ENERGY EFFICIENCY MEASURES AND PRIVATE HOUSEHOLDS IN NIGERIA

KAZEEM FASOYE*
Department of Economics, Obafemi Awolowo University, Ile-Ife, Nigeria
Phone No: 08038166046
Correspondence Email address: qosimfasoye@yahoo.com

ABIODUN S. OLAYIWOLA
Department of Economics, College of Arts, Management and Social Sciences,
Chrisland University, Abeokuta, Nigeria
Phone No: 08034990654
Email Address: abiodunolayiwola37@gmail.com

ABSTRACT
The paper examines the impact of energy use on households in Nigeria. Adopting the results of the survey conducted by Ochedi and Taki, (2019) on energy efficiency in the residential neighborhoods of Kogi State, Nigeria, the findings reveal that energy measures, to a greater extent, are not efficient in private households in Nigeria. Also, a lack of awareness and regulatory challenges impede Nigeria's adoption of energy-efficient measures while a lack of confidence in energy savings, as displayed by the respondents' level of energy efficiency measures, hinders the progress. It is recommended that stakeholders invest in renewable energy sources to build a resilient Nigerian economy, like developed countries.

Keywords: Adoption**,** Energy Efficiency, Measures, Private Households, Nigeria

JEL Classification: Q42, Q48, Q4

1 INTRODUCTION
Energy efficiency is a crucial aspect of sustainable development, playing a pivotal role in reducing energy consumption, mitigating environmental impact, and improving overall economic productivity. In the context of private households in Nigeria, the need for effective energy efficiency measures is paramount. Nigeria, being one of the most populous countries in Africa, faces energy challenges that include unreliable power supply, high energy costs, and environmental concerns (Oyedele and Oluwalaiye, 2023). Nigeria, with its rapidly growing population, is experiencing an increasing demand for energy, primarily driven by urbanization and industrialization and the current energy infrastructure faces challenges such as insufficient power generation, transmission losses, and inadequate access to electricity in many regions (Adeniyi, 2023). Nigeria faces a power crisis, with 60% to 70% of the population lacking electricity (NBS, 2021).

Therefore, private households in Nigeria often rely on various energy sources, including electricity, biomass, and fossil fuels and as a result, inefficient energy use in households contributes to high utility bills, energy waste, and environmental pollution (Samuel, Njiforti, Duru, and Jibril, 2022). Enhancing energy efficiency in private households can lead to reduced energy bills, improved energy security, and minimized environmental impact (Shamwil, Bala, Shehu, Yunusa and Yaro, 2023). Increased energy efficiency contributes to the overall resilience of the energy sector and supports the country's sustainable development goals.

The basis for any nation's sustainable development is considered by many to be its access to an adequate supply of energy. As a result, the Sustainable Energy for All (SE4All) Initiative, established in 2011, aims to achieve global energy access. The Economic Community of West African States (ECOWAS) member states have adopted templates to create and carry out

National Energy Action Plans within the framework of the SE4All Initiative (Adebisi and Yabo, 2016). The Federal Government of Nigeria has established measures and strategies to achieve the SE4ALL goals by gathering data, exchanges, and suggestions with stakeholders in both the public and private sectors. The Nigerian National Renewable Energy Action Plan (NREAP) was developed with the assistance of stakeholders to reach 30,000 MW of power by 2030, with 30% coming from renewable energy sources (Fleitera, Schleich, and Ravivanpong, 2012). It is pursued in three stages: stable, sustainable, and uninterruptible power supply (Yusuf, 2021).

According to Unnikrishnan, Rauf, Anju, and Indrayani (2019), domestic household is regarded as one of the main pillars of an economy and the primary drivers of economic growth. Nigeria's economy has been among the fastest-growing in Africa, with an average yearly growth rate of 5.9% (Unnikrishnan, Rauf, Anju, and Indrayani, 2019). Energy demand has risen due to rapid economic development and investments in infrastructure and mining. Nigeria's rapid economic development and investments in infrastructure and mining have led to increased energy demand. If not addressed, energy efficiency issues will persist, causing increased consumption and carbon emissions. The conglomerate of households accounts for over 80% of registered companies in the country (Ibe and Ndubuisi, 2019). However, Nigeria's government recognizes energy efficiency measures as crucial for policy and action. The private sector's proactive participation is essential for achieving energy efficiency goals. However, obstacles hinder households from identifying and implementing energy efficiency opportunities.

Following the above, the study intends to proffer an answer to this research question: How efficient are the energy measures on private households in Nigeria? The study aims to identify energy efficiency measures for Nigeria's economic growth, highlighting limited success in private households despite government efforts. This is done by examining the energy efficiency in Nigerian private households, focusing on the impact of energy use. The remaining parts of this paper include Literature Review, Methodology, Results, and Conclusion, presenting key findings.

2 LITERATURE REVIEW

Empirical studies indicate that Nigeria faces significant challenges in its energy sector, including unreliable power supply, transmission losses, and inadequate infrastructure. (EIA, 2021). As a result, the demand for energy in Nigeria is rising due to population growth, urbanization, and industrialization, necessitating a focus on efficient energy consumption in households. Research reveals a diverse energy mix in among the households in sub-Saharan Africa, with electricity, biomass, and fossil fuels being primary sources. (Oyedele and Oluwalaiye, 2023). It is concluded that high reliance on traditional biomass for cooking contributes to indoor air pollution, affecting both health and the environment.

Again, studies emphasize the importance of appliance upgradation in households, indicating that the adoption of energy-efficient appliances can significantly reduce electricity consumption. (Oyedepo, 2019). This is a component of behavioral changes, such as energy-saving practices, that are recognized as essential for achieving sustained energy efficiency in households. (Ogbeide-Osaretin and Efe, 2022). Analysis of government initiatives reveals the implementation of policies aimed at promoting energy efficiency, including incentives for renewable energy adoption and appliance efficiency standards. (NEPAN, 2022). Against this background, challenges in policy implementation, such as enforcement issues and lack of awareness, are identified as potential barriers to achieving widespread energy efficiency in households. (Samuel, Njiforti, Duru, and Jibril, 2022).

Opportunities for job creation and economic growth are identified through the development and promotion of the energy efficiency sector in Nigeria (Shamwil, Bala, Shehu, Yunusa and Yaro, 2023). Studies emphasize the importance of community engagement and social dynamics in driving energy efficiency measures, suggesting that community-based programs can effectively promote behavioral changes (Adeniyi, 2023).

Global efforts to reduce energy consumption by buildings aim to improve wellbeing and environmental protection. Nigeria faces challenges in energy-efficient design, including poverty, lack of awareness, and insufficient regulatory bodies ((Ochedi and Taki, 2019). Addressing these issues can improve Nigeria's potential for reducing carbon footprints and enhancing wellbeing. The empirical study of Hussaini, (2018) examines energy efficiency practices in Nigeria's housing sector to reduce demand, ensure security, and address energy crisis. Findings reveal low efficiency in design, appliances, and occupant behavior, prompting Nigeria's government and stakeholders to implement strategic measures.
The behavioral approach to energy conservation addresses challenges like resource depletion, climate change, and environmental pollution, focusing on human behavior and understanding consumption (AbdulMajid and Hussaini, 2011). Despite advancements in design and technology, existing models have insufficient contributions to sustainable development in energy conservation. The paper examines Nigerian households' energy efficiency practices through opinion survey in Bauchi, revealing individual awareness and education impact. Bernard and Nwokoye (2015) analyze Nigeria's energy consumption and economic growth, finding a decrease in energy efficiency. They suggest boosting industrial activities through policies like credit availability, climate protection, import substitution, tax relief, and feedback.

Nigeria faces a power crisis, with 60% to 70% of the population lacking electricity and diversifying energy sources and adopting new technologies can reduce energy wastage and save costs (Oyedepo, 2012a). Implementing renewable energy targets may have economic costs, but offsets can be offset by selling carbon credits. Targeted interventions reduce local air pollution and greenhouse gas emissions. Nigeria's policies and governance system struggle to encourage energy-efficient appliance adoption, with weak policies, overlapping organizations, and limited resources (Gana and Hoppe, 2017). A well-formulated policy mix is needed to drive this process. This article offers suggestions for policy design to promote energy-efficient electrical appliance adoption in Nigeria.
Energy management is crucial for sustainable development and climate change mitigation in Nigeria. Thus, increasing energy efficiencies promotes economic growth, job creation, and income savings, while Nigeria's energy policy undermines its importance for environmental and economic growth (Oyedepo, 2012b). Automated energy metering systems enhance transparency, self-control, efficiency, and equity in energy use (Aliu, 2020). The study found significant differences in electricity consumption levels between postpaid and prepaid metered households in Nigeria. However, few studies explore the impact of household attributes, dwelling characteristics, and metering systems on residential energy efficiency.

The literature underscores the critical need for comprehensive approaches to address energy efficiency in private households in Nigeria. It also provides insights into the current state of energy efficiency measures in private households in Nigeria, identifying challenges, opportunities, and potential areas for future research and policy development. The interdisciplinary nature of this field necessitates collaborative efforts from researchers, policymakers, and communities to achieve sustainable energy practices in Nigerian households.

3 METHOLOGY

The study adopted result of the survey conducted by Ochedi and Taki, (2019) on energy efficiency in the residential neighborhoods of Kogi State, Nigeria. The instrument has two sections: section A comprised of structured questions for demographic information about the respondents while section B is premised on semi-structured questions aimed at providing data on the challenges to achieving energy efficiency in Nigeria.

The descriptive characteristics of the variables in the model are presented in the Table 1 below.

Table 1: **Summary Statistics of the Variables**

Summary Statistics	Value
Mean	5
Standard Error	1
Median	5
Mode	5
Standard Deviation	0.2
Range	2
Minimum	1
Maximum	6

Author's computation adapted from Ochedi and Taki, (2019)

From the Table 1 above, it is shown that the mean and the standard deviation values of all the variables are positive. This implies that the variable represent the actual dataset as they appear to have significantly spread out from their average values. Thus, the variables appear to be relatively stable and less volatile as their data cluster around their respective mean values. It is also shown that the series display a high level of consistency as their mean, median and modal values are within the maximum and minimum values of the series.

It is evidenced from the Table 1 above that all the respondents of the study were drawn from the urban areas as a result of the fact that these places have access to electricity. Though, Nigeria has applied series of energy efficiency measures in the past, but other measures which can be adopted in Nigeria are enumerated as well. Non-probability sampling as adopted in the sampled paper is used for the selection of respondents. The choice of the sampling technique is informed by the fact that it is faster, cost-effective, and highly motivated than probability sampling due to its known sample.

5 RESULTS AND DISCUSION

The findings of this study are presented in the Table 1 below. Also, efforts made by Nigerian government to enhance energy efficiency as well **as** the best energy efficiency measures from around the world which can be adopted in Nigeria are present in this section.

Table 2: Respondents' Demographic Characteristics and Level of Awareness on Energy Efficient Measures in Nigeria

Variable	No of Respondent	Proportion (%)
Age Group		
20 – 30	0	0
31 – 40	5	41.7
41 and above	7	58.3
Education Level		
Graduate	2	16.7
Postgraduate	10	83.3

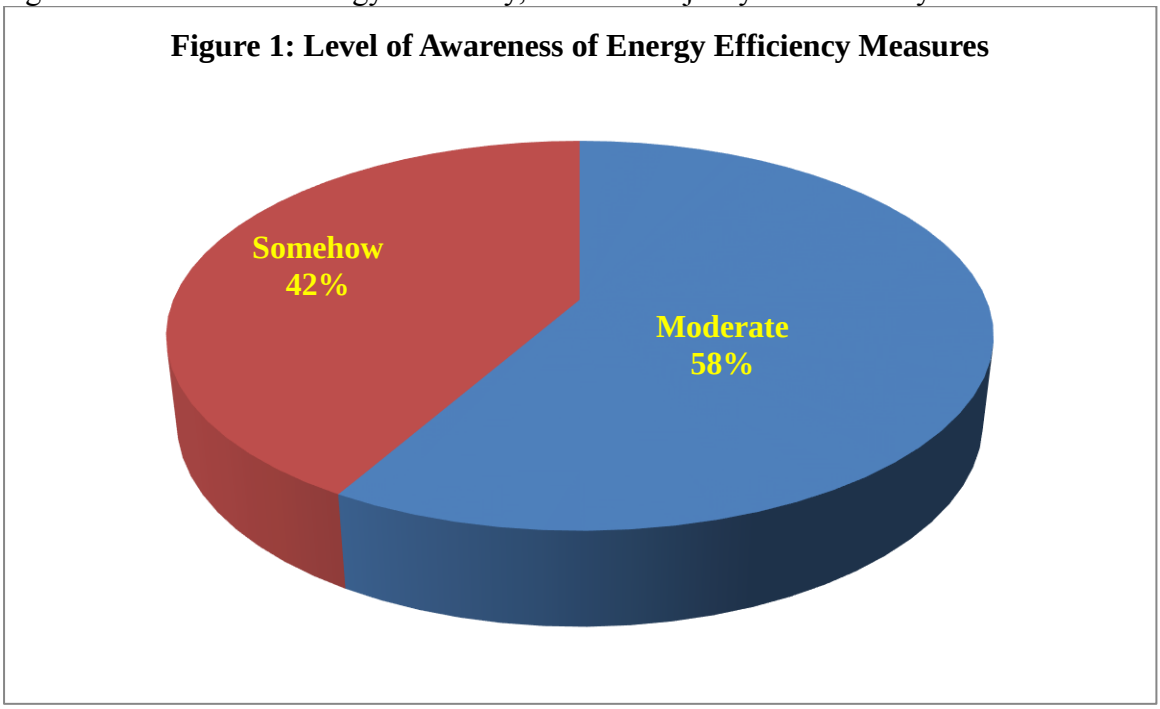
Designation		
Academic	4	33.3
Private	1	8.4
Public	7	58.3
Years of Experience		
1 – 5	2	16.7
5 – 10	4	33.3
Above 15	6	50.0
Level of awareness on energy efficiency measures		
Moderate	7	58.3
Somehow	5	41.7

Source: Adapted from Ochedi and Taki, (2019)

From the Table 2 above, the respondents are between the age of 31 and above while greater percentage of them are 41 and above (58.3%). They are not only adults; they are equally predominantly well-read as 83.3% of them are postgraduates. The respondents are proportionally spread across academic, private and public sectors with varied years of experience. It is revealed from the responses that many respondents, despite the fact that majority of them are well read, lack the basic understanding on energy efficiency products and their rating/labeling mode and as such could not offer satisfactory and reliable responses on issues relating to adoption of energy efficiency measures.

The respondents' apparent display of level of awareness on energy efficiency measures (as shown in Figure 1) is at variance with their corresponding level of exposure. Only just above average (58.3%) of them have moderate level of awareness on energy efficiency measures while 41.7% is skeptical about their levels of awareness on energy efficiency measures. This constitutes drawbacks on the impact of energy use by households in the country and the results are line with the findings of Hussaini, (2018) and Oyedele and Oluwalaiye, (2023) which reveal a low level of energy efficiency consideration in housing design practice; a very low level of appliances efficiency; and a much low level of energy efficiency practice by the households. The results also corroborate the findings of Bernard and Nwokoye, (2015) which show a significant decrease in energy efficiency, with the majority consumed by households

Figure 1: Level of Awareness of Energy Efficiency Measures



Author's graphical illustration adapted from Ochedi and Taki, (2019)

The low level of awareness on energy efficiency measures is assumed to have triggered the lingering energy use deficit which affects the country on multiple levels: at household, business and even at economy level (Ochedi and Taki, (2019). According to the findings of the authors, more than 40 percent of households in Nigeria own generators and bear the accompanying costs. It is also reported by African Development Bank (AfDB) in 2022 that Nigerians spend $14 billion fuelling petrol- or diesel-powered generators.

6 CONCLUSION AND POLICY RECOMMENDATIONS

Majority of people, according to the responses, are familiar with the word "energy efficiency," but few are aware of what it actually means in practice or of its advantages. It is therefore concluded that lack of awareness and understanding as well as regulatory and policy challenges are among the significant barriers to the adoption of energy-efficient measures in Nigeria. Also, availability of staff dedicated to promote the desired awareness on energy efficiency measures is low and lack of confidence in obtaining energy savings resulting from energy efficiency measures as well. Thus, energy measures, to a greater extent, are not efficient in private households in Nigeria. To take advantage of the opportunity that renewable energy sources present and the ability to construct a more resilient economy for the Nigerian state, similar to that of its counterparts in advanced nations, significant investment and intervention by relevant stakeholders are required. Thus, improving energy efficiency in private households in Nigeria is a multifaceted challenge that requires a holistic approach. Through awareness campaigns, policy support and technological innovations, Nigeria can harness the benefits of energy efficiency, contributing to a more sustainable and resilient energy future.

Limitation

The study is only limited to adoption of energy efficiency measures in private households of urban residential areas of Kogi State, Nigeria. Future study can investigate the challenges of adopting energy efficiency measures in rural areas in Nigeria.

References

AbdulMajid, N. H. and Hussaini, I. U. (2011). The Challenges of Energy Efficiency Practice in the Nigerian Households. *Third International Conference on Applied Energy* - 16-18 May 2011 - Perugia, Italy.

Adeniyi, O. I. (2023). Industrialisation and Industrial Output Nexus in Nigeria: A New Empirical Evidence. *Journal of Economics and Allied Research*, 8(3), September, 123-130

Adebisi, A. and Yabo, F. Y. (2016). The National Energy Efficiency Action Plan (NEEAP) for Nigeria (2015 – 2030). Adopted by Inter-Ministerial Committee on Renewable Energy and Energy Efficiency (ICREEE). National Council on Power (NACOP)

Aliu, I. R. (2020). Energy Efficiency in Postpaid-Prepaid Metered Homes: Analyzing Effects of Socio-Economic, Housing, and Metering Factors in Lagos, Nigeria. *Energy efficiency*, 13, 853 – 869.

Bernard, O. A. Nwokoye, E. S. (2015). Measuring Energy Efficiency in Nigeria: Energy Intensity and Energy-GDP Elasticity Approach. *Nigerian Journal of Energy and Environmental Economics,* 7(1).

Environmental Impact Assessment (EIA, 2021). The Application of Science. *Ecological Indicator*, 4(2), 125 – 138.

Gana, J. A. and Hoppe, T. (2017). Assessment of the Governance System Regarding Adoption of Energy Efficient Appliances by Households in Nigeria. *Energies*, 10, 132; doi:10.3390/en10010132

Geissler, S., Österreicher. D. and Macharm, E. (2018). Transition Towards Energy Efficiency: Developing the Nigerian Building Energy Efficiency Code. *Sustainability*, 10, 2620; doi:10.3390/su10082620

Ibe, E. and Ndubuisi, O. D. (2019). Energy Efficiency in Medium and Small-Scale Enterprises (SMEs) and Economic Growth in Nigeria. *DBN Journal of Economic Growth and Sustainable Development*, 2(1), 78 – 90.

Fleitera, T., Schleich, J. and Ravivanpong, P. (2012). Adoption of Energy-Efficiency Measures in SMEs - An Empirical Analysis Based on Energy Audit Data. *Energy policy*, 51, 863 - 875.

Ochedi, E. T. and Taki, A. (2019). Towards Energy Efficient Buildings in Nigeria: Challenges and Opportunities. *Journal of Engineering and Architecture*, 7 (2), 125 – 133.

Ogbeide-Osaretin, E. N. and Efe, O. M. (2022). Climate Change Mitigation and Gender Inequality Nexus: Evidence from Sub-Saharan Africa. *Journal of Economics and Allied Research*, 7(1), 1-12

Oyedele, O. and Oluwalaiye, O. B. (2023). Energy Consumption, CO_2 Emission and Population health in Sub- Saharan Africa. *Journal of Economics and Allied Research*, 8(3),September, 180 – 207.

Oyedepo, S. O. (2012a). Energy and Sustainable Development in Nigeria: The Way Forward. *Sustainability and Society*, 2, 15.

Oyedepo, S. O. (2012b). Energy efficiency and conservation measures: Tools for sustainable energy development in Nigeria. *International journal of energy engineering, 2(3), 86 – 98.*

National Bureau of Statistics (NBS, 2021). Socio- Demographic Statistics, vol. 3, No 10.

Samuel, A. K., Njiforti, P. P., Duru, M. C. and Jibril, M. S. (2022). Impact of climate change on Nigerian agricultural sector crop production. *Journal of Economics and Allied Research*, 7(1), 105-115.

Shamwil, M., Bala, A., Shehu, K. K., Yunusa, A. and Yaro, I. M. (2023). Asymmetric Impact of Some Selected Macroeconomic Variables on Natural Gas Consumption in Nigeria. *Journal of Economics and Allied Research*, 8(1), 252-265.

Yusuf, M. (2021). An analysis of the impact of oil price shocks on the growth of the Nigerian economy, 1970 – 2019. *African journal of business management*, 9, 103–115.

Unnikrishnan, S., Rauf, I., Anju, S. and Indrayani, M. N. (2019). Safety management practices in Small and Medium Enterprises in India. Safety and Health at work 6 (1):46–55.