

Biohydrogen production through biomethane steam reforming with CCUS for decarbonizing Spain's tile industry

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Abstract-

Renewable hydrogen production is a fundamental element in the pathway towards industrial decarbonization. While electrolysis is the primary method for producing renewable hydrogen, there is considerable potential in using renewable gases to complement this process. By upgrading biogas from anaerobic digestion of organic waste to biomethane and feeding it into a steam methane reforming facility where biogenic CO₂ is captured, biohydrogen with negative emissions (HyBECCS) can be produced. This study focuses on the decarbonization potential of HyBECCS, specifically in the Spanish tile sector, assessing HyBECCS/natural gas and biomethane/natural gas blends. Results show that HyBECCS blends save over 37% of biomethane compared to biomethane/natural gas blends for the same emissions reduction. A 50% HyBECCS/natural gas blend is proposed, which requires 4.7 TWh of biomethane to meet the tile sector's demand, representing less than 3% of Spain's total biomethane production potential. The cost analysis reveals that this 50% HyBECCS blend, achieving a 53.4% reduction in emissions, is competitive with pure natural gas when natural gas prices exceed 16.5 €/MWh, when biomethane comes from the organic fraction of municipal solid waste. This blend always exhibits lower costs than natural gas if biogas comes from landfills.

Index Terms- HyBECCS; biogenic CO₂; carbon capture, use and storage; hard-to-abate sectors; natural gas blends with renewable gases

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