

RURAL SOLAR OFF-GRID ELECTRIFICATION AND SELECTED INDICATORS OF SOCIOECONOMIC DEVELOPMENT: A CASE STUDY OF NIGERIA.

Timileyin Gabriel Olajuwon
University of the Western Cape
4284200@myuwc.ac.za

Lucia Osei Asamoah
University of the Western Cape
4223742@myuwc.ac.za

EXTENDED ABSTRACT

Rapid population expansion, especially in underdeveloped areas, creates both obstacles and opportunities for socioeconomic development. Although electricity is essential for achieving sustainable development, it is generally considered a major hindrance to economic advancement and the delivery of public services in underdeveloped countries. With the dramatic increase in global population development in rural areas in the global North, there has been a surge in demand for electricity, emphasizing the importance of increased utilization of renewable energy sources. However, roughly 1.3 billion people do not have access to electricity, and many households in developed countries continue to lack this important energy source. Therefore, it becomes essential to build partnerships between climate finance and sustainable energy for all to realize universal energy access before 2030. As a way to address energy poverty and environmental concerns, there has been a shift towards renewable energy sources as part of the global pursuit of sustainable development. Even though a sizable portion of the population in emerging nations lives in rural areas and relies heavily on agriculture for both income and consumption needs, academic research has shown that an inadequate and inconsistent energy supply hinders productivity, growth potential, and income levels.

In light of this, developing resilient energy systems is crucial to advancing sustainable cities and communities. Unfortunately, for a variety of reasons—such as remoteness, low demand for electricity, and inadequate payment ability—power distributors regularly ignore isolated communities in countries with inadequate national energy supply. For example, a large number of people in Nigeria's rural villages lack access to grid electricity and even those who do have frequent power outages—supply disruptions occurring more than 60% of the time. Nigeria is heavily dependent on fossil fuels, which provide most of the nation's electricity through the national electrical system and more than 90% of its foreign exchange earnings. The over-reliance on fossil fuels and the national power grid for the generation and distribution of electricity has hindered sustainable electrification efforts and the development of green energy in Nigeria; however, declining off-grid electrification technology costs have accelerated the use of solar electrification solutions. Research has shown that using solar energy to power small-scale electrification initiatives and regional energy has become a significant and environmentally responsible approach to expanding access to electricity.

Against this backdrop and further solar-off-grid electrification project plans of international development agencies, this study seeks to examine the impact of rural electrification on socio-economic development. The study will be examined using the indicators of socioeconomic development which are: Household Income, and cooking behaviour. Household income data is a reliable and comprehensive indication of

socioeconomic growth. The present cross-sectional dataset allows for an assessment of the short- to medium-term effects of electrification on household income. However, due to constraints in the existing dataset, it is not possible to analyse the long-term income implications. Furthermore, the study attempts to advance the understanding of the complicated interaction between electrification, environmental improvement, and human health by challenging the widespread scepticism surrounding the replacement of carbon-intensive biofuels-based cooking with clean and green energy. Through a quantitative impact evaluation of the Solar Electrification Project in Nigeria, the study would contribute to a better understanding of the nexus between rural solar off-grid electrification and socioeconomic development in the context of Sub-Saharan Africa, especially in the far-to-reach communities.

The study makes use of the Sustainable Livelihoods Framework created by the DFID, which specifies six key principles: sustainability, building on strengths, macro-micro connections, holistic, dynamic, and people-centeredness. The needs and priorities of individuals are given a lot of attention in this Sustainable Livelihoods Framework (SLF), which recognizes that they are the main drivers of change in their own lives. It adopts a comprehensive approach to livelihoods, considering the many facets of people's lives, such as the social, economic, cultural, and political facets. The framework also emphasizes how important it is to understand potential changes and how they may affect people's quality of life. The SLF seeks to advance long-term sustainable lifestyles for both individuals and the larger community and environment. The Sustainable Livelihood Approach (SLA) would make it easier to comprehend how electricity affects socioeconomic patterns. The Sustainable Livelihood Approach (SLA) stresses the importance of access to and control over resources, particularly financial wealth, in influencing people's lives. Within the context of sustainable livelihoods, community electrification is critical in enhancing the economic well-being of households, allowing them to improve their income and ensure sustainable livelihoods. This has a significant impact on income levels. This study therefore seeks to understand how solar off-grid energy may potentially function as a new source of revenue for homes by examining household income using the SLA framework.

Furthermore, electronic cooking (or e-cooking), which uses renewable energy sources and energy-efficient cooking gadgets, has tremendous potential as a long-term and dependable option to attain universal access to clean cooking facilities. However, despite significant success in electrification initiatives, with an annual pace of 100 million people getting access since 2012, the worldwide number of people lacking access to clean cooking remains stable. Traditional cooking practices are harmful to both human health and the environment; however, switching to electric cooking can mitigate these risks by eliminating harmful smoke and reducing respiratory and cardiovascular diseases caused by indoor air pollution. Cooking behaviour is a crucial part of sustainable livelihoods as it intersects with numerous facets of capital, including natural, social, human, financial, and physical capital, the SLA, therefore, offers an understanding of how the use of solar off-grid electricity affects the cooking behaviour of the rural communities.

The study will take place in the electrified Idi-ita/Onibambu community and the non-electrified Oriokuta community, both in western Nigeria. The communities were chosen from a list of 150 in Osun State that were polled about taking part in the Bank of Industry's Solar Electrification Project. A total of 200 respondents will be chosen at random from a population list provided by ASL using an Excel 'RAND()' function. The list included 650 registered homes from the electrified Idi-ita/onibambu community and 400 registered households from the non-electrified Oriokuta community.

Characteristics	Idi-ita/Onibambu (Treatment Group)	Oriokuta (Control Group)
Population	650	400
Economic Activities	Farming	

Quantitative research is the main emphasis of this study. Primary data would be collected for this purpose utilizing a questionnaire. The questionnaire would be administered at the two randomly chosen electrified and non-electrified villages. 200 heads of households will complete the questionnaire. The study will use a double empirical analytic approach. Propensity Score Matching comes in first, followed by Ordinal Logistic Regression. The two analytical techniques are necessary to guarantee the confinement of the propensity score matching estimator. In addition, ordinal logistic regression would support the propensity score matching method's findings, whereas equivalent results from both PSM and ordinal logistic regression are meant to support the reliability of the findings.

It is proposed that households without access to power, and those with energy access move up one unit in the income spectrum. The most obvious conclusion to come out of the data, though, is that household cooking fuel uptake in Nigerian rural communities has not been impacted by energy access. It is also proposed that the observed pattern of cooking fuel uptake is still present. the same in homes with and without electricity. These unfavourable outcomes should not be interpreted as evidence that rural electrification programs have no positive impact on the environment, instead, they serve as a catalyst for the evaluation of the variables and the evaluation of the incentive systems surrounding the introduction of electricity-based cooking in rural regions. This research could be used to support the combination of rural electricity projects with other policies that would support the creation of favourable conditions for efficient and ecologically friendly cooking habits, especially in rural areas in the global North.