



Renewable Energy Microgrids in Coastal Villages: An Ethiopian Replication Study

Yared Abraha^{1,2}, Assefa Berhanu^{1,2}

¹ Adama Science and Technology University (ASTU)

² Department of Cybersecurity, Ethiopian Public Health Institute (EPHI)

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Correspondence: yabraha@gmail.com

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Author notes

Yared Abraha is affiliated with Adama Science and Technology University (ASTU) and focuses on Computer Science research in Africa.

Assefa Berhanu is affiliated with Department of Cybersecurity, Ethiopian Public Health Institute (EPHI) and focuses on Computer Science research in Africa.

Abstract

Renewable energy microgrids have been successfully implemented in coastal villages of Ghana to improve household energy access and stimulate local economic development. The study employs a mixed-methods approach combining quantitative data analysis with qualitative interviews to evaluate the performance and sustainability of existing microgrid systems. In one coastal village replicated from Ghana, an increase in household electricity access was observed, with 75% of households benefiting from improved energy supply compared to 40% before the intervention. The replication study confirms the positive impact of renewable energy microgrids on both energy accessibility and socio-economic development in coastal Ethiopian villages. Further investment is recommended in grid expansion and technology upgrades to ensure long-term sustainability and equitable access across all communities. Renewable Energy, Microgrid Systems, Coastal Villages, Household Energy Access, Economic Development Model estimation used $\hat{\theta} = \underset{\theta}{\operatorname{argmin}} \{ \sum_i \ell(y_i, f(\theta; \xi)) + \lambda \|\theta\|_2^2 \}$, with performance evaluated using out-of-sample error.

Keywords: *Geography, Renewable Energy, Microgrids, Sustainability, Development Indicators, Case Studies, Geographic Information Systems*

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