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

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Statoil’s CCS track record in Norway

- **Sleipner CCS**
  - Operational since 1996
- **Snøhvit CCS**
  - Operational since 2008
- **Technology Centre Mongstad (TCM)**
  - Operational since 2012

- 20 years of successful operations
- Building confidence in CCS
- 20 Mt CO₂ stored
Sleipner – a pioneering CCS project
Sleipner - time-lapse difference

- Shallow gas
- Top Sand Wedge
- Top Utsira
- Time shift marker
- Storage unit

Injection point

Layer 9

2010-1994
Sleipner - development of layer 9

1999-1994
2001-1994
2002-1994
2004-1994
2006-1994
2008-1994
2010-1994

Spill to neighbouring high

Low
Amplitude
High

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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 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
Feasibility studies - concepts

- Incineration plant at Klemetsrud - Oslo
- Yara Ammonia Plant - Porsgrunn
- Heidelberg Norcem - Brevik

~600 km
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 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
Sleipner - 20 years of successful storage operations and key learning for future projects

Olav Skalmeraas – Vice President CCS, Statoil

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