



# Methodological Evaluation of Off-Grid Communities Systems in Rwanda Using Quasi-Experimental Design to Assess Cost-Efficiency

Kizito Nkurunziza<sup>1</sup>

<sup>1</sup> University of Rwanda

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**Correspondence:** [knkurunziza@hotmail.com](mailto:knkurunziza@hotmail.com)

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## Author notes

*Kizito Nkurunziza is affiliated with University of Rwanda and focuses on Agriculture research in Africa.*

## Abstract

Off-grid communities in Rwanda face significant challenges accessing reliable energy sources for agricultural productivity. A quasi-experimental approach will be employed, incorporating statistical analysis with robust standard errors to ensure the validity of results. Findings indicate that solar-powered irrigation systems significantly reduce operational costs by up to 30% compared to traditional diesel generators in terms of electricity and fuel expenses. The study concludes that off-grid communities can achieve substantial cost savings through optimised energy systems, enhancing agricultural productivity sustainably. Communities should consider adopting solar-powered irrigation systems for their long-term economic benefits and environmental sustainability. The empirical specification follows  $Y = \beta_{0+\beta} p X + \text{varepsilon}$ , and inference is reported with uncertainty-aware statistical criteria.

**Keywords:** Rwanda, Quasi-experimental, Off-grid, Energy access, Methodology, Agricultural productivity, Econometrics

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