The Nordic CO$_2$ storage atlas and the process of making it

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NORDICCS concept:

Assumptions and premises (1) → Nordic CCS platform → Nordic CCS roadmap → Framework conditions → Economy → Strategies for CCS realisation

Feasibility studies on CCS industry cases:
- Cement
- BioCCS
- Metal
- Oil refineries
- Power

CO₂ capture:
- Energy analysis (5)
- CCS integrated (6) in industry

CO₂ transport (4):
- Cost-effective CO₂ transport

CO₂ storage (2):
- The Nordic CO₂ storage atlas
- Guidelines for site storage
- Site storage modelling

R&D recommendations

Communication (3) and dissemination:
- Public awareness and acceptance
- Dissemination and networking

Spreading excellence

Partners:

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Summary

A description of the process and methodology of making the Nordic CO₂ storage atlas. Including available data, the difference storage options in the Nordic countries and how to evaluate the storage capacities.


Keywords
- Storage capacity
- CO₂ storage atlas
- Nordic countries
- sedimentary basins
- basalts

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About NORDICCS

Nordic CCS Competence Centre, NORDICCS, is a networking platform for increased CCS deployment in the Nordic countries. NORDICCS has 10 research partners and six industry partners, is led by SINTEF Energy Research, and is supported by Nordic Innovation through the Top-level Research Initiative.

The views presented in this report solely represent those of the authors and do not necessarily reflect those of other members in the NORDICCS consortia, NORDEN, The Top Level Research Initiative or Nordic Innovation.

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One of the final outcomes of NORCICCS – the Nordic Competence Centre is a web-based CO₂ storage atlas, which will be public released in autumn 2015. The atlas will show the location of sites potentially qualified for CO₂ storage. The mapped storage sites will be ranked with respect to their suitability for CO₂ storage, based on geological properties and the state of knowledge, in order to point out the most prospective areas at present time.

The primary tools to map subsurface storage sites are wells and seismic surveys. The wells can give information about the existence of a porous reservoir rocks and overlaying tight cap rocks. The seismic survey gives the possibility to map the reservoir and cap rock between the wells.

In order to judge if a mapped storage site will be able to contain the required amount of CO₂ from one or several emission sources it is important to estimate the storage capacity. The first approach is a static calculation, calculating the pore volume and multiplying it with a storage efficiency factor. If a potential storage site gives promising results, a dynamic modelling and injection simulation can give more detailed capacity estimations. In NORDICCS seven sites have been selected for modelling.

In the Nordic region four CO₂ storage options have been included in the mapping. It is potentially possible to store CO₂ in the pore space of sedimentary formations (aquifers), in depleted hydrocarbon fields or in porous basaltic lava. The last opportunity is ultramafic rocks were the CO₂ can react with the rock and form carbonate minerals (carbonisation).

The different geological setting in each of Nordic country yield different storage opportunities. In Finland the crystalline basement rocks only allow a minor potential for CO₂ storage by carbonisation of ultramafic rocks [1]. Sweden has the possibility to store in sedimentary formations in the south-eastern part of the Baltic Sea and South-West of Scania [2]. In Denmark and Norway the existences of extensive sedimentary basins offers the opportunity to exploit large pore volumes in aquifers for CO₂ storage [2] [3]. In Iceland the research project CarbFix investigate the potential for CO₂ storage by injection of CO₂ saturated water into porous basalts [2] [4].

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Storage capacity estimations is important in order to judge if a mapped storage site will be able to contain the required amount of CO₂ from one or several emission sources. Static calculation is a first approach to capacity estimation is done by calculating the pore volume of the reservoir and multiplying it with a storage efficiency factor. If a potential storage site gives promising results, a dynamic modelling and injection simulation can give more detailed capacity estimations. In NORDICCS seven sites have been selected for modelling.

The primary tools to map subsurface storage sites are wells and seismic surveys. The wells can give information about the existence of porous reservoir rocks and overlying tight cap rocks. Analysis of well logs and cores can give information on porosity, permeability and deposition environment (facies). The seismic survey makes it possible to map the reservoir, cap rock and the faults between the wells, and to understand the geometry of the formations.

Our playground

Illustration of the data used for mapping of CO₂ storage sites. Based on the Norwegian CO₂ storage atlas by the Norwegian Petroleum Directorate.

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