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Geological perspectives of offshore underground hydrogen storage in Ireland

Zhipeng Xiao¹, Cian Desmond², Paul Stafford², and Zili Li¹

¹Civil, Structural & Environmental Engineering, University College Cork, Cork, Ireland

²Gavin and Doherty Geosolutions, Ireland

Rapid development of renewable sources (e.g., wind turbines and geothermal energy) has been increasing the market share of renewable energy in electricity production in Ireland with a target of 70% by 2030. However, the production of renewable energy is usually fluctuating, which necessitates the strategies and technologies to match intermittent electricity generation surplus with time-varying market demand. Hydrogen gas generated from surplus renewable electricity has been acknowledged to be a promising energy carrier for balancing this energy gap. In particular, underground hydrogen storage in geological formation emerges as an economically effective and reliable method to store the gas on a large scale. To this end, it is essential to develop a comprehensive understanding of the suitable geological settings for underground hydrogen storage.

This paper investigates various geological settings in Ireland for different types of offshore underground hydrogen storage (e.g., salt caverns, depleted hydrocarbon fields, and aquifers). For each Irish offshore basin, an assessment is conducted to evaluate the potential application of underground storage methods and associated safety & serviceability concerns. The result confirms some prospective areas for different options of hydrogen underground storage at specified conditions. In particular, the offshore sedimentary basins of western and southern Ireland are considered to be suitable UHS geological settings. These shortlisted suitable geological settings deserve further investigation in greater details for the subsequent design & construction of hydrogen underground storage projects.