

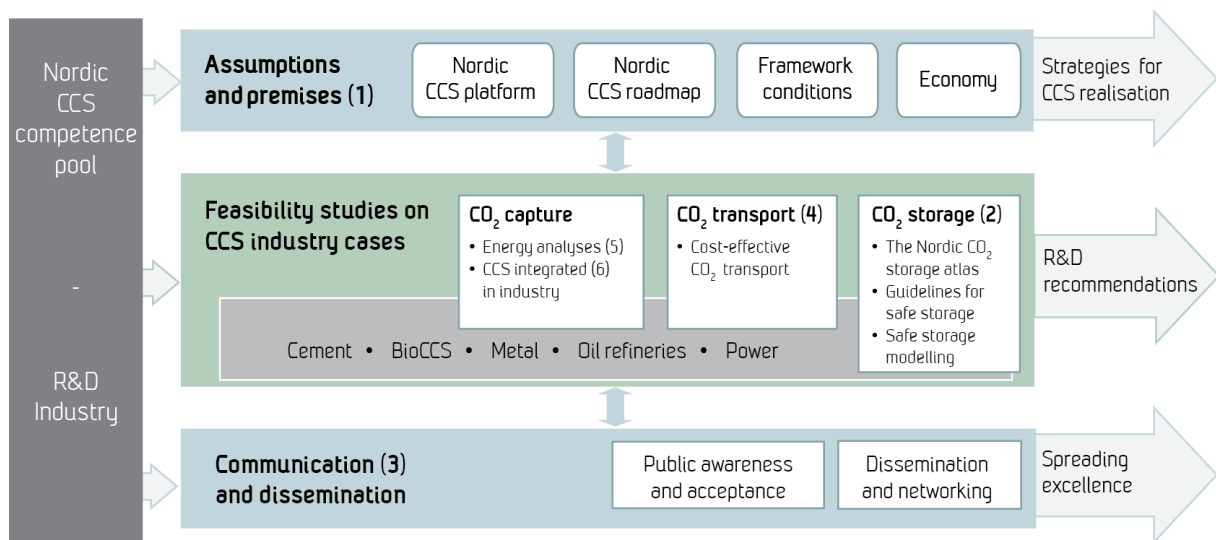
# Recommendations on CO<sub>2</sub> transport solutions

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**NORDICCS concept:**



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# Summary

The aim of this report is 1) to recommend transport solutions for CO<sub>2</sub> sources in the Nordic region, here defined as the least costly transport mode for the selected CCS cases in NORDICCS and 2) to analyse the potential for establishment of CO<sub>2</sub> clusters by means of a transportation network around the selected CCS cases in order to reduce the transportation cost.

Comparing cost for pipeline transport with cost for ship transport, it is concluded that both for the majority of the selected cases as well as for most of the emission sources in the region, ship transport will be the least costly transport mode for each source individually. It is also concluded that ship transport is the most appropriate transport mode for most of the potential clusters in the region during a ramp-up phase. This is closely related to underutilization of pipelines and risk taking in connection with underutilized pipelines. For distances shorter than 100 km and volumes smaller than 1 Mtpa, e.g. corresponding to a typical collection system containing multiple coastal sources, it has been calculated that onshore pipeline in most cases will be the least costly transport solution. More generally, it can be stated that the break-even distance where ship transport becomes least costly than pipeline transport increases as the volume increases. Yet, it should be emphasized that discharge from a ship offshore and positioning of smaller ships during injection will need to be demonstrated.

An obvious but still important conclusion is that constrained storage capability may have a profound impact on design and cost of a CO<sub>2</sub> transport system. In fact, a poor storage capability in the reservoirs in the Baltic Sea may render ship transport to Gassum and Utsira a less costly transport and storage option than the reservoirs in the Baltic Sea.

Finally, it is concluded that in the Nordic region, the Kattegat-Skagerrak area probably offers the best opportunities for a Nordic CCS system, possibly driven initially by CO<sub>2</sub> EOR which potentially may require a start-up already in 2020.

**Keywords** ship transport, cluster, ramp-up, risk taking, injectivity

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*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.*

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