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Subsurface characterization and reservoir selection in Lithuania for underground hydrogen storage

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This study investigates subsurface characterization and reservoir selection for underground hydrogen storage (UHS) in Lithuania, emphasizing geological viability and storage integrity. Lithuania's reservoirs exhibit promising characteristics for UHS, including favorable porosity, permeability, and caprock integrity. A preliminary study of 10-year simulation of hydrogen injection and recovery in the Syderiai saline aquifer demonstrated the feasibility of UHS, though recovery efficiency was reduced by nearly 50% when using a single well for both injection and production. Volumetric analysis estimated a combined storage capacity of approximately 898.5 Gg H2 (~11 TWh) for the Syderiai and Vaskai saline aquifers. After this preliminary study, a systematic approach was utilized to evaluate and rank Lithuanian geological sites for UHS using multi-criteria decision-making (MCDM) methods in details. The study involved identifying and collecting data on essential parameters, which were divided into technical, safety, and environmental aspects. Subsequently, geological options such as salt caverns, brine ponds, and depleted oil reserves were selected. The parameters were validated, converted to numerical values, and organized into a scoring matrix for compatibility with the MCDM method. Challenges such as data gaps and weight assignments were addressed by incorporating expert input and refining the methods to emphasize positively contributing parameters. The study also highlights the importance of collaboration between researchers, industry stakeholders, and policymakers to ensure safe, cost-effective, and sustainable UHS solutions that support Lithuania's transition to a clean energy system.