# Techno-economic feasibility of green hydrogen production from wind energy

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## Overview

As the demand for sustainable energy resources continues to rise, offshore wind farms have emerged as a promising solution due to their consistent and higher wind speeds in comparison to onshore wind farms. However, the substantial costs associated with infrastructure development have raised concerns. This study explores the optimal setup of offshore wind farm facilities for generating green hydrogen, which offers a promising solution to address the intermittency of renewable energy sources and the challenges of long-distance energy transmission. The approach used in this study is linear optimization, which aims to minimize the levelized cost of hydrogen (LCOH) by considering wind farm size and electrolyzer capacity as key decision variables. This research investigates four distinct scenarios, all centered around the interplay between offshore wind power generation and green hydrogen production, both offshore and onshore. It aims to estimate and compare LCOH values under various wind energy configurations, specifically when offshore wind energy production either exceeds or falls short of the electrolyzer plant's capacity. A case study is conducted, focusing on a proposed offshore wind farm to be built 22km off the coast of South Taranaki, New Zealand by the end of the decade. The findings of the study highlight several key insights. Firstly, as onshore hydrogen storage capacity increases, LCOH decreases, particularly when offshore wind farms are situated closer to the coastline. Furthermore, the LCOH for offshore green hydrogen production is notably lower compared to onshore production when the electrolyzer plant operates below its full capacity. Additionally, a sensitivity analysis involving various discount factors reveals their impact on reducing the LCOH over time. In summary, this research offers valuable insights into optimizing offshore wind farms for green hydrogen production, considering different scenarios and their implications for the levelized cost of hydrogen, to support the transition to sustainable energy sources.

**Keywords:** *Renewable energy; green hydrogen; offshore wind; Electrolyzer*

**Objectives**:

- examine the factors that contribute to reducing LCOH produced from offshore wind farms, considering the integration of a coupled desalination and electrolyser plant.
- develop a cost optimisation model to minimise the LCOH, considering variables such as hydrogen demand, energy supply from offshore wind farms, and hydrogen storage capacities. The model will aim to find the most cost-effective configuration to achieve the lowest LCOH.
- conduct a sensitivity analysis to evaluate the impact of different influencing factors on the optimal LCOH value. This analysis will be performed under various scenarios to assess the robustness and adaptability of the cost optimisation model in different conditions.

**Methods**: Optimisation model.

## Conclusions

The study concludes that green hydrogen production from offshore wind farms is competitive with onshore production. Technological advancements in offshore technology and installation methods could further reduce costs, enhancing the feasibility of this technology in the future.