

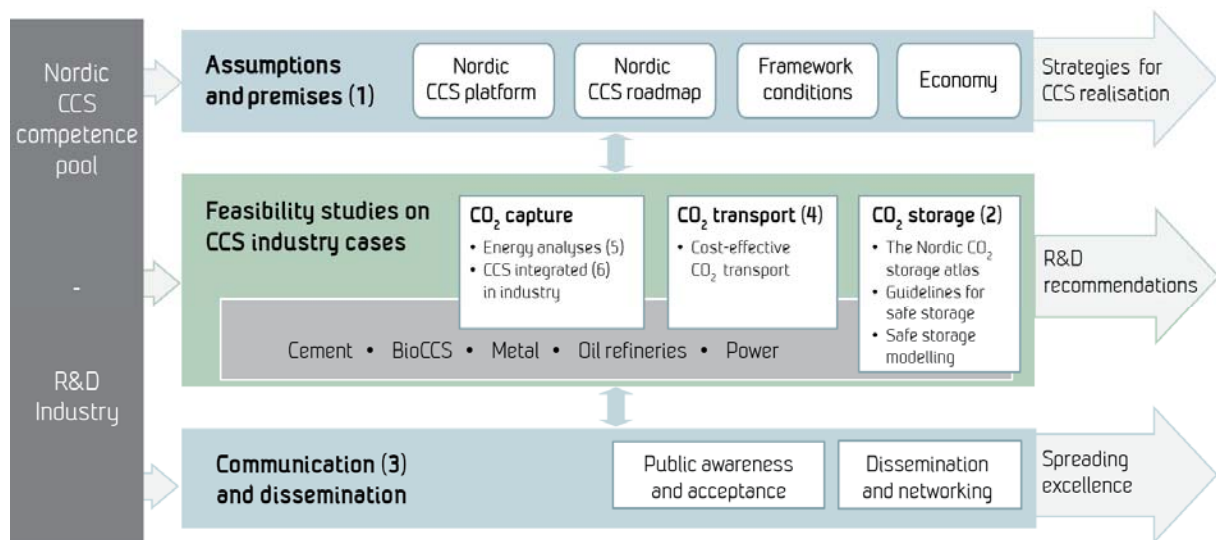
CO₂ storage atlas for Sweden - a contribution to the Nordic Competence Centre for CCS, NORDICCS

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NORDICCS concept:



Partners:



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Summary

The Swedish part of the CO₂ storage atlas is based on a screening process by analysing existing deep wells and seismic data regarding deep saline aquifers and cap rocks in SW Scania and SE Baltic Sea.

Sweden presents eight potential deep saline aquifer storage units and one single storage trap. Very preliminary estimations indicate a potential Swedish CO₂ storage capacity of 3400 Mt or more.

The poster was presented at 31st Nordic Geological Winter Meeting, 8-10 January, Lund University, Sweden.

Keywords CO₂ storage mapping, Storage Capacity, webGIS, Storage atlas, Scania, Baltic Sea.

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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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GRY MÖL MORTENSEN¹

During the last 10-20 years Nordic countries have been involved in several international CO₂ storage mapping projects. Swedish contributions have traditionally been limited. However, in 2011 all five Nordic countries joined forces in a CCS competence centre – NORDICCS, and one of the major tasks of the centre is the creation of an united Nordic CO₂ storage atlas which will be public available in 2015 as a web based Geographical Information System (GIS).

The Swedish part of the CO₂ storage atlas is based on a screening process by analysing existing deep wells and seismic data regarding deep saline aquifers and cap rocks in SW Scania and SE Baltic Sea. Parameters included are lithology, volume, net/gross, porosity, permeability, injectivity, reservoir type, salinity, CO₂ density at reservoir conditions, efficiency factor, cap rocks. The parameter values are used to estimate and model the CO₂ storage capacity. Furthermore, injection simulations of CO₂ in selected Nordic storage sites will narrow the uncertainty in storage capacity assessment. The compiled information is transferred into a GIS environment and integrated into the Nordic CO₂ storage geodatabase which is the basis for the webGIS.

In autumn 2013 the first part of the Nordic CO₂ storage atlas was completed. Sweden presents eight potential deep saline aquifer storage units and one single storage trap. Very preliminary estimations indicate a potential Swedish CO₂ storage capacity of 3400 Mt or more. However, future modelling and Swedish legislation prohibiting onshore storage will affect this number.

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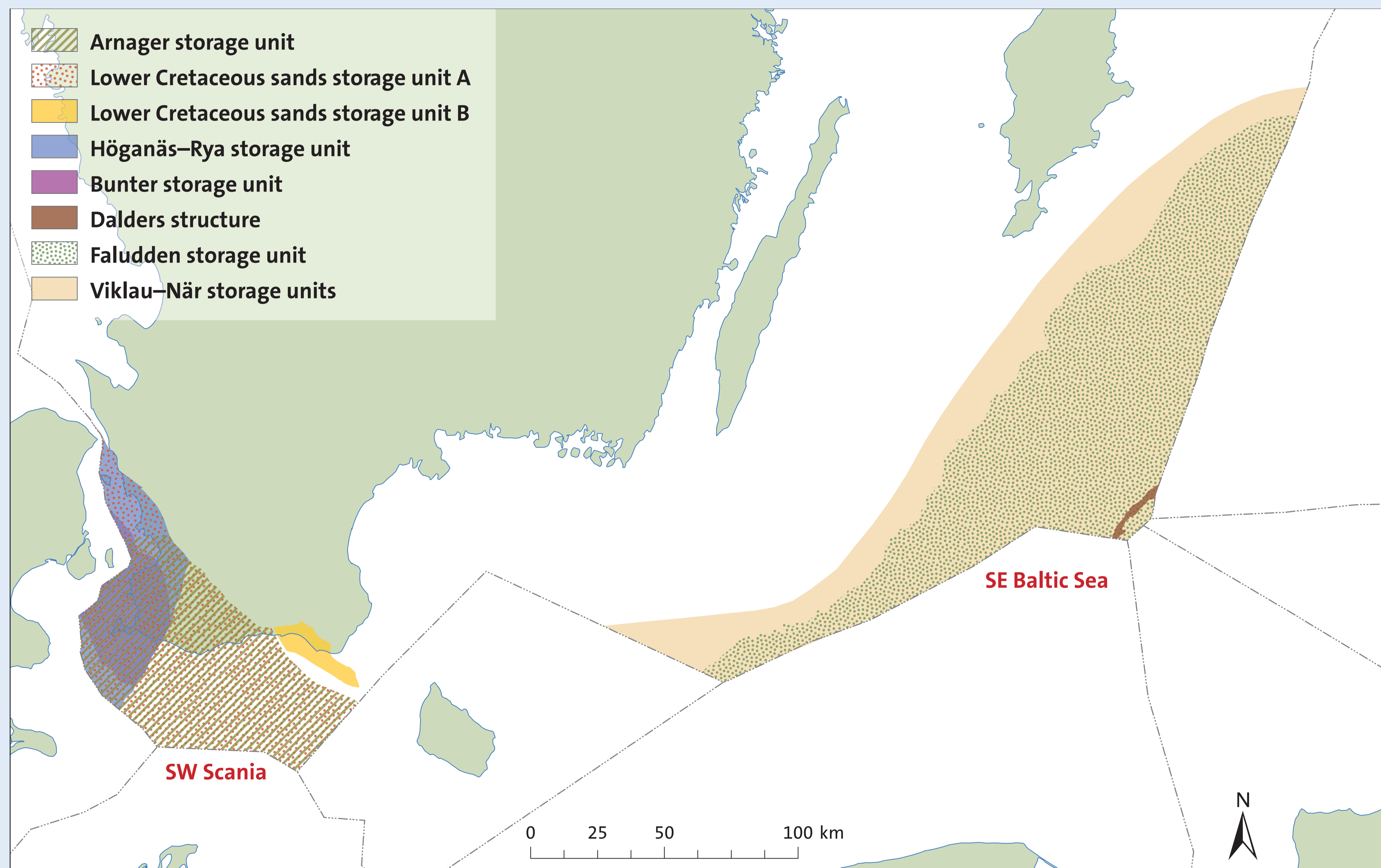
Geological Survey of Sweden, Kiliansgatan 10, SE-223 50 Lund

Nordic CCS cooperation

In 2011 the five Nordic countries joined forces in order to enhance awareness of the unique opportunities for geological storage of CO₂ in the Nordic region.

This was funded by the Nordic countries research programme – the Nordic Top-level Research Initiative together with partners from the industry. The result was the Nordic Competence Centre for CCS – NORDICCS.

The project will operate over a five year period and has the overall objective to boost the deployment of CCS in the Nordic countries by creating a durable network of excellence integrating R&D capacities and relevant industry and to demonstrate how CCS can contribute to the Nordic portfolio of climate change mitigation options.



The Southernmost part of Sweden showing the identified storage units and trap.

Potential storage sites in Sweden

Screening of available data on deep well logs and seismic have shown two areas in southern Sweden with potential for geological storage of CO₂ – the south-east Baltic Sea and south-west Scania. A total of eight storage units and one trap have been identified. Examples of important parameters are depth, lithology, volume, porosity, permeability and cap rocks.

CO₂ storage in the south-east Baltic Sea

In the south-east Baltic Sea, three potential storage units and one trap have been identified.

Early Cambrian storage units comprise two separate sandstones, the Viklau and När sandstones, both members of the File Haidar Formation. The two units consist of fine- to very fine-grained silt- and sandstones with shale and claystone interbeds, locally quartzitic. The units dip less than 1° east-south-east.

A Middle Cambrian storage unit consists of the Fa-

Generalized litho-stratigraphical logs

The well logs on the right side of the poster are generalized litho-stratigraphical logs. The Höllviksnäs-1 well log represents, in general terms, the litho-stratigraphy in south-west Scania. Likewise, the Faludden 1-2 well log is an example of a generalized litho-stratigraphic sequence from the south-east Baltic Sea.

ludden sandstone, a member of the Borgholm Formation. The Faludden sandstone consists of a clear fine-grained, well sorted, calcite cemented quartz sandstone with local interbeds of shale and siltstone. The unit has a regional distribution and dips less than 1° east-south-east. The Faludden storage unit contains a structural trap, the Dalder structure.

The topmost cap rocks consist of c. 80 m Ordovician limestone followed by c. 500 m Silurian marlstone.

fied, Early Cretaceous sequence. The Lower Cretaceous sands consist of quartz sandstone interlayered with siltstone and claystone.

The topmost storage unit in south-west Scania is the Arnager Greensand belonging to the Early-Late Cretaceous Arnager Greensand Fm. The Arnager Greensand is a fine- to medium-grained glauconitic quartz sandstone.

All storage units dip gently (1–2°) to the north-east. The topmost caprock consists of c. 1 000 m Late Cretaceous–Danian clayey–chalky limestone.

Physical parameters and estimated capacity based on the U.S. DOE for formations

Name	Depth	Thickness	Net/Gross	Porosity	Permeability	2% capacity Mt
Faludden	830	45	0,90	14	147	745
När	817	36	0,65	10	50	426
Viklau	865	57	0,65	8	30	553
Arnager Greensand	946	39	0,80	26	400	521
L. Cret. sands A	965	29	0,65	25	200	330
L. Cret. sands B	776	200	0,65	25	200	115
Höganäs-Rya	976	180	0,51	23	200	543
Bunter	1 509	137	0,67	12	300	165

Future work

In the frame of the NORDICCS project, future work will include dynamic modelling and ranking of the storage sites regarding storage capacity – seal – faults – data coverage. This is followed by a thorough geological description for the best storage sites in each country in order to improve the understanding of each site's complexity and specific characteristics. Finally, by the end of 2015, the NORDICCS storage atlas will be public available as a web-based GIS.

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