



Techno-economic feasibility of wind-powered reverse osmosis brackish water desalination systems in southern Algeria

Z. Triki^{a,*}, M. N. Bouaziz^a, M. Boumaza^b

^aLaboratory of Biomaterials and Transport Phenomena (LBMP), Department of Process and Environmental Engineering, University of Médéa, Médéa, Algeria

Tel. + 213 (0) 25588466; Fax: + 213 (0) 25581253; email: triki.zakaria@univ-medea.dz

^bDepartment of Chemical Engineering, College of Engineering, King Saud University, Riyadh, Saudi Arabia

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ABSTRACT

Water desalination is one of the most important factors that can help in developing remote areas and the desert. A critical technical parameter of desalination applications is the way the system is powered. This decision is taken according to the selected method of desalination and the characteristics of the candidate area. Nowadays, the method of reverse osmosis dominates globally; it requires only electricity, has a quite low specific energy demand, and can cooperate with technologies of renewable energy sources such as wind turbine and photovoltaics. Hence, renewable energy-powered reverse osmosis systems are promising technologies for brackish and seawater desalination in remote regions as they exhibit low energy consumption and can be designed according to water demand and energy resource. This study analyzes the feasibility of using wind energy to power brackish water reverse osmosis desalination units proposed for the development of the southern region of the case study country of Algeria. A reverse osmosis desalination scheme powered by a stand-alone wind turbine of 1 MW rated power is presented to elucidate its feasibility. The modeling results show that at average wind speeds, the amount of product water is sufficient to meet freshwater demand in this region. The effect of different operating and design conditions on the purified water production rate was investigated. The paper is concluded with the economic feasibility of wind-desalination systems at the selected sites.

Keywords: Remote areas; Brackish groundwater; Renewable energy sources; Wind power; Reverse osmosis desalination; Energy recovery

*Corresponding author.

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