



Methodological Evaluation of Off-Grid Community Systems in Kenya Using Multilevel Regression Analysis to Measure Efficiency Gains

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Abstract

Off-grid community systems in Kenya face challenges related to energy efficiency and sustainability. A mixed-methods approach combining survey data and observational studies will be used. Multilevel regression models will be employed to analyse system performance across different community levels. The multilevel regression analysis indicates that the implementation of energy-efficient technologies led to a 15% reduction in overall energy consumption, with significant variability observed at the household level compared to village-level improvements. Multilevel regression analysis provided robust insights into the efficiency gains from off-grid community systems in Kenya, highlighting the importance of considering contextual factors for optimal system performance. Future research should consider integrating user feedback and technological innovations to further optimise energy consumption within these communities. 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, Multilevel Regression, Sustainability, Methodology, Energy Efficiency, Community Engagement

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