Recommended CO_2 transport solutions in the Nordic region

NORDICCS

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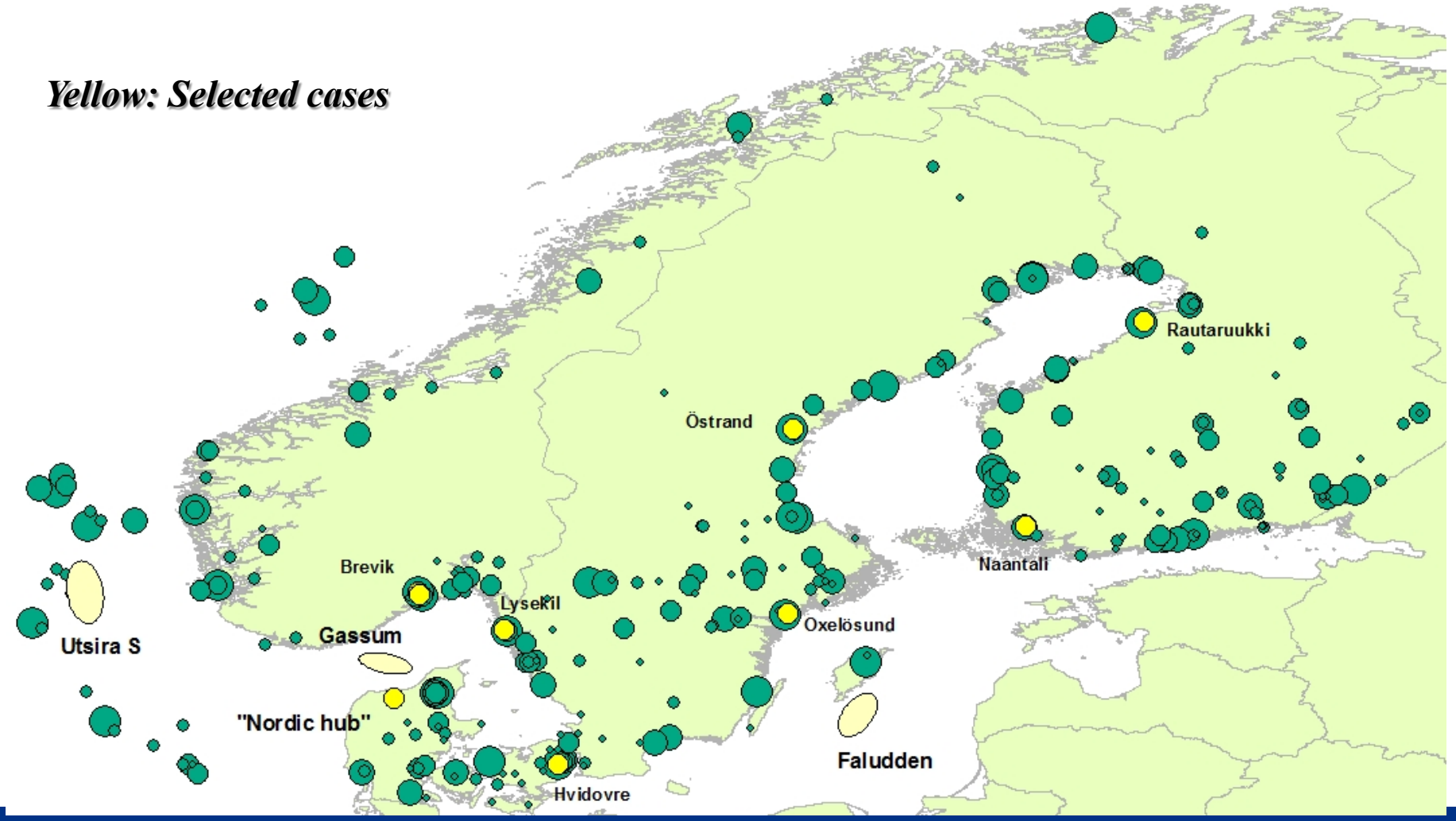
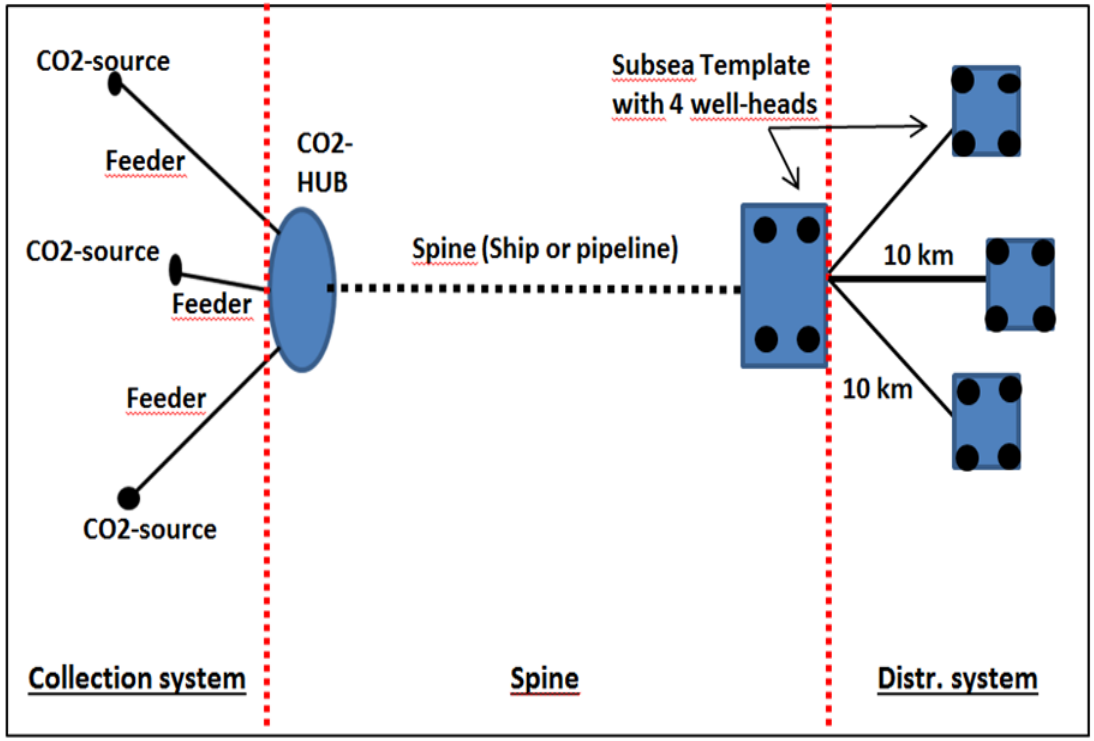
Emission sources[1] (green) and 3 relevant storage sites[2] (light yellow) in the Nordic region (Iceland not shown)



1: All sources with 2010 emissions of at least 100 ktons, 2: Size/shape illustrative only

System parameters



- Cost calculations start after compression up to 70 bar
- Cost calculations end at the last injection well at 70 bar
- Minimum pressure 70 bar
- All transport distances measured in GIS – 10% added offshore, 20% onshore
- Max pipeline diameter 48″.
- Ship size max 40,000 m^3
- Ship transport at 7 bar/-50°C, 12 knots, 16 h for loading, 54 h for unloading
- Cost includes subsea templates distribution lines, well heads, umbilicals
- 2012 €, NPV, 8% discount rate

Applied methodology

- Compared cost ship versus pipe as a function of volume and distance
- Calculated Pipeline volumetric break-even point for eight selected sites
- Calculated specific transport cost for eight selected sites
- Investigated the potential role of injectivity on the choice of reservoir (and transport route)
- Analysed the effect of underutilised pipelines on cost for pipeline transport (not shown here).

Main conclusions

- Ship transport is the least costly transport option for *most of* the sources in the region individually.
- Ship transport is the least costly transport option for *most of* the potential cluster systems in the region during ramp-up.
- Kattegatt-Skagerrak region offers the best prospects for build-up of a *pipeline* transportation system.
- Poor storage/injection capacity in reservoirs in the Baltic Sea *may* make it more cost efficient to transport the CO_2 to storage sites in the Skagerrak region or in the North Sea.
- Regulatory barriers still remaining both for export of CO_2 for storage as well as for ship transport of CO_2.
- Positioning *of* ship during injection and discharging *from* ship need to be demonstrated

Acknowledgement

Discussions with geologists at Sintef, Norway and with personnel at Gassco, Norway greatly appreciated.

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