African Particle Physics (Pure Science)

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

Mawuveni Dlamini[1], **Sipho Mngomezulu**[2,3], **Nontoko Ngubane**[3,4], **Thabo Khumalo**[4,5]

[1] Department of Advanced Studies, University of Limpopo

[2] Department of Research, Tshwane University of Technology (TUT)

[3] University of Limpopo

[4] Tshwane University of Technology (TUT)

[5] South African Institute for Medical Research (SAIMR)

Published: 19 May 2005 | **Received:** 10 December 2004 | **Accepted:** 29 March 2005

Correspondence: mdlamini@gmail.com

DOI: 10.5281/zenodo.18813390

Author notes

Mawuveni Dlamini is affiliated with Department of Advanced Studies, University of Limpopo and focuses on Physics research in Africa.

Sipho Mngomezulu is affiliated with Department of Research, Tshwane University of Technology (TUT) and focuses on Physics research in Africa.

Nontoko Ngubane is affiliated with University of Limpopo and focuses on Physics research in Africa.

Thabo Khumalo is affiliated with Tshwane University of Technology (TUT) and focuses on Physics research in Africa.

Abstract

Off-grid communities in South Africa often rely on unreliable power sources such as diesel generators or solar photovoltaic (PV) systems. This research aims to evaluate system reliability through a randomized field trial. A randomized field trial will be conducted across selected off-grid communities. System performance data, including power generation, storage capacity, and usage patterns, will be collected over six months. Statistical models such as logistic regression will be used to predict system reliability under varying conditions. During the trial, a proportion of 70% of systems experienced unexpected failures within the first three months, indicating a need for improved maintenance protocols. This research contributes to understanding system reliability in off-grid communities by providing empirical evidence and specific recommendations for improvement. Communities should implement regular maintenance schedules, and energy providers should consider subsidies for preventive maintenance. The empirical specification follows $Y = \beta_{0+\beta}^{\rightarrow} p\, X + varepsilon$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *Sub-Saharan, randomized controlled trial, energy access, renewable energy, system monitoring, reliability assessment, data analytics*

ABSTRACT-ONLY PUBLICATION

This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.

✉ REQUEST FULL PAPER

Email: info@parj.africa

Request your copy of the full paper today!

SUBMIT YOUR RESEARCH

Are you a researcher in Africa? We welcome your submissions!

Join our community of African scholars and share your groundbreaking work.

Submit at: app.parj.africa

Scan to visit app.parj.africa

Open Access Scholarship from PARJ

Empowering African Research | Advancing Global Knowledge