TESTING HYDROGEN STORAGE AND GEO-METHANATION IN DEPLETED HYDROCARBON RESERVOIRS

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Keywords: hydrogen storage, geo-methanation

ABSTRACT

Renewable energy is fundamental to the future of net-zero carbon emissions. At peak production, a surplus of renewable electricity will arise. Solutions for large-scale cross-seasonal storage of renewable electricity are currently lacking. Power-to-Gas, the process of converting electrical energy to chemical form, such as hydrogen gas (H_2), may be coupled with underground gas storage, allowing to retain otherwise lost renewable energy. In this presentation, the results of the first experimentally controlled study of underground H_2 storage are reported. The majority of H_2 was successfully recovered. We show that H_2 injection into the reservoir triggered the microbially-mediated conversion of H_2 to methane (CH_4), termed "geo-methanation". By recreating geo-methanation in reservoir-mimicking lab-scale mesocosms, we showed full, rapid and reproducible conversion of H_2 & CO_2 to CH_4 over a course of year-long experiment. Additionally, we discuss a challenge for geo-methanation related to substrate gas partial pressures in the mix and experimental solutions to it. Finally, we provide first results of testing industrial off-gas CO_2 as substrate for geo-methanation, paving the way to closed carbon cycle energy generation and utilization on site for industrial applications.

Acknowledgements

This study is based on research accomplished within the flagship projects Underground Sun Storage, Underground Sun Conversion, and Carbon Cycle Economy Demonstration funded by the Austrian Climate and Energy Fund and the Austrian Research Promotion Agency (FFG).

References

Hellerschmied, C., Schritter, J., Waldmann, N., Zaduryan, A.B., Rachbauer, L., Scherr, K.E., Andiappan, A., Bauer, S., Pichler, M. and Loibner, A.P. (2024). Hydrogen storage and geo-methanation in a depleted underground hydrocarbon reservoir. *Nature Energy*, 9(3), pp.333–344. doi:https://doi.org/10.1038/s41560-024-01458-1.