



# Bayesian Hierarchical Model for Evaluating Off-Grid Communities Systems in Kenya: A Methodological Assessment

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## Abstract

Off-grid communities in Kenya face challenges in energy access, necessitating robust solutions for sustainable development. A Bayesian hierarchical model was applied to assess the cost-effectiveness of off-grid communities' energy systems, accounting for variability across different geographical and socioeconomic settings. The analysis revealed significant variations in system costs among different regions (e.g., urban vs. rural areas), indicating a need for tailored solutions. Bayesian hierarchical modelling provided valuable insights into the cost-effectiveness of off-grid systems, highlighting regional disparities. Tailored interventions and policy recommendations are suggested based on the model's findings to optimise resource allocation in Kenya's off-grid communities. Bayesian Hierarchical Model, Off-Grid Communities, Cost-Effectiveness, Environmental Science 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, Bayesian, Hierarchical, Model, Evaluation, Sustainability

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