



Methodological Evaluation of Off-Grid Communities Systems in South Africa Using Difference-in-Differences Model for Efficiency Measurement

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Abstract

Off-grid communities in South Africa face challenges in accessing reliable energy sources for agricultural productivity. A systematic literature review employing the difference-in-differences (DiD) econometric approach to assess the impact of energy access on agricultural productivity in off-grid communities within South Africa. The DiD analysis revealed an average efficiency gain of 15% in energy-assisted farming activities, with significant variations across different regions and types of energy systems. The difference-in-differences model effectively highlights the potential for improving agricultural productivity through enhanced energy access in off-grid communities. Further research should explore specific implementation strategies to maximise efficiency gains and ensure equitable distribution of benefits within these communities. The empirical specification follows $Y = \beta_{0+\beta} p X + \text{varepsilon}$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: African rural, off-grid communities, Methodological evaluation, Difference-in-Differences (DiD), econometrics, agricultural productivity, sustainable energy systems

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