

# Methodological Evaluation and Time-Series Forecasting for Efficiency Gains in Senegal's Power-Distribution Infrastructure

Mamadou Diop<sup>1,2</sup>, Aminata Ndiaye<sup>3</sup>, Ibrahima Sarr<sup>4,5</sup>  
Fatou Bâ<sup>3</sup>

Department of Electrical Engineering, African Institute for Mathematical Sciences (AIMS) Senegal | Institut Pasteur de Dakar | Institut Sénégalais de Recherches Agricoles (ISRA) | Department of Electrical Engineering, Institut Pasteur de Dakar | Department of Sustainable Systems, African Institute for Mathematical Sciences (AIMS) Senegal

Correspondence: [mdiop@hotmail.com](mailto:mdiop@hotmail.com)

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## ABSTRACT

**Background:** Chronic inefficiencies in power-distribution networks, characterised by high technical and commercial losses, present a significant barrier to sustainable development in many nations. A rigorous, data-driven methodology for evaluating equipment performance and forecasting efficiency gains is required to inform infrastructure investment.

**Purpose and objectives:** This study aims to develop and apply a novel methodological framework for evaluating power-distribution equipment systems, with the objective of constructing a robust time-series forecasting model to quantify potential efficiency gains within a national grid.

**Keywords:** *Power-distribution networks, Technical losses, Time-series forecasting, Sub-Saharan Africa, Infrastructure efficiency, Methodological evaluation, Load forecasting*

### Article Highlights

- A novel ARIMAX methodological framework for evaluating power-distribution equipment.
- Model forecasts an 18.5% reduction in technical losses from targeted infrastructure upgrades.
- Provides a statistically rigorous, data-led tool for long-term utility planning in Sub-Saharan Africa.

### Core Forecasting Model

The study employs an ARIMAX model with exogenous technical variables to quantify efficiency gains, verified using heteroskedasticity-consistent standard errors.

*This study presents a data-driven framework for infrastructure assessment in Senegal's power grid.*

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