



# Methodological Evaluation of Power-Distribution Equipment Systems in Uganda: A Randomized Field Trial for Risk Reduction Assessment

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## Abstract

Power distribution equipment systems (PDES) play a critical role in ensuring reliable electricity supply to households and businesses in Uganda. Despite their importance, there is limited empirical evidence on how these systems affect reliability and safety. A randomized field trial design was employed, with 150 randomly selected households as participants. Data on outage frequency, duration, and equipment reliability were collected over a six-month period using standard monitoring devices. The analysis revealed that the intervention group experienced an average of 20% fewer power outages compared to the control group ( $p < 0.05$ ), indicating significant risk reduction in the tested PDES systems. This study provides robust evidence supporting the effectiveness of randomized field trials in evaluating PDES performance, contributing valuable insights for policy formulation and implementation in Uganda's energy sector. PDE suppliers should adopt more resilient equipment designs to further mitigate outages. Authorities are encouraged to implement standardised monitoring practices to ensure consistent data collection across regions. The maintenance outcome was modelled as  $Y_i = \beta_0 + \beta_1 X_i + u_i + v_i \epsilon_i$ , with robustness checked using heteroskedasticity-consistent errors.

**Keywords:** *Sub-Saharan, randomized controlled trial, power infrastructure, reliability assessment, sensor networks, grid resilience, data analytics*

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