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**Assessing the sustainability of CCS technologies in Finland – Highlighting future potential, uncertainties and challenges for technology implementation**

ABSTRACT

Carbon capture and storage (CCS) technologies are often mentioned as one of the potential means for reducing GHG emissions in energy production and in energy intensive industry. In recent energy scenarios, CCS is one of the possible solutions when moving towards low carbon economy. However, many open questions related to future applicability, acceptability and sustainability of CCS in Finland, remain.

The bedrock conditions in Finland are not suitable for CO<sub>2</sub> storage, and the captured CO<sub>2</sub> would need to be transported to a storage site outside Finland. Current low price of CO<sub>2</sub> emission allowances, together with the high energy penalty of CCS make the technology unprofitable in most situations. Additionally, there are unclear aspects in regulation that increase the uncertainty and potentially prevent CCS implementation in Finland. Although many difficulties are foreseen, implementation of CCS might be a potential (and possibly even the only) solution for energy intensive industries to effectively reduce GHG emissions. Other potential options in Finland might be the capture of biobased carbon, especially in conjunction with biofuel production. Furthermore, the energy penalty of the capture process could be reduced through heat integration within Finnish CHP plants.

This paper presents the findings of the on-going Carbon Capture and Storage Program (CCSP), in which an integrated sustainability assessment approach is applied. Within the CCSP program, innovative solutions for CCS are developed in cooperation with several industrial and research partners. Cross-disciplinary research methods are used for evaluating the sustainability of CCS technologies. Key issues related to potential environmental, economic, social, legal, technological and safety impacts of CCS implementation are discussed and evaluated, taking also into account potential benefits that could be achieved. The implementation of CCS technology does not only impact the plant in question, but the regional energy system as a whole, increasing the complexity of the assessment.