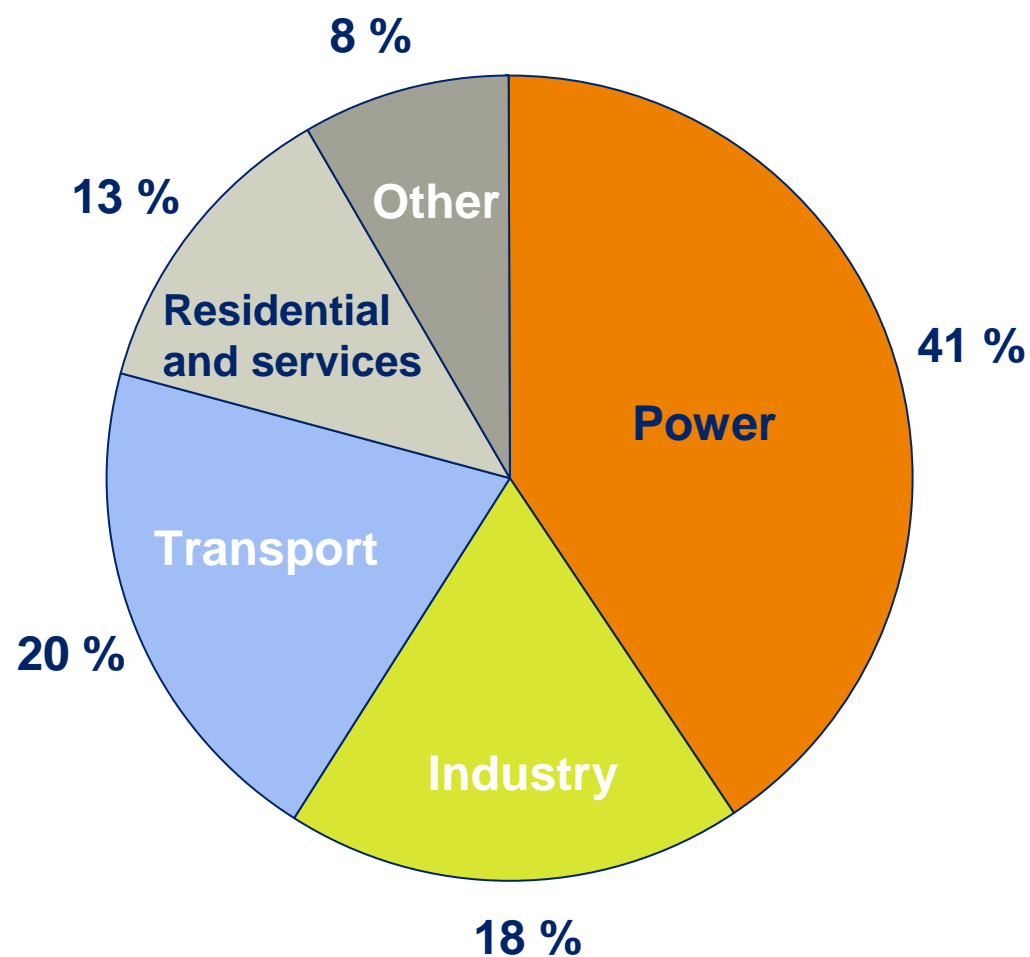
**The Kyoto Protocol, 1997**



**The Kyoto Protocol ratified, 2005**

**\* Gro Harlem Brundtland introduced a CO<sub>2</sub>-tax of about 45 US\$/ton in Norway in 1992**

## World energy-related CO<sub>2</sub>-emissions by sector 2004



Announced projects are not sanctioned before developers see an economic driver in realising them  
Other large CCS-projects internationally\*

**Power plants with CO<sub>2</sub>-capture:**

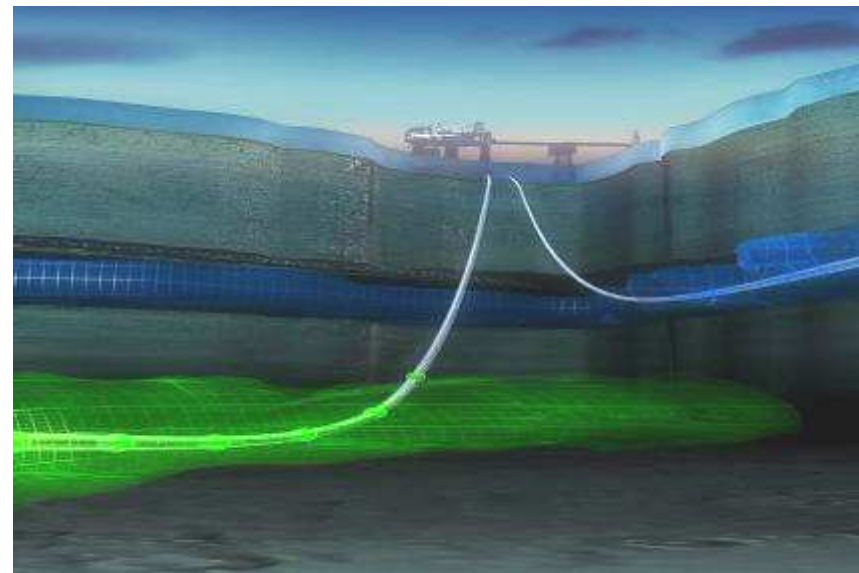
**Proposed full-scale projects**



**15 projects**

**CO<sub>2</sub>-storage projects:**

**Commercial and demonstration**



**7 projects**

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