

GREENING THE GAS GRID

Exploring the Viability of Green Hydrogen as a Partial Replacement for Natural Gas in Industrial Applications, in an Investment Under Uncertainties Scenario.

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Overview

In an era of urgent climate action, the quest for sustainable energy solutions has never been more critical. This article explores the potential of green hydrogen as a partial replacement for natural gas in industrial settings in a decentralised way, focusing on a case study employing Real Options Analysis in a path towards a greener future for industrial energy consumption.

The Green Hydrogen Uprising

Green hydrogen stands at the forefront of clean energy innovation, offering a tantalising glimpse into a future where renewable sources power industrial processes. Recent research has highlighted the financial viability of green hydrogen projects, with studies suggesting its cost-effectiveness in niche applications across the United States and Germany. Ali Khan et al. (2021, 2022) have detailed comprehensive cost assessments factoring in diverse technological elements, providing a solid foundation for our analysis.

Beyond Static Decision-Making

While previous studies have laid crucial groundwork, they often fall short of capturing the energy sector's dynamic nature, as Pindyck (2021) and Fleten et al. (2016) noted. Our research incorporates the ability to adapt and respond to unforeseen developments throughout a project's lifecycle. Moreover, we assess the value of having this ability to adapt. This approach is critical in the ever-evolving landscape of renewable energy, where technological advancements and market shifts can rapidly alter the playing field.

Decision-Making Under Uncertainty or The Real Options Analysis

At the heart of our study lies the Real Options Analysis framework. This method allows us to navigate green hydrogen adoption's complex uncertainties, including fluctuating electricity and gas prices, evolving electrolyser costs, and changing energy consumption patterns. By employing proven techniques such as lattices and Monte Carlo simulations, as explained by Cox et al. (1979) and Longstaff and Schwartz (2001), we provide a nuanced understanding of the financial implications of transitioning to green hydrogen.

Unveiling Hidden Value

Our analysis goes beyond traditional valuation methods, exploring the potential financial benefits of by-products like oxygen and Carbon Credits. We also investigate how threshold conditions impact investment decisions and overall project valuation, drawing insights from Brandão et al. (2005, 2012), Bastian-Pinto (2015) and Bastian-Pinto et al. (2021).

Conclusion: Advancing Sustainable Industrial Energy Solutions

This study contributes to the growing body of research on sustainable energy transitions by applying Real Options Analysis to adopting green hydrogen in industrial settings. Our findings demonstrate the potential of this approach to capture the dynamic uncertainties inherent in the energy sector, providing a more nuanced understanding of the financial implications of transitioning from natural gas to green hydrogen. By examining sequential adoption in 15% increments, we offer a practical framework for industrial firms to evaluate and implement decarbonisation strategies.

Future research could expand on this work by exploring the applicability of our model to diverse industrial contexts and geographical regions, further refining the understanding of green hydrogen's role in achieving global climate objectives.

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