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Evaluation of the economic and financial impact of renewable energy adoption for sustainable development in Nigeria

Ibrahim Musa[1], Yakubu Merimon Zephaniah[2], Kabiru Muhammed[3]
[1] Department of Economics, University of Abuja, Nigeria
[2] Centre for Sustainable Development University of Abuja, Nigeria
[3] Department of Economics and Development, Studies Federal University, Kashere, Nigeria

Abstract
This research work which was tagged Analysis of the Economic and Financial Impact of Renewable Energy Adoption in Nigeria looks into the financial and economic impact of Nigeria's adoption of renewable energy. The study uses a variety of techniques. Both quantitative and qualitative surveys are used. In more accurate terms, we will try to include everyone in our study. We will also meet financial institutions, industry players, community leaders and policy makers through focus groups. The OLS regression technique is used for analysis of data in this study. This aims to find out how renewable energy would impact costs. These include the development of jobs and energy savings. Also, logistic regression is used to predict the potential impact of the use of renewable energy. The main findings show that there are important economic benefits for both people and businesses when using renewable energy, including jobs and cost savings. This paper pinpoints the challenges of a circular economy. Which are limits in funding, policy fragmentation, infrastructure, technology, etc. Boskey also states that there are social factors too which create awareness and people's mistrust. As mentioned in the research article, having the political support and financial capacity and sound public knowledge can promote renewable energy use. The framework consists of energy transition dynamics, sustainable development goals, innovation diffusion mechanisms and economic resilience outcomes which help conceptualise the complex interrelationship of many facets. It would be easier to harness Nigeria's massive renewable energy potential with specialized financing options, consistent and effective policy enforcement, and improved community involvement. The findings of the research will provide knowledge that will help policy makers, investors, and other stakeholders understand how investments in renewable energy will benefit Nigeria's economy, improve energy security and ensure environmental sustainability.

Keywords: Sustainable development, OLS and renewable energy

Introduction

In order to achieve sustainable growth due to the nation's duty to mitigate the impact of climate change, the world is also moving towards renewable energy (Al-Amin *et al*., 2025) [7]. In Africa, this change is vital for dealing with energy access and economic growth issues. Nigeria is a prime example, as currently over 60m Nigerians do not have access to electricity (GIZ, 2023) [17, 18]. The economy of Nigeria can benefit from renewable energy through job creation, energy security and sustainability (Oyedepo, 2012; Adeshina, 2024) [3, 4, 35, 36]. According to Magaji *et al*. (2025a) [26, 27], increasingly people are changing their energy mix to reduce GHG emissions globally and learning to utilize the energy sustainably. The shift away from fossil fuels is urgent, especially given climate change and the serious environmental impacts that arise from using fossil fuels (Ibrahim *et al*., 2025) [19]. IRENA reported that renewable energy can reduce emissions and create jobs as per global goals. (IRENA, 2021) [23, 24]. According to World Bank (2022) [46, 47], another member of the electricity issue that the continent faces is the fact that around 600 million Africans still do not have access to electricity. The continent is blessed with abundant renewable resources such as hydropower, wind, and solar which are being harnessed for economic development and energy. The African Union acknowledged the need for renewable energy to improve electricity access in Africa as part of its Agenda 2063 (African Union 2015) [5, 6].

Nigeria is Africa's biggest economy and most populous country, experiences energy challenges. Although the country has enough fossil resources for producing electricity, it faces power shortages. According to a World Bank analysis, these disruptions cause losses of $29 billion each year. Nnaji *et al*. (2010) [31, 32]. state that pollution caused by mass consumption and burning of fossil fuels and traditional biomass causes environmental and health problems. Nigeria has renewable energy potential. Nigeria is believed to have enough solar energy to generate more than three times its energy requirements (Chineke & Igwiro, 2008) [11, 12, 13]. The proposed plan incorporates the latest concepts and policies in renewable energy implementation which would ultimately enable Malaysia to execute the RES. According to a suggestion by the Energy Commission of Nigeria, renewable energy is also an energy source. Bayo Ogunlesi, a Nigerian businessman, believes that renewable energy can be cheap and open to Nigerians. He also claims that renewable energy will likely mean less gasoline will have to be imported. It would also make Nigeria more energy secure and create a lot of jobs in Nigeria. Renewable energy has the capacity, especially in low energy rural areas, to fortify and enhance the resilience of the economy in particular (Oyedepo, 2012) [35, 36]. Also, investing in renewable energy will lead innovations and strengthen the local economy (Adeshina, 2024) [3, 4]. The renewable energy potential of Nigeria is significant but hardly used. GIZ (2023) [17, 18]. reports that the country has one of the lowest

rates globally, with almost 60 million people lacking access to power most of the time. The existing grid suffers from repeated outages and inefficiencies that discourage investments in renewable energy sources (World Bank, 2021) [44, 45]. Due to lack of transmission and distribution systems, substantial energy losses are experienced and discouraging exploitation and provision of renewable energy (Nnaji *et al*., 2010) [31, 32]. Despite multiple steps taken by the government to boost renewable energy usage, the regulatory framework remains fragmented. The Renewable Energy Master Plan (REMP), which was developed to regulate the industry, was very slowly implemented as a result of many bureaucratic inefficiencies (Energy Commission of Nigeria, 2005) [15]. Anything less and they won't take interest unless they are incentivized to. An energy policy that contributes to investment uncertainty is not needed (Adeshina, 2024) [3, 4].

The growth of renewable energy projects and foreign direct investment is hindered by uncertainty due to regulation. (IRENA, 2021) [23, 24]. As per Tanko *et al* (2025) [42], funding is one of the foremost challenges to the adoption of renewable energy technologies in Nigeria. Renewable energy projects often require significant investment costs, and raising funds has proved to be a daunting task due to inadequate bank financing in the public and private sector (Oyedepo, 2012) [35, 36]. Banks are not willing to finance renewable energy because of their ignorance of the sector and their perception of risk (Chinedu *et al*., 2021) [10]. In addition, funding for renewable energy projects is hampered due to the lack of new financing options like green bonds or public private partnerships (World Bank 2022) [46, 47]. Nigeria's renewable energy technology is still in developmental stages. Despite the numerous possibilities for solar, wind and biomass energy in the country, their realization is hampered by lack of technical know-how and local manufacturing capacity (Nnaji *et al*., 2010) [31,32]. Importing technology makes it more expensive and reveals a gap in the supply chain. In addition, R&D projects focused on renewable energy solutions do not limit innovation and localised application (IRENA 2021) [23, 24]. The adoption of renewable energy in Nigeria is influenced by social and cultural factors in Nigeria. Per GIZ (2023) [17, 18], lack of public awareness of renewable energy technologies has led to low acceptance and resistance to change. Many communities are suspicious of the reliability and effectiveness of renewable options and prefer the use of traditional energy sources. Also, failure to engage the community during the process of renewable energy projects might create multiple conflicts that prevent the process from taking place. Nigeria's take on renewable energy is influenced by a number of interconnected issues.

To address these problems, the government, the economic and social sectors, and civil society must contribute to enabling renewable energy. Nigeria will capitalize on the economic and financial aspects of renewable energy through the development of infrastructure, reform and alteration of policies, financing, technology, and public acceptability. This paper discusses the financial and economic impact of Nigeria's adoption of renewable energy on sustainable development.

Literature Review

In the next section, the content presently available on the financial and economic impact of renewable energy adoption in Nigeria will be reviewed.

Review of Concepts

Renewable Energy

Many nations are replacing fossil fuels with sustainable energy to reduce the greenhouse gases produced and help the earth in fighting climate change. As per the International Renewable Energy Agency (IRENA, 2021) [23, 24]. renewable energy spatial capacity, especially solar and wind energy, is rapidly expanding. According to IRENA 2021 [23, 24], the global shift to renewable energy is expected to ensure energy security. The 2015 Paris Agreement suggests a switch to renewable energy will keep global warming well below 2 degrees Celsius. International collaboration (BloombergNEF, 2021) [9]. has led to global investments in renewable energy of $303.5 billion in 2020.

Sustainable Development

Sustainable development safeguards today's needs while ensuring future generations have their needs met. This document was produced by the Brundtland Commission in 1987 and it mentions social inclusion, economic development and environmental sustainability (Magaji *et al*., 2025b) [26, 27], due to their interlinkages. In Nigeria, using renewable energy is connected with sustainable development goals. Renewable energy can help to accelerate economic growth, create jobs, and generate a sustainable environment by diversifying the energy mix and reducing dependence on fossil fuel. The renewable energy development is included in the national plans of many nations. The UN Sustainable Development Goals (SDGs) refer to this inclusion. SDG 7: Affordable and Clean Energy and SDG 13: Climate Action are the SDGs which are being targeted.

Theoretical Framework

To underpin this study, Sustainable Development Theory is used.

Theory of Sustainable Development

Sustainable development tackles the environmental consequences of economic growth and other issues (Ologbonori *et al*., 2025) [33]. Essentially, it meets present needs without compromising those of the future generations (World Commission on Environment and Development [WCED], 1987) [48]. Economic growth, social inclusion and environmental protection affect each other. They can contribute to world stability in the longer term. As such, the goal attempts to link them (Barbier, 1987; Sachs, 2015) [8, 40]. The earlier theories of development based only on economics gave rise to sustainable development theory. Social justice and environmental constraints were ignored in traditional economic development models (Musa *et al*., 2024) [30]. which resulted in increasing inequality and ecological degradation (Redclift, 2005) [38]. So, the sustainable development approach makes a case against the notion that simply growing the economy will improve wellbeing. Rather, it requires a balance between social equity, ecological integrity, and economic efficiency (Pearce, Markandya, & Barbier, 1989) [37]. One might interpret sustainable development as the concept of systems. This shows the connection of social, economic, and ecological systems. Further, systems must cooperate for balance to be there (Meadows, Meadows, & Randers, 2004) [29]. According to Daly and Farley, we must integrate resource inputs and natural systems into national and global

economic systems. Economists argue that the systems emerge from the above factors. The idea of development as progress in both quality and quantity is underlined by its effects for better environment and enhancement of human wellbeing (Olusola *et al*., 2025) [34]. The United Nations' 2030 [30] Agenda for Sustainable Development contains 17 Sustainable Development Goals (SDGs), which call for action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity (UN, 2015). The SDGs show that sustainable development theory (Abiola *et al*., 2025) [1] is multidimensional as they address governance, environmental degradation and economic inequality simultaneously. Some critics assert that the concept of sustainable development is very seductive in theory, but in practice is largely based on a conflict between nature and development (Adams 2009) [2]. Even today, this theory's relevance is found in academic debates and policy frameworks which offers a deeper understanding of long-term ecological and human development (Le Blanc, 2015) [25].

Review of Empirical Studies

Adeshina (2024) [3, 4] conducted a quantitative analysis of the economic impact of various renewable energy projects in Nigeria. He analyzes the potential financial impact of different renewable energy projects in Nigeria. Studies reveal that wind farms and solar energy projects have cut energy costs by around 30% in some areas. In addition, they enhanced economic development by charging up the neighbourhood and invigorating small businesses. This suggests that renewable energy can empower impoverished people like them economically.

GIZ (2023) [17, 18] describes Nigeria's renewable energy projects and the challenges they are facing. Nigeria's renewable energy plans and the problems they face. The IEA states that doubt and lack of information about renewable energy technology adoption occur mainly due to the social and cultural background of the people. The best way to tackle social obstacles in renewable energy adoption is to enhance public awareness and participation in that regard.

IRENA compares the financing of renewable energy projects in Nigeria and other countries (2020). The research demonstrates how public-private partnerships and green bonds can help countries mobilise finance to fund renewable projects. A country can attract substantial financial inflows from a range of sources or channels. The study mentions that customized financing options will reduce the financial barriers to renewable energy in Nigeria.

In relation to Nigeria, the 2021 [44, 45]. World Bank report, which is an empirical study, looked at the effectiveness of the funding model using renewable energy projects data in Nigeria. Furthermore, the research showed that PPP projects are more likely to achieve financial closure than public programs. The statement also stressed the importance of enhancing the capacity of regional finance institutions to finance renewable energy. The study indicates that PPP can enhance the bankability of renewable energy projects in Nigeria.

According to Adeshina (2024) [3, 4], qualitative interviews along with a quantitative analysis on the use of policy framework for adoption of renewable energy were assessed. The study found that better facilitation of investors is likely to lead to more investment by the private sector, particularly in feed-in tariffs and tax credits. However, there were difficulties because there was no consistent policy. An experienced and favourable policy environment will attract investments in renewable sources of energy.

GIZ conducted an analysis to evaluate the social implications of renewable energy projects. This analysis consisted of several case studies and interviews with relevant experts. After the research ended, it was stated by the researchers that renewable energy projects improved the standard of living in villages. Access to reliable electricity helps small businesses and makes health and education easier. Nonetheless, it is essential to highlight the training and support provided by community members. All renewable energy projects should incorporate social impact assessment as part of their design and feasibility study.

Ojo *et al* (2021) adopted surveys and case studies as their mixed-methods approach to ascertain how technological advances encourage the adoption of renewable energy. As a result of advances in solar technology, notably increased efficiency and reduced prices, solar energy utilization is on the rise in Nigeria. Another major finding was off-grid solutions as a way of addressing energy access problems in remote areas. As per research findings, Nigeria needs money for technology investments that would make renewable energy choices more viable as well as cheaper.

The World Bank's 2021 [44, 45]. research and IRENA's 2020 [23, 24]. research described different funding sources that could support the growth of renewable energy projects in Nigeria. IRENA experts say that green bonds and public-private partnerships among innovative financing options are relevant. In that period, the World Bank said that PPPs made renewable energy projects financially viable.

In terms of renewable energy deployment, the literature on Nigeria is lacking in several aspects. Without these gaps, the interplay between financial and economic conclusions of different sources on renewable energy would not be fully appreciated. Most of the investigations into the topic use theoretical frameworks and small case studies. They neglect the big data and analysis of core economic benefits like cost-cutting, job creation and local development. Research on barriers to the adoption of renewable energy is fragmented and mostly uncoordinated. Not much research has provided a logical and systematic framework for the classification and ranking of the financial, technological, sociocultural, regulatory and infrastructural aspects. Few studies look at how these obstacles to adoption work together.

The financial systems' assessment also had substantial gaps. Although the literature suggests that there are only a few different financing models, little research exists concerning Nigeria's creative financing, such as microfinance, PPPs, and green bonds. When it comes to policy, the same is true. Many papers do not analyze the effectiveness of current renewable energy policies or the challenges of their implementation, their downstream effects, and conformity with international best practices.

There is also a lack of research into successful community engagement strategies that use local knowledge and help build trust for renewable energy. Not much research exists on innovation and technology suitability. This includes items such as energy storage, smart grids and more. Basically, debriefs on the effects, use, and more of cutting-edge technology. This is relevant to Nigerian renewable energy.

Future research must be empirical, based on a multidisciplinary approach and context-specific so as to close the gaps and support efficient decision-making by policy, financing and technology, community participation, and the strategy opted in Nigeria's renewable energy transition.

Methodology

Research Design

The study will use quantitative and qualitative methods. This would help to understand the financial and economic impacts of the adoption of renewable energy in Nigeria through quantitative and qualitative data collection.

For the quantitative part of the study, surveys and analyzing data from previous studies will be used. Examining the employment, cost and investment elements will allow for assessment of the economic benefits of renewable energy.

For qualitative data we will conduct focus group discussions of project implementers (if possible) as well as semi-structured interviews with industry analysts, policy makers, community leaders, etc. Qualitative factors will clarify issues related to policy framework efficacy, degree of community participation and adoption challenges.

The Study Population

The following people are the study's target population. The national legislators and government representatives from relevant ministries, as well as agencies that engage in energy policy and development of renewable. People who work in renewable energy are consultants, engineers and project developers. Leaders and other representatives of local communities that have adopted or are affected by renewable energy projects. Representatives of banks and financial institutions to fund renewable energy programmes

Sampling and Size Techniques

The study shall apply the stratified random sampling technique to ensure representation of different segments of the population (e.g., legislators, industry experts, community leaders). The green energy industry will divide people into different classes based on their functions in this industry. Furthermore, key informants for qualitative interviews will be selected using purposive sampling. People will be picked based on their experience and knowledge of renewable energy. sample size. In total, the quantitative survey will have a target audience of about 300 respondents. The size of the sample is thought to be adequate to yield statistical power and reliability. Simple samples will be spread out over the various layers to guarantee each one is represented. This qualitative portion will involve semi-structured interviews of twenty to thirty key informants. We will hold two or three group discussions with the community. A focus group consisting of six to ten persons would be used to facilitate discussions.

Study Area

The study will focus primarily on Nigeria especially given the country's high potential for renewable energy and project operation. The state of Niger will serve as a case study. The area's weather is a great resource for solar energy due to the sun's rays. People living in urban and rural areas of the state will begin to be selected for off-grid renewable energy solutions such as mini-grids and solar household systems for electrification. Niger State is located in the geo-political area of Nigeria. Niger is one of Nigeria's biggest and most populated States. Maharashtra has been facing serious energy problems. The state depends heavily on fossil fuels and faces regular power cuts. Furthermore, rural areas lack reliable access to electricity. Costs of fossil fuel are becoming increasingly volatile, impacting governments' budgets, the industry, and the cost of living. Cultural factors significantly influence how we adopt and use renewable energy technologies. To interact with communities and promote renewable energy, the mindsets and practices of communities must be understood.

Model Details

The econometric models to be employed in investigating the financial and economic implications of Nigeria's adoption of renewable energy sources and potential benefits are presented in this section. To examine the impact of renewable energy uptake on economic indicators, and the factors that influence renewable energy technology, models for renewable energy adoption would be built.

Model:1 Economic Impact of Renewable Energy Adoption

To assess the economic impact of renewable energy adoption, we will use a multiple linear regression model. This model will help evaluate how renewable energy adoption influences key economic indicators such as job creation, energy cost savings, and local economic development.

$$Y_i = \beta_0 + \beta_1 RE_i + \beta_2 X_i + \varepsilon_t \ldots\ldots\ldots 3.1$$

Where:

Y_i: Economic indicator (job creation, energy cost savings) for region i

RE_i: Renewable energy adoption variable (installed capacity, number of projects) for region i

X_i: Vector of control variables (GDP per capita, population, education level, infrastructure quality) for region i

β_0: Intercept

β_i: Coefficients to be estimated

ε_t: Error term

Model:2 Factors Influencing Renewable Energy Adoption

To analyse the factors influencing the adoption of renewable energy technologies, we will use a logistic regression model. This model is appropriate for binary outcomes, such as whether a community has adopted renewable energy (1) or not (0).

$$logit(P_i) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots \ldots\ldots\ldots + \beta_k X_k + \varepsilon_t \ldots\ldots\ldots\ldots 3.2$$

Where:

P_i Probability of renewable energy adoption in community i

$X_1, X_2 \ldots X_k$ Vector of independent variables (awareness level, income level, access to financing, policy support) for community (i)

β_0: Intercept

β_i: Coefficients to be estimated

ε_t: Error term

Estimation Techniques

Ordinary Least Squares (OLS) for Model 1

The multiple linear regression model will be estimated using Ordinary Least Squares (OLS) estimation techniques. OLS is suitable for estimating the parameters of the linear regression model, provided that the assumptions of linearity, independence, homoscedasticity, and normality of errors are met.

Logistic Regression for Model 2

The logistic regression model will be estimated using maximum likelihood estimation (MLE). MLE is appropriate for estimating the parameters of models with binary outcomes, as it maximises the likelihood of observing the given data under the specified model.

Diagnostic Tests

To ensure the robustness of the econometric models, several diagnostic tests will be conducted.

Model 1 (OLS)

1. **Multicollinearity:** Variance Inflation Factor (VIF) will be calculated to check for multicollinearity among independent variables.
2. **Heteroscedasticity:** Breusch-Pagan or White test will be conducted to assess the presence of heteroscedasticity in the residuals.
3. **Normality of Residuals:** The Shapiro-Wilk test or Q-Q plot will be used to check the normality of residuals.

Model 2 (Logistic Regression)

1. **Goodness of Fit:** The Hosmer-Lemeshow test will be used to assess the goodness of fit of the logistic regression model.
2. **Model Specification:** The linktest will be conducted to check for model specification errors.

Variable Description, Measurement, and Sources

In this section, we outline the key variables used in the econometric models specified earlier, including their descriptions, measurement methods, and sources of data. The variables are categorised into dependent variables, independent variables, and control variables.

Dependent Variables

1. **Model 1:** Economic Impact of Renewable Energy Adoption

- **Job Creation (Y1):** The number of jobs created as a result of renewable energy projects in a specific region.

Measurement: Total number of jobs reported by renewable energy projects (e.g., solar, wind, biomass) within the region.

Source: Project reports from renewable energy companies, government labour statistics, and industry associations.

- **Energy Cost Savings (Y2):** The reduction in energy costs for households and businesses due to the adoption of renewable energy.

Measurement: Average percentage reduction in energy bills reported by users of renewable energy systems compared to traditional energy sources.

Source: Surveys of households and businesses, utility company reports, and studies from energy research organisations.

2. **Model 2:** Factors Influencing Renewable Energy Adoption

- R**enewable Energy Adoption (P):** A binary variable indicating whether a community has adopted renewable energy technologies (1) or not (0).

Measurement: Presence of renewable energy systems (e.g., solar panels, wind turbines) in the community.

Source: Surveys conducted in communities, local government records, and project implementation reports.

Independent Variables

1. **Model 1:** Economic Impact of Renewable Energy Adoption

- **Renewable Energy Adoption Variable (RE):** The level of renewable energy adoption in the region, measured by installed capacity or number of projects.

Measurement: Total installed capacity (in megawatts) of renewable energy sources in the region.

Source: Reports from the Energy Commission of Nigeria, renewable energy project databases, and industry publications.

2. **Model 2:** Factors Influencing Renewable Energy Adoption

- **Awareness Level (X1):** The level of awareness about renewable energy technologies among community members.

Measurement: Measured on a Likert scale (1-5) based on survey responses regarding knowledge of renewable energy benefits and technologies.

Source: Surveys conducted in communities.

- **Income Level (X2):** The average income level of households in the community.

Measurement: Average monthly income reported by households in the community.

Source: National Bureau of Statistics (NBS) reports and community surveys.

- **Access to Financing (X3):** The availability of financial resources for investing in renewable energy technologies.

Measurement: Measured as a binary variable indicating whether financing options (e.g., loans, grants) are available (1) or not (0).

Source: Surveys of local financial institutions and community members.

- **Policy Support (X4):** The extent of government support for renewable energy initiatives in the community.

Measurement: Measured on a Likert scale (1-5) based on survey responses regarding perceived government support and incentives for renewable energy.

Source: Surveys conducted in communities and policy analysis reports.

Control Variables

- **GDP per Capita (C1):** The economic output per person in the region, serving as a control for overall economic development.

Measurement: Total GDP of the region divided by the population.
Source: National Bureau of Statistics (NBS) and World Bank data.

- **Population (C2):** The total population of the region, serving as a demographic control variable.

Measurement: Total number of residents in the region.
Source: National Bureau of Statistics (NBS) and local government records.

- **Education Level (C3):** The average level of education attained by individuals in the community.

Measurement: Percentage of the population with secondary education or higher.
Source: National Bureau of Statistics (NBS) and community surveys.

- **Infrastructure Quality (C4):** The quality of infrastructure in the region, which may influence renewable energy adoption.

Measurement: Measured on a Likert scale (1-5) based on survey responses regarding the condition of roads, electricity supply, and communication facilities.
Source: Surveys conducted in communities and local government assessments.

Data Analysis and Presentation

Presentation of Data

For this research, data was gathered through surveys, interviews and secondary data sources. While the statistics of the Quantitative one, qualitative one was analyzed through the theme analysis. In a quantitative survey, 300 people participated.

Table 4.1: Descriptive Statistics of Socioeconomic Variables of Respondents

Variable	Category	Frequency (n)	Percentage (%)
Age	18-24	45	15.0
	25-34	135	45.0
	35-44	75	25.0
	45-54	30	10.0
	55 and above	15	5.0
Gender	Male	180	60.0
	Female	120	40.0
Educational Level	No formal education	15	5.0
	Primary education	30	10.0
	Secondary education	75	25.0
	Tertiary education	180	60.0
Occupation	Student	30	10.0
	Employed (Public Sector)	90	30.0
	Employed (Private Sector)	120	40.0
	Self-employed	30	10.0
	Unemployed	30	10.0
Location	Urban area	210	70.0
	Suburban area	60	20.0
	Rural area	30	10.0
Household Size	1-2 members	60	20.0
	3-4 members	90	30.0
	5-6 members	90	30.0
	7 or more members	60	20.0
Monthly Household Income	Less than ₦30,000	60	20.0
	₦30,000 - ₦60,000	90	30.0
	₦61,000 - ₦100,000	75	25.0
	₦101,000 - ₦150,000	45	15.0
	More than ₦150,000	30	10.0

Source: Researcher's Computation, 2025

The descriptive statistics in Table 4.1 give a detailed description of the socioeconomic characteristics of the respondents on renewable energy in Nigeria. This section analyses and evaluates those factors, synthesized results with literature or existing studies. (Computation of Researcher, 2025)

Distribution of Age

According to the feedback, most responders (45%) were between 25 and 34 years old, showing the younger generation is more accepting of new technology such as renewable energy than any other older generation and will need less persuasion. As Oyedepo (2012) [35, 36]. affirms, the youth are generally more open to sustainability initiatives and ideas. People in the middle age group are joining in the renewable energy debate, as indicated by the huge percentage score of 25% who were aged between 35 and 44. Middle-aged people are probably richer than children.

Representation of Gender

The gender mix of the population is male, with 60% of the respondents being male. In a lot of places in Nigeria, when people talk about technology and energy, that is the assumption. Because women's voices are largely absent from the energy discourse, findings of the study may be biased.
Programs for renewable energy require more women. According to studies, when women participate in energy programs, they produce better community-based and sustainable solutions (GIZ, 2023) [17, 18].

Level of Education

The sample has a pretty good educational profile given that 60% of respondents said they completed tertiary education. People with higher levels of education tend to have more knowledge about and understand renewable energy technologies better (Adeshina, 2024) [3, 4]. Additionally, higher education makes it easier to make decisions when it comes to energy use quickly. Nevertheless, the absence of formal education among 5% of respondents highlights the importance of orientation and outreach to the less educated population about the benefits of renewable energy (World Bank, 2021) [44, 45].

Occupation

As for the type of occupations, 40% of the respondents are in the private sector while 30% are in the public sector. Because the respondents come from a range of economic backgrounds, their opinions towards renewable energy adoption may differ (IRENA, 2021) [23, 24]. I revealed that one in ten is unemployed in the renewable energy economics study. According to Oyedepo, 2012 [35, 36]. social initiatives for renewable energy can generate employment in rural areas.

Location

70% of respondents live in the urban areas, which may affect the views on the acceptance of solar energy. Urban populations are generally better informed than their rural counterparts. People prefer cities; useful lessons learned in rural areas may not be applied because we choose to learn in the developed cities. As per Nnaji *et al*. (2010) [31, 32], 10% of rural energy users believe that the energy planners should address the requirements and difficulties of the people living in these rural communities that mainly depend on traditional sources of energy.

Size of the Household

Based on who was interviewed for this data, it seems that 30% of people live in five or six-people households. This is noteworthy to identify energy usage patterns. Switching to renewable energy options will help save money and secure energy supply as bigger houses may need more energy (Adeshina, 2024) [3, 4].

Household Income Per month

Among the respondents, 30% earn between N30,000 and N60,000 per month, which mirrors the average Nigerian. Due to this level of income, households may not be able to invest in renewable technology that requires upfront capital (World Bank, 2022) [46, 47]. According to the estimates (IRENA 2020), 20% of respondents earn less than N30,000. Thus, renewable energy and financing options should be affordable enough to facilitate the switch of low-income energy consumers to renewable energy. Due to the comprehensive analysis of socioeconomic factors, knowledge of the demographic factors that will affect Nigeria will be known. A young, educated group is emerging, open to new ideas. To make it popular, the primary barriers of gender disparity, lack of awareness, and budgetary limitations must be properly addressed. To formulate a targeted plan for renewable energy, it is crucial to be acquainted with the socioeconomic characteristics of the respondents in Nigeria. Stakeholders and policymakers need to look at these things when formulating strategies for renewable energy sources so that they are affordable, accessible, and efficient for all. To make energy policy more inclusive, more research could be done to understand the blockages being faced by different groups.

Survey Responses

Table 4.2: Survey Responses to Research Questions and Objectives

Research Question/Objective	Response Category	Frequency (n)	Percentage (%)
Key Economic Benefits of Renewable Energy Adoption	Job Creation	195	65.0
	Cost Savings	120	70.0
	Increased Energy Security	180	60.0
	Local Economic Development	150	50.0
Financing Mechanisms Available for Renewable Energy Projects	Access to Loans	120	40.0
	Government Grants	90	30.0
	Community Funding	60	20.0
	No Access to Financing	30	10.0
Role of Public Perception and Community Engagement	High Awareness	90	30.0
	Moderate Awareness	120	40.0
	Low Awareness	90	30.0
	Community Engagement in Projects	150	50.0
Technological Innovations Necessary for Renewable Energy Systems	Improved Efficiency	180	60.00
	Better Energy Storage Solutions	150	50.0
	Enhanced Grid Integration	120	40.0
	More Affordable Technologies	90	30.0
Strategies for Sustainable Economic Growth	Increased Government Incentives	210	70.0
	Public Awareness Campaigns	180	60.0
	Community Engagement Initiatives	150	50.0
	Improved Financing Options	120	40.0

Source: Researcher's Computation, 2025

The above table presents the responses of the respondents regarding the use of renewable energy in Nigeria. The subsequent section will synthesise the findings with pertinent literature and connect the findings to the study questions and objectives. (Computation of the Researcher, 2025).

Economic Benefits of Renewable Energy Adoption

Survey findings indicate that a significant number of respondents, comprising 65%, believe that the job creation is a monetary advantage of renewable energy. Based on Oyedepo (2012) [35, 36], renewable energy could create "over one million jobs" in Nigeria by 2030. Savings up to 70% would mean the poor can afford green energy. Besides the cost, Nigeria's rural and poor communities have long been on the dark and cannot afford the expensive on-grid solutions (Adeshina, 2024) [3, 4]. Contemporary technologies also increasingly enable energy security (60%). We can secure energy when we diversify our energy sources and reduce our dependence on fossil fuels. Blackouts in Nigeria are costing the economy over USD 29 billion every year. As per the world bank (2021) [44, 45]. findings, the economic impact of a renewable energy policy, enhancing comfort, stability, or resilience mainly applies to rural or under-delivered locations or communities.

Financing Mechanism for Renewable Energy Projects

Responses regarding possible financing mechanisms indicate that the most known financing sources for renewable energy projects are: government grant (30%), and

loan availability (40%). Yet, the 10% of total who state they cannot obtain financing presents a substantial challenge to its adoption. The findings agree with IRENA (2020) [23, 24], which uncovered that perceived risks and high upfront costs hinder investment in renewable energy in Nigeria.

Only 20% of the surveyed stakeholders know about community-based sources for funding. To raise money for renewable energy funding, innovative financing strategies including public-private partnership (PPP) and green bonds are important (GIZ, 2023) [17, 18]. To attract investment and grow the renewable energy industry in Nigeria, it is important to tackle these funding challenges.

Community Involvement and Public Perception

Renewable energy benefits are moderately known to the public, according to this poll. As reported, 40 percent of the respondents are not so aware. In 2010, a survey showed that the public was not adequately aware of renewable energy technologies (Nnaji *et al*.). Half of the people who responded highlighted the importance of engaging the community for the project. Research shows when communities participate in decision-making processes communities are more accepting and trustful (Chineke & Igwiro, 2008) [11, 12, 13]. A study claims that a renewable energy project is more likely to succeed when the community is involved and knowledgeable. Nigerians are very cautious or sceptical against adopting renewable energy sources in favour of its conventional energy source (GIZ, 2023) [17, 18].

Innovative Tech Development Essential for Renewable Energy Systems

As per the findings, 60% of respondents mention the need to increase efficiency and that 50% believe renewable energy must have better energy storage technology. As a result, renewable energy systems are becoming more feasible and reliable due to technological advancements (Ojo *et al*. 2021). According to a 40% increase in grid integration, organizations need to make investments for enhancing their infrastructure for renewable energy technologies. Renewable energy will be more useful as it integrates into existing systems (IRENA, 2021) [23, 24].

Techniques for Long-Term Economic Development

Those surveyed believe awareness campaigns (60%) and more government incentives (70%) are likely to be the most successful ways for promoting renewable energy, finds the study. According to Adeshina 2024 [3, 4], we need clear and consistent rules to get the private sector to invest in renewable energy. Half the initiatives in the plan only aim for community participation activities. This says the best solutions are found where those involved are local. This way, renewable energy projects can be easily done and help the community.

Analysis of the survey results reveals mixed views on Nigeria's deployment of renewable energy. The economic impact is recognised. However, there are constraints related to technology, perception, social acceptance and application of the technologies.

The results of the review show the poor coordination of the public, commercial and civil society sectors. Renewable energy must be supported and suitably coordinated through stakeholders. Removing the above-mentioned obstacles and the use of this integrated system can unleash the full potential of renewable energy.

The analysis and discussions of the findings show how socioeconomic factors impact people's experience and views of renewable energy and uptake in Nigeria. This would inform stakeholders and policymakers of the renewable energy measures necessary for the sustainable development of Nigeria. Future studies must focus on the challenges and opportunities of using renewable energy for different demographic groups.

Estimation Results

This section shows the estimation results of the econometric models used to investigate the financial and economic effects of Nigeria's renewable energy adoption. Using Ordinary Least Squares (OLS) modelling (model 1), this study measures the impact of renewable energy use. It uses logistic regression (Model 2) to investigate the factors that influence the uptake of renewable energy. The OLS regression model was used to evaluate the impact of the use of renewable energy on important economic variables such as jobs created, energy cost savings and local economic development (model 1).

Ordinary Least Squares (OLS) for Model 1

The OLS regression model was utilized to evaluate the relationship between renewable energy adoption and key economic indicators such as job creation, energy cost savings, and local economic development. The model specification is as follows:

$$Y_i = \beta_0 + \beta_1 RE_i + \beta_2 X_i + \varepsilon_t \quad \text{.....3.1}$$

Where:

Y_i; Economic indicator (job creation, energy cost savings) for region i

RE_i: Renewable energy adoption variable (installed capacity, number of projects) for region i

X_i: Vector of control variables (GDP per capita, population, education level, infrastructure quality) for region i

β_0: Intercept

β_i: Coefficients to be estimated

ε_t: Error term

Table 4.3: OLS Regression Results for Model 1

Variable	Coefficient (β)	Standard Error	t-Statistic	p-value
Intercept	2.50	0.45	5.56	0.0001
RE	0.75	0,01	7.56	0.0000
GDP per Capita	0.30	0.05	6.00	0.0000
Population	-0.02	0.01	-2.00	0.0450
Education Level	0.40	0.08	5.00	0.0001
Infrastructure Quality	0.25	0.07	3.57	0.0005

Model Fit Statistics

- **R-squared:** 0.65

- **Adjusted R-squared:** 0.63
- **F-statistic:** 32.50
- **p-value (F-statistic):** 0.0000

When renewable energy is used, economic indicators increase by 0.75 ($p < 0.0001$). This means that with every extra usage of renewable energy, the economic benefit increases. According to economic indicators, high developmental levels indicate the use of renewable energy. GDP per capita has a positive correlation with economic indicators in a similar fashion. The negative coefficient of population -0.02 suggests that population growth is likely to cause a decline in per capita income probably due to depletion of resources. The model's explanatory power of 65% for the economic indicators indicates a good fit for the data.

Logistic Regression for Model 2

The logistic regression model was employed to analyze the factors influencing the adoption of renewable energy technologies. The model specification is as follows:

$$logit(P_i) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots \ldots + \beta_k X_k + \varepsilon_t \ldots\ldots\ldots 3.2$$

Where:

P_i Probability of renewable energy adoption in community i

$X_1, X_2 \ldots X_k$ Vector of independent variables (e.g., awareness level, income level, access to financing, policy support) for community \(i\)

β_0: Intercept

β_i: Coefficients to be estimated

ε_t: Error term

Table 4.4: Logistic Regression Results for Model 2

Variable	Coefficient (β)	Standard Error	t-Statistic	p-value
Intercept	-1.20	0.35	-3.43	0.0006
Awareness Level	0.85	0.20	4.25	0.0000
Income Level	0.50	0.15	3.33	0.0009
Access to Financing	1.10	0.25	4.40	0.0000
Policy Support	0.75	0.18	4.17	0.0000

Source: Researcher's Computation, 2025

Model Fit Statistics:

- **Pseudo R-squared:** 0.45
- **Likelihood Ratio Test:** 50.00

p-value (Likelihood Ratio Test): 0.0000

The results of the logistic regression indicate that level of awareness ($b = 0.85$, $p < 0.0000$) is a significant predictor on the adoption of renewable energy. As people become more aware, the chances of adoption increase. Community adoption of renewable energy technology is a matter of financial resources ($b=1.10$, $p<0.0000$). Financing of renewable energy technologies is closely corresponded with high uptake of renewable energy technologies. Support from the government and police support platforms need policy change from the government so that the performance of the system can be maximized. The model can explain 45% of the variation in the probability of adoption. In other words, it can account for the adoption of 45% of the species examined which is a significant margin.

Economic Impact of Renewable Adoption

According to the results of the logistic regression and OLS methods, using renewable energy is desirable in Nigeria. As people learn more about renewable energy technologies, new industries, and jobs will grow. These new industries and jobs will be essential for ongoing national development and lasting economic growth. In the future there must be better regulations which would make the switch easier. This paper shows the economic importance of renewable resources in Nigeria and the factors that influence the local acceptability of alternative resources using a combination of conventional and log estimating methodology. While you explain important issues, you talk about information from past or present inquiries which is real or imagined. The Economic Impact of the Adoption of Renewable Energy (OLS Results) An OLS analysis finds a 0.75% relationship between renewable energy and its effect on indeces with a p value of less than .0001. Prbs. This means that everywhere renewable energy is used, the unit, amount or site benefited receives the same uniform one unit. The research supports Oyedepo's 2012 [35, 36]. assertion that the use of renewable energy generates a wide range of jobs and economic growth in Nigeria.

Switching to renewable energy could create jobs and boost competitiveness, which is a huge advantage. As per ILO, millions of works presents globally due to renewable energy sources. According to my research, alternate power generation techniques must resolve the problems of employment. 70% of people prefer to be in a better position and will have more security. Households and businesses can save money by changing to natural power. Decrease the price of fuel to help increase Nigeria's economy overall in the long run. Switching to renewable energy will benefit your country and reduce the likelihood of power failures. It is estimated that $29 million is squandered annually. The models include relevant context-specific control variables that are parasitic infomers.

Factors Influencing Renewable Energy Adoption

The impact of the utilization of renewable sources of energy has significantly enhanced after the adoption of Economic Development with a Coefficient Positive 0.30. Economic growth makes investment in options based on renewable energy easier. results of logistic regression on adoption factors. The results of the logistic regression reveal that renewable energy has several important predictors. The two major factors are access to finances ($b = 1.10$, $p<0.0000$) and level of awareness ($b = 0.85$, $p<0.0000$). People who are well-informed about renewable energy tends to accept it more. This shows a good sign of acceptance. Public awareness is key to overcoming scepticism and resisting the refusal to accept renewable energy technologies through education (Nnaji *et al*., 2010) [31, 32]. The study states that increased awareness can improve the consumption of renewable energy products. According to the result, accessibility to financing ($b = 1.10$) is one of the key barriers for renewable energy which evidences a major impact factor. Chineke and Igwiro (2008) [11, 12, 13]. stated that most banks will hesitate to invest in renewable energy. They think the industry has different risks and they do not see it. As per findings, developing innovative financing mechanisms, such as green bonds and public-private partnerships (PPPs), will be necessary to mobilise money

and promote renewables (IRENA, 2020) [23, 24]. The policy support coefficient is 0.75 called out the importance that revenue earner activities have in assimilating renewable energy technologies. Predictable and clear policies can lead to investment by the private sector (Adeshina, 2024) [3, 4]. The study recommends the design of policies to support development of renewable energy as follow-up to the Energy Commission of Nigeria (2005) [15].

Results of Diagnostic Tests for the Econometric Moels

The estimates' results reveal a complicated relationship among renewable energy adoption, its economic benefits, and the factors affecting renewable energy adoption. The finding that there is a high positive correlation between renewable energy and economic benefit is a good encouragement that renewable energy will enhance the economy of Nigeria. To achieve this, some public awareness will also be necessary; obstacles for funding and policy support must be in place. The report stresses that the public and corporate sectors and civil society must work together to create a conducive environment for renewable energy. Renewable energy could boost economic growth and sustainable development. To make financing, laws effective and raise awareness should be done by Nigeria. A review of the results suggests that renewable energy is important to Nigeria's economic development and growth processes. The results of this study may assist policymakers and others in developing interventions to enhance the use of renewable energy. Future studies concerning the movements of renewable energy uptake focus mainly on specific possibilities or problems that apply to specific groups. Findings from the Econometric

Model Diagnostic Tests

This paper presents the results of diagnostic tests used to assess the reliability and robustness of the econometric models used in this study - the logit regression model for Model 2 and ordinary least squares (OLS) regression model for Model 1. The diagnostic tests must verify the assumptions of each model. OLS Model Diagnostic Tests (Model 1).

Multicollinearity

There was no multicollinearity among independent variables as all had VIF values less than 5. If independent variables are highly correlated, the OLS estimates may not have the desirable properties. High VIF signifies near correlation.

Heteroscedasticity

The estimated value of the Breusch-Pagan test statistic was 1.85, p = 0.175. We cannot reject the null hypohtesis of homoscedasticity. It means that the residuals all have constant variance return a p-value greater than 0.05. The residuals are normal. Test statistic: 0.95; p-value: 0.065. Conclusion: data is normal. Since the errors are normally distributed, and given that P-value tells us we cannot reject the assumption of normality.

Logistic Regression Model Diagnostic Tests (Model 2)

Goodness of Fit

The Hosmer-Lemeshow test statistic was 8.45 with a p-value of 0.397. P-value is more than 0.05. Therefore, the null hypothesis is not rejected. The model thus fits the facts.

Model Specification

This result from the linktest shows that the model is correctly specified because the p-value for the squared term is 0.210. If the squared term yields a large p-value, then there may be misspecification. However, we don't locate any proof of one. An overview of the findings from the diagnostic tests. In conclusion, the p-value for the Diagnostic Test Model Type Test Statistic. There is no evidence of multicollinearity. The model shows constant variation or homoscedasticity. The OLS model's residuals follows a normal distribution. The data is well-fitted by the model.

The LOGISTIC model is used to accurately specify the model. The diagnostic tests show that OLS and Logistic Regression models meet the assumptions necessary for unbiased estimation. Paraphrase this (30 words):

Computation of the Researcher, 2025 since homoscedasticity has been proven, no multicollinearity occurs and the OLS model's residuals are normally distributed. Hence estimates can be trusted.

The Logistic Regression model is appropriately defined and has a good fit, indicating that it captures the determinants of renewable energy adoption. The outcomes help to strengthen the findings, and this makes the study conclusions more credible.

Summary of Diagnostic Test Results

Diagnostic Test	Model Type	Test Statistic	p-value	Conclusion
Multicollinearity	OLS Model	VIF < 5	-	No multicollinearity detected
Heteroscedasticity	OLS Model	1.85	0.175	Homoscedasticity confirmed
Normality of Residuals	OLS Model	0.95	0.065	Residuals are normally distributed
Goodness of Fit	Logistic Model	8.45	0.397	Model fits the data well
Model Specification	Logistic Model	-	0.210	Model is correctly specified

Source: Researcher's Computation, 2025

The results of the diagnostic tests indicate that both the OLS and Logistic Regression models meet the necessary assumptions for valid estimation. The absence of multicollinearity, confirmation of homoscedasticity, and normality of residuals for the OLS model suggest that the estimates are reliable. Similarly, the goodness of fit and correct specification of the Logistic Regression model indicate that it effectively captures the factors influencing renewable energy adoption. These findings enhance the credibility of the results and support the conclusions drawn from the analysis.

Summary, Conclusion, and Suggestions.

Summary

The main objective of the study was to examine the financial and economic consequences of renewable energy in Nigeria. To assess important advantages and opportunities and challenges, use documentary sources and qualitative data collection, or use quantitative and

qualitative data collection. Here is a comprehensive summary of the key conclusions.

The Financial Advantages of Renewable Energy

The growth of renewable energy leads to more jobs. For example, this will see many new job openings in the field of renewable energy. A study showed that new green energies create a lot of jobs. They sure do have the power to create millions of jobs in future. Also, most of these will occur in rural areas where unemployment is high. The creation of green jobs and fostering local businesses through the manufacture, installation and maintenance of renewable energy components would assist in poverty alleviation. Solar and wind turbine energy systems help businesses and homes realize energy savings through renewable energy systems. This is especially true for remote and off-grid areas where electricity access is limited. The first economic benefit of renewable energy systems is reduced energy costs for homes and commercial buildings. Nigeria can attain energy security through increased renewable energy utilization. It is possible to produce electricity through methods other than fossil fuels. Our energy will be more secure and stable as a result. Reducing the frequent outage of power in the country, which analysts estimate is costing the Nigerian economy billions yearly.

The renewable energy sector stimulates local economic growth and creates lots of jobs. We can help businesses and improve efficiency by investing in renewable energy infrastructure. Renewable energy works can attract investment and lend support to local development, specifically in rural and remote areas.

Conclusion

Renewable energy can help enhance a sustainable economic growth in Nigeria. These steps will boost local economies, enhance energy security, create plenty of jobs and reduce energy prices. Switching to renewable energy may have challenges. If Nigeria can solve its infrastructure, financial, wrong policy, technology, sociocultural and environmental problems, it can achieve much more in renewable energy.

Nigeria needs coordinated plans and actions for success in renewable energy deployment. Representatives should: communicate support continuously and articulate objectives clearly. They need to provide the community with knowledge about the benefits of using renewable energy.

Recommendations

Make sure that the Regulatory Frameworks are streamlined and REMP is implemented, Investment from the private sector is key to scaling up renewable energy, and this can be achieved through long-term, stable policies and incentives. Among the ideas are feed-in tariffs and tax benefits, we ought to create special funding mechanisms for the Renewable Energy sector through Public-Private Partnership, microfinance, and Green Bonds, provide monetary assistance to companies to help them transition to green or renewable energy.

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