



Evaluating Solar-Powered Street Lighting Systems in Rural Mozambique: A Methodological Approach

Nkulu Mabote¹

¹ Department of Sustainable Systems, Eduardo Mondlane University (UEM), Maputo

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Correspondence: nmabote@yahoo.com

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Author notes

Nkulu Mabote is affiliated with Department of Sustainable Systems, Eduardo Mondlane University (UEM), Maputo and focuses on Engineering research in Africa.

Abstract

Solar-powered street lighting systems have been implemented in rural areas of Mozambique to address energy poverty and improve safety. However, their long-term effectiveness and energy savings need empirical evaluation. A mixed-method approach combining quantitative surveys and qualitative case studies was employed. The study utilised regression analysis with robust standard errors to quantify energy savings, accounting for potential confounders such as climate variability and local electricity supply. Across the surveyed areas, solar-powered street lighting systems achieved an average annual energy reduction of 25% compared to traditional kerosene lamps, indicating significant environmental benefits. Variability in results was explained by regional differences in sunlight availability. The methodological framework successfully identified consistent and variable factors influencing energy savings, providing a foundation for future policy recommendations aimed at maximising the impact of solar lighting systems in rural Mozambique. Policy makers should prioritise implementation sites based on high sunlight exposure to maximise energy savings. Continuous monitoring and technological upgrades are recommended to sustain system performance over time. 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: *Sustainable Energy, Rural Development, Photovoltaic Systems, Case Study Methodology, Renewable Energy Integration, Geographic Information Systems, Cost-Benefit Analysis*

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