



Methodological Evaluation of Off-Grid Communities Systems in Kenya: A Panel Data Estimation Study on Cost-Efficiency

Chirchir Ogina¹, Nyambaga Koech^{2,3}, Kibet Mutiso⁴, Oluochi Njoroge²

¹ Strathmore University

² Jomo Kenyatta University of Agriculture and Technology (JKUAT)

³ Kenyatta University

⁴ Department of Artificial Intelligence, Jomo Kenyatta University of Agriculture and Technology (JKUAT)

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Correspondence: cogina@gmail.com

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Author notes

*Chirchir Ogina is affiliated with Strathmore University and focuses on Computer Science research in Africa.
Nyambaga Koech is affiliated with Jomo Kenyatta University of Agriculture and Technology (JKUAT) and focuses on
Computer Science research in Africa.*

*Kibet Mutiso is affiliated with Department of Artificial Intelligence, Jomo Kenyatta University of Agriculture and
Technology (JKUAT) and focuses on Computer Science research in Africa.*

*Oluochi Njoroge is affiliated with Jomo Kenyatta University of Agriculture and Technology (JKUAT) and focuses on
Computer Science research in Africa.*

Abstract

Off-grid communities in Kenya face significant challenges in accessing reliable electricity sources. Traditional off-grid systems are often inefficient and costly. A comprehensive review of existing methodologies including econometric models to estimate cost-efficiency ratios. Panel data analysis will be employed to account for temporal and spatial variations in system performance. Panel-data models reveal substantial heterogeneity in cost-effectiveness across different off-grid systems, highlighting the importance of considering local conditions and technological advancements. The review underscores the need for tailored policy recommendations based on empirical evidence from various geographical settings to optimise resource allocation for sustainable energy solutions. Policy makers should consider implementing adaptive management strategies that incorporate ongoing monitoring and evaluation cycles to ensure long-term cost-effectiveness of off-grid systems in Kenya. Model estimation used $\hat{\theta} = \underset{\theta}{\operatorname{argmin}} \{ \theta \} \operatorname{sumiell} (y_i, f\theta (\xi)) + \lambda l \operatorname{Vert} \theta r \operatorname{Vert} 2^2$, with performance evaluated using out-of-sample error.

Keywords: *Sub-Saharan, panel-data, econometrics, renewable-energy, efficiency-analysis, cost-benefit, geographic-research*

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