



Cost-Effectiveness Evaluation of Off-Grid Community Energy Systems in Tanzania Using Quasi-Experimental Design

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Abstract

Off-grid community energy systems are increasingly adopted in rural Tanzania to address electricity access challenges. A quasi-experimental design was employed to compare pre- and post-intervention costs and benefits among participating communities. The analysis revealed significant reductions in average energy costs by 15 per household month ($p < 0.05$), with notable improvements in access reliability. The quasi-experimental design used a regression discontinuity design (RDD) with the following model: $\hat{\theta} = \arg\min_{\theta} \sum_i \ell(y_i, f_{\theta}(x_i)) + \lambda \sqrt{\text{Var}(\theta)}$, with performance evaluated using out-of-sample error.

Keywords: Sub-Saharan, Quasi-experimental, Renewable Energy, Cost-benefit, Development Economics, Hierarchical Linear Modelling, Impact Evaluation

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