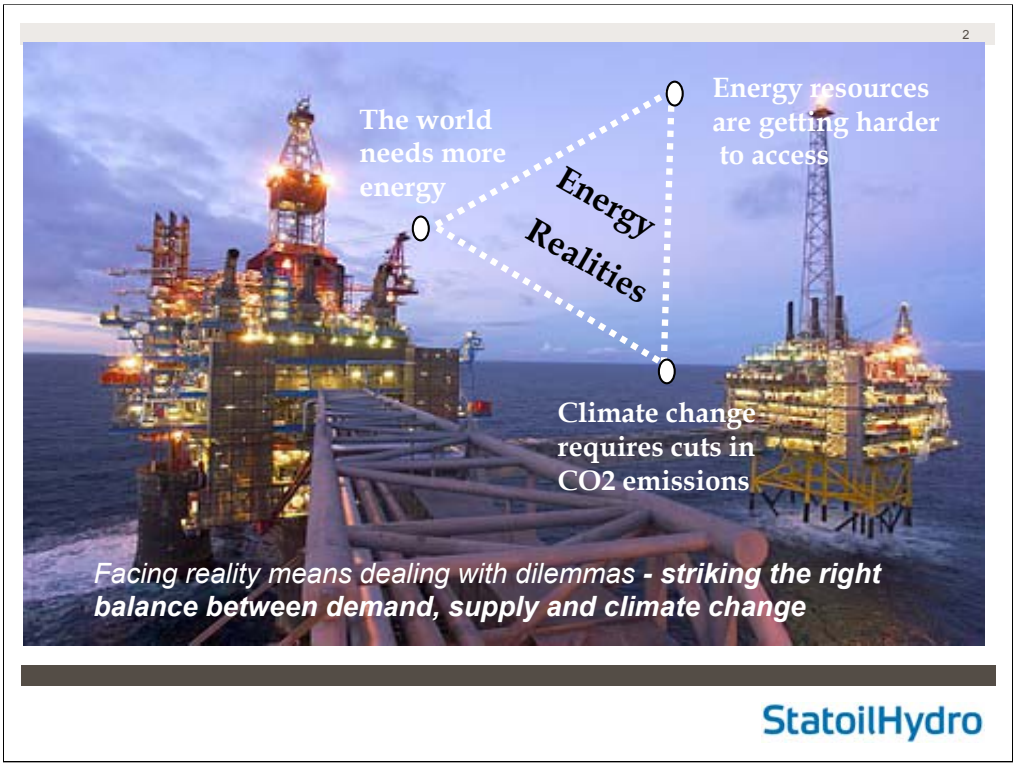
Towards a Low-Carbon Future: the Role of CCS

India-Europe Business Partnership Summit

Brussels, 2 October 2009

StatoilHydro



•Demand for energy is expected to expand by 40-50% over coming decades, driven primarily by population growth and by the general increase in prosperity. Access to energy is essential for economic development. A rising population creates a greater need for lighting, heating, transport, industrial production and so forth. More than 1.5 billion people currently live without electricity. That calls for access to energy at an affordable price.

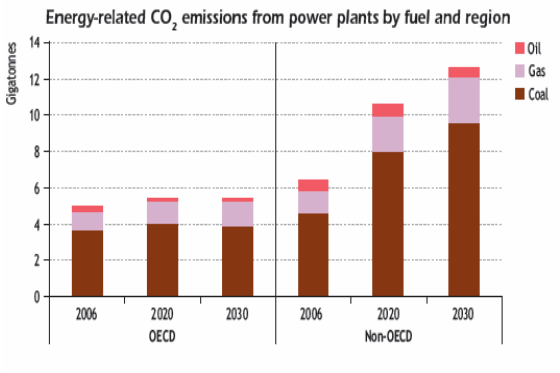
•Hydrocarbons will dominate energy mix in decades to come (see next slide)
The challenge is how this energy can be developed and produced, and at the same time limit carbon emissions.

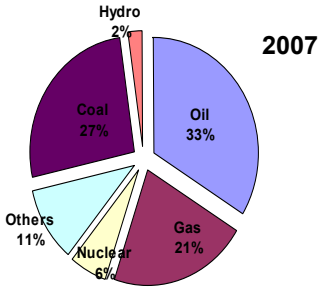
•Scale of challenge requires all options

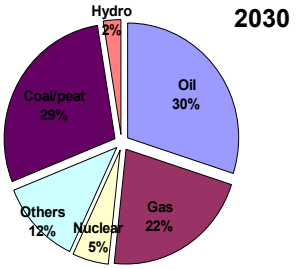
Energy efficiency is one important tool. Other necessary tools for transition to a low carbon society include CCS, fuel-switching (e.g. to natural gas) and renewables. By combining renewables and fossil fuels (e.g. wind+natural gas) the renewable potential could be increased.

The World Energy Mix 2007 vs. 2030 (IEA WEO 2008)

The world will remain highly dependent on hydrocarbons for decades to come







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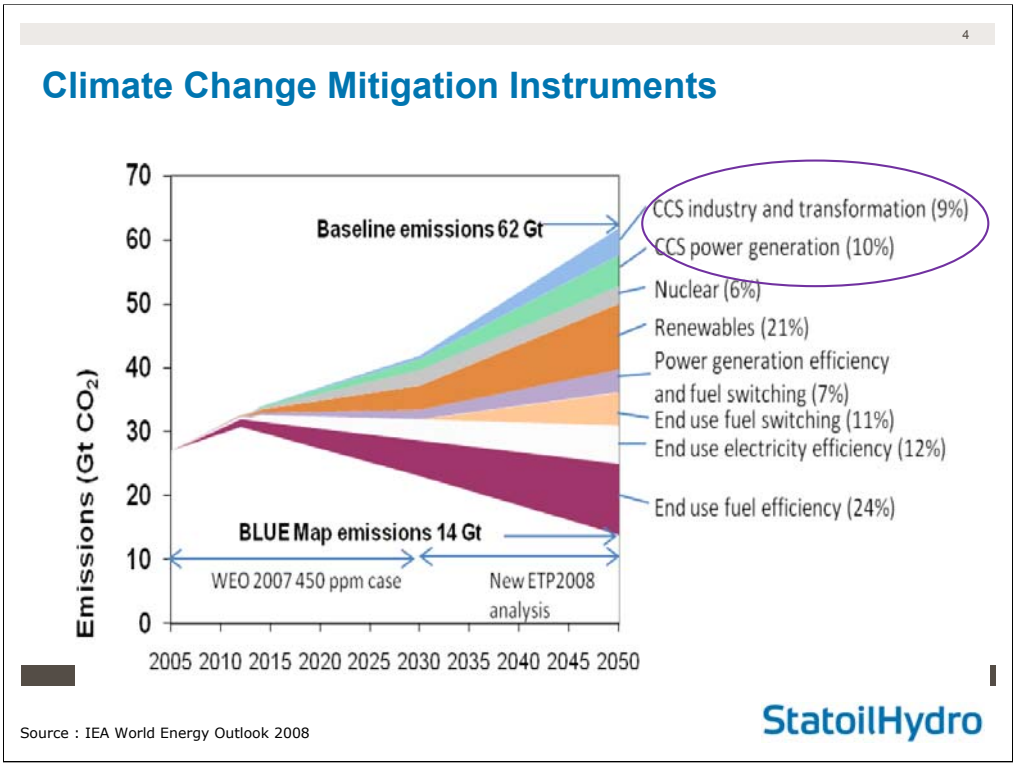


CCS will have to deliver almost 20% of the total reductions that we need to achieve in 2050 if we want to cost-effectively stabilise GHG concentrations in the atmosphere at an acceptable level.

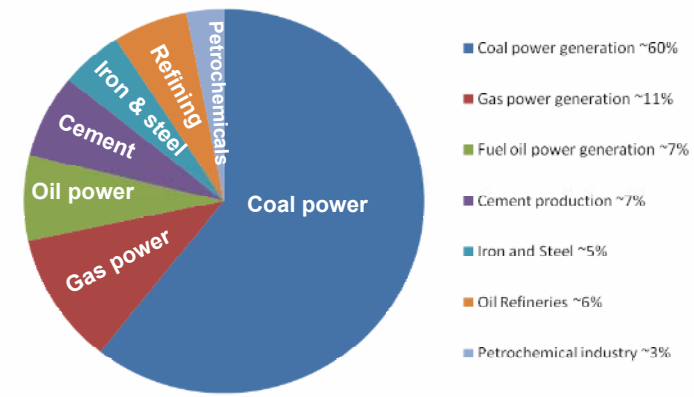
Prognosis from International Energy Agency's perspectives towards 2050.

CCS is one out of several tools in the tool-box

This climate change tool-box contains the 5 real options for climate change mitigation

1. Use less energy through
    - Reduced consumption (do without)
    - Use energy more efficiently (less thirsty cars etc.)
    - Convert energy more efficiently along the chain (i.e. electricity generation)
2. Fuel switching from high to lower carbon fuels
3. Renewables: Wind, sun, geothermal, bio etc.
4. CO2-storage underground (CCS)
5. Nuclear power

The CO2 Challenge and the Potential of CCS



- **56% of all man-made CO2 emissions**
- **About 7500 large[1)] point sources in industry**

1) Point sources larger than 0,1 million tons/yr CO_2

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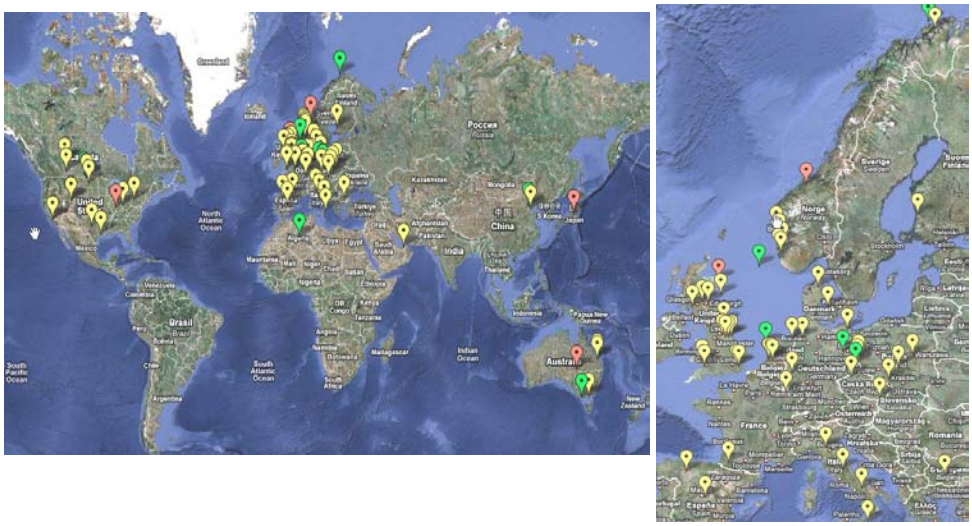
Rising to the Challenge – Planned CCS Projects



Map credit: (www.geos.ed.ac.uk/ccsmap)

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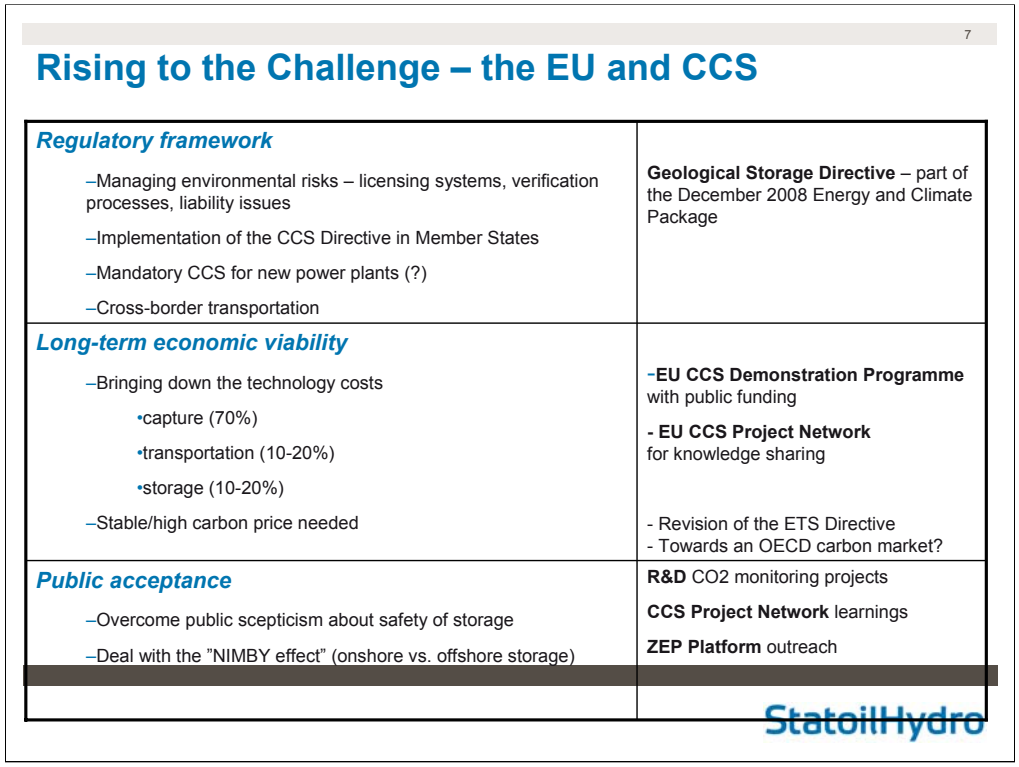
This map from the Scottish Centre for Carbon Storage shows commercially significant CCS sites (planned or operational) around the globe. The map focuses on proposed full scale or ”large” CCS sites around the world. *”Large*' refers to the amount of CO2 that is planned to be injected. Any site planning on injecting over 700,000 tonnes CO2 per year has been included

Green indicates sites which are currently injecting CO2

Yellow indicates planned CCS sites. Generally plan on injecting at least 700,000 tonnes CO2 per year.

Red indicates sites which have been cancelled or have completed injection.

There are numerous aspiring CCS projests in EU in particular but also globally. The question is how many will go ahead?



Importance of CCS for the EU

- •CCS in international climate negotuations: CCS should be part of a climate deal – Commitment to cooperate with developping countries: transfer of technologies
- •Opportunities for European industries
- •Research programme for CCS since 1980's

CCS Directive agreed in December 2008. Sets the legal framework for CO2 geological storage in the EU and EEA

- Rules for managing environmental risks
- Changes to existing legislation and use of existing frameworks
- Exploration permits, storage permits, CO2 stream, leakages, closure and post-closure obligations by operators, transfer of responsibility
- Enabling framework – Member States decide where and when, companies decide on the basis of carbon market

Review in 2015, possible mandatory CCS or EPS (Emissions Performance standard)

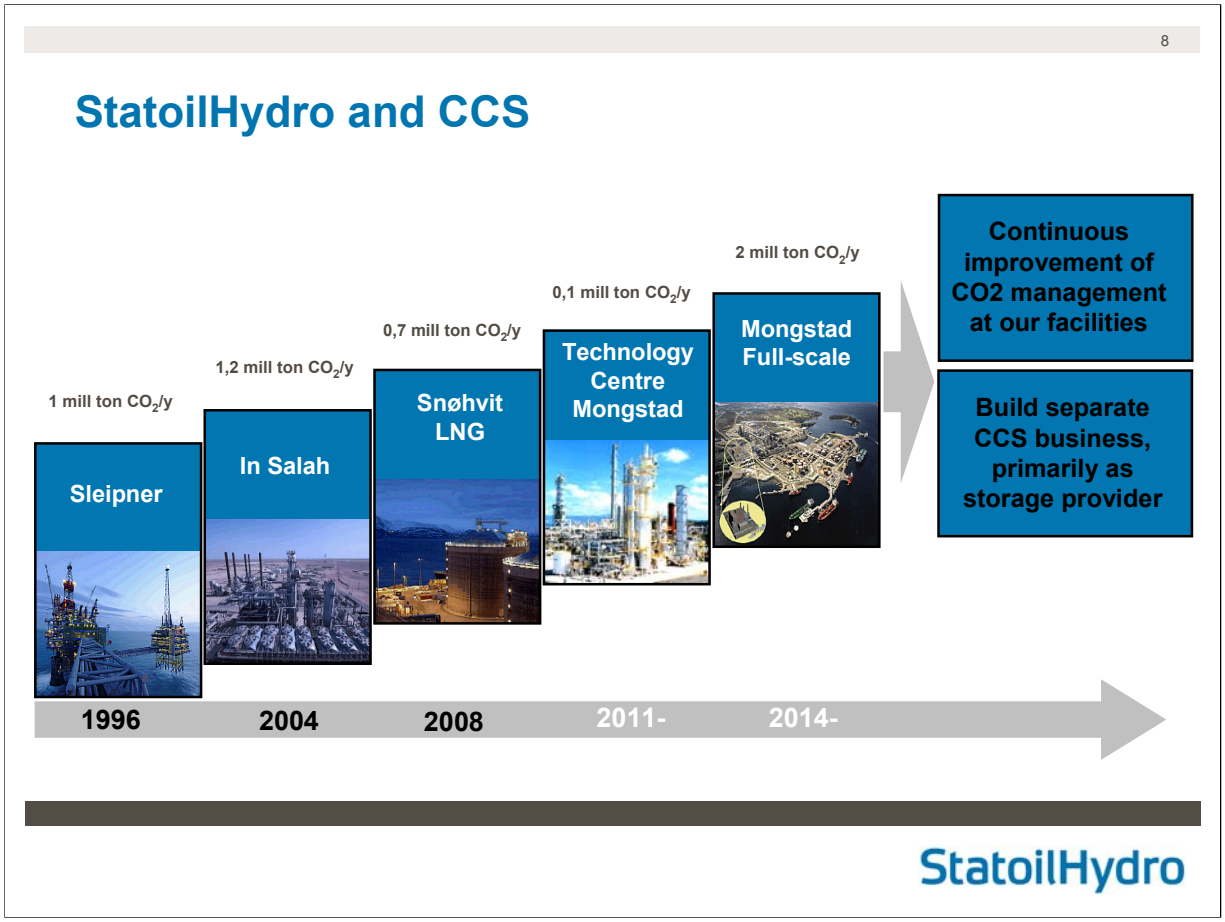
EU CCS Demonstration programme (up to 12 CCS projects)

Projects will be financed via two mechanisms:

1,05 billion for CCS in economic recovery package

300 million EUAs for demonstration projects

CCS Project Network (to be established before end 2009): knowledge sharing network led by Den Norsk Veritas (projects that are not funded by the EU can also participate within this network)



There are only four large and some smaller CO2-storage projects in operation.
All these projects are related to different types of gas production.

1. **StatoilHydro operated Sleipner** in Norway mentioned previously

2.BP operated In Salah in Algeria – where StatoilHydro is a partner.
Objective: Towards 1 million tons/yr CO2-injection
Operating successfully from 2004
CO2 extracted from natural gas

3. StatoilHydro operated Snøhvit – it is the worlds first LNG plant with CCS
The CO2 capture and storage part of the plant has been operating since April last year
CO2 is transported back to the storage formation in a 152 km pipeline lying on the sea floor

4. StatoilHydro capture from flue gas project

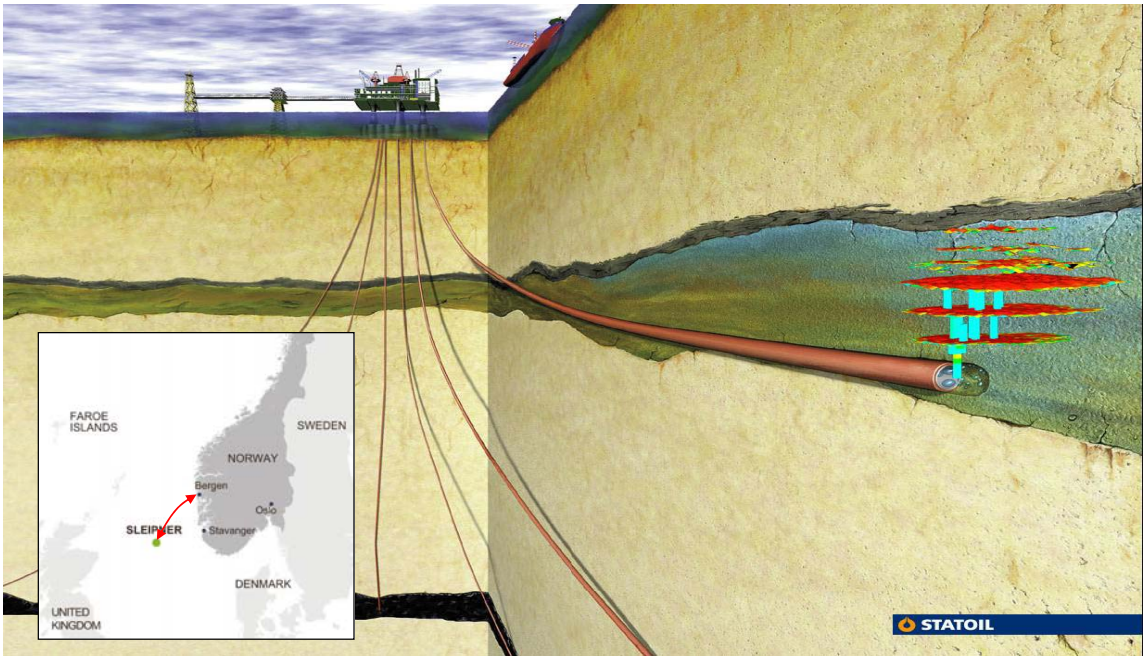
StatoilHydro has now decided to further develop its CCS expertise by launching, in cooperation with the Norwegian government, a project of CO2 capture from the flue gas of a large scale gas fired power plant.

In 2006, Statoilhydro and the Norwegian government signed an agreement concerning **a two-stage process developing CCS from a combined heat and power (CHP) station and a refinery** at Mongstad, just north of Bergen, in Norway. The project calls for the addition of a (CHP) station to existing refinery facilities, enhancing the efficiency of the plant.

In the first stage Statoilhydro is taking part in a group of companies developing **the European CO2Test Centre (TCM)** To ensure that findings from the TCM have the broadest possible relevance, plans call for carbon capture to be tested from two flue gas sources using two different technologies. One of these technologies is amine-based, while the other rests on carbonate. Due to operate independently, the two carbon capture facilities will be able to capture flue gases from Mongstad's CHP as well as the refinery cracker. The facility will have an annual capacity for capturing about 100,000 tonnes of carbon dioxide and is due to be ready by 2012.

In a latter stage, Statoilhydro and the Norwegian government also plan to establish a **full-scale**

The Sleipner CO2-injection



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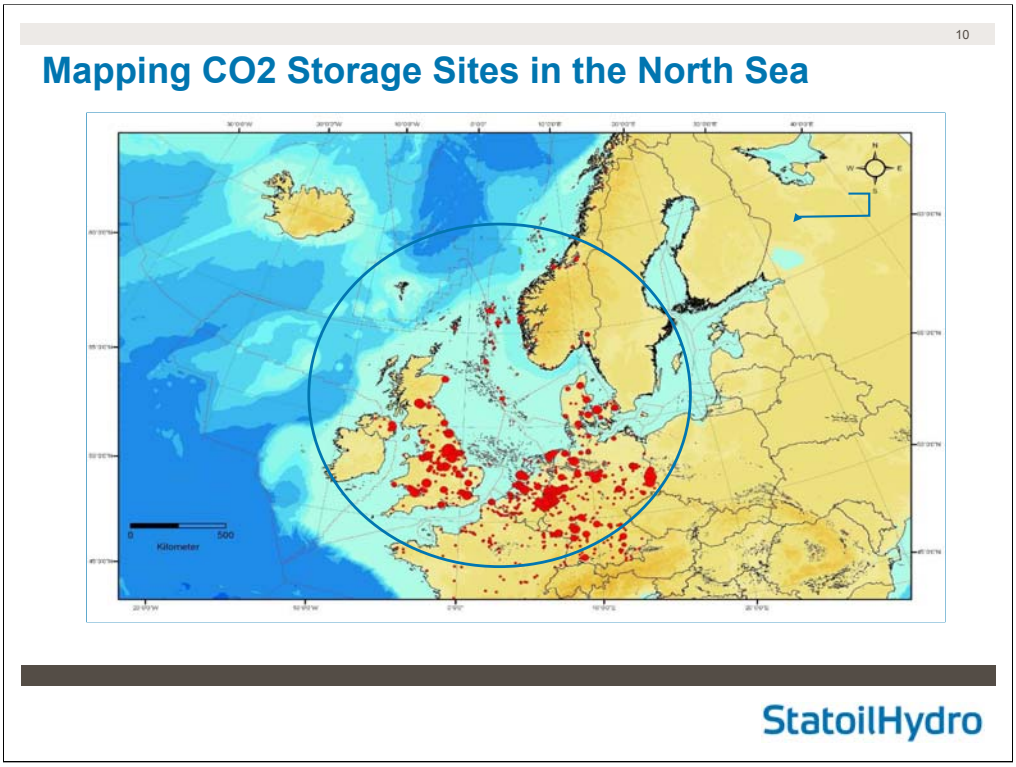
On the basis of StatoilHydro's experience and know-how in relation to oil and gas reservoirs, we are currently operating three large-scale commercial projects involving carbon capture from natural gas with varying degrees of maturity: **The Sleipner** area in the North Sea; **Snøhvit** LNG production in northern Norway; **In Salah** in Algeria. In all of these projects carbon dioxide is captured using a conventional amine process and stored in geological layers. The Norwegian CO2 cost of approximately €40 per tonne of CO2 including CO2 tax and climate quota costs, makes the CCS process cost-effective.

StatoilHydro operated Sleipner in Norway,

The StatoilHydro-operated Sleipner field is a large oil & gas producer in the Norwegian sector of the North Sea. The daily gas export expected for 2009 is 24 million cubic metres and 4 000 Sm3 of light oil. The CO2 is stored in a deep saline aquifer over 800 metres below the seabed. Since 1996, 1 million tonnes/year of CO2 have been captured and stored in the Utsira geological formation



The injections at Sleipner, In Salah and Snøhvit has already given extensive knowledge on the behaviour of CO2 in the subsurface, and improved methods to monitor this.

In Snøhvit for example, a separate monitoring programme has been established to examine how carbon dioxide behaves in the reservoir. This programme is partly financed by the EU.

StatoilHydro will nevertheless carry on its significant R&D efforts on CO2 Storage addressing storage capacity assessments, and better understanding, modelling and monitoring of CO2 flow within the underground in order to strengthen its expertise on storage. In this perspective StatoilHydro is now starting a mapping programme of storage sites within the North Sea area.

Potential of storage under the North Sea: (article http://www.telegraph.co.uk/earth/earthnews/6231646/North-Sea-could-store-100-years-worth-of-carbon-dioxide.html)

Ed Miliband last week : "There's enough potential under the North Sea to store more than 100 years worth of CO2 emissions from the UK's power fleet,"

"We are also working closely with Norway and other North Sea Basin countries to ensure the North Sea fulfils its potential in the deployment of CCS in Europe.

"We want to get the UK regulatory framework in place so we can harness that potential and make the North Sea part of the CCS revolution."

He warned that without CCS, which could cut up to 90 per cent of emissions from fossil-fuelled power plants such as coal-fired stations, there was no solution to climate change.