Title : An analysis of the economic viability of producing hydrogen through electrolysis in the UK in relation to offshore wind energy using an incentive programme (CfD).

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Introduction

The expansion of renewable energy options has gained significance as environmental issues related to global warming which have become more acute, especially in combination with the current, ever-rising global gas and oil prices, which permeate every significant sector of the economy and restrain global economic growth by impacting the market dynamics for goods other than oil and natural gas. Increased electricity prices, shipping, agricultural, logistics, air travel, fertiliser, and other commodity production. The UK energy security and net zero cannot be guaranteed by such unpredictability. Consequently green hydrogen generation using the offshore wind potential offers the advantage to decarbonise traditionally hard sectors, while providing to the energy mix required to reduce the reliance on foreign oil and gas. While aiding the creation of a new circular economy.

METHODOLOGY

The methodology will examine the economic potential in hydrogen production by electrolysis, the economic indicators used to assess the risk analysis of this project is divided into five points of interests

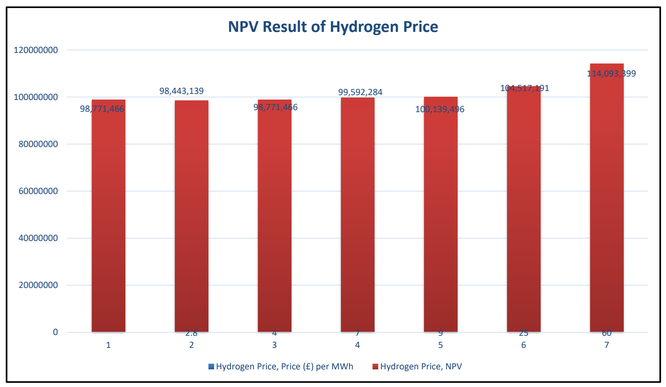
METHODOLOGICAL APPROACH

The Aberdeen windfarm will be investigated to study the surrounding conditions, with an emphasis on the available power supply. This entails determining how much installed capacity is available and how much capacity would be generated at the wind farm. Costs associated with offshore wind projects are also monitored in order to better understand CAPEX and generation pricing.

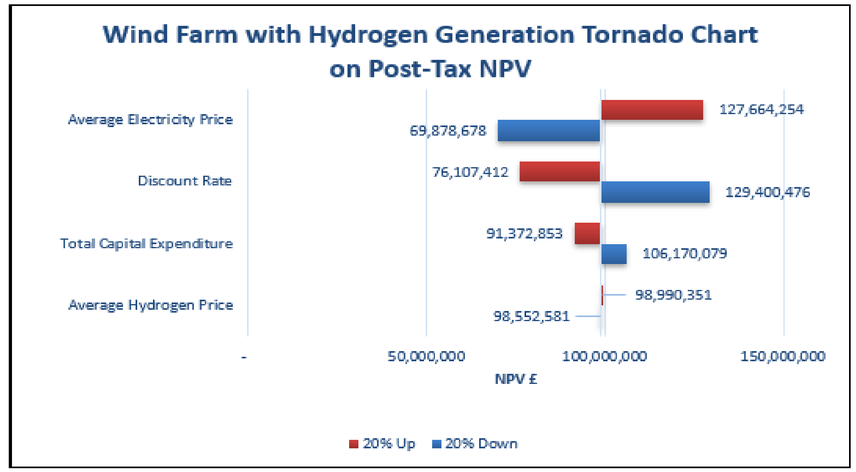
- Evaluating the economic market for hydrogen/electricity and detecting possible demand generated by the energy sector, such as heating.
- A technological breakdown of how hydrogen gas may be created, using renewable wind power, will be conducted alongside investigating the costs of producing hydrogen.
- Present how a hydrogen generation system linked with an offshore wind energy farm functions and how much electricity/hydrogen is produced per hour. Connect this model to an economic study to determine its worth in terms of net present value (NPV), IRR, payback period, Profitability Index, levelized cost of energy (LCOE), and the levelized cost of hydrogen (LCOH) In this analysis the LCOH is estimated as delivered by PEM electrolyser. There are no further conversion, storage, or transportation costs considered.
- The last section includes a sensitivity analysis of how profitability fluctuates with various variable modifications. This allows for the drawing of conclusions on economic potential and impact factors.

Results Summary

Summary Output	
Levelized cost of energy (LCOE) KWh/year	0.499984862
Levelized cost of hydrogen (LCOH) KWh/year	4.399866785
Electricity Output	139278744
Hydrogen output	15827130
NPV electricity output	£125,025,802.51
NPV Hydrogen output	£14,207,477.56
Pre-Tax Net Present Value	£137,779,373.03
Post Tax Net Present Value	£98,771,466.17
Post Tax Internal Rate of Return	0.34
Profitability Index	2.12
NPV Capex	42164542.19
Post Tax NPV Capex Ratio	2.3
Approximate Simple Payback (years)	4
NPV Total Cost	54372422.04



Sensitivity Analysis - Range					
	NPV	Min NPV	Max NPV	Range	Rank
		48	72		
Average Electricity Price (£) per MWh	98,771,466	69,878,678	127,664,254	57,785,577	4
		9.12%	13.68%		
Discount Rate (%)	98,771,466	129,400,476	76,107,412	53,293,064	3
		34,800,000	52,200,000		
Total Capital Expenditure (£)	98,771,466	106,170,079	91,372,853	14,797,226	2
		3.20	4.80		
Average Hydrogen Price (£) per MWh	98,771,466	98,552,581	98,990,351	437,770	1



Conclusion and Recommendation

- The use of incentive scheme such as green hydrogen (CfD) increase the prospect of project investment by makes investments easier for guaranteed revenues as it can be quantified and this helps lower cost in the long term by providing the venture room to expand and become self sustaining.
- The model allows stake holders to make educated judgments regarding the possibility of achieving certain targets and, lastly, providing the judgement makers with the tools to optimise the portfolio, which provides better way to structure and assess the venture potential.
- Consideration should be paid to evaluating the possible method and cost of dispersed generation of hydrogen using various wind generators. Incorporating electrolyser that are positioned far away from the wind farm receiving power from multiple wind farm that are producing allowing for mitigating short fall in wind gust. This scenario has the benefit of allowing the utilisation of spare power generation from numerous independent wind turbines, which raises the load factor and reduce the cost of the hydrogen generation system.

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