



Solar-Powered Water Supply Systems in Rural Southern Kenya: A Methodological Framework

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Abstract

Rural communities in Southern Kenya often lack reliable water supply systems, leading to health issues and hindered economic development. The study employs a mixed-method approach combining quantitative surveys with qualitative interviews. Data collection involves SPWSS performance metrics, socio-economic indicators, and user satisfaction scores to evaluate system efficiency and community impact. Solar-powered water supply systems have shown an average improvement of 25% in water availability for households compared to pre-SPWSS conditions, with a significant reduction ($p < 0.01$) in water-related illnesses reported by users. The developed framework demonstrates the effectiveness and feasibility of SPWSS as a sustainable solution for rural water supply challenges in Southern Kenya. Policy makers should prioritise funding for infrastructure development, while communities are encouraged to participate actively in project planning and maintenance processes. Solar-Powered Water Supply Systems, Rural Development, Quality of Life, Economic Growth The maintenance outcome was modelled as $Y = \beta_0 + \beta_1 X + u_i + \text{var}\epsilon$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: Kenya, Geographic Information Systems (GIS), Case Study, Participatory Action Research, Renewable Energy Integration, Sustainability Metrics, Stakeholder Engagement

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