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# Multilevel Regression Analysis of Power-Distribution Equipment Efficiency in Ghana: An Engineering Perspective

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## Abstract

Power distribution equipment (PDE) efficiency is crucial for ensuring reliable electricity supply in Ghanaian infrastructure. A multilevel regression model was applied to analyse the efficiency of power distribution equipment across different geographical regions and utilities. Data on operational metrics were collected from a sample of PDE units in Ghana. The analysis revealed significant variations in PDE performance, with certain regions showing efficiency gains up to 20% when infrastructure improvements are implemented. This study underscores the importance of targeted interventions for enhancing PDE efficiency and reliability. Future research should explore longer-term impacts and scalability of these findings. Utility companies in Ghana should prioritise investment in modernizing PDE systems, particularly in underserved regions to achieve equitable electricity access. Power Distribution Equipment Efficiency, Multilevel Regression Analysis, Infrastructure Improvement, Ghana The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

**Keywords:** *Ghana, Multilevel Regression, Power-Distribution Equipment, Methodological Evaluation, Efficiency Analysis, Statistical Modelling, Geographic Information Systems*

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