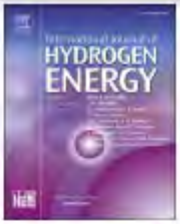
Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/he



Development of an optimization model for the feasibility analysis of hydrogen application as energy storage system in microgrids

Isnel Ubaque Diaz [a,*], *Wendell de Queiróz Lamas* [a], *Roberto Cayetano Lotero* [b]

[a] *Institute of Energy and Environment, University of São Paulo (IEE-USP), Av. Professor Luciano Gualberto, 1289, São Paulo, Brazil*

[b] *State University of West Paraná (UNIOESTE), Av. Tancredo Neves, 6731, Itaipu Technological Park, Foz do Iguaçu, Brazil*

HIGHLIGHTS

- A MILP model for assessment of microgrid with H_2 energy storage system.
- Analyzing several generation and energy storage technologies investment options.
- Eight investment optimization scenarios relative to two distinct reference cases.
- Microgrid results include optimal portfolio, optimal dispatch, and detailed costs.
- In current market conditions H_2 investment is environmental but not economic viable.

ARTICLE INFO

Article history:
Received 16 November 2022
Received in revised form
9 January 2023
Accepted 11 January 2023
Available online 31 January 2023

Keywords:
Distributed energy resources (DER)
Green hydrogen
Renewable energy sources

ABSTRACT

Hydrogen can be used as an Energy Storage System (ESS) in a microgrid allowing to store surplus generation of variable renewable sources for later use. Research in the area mainly refers to the sizing of the components, however few studies evaluate the optimal technology selection and operation of microgrids using hydrogen as ESS. In this work, a model to determines optimal selection and to dispatch of Distributed Energy Resources (DER) allowing to evaluate the viability of hydrogen application as ESS in a microgrid is developed. The model is implemented in GAMS, using mixed integer linear programming, and applied in a hypothetical microgrid using as input data load profiles and commercial data available in literature. The results indicate the economical and environmental benefits of DER adoption, but the currently high investment costs make it infeasible to adopt hydrogen into a microgrid. However, when considering environmental costs and market prospects, the adoption of this technology became a good alternative, improving the energy management and reducing the total annual cost of the microgrid by 14.1%.