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Bayesian Hierarchical Models for Evaluating Off-Grid Communities Systems in Rwanda: A Methodological Framework

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Abstract

Rwanda aims to reduce off-grid communities' reliance on fossil fuels for energy by promoting renewable energy systems. This study focuses on evaluating and optimising such systems. The approach involves constructing a Bayesian hierarchical model to account for spatial variability and heterogeneity among different communities. This model will incorporate data from multiple sources including weather patterns, socio-economic factors, and energy consumption habits. The framework provides robust tools for policymakers and practitioners to optimise off-grid community solar projects, thereby enhancing energy access and sustainability. Implementing the Bayesian hierarchical model can lead to more efficient resource allocation and risk management strategies in off-grid communities across Rwanda. Model estimation used $\hat{\{}\theta\}=argmin\{\theta\}sumiell(yi,f\theta(\xi))+\lambda lVert\theta rVert2^{2}$, with performance evaluated using out-of-sample error.

Keywords: *Geographic, African, Hierarchical, Bayesian, Modelling, Evaluation, Methodology*

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