



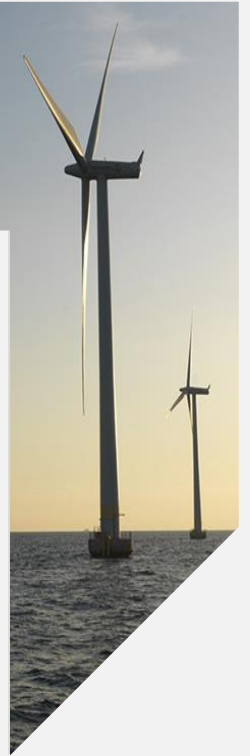
UiO : Universitetet i Oslo

# CCS in Norway and research collaborations

**Elin Skurtveit**

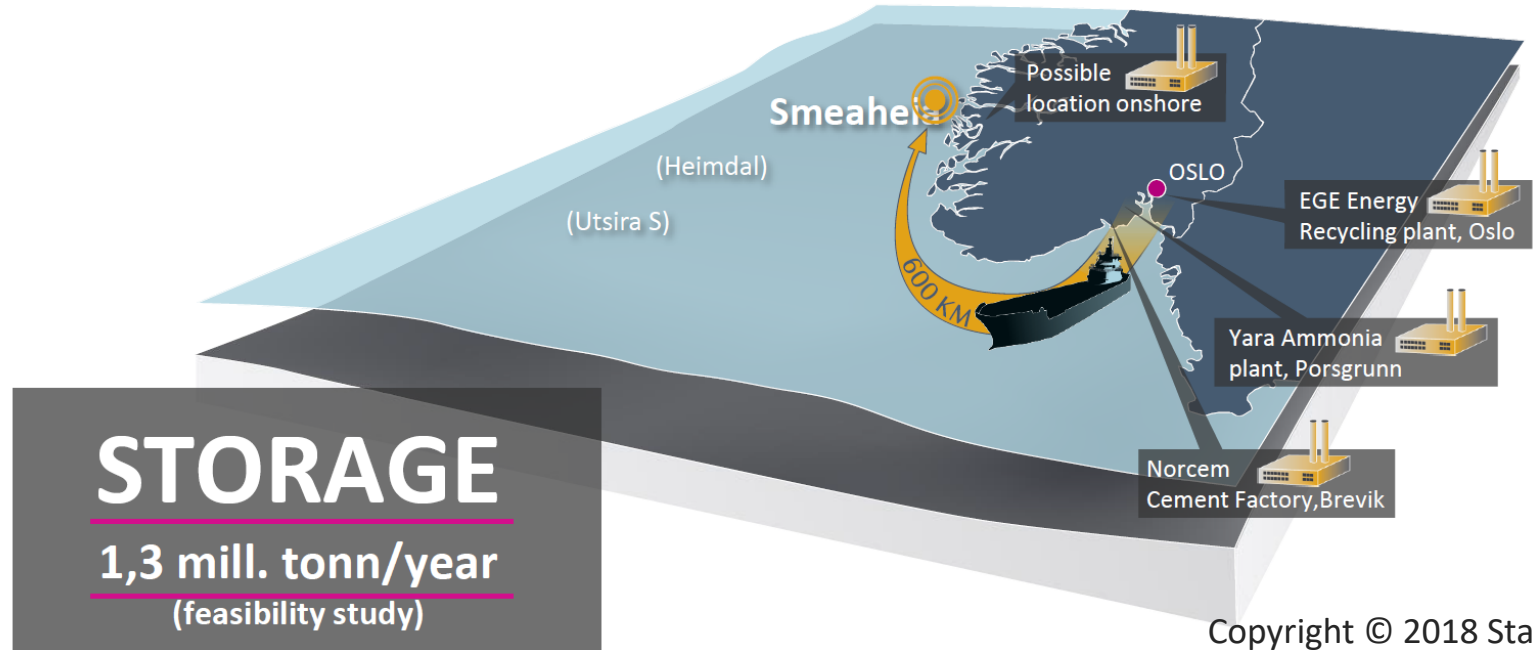
Norwegian Geotechnical Institute

University of Oslo, Department of Geoscience



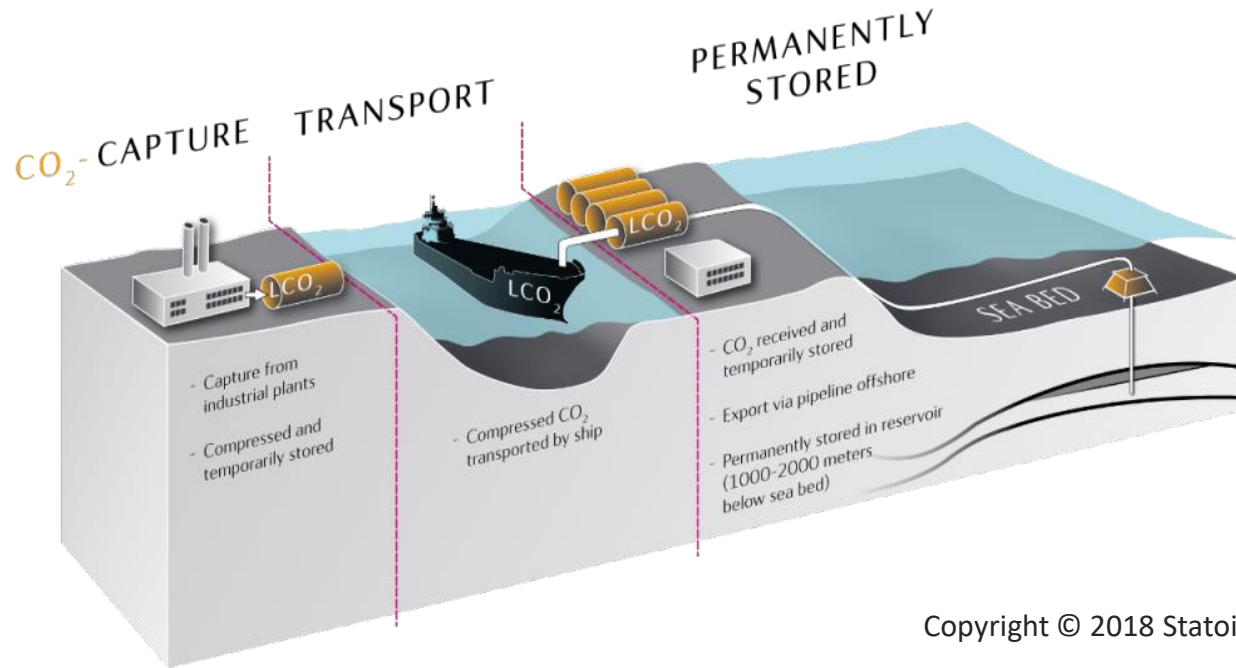
# Gassnova Feasebility study July 2016

## Feasibility study



# Northern Lights project – Equinor, Total, Shell

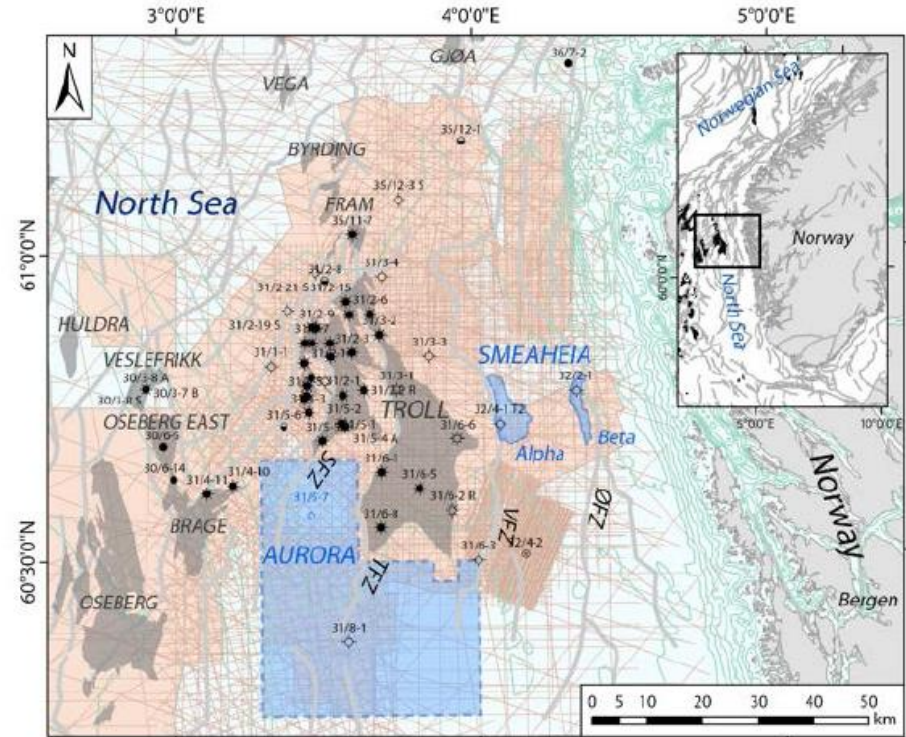
Open access transport and storage infrastructure for CO<sub>2</sub>



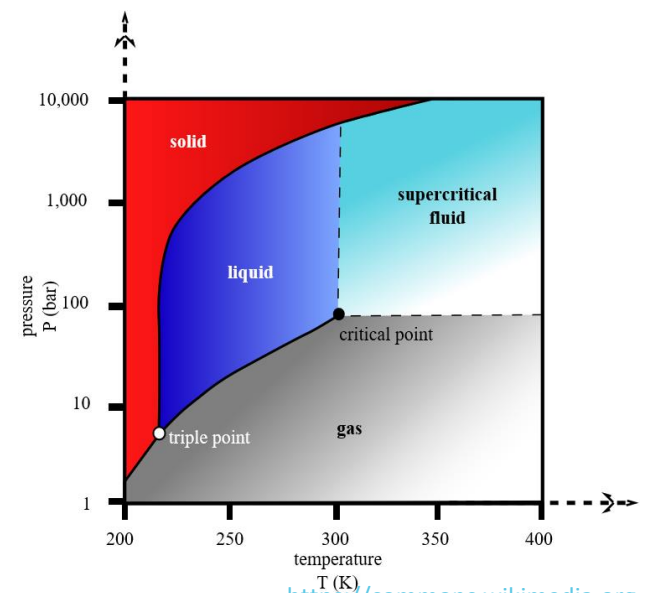
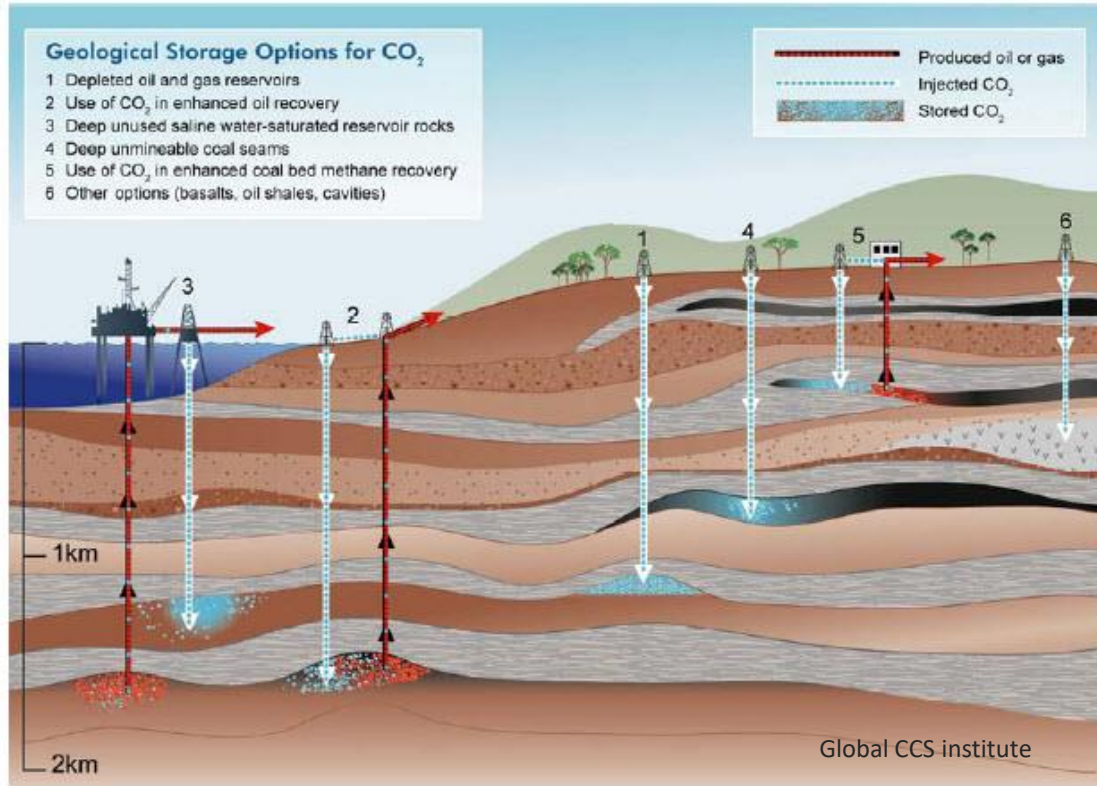
Copyright © 2018 Statoil ASA

# CO<sub>2</sub> storage on the Norwegian Continental Shelf

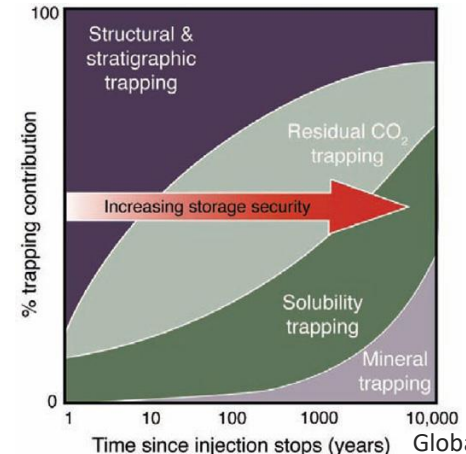
- 2019 - first exploitation permit for CO<sub>2</sub> storage
- Aurora
  - well drilling Dec 2019
- Gamma prospect drilled oct 2019
  - Dry and potential for CO<sub>2</sub> storage



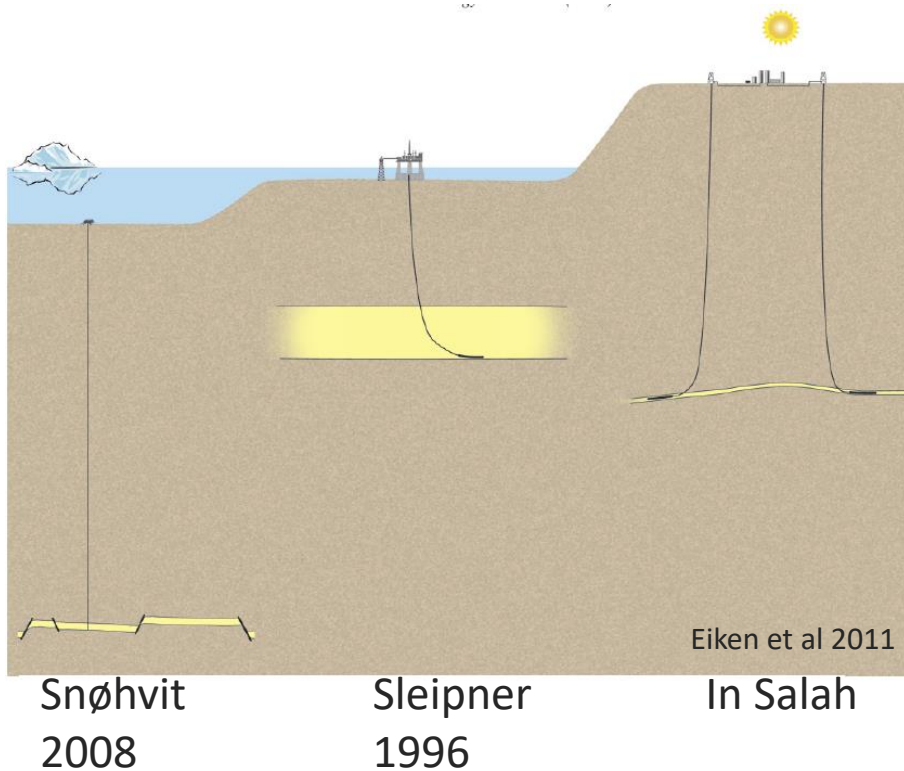
# CO<sub>2</sub> storage principles



<https://commons.wikimedia.org>



# Norwegian experience and challenges



## Technical challenges identified:

- Pressure release systems
- Flow assurance
- Fit for purpose subsea system
- Well design and integrity
- Cost efficient reservoir and overburden monitoring

- EU SET plan
- Mission Innovation reports

# Research activities and collaboration

➤ **2008 – 2012: SSC-RAMORE** -  
Subsurface Storage of CO<sub>2</sub> - Risk  
Assessment, MOnitoring and  
Remediation

Fluid rock  
interaction

- Geomechanical effects related to CO<sub>2</sub> alteration
- Development of CO<sub>2</sub> laboratory test equipment

➤ **2010-2018: FME SUCCESS**

➤ Partner in several Climit funded  
projects, KPNs

Monitoring  
Geomech

- Coupled flow-geomechanical simulations
- Effects of CO<sub>2</sub> on velocity and resistivity of reservoirs

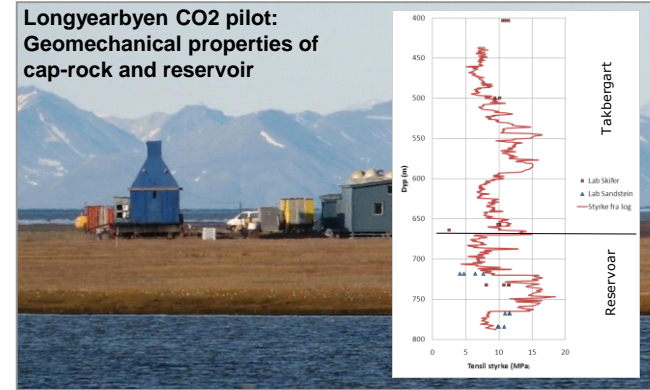
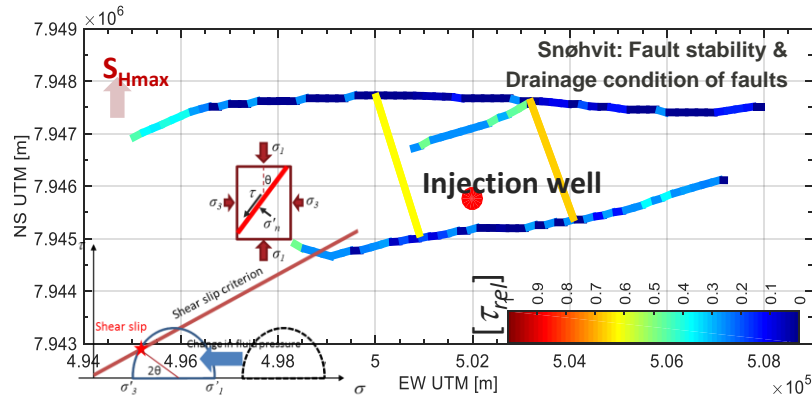
➤ **2016-2024: FME NCCS**

➤ **2016 ->** IGCCS, OASIS,  
ACT4storage, COTEC, FRISK,  
SENSE

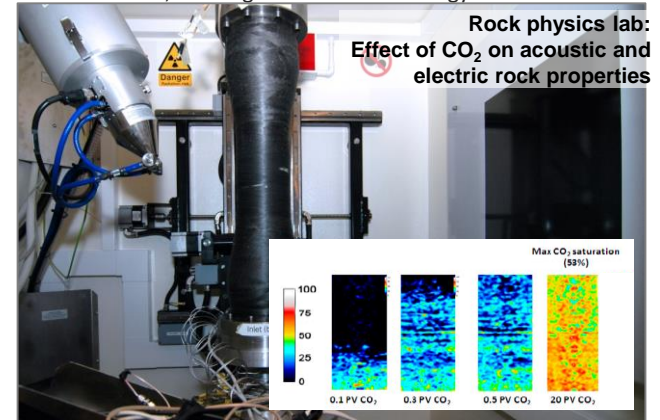
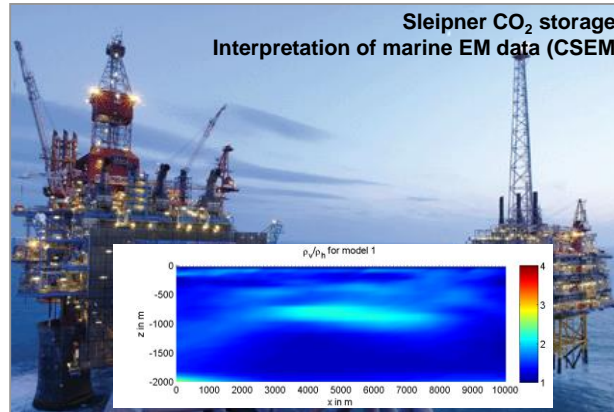
Large scale  
injection

- Storage integrity and pressure limitations
- Cost efficient monitoring
- Industry involvement and pilots

# Geological models, geomechanical and geophysical testing and modelling related to Norwegian CO2 field pilots



Bohloli et al., Norwegian Journal of Geology 2014



Park et al., Energy Procedia 2013

Binyam et al (2013) Geophysical Prospecting



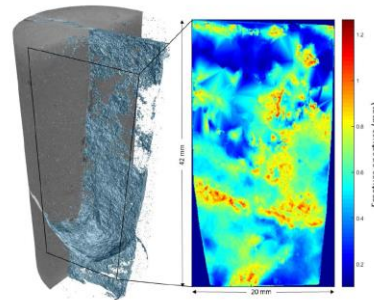
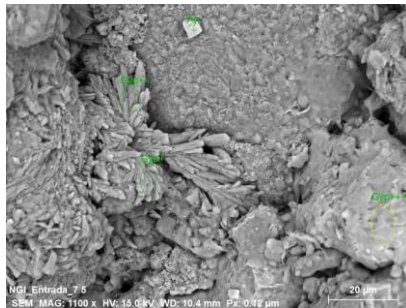
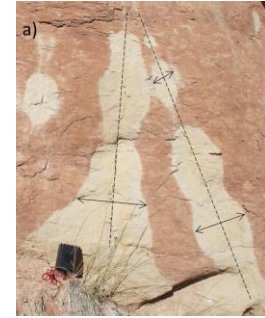
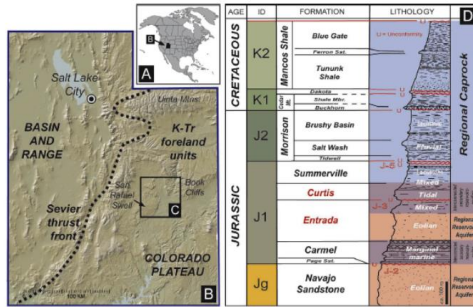
[www.fme-success.no](http://www.fme-success.no)





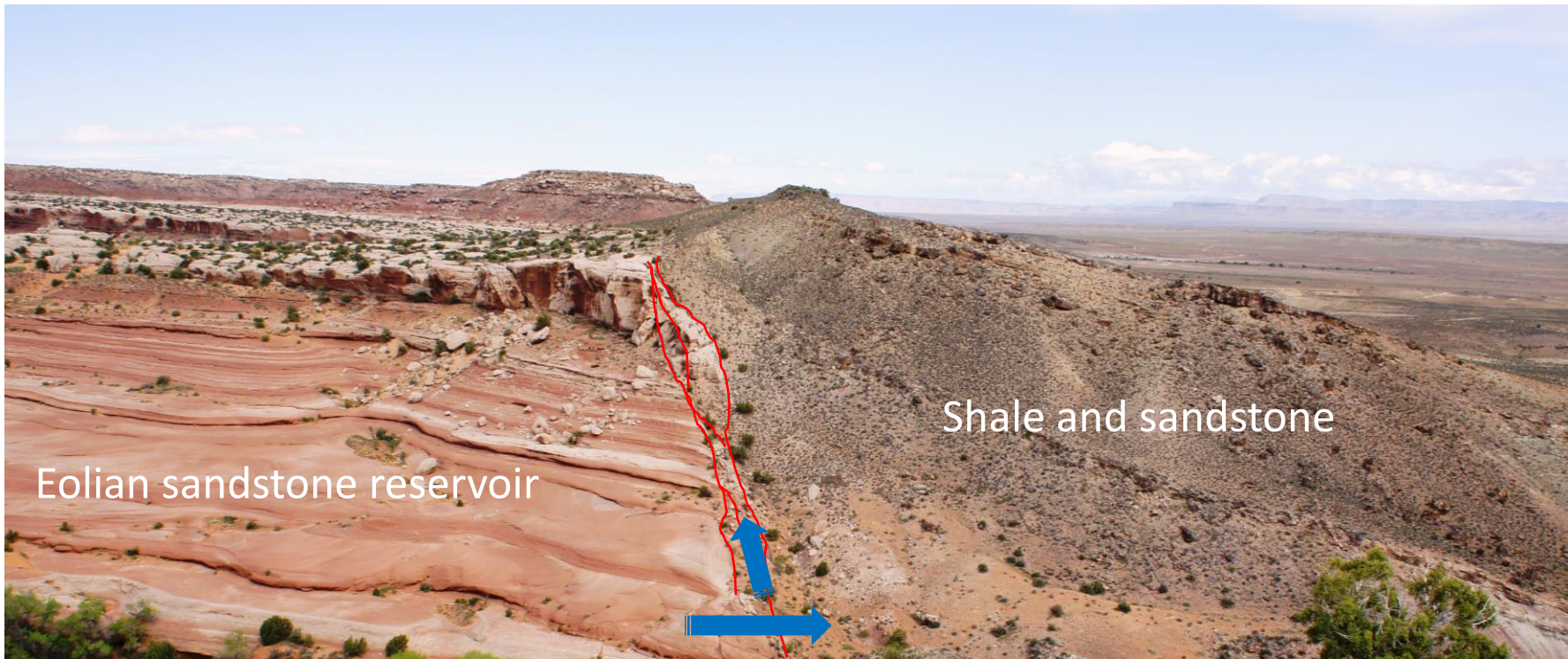
# CO<sub>2</sub> Seal Bypass

Using field analogs in Utah, USA to understand CO<sub>2</sub> migration in natural systems



## Vision

*NCCS will enable fast-track CCS deployment through industry-driven science-based innovation, addressing the major barriers identified within demonstration and industry projects, aiming at becoming a world-leading CCS centre*



Eolian sandstone reservoir

Shale and sandstone

Bartlett Wash Fault, Utah, USA

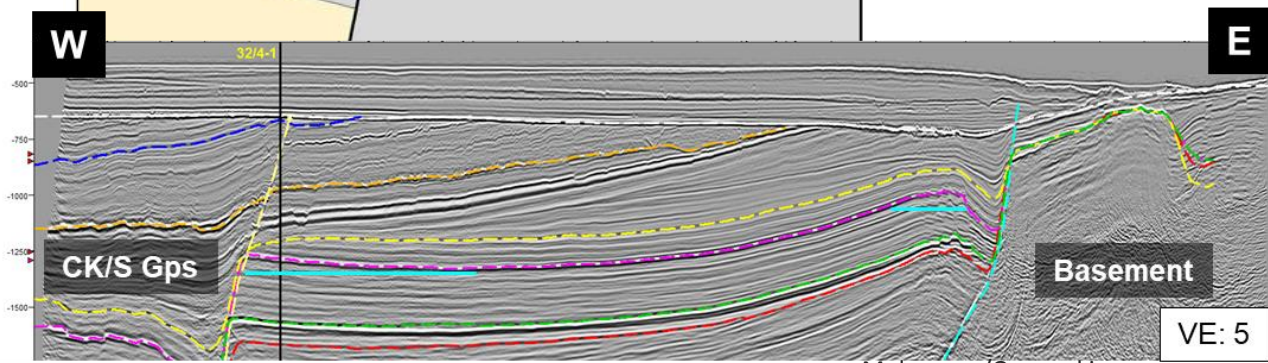
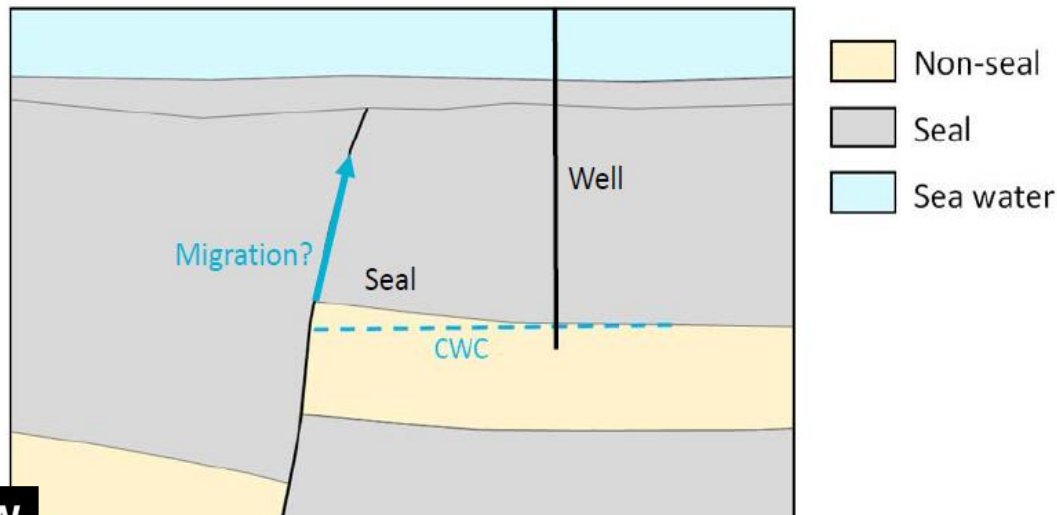
Reservoir bounding fault, ~200 m throw

# Quantification of risk?

Faults are common traps for oil & gas

Knowledge needs:

- Models addressing up-along-fault flow
- Faults in overburden
- Dynamic seal



# Value creation

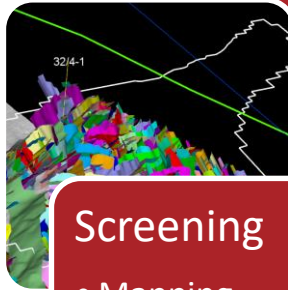
Site  
readiness

Identification

Maturation

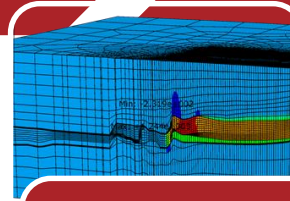
Qualification

Faults



Screening

- Mapping
- Juxtaposition
- Stability



Models

- Advanced models
- Detailed interpretation



Risk

- Quantification
- Mitigation

Research  
tasks

Smeaheia

Deformation

Along-fault flow

Geological understanding

Fluid migration

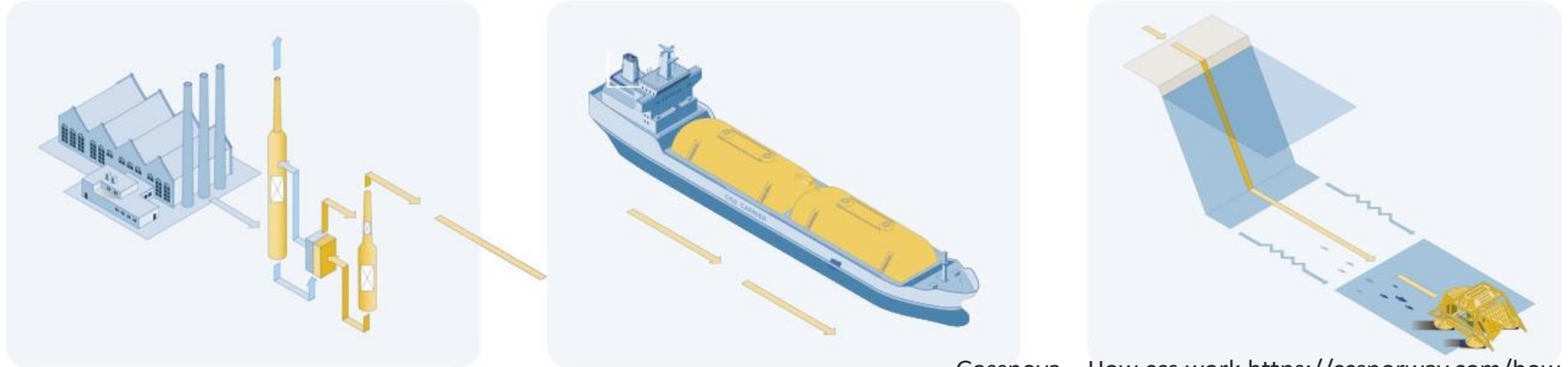
Fault architecture

Reactivation

Operators  
Stakeholders  
Funding  
agencies

# Way forward for CCS

- ↗ International collaborations
- ↗ EU plans
- ↗ Collaboration with social science
  - Social acceptance, implementation of green energy solutions





#påsikkergrunn