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Geological Storage od CO_2 in the Southern Baltic Sea

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Geological Storage of CO_2 in the Southern Baltic Sea Region

The BASTOR project identifies and characterises the potential CO_2 storage sites in the southern Baltic Sea. A regional theoretical storage capacity of 16Gt of CO_2 in the Middle Cambrian sandstone beneath 900 metres of cap rock was estimated. 1.9Gt of this storage potential is estimated in the Dalders Monocline with some 743Mt CO_2 in individual hydrocarbon and saline aquifer structures located mainly offshore Latvia and 128Mt in the Dalders Structure.

Although the study has established a relatively large theoretical storage capacity, there is no effective capacity proven within these totals. Dynamic modelling undertaken in the Southern Swedish sector suggests that the relatively poor permeability and porosity characteristics would limit the injection rate to 0.5Mt per well per annum and restrict the reservoir pressure increase to 50% above the hydrostatic pressure for an injection period of 50 years. The dynamic modelling for this area suggests that an injection strategy for this sector would be limited to 5 injection wells giving a total injection capacity of 2.5 Mt per annum. Based on these results, the potential of the Southern Swedish offshore sector to sustain injection rates of CO_2 required for regional industrial capture, even when using horizontal wells, brine extraction and hydraulic fracturing, would appear to be very low.

Areas to the north east of the Monocline, such as offshore Latvia have been identified as having better reservoir quality despite limited data being available. These areas could sustain higher rates of injection and prove suitable areas for commercial storage. Furthermore, the regional storage capacity assessment demonstrated that there are sweet spots in the Cambrian reservoir such as onshore Latvia, where there is commercial gas storage, and both onshore and offshore Kaliningrad, where there is ongoing hydrocarbon production.

The potential for seal failure was investigated as part of the BASTOR study and three possible modes of seal failure were identified. These include top seal failure, migration up the bounding fault planes and leakage across fault planes. The risk associated with all of these is considered low, based on currently available data.

A test injection methodology aimed at assessing the commercial viability of CO_2 injection in the Baltic Sea region has been designed. This includes the characterisation of reservoir, caprock and hydraulic properties, pump testing as well as CO_2 migration and trapping using a phased approach methodology. An outline MMV programme has been developed based on the results of the dynamic modelling and the development phases of a CO_2 injection site.

Since the potential to store significant quantities of CO_2 in the Swedish part of the Dalders Monocline appears to be limited, exploration efforts and the acquisition of new, site specific data through geophysical surveys, drilling and injection testing as well as detailed sampling and laboratory analyses, should be focussed on areas of better reservoir qualities than the current study area. New data covering the north eastern portion of the Dalders Monocline, in particular offshore Latvia and onshore as well as offshore Kaliningrad, would allow a detailed charterisation of individual potential sites for CO_2 storage. This would also define site-specific seal integrity as well as chracterise small-scale fault structures that would ultimately dictate the potential injection and storage conditions.