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Economic feasibility of electricity, ammonia and methanol production by onshore and offshore Underground Coal Gasification

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Underground Coal Gasification (UCG) enables the utilisation of coal reserves that are currently not economically exploitable due to complex geological boundary conditions. The high-calorific synthesis gas resulting from UCG can be utilised for, e.g., production of electricity, fuels and chemical feedstock. The aim of the present study is to identify economically competitive, site-specific end-use options for onshore and offshore produced UCG synthesis gas, taking into consideration Carbon Capture and Storage (CCS) as well as its Utilisation (CCU).
Our results demonstrate that boundary conditions favouring electricity, methanol and ammonia production exhibit low air separation costs, high synthesis gas calorific values and H2/N2 ratios as well as low CO_2 shares of max. 10%. Hereby, a gasification agent share of more than 30% O_2 by volume is not favourable from economic and environmental viewpoints.
Further study findings demonstrate that compared to the costs of the offshore platform, offshore drilling costs are negligible. Consequently, parameter uncertainties related to drilling costs can be neglected.
In summary, our techno-economic process modelling results reveal that the investigated process chains with high CO_2 shares in the synthesis gas are the most cost-intensive ones. Offshore UCG-CCS/CCU costs are twice as high as the onshore ones, while all investigated scenarios except for offshore ammonia production would be competitive on the European market (Nakaten and Kempka, 2017).

Literature

Nakaten, N.C., Kempka, T. (2017): Techno-Economic Comparison of Onshore and Offshore Underground Coal Gasification End-Product Competitiveness. Energies, 10, 1643, doi: 10.3390/en10101643.