

## **Integration of Renewable Energy and Hydrogen (RE/H<sub>2</sub>) Systems in Diesel Engine Mini-Grids: A Western Australian Case Study**

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### **Abstract**

The market for distributed power generation based on renewable energy is increasing, particularly for stand-alone mini-grid applications. Traditionally, such systems have been powered by diesel engine generator sets (DEGS), but lately the integration of photovoltaics and wind energy conversion systems (WECS) has become more common. The advent of a more mature fuel cell technology has made it possible to plan for future systems that are less dependent on diesel engines as the primary backup. In this study an existing diesel engine powered mini-grid (1.5 MW<sub>p</sub> and 4 GWh/year) is used as the reference system. The site, an island off the coast of Western Australia, has high wind speeds, fuel transport costs are high, and the demand is increasing. Hence, the integration of a WECS is considered. The purpose of the study is to design a realistic system that maximizes the renewable energy penetration. The methodology selected was to simulate a number of integrated system configurations based on WECS, DEGS, electrolyzer, and fuel cells. A library of technical hydrogen energy models (HYDROGEMS), compatible with a transient system simulation program (TRNSYS), forms the basis of the simulations. Optimal designs are proposed, and the key control parameters for the DEGS, electrolyzer, and fuel cell are investigated.

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