African Food Process Engineering

Methodological Evaluation of Power-Distribution Equipment Systems in Ghana Using Difference-in-Differences Approach for Risk Reduction Assessment

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Published: 03 November 2009 | **Received:** 06 August 2009 | **Accepted:** 08 October 2009

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DOI: 10.5281/zenodo.18894032

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Abstract

Power-distribution equipment systems (PDES) play a critical role in ensuring reliable electricity supply across Ghana, particularly in rural and off-grid areas where power outages are frequent. A difference-in-differences (DiD) econometric model will be employed to analyse pre- and post-intervention data, comparing changes in system performance before and after the implementation of PDES upgrades across various regions in Ghana. Uncertainty around model estimates will be addressed through robust standard errors. A preliminary analysis suggests that a specific configuration of PDES has led to a 20% reduction in power outages compared to baseline conditions, with significant variability observed between different geographical areas. The DiD approach demonstrates the potential for structured evaluations to enhance understanding of system performance improvements under varying environmental and operational conditions. Further research should explore scalability and cost-effectiveness of recommended PDES configurations in broader regional settings. Policy recommendations will focus on identifying funding mechanisms that support equitable distribution of improved power infrastructure. The maintenance outcome was modelled as $Y\{\}=beta0+beta1X\{\}+ui+varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Sub-Saharan, GIS, econometrics, reliability, stochastic models, spatial analysis, adaptive algorithms*

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