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Techno-economic Assessment of Green Hydrogen Systems

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Abstract

The world is currently undergoing a massive energy transition from fossil fuel energy sources to carbon-free and renewable energy sources. Green hydrogen has gained interest in recent years for the role it can play in the global clean energy transition. The versatility of hydrogen as an energy carrier is outlined as the key contributor to decarbonisation in many countries. Green hydrogen can be produced from renewable energies such as wind, hydro, solar and biomass. Different supply pathways are available for the production, storage, transport, and distribution of green hydrogen for various end-use applications such as Power-to-Gas (P2G), Power-to-Power (P2P) and Power-to-X (P2X).

Hydrogen energy systems are moving into large-scale and real-time applications as a result of years of R&D experience. In this new phase, there are many challenges and limitations to overcome for a large-scale deployment of green hydrogen. Renewable hydrogen-based alternatives must reach economic competitiveness to become a realistic alternative to fossil fuels for power supply. Techno-economic assessment (TEA) is a cost-benefit comparison that considers technological and economic factors. TEA assesses and optimises the process by considering the market forecast and profitability and provides a reliable pathway for large-scale deployment by taking into account risks, challenges and opportunities from technology learning and advancement.

This presentation aims to provide an overview of the integrated green hydrogen-based system modelling and TEA approach taken by the “Techno-economics for Decarbonisation Team” at CSIRO. The main issues with using renewable energy are the high cost and intermittency of supply while many industries need a constant and reliable supply of energy. To give the industries the best solution, we work on the development of an integrated energy system, that oversees the supply and demand profile, different energy and storage and distribution options. The preferred solution might be unique to that particular industry and scenario. Some of the important factors to consider are location, existing policies and favourable social licences, capacity factor, temperature range, availability of energy resources and cost.