

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



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CSLF Workshop in association with the Carbon Capture and Storage Association

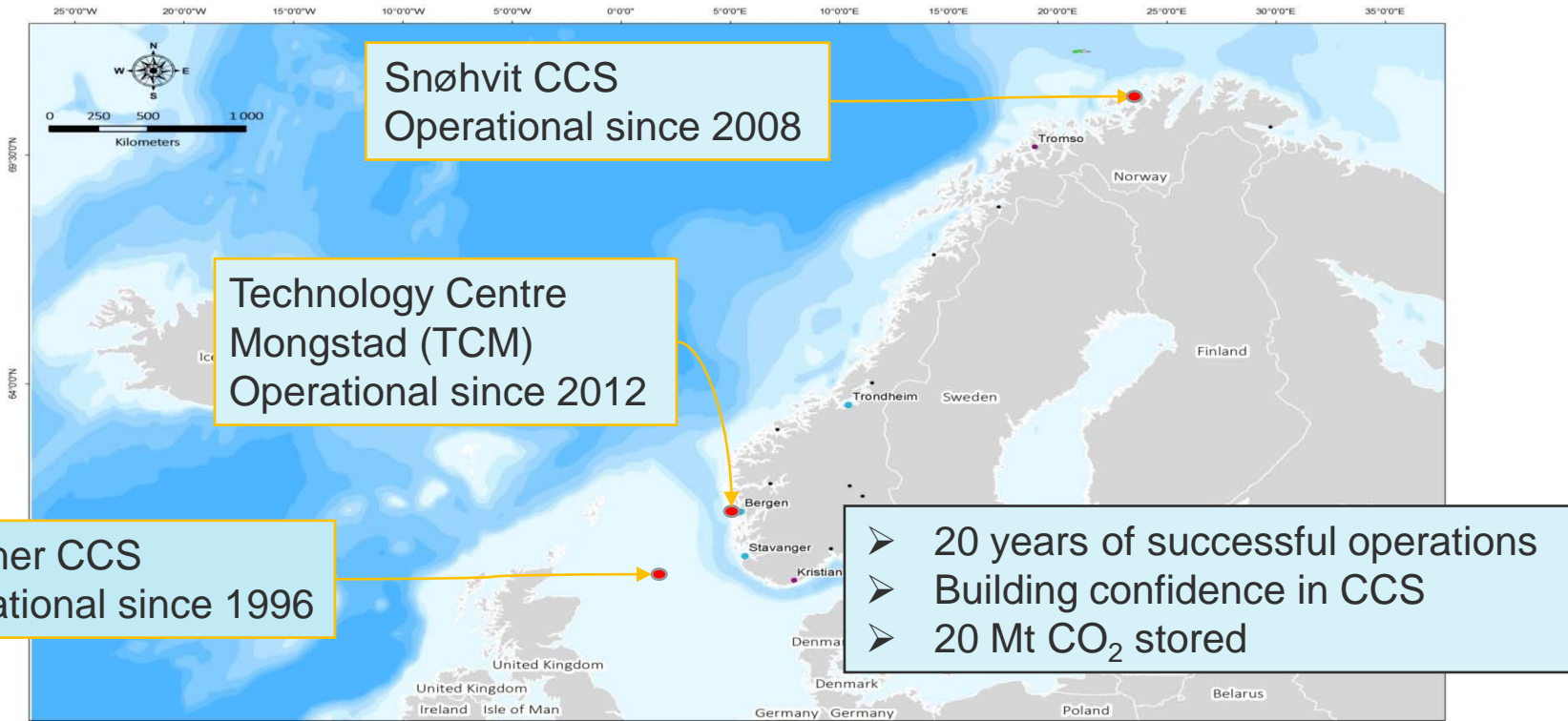
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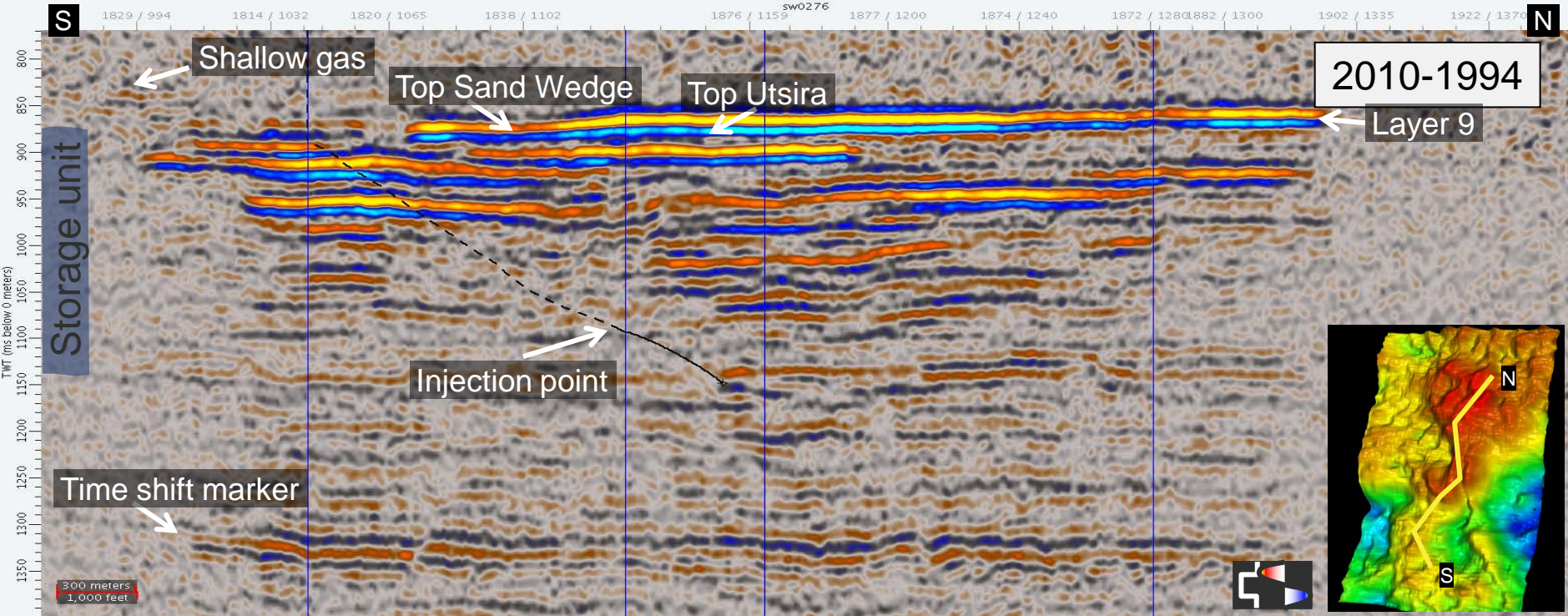
Statoil's CCS track record in Norway



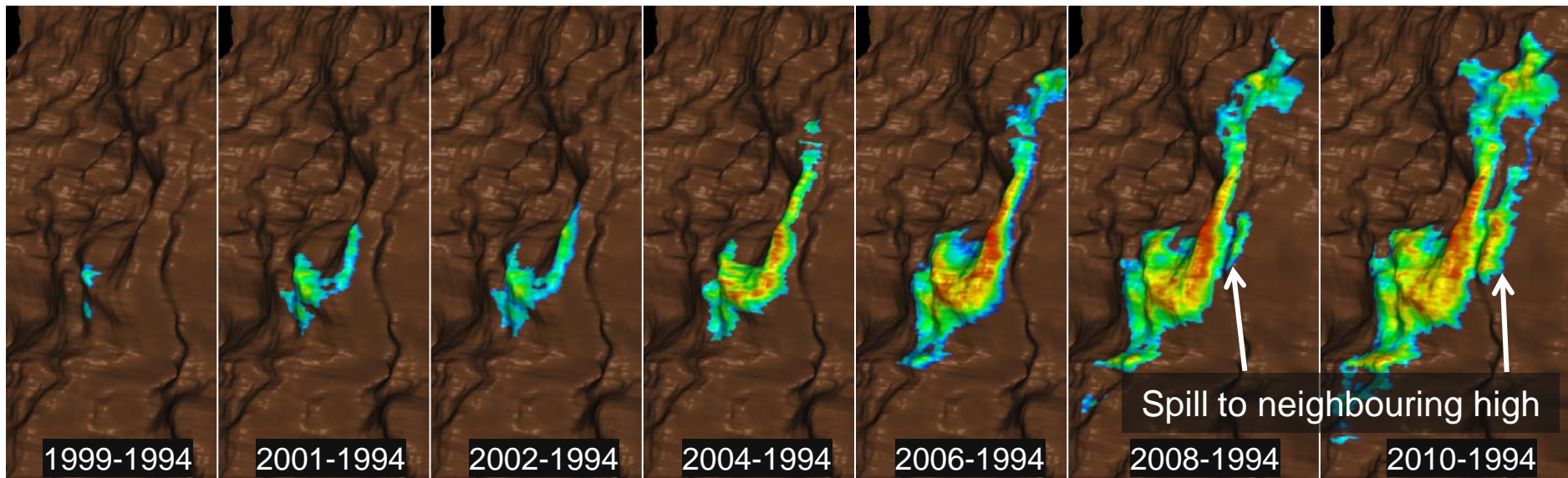
Sleipner – a pioneering CCS project



Sleipner - time-lapse difference



Sleipner - development of layer 9



Low



High

Amplitude

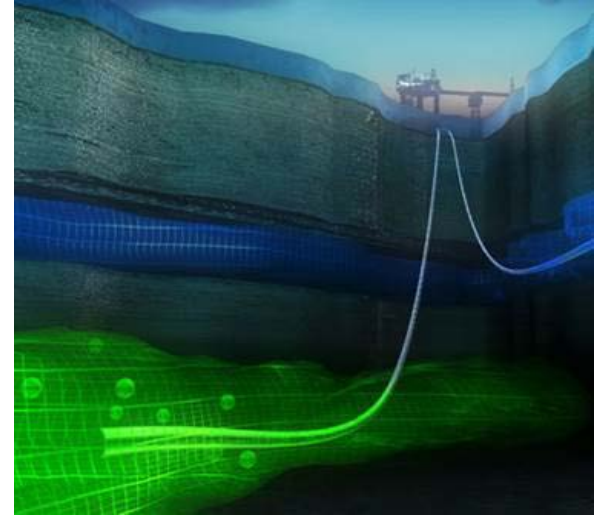
Sleipner - technology learning/check list

- CO₂ 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 CO₂ 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

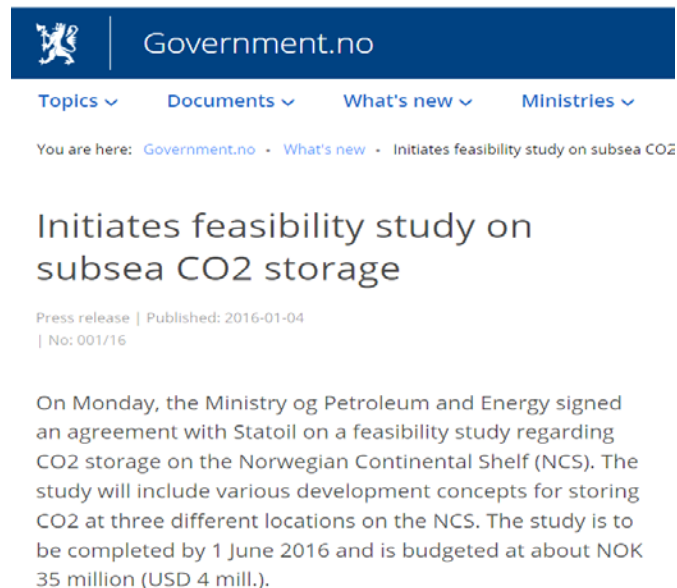
- Storage sites development
- Business models
- A strong public private partnership necessary
- Balance between risk and reward
- Regulatory framework to support deployment
- CCS (... and storage) to be commercial viable



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

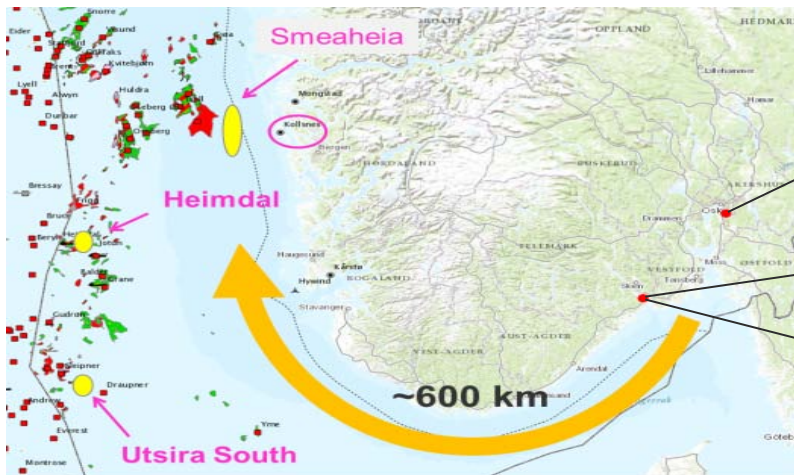
CCS feasibility studies in Norway

- 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



The screenshot shows the Government.no website header with the Norwegian coat of arms and the text 'Government.no'. Below the header are navigation links: 'Topics', 'Documents', 'What's new', and 'Ministries'. A breadcrumb trail reads 'You are here: Government.no - What's new - Initiates feasibility study on subsea CO2'. The main heading is 'Initiates feasibility study on subsea CO2 storage'. Below this, it says 'Press release | Published: 2016-01-04 | No: 001/16'. The body text states: 'On Monday, the Ministry of 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

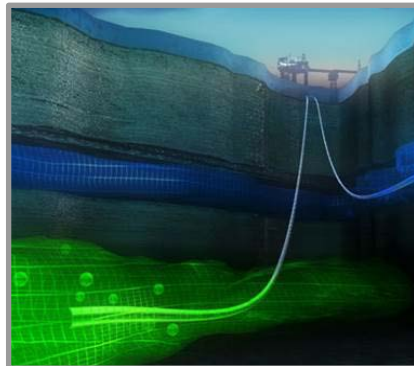


Yara Ammonia Plant - Porsgrunn

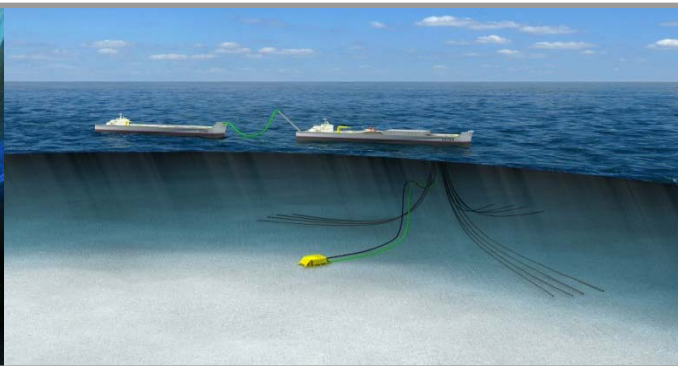


Heidelberg Norcem - Brevik

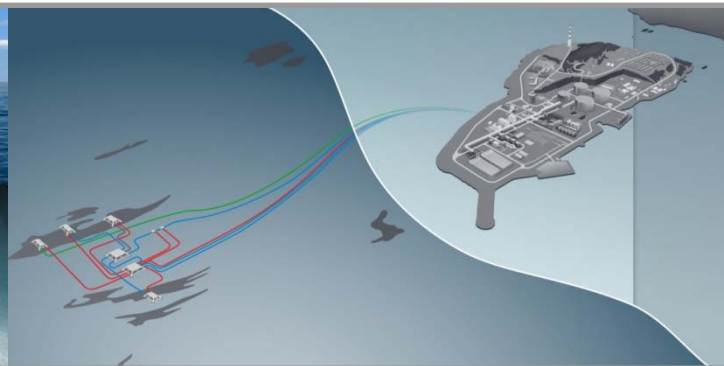
Learning from other projects



Sleipner, Snøhvit
and In Salah

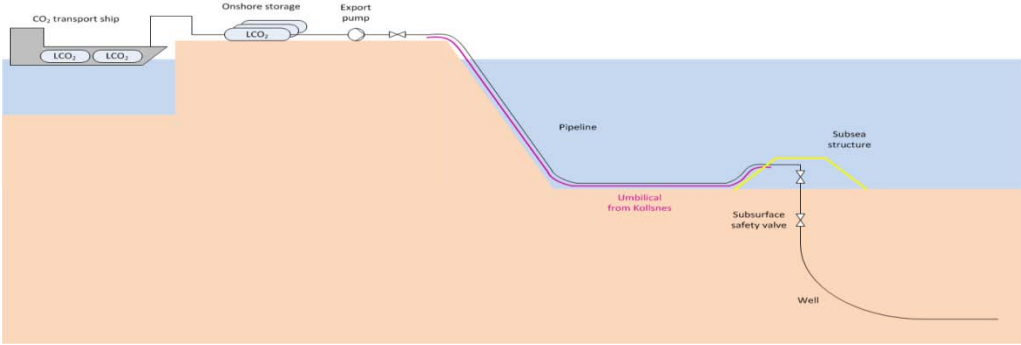
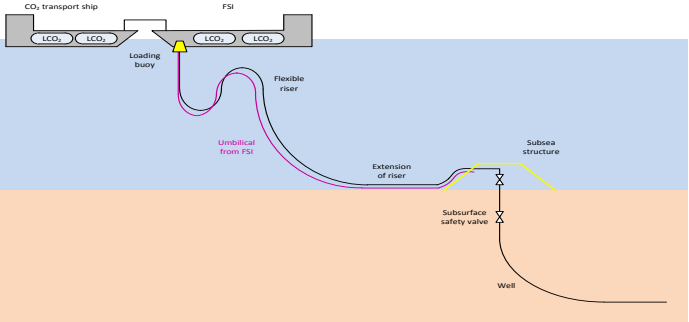
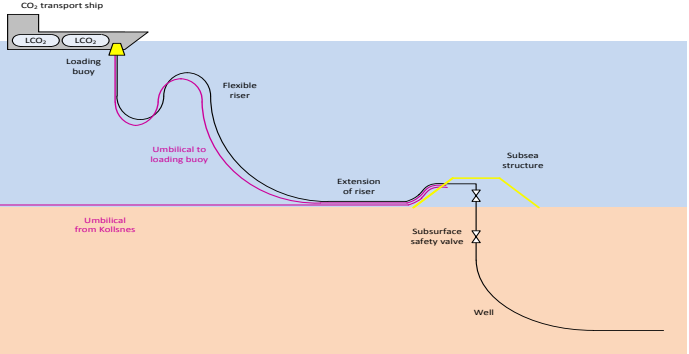


Offshore oil
loading concepts



Snøhvit subsea
development

Norwegian storage - concepts



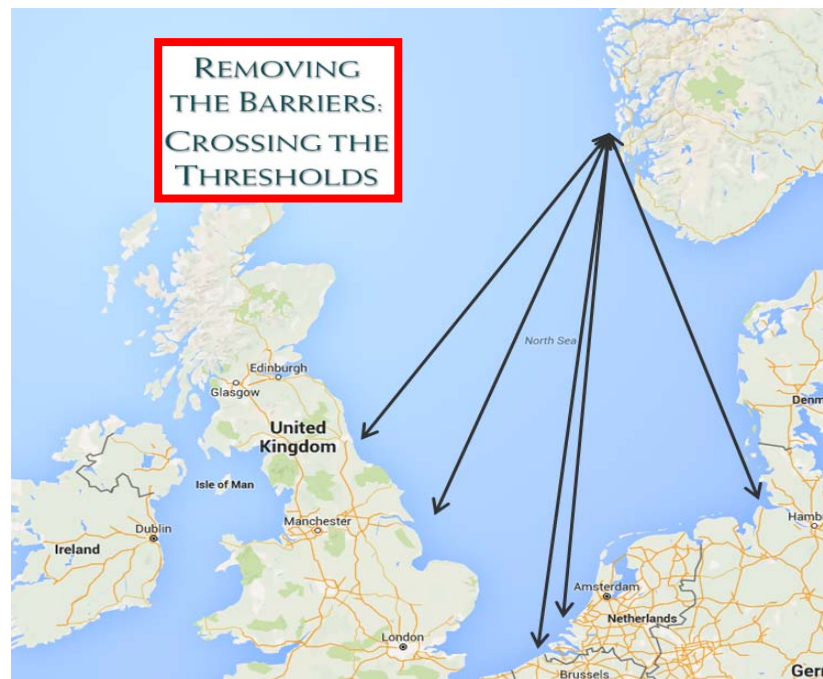
Norwegian storage – further deployment

The Norwegian full scale project

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

Pipeline development between markets

Well developed CO₂-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 CO₂ 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

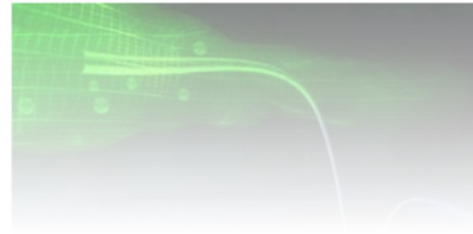
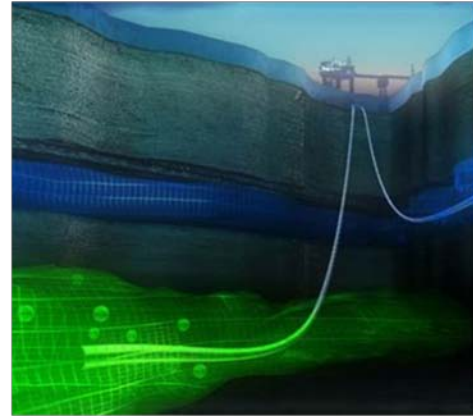
Statoil. The Power of Possible

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

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