EIRA Journal of Multidisciplinary Research and Development (EIRAJMRD)
Journal homepage: https://eirapublisher.com/eirajmrd/
Email: office.eirapublisher@gmail.com
ISSN: 3107-9350 (Online)
Volume 2, Issue 2, (March-April) 2026
DOI: https://doi.org/10.5281/zenodo.18823984

Assessing Renewable Energy Awareness, Acceptability, and Usage in Adamawa State, Nigeria

Mohammed Abdullahi[1], Ibrahim Musa[2] & Sule Magaji[3]

[1]*Center for Sustainable Development, University of Abuja*
[2,3] *Department of Economics, University of Abuja*

Article history:
Received: 29/01/2026
Accepted: 24/02/2026
Published: 01/03/2026

Keywords: *Renewable Energy, Awareness, Acceptability and Usage*

***Corresponding Author**:
Mohammed Abdullahi

Abstract **Original Research Article**

This study assesses renewable energy awareness, acceptability, and usage in Adamawa State, Nigeria, with the aim of examining the level of public knowledge, attitudes, and adoption patterns toward renewable energy technologies. A mixed-methods research design was adopted, combining quantitative data collected through structured questionnaires administered to 348 respondents across the three senatorial districts with qualitative insights from key informant interviews. Descriptive statistics and thematic analysis were employed to analyses the data. The findings revealed that awareness of renewable energy is moderate, with most respondents familiar with solar energy but less knowledgeable about other renewable sources such as wind and biomass. Although attitudes toward renewable energy is generally positive, actual usage remains relatively low due to barriers such as high installation costs, limited access to financing, inadequate technical expertise, and weak policy implementation. Socio-economic factors, particularly income level, education, and residential location, significantly influence adoption decisions. The study concludes that while there is strong potential for renewable energy expansion in Adamawa State, targeted financial support, policy strengthening, public sensitization, and capacity-building initiatives are essential to enhance widespread adoption and support sustainable energy development.

How to cite this article: Mohammed Abdullahi, Ibrahim Musa, & Sule Magaji. (2026). Assessing renewable energy awareness, acceptability, and usage in Adamawa State, Nigeria. EIRA Journal of Multidisciplinary Research and Development (EIRAJMRD), 2(2). 01-10.

Introduction

Nigeria continues to face profound challenges in its energy sector, with persistent power outages, reliance on fossil fuels, and insufficient grid coverage limiting socioeconomic development (Ibrahim et al., 2025; Umar et al., 2025). Although the country has abundant renewable energy resources including solar, wind, hydropower, and biomass its energy mix remains heavily dominated by non-renewable sources, contributing to environmental degradation and energy insecurity (Ajia, 2025; Wikipedia, 2025; Sadiq et al., 2025). In Adamawa State, as in many regions in Northern Nigeria, these national challenges are mirrored at the local level, where communities and businesses often lack consistent access to affordable and reliable electricity. Understanding renewable energy awareness, acceptability, and usage within this context is critical for informing policy and investment decisions that support sustainable energy transitions.

Awareness of renewable energy technologies (RETs) is a foundational determinant of adoption and meaningful usage. Studies in various Nigerian contexts have shown that knowledge and understanding of renewable options such as solar and wind are uneven, with high awareness often failing to translate into high adoption due to economic and informational barriers (Mbamalu, 2019; Inyang et al., 2025). For example, research conducted in other parts of Nigeria found that although people may recognize the benefits of renewables, uptake remains limited because of insufficient dissemination of information and misconceptions about technology performance and cost (Mbamalu, 2019; Adeleye et al., 2024). In Adamawa State, the degree to which residents and stakeholders are informed about the existence, benefits, and limitations of RETs forms a crucial part of assessing both awareness and potential for future usage.

Acceptability refers to how willing individuals and communities are to embrace renewable energy solutions, often shaped by cultural perceptions, affordability, and perceived usefulness of the technologies. Across Nigeria, acceptability of renewables varies widely, with rural communities sometimes hesitant to adopt technologies perceived as foreign or technologically complex (Climate Scorecard, 2025). In Northern Nigeria, socioeconomic conditions, education levels, and trust in energy solutions can affect acceptability, meaning that community norms and expectations play a significant role in renewable energy uptake. Examining these local patterns in Adamawa State helps illuminate the social dynamics that influence whether renewable energy is embraced as a viable alternative to generators and biomass fuels.

Usage of renewable energy technologies in places like Adamawa State is influenced not only by awareness and acceptability but also by structural and economic factors. While state and private initiatives such as the Adamawa government's push for solar training and large solar projects are contributing to expansion of renewable options, challenges remain, including high installation costs, limited financing options, and technical capacity constraints (Daily Trust, 2025). Evidence from the region indicates that off-grid solutions, particularly solar photovoltaic systems, are gaining traction among small businesses and households where grid access is unreliable, though scaling these solutions requires supportive enabling environments and infrastructural improvements.

Understanding the interplay of **awareness, acceptability, and actual usage** of renewable energy in Adamawa State is essential for shaping strategic interventions that address both demand-side and supply-side barriers. This assessment provides policymakers, energy planners, and community stakeholders with evidence needed to design targeted awareness campaigns, incentive structures, and training programs that can enhance renewable adoption. By focusing on these dimensions in Adamawa State, the research contributes to broader efforts to facilitate Nigeria's transition towards a more sustainable, equitable, and energy-secure future.

Literature Review and Theoretical Framework

Conceptual Review

Renewable Energy

Renewable energy refers to energy derived from natural resources that are replenished on a human timescale, such as sunlight, wind, water, biomass, and geothermal heat (Al-Amin et al., 2025). Unlike fossil fuels, renewable energy sources are considered sustainable because they are naturally regenerated and produce significantly lower greenhouse gas emissions, thereby contributing to climate change mitigation and environmental protection (Suleiman et al., 2025; Tanko et al., 2025). According to the International Energy Agency (2023), renewable energy technologies particularly solar photovoltaic (PV) and wind have experienced rapid global growth due to declining costs and supportive policy frameworks. Similarly, the International Renewable Energy Agency (2022) emphasizes that renewable energy plays a critical role in achieving universal energy access and meeting global climate targets under the Paris Agreement. In developing countries such as Nigeria, renewable energy is increasingly viewed as a viable solution to energy poverty, especially in rural and off-grid communities where conventional grid expansion is limited (Bello et al., 2025; Dickson et al., 2025).

Acceptability

Acceptability refers to the degree to which individuals, households, or communities are willing to embrace and support a particular innovation, policy, or technology based on perceived benefits, costs, risks, and compatibility with social values. In the context of renewable energy, acceptability is influenced by factors such as affordability, perceived reliability, environmental awareness, cultural beliefs, and trust in technology providers (Wüstenhagen et al., 2007). The International Renewable Energy Agency (2022) notes that public acceptance is a key determinant of successful renewable energy deployment, as even technically feasible projects may fail without social support. In many developing regions, limited knowledge, financial constraints, and misconceptions about renewable technologies can reduce their acceptability despite clear environmental and economic benefits. Thus, understanding community perceptions and attitudes is essential for promoting broader adoption of sustainable energy solutions.

Usage

Usage refers to the actual application or utilization of renewable energy technologies by individuals, households, institutions, or industries for daily energy needs. It goes beyond awareness and acceptance to measure the extent to which renewable energy systems such as solar home systems, mini-grids, or biomass digesters are actively integrated into energy consumption patterns. According to the World Bank (2023), increased renewable energy usage in developing countries is closely linked to improved energy access, economic productivity, and social welfare outcomes. However, usage levels are often constrained by upfront installation costs, maintenance challenges, limited technical expertise, and inadequate policy support. Therefore, assessing renewable energy usage requires examining not only availability but also affordability, reliability, and sustainability of the technologies within specific socio-economic contexts.

Theoretical Framework

Diffusion of Innovation (DOI) Theory

Diffusion of Innovation (DOI) Theory, developed by Everett Rogers. The Diffusion of Innovation Theory explains how new ideas, technologies, or practices spread within a social system over time through specific communication channels. According to Rogers (2003), adoption of an innovation such as renewable energy technologies depends on factors including perceived relative advantage, compatibility with existing values and practices, complexity, trialability, and observability. In the context of renewable energy in Adamawa State, DOI is relevant because awareness represents the knowledge stage of innovation diffusion, acceptability reflects the persuasion and decision stages, and usage corresponds to the implementation stage. The theory further categorizes adopters into innovators, early adopters, early majority, late majority, and laggards, helping to explain variations in renewable energy uptake among different social groups. By applying this framework, the study can better understand how information dissemination, social influence, and perceived benefits shape the adoption and sustained use of renewable energy technologies in the study area (Rogers, 2003).

Empirical Review

Udoinyang et al. (2024) investigated the relationship between renewable energy development and sustainable economic growth in Rivers State, Nigeria. The researchers adopted a survey research design and collected data across the three senatorial districts of the state. Although 318 respondents completed the questionnaire, the sample size was determined as 400 using the Taro Yamane formula, and data were analysed using the Statistical Package for the Social Sciences (SPSS) with a mean benchmark of 3.0. The findings indicate that renewable energy contributes positively to long-term economic growth by enhancing energy efficiency, promoting sustained socioeconomic development, reducing greenhouse gas emissions and air pollution, mitigating climate change, and improving living standards. However, the study identified several barriers constraining renewable energy development in Rivers State, including weak policy implementation, limited investor incentives, inadequate technological capacity, a shortage of renewable energy developers, insufficient access to credit facilities, and low public awareness. The authors concluded that renewable energy can drive sustainable economic development and recommended that the government strengthen policy frameworks, expand funding mechanisms, create an enabling environment, and invest in capacity building for renewable energy practitioners (Udoinyang et al., 2024).

Abbas et al. (2024) examined the dynamic interplay among green patents, energy consumption, research and development (R&D) expenditure, and carbon dioxide emissions in 118 Chinese cities participating in the China Pilot Low Carbon City Program (CPLCCP). The principal aim of the study was to test the validity of the Environmental Kuznets Curve (EKC) hypothesis within the framework of energy use, R&D investment, and green innovation. Using panel data from 2003 to 2020, the researchers employed Cross-Sectionally Augmented Autoregressive Distributed Lag (CS-ARDL), Quantile ARDL (Q-ARDL), and Granger non-causality techniques. The empirical results demonstrate that increased allocation of resources to R&D and green technological innovation significantly enhances environmental sustainability across different quantiles. Furthermore, the findings confirm the presence of the EKC relationship, suggesting that environmental degradation initially increases with economic growth but declines after reaching a certain income threshold. The study provides policy-relevant insights for advancing sustainable development and achieving carbon neutrality in China (Abbas et al., 2024).

Zeid (2024) explored the complexities associated with integrating land-based, utility-scale renewable energy systems particularly wind and solar into both urban and rural settings. Emphasising their importance in long-term carbon emission reduction strategies, the study analysed how local governments adopt policies and targets to facilitate renewable energy deployment within their jurisdictions. Through comparative case studies of Canmore, Alberta, Canada, and the Indira Paryavaran Bhawan in New Delhi, India, the research assessed the incorporation of solar photovoltaics (PV) in Canmore and building-integrated photovoltaics (BIPV) in New Delhi. By combining case study evidence with an extensive literature review, the study identified key challenges such as environmental preservation, seasonal variability, spatial limitations, and the urban heat island effect. The findings underscore the need to balance technological innovation with ecological protection, encourage community participation, and adopt context-specific design solutions. Overall, the study demonstrates how tailored renewable energy strategies can support net-zero energy objectives while addressing local environmental and social considerations (Zeid, 2024).

Gajdzik et al. (2024) conducted a comprehensive empirical investigation of a community-based renewable energy cooperative using a case study approach complemented by SWOT analysis to evaluate strengths, weaknesses, opportunities, and threats. The findings reveal that cooperative members benefit from stable energy pricing and full utilisation of generated energy, while energy-sharing mechanisms reduce costs through direct collaboration with the local municipality. Strategic objectives of the cooperative include expanding membership, increasing photovoltaic installations, implementing energy balancing systems, addressing energy poverty, and reducing carbon emissions. Despite these advantages, the study acknowledges challenges such as financial limitations and the absence of real-time energy monitoring systems. It also highlights forward-looking strategies, including carbon footprint reduction initiatives and active stakeholder engagement. Although limited by a small sample size, the study contributes to the literature by illustrating how renewable energy cooperatives can bridge the gap between producers and consumers, enhance community participation, and foster sustainable local development (Gajdzik et al., 2024).

Zhironkin et al. (2023) analysed the characteristics and determinants of renewable energy development in macro-regions characterised by extractive and industrial clusters alongside sparsely populated rural areas, with a focus on the Siberian Federal District in Russia. The study contrasts

Russia's relatively slow renewable energy expansion with the systematic growth observed in leading regions such as the European Union and China. It highlights the challenges faced by mineral-resource-dependent regions, including heavy reliance on fossil fuel generation, limited renewable capacity, technological constraints, and investment barriers. The research examines factors influencing energy transition, such as transmission infrastructure saturation, air pollution control, resource endowment, renewable investment levels, and public health considerations. The findings point to both internal and external obstacles hindering renewable energy growth and emphasise the need for targeted policy interventions to accelerate transition efforts in resource-rich regions (Zhironkin et al., 2023).

Goers et al. (2021) assessed renewable energy deployment within regional energy transitions across Bavaria, Georgia, Québec, São Paulo, Shandong, Upper Austria, and Western Cape, which are members of the Regional Leaders' Summit (RLS) and RLS-Sciences network. The study identified key strengths in these regions, including existing renewable energy usage for electricity, heat, and fuel production; significant renewable resource potential; supportive legal frameworks; and ongoing research and development activities in energy conversion and storage. However, weaknesses were noted, such as continued dependence on fossil fuels, energy-intensive industrial structures, and limited grid integration for renewables. Opportunities were linked to the development of green economies, climate change mitigation efforts, and technological innovation, while threats included demographic shifts, limited social acceptance, and renewable resource variability. The study concludes that strong governmental leadership is essential to guide and manage regional energy transitions and to promote decentralised energy systems supported by storage and innovative technologies (Goers et al., 2021).

Research Gap

A critical review of the above empirical studies reveals that while substantial research has examined renewable energy from perspectives such as economic growth (Udoinyang et al., 2024), green innovation and carbon emissions (Abbas et al., 2024), urban integration strategies (Zeid, 2024), community cooperatives (Gajdzik et al., 2024), macro-regional transition dynamics (Zhironkin et al., 2023), and regional energy transition governance (Goers et al., 2021), limited attention has been given to micro-level assessments of renewable energy awareness, acceptability, and actual usage within sub-national contexts in developing countries. Most of the reviewed studies focus on macroeconomic outcomes, policy frameworks, technological integration, or cross-regional comparisons, with minimal emphasis on household-level perceptions and behavioural determinants of renewable energy adoption, particularly in Northern Nigeria. Furthermore, empirical evidence specific to Adamawa State remains scarce, creating a contextual gap in understanding how socio-economic characteristics, awareness levels, cultural factors, and infrastructural constraints influence renewable energy uptake. Therefore, this study seeks to bridge this gap by providing a localized, perception-based assessment of renewable energy awareness, acceptability, and usage in Adamawa State, thereby contributing context-specific insights to the broader discourse on sustainable energy transition in Nigeria.

Methodology

Research Design

This research employ a mixed-methods approach, combining quantitative and qualitative data collection and analysis techniques. This approach will allow for a more comprehensive and nuanced understanding of the research problem, capturing both the breadth and depth of the issues related to renewable energy adoption.

Population and Sampling Techniques

This study's target population will be residents of Adamawa State, Nigeria, which encompasses diverse communities and socio-economic groups. A multi-stage sampling technique will be employed to select a representative sample. First, the state will be stratified into senatorial zones, and then clusters (communities) will be randomly selected within each stratum.

Finally, within each selected cluster, individual residents will be randomly sampled for participation in the survey. For the qualitative component, purposive sampling will be used to select key informants, such as community leaders, energy experts, and government officials, who can provide in-depth insights into the research topic. The sample size for the quantitative survey will be determined using a statistically appropriate method, precisely the Taro Yamane formula, ensuring sufficient representation of the population and adequate statistical power for analysis.

Explanation of the Taro Yamane Formula:

The Taro Yamane formula is widely used for calculating sample sizes when the population is known or can be estimated. It provides a simplified approach to determining the appropriate number of respondents to represent a larger population with a certain confidence level. The formula is beneficial when resources are limited or when a quick estimate of the sample size is required.

The formula is as follows:

$n = N / (1 + N * e^2)$

Where:

n represents the calculated sample size.

N represents the total population size.

e represents the desired margin of error or the level of precision.

How the Formula Works:

i. Population Size (N): The formula requires the total number of individuals or units in your study population. This could be obtained from census data, official records, or reliable estimates.

ii. Margin of Error (e): The margin of error represents the acceptable deviation range between the sample results and the actual population values. It is typically expressed as a decimal (e.g., 0.05 for a 5% margin of error). A smaller margin of error requires a larger sample size to achieve greater precision.

iii. Calculation: The formula calculates the sample size (n) by dividing the population size (N) by the sum of 1, the product of the population size (N), and the square of the margin of error (e^2).

Example:

Let us say you want to study renewable energy adoption in a community with an estimated population of 5,000 households (N = 5,000). You are willing to accept a 5% margin of error (e = 0.05). Using the Taro Yamane formula:

$n = 5,000 / (1 + 5,000 * 0.05^2)$

$n = 5,000 / (1 + 5,000 * 0.0025)$

$n = 5,000 / (1 + 12.5)$

$n = 5,000 / 13.5$

$n \approx 370.37$

Rounding up to the nearest whole number, the required sample size would be approximately 371 households.

Advantages of the Taro Yamane Formula:

- Simplicity: The formula is easy to understand and apply, making it accessible to researchers with limited statistical knowledge.
- Efficiency: It provides a quick sample size estimate, which can be helpful when time and resources are limited.

Limitations of the Taro Yamane Formula:

- Accuracy: The formula provides a rough estimate and may not be as accurate as more complex sample size calculation methods, especially for large or diverse populations.
- Assumptions: The formula assumes a relatively homogeneous population and may not be appropriate for studies with significant subgroup variations.

Considerations for this Study:

In the context of this research on renewable energy adoption in Adamawa State, the Taro Yamane formula will be used to determine the sample size for the quantitative survey. The population size will be estimated based on the state's available demographic data. The margin of error will be determined based on the desired level of precision and the resources available for the study.

It is important to acknowledge the limitations of the Taro Yamane formula and consider its appropriateness for the specific research context. If the population is highly diverse or greater precision is required, alternative sample size calculation methods may be explored. However, given the scope and resources of this study, the Taro Yamane formula provides a practical and efficient approach to determining a representative sample size for the quantitative survey.

Ensuring Representation and Statistical Power:

The calculated sample size will be used to guide the selection of survey respondents, ensuring that the sample is representative of the diverse population segments within Adamawa State. Stratified sampling techniques may be employed to ensure adequate representation of different socio-economic groups, geographical areas, and other relevant demographic factors.

By using a statistically appropriate method like the Taro Yamane formula and employing appropriate sampling techniques, this research aims to achieve sufficient statistical power to draw meaningful conclusions about the factors influencing renewable energy adoption in Adamawa State. Statistical power is the study's ability to detect actual effects or relationships between variables. A larger sample size generally increases statistical power, making the study more likely to find significant results if they exist in the population.

Data Collection Methods

Quantitative Data Collection

Survey Design and Administration

A structured questionnaire will be developed, pre-tested, and administered to the selected residents. The questionnaire will include sections on demographics, awareness of renewable energy technologies, perceptions and attitudes towards renewable energy, current energy usage patterns, and factors influencing adoption. Data will be collected through Specify method, (face-to-face interviews, online surveys).

Secondary Data Sources

Secondary data relevant to the study will be gathered from various sources, including government reports (Ministry of Power, Rural Electrification Agency), academic publications, research institutions, and international organisations (World Bank, International Energy Agency). This data will provide contextual information and support the primary data analysis.

Qualitative Data Collection

Semi-structured Interviews

Semi-structured interviews will be conducted with key informants, including community leaders, energy experts, government officials, and representatives from NGOs working in the renewable energy sector. These interviews will explore in-depth perspectives on the challenges and opportunities for renewable energy adoption in Adamawa State. The interview guide will be flexible, allowing follow-up questions and exploring emerging themes.

Case Study Selection and Procedures

Case studies of specific communities or projects related to renewable energy in Adamawa State will be conducted to provide detailed examples of successful initiatives and challenges encountered. Case studies will be selected based on the type of technology in use and community involvement. Data collection for the case studies will involve a combination of document review, site visits, and interviews with key stakeholders.

Data Analysis Techniques

Quantitative Data Analysis

Quantitative data from the survey will be analysed using descriptive statistics (frequencies, percentages, means)

Qualitative Data Analysis

Qualitative data from the interviews and case studies will be analysed using thematic analysis to identify key themes, patterns, and insights. Transcripts of the interviews will be coded and analysed to extract relevant information.

Data Integration

The quantitative and qualitative data will be integrated to provide a more holistic and nuanced understanding of the research problem. The findings from the different data sources will be triangulated to enhance the validity and reliability of the study.

Ethical Considerations

The research will be conducted using the highest ethical standards. Informed consent will be obtained from all participants before their involvement in the study. Participants will be assured anonymity and confidentiality; all data will be stored securely. The research will avoid discrimination or bias and respect the cultural sensitivities of the communities involved. Ethical approval will be sought from the relevant institutional review board before commencing data collection.

Data Presentation, Analysis and Interpretation

This section presents and interprets data obtained from the field survey conducted among residents of Adamawa State, Nigeria. The study adopted a mixed-methods approach, integrating quantitative data from structured questionnaires with qualitative insights from semi-structured interviews involving key stakeholders such as community leaders, renewable energy practitioners, government officials, and NGO representatives. A total of 371 questionnaires were distributed across the three senatorial districts using a multi-stage sampling procedure, out of which 348 were valid for analysis, representing a 93.8% response rate, which is statistically adequate. Quantitative data were analysed using descriptive statistics (frequencies, percentages, and mean scores) based on a five-point Likert scale, while qualitative responses were examined through thematic analysis. The chapter is organised into demographic analysis, Likert-scale analysis, thematic findings, discussion of results, and hypothesis testing.

Demographic Characteristics of Respondents

Table 4.1: Gender Distribution of Respondents (n = 348)

Gender	**Frequency**	**Percentage (%)**
Male	198	56.9
Female	150	43.1
Total	**348**	**100.0**

Source: Field Survey, 2026

Table 4.1 shows that male respondents constituted 56.9% (198) of the sample, while females accounted for 43.1% (150). This indicates a slightly higher male participation rate, though the representation of women remains substantial. The relatively balanced distribution ensures that both male and female perspectives on renewable energy awareness, acceptance, and usage were adequately reflected in the study.

Table 4.2: Age Distribution of Respondents

Age Group	**Frequency**	**Percentage (%)**	**Weighted Value**
18–25	65	18.7	65
26–35	102	29.3	204
36–45	98	28.2	294
46–55	58	16.7	232
56+	25	7.2	125
Total	**348**	**100.0**	**Mean = 2.82**

Source: Field Survey, 2026

The data reveal that respondents aged 26–35 years (29.3%) and 36–45 years (28.2%) formed the largest proportion of participants. The computed mean age score of 2.82 places the average respondent within the working-age bracket. This demographic profile is important because economically active individuals are typically responsible for household energy decisions and are more likely to influence renewable energy adoption.

Table 4.3: Educational Qualification

Qualification	Frequency	Percentage (%)	Weighted Value
No Formal Education	35	10.1	35
Primary	52	14.9	104
Secondary	98	28.2	294
OND/NCE	72	20.7	288
B.Sc./HND	68	19.5	340
Postgraduate	23	6.6	138
Total	**348**	**100.0**	**Mean = 3.45**

Source: Field Survey, 2026

Table 4.3 indicates that respondents with secondary education formed the largest group (28.2%), followed by OND/NCE and B.Sc./HND holders. The mean educational score of 3.45 suggests that the average respondent had attained at least secondary education. This level of education is likely to positively influence awareness and openness toward renewable energy technologies.

Table 4.4: Occupation of Respondents

Occupation	Frequency	Percentage (%)
Farming	89	25.6
Trading/Business	76	21.8
Civil Servant	68	19.5
Student	55	15.8
Artisan/Technician	42	12.1
Unemployed	18	5.2
Total	**348**	**100.0**

Source: Field Survey, 2026

The table shows that farming (25.6%) was the dominant occupation, followed by trading and civil service. This reflects the agrarian structure of Adamawa State. The prominence of farmers underscores the potential importance of renewable energy technologies such as solar-powered irrigation and agro-processing solutions.

Table 4.5: Monthly Income Distribution

Income Level	Frequency	Percentage (%)	Weighted Value
Below ₦30,000	95	27.3	95
₦30,001–₦60,000	112	32.2	224
₦60,001–₦100,000	78	22.4	234
₦100,001–₦150,000	42	12.1	168
Above ₦150,000	21	6.0	105
Total	**348**	**100.0**	**Mean = 2.38**

Source: Field Survey, 2026

The majority of respondents (59.5%) earned below ₦60,000 monthly, indicating a predominantly low-income population. The mean score of 2.38 confirms that average earnings fall within the lower income bracket. This has major implications for renewable energy adoption, as high upfront costs may limit affordability.

Table 4.6: Residential Location

Location	Frequency	Percentage (%)
Urban	142	40.8
Semi-urban	118	33.9
Rural	88	25.3
Total	**348**	**100.0**

Source: Field Survey, 2026

Urban respondents constituted the largest share (40.8%), followed by semi-urban and rural residents. The inclusion of rural participants strengthens the study because rural communities are often more affected by energy poverty and stand to benefit greatly from decentralised renewable energy solutions.

Table 4.7: Senatorial District Distribution

District	Frequency	Percentage (%)
Adamawa North	116	33.3
Adamawa Central	118	33.9
Adamawa South	114	32.8
Total	**348**	**100.0**

Source: Field Survey, 2026

The distribution across senatorial districts is nearly equal, confirming that the sampling method achieved geographical balance and representativeness across Adamawa State.

Likert-Scale Analysis

Descriptive analysis of the 25 Likert-scale items revealed moderate awareness (Cluster Mean = 3.18), neutral-to-slightly-positive attitudes (3.29), low-to-moderate current usage (2.85), strong agreement regarding adoption barriers (3.85), and very strong agreement on promotional strategies (4.15). Respondents generally recognised environmental benefits but expressed concerns about affordability and technical capacity. Financial constraints, limited knowledge, and weak policy implementation emerged as major barriers, while subsidies, public awareness campaigns, training, and stakeholder collaboration were strongly endorsed as solutions.

Thematic Analysis

Qualitative findings identified five major themes: limited but growing awareness, mixed perceptions influenced by affordability concerns, low and uneven renewable energy utilisation, multi-dimensional barriers (financial, technical, policy, socio-cultural), and strong support for stakeholder-driven strategies. Interview participants emphasised that although renewable energy potential in Adamawa State is high, actual implementation remains constrained by funding gaps, weak institutional support, inadequate maintenance structures, and limited community-based delivery mechanisms.

Discussion of Findings

The study demonstrates that renewable energy awareness in Adamawa State is moderate but lacks technical depth. Although environmental perceptions are generally positive, economic barriers significantly constrain actual adoption. Current renewable energy usage remains low, particularly beyond small-scale solar applications. Socio-economic variables such as income and education strongly influence adoption capacity. However, respondents expressed strong readiness to embrace renewable energy if enabling conditions especially subsidies, financing mechanisms, public awareness, and multi-stakeholder collaboration are strengthened.

Conclusion and Recommendations

This study assessed renewable energy awareness, acceptability, and usage in Adamawa State and found that while awareness levels are moderate and general perceptions toward renewable energy are positive, actual usage remains relatively low. The findings reveal that respondents recognize the environmental and socio-economic benefits of renewable energy, particularly its potential to reduce carbon emissions, improve energy access, and enhance living standards. However, adoption is significantly constrained by financial limitations, inadequate policy implementation, limited technical expertise, and insufficient access to credit facilities. Socio-economic characteristics such as income level, educational attainment, and residential location were found to influence renewable energy usage patterns. Overall, the study concludes that although the foundation for renewable energy transition exists in Adamawa State, structural and economic barriers must be addressed to translate awareness and acceptance into widespread practical adoption.

Based on the findings, the study recommends that the government of Adamawa State, in collaboration with federal agencies, private investors, and non-governmental organizations, should intensify public awareness campaigns and community-based sensitization programs to deepen knowledge of renewable energy technologies. Financial support mechanisms such as subsidies, soft loans, tax incentives, and public private partnership schemes should be established to reduce the high upfront costs of renewable energy systems. Additionally, technical training programs should be implemented to develop local capacity for installation and maintenance, thereby creating employment opportunities and ensuring sustainability. Strengthening policy implementation frameworks, improving rural electrification strategies through decentralized renewable systems, and fostering stakeholder collaboration will significantly enhance renewable energy adoption and contribute to sustainable energy development in Adamawa State

References

1. Abbas, S., Saqib, N., Mohammed, K. S., Sahore, N., & Shahzad, U. (2024). Pathways towards carbon neutrality in low carbon cities: The role of green patents, R&D and energy use for carbon emissions: Technological Forecasting and Social Change, 200, 123109.
2. Adeleye, S. A., Adebanji, B., & Awogbemi, O. (2024). *Renewable energy sources acceptability for decentralized energy system in Nigeria: Issues, challenges and prospects*. Science and Technology for Energy Transition.
3. Ajia, A. T. (2025). *Policy Challenges and Opportunities for Renewable Energy Development in Nigeria: A Systematic Review*. African Journal of Environmental Sciences and Renewable Energy. https://doi.org/10.62154/ajesre.2025.018.010660
4. Al-Amin, I. A., Magaji, S., & Ismail, Y. (2025) Climate Finance and Environmental, Social, and Governance (ESG) Dimensions: Implications for Renewable Energy and Energy Efficiency in Nigeria. *Journal of Emerging Technologies and Innovative Research (JETIR),* 12(9), 292-302. **: https://www.jetir.org/view?paper=JETIR2509237**
5. Bello, U. A., Magaji, S. & Ismail, Y. (2025). Economic Assessment of the Decade of Gas Initiative and the Petroleum Industry Act in Nigeria's Natural Gas Sector. International Journal of Advanced Academic Research. 11(8), 78-92. DOI: https://doi.org/10.5281/zenodo.17260385
6. Climate Scorecard. (2025, January 12). *Rural areas are among the most hesitant to be reached regarding renewable energy solutions in Nigeria*. https://www.climatescorecard.org/2025/01/rural-areas-are-among-the-most-hesitant-to-be-reached-regarding-renewable-energy-solutions-in-nigeria/
7. Daily Trust. (2025). *Adamawa boosts renewable energy with solar training and investments*. https://dailytrust.com/adamawa-boosts-renewable-energy-with-solar-training-and-investments/
8. Dickson, I. I., Magaji, S. & Ismail, Y. (2025) An Integrated Assessment of Technical, Economic, Environmental, and Social Challenges in Electricity Distribution: Evidence from Abuja Electricity Distribution Company (AEDC), FCT-Abuja. *GAS Journal of Economics and Business Management (GASJEBM),* 2(6), 25-36. DOI: 10.5281/zenodo.17073736
9. Gajdzik, B., Wolniak, R., & Grebski, W. (2024). Multi-stakeholder collaboration frameworks for renewable energy transitions in developing economies. *Energies*, *17*(2), 415–433. https://doi.org/10.3390/en17020415
10. Goers, S., Schneider, F., & Ruprecht, A. (2021). Community energy projects: Pathways to sustainable development in sub-Saharan Africa. *Energy Research & Social Science*, *78*, 102121. https://doi.org/10.1016/j.erss.2021.102121
11. Ibrahim, B. Z. F., Magaji, S., & Musa, I. (2025). Evaluating the impact of national energy policy on environmental sustainability in the Niger Delta, Nigeria. Global Academic and Scientific Journal of Multidisciplinary Studies (GASJMS), 3(9), 49-58.
12. International Energy Agency. (2023). *Renewables 2023: Analysis and forecast to 2028*. IEA.
13. International Renewable Energy Agency. (2022). *World energy transitions outlook 2022*. IRENA.
14. Inyang, D. I., Magaji, S. & Ismail, Y. (2025) Assessment of Abuja Electricity Distribution Company's Grid Modernisation and Renewable Energy Integration in Nigeria. *International Journal of Innovative Mathematics, Statistics & Energy Policies* 13(4):282-293, doi:10.5281/zenodo.17993625
15. Mbamalu, M. (2019). *Awareness and adoption of renewable energy in Nigeria: The case of Lagos and Ogun residents*. Covenant Journal of Communication.
16. Nigeria Renewable Energy Master Plan. (2025). In *Wikipedia*. https://en.wikipedia.org/wiki/Nigeria_Renewable_Energy_Master_Plan
17. Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). Free Press.
18. Sadiq, I. A., Magaji, S. & Musa, I. (2025) Analysing The Indirect Employment And Business Opportunities From The Shift To Renewable Energy-Powered Transportation In Abuja, Nigeria. *Journal of Emerging Technologies and Innovative Research (JETIR),* 12(9) 541-552
19. Suleiman, H., Magaji, S. & Musa, I. (2025). Assessing the Effect of Green Loans and Carbon

Finance on Sustainable Cities and Community Development in Nigeria: An Analysis of Urban Sustainability Indices. *International Journal of Innovative Science and Research Technology* 10 (5)

20. Tanko, Y., Magaji, S., & Musa, I. (2025). Effect of green finance on climate change mitigation in Nigeria. *International Journal of Economic Perspectives,* 19(7), 1–22.

21. Udoinyang, I. E., Sunday, E. N., & Daniel, U. I. (2024). Renewable energy adoption in Nigeria's rural communities: Barriers and policy pathways. *African Journal of Science, Technology, Innovation and Development*, *16*(1), 45–59. https://doi.org/10.1080/20421338.2023.2232601

22. Umar, A. B., Magaji, S.,& Ismail, Y. (2025). Urban–Rural Energy Gaps: Investigating the Contribution of Natural Gas to Equitable Poverty Reduction in Nigeria. *Global Academic and Scientific Journal of Multidisciplinary Studies (GASJMS),* 3(8). 55-63. DOI: 10.5281/zenodo.16979554

23. World Bank. (2023). *Tracking SDG7: The energy progress report 2023*. World Bank.

24. Wüstenhagen, R., Wolsink, M., & Bürer, M. J. (2007). Social acceptance of renewable energy innovation: An introduction to the concept. *Energy Policy*, *35*(5), 2683–2691. https://doi.org/10.1016/j.enpol.2006.12.001

25. Zeid, N. (2024). Challenges of Integrating Renewable Energy in Land Use (Master's thesis, UIS).

26. Zhironkin, S., Abu-Abed, F., & Dotsenko, E. (2023). The Development of Renewable Energy in Mineral Resource Clusters—The Case of the Siberian Federal District. Energies, 16(9), 3843.