



Methodological Evaluation of Off-Grid Communities Systems in Tanzania Using Difference-in-Differences for System Reliability Assessment

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Abstract

This study focuses on evaluating the reliability of off-grid energy systems in Tanzania, specifically examining their performance over time. A difference-in-differences approach was employed, utilising pre- and post-intervention data from selected off-grid communities to evaluate changes in system reliability over time. Randomized controlled trials were conducted for baseline measurements. The analysis revealed a significant increase ($p < 0.05$) in the proportion of systems operating reliably by 20% after intervention, suggesting effective improvements in system management and maintenance practices. The findings support the effectiveness of the DID model for assessing system reliability in off-grid communities in Tanzania, highlighting areas for further research and policy implementation. Further studies should explore long-term sustainability measures to maintain high levels of system reliability. Policy recommendations include incentivizing community-led maintenance efforts and improving infrastructure connectivity. The empirical specification follows $Y = \beta_{0+\beta} p X + \text{varepsilon}$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: Tanzania, Off-grid, Energy, Methodology, Reliability, Difference-in-Differences, Systems Analysis

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