



# Off-grid Communities Systems Adoption in South Africa: A Time-Series Forecasting Model for Methodological Evaluation

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## Abstract

Off-grid communities in South Africa are increasingly adopting alternative energy systems to reduce reliance on grid power. These systems play a critical role in meeting energy demands and reducing environmental impacts. A longitudinal study employing a time-series forecasting model was conducted to measure the adoption rates of these systems. Data from multiple communities were collected and analysed over several years. The forecasted model revealed that adoption rates in off-grid communities have been increasing at an average annual rate of 15%, with significant variability across different regions. This study provides a robust methodological framework for evaluating the diffusion of solar panel systems in South Africa's off-grid communities, contributing to sustainable energy planning. Future research should explore the socio-economic factors influencing adoption rates and consider regional variations in forecasting models. off-grid communities, solar panels, time-series forecasting, adoption rate, South Africa 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, sustainability, econometrics, forecasting, GIS, data analytics*

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