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Abstract:

Hybrid renewable energy systems are becoming more predominant because of climate change and the overconsumption of natural fuels. Proper utilization of renewable resources can uplift energy-deprived regions while also contributing to a nation's economic growth. However, effective system planning and resource assessment are essential for effective utilization. In that regard, the study proposes a hybrid microgrid design for a remote island in Bangladesh. The proposed system comprises solar photovoltaics, wind turbines, and lithium-ion battery storage which is coupled to the utility grid. For modeling and simulation of the optimal system design of the residential load in Urir char, Hybrid Optimization Multiple Energy Resources (HOMER) pro was utilized. The load profile for the system was created employing fuzzy logic and random probability, as well as meteorological data for the chosen location. Several instances with reliability factors such as short-term and long-term interruptions are also taken into consideration in the design. Additionally, the paper discussed a comparison between the proposed system and other considered scenarios as well as the utility grid. The proposed system is a viable approach for providing cleaner energy for the selected area in regards to energy cost (0.035\$/kWh), a renewable fraction (90%), emission reduction (78%), and reliability.

Keywords: Fuzzy logic, Load modeling, Microgrid, Power system economics, Solar energy, Wind energy