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Mitigation of climate change through the analysis and reduction of greenhouse gases in desalination plants

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ABSTRACT

Within the lines of work currently being proposed concerning the water-energy nexus, this work focuses on energy consumption in the desalination process and the consequent emission of greenhouse gases (GHGs). To demonstrate this crucial problem, a life cycle assessment was developed and applied to a real plant located in the Canary Islands, Spain. In the analysis, the environmental consequences of each phase of the process were quantified. Prior to this, a review of the different calculation tools was undertaken with the intention of selecting the one that best matches the plant in order to obtain the most reliable results possible. The plant was selected for analysis on the basis of its size, with an average supply capacity in the island territory, as well as the availability of renewable energy resources. Calculation of the GHG emissions generated by the plant's energy consumption confirmed its contribution to climate change. To mitigate this contribution, a methodology is developed to determine the feasibility of renewable energy synergies to obtain a clean energy mix. This methodology, applicable to any reverse osmosis desalination system, was applied to the plant under study, with a resulting proposal for a sustainable energy system that avoids the emission of 21,781 tons of GHGs. By extending the application of the proposed methodology to other reverse osmosis desalination plants on the island, a considerable reduction in GHG emissions and its impact on climate change could be achieved at this stage of the water cycle.

Keywords: Desalination; Energy; Life Cycle Assessment; Renewable energy; Greenhouse gases; Water-energy nexus

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