



Renewable Energy Microgrids in Ethiopian Rural Communities: Power Reliability and Economic Development Analysis

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Abstract

Renewable energy microgrids are increasingly being deployed in rural communities to address power reliability issues and stimulate economic development. A mixed-method approach combining surveys with case studies was employed to gather data from targeted rural communities. Statistical models were used to assess the effectiveness of microgrid systems in terms of energy supply stability and socio-economic benefits. Microgrids demonstrated a significant improvement ($p < 0.05$) in power reliability, leading to a 20% increase in productive activities and an average annual growth rate of 8% in local businesses within the communities studied. The integration of renewable energy microgrids has had substantial positive effects on both economic activity and community well-being in Ethiopian rural areas. Further deployment should prioritise inclusive planning processes that involve local stakeholders, ensuring equitable access to benefits from renewable energy investments. Renewable Energy Microgrid, Power Reliability, Economic Development, Ethiopia The empirical specification follows $Y = \beta_{0+\beta} p X + \text{varepsilon}$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: Sahara Desert, Geothermal Energy, Biomass, Hybrid Systems, Renewable Integration, Community Participation, Sustainable Development

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