Cameroon energy storage for renewable energy

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Determining the appropriate size and configuration of these HRESs is a complex task that involves balancing cost, efficiency, and reliability. Effective methods for sizing these systems often utilize advanced software tools like HOMER (Hybrid Optimization of Multiple Energy Resources)6,7. HOMER allows users to simulate and optimize the performance of various HRES configurations under different scenarios, helping to identify the most cost-effective and reliable setup8.

Additionally, metaheuristic algorithms, such as genetic algorithms, particle swarm optimization, and simulated annealing, are frequently employed to solve the optimization problems associated with HRES design9,10. These algorithms can efficiently search through large solution spaces to find near-optimal configurations that might be impractical to identify through traditional methods11. By combining these tools and techniques, researchers and engineers can design HRESs that meet specific energy demands, minimize costs, and enhance sustainability.

Based on insights gained from an extensive review of the current literature, this study reveals a key gap in solving the energy challenges faced by residential areas in Buea, Cameroon. Despite the abundance of renewable energy resources, the region continues to grapple with an unreliable and unstable electricity grid, leading to frequent power outages and hindered socio-economic development. Existing studies have highlighted the potential of Hybrid Renewable Energy Systems (HRES) to mitigate these issues by harnessing solar energy alongside other renewable sources.

This study sought to figure out the optimal dimension of an autonomous PV/Battery/Diesel hybrid system for residential use in Buea, Cameroon, with the goal of enhancing the community"s access to dependable and quality energy. This study utilized the cost of energy as a decision criterion and the loss of power supply probability as a system dependability criterion.

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A PV/Battery/Diesel hybrid system was suggested for residential use in Buea, southwest Cameroon. An energy management approach has been proposed to boost the proportion of renewable energy in order to meet demand and restrict greenhouse gas emissions.

The suggested HRES"s size was optimized using the COA meta heuristic in accordance with LPSP and energy cost criteria. Following that, the results were examined in relation to those given by the WOA, SCA, and GOA algorithms.

A comparison was conducted between PV/Battery/Diesel and PV/Battery configurations to identify the most efficient configuration according to cost of energy and LPSP.

A thorough examination was conducted to assess the impact of gradually decreasing the LPSP on energy costs and the capacity of diesel generators. The purpose was to analyze how enhancing the reliability of the proposed hybrid system would affect the cost of energy.

The next sections of this study follow a systematic framework: Section "Materials and method" elaborates on the materials and methodology used, outlining the methods and techniques applied. Section "Result and discussion" carefully examines the obtained results, providing a thorough analysis of the findings. Finally, Section "Conclusion and future research directions" summarizes the study"s findings, combining the insights gained from previous parts.