An Environmentally-Friendly Tourist Village in Egypt Based on a Hybrid Renewable Energy System—Part One: What Is the Optimum City?

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Abstract:

The main objective of this study is to discuss the economical and the environmental analysis of a net zero energy (NZE) tourist village in Alexandria, Egypt, by maximizing the renewable energy fraction and minimizing the greenhouse gases (GHG) emissions. The hybrid photovoltaics (PV)/wind/diesel/battery system is found to be the optimum hybrid renewable energy system (HRES) for the proposed tourist village under the study. The optimum HRES consists of 1600 kW of PV panels (58.09% solar energy penetration), 1000 kW of wind turbines (41.34% wind energy penetration), 1000 kW of power converters, 200 kW diesel generator (only 0.57% diesel generator penetration) in addition to 2000 batteries with the capacity of 589 Ah each. The levelized cost of energy (COE) from the optimum HRES is $0.17/kWh and the total net present cost (NPC) of this system is $15,383,360. Additionally, the maximum renewable energy fraction is 99.1% and the amount of GHG emitted from the optimum HRES is only 31,289 kg/year, which is negligible in comparison with the other system configurations, therefore the optimum HRES can be considered as a green system. In addition to this, the achieved percentage of the capacity shortage and the unmet load in the optimal HRES is only 0% for both.

Keywords:

an environmentally-friendly tourist village; the effects of ambient temperature; GHG emission penalties; cost of energy (COE); net present cost (NPC)

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