

REAL OPTIONS APPROACH FOR FLEXIBLE USE OF GREEN HYDROGEN IN BRAZIL'S RENEWABLE ENERGY LANDSCAPE

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Overview

Air pollution and global warming are pressing issues requiring the decarbonisation of critical sectors of the worldwide economy. Brazil stands at the forefront of renewable energy utilisation for electricity production, presenting a unique opportunity to pioneer the production of green hydrogen to mitigate environmental difficulties. This study employs a real options analytical framework to assess a hypothetical investment in an electrolyser and an ammonia synthesis plant. This approach capitalises on hydrogen's versatility, enabling its application across various sectors. Specifically, the study considers a 'switch option', allowing investors to determine the optimal periods for green hydrogen production and its distribution to selected industries or its conversion to green ammonia. This strategic choice aims to optimise the investment's final cash flows by leveraging market conditions.

The valuation of this switch option involves a comparative analysis between the investment's net present value and the baseline scenario of selling electricity within the free market, which is characterised by significant price volatility and a consequent heightened risk of financial loss.

Methods

In this study, we apply the real options analysis (ROA) framework to explore the strategic 'switch option,' enabling the decision between selling electricity to the grid or diverting resources to produce green ammonia, contingent upon which option presents a more favourable financial outcome. To do this, we explore stochastic price modelling techniques to forecast financial returns under uncertain market conditions. The Geometric Brownian Motion (GBM) and the Mean Reverting Process (MRP) are among the electricity and ammonia forecasting pricing models employed.

Results

Preliminary findings from a simplified model suggest that incorporating the switch option enhances the investment's returns. This enhancement arises from the flexibility to adapt production and sales strategies in alignment with prevailing market dynamics for electricity or ammonia.

Conclusions

While the GBM model offers simplicity in its application, it is noted that it may erroneously overestimate financial outcomes. In contrast, the article illustrates that the Mean Reverting Process provides a more nuanced understanding of price behaviours, potentially leading to a more accurate valuation of the switching option.

Real options valuation offers a robust framework for evaluating the flexibility inherent in investment opportunities, particularly those that involve significant uncertainty and the potential for adapting strategies in response to market developments. Critically, the analysis reveals that the value derived from the capability to switch between electricity sales and ammonia production is amplified when the prices of these two outputs are negatively correlated, underscoring the importance of sophisticated pricing models in evaluating the economic viability of investments with multiple operational pathways.

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