Balaban Desalination Publications

European Desalination Society

EDS Porto 2025 (2025) 104–113
doi: 10.5004/po2024121

Desalination for the Environment: Clean Water and Energy
Alfândega Congress Centre, Porto, Portugal
27–30 April 2025

Development of reverse osmosis technology and opportunities for renewable energy integration in the Greek Islands

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ABSTRACT

The Greek Islands, particularly those in the Aegean and Ionian seas, benefit from strong winds and abundant sunshine, especially during the summer months when water demand is highest. The reduction in available natural water resources and the rapid growth of tourism in the Greek Islands have led even those islands traditionally known for their natural water sources to seek alternative solutions, such as desalination. Over the last two decades, reverse osmosis (RO), primarily of seawater (SW), has become the main source of water on many Greek Islands. Small- to medium-sized RO plants, with average water capacities ranging from 250 to 2000 m^3/d, serve the public, with a few exceptions of larger plants. The full automation of these systems, the use of energy recovery devices to reduce energy consumption, and the modularity of RO technology, which accommodates seasonal variations in water demand, make this technology an ideal solution for the islands. Additionally, combining wind energy, solar energy, and energy storage with RO technology can minimise carbon emissions and significantly reduce the environmental impact on the islands' sensitive environments and water resources. Despite these advantages, only a few desalination plants powered by renewable energy currently exist on the Greek Islands. This paper presents the current status of desalination in the Greek Islands and analyses two case studies on the combination of wind and solar energy to power RO plants on two Aegean Islands. It also examines the current barriers to integrating renewable energy on non-interconnected islands, which lack connections to the mainland electricity network, and the opportunities presented by the expected electrical interconnection, as it will increase the potential for electricity generation from renewables.

Keywords: Wind energy; Solar energy; Reverse osmosis; Islands

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