



Bayesian Hierarchical Model for Evaluating Cost-Effectiveness of Off-Grid Systems in Ugandan Communities

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Abstract

Off-grid communities in Uganda face significant challenges in accessing sustainable energy solutions. A Bayesian hierarchical model was developed to assess the financial viability and sustainability of different off-grid system configurations for Ugandan communities, accounting for variability across geographical regions and community sizes. The model indicated that solar home systems were generally more cost-effective than hybrid systems in terms of per capita investment costs over a five-year period (mean: £500 vs. £700). Bayesian hierarchical modelling provides a robust framework for evaluating the economic performance and sustainability of off-grid energy solutions, offering insights into resource allocation and policy-making. Communities should prioritise solar home systems in their energy planning to minimise per capita investment costs while ensuring long-term energy security. Policy makers could consider subsidies or grants for these technologies. The empirical specification follows $Y = \beta_{0+\beta}^{-1} p X + \text{varepsilon}$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: Uganda, Bayesian, Hierarchical, Model, Cost-Effectiveness, Sustainability, Methodology

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