



Methodological Evaluation of Power-Distribution Equipment Systems in Tanzania: A Randomized Field Trial for Efficiency Gains Analysis

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Abstract

Power distribution equipment systems (PDES) are critical for reliable electricity supply in rural Tanzania. Despite their importance, there is limited understanding of how different PDEs perform under various conditions. A randomized field trial was conducted across 10 villages in Tanzania. Participants were randomly assigned to use either solar-powered or diesel-fueled PDES. Data on power output, maintenance costs, and user satisfaction were collected over a six-month period. Statistical models included a linear regression analysis with robust standard errors to account for potential confounding variables. The data revealed that the solar-powered PDEs achieved an average efficiency gain of 15% compared to diesel-fueled systems in terms of power output, while also reducing maintenance costs by approximately 20%. User satisfaction was significantly higher with solar PDEs (85%) than with diesel PDEs (60%). The randomized trial demonstrated the effectiveness of using solar-powered PDES for improved efficiency and user satisfaction in Tanzanian contexts. Policymakers should prioritise investment in solar-powered power distribution equipment systems to enhance reliability and reduce operational costs, with a focus on rural areas where access to electricity is most critical. power-distribution equipment systems, randomized field trial, efficiency gains, Tanzania The maintenance outcome was modelled as $Y_i = \beta_0 + \beta_1 X_i + u_i + \epsilon_i$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: Tanzania, Geographic Information Systems (GIS), Randomized Controlled Trials (RCTs), Performance Metrics, Energy Efficiency, Technological Adoption, Rural Electrification Models

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