Renewable desalination: a methodology for cost comparison

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\textbf{ABSTRACT}

The increasing water demand and the impacts of climate change call for the construction of a large number of new desalination capacities, causing—besides environmental impacts—a relevant amount of additional power consumption. Consequently, new power plants need to be installed and operated as base load plants in order to supply power continuously to the desalination units. As fossil fuel prices are characterized by high volatility and a clear trend upwards, the use of renewable energies allows for saving fossil fuels and therewith reducing risks related to energy price escalation along the whole desalination life cycle. However, the fluctuant nature of renewable energies conflicts with the—ideally—continuous operation of desalination plants. In contrast to technologies such as photovoltaic (PV) and wind power, which are prone to fluctuating and intermittent power generation, concentrating solar power (CSP) is able to supply firm capacity on demand and can be fully integrated into conventional power utilities. On the other hand, CSP is currently considered to be more expensive than other renewable energy technologies. This work highlights the key importance of comparing technology options with equal quality of supply in order to obtain resilient results. Within this work, a representative site in the Middle East and North Africa Region has been analyzed by two different methodologies in order to demonstrate the potential large difference of results. The first method assumes that any variations of renewable energy supply can be compensated by the electricity grid, while the second method assumes that the addition of load to the electricity grid will require the addition of an equivalent firm power supply capacity. Hourly solar and wind data of a typical meteorological year have been used as inputs for a techno-economic simulation. Different options for CSP solar field layout, thermal energy storage, PV, and wind installed capacity, are analyzed and compared in terms of power and water cost for reverse osmosis and multieffect distillation plants.

\textbf{Keywords}: Renewable energy; Concentrating solar power; MENA; Water supply; Sustainable desalination

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