



Assessing Off-Grid Solar Microgrids for Energy Access in Northern Ghanaian Communities

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Abstract

Off-grid solar microgrids have emerged as a promising solution for enhancing energy access in remote communities, particularly in Africa where traditional grid infrastructure is often inadequate or non-existent. The research employs a mixed-methods approach, combining quantitative data from household surveys with qualitative interviews to assess operational efficiency and community acceptance. A significant proportion (75%) of households reported improved daily activities due to the availability of electricity from off-grid solar microgrids. Technical performance metrics showed an average energy yield per unit of investment exceeding 0.50 per watt – hour , with robust standard errors indicating high reliability . Off – grid solar microgrids demonstrate $\hat{\theta} = \operatorname{argmin}_{\theta} \sum_i \ell(y_i, f_{\theta}(x_i)) + \lambda \sqrt{\theta}$, with performance evaluated using out-of-sample error.

Keywords: Sub-Saharan, GIS, IoT, EnergyHarmonics, RenewableEnergyIntegration, SmartMeters, RuralElectrification

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