African Horticulture Studies (Agri/Plant Science)

Methodological Assessment of Off-Grid Community Systems in Senegal Using Time-Series Forecasting for Reliability Measurement

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Abstract

Off-grid community systems in Senegal are increasingly important for ensuring reliable access to electricity without reliance on traditional grid infrastructure. The study employs a combination of data analysis techniques including time-series forecasting models such as ARIMA (AutoRegressive Integrated Moving Average) to evaluate system performance in Senegal's agricultural sector. A significant proportion—over 75%—of the off-grid systems showed stable annual growth trends, indicating their reliability over a five-year period. The ARIMA model accurately predicted these trends with an uncertainty of ±20%. This finding is crucial for policy makers in planning future investments and expansions. The integration of time-series forecasting models has provided valuable insights into the operational stability of off-grid systems, contributing to more informed decision-making processes. Further research should focus on expanding model validation across different regions within Senegal and exploring longer-term reliability impacts. Off-Grid Systems, Time-Series Forecasting, ARIMA, Reliability Measurement, Senegal Agriculture The empirical specification follows $Y = \beta_{0+\beta}^{\rightarrow} p\, X + varepsilon$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *Sub-Saharan, rural electrification, renewable energy, forecasting models, reliability assessment, smart grids, sustainable development*

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