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Optimization and Feasibility Analysis of a PV/Wind/ Battery Hybrid Energy Conversion

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Abstract : In this paper, the optimum design for renewable energy system powered an aquaculture pond was determined. Hybrid Optimization Model for Electric Renewable (HOMER) software program, which is developed by U.S National Renewable Energy Laboratory (NREL), is used for analyzing the feasibility of the stand-alone and hybrid system in this study. HOMER program determines whether renewable energy resources satisfy hourly electric demand or not. The program calculates energy balance for every 8760 hours in a year to simulate operation of the system. This optimization compares the demand for the electrical energy for each hour of the year with the energy supplied by the system for that hour and calculates the relevant energy flow for each component in the model. The essential principle is to minimize the total system cost while HOMER ensures control of the system. Moreover the feasibility analysis of the energy system is also studied. Wind speed, solar irradiance, interest rate and capacity shortage are the parameters which are taken into consideration. The simulation results indicate that the hybrid system is the best choice in this study, yielding lower net present cost. Thus, it provides higher system performance than PV or wind stand-alone systems.

Keywords : wind stand-alone system, photovoltaic stand-alone system, hybrid system, optimum system sizing, feasibility, cost analysis
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