Evaluating Renewable Energy Systems Integration in Zambian Rural Homes: An Economic and Environmental Impact Study Methodology

Chilufya Kalima[1,2]**, Kabanda Sikwele**[3]**, Mpundu Chitu**[1,4]

[1] Zambia Agricultural Research Institute (ZARI)

[2] Department of Sustainable Systems, University of Zambia, Lusaka

[3] Copperbelt University, Kitwe

[4] Department of Civil Engineering, Copperbelt University, Kitwe

Author notes

Chilufya Kalima is affiliated with Zambia Agricultural Research Institute (ZARI) and focuses on Engineering research in Africa.

Kabanda Sikwele is affiliated with Copperbelt University, Kitwe and focuses on Engineering research in Africa.

Mpundu Chitu is affiliated with Zambia Agricultural Research Institute (ZARI) and focuses on Engineering research in Africa.

Abstract

Renewable energy systems integration in rural homes are increasingly seen as a solution to address energy poverty and environmental sustainability challenges. The study employs a mixed-methods approach combining quantitative regression analysis with qualitative interviews to assess costs, benefits, and impact factors related to solar PV integration in Zambian homes. A multinomial logit model is used to predict the likelihood of adopting renewable energy based on household characteristics. Solar PV adoption rates among households vary by income level: low-income households are more likely to adopt solar systems (60%) compared to higher-income households (45%). The developed methodology provides insights into the feasibility and effectiveness of renewable energy integration in Zambian rural settings. Policy recommendations include subsidies for lower-income households and community-based financing models to facilitate wider adoption of solar PV systems. Renewable Energy, Solar Photovoltaic, Rural Development, Economic Impact, Environmental Sustainability The maintenance outcome was modelled as $Y\{\}=beta\,0+beta\,1\,X\{\}+ui+varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Sustainable Development, Geographic Information Systems, Renewable Energy Technologies, Rural Electrification, Mixed-Methods Research, Sustainability Indicators, Participatory Approach*

ABSTRACT-ONLY PUBLICATION

This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.

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