AFRICAN CIVIL ENGINEERING JOURNAL

CASE STUDY

A Randomised Field Trial of Distribution Network Efficiency Gains in Rwanda

A Methodological Evaluation of Equipment Systems

Samuel Habimana[1,2] | **Jean de Dieu Uwimana**[3]
Valérie Mukamana[4]

1 *Department of Sustainable Systems, Rwanda Environment Management Authority (REMA)*
2 *Department of Electrical Engineering, African Leadership University (ALU), Kigali*
3 *Department of Civil Engineering, African Leadership University (ALU), Kigali*
4 *Rwanda Environment Management Authority (REMA)*

Correspondence: shabimana@outlook.com

Received: 31 March 2008 | Accepted: 28 June 2008 | Published: 16 August 2008 | **DOI:** 10.5281/zenodo.18965782

ABSTRACT

Background: Power distribution losses in sub-Saharan Africa remain persistently high, undermining grid reliability and economic development. Technical losses, stemming from inefficient network equipment, are a critical yet under-measured component. There is a paucity of robust field data comparing the real-world performance of different equipment systems under operational conditions.

Purpose and objectives: This case study presents a methodological evaluation of a randomised field trial designed to quantify efficiency gains from alternative distribution equipment. The primary objective was to establish a rigorous field-testing protocol and apply it to compare the performance of conventional conductors against modern low-loss alternatives in a real network.

Keywords: *Sub-Saharan Africa, Power Distribution Losses, Randomised Field Trial, Network Efficiency, Technical Losses, Grid Reliability, Distribution Network Equipment*

Article Highlights

- A randomised controlled trial protocol for evaluating distribution equipment in operational networks.
- Modern low-loss conductors reduced technical losses by 2.8 percentage points versus conventional systems.
- Differences-in-differences model isolated equipment effects from confounding variables.
- Provides a robust methodological framework for utility procurement and regulatory decision-making.

Core Analytical Model

The analysis employed a differences-in-differences model: $Y_{it} = \beta0 + \beta1\ Treat_i + \beta2\ Post_t + \beta3\ (Treat_i \times Post_t) + \varepsilon_{it}$, with technical loss ($Y_{it}$) as the outcome. Standard errors were clustered at the feeder level.

This study establishes a field-testing protocol for quantifying real-world equipment performance.