



Methodological Evaluation of Off-Grid Communities Systems in Nigeria Using Time-Series Forecasting Models for Efficiency Measurement

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Abstract

Off-grid communities in Nigeria face challenges related to energy supply for agricultural activities. A systematic review of existing literature on off-grid systems, focusing on methodologies used for evaluating system performance and proposing a novel time-series forecasting model for efficiency gains. The analysis revealed that while various evaluation methods exist, the application of time-series forecasting models showed promise in measuring efficiency gains more accurately than traditional metrics. A time-series forecasting model was proposed as an innovative method to enhance the measurement of efficiency gains in off-grid agricultural systems. Further research should validate this model across different regions and scale up its application for broader impact. The empirical specification follows $Y = \beta_{0+\beta} \vec{p} X + \text{varepsilon}$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *African agriculture, GIS, rural development, off-grid systems, sustainability metrics, time-series analysis, energy efficiency*

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