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Assessing the feasibility of large-scale hydrogen storage in salt caverns on the UKCS using 3D seismic data

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The energy industry in the UK faces a challenge to decarbonize to support reaching net zero CO2 emissions by 2050. In nearly all scenarios emission reductions are characterized not only by energy demand reductions, but also the decarbonization of electricity and heating. The use of hydrogen as a replacement for natural gas is one proposed solution, where renewable hydrogen is either blended into the gas grid or used directly. To ensure continuity of supply large scale hydrogen storage will be needed to meet this demand.

Hydrogen has been stored in small volumes (<25GWh) in salt caverns at various locations onshore in the United Kingdom since 1959. These caverns store hydrogen for industrial usage. In order to meet the demand for energy related hydrogen storage an increasing number of new and potentially larger storage options will be needed. Engineering of larger salt caverns for a hydrogen energy system will require thick salt formations which are optimally located with respect to both the hydrogen production facility and the end use. The Permian and Triassic salts deposits of both the Southern North Sea and the East Irish Sea offer vast areas for potential cavern development. Previous studies have described the landscape of underground gas storage onshore and offshore the UK, but to date there have been few detailed geophysical and geological studies on the hydrogen storage potential offshore.

The identification of suitable storage sites requires an understanding of the subsurface geology including potential structural discontinuities which could compromise the integrity of storage sites and be pathways for leakage. This analysis of hydrogen storage sites will utilise extensive existing modern 3D seismic data and well data taken from the Southern North Sea. We describe the geological setting of the Permo-triassic salt in the SNS in relation to the potential to develop salt cavern storage and develop play risk assessment maps. These risk assessment maps form part of a play fairway analysis workflow in order to identify the optimal storage sites for hydrogen on the UCKS.