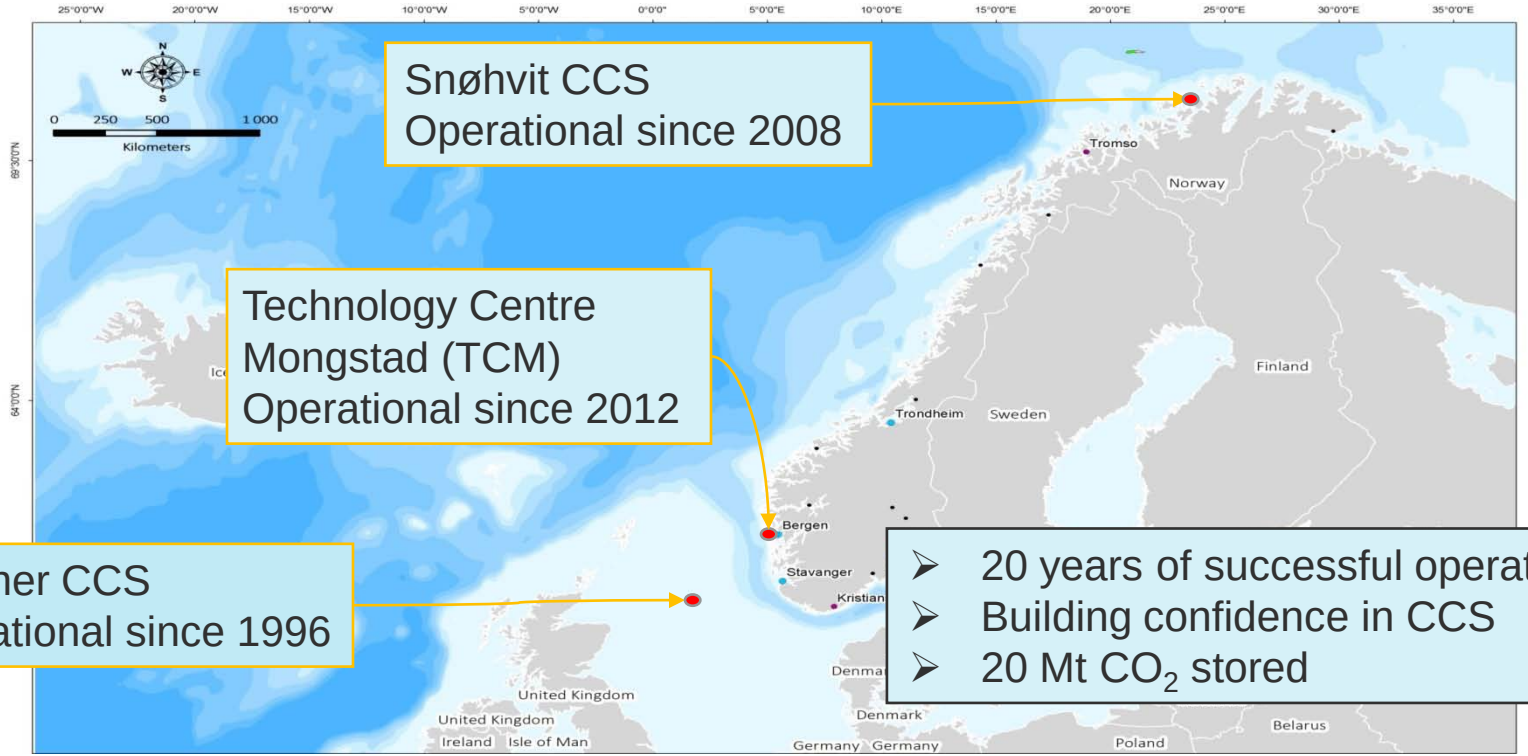
Sleipner – 20 years of successful storage operations and key learning for future projects

Olav Skalmeraas – Vice President CCS, Statoil

CSLF Workshop in association with the Carbon Capture and Storage Association

Wednesday 29 June 2016

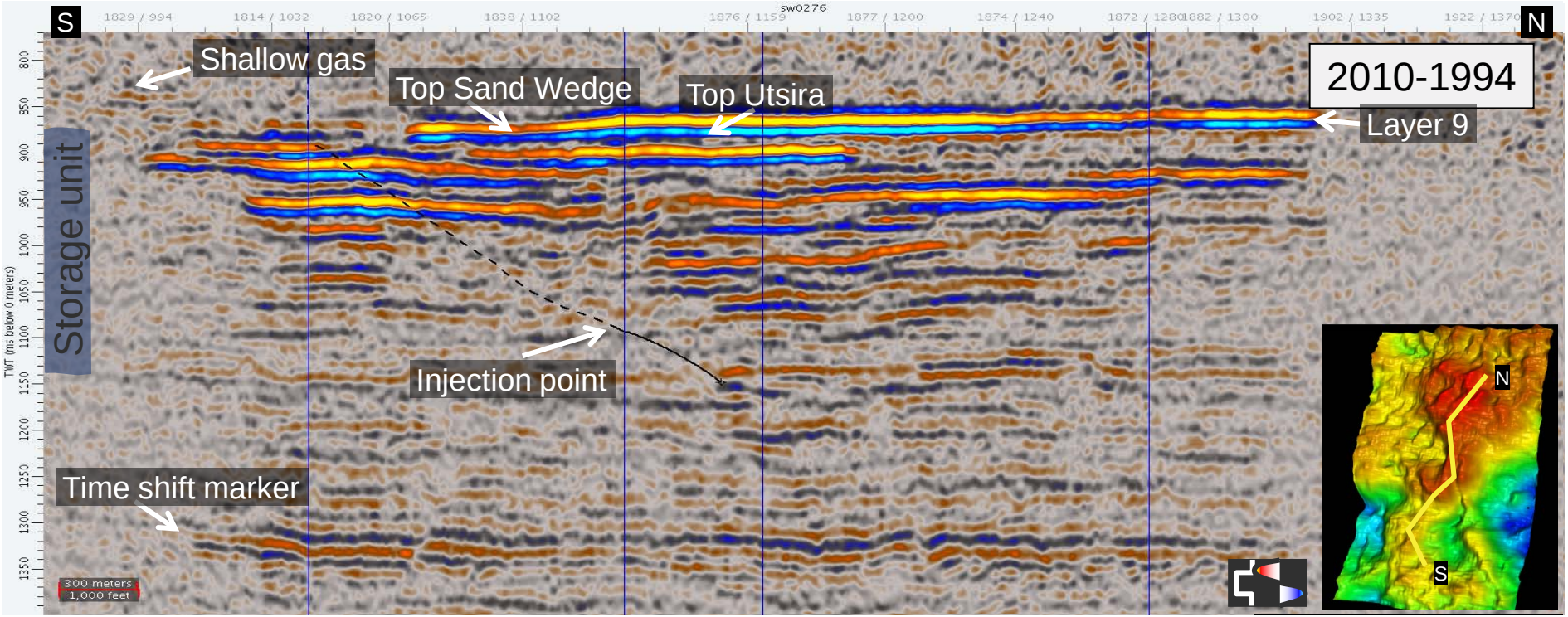
Statoil's CCS track record in Norway



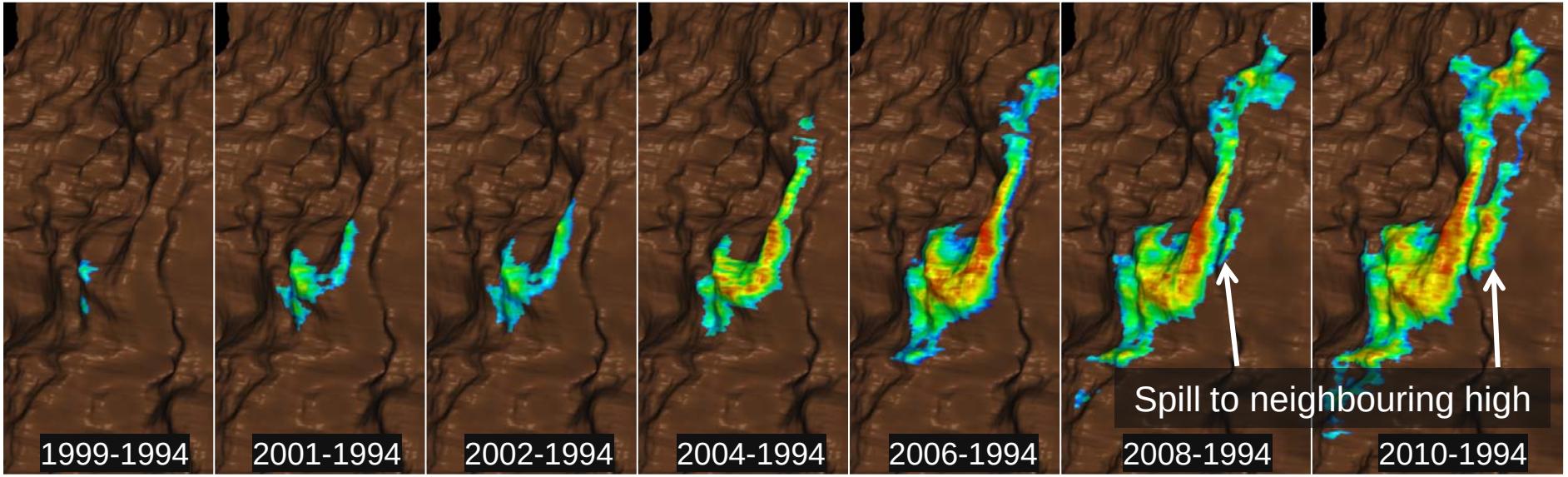
- 20 years of successful operations
- Building confidence in CCS
- 20 Mt CO_2 stored

Sleipner – a pioneering CCS project

Sleipner - time-lapse difference



Sleipner - development of layer 9



Low — High

Amplitude

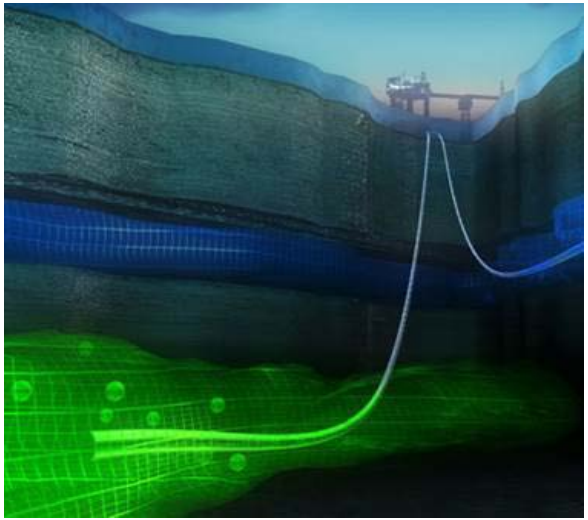
Sleipner - technology learning/check list

- CO_2 rates, pressures, temperatures
- Reservoir depth, water depth
- Storage site capacity
- Well design
- Site performance (plume behaviour)
- Reservoir properties

- Overburden & seal characteristics
- Risk evaluation
- Monitoring plan
- Regulatory conformance

Sleipner - lesson learned - summarised

- Value of geophysical imaging and monitoring data
- Practical learning about capacity and injectivity
- Improved understanding of CO_2 storage processes
- Building confidence in models and forecasts
- Openness and sharing of data



…but there must be a but …

New value chains – new challenges

Sleipner/Snøhvit

- Harmonised ownership - no conflict of interest
- Costs and risks to a large degree manageable

Storage provider for third parties

- Commercial risk along the value chain – conflict of interest
- Costs and risks an outstanding issue not yet solved

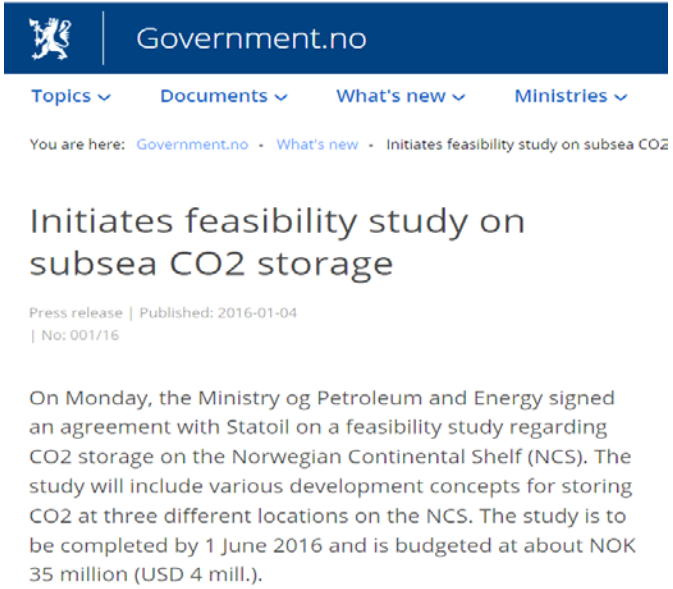
Storage – from a business perspective

- Storage sites development
- Business models
- A strong public private partnership necessary
- Balance between risk and reward
- Regulatory framework to support deployment
- CCS (… and storage) to be commercial viable

… the business model can only be sufficiently advanced and tested in concrete projects …

CCS feasibility studies in Norway

- Norwegian Government initiated feasibility studies from 3 sources - including transportation and 3 storage sites
- Statoil responsible for storage studies – report finished 1 June
- Results from feasibility studies to be published primo July



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Topics Documents What's new Ministries

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Initiates feasibility study on subsea CO2 storage

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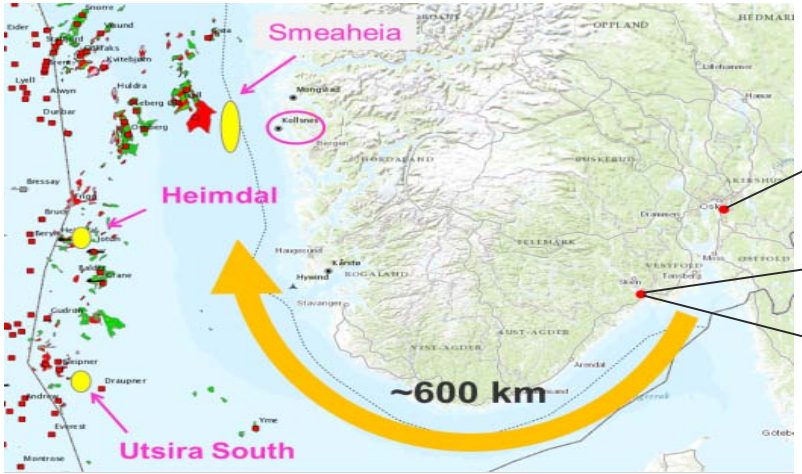
| No: 001/16

On Monday, the Ministry og Petroleum and Energy signed an agreement with Statoil on a feasibility study regarding CO2 storage on the Norwegian Continental Shelf (NCS). The study will include various development concepts for storing CO2 at three different locations on the NCS. The study is to be completed by 1 June 2016 and is budgeted at about NOK 35 million (USD 4 mill.).

Feasibility studies - concepts

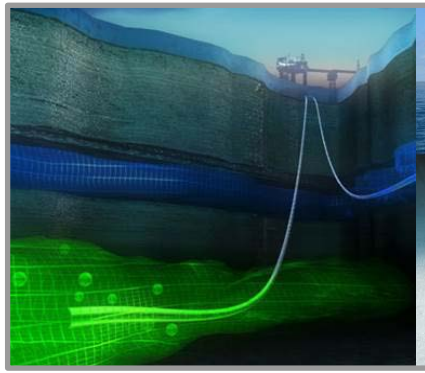


Incineration plant at Klemetsrud - Oslo

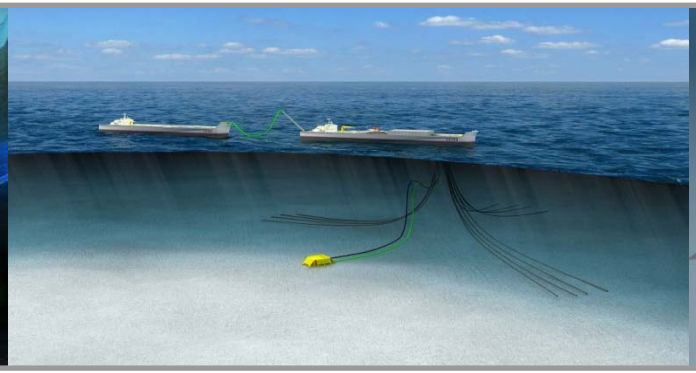
Yara Ammonia Plant - Porsgrunn

Heidelberg Norcem - Brevik

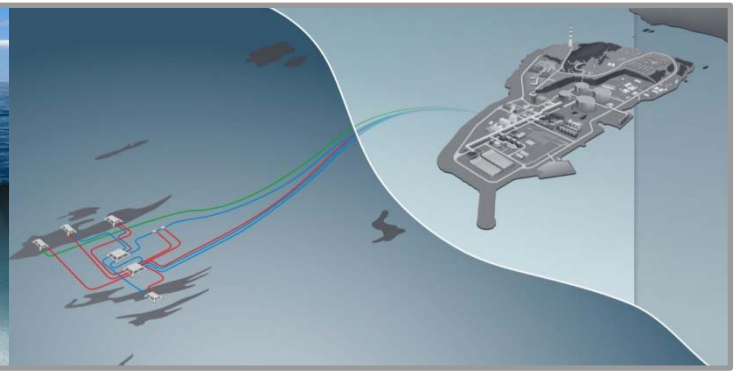
Learning from other projects



Sleipner, Snøhvit and In Salah

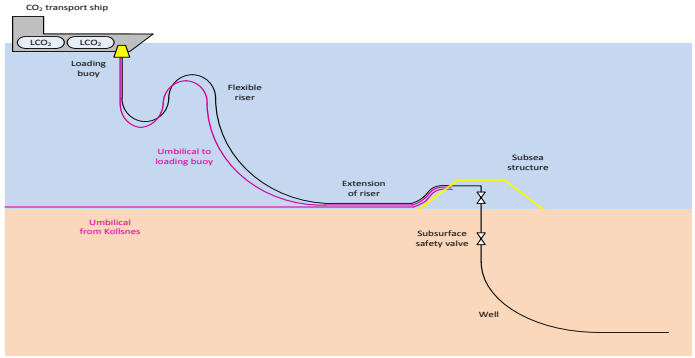


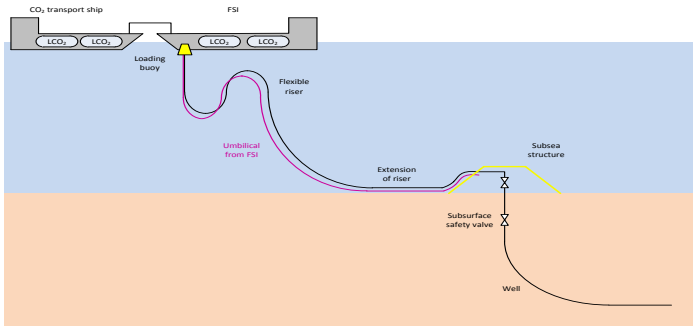
Offshore oil loading concepts

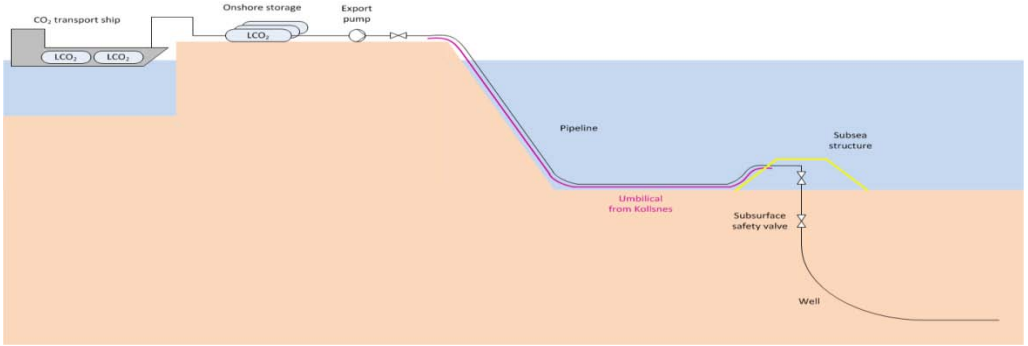


Snøhvit subsea development

Norwegian storage - concepts







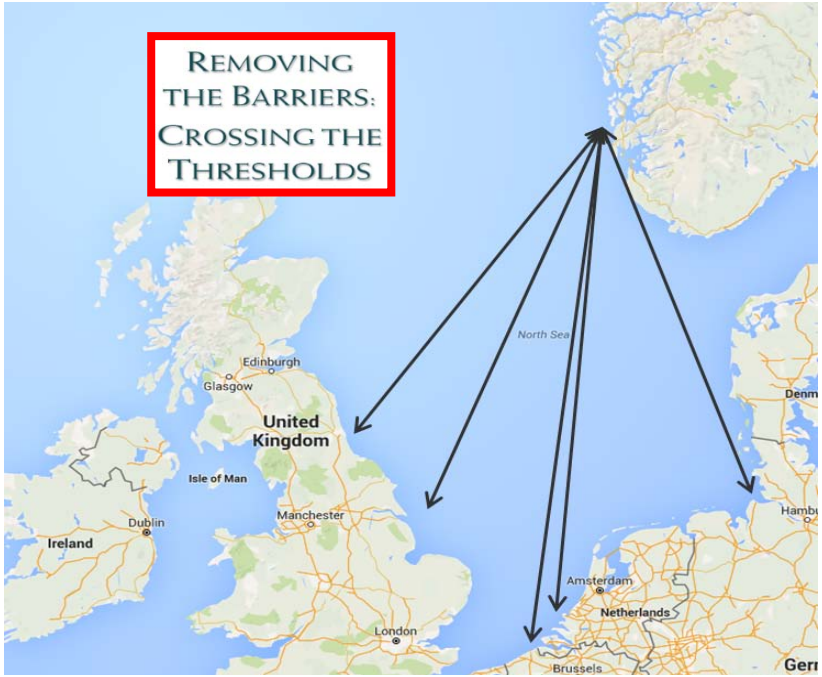
Norwegian storage – further deployment

The Norwegian full scale project

Step-wise development from the UK and/or the Continent

Pipeline development between markets

Well developed CO_2-infrastructure in the North Sea



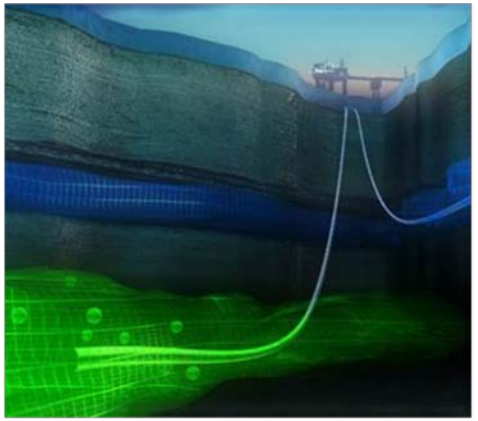
Distance Kollsnes: Teesside 760 km; Humber 850 km; Rotterdam 950 km; Hamburg 900 km; Antwerp 1,100 km

Final remarks – learning and experience

- 20 years successful CO_2 storage – to be replicated
- Business model, regulatory issues and commercial drivers for wide deployment – still barriers
- Further deployment of CCS requires establishment of CCS value chains – now!
- Norway a front-runner - Statoil is impatient and encourage states to establish and have an active and close CCS public-private-partnership
- Statoil exploring being a storage provider as a new business on its own merits

The sunrise -
not the sunset

Statoil. The Power of Possible



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