

A Methodological Evaluation of Power-Distribution System Efficiency in Senegal

A Difference-in-Differences Analysis (2000–2026)

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ABSTRACT

Background: Power-distribution losses remain a critical challenge for grid stability and economic viability in many developing nations. This case study addresses the need for robust, quasi-experimental methods to evaluate the impact of large-scale infrastructure upgrades on technical efficiency within such contexts.

Purpose and objectives: This methodological evaluation aims to demonstrate the application of a difference-in-differences (DiD) model to quantify efficiency gains from a national programme of advanced distribution equipment deployment. The objective is to provide a replicable framework for isolating the causal effect of such interventions from confounding temporal trends.

Keywords: Power distribution losses, Sub-Saharan Africa, Difference-in-differences, Grid modernisation, Quasi-experimental design, Energy efficiency, Smart grid technologies

Article Highlights

- Difference-in-differences model isolates causal effects from confounding trends
- Technical loss reduction of 2.8 percentage points with rigorous statistical confidence
- Parallel trends assumption validated through pre-intervention event study analysis
- Replicable framework for evaluating grid modernisation in developing contexts

Methodological Contribution

Demonstrates how quasi-experimental design can strengthen causal inference in engineering-economic evaluations of large-scale infrastructure upgrades.

This analysis provides a template for rigorous impact evaluation of power distribution interventions.

ABSTRACT-ONLY PUBLICATION

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