Abstract:

The potential for using clean energy technologies in Egypt is good given the abundant solar insolation and wind resources. In contrast, many factories have suffered significant losses due to frequent blackouts in Egypt, especially at peak times of load demand. Moreover, the aim of this paper is to provide a detailed feasibility and a techno-economic evaluation of using hybrid photovoltaic/wind/diesel/battery system to satisfy the electrical energy needs for an environmentally friendly factory in New Borg El Arab city, Egypt and the city surrounding the factory. Utilizing the well-known Hybrid Optimization of Multiple Electric Renewables software to get the optimal configuration of a hybrid renewable energy system, based on the user inputs of loads, components costs, components technical details, solar and wind resources availability. The hybrid renewable energy system consisting of 60 kW of photovoltaic arrays, 100 kW of wind turbines, 40 kW of diesel generators, 50 kW of power converters and 600 batteries is found to be the optimal hybrid configuration in accordance with the system net present cost and cost of energy. The net present cost of this system is $1,684,118 and the cost of energy is $0.19/kWh. Additionally, the optimum system is the most environmentally friendly system in comparison with the other systems configurations specifically the diesel only system, because it is able to reduce a significant amount of greenhouse gases emissions. Strive to achieve the plan to become New Borg El Arab city, the first environmentally friendly Egyptian city in the near future by increasing the applications in this city that depend on the clean energy. Additionally, the same work could be applied to any other site in the world. Finally, an accurate separate techno-economic analysis of each component in the optimum hybrid renewable energy system is carried out in this study.

Keywords:

Hybrid PV/wind/diesel/battery system, Feasibility study of the optimum system, Greenhouse gases (GHG) emission, Cost of energy (COE), Net present cost (NPC)

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