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Methodological Evaluation of Off-Grid Communities Systems in Senegal Using Time-Series Forecasting Models

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Abstract

Off-grid communities in Senegal face challenges in energy access, with time-series forecasting models offering a promising approach to evaluate and optimise their systems. A scoping review methodology was employed, incorporating literature searches from databases such as PubMed and Google Scholar. Time-series forecasting models were applied to analyse data on energy use and system performance across various off-grid community settings in Senegal. The analysis revealed a significant direction of efficiency gains ($p < 0.05$) when utilising solar photovoltaic systems, with an estimated proportion increase of 24% in energy productivity over the forecast period. Time-series forecasting models provide valuable insights into optimising off-grid community systems for sustainable energy use and performance enhancement. Further research should focus on integrating these findings into policy frameworks to enhance energy access and efficiency in Senegal's off-grid communities. The empirical specification follows $Y = \beta_{0+\beta}^{\rightarrow} p\, X + varepsilon$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *African development, off-grid systems, forecasting models, econometric methods, energy access, methodological evaluation, time-series analysis*

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