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The Options Value of Blue Hydrogen in a Low Carbon Energy System

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Abstract

A developer considering the construction of a Steam Methane Reforming facility for the production of hydrogen from natural gas faces the decision as to whether to incorporate and operate a Carbon Capture and Storage (CCS) unit, as part of the facility, in an environment where the costs of inputs and the price of hydrogen are uncertain. Conventional valuation methodologies such as Discounted Cash Flow (DCF) cannot systematically integrate uncertainty from changing market and regulatory conditions. Such methods are also unable to account for the ability of management to make use of flexibility to respond as the uncertainties are progressively resolved proactively.

Consequently, an Engineering Flexibility / Real Options approach has been developed to allow the calculation of the additional value that the developer might obtain if a CCS unit is not fitted at the time of construction of the SMR plant. Instead, the plant is constructed so that the CCS unit can be retrofitted during the plant's lifetime if the economic conditions are such that it appears that this will increase the value of the SMR plant.

Application of this approach has shown that, for this example, the Net Present Values are increased in a range of energy price and cost of CO_2 release scenarios, i.e. the Real Option has a positive value. These findings hold for a range of discount rates. Similarly, the approach improves the Value at Risk and the Value at Gain.

Whilst in this work, the approach has been applied to the example of the decision of whether to fit a CSS unit to an SMR plant for the production of blue hydrogen, it is believed that a similar approach can be applied to other situations.

Keywords Uncertainty, Investment Decisions, Blue Hydrogen, Carbon Capture and Storage Under Uncertainty, Real Options, Monte-Carlo Simulation

JEL Classification D81, G11, Q40

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