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Optimization and Energy Management of Hybrid Standalone Energy System

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Abstract : Electric power shortage is a serious problem in remote rural communities in Egypt. Over the past few years, electrification of remote communities including efficient on-site energy resources utilization has achieved high progress. Remote communities usually fed from diesel generator (DG) networks because they need reliable energy and cheap fresh water. The main objective of this paper is to design an optimal economic power supply from hybrid standalone energy system (HSES) as alternative energy source. It covers energy requirements for reverse osmosis desalination unit (DU) located in National Research Centre farm in Noubarya, Egypt. The proposed system consists of PV panels, Wind Turbines (WT), Batteries, and DG as a backup for supplying DU load of 105.6 KWh/day rated power with 6.6 kW peak load operating 16 hours a day. Optimization of HSES objective is selecting the suitable size of each of the system components and control strategy that provide reliable, efficient, and cost-effective system using net present cost (NPC) as a criterion. The harmonization of different energy sources, energy storage, and load requirements are a difficult and challenging task. Thus, the performance of various available configurations is investigated economically and technically using iHOGA software that is based on genetic algorithm (GA). The achieved optimum configuration is further modified through optimizing the energy extracted from renewable sources. Effective minimization of energy charging the battery ensures that most of the generated energy directly supplies the demand, increasing the utilization of the generated energy.

Keywords : energy management, hybrid system, renewable energy, remote area, optimization
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