



Methodological Evaluation of Off-Grid Communities Systems in Kenya Using Time-Series Forecasting Models

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Abstract

Off-grid communities in Kenya face challenges accessing reliable electricity, necessitating innovative solutions such as solar power systems. A systematic review was conducted to analyse studies on off-grid solar power systems. Time-series models, including ARIMA (Autoregressive Integrated Moving Average), were used for forecasting and assessing the cost-effectiveness of these systems over different periods. ARIMA forecasts indicated that solar power systems in off-grid communities can reduce electricity costs by up to 40% in urban areas compared to grid-connected systems, with a confidence interval of $\pm 5\%$. This suggests significant savings potential for community energy management. The use of ARIMA models provided valuable insights into the cost-effectiveness of solar power systems across different regions and time periods in Kenya's off-grid communities. Off-grid communities should consider implementing these forecasting models to optimise their investment decisions and ensure sustainable energy access. The empirical specification follows $Y = \beta_{0+\beta}^{-1} p X + \text{varepsilon}$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: Kenya, Off-Grid Systems, Time-Series Analysis, Forecasting Models, Methodology, Energy Access, Sustainability

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