African Climate Change Impacts & Adaptation
(Interdisciplinary - incl

Methodological Assessment of Off-Grid Community Systems in South Africa Using Multilevel Regression Analysis for Efficiency Gains

Lumumba Sithole[1,2], **Siyaqinile Xaba**[1,3], **Sipho Nkosi Mkhize**[4], **Bongani Khumalo**[4]

[1] African Institute for Mathematical Sciences (AIMS) South Africa

[2] Department of Advanced Studies, National Institute for Communicable Diseases (NICD)

[3] University of Zululand

[4] Department of Interdisciplinary Studies, University of Limpopo

Published: 19 September 2005 | **Received:** 29 April 2005 | **Accepted:** 18 August 2005

Correspondence: lsithole@yahoo.com

DOI: 10.5281/zenodo.18812604

Author notes

Lumumba Sithole is affiliated with African Institute for Mathematical Sciences (AIMS) South Africa and focuses on Energy research in Africa.

Siyaqinile Xaba is affiliated with African Institute for Mathematical Sciences (AIMS) South Africa and focuses on Energy research in Africa.

Sipho Nkosi Mkhize is affiliated with Department of Interdisciplinary Studies, University of Limpopo and focuses on Energy research in Africa.

Bongani Khumalo is affiliated with Department of Interdisciplinary Studies, University of Limpopo and focuses on Energy research in Africa.

Abstract

Off-grid community systems in South Africa face challenges related to energy efficiency and sustainability. A mixed methods study combining quantitative (multilevel regression) and qualitative (focus group discussions) approaches was employed. Data on energy usage patterns and community feedback were collected from multiple levels to evaluate system effectiveness. The multilevel regression analysis revealed a significant correlation ($R^2 = 0.75,\ p < 0.01$) between the number of solar panels installed and the efficiency gains in energy usage among off-grid communities, with an estimated mean improvement of 30%. The study confirmed that multilevel regression analysis is a robust method for evaluating energy system performance at various levels within South African communities. Further research should focus on policy implications and implementation strategies to maximise the efficiency gains observed in this study. Off-grid systems, Multilevel regression, Energy efficiency, Community feedback, South Africa

Keywords: *African development, mixed methods, regression analysis, community systems, sustainability, energy efficiency, multilevel modelling*

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