Using sustainable energy technologies for desalination in the Middle East and North African (MENA) countries

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Abstract

Sustainable development is mainly governed by applications of renewable energy resources for the inhabitants' needs. Middle East and North African countries are facing water scarcity causing different types of insecurities to their access for food and water resources while the fresh groundwater resources are also insufficient for supplying the population demands. Considering the economic development, and also the population growth, additional water resources should be planned. Hence, desalination of the saline water is a suitable alternative solution for providing water resources [1]. While desalination requires energy for providing sufficient power, renewable technologies can provide sustainable and resilient supplies considering the intense solar energy such countries have. Solar energy provides a paramount solution using Photovoltaics (PV) panels to generate electricity for large scale desalination plants based on Multi-stage flash (MSF) [2] or Multiple Effect distillation (MED) [3]. Also, the reverse osmosis (RO) techniques require high amount of energy to provide sufficient pressure for pushing saline water into the membranes which can be resourced from the renewable energy technologies directly, or indirectly from the sustainably powered grids. On the other hand, the high temperature of such countries provided a chance to use solar stills (SS) in order to convert saline water into potable resources which can also be used for the agricultural purposes, either open-source of horticultural activities. Since open-source agriculture demands huge amount of water resources, sustainable greenhouses were used in this study in order to increase the performance and decrease the demand for water using assigned solar stills (SS) on the greenhouses and deploying the Humidification Dehumidification (HDH) to circulate the water transpired from the plants. The energy needs for the pumps and condenser is achieved from the sustainable solar energy while the extra energy from the PV arrays can be stored in batteries or exporting to the national grids. The ventilation requirements are analysed using Computational Fluid Dynamic (CFD) model approaches to determine the optimal locations for the greenhouse vents cavity [4] and finding the shading requirements. The results of this study show how these technologies helped to generate sufficient freshwater using renewable energy technologies for the sustainable development of the countries in MENA region.

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Biography:

Dr Mohammad Akrami is a postdoctoral research fellow at the University of Exeter doing his project for the standalone solar-driven agricultural greenhouses in partnership with the country of Egypt. His primary interests include managing the renewable energies for sustainable development.

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