Abstract

This work undertakes a techno-economic comparative analysis of the design of photo- voltaic panel/wind turbine/electrolyzer-H2 tank–fuel cell/electrolyzer-H2 tank (configuration 1) and photovoltaic panel/wind turbine/battery/electrolyzer-H2 tank (configuration 2) to supply electricity to a simulated house and a hydrogen-powered vehicle on Jeju Island. The aim is to find a system that will make optimum use of the excess energy produced by renewable energies to power the hydrogen vehicle while guaranteeing the reliability and cost-effectiveness of the entire system. In addition to evaluating the Loss of Power Supply Probability (LPSP) and the Levelized Cost of Energy (LCOE), the search for achieving that objective leads to the evaluation of two new performance indicators: Loss of Hydrogen Supply Probability (LHSP) and Levelized Cost of Hydrogen (LCOH). After anal- ysis, for $0 < LPSP < 1$ and $0 < LHSP < 1$ used as the constraints in a multi-objective genetic algorithm, configuration 1 turns out to be the most efficient loads feeder with an LCOE of 0.3322 USD/kWh, an LPSP of 0% concerning the simulated house load, an LCOH of 11.5671 USD/kg for a 5 kg hydrogen storage, and an LHSP of 0.0043% regarding the hydrogen vehicle load.