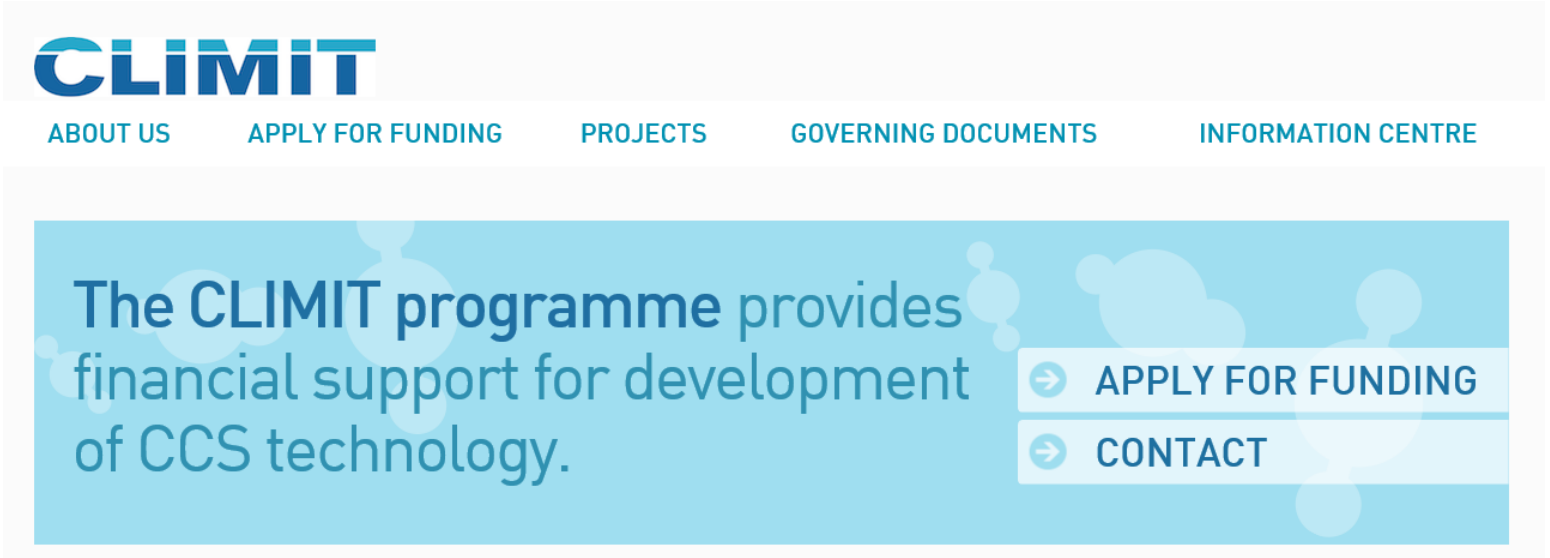

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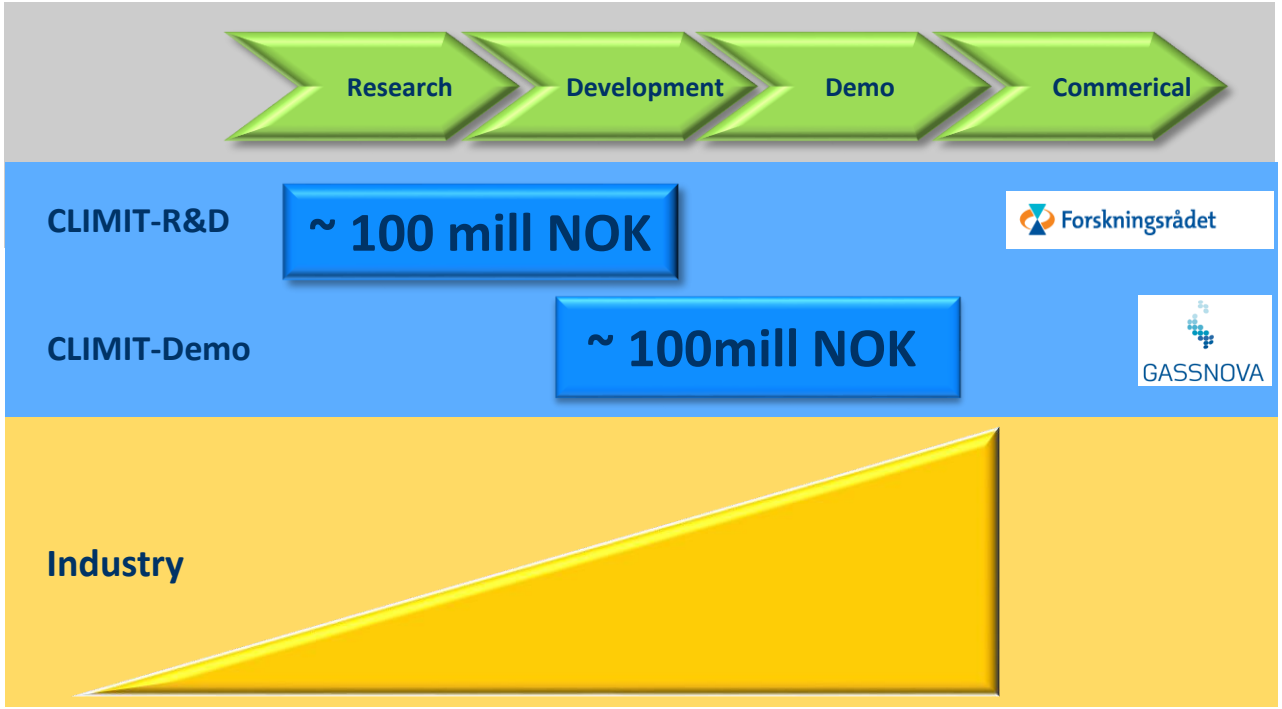
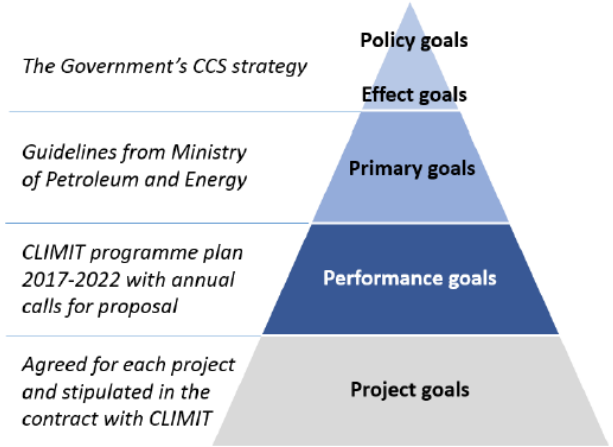
CLIMIT: National programme for CCS technology developement

- Mandate
  - 2005: Gasfired power-generation with CCS
  - 2008: Generalized to deal with emissions from all fossil fuels…..
  - 2010: also including industry CO2 emissions
- More than 300 projects have received support
  - Approx. NOK 1.7 billion NOK/ 220 bill $ in funding since 2005
- Taken Norway to the forefront of international research and technology developement



Programplan

- Reflects
  - Government ambisions
  - Industry needs
  - R&D challenges

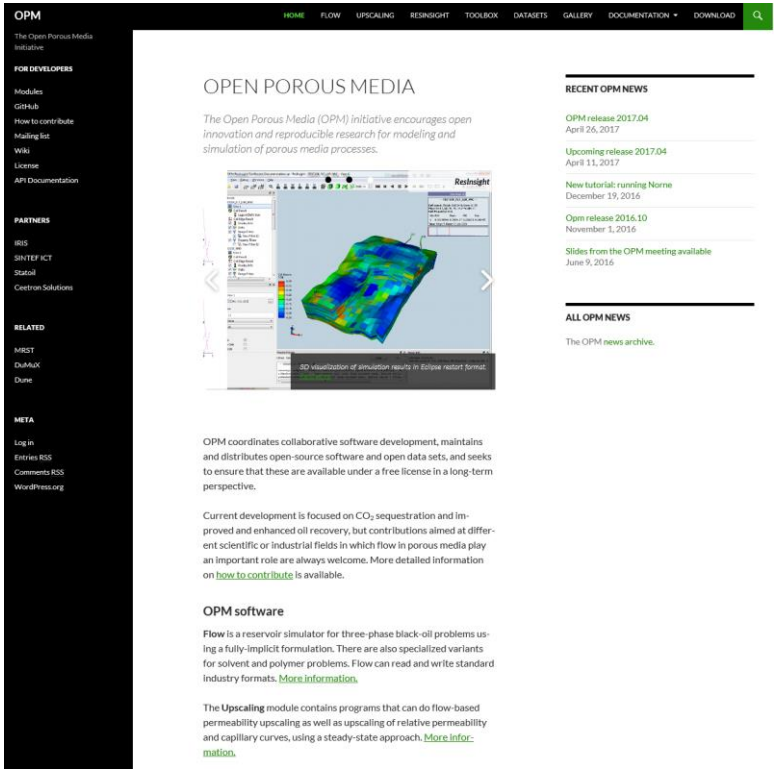


"The CLIMIT Programme Plan for 2017-2022 **describes how the programme is organised, focus areas for new R&D&D ..and what is expected of applicants that are awarded support from the programme**"

Focus areas CO2 storage: climit programme plan

- The next offshore CO2 storage sites will mainly be developed using current petroleum technologies. Costs and risks can be reduced by looking at simplifications, standardisation and optimisation of technology elements that are used in wells, subsea templates and other installations.
- **Reduce uncertainty;**
  - New or improved experimental analyses and calculation methods can increase our understanding of storage capacity, injectivity, sealing and flow properties. This will reduce the uncertainty of an investment decision for a CO2 storage site.
  - Improved methods will also provide more assurance that a storage site can be operated without negative environmental impact.
- **Reduce cost**
  - There is a need for cost-effective solutions for evaluating, building and operating CO2 storage sites with associated injection wells and subsea installations. Simulation tools are particularly important during the evaluation phase, the injection phase, as well as after injection is completed.
  - **Methods for monitoring reservoirs, cap-rocks and the marine environment** should be developed further for a more cost-effective real time monitoring of the most critical parameters.
  - There will be a need to develop improved methods, procedures and tools for securing and de-commissioning storage sites, and for monitoring after injection is completed. Procedures for quantifying the risk associated with undesirable incidents in a lifecycle perspective are important in this context.
  - It is also important to develop methods to prevent or mitigate undesirable incidents. Methods for assessing and mitigating problems related to legacy wells are of particular interest in this connection.
- **"CO2-use"**
  - Projects that examine use of **CO2 for enhanced oil recovery in combination with long-term storage**, will qualify for support. This could increase the commercial value of the CCS projects now, as well as provide useful experience for subsequent storage facilities.

SIMCO2; simulation of CO2 injection in connection with EOR and storage



- Project led by IRIS in cooperation with Sintef and Statoil
- Open-source software
  - Code available trough OPM for other to build on: testing, improvments etc
  - Broad user and developement platform

Offshore monitoring - storage locations

- Norwegian Geotechnical institute
  - Leakage detections
- Norsar
  - Microseismic monotoring- bacground, measurement network
- OCTIO geophysical
  - Seabottom sensor network

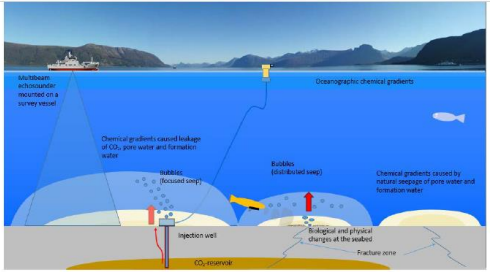


Figure 2 - Illustration of a GCS monitoring scenario with CO_2 leakage through an injection well and a fracture zone. Note that the illustration is out of scale, a CO_2 reservoir will be much deeper (kilometers) beneath the seabed.

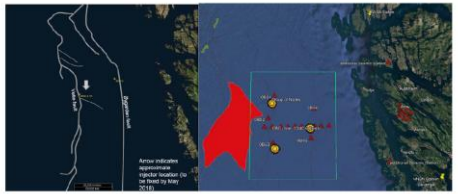
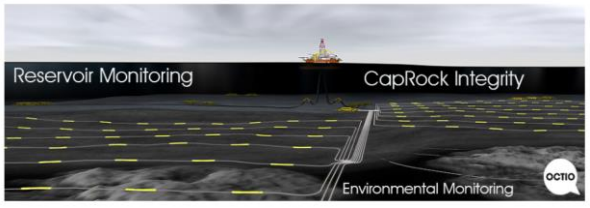
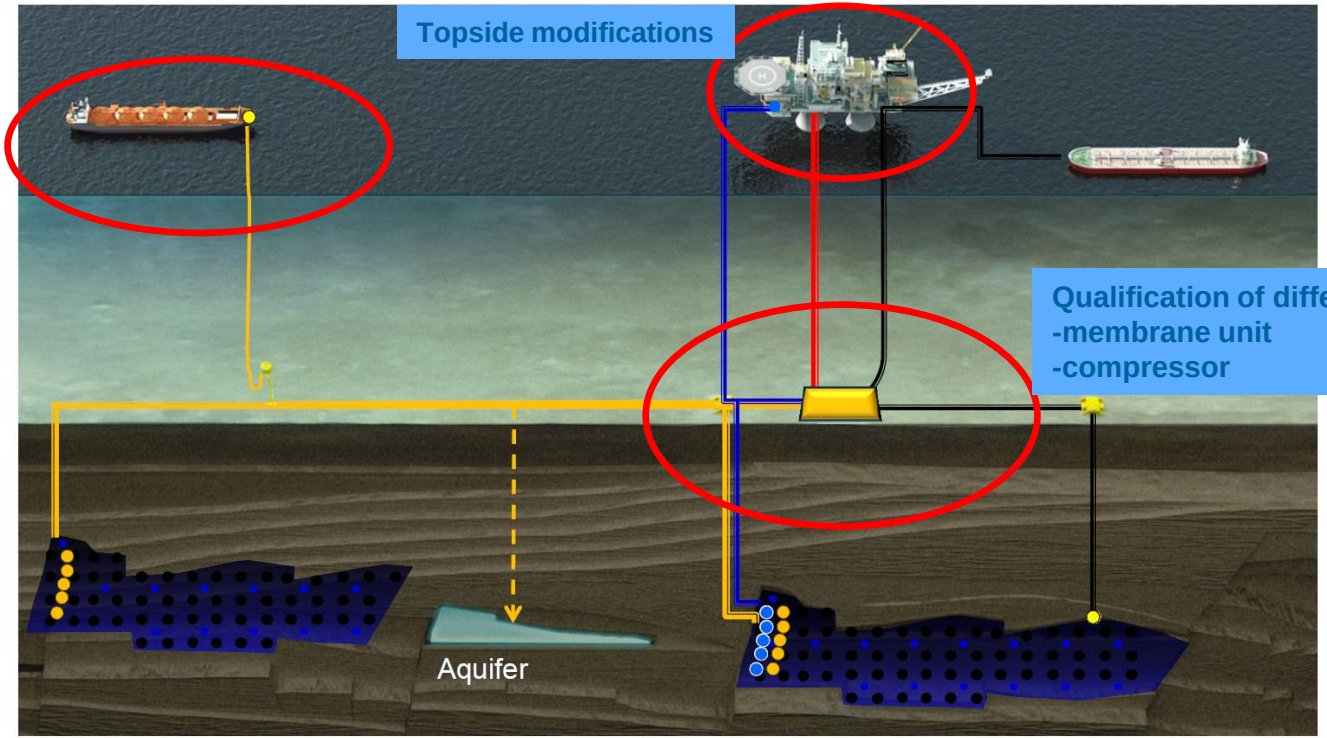


Figure1: *The map to the left shows the main faults within the Smeaheia region, including the Vette and Øygarden faults and the arrow indicates the potential injection location. Right: map showing the larger Smeaheia region including the Troll field outlines to the West and the Norwegian mainland. The yellow pins show the closest existing and operational seismometer stations. The triangles in red show conceptual positions of additional seismometers, either placed in an array-configuration and single sensors onshore, or in different configurations such as a line, or in groups offshore. The yellow suns offshore represent a group or array of sensors.*

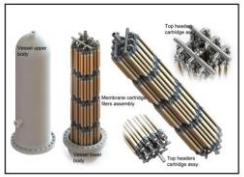


Aker's CO2-EOR concept, Climit support



Qualification of different technology elements
-membrane unit
-compressor

Compact membrane packing



- Onshore stacking not feasible subsea
- Compact packing arrangement developed by AKSO

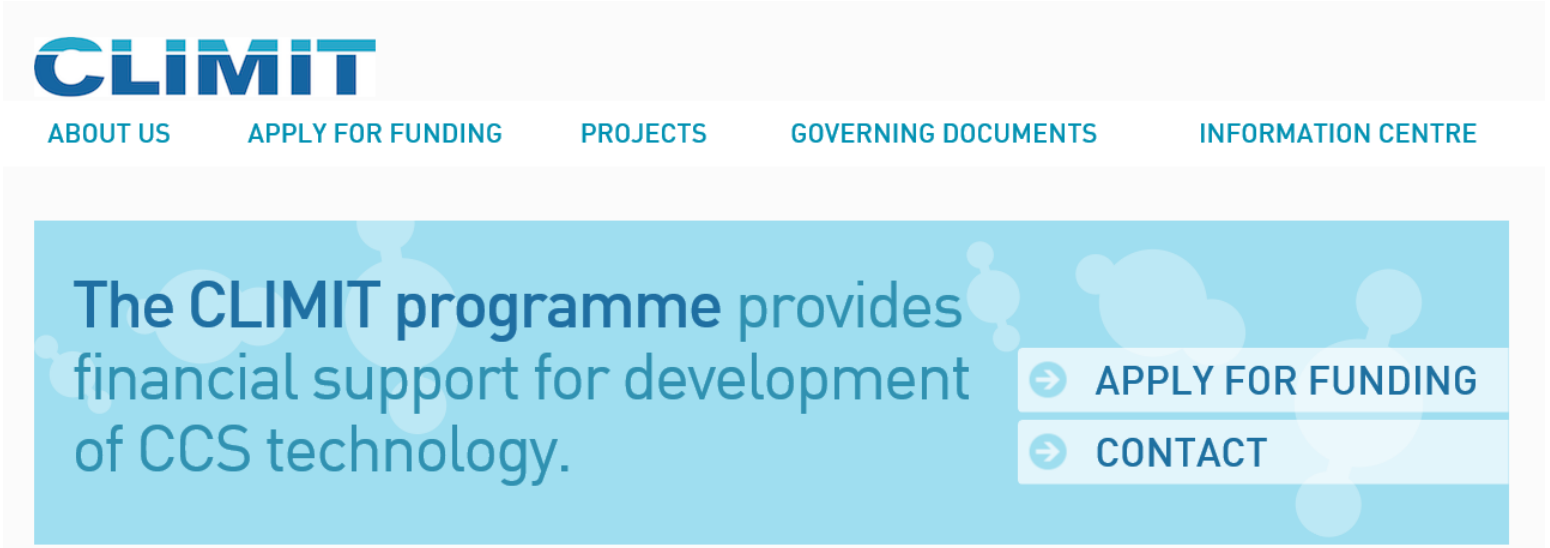
Compression System

2010 – 2015 Asgard:

- 21 MSm³/d flow rate
- 2 x 11.5 MW compressor power
- 300 m water depth
- 40 km step-out distance
- Topside Variable Speed Drives, Circuit breakers and UPS
- Delivered by Aker Solutions

Funding opportunities

- CLIMIT-R&D annual call for R&D projects
- CLIMIT-demo : open call for D&D projects
- Cooperation with EU
  - ACT, H2020
- Bilateral cooperation
  - US (co-financing)
  - NL (CATO-2: joint call in 2015)



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