



Methodological Evaluation of Off-Grid Communities Systems in Ghana: Panel Data Estimation for Measuring Adoption Rates

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Abstract

Off-grid communities in Ghana rely on various renewable energy systems for electricity supply. Understanding adoption rates is crucial for policy and resource allocation. Panel data analysis was applied to assess the impact of system type (solar vs. wind) and community characteristics (income level, size) on adoption rates over a five-year period. Solar systems demonstrated higher adoption rates compared to wind in communities with lower income levels, indicating that affordability is a key factor. The analysis supports the hypothesis that socio-economic indicators are significant predictors of off-grid energy system adoption. Policy makers should prioritise interventions aimed at increasing access to affordable renewable energy technologies for low-income communities. The empirical specification follows $Y = \beta_{0+\beta} p X + \text{varepsilon}$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *Sub-Saharan, renewable energy, econometrics, panel data, stochastic frontier, GIS, sustainability*

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