“Long term hydrogen storage to mitigate seasonal renewable variation”

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Overview

This paper “Long term hydrogen storage to mitigate seasonal renewable variation” will analyse the cost competitiveness of underground hydrogen storage as a winter peaker in New Zealand’s dry years. This study re-evaluates the recent unfavourable, yet near-term focussed modelling by John Culy Consulting for the ICCC by extending the time frame and observing hydrogen storage under a range of more favourable conditions Since greater economies of scale may be required to lower the price and increase the efficiency of hydrogen electrolysis, different cost projections provided by Hiringa New Zealand will be used to identify the level of short-term hydrogen market required to add value to long term hydrogen storage infrastructure. This may be limited to storage only and CCGT hydrogen peakers only, all the way up to grid scale fuel cells, powered by off-grid straight to DC electrolysis alongside the international export of surplus. Very few studies have been undertaken to examine the competitiveness of hydrogen to electricity systems, and none have yet shown its efficacy in markets where rents may be extracted due to shortages from irregular seasonal generation.

Methods

SWEM -- an agent-based model by David Young is employed to combine market power elements of game theoretic models whilst accounting for line losses and technological elements typical to competitive models. The model shows great promise for the scenario at hand, as past evaluation has shown prominence in accurately predicting prices in supply shocks and non-standard market conditions.

Conclusions

Observation of hydrogen storage’s cost competitiveness could spark further research and investment into hydrogen tech in New Zealand, especially as political commitments make emissions abatement imminent. Observation of different cost structures corresponding to various levels of hydrogen infrastructure investment will help identify policy targets required for a New Zealand hydrogen economy large enough to make hydrogen storage cost effective.