

CCS in Norway – CLIMIT, TCM and Full Scale Demonstration



GASSNOVA

Svein G. Bekken, Gassnova SF

Gassnova SF shall facilitate the Norwegian State's participation in CCS projects so as to provide maximum benefit for the State or State-owned entities.

- CLIMIT programme
- CO₂ Technology Centre Mongstad
- CCS projects
- Advisory functions



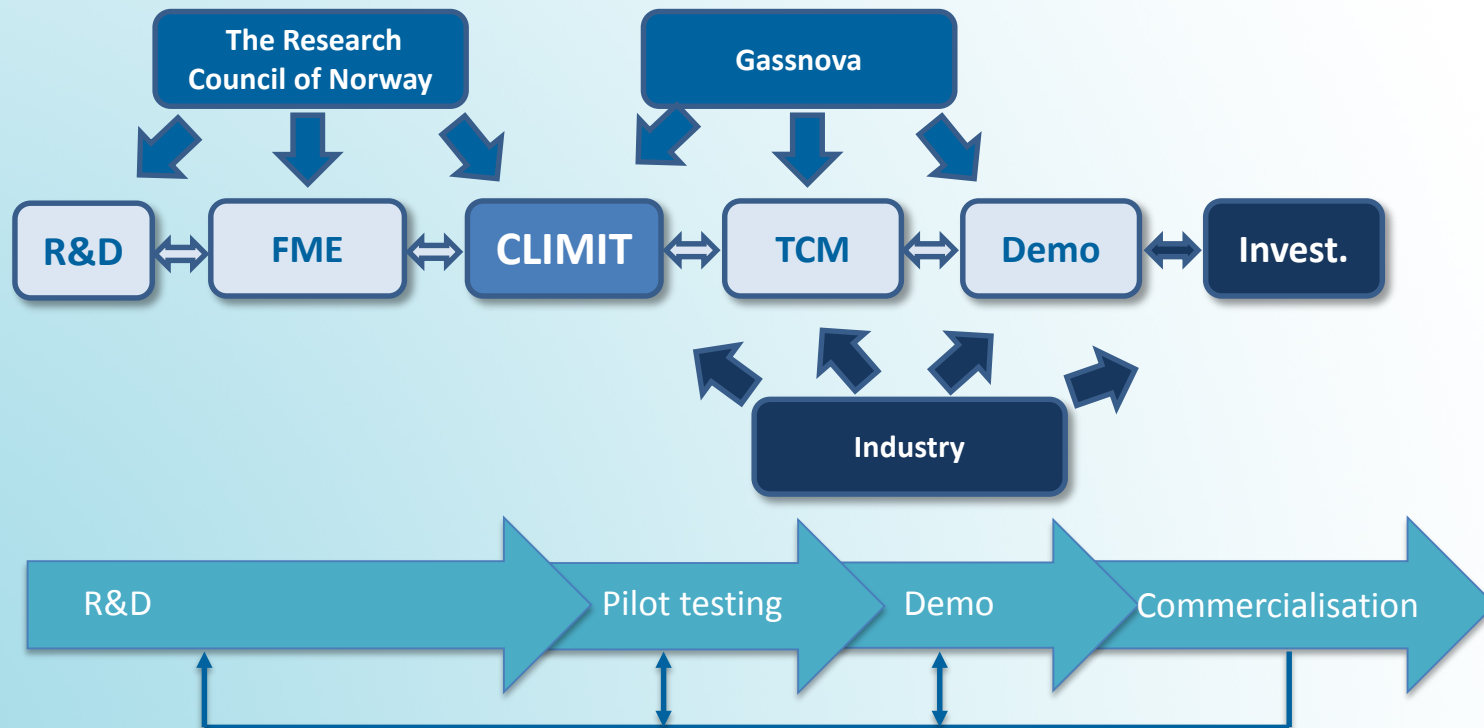
NORWAY: MORE THAN 10 YEARS CCS TECHNOLOGY DEVELOPMENT

EFFORTS FROM R&D TO FULL SCALE CCS



NORWAY:

GOVERNMENT: CONTINUED COMMITMENT TO CCS ACTIVITIES ALONG THE WHOLE VALUE CHAIN





CLIMIT: FROM R&D - DEMO

- Annual budget 20 M€
- More than 300 projects have received support
- Approx. 170 M€ in funding since 2005
- Taken Norway to the forefront of international research, and made us a key player

CLIMIT: SUPPORT THAT HAS YIELDED RESULTS

INCREASED KNOWLEDGE AND GENERATED ALTERNATIVES...

CAPTURE

- More effective chemicals
- Qualified material selection
- New methods
- Experience from industrial emissions

ENVIRONMENTAL IMPACT

- Amine emissions

TRANSPORT

- Pilot testing of solutions
- Corrosion

STORAGE

- Capacity simulation
- Monitoring
- Improved oil recovery

INTERNATIONAL COOPERATION

- USA
- Germany
- The Netherlands
- UK
- ...



SOLVit

Solvents for the next generation of post combustion CO₂ capture systems

- Aker Solutions amine technology
- 8 yrs (2008 – 2015), 33 M€ (13 M€ from CLIMIT)
- **Partners:** Sintef, NTNU, EON, EnBW, Scottish Power, Statkraft
- **Test sites:** lab., Tiller, MTU, Heilbronn and TCM
- **Main results:** 35 % reduced energy consumption, reduced degradation and reduced environmental impact



Norcem

CO₂ Capture Test Facility at Norcem Brevik

- Four technologies tested: Amines, Membranes, Solid Sorbents and Ca-Looping
- 4 yrs (2013 - 2017), 9,3 M€ (7 M€ from CLIMIT)
- **Partners:** ECRA, Aker (amine), Alstom (Ca-L), RTI (sorbents), NTNU/Air Products (membranes)
- **Test sites:** Norcem Brevik and IFK (Ca-Looping)
- **Main results:** Field testing of four technologies and a full-scale evaluations (*benchmark study*) based on input from field testing and modelling
Concept study of Aker's amine technology – basis for Norway's ongoing feasibility study

CO₂ TECHNOLOGY CENTRE MONGSTAD (TCM)



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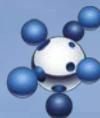
75.12%



Statoil

20%

sasol
reaching new frontiers



2.44%



2.44%



FEASIBILITY STUDIES FULL SCALE: STATUS CO₂-CAPTURE

PROGRESS ACCORDING TO PLAN

- Diversity: three projects – from three different industries – great potential for learning and technology development
- Motivation: Preparation for staying competitive in the low carbon society
- Interface to the authorities: intermediate storage/transportation
- Business model and financing



FEASIBILITY STUDIES FULL SCALE: CO₂ STORAGE



- Feasibility study contract awarded Statoil
- Three locations, five solutions, will be studied

CCS A PART OF THE SOLUTION

FOR A COMPETITIVE AND SUSTAINABLE LOW CARBON SOCIETY



- We need to realize full scale projects in Europe to develop CCS further
- Norway is a leader in CCS – and has ambitions to continue to be so