NORWEGIAN PETROLEUM DIRECTORATE

The hunt for a suitable CO_2 Storage under the North Sea

National and Regional CCS initiatives – the role of the NPD

Norwegian Petroleum Directorate

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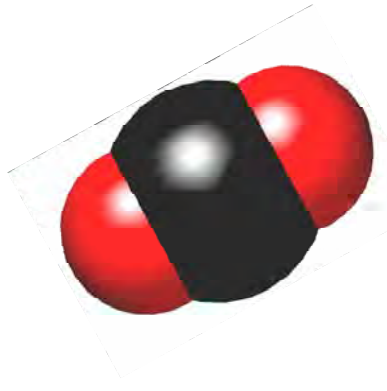


Norwegian Petroleum Directorate, NPD

- established in 1972
- some 200 employees
- reporting to the Ministry of Petroleum and Energy
- overall objective

”The Norwegian Petroleum Directorate shall contribute to ***creating the greatest possible value for society from oil and gas activities by means of prudent resource management****, based on safety, emergency preparedness and safeguarding the natural environment.”*

Petroleum Resource Management - Advisory role

Advisor to the Ministry of Petroleum and Energy (MPE)

The NPD gives professional advice to the MPE on issues in all phases of the petroleum activity. Decisions are taken by the Government and Parliament (Storting).

The Ministry of Petroleum and Energy, MPE, has given NPD a CO_2 mandate

- Consider posibilities and the potensial for safe long-term storage of CO_2 on the Norwegian Continental Shelf
- Compose an ”atlas” for suitable storage reservoirs/sinks and estimation of the storage potensial, as a basis for the authorities decisions
- Chair a steering group for all Norwegian CO_2 storing initiatives

CCS initiatives / projects

- Mapping of possible sinks offshore Norway
- Climate Cure
- One North Sea Initiative

Feasible CO_2 sinks :

Scope

- Safe storage of CO_2
- Storage of CO_2 to be used in possible EOR projects

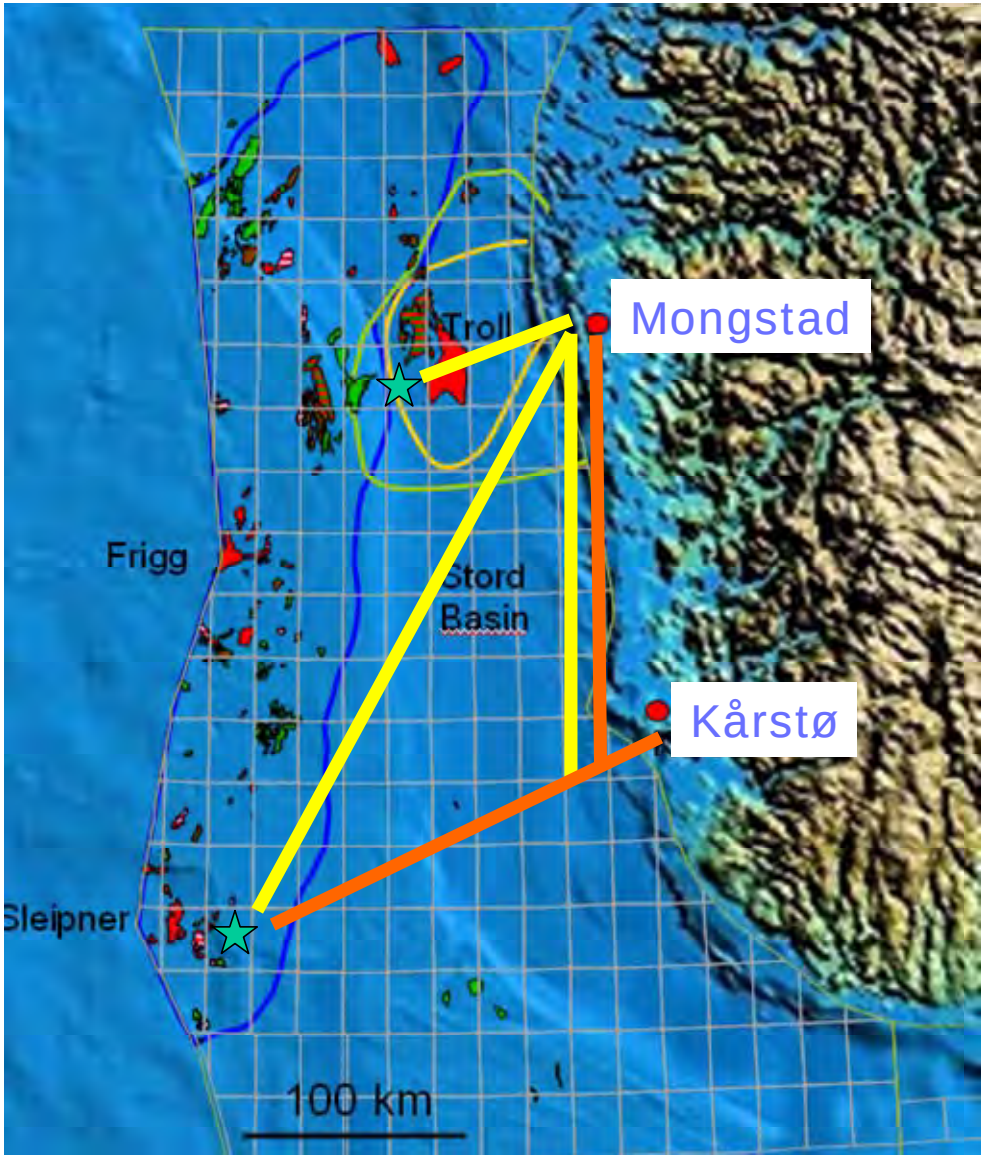
Type

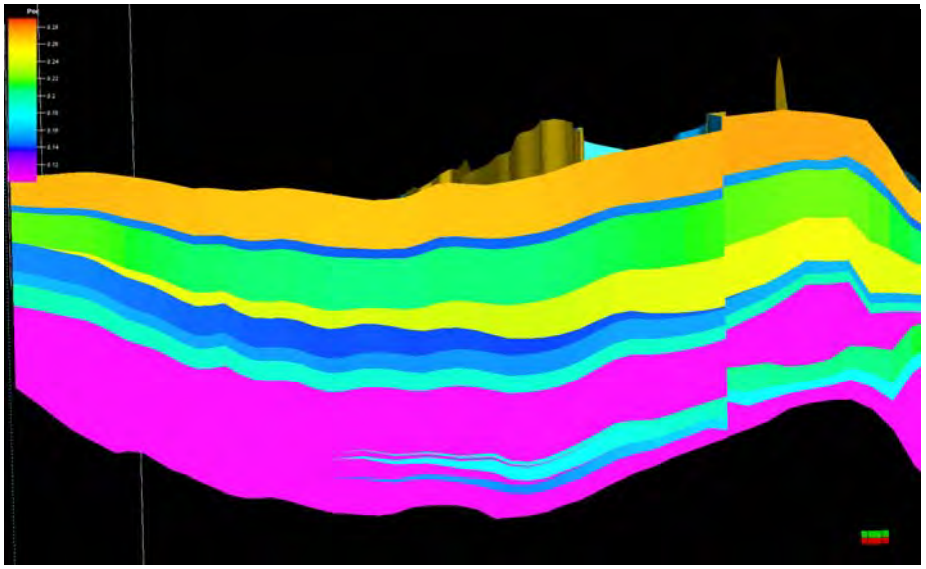
- Saline aquiferes
- Defined geological structures
  - Injection reservoirs identified by dry-drilled exploration wells
- Ceased hydrocarbon fields

Dry and drilled structures

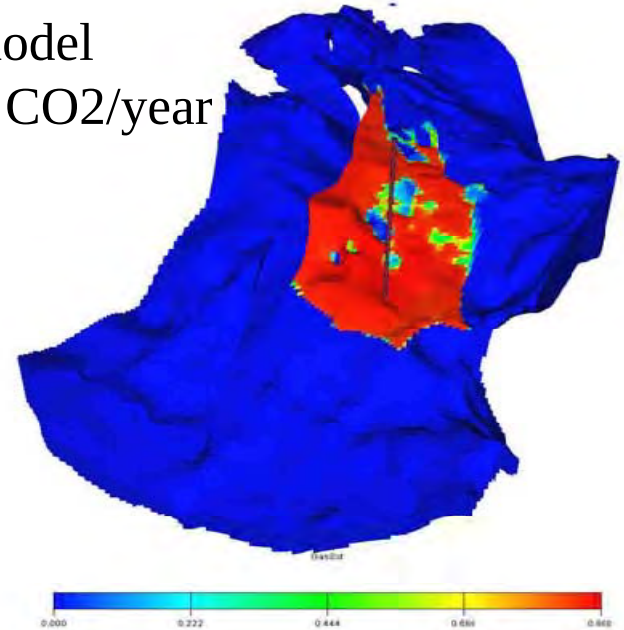
- Norways exploration history shows 50 % success fra appr. 2000 wells!
- That's 50 % structures that are empty
- Several of these structures can keep CO_2!
- The NPD are now mapping these structures
  - Geographical position and proximity to infrastructure
  - Storage capacity

Example: Storing of CO_2 from European Test Lab at Mongstad. Johansen formation (saline aquifer)





Simulation model
3 mill tonnes CO2/year
In 110 years



One North Sea - objective

- **Initiated** by the Norwegian and UK Energy Ministers in May 2009
- **Identify** the **storage potential** in the North Sea (Norway and UK)
- **Estimate** a likely CO_2 **storage need** for Europe
- **Identify** challenges with regard to **transport** of CO_2 across countries
- **Optimize** CO_2 transportation **infrastructure**

UNITED KINGDOM

The UK has a legally binding target of at least an 80 % cut in greenhouse gas emissions by 2050, to be achieved through action in the UK and abroad, as well as a reduction in emissions of at least 34 % by 2020.[1]

The UK is one of the first countries to undertake a CCS competition to demonstrate 300MW net post-combustion capture on a coal power plant in 2014.

The UK has also implemented a Carbon Capture Readiness policy for all new large combustion plant and is undertaking consultations on:

- Proposals for a framework for the development of clean coal, including inter alia: providing financial support for up to four commercial-scale CCS demonstrations in Britain requiring any new coal power station in England and Wales to demonstrate CCS on a defined part of its capacity and requiring new coal power stations to retrofit CCS to their full capacity within five years of CCS being independently judged technically and economically proven.
- Proposals for an offshore carbon dioxide storage licensing regime.

Regional consortia are examining CCS infrastructure potential for the Yorkshire and Humber region and for Scotland.

[1] Against a 1990 baseline.

NETHERLANDS

The Ministries of the Environment and Economic Affairs have published "An agenda for 2007-2020 to make CCS work". In June 2009 the Cabinet of Ministers sent a CCS Policy Letter to Parliament on the usefulness and necessity of CCS for climate change policy and on financial issues and CO_2 infrastructure.

CATO and CATO-2, co-ordinated by Utrecht University and TNO are ambitious research and development programmes on all aspects of CCS.

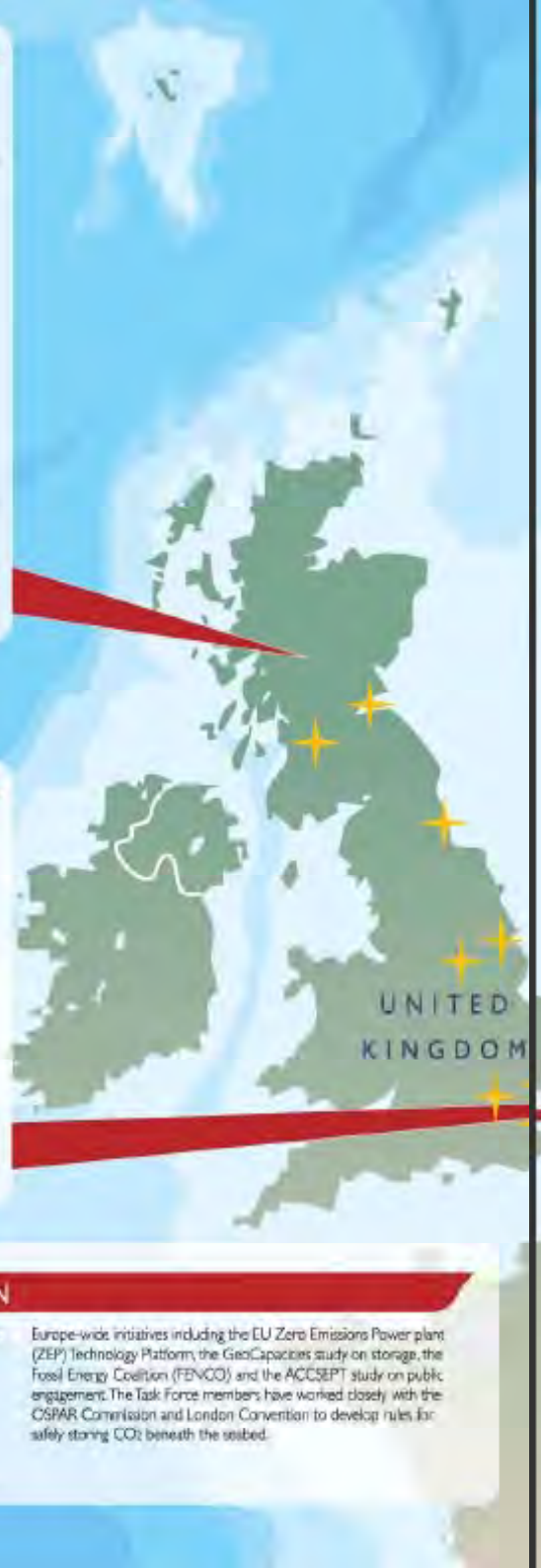
The Rotterdam Climate Initiative has carried out an analysis for a full chain business case and network approach for CCS.

In realising one of the European CCS demonstration projects, the Northern Netherland presented an Action Plan in February 2009. Three techniques for capturing CO_2, combined with transport and exploration of storage possibilities, have been presented in an integrated business case.

INTERNATIONAL COORDINATION

The Task Force is developing recommendations on site risk assessment and qualification and on monitoring, verification, accounting and reporting guidelines.

Task Force countries are working closely together on international activities to optimise CCS deployment. These include the Carbon Sequestration Leadership Forum (CSLF), the International Energy Agency (IEA), the Global CCS Institute (GCCSI), as well as Europe-wide initiatives including the EU Zero Emissions Power plant (ZEP) Technology Platform, the GeoCapacities study on storage, the Fossil Energy Coalition (FENCO) and the ACCSEPT study on public engagement. The Task Force members have worked closely with the OSPAR Commission and London Convention to develop rules for safely storing CO_2 beneath the seabed.



NORWAY

Norway's ambition is to reduce its greenhouse gas emissions by the equivalent of 30% of its own 1990 emissions by 2020.

The Sleipner and Snøhvit CCS projects are separating and injecting CO_2 into deep saline aquifers for long term monitoring and storage.

The Ministry of Petroleum and Energy has established the CLIMIT Programme and the Gassnova company to stimulate CCS research and deployment.

The European CO_2 Technology Centre Mongstad (TCM) is under construction. The primary objective is to develop, test and qualify new CO_2 capture technologies with the aim to reduce costs and risks associated with large-scale CO_2 capture plants.

The Norwegian Petroleum Directorate is mapping possible storage sites on the Norwegian Continental Shelf.

Det Norske Veritas is investigating common standards and specifications for CCS infrastructure.

GERMANY

The state of development and perspectives of CCS-technologies in Germany were summarized in a cabinet report published in September 2007.

Support for further research and development including demonstration projects is given by the "Integrated Energy and Climate Package" which aims to deliver a cut in CO_2 emissions against a 1990 baseline of at least 30%.

Two research and development programs – COORETEC (CO_2-reduction technologies, www.cooretec.de) and GEOTECHNOLOGIEN (www.geotechnologien.de) – are focussed on the development of low emission power plants based on fossil fuels. COORETEC is focussed on power plant technologies including CO_2 capture. GEOTECHNOLOGIEN focuses on the long-term safe and environmentally friendly CO_2-storage and corresponding storage technologies.

Several pilot plants are already testing capture technologies (Oxyfuel and Postcombustion) at small scale. Storage is tested within the European research project CO2SINK (www.co2sink.org) at the Ketzin test site in Brandenburg and the storage potential is analyzed by the Federal Institute for Geosciences and Natural Resources (BGR) and the Geological Surveys of the Federal States. National partners and BGR commenced in 2008 the project "Geo-Potential of the German North Sea sector" which includes a detailed estimation of storage capacities.

Climate Cure - a Government initiative

- **NPD's CCS mandate**
  - Describe how CCS can contribute to reach the Norwegian political goal of 30% reduction of CO_2 emission by 2020.

Major Norwegian CO_2 emission sources and possible sinks

Possible sinks

CO2 emission sources

The Norwegian pipeline infrastructure

Evaluate the possibilitiy of using some of the pipelines for CO_2 transport

Deliverables

- One North Sea Objective
  - Report February 2010
- Climate-Cure 2030
  - Final report February 2010
- Atlas for possible storage sites offshore Norway
  - Release 2012, NPD web

Summary

- CCS high political priority
- Mapping and qualifying of possible offshore CO_2 storage high priority in NPD
- Provides storage sites for both Norwegian and European emission sources
- Challenge to meet public resistance to onshore storage
- Broader public acceptance for offshore storage

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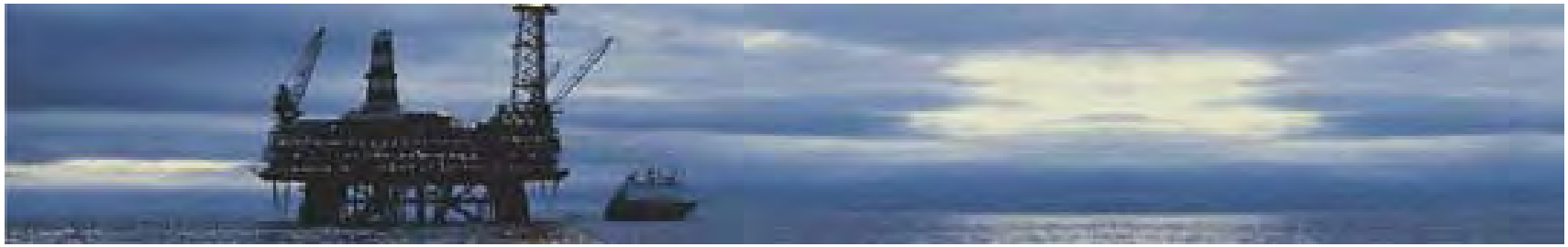
Thank you for your attention!



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