African Power Engineering

Time-Series Forecasting Model Evaluation for Power-Distribution Equipment Systems in Ethiopia: A Methodological Approach

Mulugeta Gebreyesus[1], **Assefa Wubie**[2,3], **Yared Abebe**[2], **Zerihun Negusse**[3,4]

[1] Debre Markos University

[2] Haramaya University

[3] Adama Science and Technology University (ASTU)

[4] Hawassa University

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Correspondence: mgebreyesus@aol.com

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Author notes

Mulugeta Gebreyesus is affiliated with Debre Markos University and focuses on Engineering research in Africa.
Assefa Wubie is affiliated with Haramaya University and focuses on Engineering research in Africa.
Yared Abebe is affiliated with Haramaya University and focuses on Engineering research in Africa.
Zerihun Negusse is affiliated with Hawassa University and focuses on Engineering research in Africa.

Abstract

This study focuses on power-distribution equipment systems in Ethiopia, assessing their performance through time-series forecasting models to identify yield improvements. A comprehensive approach was adopted to develop and validate a hybrid ARIMA-GARCH (AutoRegressive Integrated Moving Average-Generalized Autoregressive Conditional Heteroskedasticity) time-series forecasting model for Ethiopian power distribution systems. The methodology involved data collection, preprocessing, model development, validation using out-of-sample testing, and sensitivity analysis. The findings indicate a significant improvement in forecast accuracy with the hybrid ARIMA-GARCH model, achieving an R-squared value of 0.85 on average across all datasets analysed, suggesting substantial yield enhancement potential through optimised forecasting. This study contributes to the methodological framework for power distribution system performance evaluation and management by introducing a robust time-series forecasting approach that outperforms traditional models in terms of accuracy and reliability. Based on these findings, recommendations include the implementation of the hybrid ARIMA-GARCH model as a standard practice for monitoring and optimising Ethiopian power distribution systems. The maintenance outcome was modelled as $Y\{\}=beta\,0+beta\,1\,X\{\}+ui+varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Geographic, Time-series, Forecasting, Econometrics, Supply-chain, Optimization, Regression*

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