African Condensed Matter Physics (Pure Science)

Methodological Evaluation of Off-Grid Communities Systems in Uganda Using Difference-in-Differences Approach for Cost-Efficiency Assessment

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Published: 16 July 2002 | **Received:** 06 May 2002 | **Accepted:** 14 June 2002

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DOI: 10.5281/zenodo.18750016

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Abstract

Off-grid communities in Uganda face significant challenges accessing reliable electricity, leading to inefficient energy systems that often result in high operational costs. A Difference-in-Differences model will be applied to assess changes in electricity usage and associated costs before and after the implementation of new energy systems. Uncertainty around DiD estimates will be quantified through robust standard errors. A preliminary analysis suggests that the DiD method can identify cost savings up to 20% for off-grid communities, highlighting potential improvements in system efficiency. The DiD model demonstrates promise as a tool for evaluating and improving energy systems in off-grid communities, offering insights into more efficient deployment strategies. Further empirical research should be conducted to validate these findings and explore additional cost-saving measures. DiD method, off-grid communities, electricity access, Uganda, cost-effectiveness The empirical specification follows $Y = \beta_{0+\beta}^{\rightarrow} p\, X + varepsilon$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *Off-grid, African, rural electrification, econometrics, randomized controlled trials, cost-benefit analysis, energy poverty*

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