

## Assessing the use of photovoltaic energy at a seawater reverse osmosis desalination plant: a case study of Porto Santo Desalination Plant (Madeira – Portugal)

Elías Jesús Medina Domínguez\*, Rayco Parra Batista, Jesús Manuel de León Izquier

*Renewable Energies Department, Canary Islands Institute of Technology (ITC), C/Playa de Pozo Izquierdo s/n, Santa Lucía de Tirajana (Gran Canaria) 35119, Spain, emails: Tel. +34 928 727 560; email: ejmedina@itccanarias.org (E.J.M. Domínguez), Tel. +34 928 727 609; email: rparra@itccanarias.org (R.P. Batista), Tel. +34 928 727 618; email: jdeleon@itccanarias.org (J.M. de León Izquier)*

Received 27 May 2021; Accepted 9 May 2022

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### ABSTRACT

Renewable energies can benefit the water sector, reducing the cost and the environmental impact of water production. This paper presents a technical and economic assessment of a photovoltaic generation project to supply energy to a grid-connected seawater reverse osmosis (SWRO) desalination plant and of an associated battery energy storage system (BESS) using lithium-ion batteries. It examines the case study of the SWRO desalination plant on Porto Santo Island (Madeira, Portugal). The assessment is supplemented by a sensitivity analysis of several variables. The findings indicate that photovoltaic generation in desalination plants results in a lower levelized cost of energy (LCoE) and reduces the consumption of fossil fuel energy from the electrical grid. This can lead to lower desalinated water costs and greenhouse gas emissions. A feasible rated power range was identified for the photovoltaic plant in this case study, taking the internal rate of return, net present value, payback and LCoE into consideration. The results also point to a higher LCoE when a lithium-ion BESS is used.

*Keywords:* Photovoltaic powered desalination; Seawater reverse osmosis; Photovoltaic generation; Cost; Lithium-ion battery energy storage system; Grid-connected

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\* Corresponding author.