This paper presents an overview of using solar energy in running desalination systems, called solar desalination. Solar energy can be converted directly to electric energy, which can operate electrically driven desalting systems such as reverse osmosis (RO), electrodialysis (ED), and mechanical vapor compression systems. Solar energy can also be converted to the thermal energy that can operate the mainly used thermally operated desalination system such as multistage flash (MSF), conventional multieffect (ME), and multieffect thermal vapor compression (ME-TVC), and emerging membrane distillation and humidification–dehumidification desalination systems. The thermal energy converted from solar energy can also be used to produce high-pressure steam running power plant producing electric power to operate mechanically driven desalting systems, and/or extracted steam at relatively low pressure to operate thermally driven desalting system. The main obstacle that hinders the use of solar desalination is the initial investment cost. This paper discusses the use of the solar desalination and calculates the investment cost to install solar desalination plants. These include photovoltaic (PV)-driven RO system, and thermally driven MSF and ME plants by steam directly generated by solar collectors, or by steam extracted from solar steam power plants operated by the concentrated solar collectors. The results revealed that PV-RO desalting system has the highest specific capital cost, among the considered systems, because the expensive storage of the electric energy in batteries, and the fact solar energy supply lasts about one third of the day. It showed also that using the thermally generated energy from concentrated solar collectors operating power plant is much cheaper than using this thermal energy when directly operating the desalination system.

Keywords: CSP solar energy; Photovoltaic; Reverse osmosis; MED; Water cost