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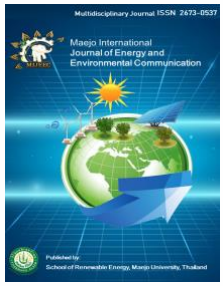

ARTICLE

Evaluation of public understanding of renewable energy use in sub-Saharan Africa

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ABSTRACT

This work was on information circulation and energy economics by the evaluation of public understanding of renewable energy use, environmental impacts and investments in sub-Saharan Africa. The scope was only on Kenya, Ghana, Nigeria and the Benin Republic. The objectives cover the desire to find out the most common of the types of energy consumption in the affected countries; to find out the level of public understanding about renewable energy; to find out the level of investments on renewable energy as well as to know the knowledge about the environmental impact of energy usages. The method of research was an online survey of, and 14,814,460 persons and sample size are 1000 persons. The instrument of research was the structured questionnaire proportionately shared and mailed electronically to respondents of the affected counties. Two theories were applied being the diffusion of innovations and technological determinism. The major findings were that public understanding of renewable energy was critically low in Sub-Saharan Africa though some moderate awareness exists. It was concluded that the biggest barrier in the use of RE in Sub-Saharan Africa is due to lack of public awareness, followed by regulatory barriers and cost. Unawareness is an invisible but powerful obstacle to the mainstream adoption of renewable energy in Sub-Saharan Africa. Beyond the technical and financial limitations, lack of understanding and exposure is one of the key factors that delays the energy transition. Energy education, targeted communication and grassroots outreach are important in overcoming this hurdle and ensuring that sub-Saharan Africa draws on its enormous renewable potential for sustainable development. Recommendations included that renewable energy companies, with the help of governments, could engage in awareness-raising as part of their market expansion strategies.

1. Introduction

Axiomatically, knowledge is power in the social sciences, while in the applied Sciences energy is power. In the same vein, every aspect of knowledge in the social sciences and the Applied Sciences are related to fast-track and deepen growth and development (Bauid et al., 2022; Pandi et al., 2025). Knowledge fastens the adoption of skills, innovations, and the application of technology. It is the combination of knowledge and acceptance for application that can prompt the development of persons, industries, communities, and countries. Rogers (2003) states that the diffusion of innovations relies very much on knowledge dissemination. Potential adopters need to know what innovation's function is and what its benefits are before they can proceed with adoption and implementation. Apart from the physical exertion of prowess that throws weight and sweat in the striking, scratching, scrabbling, renovation, or excavation of a surface or objects to refined stages, there are natural and man-made sources of energy that equally drive production, processing, or manufacturing, distribution of goods and services. While physical energy remains cumbersome

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and tedious, machine-related forms of energy give less burden (Mejica et al., 2022). From the Stone Age forms of energy in the use of firewood, electricity has come on stream to dominate the energy scene. However, as the days come, there have been innovations bringing about the conversion of energy in the form of wind, waste, water, and Sun to create alternative sources of energy, otherwise christened the renewable energy sources (Ramaraj & Dussadee, 2015). Several countries in the advanced nations have since put electricity with associated fuel and gas sources of energy to rest based on additional advantages above the risks of the previous ones (Pandi et al., 2024). Energy is not only a factor of production but is also a commodity itself, the availability or price of which can impact inflation, balance of trade, and Gross Domestic Product (Chaiboonsri et al., 2024).

The global transition to renewable energy is not just a matter of technology and environmental considerations but rather goes to the heart of the dynamics of information flow, public perception, and economic investment strategies (Dussadee et al., 2022; Tongsiri et al., 2023). Energy economics examines how energy is produced, distributed, and consumed, in connection with cost and policy, and the adoption of renewable energy depends upon having access to suitably urgent, accurate, and convincing information (Onyemowo et al., 2024; Taechawatchananont et al., 2024). The flow of information, particularly on renewable energy options (e.g., solar, wind, biomass), is an important factor affecting individual and institutional decision-making on adoption and investment (Wolsink, 2012). In Sub-Saharan African countries such as Nigeria, Kenya, and Ghana, where energy access is still inconsistent and fossil fuel dependency is still high, understanding how information on renewable energy is distributed and how this affects public awareness and investment behavior is critical to influencing energy policy and sustainable development (Aklin et al., 2018; Eberhard et al., 2018). In emerging economies of Sub-Saharan countries, the role of public understanding, led by media stories, government awareness campaigns, and educational outreach, is critical to demystifying renewable technologies and encouraging domestic and foreign investments (Amoako & Dzisi, 2020).

Information distribution has an impact on energy economics, where it affects investment trends, energy literacy, and the willingness of citizens and stakeholders to adopt green solutions. In societies where people have little trust in institutions and a lack of media literacy, misinformation, as well as a lack of engagement, stifles progress. For example, even though the cost of photovoltaic technologies has decreased significantly worldwide, their adoption is slow due to misinformation on cost-effectiveness and maintenance. In both Nigeria and Ghana, social media, radio, and community outreach programmers are an important part of shaping public understanding. However, challenges such as internet access, language barriers, and policy inconsistency reduce the impact of these media (Odularu & Okonkwo, 2019).

Moreover, there are strong links between energy economics in these regions and foreign direct investments (FDIs) and international aid, so public understanding of energy economics there is essential for establishing a conducive investment climate. Investors consider risk partly in terms of macroeconomic stability, policy transparency, and regulatory clarity, as these factors significantly shape FDI inflows and investment behavior (Asumadu-Sarkodie & Owusu, 2016; Chatter et al., 2025a, b). Without strong awareness at the grassroots levels, policy changes may not have the intended effect of building market confidence, which is needed to finance renewable energy projects.

Hence, it is important to evaluate the distribution of information on RE and the extent to which this information informs economic choices among the public for the sustainable energy future of both nations. The study of public understanding in Nigeria and Ghana contributes to a unique lens in studying the communication strategies, energy policy, and investment psychology in the African context. Furthermore, it offers a critical appraisal of whether the population is well-prepared to give support and participate in the case of renewable energy transitions not only as consumers, but as informed investors and advocates. CSS researchers find that understanding this dynamic is in the best interest of bridging the gap between availability and actual deployment of renewable energy infrastructure. There is now a strong body of literature advocating for the need to develop integrated approaches that integrate energy economics, behavioral insights, and participatory communication models in order to increase the societal acceptance and use of clean energy (Sovacool, 2014; Khetrapal et al., 2022).

There are global calls for a transition from electrical energy to renewable energy (Mejica et al., 2023; Onyemowo et al., 2024). In policy statements, many African nations, including Nigeria and Ghana appreciate the calls but are yet to adhere to these international trends due to systemic challenges which hamper widespread adoption and investment in clean energy technologies. For example, Nigeria has achieved a significant policy change with the signing of the Electricity Act 2023, which decentralizes the fuel electricity market by allowing individual states to generate, transmit, and distribute electricity within their territories. This reformation represents a massive departure from centralized energy control and opens up new opportunities for sub-national governments and private actors to explore renewable energy options such as solar and wind and mini grids. However, whilst the Act is progressive in intention, its success will rely heavily on the understanding of the public about renewable energy technologies, how investment will occur, and the underlying economics. In Ghana, the public energy policy is anchored in its old Renewable Energy Act of 2011 that defines renewable sources and legally empowers the introduction of net-metering and feed-in-tariffs. Under the Renewable Energy Master Plan (REMP), the government seeks to reach non-hydro renewables by 2030, to complement net zero emissions by 2060, and blend an expanded green energy Investment supporting solar deployment in public institutions and private investment.

Hence, in Nigeria and Ghana, there has been a visible growth in solar-powered street lighting projects, sometimes boosted by government intervention, donor-funded initiatives, and the work of development institutions. These initiatives have helped to show the practicality of renewable energy, both in urban and rural communities. However, their impact has been highly symbolic and piecemeal, with limited public education/campaigns accompanying such infrastructural deployments. As a result, although solar panels are becoming an increasingly visible aspect of public infrastructure, the average citizen's understanding of renewable energy systems, cost-benefit implications, or opportunity for domestic investment appears negligible.

This disconnect is a severe challenge to the development of sustainable energy. The democratization of electricity generation, which the Electricity Act in Nigeria and similar reforms in Ghana attempt to achieve, can only perform the purpose for which they are designed if citizens and local investors are properly educated and economically incentivized to partake in the energy revolution. Without an informed public, it is possible that the market for renewables will not grow outside of donor-sponsored installations and public-sector-led pilot installations. Moreover, information gaps in the flow of information resulting from insufficient media coverage, lack of educational programming, and failure to communicate policies can threaten and undermine the socio-economic benefits generated by such reforms.

Therefore, this study aims to examine how the distribution of information and communication approaches affects people's understanding and investment in RE in Nigeria and Ghana. It also intended to examine the role of institutional frameworks and policy

reforms in shaping the energy economics space as well as facilitating or hampering the role of grassroots in the renewable energy transition.

2. Methodology

The method adopted for this work was online surveys. Online surveys have emerged as a cost-effective and time-efficient data collection tool, particularly valuable in contexts where physical access to respondents may be limited due to geographical, infrastructural, or security constraints. According to Akpan and Udo (2025), digital academic research tools have become the latest in getting public perception on subjects, especially educated or urban-based populations where internet access exists. The authors stressed that online surveys are especially helpful to reach stakeholders, students, policy influencers, and diaspora groups who have an influential opinion in shaping discourse around investments and public acceptance. Still, online surveys have their advantages, including speed, anonymity, and a wide geographic scope to provide more inclusive and balanced insights.

2.1 Population

Using the most recent population figures from the Benin Republic, at 14,814,460. Ghana 34,600,000, Kenya 57,530,000, Nigeria 235, 000,000, the population of this study was put at 341,944,460 persons. The sample size was pegged at 1000 persons. In sampling, the distribution of 1,000 questionnaire proportional to the population. Benin Republic had 43 copies, Ghana: 101 copies, Kenya: 168 copies, and Nigeria: 687 copies.

2.2 Instrument of Data Collection

The instrument of data collection for the study was a structured questionnaire with 10 closed ended inquiries and options from variables. The questionnaire was mailed, and respondents were informed that it was only for academic purposes to guarantee confidentiality. The Validity was done through the face value, where the expertise of two persons was sought to state agreement on questions and options.

2.3 Method of Data Collection

The respondents were sent the questionnaire through emails gotten from Email Hunters. They were asked to tick the option of their choice for each question. The questions were made simple to check ambiguities and reduce the time spent on internets. They were given two weeks to make a return or reply to the emails sent to them anonymously.

2.4 Data Analysis

The data collected from respondents in the respective countries through electronic mail were analysed using frequency tables with variables, responses, the totals, and the percentages. This was supported by the presentation of bar charts for each of the analyses. This enabled simple interpretations to ascertain the results based on the highest and the lowest percentage scores to answer each of the objectives raised.

3. Results

Study results showing the total number of respondents for each energy source across Kenya, Ghana, Nigeria, and Benin. Out of 1,000 respondents, the analysis shows dominance of National Grid (67%) by 673 respondents, making the national electricity grid the most recognized and likely most relied-upon source of energy across all countries. Nigeria alone accounts for 530 of these, reflecting both a large population and central reliance on grid power, even if unstable. Secondary Dependence on Fuel Generators (by 144 or 14%). Traditional Energy (Firewood had 78 or 8% responses, there is low recognition of Solar by 74 or 7% respondents, indicating potential for expansion and investment in renewable technologies.

Minimal Awareness of Biogas and Kerosene by 10 or 1% and 21 or 2% respondents. These sources appear inaccessible and outdated. The high reliance on the national grid, particularly in Nigeria, reflects vulnerability to power outages and the need for better grid management and diversification. There is a clear opportunity for awareness campaigns, subsidies, and public-private investment in solar infrastructure. Widespread use of petrol/diesel generators (14%) points to high energy insecurity and raises environmental and cost concerns. The continued use of firewood and charcoal underscores persistent rural energy poverty. The very low adoption of biogas at (1%) shows that bio-energy technologies remain underutilized.

Table 1 shows that out of 1000 respondents, 631 0r 63% reported poor understanding, which shows clearly that renewable energy education is critically lacking across the region. The low percentage of 42 or 4% in “Excellent” and 118 or 12% “Good” categories suggests that targeted public awareness and educational initiatives are lacking. Fair understanding had 209 or (21%) may involve partial or incorrect knowledge, indicating that communication strategies have complex technical concepts and terms.

Table 1. The most common source of energy people use in select sub-Sahara countries

Energy	Kenya	Ghana	Nigeria	Benin	Total	%
Nat. Grid	76	55	530	12	673	67%
Fuel	45	4	85	10	144	14%
Firewood	24	23	20	11	78	8%
Biogas	0	0	10	0	10	1%
Solar	13	19	42	0	74	7%
Kerosene	10	0	0	11	21	2%
Total	168	101	687	44	1000	100%

Table 2. The level of Public understanding of Renewable Energy

Understanding	Kenya	Ghana	Nigeria	Benin	Total	%
Excellent	12	10	20	0	42	4%
Good	18	11	78	11	118	12%
Fair	34	20	145	10	209	21%
Poor	104	60	444	23	631	63%
Total	168	101	687	44	1000	100%

Table 3. Sources of Information on Energy Types in Sub-Saharan Africa

Source of Information	Kenya	Ghana	Nigeria	Benin	Total	%
Radio	54	49	382	22	507	51%
Television	30	20	159	5	214	21%
Word of Mouth	52	19	78	14	163	16%
Social Media / Online	22	12	33	2	69	7%
Print (Newspapers, Flyers)	10	1	35	1	47	5%
Total	168	101	687	44	1000	100%

Table 4. Factors Discouraging Public Adoption of Renewable Energy

Factors	Kenya	Ghana	Nigeria	Benin	Total	%
Cost	45	26	125	13	209	21%
Infrastructure	11	0	15	0	26	3%
Unawareness	102	58	361	22	543	54%
Regulation	10	17	186	9	222	22%
Total	168	101	687	44	1000	100%

Table 5. Public Assessment of Renewable Energy Economic Investment Structures

Assessment Category	Kenya	Ghana	Nigeria	Benin	Total	Percentage (%)
Very Abundant	15	38	20	14	87	9%
Abundant	30	42	30	0	102	10%
Low	100	21	405	15	541	54%
Very Low	18	0	192	10	220	22%
None	5	0	40	5	50	5%
Total	168	101	687	44	1000	100%

Table 6. Assumed Environmental impacts of energy Consumption

Impacts	Kenya	Ghana	Nigeria	Benin	Total	Percentage (%)
Deforestation	105	58	420	24	607	61%
Air Pollution	40	22	80	0	142	14%
Green House	10	21	5	15	51	5%
Noise	8	0	181	0	189	19%
Spillage	5	0	2	5	12	1%
Total	168	101	687	44	1000	100%

Analysis of sources of information on energy availability shows radio had 507 or 51% saying that most people relied upon radio, especially in Nigeria and Kenya. Radio is trusted and accessible in rural areas. Television had 214 or 21% as the second most common source of information, and it is dominant in urban and electrified areas. Word of Mouth had 163 or 16% being a source of information, significant in areas with limited modern media access, and it is often driven by community trust and local discussions. Social media / online attracted 69 or 7%, showing it as a growing source of information among youth and urban populations, especially in Nigeria. Print media had 47 or 5% as the least used due to literacy and distribution issues common among professionals and students. The Implications are that radio is

essential for outreach, while the high level of word of mouth (16%) shows the role of local leaders, friends, and community discussions. Energy awareness campaigns must involve community activities. With only 5% reach, print media is no longer an effective mass tool for energy communication. It should be reserved for niche audiences, such as academics or in the professional world. Table 4 represents the hindrances to renewable energy adoption in Kenya, Ghana, Nigeria, and Benin. Each bar indicates how many people identified each factor and what percent (%) of the entire
sample has identified each factor. Out of 1000 persons, 543 or 54%, being over half of the respondents, said lack of awareness. This makes public education campaigns and community sensitization an urgent need of the hour. The concern about regulation from 222 or 22% of persons indicates that there is a need for governments to simplify licensing, offer incentives, and support private sector involvement in renewable energy. Cost attracted 209 or 21% persons, while the least cited barrier of infrastructure at 26 or 3% bordering on storage, grids, or supply chains.

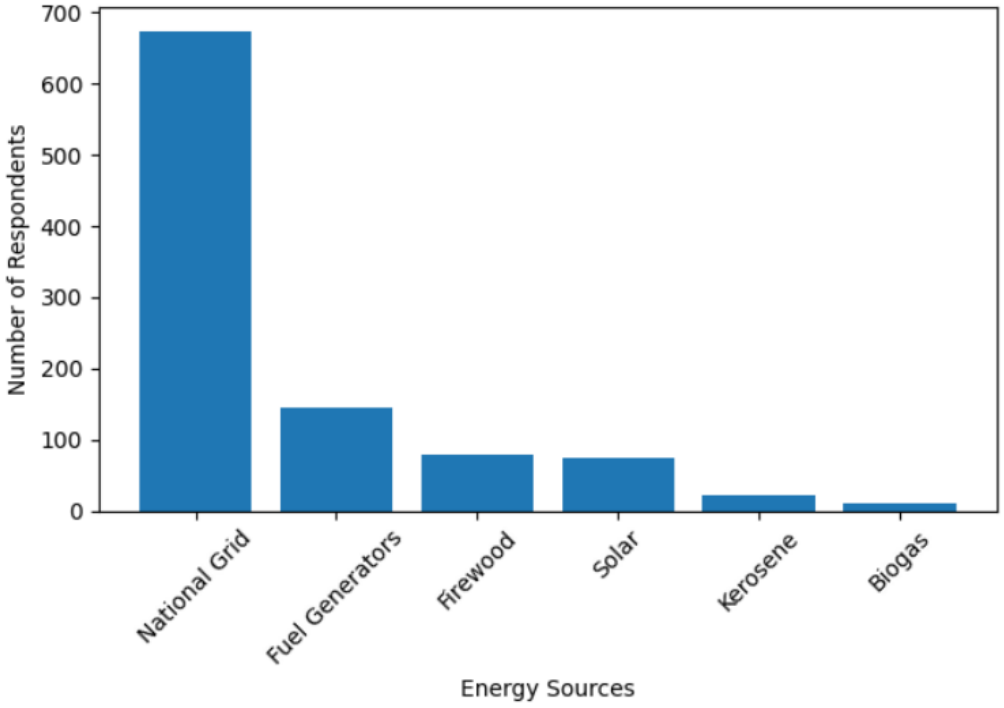

Figure 1. Distribution of Primary Energy Sources Used by Respondents Across Kenya, Ghana, Nigeria, and Benin (n = 1,000).

Figure 1 illustrates the dominance of the national electricity grid (67%) as the primary energy source, followed by fuel generators (14%), while solar (7%), firewood (8%), kerosene (2%), and biogas (1%) show comparatively lower utilization levels across the surveyed Sub-Saharan African countries. The table shows the public's assessment of renewable energy investment structures in four African countries (Kenya, Ghana, Nigeria, and Benin). The assessments are categorized as Very Abundant, Abundant, Low, Very Low, and None, with corresponding figures. The dominant public perception is that renewable energy investment structures are Low, with 541 respondents (54%) indicating this across all four countries. This is followed by Very Low 220 or 22% and Abundant 102 or 10%, showing a general lack of satisfaction or confidence in the current level of renewable energy investments. This suggests a strong perception of inadequate renewable energy structures and a critical gap or public disconnection from renewable energy investment structures. Table 5 illustrates the assumed environmental impacts of energy consumption among 1,000 respondents in Kenya, Ghana,

Nigeria and Benin. Deforestation had 607 or 61% responses as the most widely acknowledged impact, largely attributed to the heavy use of firewood and charcoal across the region. Noise pollution had 189 or 19%, especially from generators, air pollution had 142 or 14% from indoor fuel use like kerosene and biomass, Greenhouse gas emissions had 51 or 5%, and spillage 12 or 1%. This suggests limited public understanding of long-term consequences.

4. Discussion

Public understanding of renewable energy is critically low in Sub-Saharan Africa. The Implications are that radio is essential for outreach, while the high level of word of mouth (16%) shows the role of local leaders, friends, and community discussions. Energy awareness campaigns should have community involvement strategies. With only 5% reach, print media is no longer an effective mass tool for energy communication. It should be reserved for niche audiences, such as academics or in the professional world.

Table 4 and Bar chart 4 represent the hindrances of renewable energy adoption in Kenya, Ghana, Nigeria, and Benin. Each bar indicates how many people identified each factor and what percent (%) of the entire sample has identified each factor. Out of 1000 persons, 543 or 54%, being over half of the respondents, said lack

of awareness. This makes public education campaigns, and community sensitizes the urgent need of the hour. The concern about regulation from 222 or 22% of persons indicates the need for governments to simplify licensing, offer incentives, and support private sector involvement in renewable energy. Cost attracted 209 or 21% persons, while the least cited barrier of infrastructure at 26 or 3% bordering on storage, grids, or supply chains. The table shows the public's assessment of renewable energy investment structures in four African countries (Kenya, Ghana, Nigeria, and Benin). The assessments are categorized as Very Abundant, Abundant, Low, Very Low, and None, with corresponding study findings.

5. Conclusion

Energy economies represent a critical domain in understanding global economic structures, environmental outcomes, and developmental strategies. The interplay between energy availability, economic growth, and sustainable development continues to define national policy choices and international cooperation frameworks. A resilient energy economy balances efficiency, equity, and ecological integrity, adapting to emerging technological and environmental realities. The challenges facing energy economies in sub-Saharan Africa are multifaceted and interconnected. Infrastructure deficits, financial constraints, policy and regulatory inefficiencies, and environmental concerns all contribute to the region's energy access gap and hinder economic development. Addressing these challenges requires a coordinated approach that involves governments, the private sector, and international organizations. Investments in infrastructure, improvements in policy and regulatory frameworks, and the promotion of renewable energy are essential for unlocking sub-Saharan Africa's energy potential and driving sustainable development. The greatest obstacle to renewable energy use in Sub-Saharan Africa is the lack of public awareness, followed by regulatory hurdles and cost issues. Unawareness is a silent but formidable barrier to the widespread adoption of renewable energy in Sub-Saharan Africa. Beyond technical and financial constraints, the lack of understanding and exposure significantly slows the energy transition. Energy education, targeted communication, and grassroots outreach are critical to overcoming this barrier and ensuring that sub-Saharan Africa leverages its vast renewable potential for sustainable development. Consequently, governments, NGOs, and energy firms are expected to prioritize education and policy reform to overcome barriers and promote widespread adoption. Radio remains the most common and trusted source of information about energy types and availability in Sub-Saharan Africa, followed by television and interpersonal communication. For energy education to be effective, multichannel approaches, especially radio, community engagement, and mobile messaging, are essential. The dominance of radio and word-of-mouth communication means energy outreach in Sub-Saharan Africa must be grounded in local language, trust networks, and low-cost media. Blending traditional media with digital expansion can offer the chance of scaling public awareness on energy availability and sustainability. This analysis reveals a critical perception gap in the landscape of renewable energy investments in West and East Africa. While expectant signs exist in Ghana and Kenya, the overwhelmingly negative assessment in Nigeria and Benin calls for urgent policy and infrastructural redress.

6. Recommendations

Governments, NGOs, and energy companies need to focus on education, access to money, and policy change to overcome these barriers and support large-scale adoption. Renewable energy businesses can, together with governments, participate in awareness-raising in their market expansion efforts. Efforts are needed for promoting waste-to-energy innovations, especially in agricultural regions. Regional stakeholders would have to focus on inclusive and visible renewable energy initiatives that can address the expectations of the public and support long-term sustainability

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