African Ocean Biology (Earth/Environmental Science)

# Methodological Evaluation of Off-Grid Communities Systems in Senegal: A Randomized Field Trial on System Reliability

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## Abstract

Off-grid communities in Senegal often rely on renewable energy systems for water supply, lighting, and other essential services. These systems are crucial for improving living standards and sustainability but can be unreliable due to varying climatic conditions and technical issues. A randomized field trial will be conducted across different regions of Senegal with varying climatic conditions. A statistical model will be used to assess the reliability of solar-powered water pumps, considering both technical performance metrics and user feedback as explanatory variables. This study provides insights into the reliability of off-grid community systems in Senegal, highlighting the importance of considering both climatic and operational factors to enhance system performance and user satisfaction. Based on these findings, recommendations will be made for improving system design, maintenance schedules, and climate resilience strategies to ensure a more reliable energy supply for off-grid communities in Senegal. The empirical specification follows $Y = \beta_{0+\beta}^{\rightarrow} p\, X + varepsilon$, and inference is reported with uncertainty-aware statistical criteria.

**Keywords:** *Sub-Saharan, renewable energy, randomized trials, sustainability metrics, community infrastructure, system reliability, resilience analysis*

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