



# Time-Series Forecasting Model for Clinical Outcomes in Off-Grid Communities of Uganda: An Energy Perspective

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## Abstract

The healthcare sector in off-grid communities of Uganda is often constrained by limited access to electricity, leading to suboptimal clinical outcomes. A hybrid ARIMA-GARCH (AutoRegressive Integrated Moving Average - Generalized Autoregressive Conditional Heteroskedasticity) model was employed to forecast clinical outcomes, incorporating uncertainty through robust standard errors. The model demonstrated a strong correlation between electricity access and improved health metrics, with an average prediction error of  $\pm 10\%$  over one year. The hybrid ARIMA-GARCH model provided reliable forecasts for clinical outcomes in off-grid communities, highlighting the need for sustainable energy solutions. Investment in renewable energy projects should be prioritised to ensure consistent and reliable electricity supply, thereby improving health outcomes. The empirical specification follows  $Y = \beta_{0+\beta}^{-1} p X + \text{varepsilon}$ , and inference is reported with uncertainty-aware statistical criteria.

**Keywords:** Uganda, Off-Grid, Renewable Energy, Time-Series Analysis, Forecasting, GARCH, ARIMA

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