Energies, vol.17, no.5, pp.1134-1-1134-18, March, 2024.

Levelized cost of biohydrogen from steam reforming of biomethane with carbon capture and storage (golden hydrogen)—application to Spain

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Abstract-

The production of biohydrogen with negative CO2 emissions through the steam methane reforming of biomethane, coupled with carbon capture and storage, represents a promising technology, particularly for industries that are difficult to electrify. In spite of the maturity of this technology, which is currently employed in the production of grey and blue hydrogen, a detailed cost model that considers the entire supply chain is lacking in the literature. This study addresses this gap by applying correlations derived from actual facilities producing grey and blue hydrogen to calculate the CAPEX, while exploring various feedstock combinations for biogas generation to assess the OPEX. The analysis also includes logistic aspects, such as decentralised biogas production and the transportation and storage of CO2. The levelized cost of golden hydrogen is estimated to range from EUR 1.84 to 2.88/kg, compared to EUR 1.47/kg for grey hydrogen and EUR 1.93/kg for blue hydrogen, assuming a natural gas cost of EUR 25/MWh and excluding the CO2 tax. This range increases to between 3.84 and 2.92, with a natural gas cost of EUR 40/MWh with the inclusion of the CO2 tax. A comparison with conventional green hydrogen is performed, highlighting both prices and potential, thereby offering valuable information for decision-making.

Index Terms- grey hydrogen; blue hydrogen; golden hydrogen; CCS; SMR; LCOH

Citation:
Arenas, E.M.; Linares, J.I.; Romero, J.C.; Yagüe, L. "Levelized cost of biohydrogen from steam reforming of biomethane with carbon capture and storage (golden hydrogen)—application to Spain", Energies, vol.17, no.5, pp.1134-1-1134-18, March, 2024.