Methodological Evaluation of Off-Grid Communities Systems in Rwanda: A Randomized Field Trial for Risk Reduction Assessment

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Abstract

Off-grid communities in Rwanda face challenges related to energy access, often relying on expensive or unreliable grid-based solutions. A randomized field trial was conducted among 100 households in off-grid communities, employing a logistic regression model to analyse data on system reliability and user satisfaction. The analysis revealed that the new solar-powered systems had an average success rate of 95% in providing continuous power, with significant improvements noted in user satisfaction levels compared to traditional kerosene lamps ($p < 0.01$). This study provides robust evidence for the adoption of off-grid energy solutions as a viable risk mitigation strategy. Communities and policymakers should consider investing in these systems, which not only enhance energy security but also contribute to sustainable development goals. 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: *Sub-Saharan, randomized controlled trial, GIS, sustainability metrics, renewable energy systems, community engagement, impact assessment*

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