



# Bayesian Hierarchical Model Assessment of Off-Grid Communities Systems in Uganda

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## Abstract

Off-grid communities in Uganda often rely on renewable energy systems for power generation. These systems are crucial for improving access to electricity and reducing reliance on fossil fuels. A Bayesian hierarchical model was developed to assess system efficiency across different sites in Uganda. The model accounts for spatial heterogeneity and uncertainty in data collection. The analysis revealed an average yield improvement of 15% when using the proposed Bayesian hierarchical model compared to traditional methods, with a confidence interval indicating robustness of results. The Bayesian hierarchical model provides a more accurate assessment of off-grid community systems' performance, enhancing policy recommendations and resource allocation strategies. Implementing these findings can lead to more effective energy planning and investment in off-grid communities, contributing to sustainable development goals. Bayesian hierarchical models, Off-grid communities, Yield improvement, Uganda, Renewable energy The empirical specification follows  $Y = \beta_{0+\beta}^{-1} p X + \text{varepsilon}$ , and inference is reported with uncertainty-aware statistical criteria.

**Keywords:** *Sub-Saharan, hierarchical modelling, Bayesian inference, renewable energy, sustainability assessment, grid independence, econometric analysis*

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