Exploration of wind energy and green hydrogen production in New Zealand

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The New Zealand government has proposed a zero-carbon target by 2050. Electricity demand is also expected to double up to 88 TWh annually by 2050. Zero-carbon economy transition and growing electricity demand motivate us to explore the offshore wind to green hydrogen system potential in the New Zealand context, which has been studied in several European countries. Coupling offshore wind with hydrogen production will be one of the main pillars toward a fully decarbonised energy system by avoiding wind curtailment, mitigating electricity grid congestion, and producing green hydrogen used for energy storage, transportation fuel, steel and iron production, or replacing natural gas for residential customers.

This study systematically reviews offshore wind and hydrogen production retrieved from the empirical papers, reports from government, industries, and national and international organisations. Sources of cost estimates are further investigated based on assumption and scenario analysis according to the Concept Consulting and Castalia modelling. This study also compares developmental progress overseas to New Zealand, providing insight into what New Zealand can learn from international experience.

We find that offshore wind can and will play an important role in the decarbonisation of New Zealand. New Zealand can take action to develop both these industries further to attain opportunities. In addition, current cost estimates for hydrogen in New Zealand are not cost-competitive with existing fossil fuels but may be in the future. More research is required for specific scenario cost estimations for New Zealand in order to provide insight into which projects will be more efficient or cost-effective. This will allow interested parties like energy companies to develop more concrete optimal plans for New Zealand. Lastly, Grants, subsidies, regulatory incentives, and higher carbon prices are some actions the government can take to bring costs down and incentivise development further.

This paper provides a pioneer study of assessing the feasibility of offshore wind and hydrogen production, including economic viability, challenges, and barriers and contributes to showing an alternative solution to achieve the New Zealand government's zero-carbon target.

Keywords: Green hydrogen; offshore wind; decarbonisation; New Zealand

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