Cost-Efficiency Assessment of Power-Distribution Systems in Tanzanian Rural Settings: A Randomized Field Trial

Ntilea Makwelu[1]

[1] Department of Civil Engineering, National Institute for Medical Research (NIMR)

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Correspondence: nmakwelu@hotmail.com

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Author notes

Ntilea Makwelu is affiliated with Department of Civil Engineering, National Institute for Medical Research (NIMR) and focuses on Engineering research in Africa.

Abstract

Power distribution systems in Tanzanian rural settings are often inefficient and costly, leading to poor service delivery and high maintenance costs. A randomized controlled trial was conducted with 100 households randomly assigned to receive either traditional or state-of-the-art power distribution systems. Data on energy usage, maintenance costs, and system reliability were collected over six months. The advanced power-distribution system showed a 25% reduction in maintenance costs compared to the traditional system ($p < 0.01$), with no significant difference in overall energy consumption. The randomized field trial demonstrated that state-of-the-art power distribution systems are more cost-effective in Tanzanian rural settings, reducing maintenance expenses by approximately 25%. Policy makers should consider implementing these advanced systems to improve service delivery and reduce operational costs in Tanzania's rural areas. Power Distribution Systems, Rural Energy Access, Cost-Effectiveness, Randomized Field Trial The maintenance outcome was modelled as $Y\{\} = beta0 + beta1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Tanzania, Geographic Information Systems (GIS), Randomized Controlled Trials (RCT), Cost-Benefit Analysis, Energy Efficiency, Renewable Energy Integration, Technological Adoption*

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