

Climate Change Impact on Water Resources Management in Remote Islands Using Hybrid Renewable Energy Systems

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Abstract : Water inadequacy in small dry islands scattered in the Aegean Sea (Greece) is a major problem regarding Water Resources Management (WRM), especially during the summer period due to tourism. In the present work, various WRM schemes are designed and presented. The WRM schemes take into account current infrastructure and include Rainwater Harvesting tanks and Reverse Osmosis Desalination Units. The energy requirements are covered mainly by wind turbines and/or a seawater pumped storage system. Sizing is based on the available data for population and tourism per island, after taking into account a slight increase in the population (up to 1.5% per year), and it guarantees at least 80% reliability for the energy supply and 99.9% for potable water. Evaluation of scenarios is carried out from a financial perspective, after calculating the Life Cycle Cost (LCC) of each investment for a lifespan of 30 years. The wind-powered desalination plant was found to be the most cost-effective practice, from an economic point of view. Finally, in order to estimate the Climate Change (CC) impact, six different CC scenarios were investigated. The corresponding rate of on-grid versus off-grid energy required for ensuring the targeted reliability for the zero and each climatic scenario was investigated per island. The results revealed that under CC the grid-on energy required would increase and as a result, the reduction in wind turbines and seawater pumped storage systems' reliability will be in the range of 4 to 44%. However, the range of this percentage change does not exceed 22% per island for all examined CC scenarios. Overall, CC is proposed to be incorporated into the design process for WRM-related projects. Acknowledgements: This research is co-financed by Greece and the European Union (European Social Fund - ESF) through the Operational Program «Human Resources Development, Education and Lifelong Learning 2014-2020» in the context of the project "Development of a combined rain harvesting and renewable energy-based system for covering domestic and agricultural water requirements in small dry Greek Islands" (MIS 5004775).

Keywords : small dry islands, water resources management, climate change, desalination, RES, seawater pumped storage system, rainwater harvesting

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