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Comparative performance analysis for optimally designed on-grid and off-grid hybrid power systems for a Limpopo, South Africa Community Development Centre energy system

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The current global energy crisis is threatening sustainable development. In South Africa, the continuous increase in power outages (load shedding) is crippling the country's economic growth, as evidenced by the recently witnessed closure of several small businesses. An avalanche in implementing different renewable energy technologies has been witnessed, with several residential buildings and firms turning their roof space to photovoltaics renewable energy generators. Local municipalities have different by-laws for connecting distributed renewable energy generators to the local grid, making it difficult to implement these PV systems . Additionally, PV systems configurations require an understanding of optimal configuration and proper scheduling to match the load demand. Thus, off-grid grid-tied, and grid-interactive hybrid PV energy systems design, scheduling and performance analysis are gaining increasing attention from academia and industry to enhance their integration as an alternative energy source. However, choosing the most appropriate system configuration for specific load characteristics, especially when the utility grid is available, can result in losses due to sub-optimal planning and operational strategy. This study aims to provide a comprehensive understanding and fill the knowledge gap on grid-connected photovoltaic and hybrid power systems design and operation using Masia Development Center, Limpopo as a case study . The idea of this study is not to claim or confirm the performance of an installed PV system but to show the feasibility of off-grid and grid-interactive hybrid renewable energy system (HRES) in a residential house or on a small scale. The solar resource data for this study were analysed for PV applications. Load characteristic data of the system were collected and used for optimisation simulations with a hybrid electric renewable energy optimisation model (HOMER). Different dispatch strategies were applied to determine the optimal configuration for the three most common PV system configurations (off-grid/isolated hybrid and grid-tied) per case. The study aims to help residents, non-profit organisations, and the government better share scarce resources to achieve energy goals and meet Sustainable Development Goal (SDG) , ensuring access to sustainable, affordable, reliable, and modern energy.

Apply to be considered for a student ; award (Yes / No)?

yes

Level for award;(Hons, MSc, PhD, N/A)?

MSc

Consent on use of personal information: Abstract Submission

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