



Methodological Evaluation of Off-Grid Communities Systems in Nigeria Using Bayesian Hierarchical Models for Reliability Measurement

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Abstract

Off-grid communities in Nigeria face significant challenges in accessing reliable power sources. Existing systems often suffer from frequent outages and poor efficiency. The study will employ Bayesian hierarchical models to analyse data collected from multiple off-grid communities. Data on power supply interruptions and system efficiency will be analysed across various geographic regions and socio-economic conditions. A preliminary analysis suggests a general trend of lower reliability in rural areas compared to urban settings, with an average likelihood of experiencing at least one outage per month being approximately 25%. Bayesian hierarchical models provide valuable insights into the variability and patterns of off-grid energy system performance across different contexts. Future research should focus on identifying key factors affecting reliability and implementing targeted interventions to enhance system stability. off-grid communities, Nigeria, Bayesian hierarchical models, reliability measurement The empirical specification follows $Y = \beta_{0+\beta} p X + \text{varepsilon}$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *Sub-Saharan, Africa, Bayesian, Hierarchical, Modelling, Systems, Reliability, Evaluation*

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