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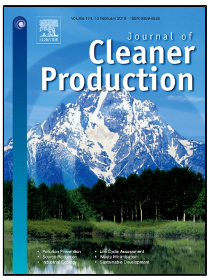

Flexible hybrid renewable energy system design for a typical remote village located in tropical climate

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Flexible hybrid renewable energy system design for a typical remote village located in tropical climate

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Abstract

Energy management and sustainable resources are regarded as major concerns when designing hybrid energy systems. Finding an efficient framework that combines reliable design and satisfies continuous operation at minimal cost at all conditions is essential for both customers and investors. In this regard, this paper details the adoption of a creative approach using HOMER software to come up with a flexible design of a hybrid system that includes conventional and renewable energy sources. This study involves a comprehensive survey in this field, detailed techno-economic assessments, analyses of operational performance, and the evaluation of environmental aspects pertaining to the aforementioned system. It investigates all conditions that influence the system for both off-grid and on-grid connections by examining it over a typical remote Malaysian village. A sensitivity analysis was also conducted at all stages to verify the optimum design among all changes of different sell-back, power purchase, fuel prices, load growth, and other variables. Also, this study was proceeded to determine and examine the technical, economical and environmental aspects of the system. The results showed that the optimum system for both off-grid and on-grid connections consists of 300 kWp of photovoltaic (PV) modules, two diesel generators rated at 100 kW and 50 kW, a 150 kW converter and 330 kWh battery banks. The total Net Present Cost (NPC) and Cost of Energy (COE) fell within (1500000.0 – 2450000.0 $) and (0.151 – 0.233 $/kWh), respectively, for different renewable energy fraction (RF) values of (23-55.43 %) and CO_2 emissions of (245284.0 – 570643.0 kg/Yr). Moreover, the results indicated the importance of considering all parameters prior to the implementation of