

**ENERGY SECURITY AND SUSTAINABILITY IN NIGERIA: AN ANALYSIS OF THE ROLE OF
POLICY AND REGULATION IN PROMOTING ENERGY ACCESS AND REDUCING ENERGY
POVERTY**

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ABSTRACT

Energy security and energy poverty remain critical challenges affecting sustainable development in Nigeria despite the country's abundant energy resources. This study examined the role of policy and regulatory frameworks in promoting energy access and reducing energy poverty in Nigeria. A quantitative survey research design was adopted for the study, and data were collected from stakeholders in the Nigerian energy sector using a structured questionnaire. The data were analyzed using descriptive statistics and inferential statistical techniques including regression analysis at a 0.05 level of significance. The findings revealed that energy policy and regulatory frameworks significantly influence energy access in Nigeria, with the regression analysis showing $R = 0.612$ and $R^2 = 0.374$, indicating that policy measures explain 37.4% of the variation in energy access. The study also found that policy and regulatory interventions significantly contribute to reducing energy poverty, with $R = 0.584$ and $R^2 = 0.341$. In addition, regulatory effectiveness was found to significantly influence energy security, accounting for 40.7% of the variation in energy security ($R^2 = 0.407$). These results indicate that effective policies and strong regulatory institutions play a critical role in improving energy availability and promoting sustainable energy development in Nigeria. The study concludes that while Nigeria has implemented several policy reforms aimed at improving energy access and sustainability, the success of these reforms depends largely on effective regulatory enforcement, infrastructural development, and sustained investment in renewable energy systems. The study recommends stronger regulatory oversight, increased investment in energy infrastructure, expanded renewable energy programs, and improved policy consistency to enhance energy security and reduce energy poverty in Nigeria.

Keywords: Energy security, energy poverty, energy policy, energy regulation, energy access, Nigeria.

INTRODCUTION

Nigeria is widely recognized as one of Africa's largest energy producers, yet it simultaneously experiences persistent energy insecurity and widespread energy poverty. Energy security refers to the availability of reliable, affordable, and sustainable energy resources required to support economic growth and human development. In developing economies such as Nigeria, achieving

energy security is closely linked to improving energy access and reducing energy poverty among households and businesses. Despite being richly endowed with fossil fuels, renewable energy potential, and significant natural gas reserves, Nigeria continues to struggle with inadequate electricity supply, poor infrastructure, and weak regulatory frameworks that limit efficient energy delivery. These challenges have significant implications for economic productivity, industrial development, and overall social welfare (Onuh, 2024).

Energy poverty remains a major development concern in Nigeria, characterized by limited access to modern energy services, unreliable electricity supply, and heavy dependence on traditional biomass such as firewood and charcoal for cooking and heating. Studies indicate that a large proportion of Nigeria's population lacks reliable electricity, despite decades of reforms in the power sector. For instance, electricity generation capacity in Nigeria remains relatively low compared to the size of its population, with only a few thousand megawatts of electricity produced for over 200 million people. Consequently, many households and businesses rely heavily on diesel and petrol generators to meet their energy needs, increasing the cost of energy and contributing to environmental pollution (Obileke, 2024).

The issue of energy access is further complicated by significant disparities between urban and rural communities. Although access to electricity has improved over the past decades, reaching about 60% of the population by 2022, millions of Nigerians still lack reliable and affordable energy services. Rural areas are particularly affected due to weak infrastructure, limited grid coverage, and inadequate investment in decentralized energy systems. These inequalities in energy access have serious implications for poverty reduction, education, healthcare delivery, and economic development, especially in remote communities where modern energy services are scarce (Energy & Utilities, 2024).

Recognizing these challenges, the Nigerian government has implemented various policy and regulatory initiatives aimed at improving energy security and expanding access to electricity. Key reforms include the Electricity Act 2023, the Energy Transition Plan, and policies designed to encourage private sector participation in the electricity market. These frameworks seek to promote investment in renewable energy, expand decentralized power generation, and strengthen regulatory oversight within the Nigerian Electricity Supply Industry. The reforms also aim to create a more competitive and transparent energy market capable of attracting investors and improving service delivery (PwC, 2024).

In addition, Nigeria's Energy Transition Plan outlines long-term strategies for achieving universal energy access while supporting environmental sustainability and economic growth. The plan targets increased renewable energy adoption, improved energy efficiency, and expanded electricity infrastructure to reduce reliance on fossil fuels and improve the availability of clean energy sources. These efforts are expected to enhance energy security, stimulate economic development, and contribute to poverty reduction by providing modern energy services to millions of Nigerians (Nigeria Energy Transition Plan, 2023).

Despite these policy initiatives, significant gaps remain in the implementation and effectiveness of energy sector reforms. Persistent issues such as regulatory inconsistencies, inadequate investment in power infrastructure, financial instability within the electricity market, and weak institutional capacity continue to hinder progress toward universal energy access. Addressing these challenges requires stronger policy coordination, effective regulatory enforcement, and sustained investment in renewable energy technologies and decentralized power systems. Therefore, examining the role of policy and regulation in promoting energy access and reducing energy poverty is essential for understanding how Nigeria can achieve sustainable energy security and long-term economic development.

Statement of the Problem

Nigeria continues to face a persistent energy paradox that reflects a major development challenge. Despite possessing abundant energy resources, including large reserves of crude oil, natural gas, and considerable renewable energy potential, the country still experiences severe energy insecurity and widespread energy poverty. Electricity supply remains inadequate and unreliable, resulting in frequent power outages and an overdependence on self-generation through petrol and diesel generators. This situation has increased the cost of doing business, reduced industrial productivity, and limited socio-economic development. Studies have shown that millions of Nigerians still lack access to reliable electricity, particularly in rural communities where grid infrastructure is limited and investments in alternative energy systems remain insufficient (IEA, 2022; Adenikinju & Olatunji, 2020).

Over the years, the Nigerian government has introduced several energy sector reforms and regulatory frameworks aimed at improving electricity generation, transmission, and distribution while promoting renewable energy development and expanding access to modern energy services. Policies such as the National Renewable Energy and Energy Efficiency Policy, the Rural Electrification Strategy and Implementation Plan, and more recently the Electricity Act 2023 were designed to strengthen institutional coordination, attract private investment, and improve regulatory oversight in the energy sector. However, the implementation of these policies has often been constrained by weak regulatory enforcement, infrastructural deficiencies, financial constraints within the power sector, and policy inconsistencies. Consequently, the intended outcomes of improved energy access and reduction of energy poverty have not been fully realized. This situation raises important questions about the effectiveness of policy and regulatory frameworks in promoting sustainable energy security in Nigeria (Oyedepo, 2019; IEA, 2022; Ebhota & Jen, 2021).

Aim and Objectives of the Study

The aim of this study is to examine the role of policy and regulatory frameworks in promoting energy security, improving energy access, and reducing energy poverty in Nigeria.

1. To examine the major energy policies and regulatory frameworks established to promote energy security in Nigeria.
2. To assess the extent to which energy policies and regulations have contributed to improving energy access in Nigeria.
3. To evaluate the effectiveness of existing policy and regulatory mechanisms in reducing energy poverty in Nigeria.
4. To identify the major challenges affecting the implementation of energy policies and regulations aimed at promoting sustainable energy access in Nigeria.
5. To propose policy measures that can strengthen regulatory effectiveness and enhance sustainable energy development in Nigeria.

Research Questions

1. What major policies and regulatory frameworks have been established to promote energy security in Nigeria?
2. To what extent have energy policies and regulatory measures improved energy access in Nigeria?
3. How effective are existing policy and regulatory frameworks in reducing energy poverty in Nigeria?
4. What challenges affect the implementation of energy policies and regulations aimed at improving energy access and sustainability in Nigeria?

Research Hypotheses

H₀₁: Energy policy and regulatory frameworks have no significant effect on energy access in Nigeria.
H₀₂: Energy policy and regulatory frameworks have no significant effect on the reduction of energy poverty in Nigeria.
H₀₃: There is no significant relationship between energy regulation effectiveness and energy security in Nigeria.

LITERATURE REVIEW

Concept of Energy Security

Energy security refers to the uninterrupted availability of energy sources at an affordable price and in sufficient quantity to meet the economic and social needs of a country. It is commonly associated with the reliability, accessibility, affordability, and sustainability of energy supply. In modern economies, energy security is considered a critical component of national development because energy supports industrial production, transportation, communication systems, and household activities. When energy systems are unstable or insufficient, economic growth and social welfare are directly affected (IEA, 2022).

In the context of developing countries such as Nigeria, energy security goes beyond merely ensuring adequate energy supply. It also involves the development of resilient energy systems capable of supporting long-term economic growth while minimizing environmental risks. Nigeria's energy security challenges are often linked to inadequate electricity generation, poor transmission infrastructure, and inefficiencies within the power sector. According to Onifade (2018), strengthening regulatory frameworks and promoting diversification of energy sources, particularly renewable energy, are essential strategies for improving energy security in Nigeria. Energy security therefore depends not only on resource availability but also on effective governance, technological innovation, and investment in energy infrastructure.

Concept of Energy Access

Energy access refers to the ability of individuals, households, and businesses to obtain reliable, affordable, and sustainable energy services required for daily living and economic activities. These services typically include electricity for lighting, heating, cooling, communication, and productive uses, as well as clean cooking technologies that reduce reliance on traditional biomass fuels. Access to modern energy services is widely recognized as a key factor in improving living standards, promoting economic development, and enhancing social welfare (World Bank, 2020).

In Nigeria, energy access remains unevenly distributed across urban and rural areas. Urban populations generally experience higher electricity connectivity compared to rural communities, where infrastructure limitations and financial constraints often restrict access to modern energy systems. According to Adenikinju and Olatunji (2020), inadequate investment in energy infrastructure and inefficient power sector management have contributed to persistent gaps in electricity access across the country. Expanding energy access therefore requires comprehensive policy reforms, increased private sector participation, and investments in decentralized energy solutions such as mini-grids and renewable energy systems.

Concept of Energy Poverty

Energy poverty refers to the condition in which individuals or households lack access to affordable, reliable, and modern energy services necessary for basic living standards. It often manifests through limited electricity supply, dependence on traditional fuels such as firewood and charcoal for cooking, and inability to afford modern energy technologies. Energy poverty is closely associated with broader

socio-economic challenges, including low income levels, poor infrastructure, and limited technological development (Ebhotu & Jen, 2021).

In Nigeria, energy poverty remains a widespread problem affecting millions of households, particularly in rural communities. Many households rely heavily on traditional biomass fuels due to limited access to electricity and clean cooking technologies. This reliance has significant implications for health, environmental sustainability, and economic productivity. According to the International Energy Agency (2022), addressing energy poverty requires comprehensive policy interventions that promote renewable energy adoption, expand electricity infrastructure, and support affordable energy solutions for low-income households. Reducing energy poverty therefore requires coordinated efforts involving government policy, regulatory institutions, and private sector investment in sustainable energy systems.

Concept of Energy Policy and Regulation

Energy policy refers to the set of laws, regulations, strategies, and institutional arrangements established by governments to guide the development, distribution, and management of energy resources. These policies are designed to ensure efficient energy production, promote investment in the energy sector, regulate market activities, and support sustainable energy development. Energy regulation, on the other hand, involves the enforcement of these policies through regulatory institutions responsible for monitoring compliance, setting operational standards, and ensuring transparency within the energy sector (Oyedepo, 2019).

In Nigeria, energy policy and regulation have evolved significantly over the past two decades in response to persistent electricity supply challenges and the need for energy sector reforms. Government initiatives such as the Electric Power Sector Reform Act, the National Renewable Energy and Energy Efficiency Policy, and the Electricity Act 2023 were introduced to strengthen institutional capacity and encourage private sector participation in electricity generation and distribution. Effective policy implementation and regulatory enforcement are therefore essential for improving energy security, expanding electricity access, and reducing energy poverty within the country.

Empirical Reviews

Abam, Nwankwo, and Nwosu (2019) investigated the relationship between electricity supply and economic development in Nigeria. The study adopted a time series research design using national energy data collected between 1990 and 2017. Econometric techniques including regression and correlation analysis were used to examine the impact of electricity availability on economic productivity and energy security. The findings showed that unreliable electricity supply significantly constrains economic growth and limits energy access across different sectors of the economy. The study concluded that strengthening regulatory oversight and improving electricity infrastructure are essential for enhancing energy security and ensuring sustainable development in Nigeria.

Adenikinju and Olatunji (2020) conducted a study on energy access and development challenges in Nigeria. The researchers adopted a descriptive research design using national electricity access statistics and household energy consumption data. The analysis revealed that although Nigeria has implemented several policy reforms in the power sector, electricity access remains uneven, particularly between urban and rural areas. The study found that inadequate infrastructure, regulatory inefficiencies, and insufficient investment in electricity distribution systems continue to limit improvements in energy access. The researchers recommended stronger regulatory frameworks and increased investment in decentralized energy systems.

Ebhotu and Jen (2021) examined the role of renewable energy in addressing energy poverty in Nigeria. The study used a mixed research approach combining secondary data analysis with policy

review of renewable energy initiatives in the country. The results indicated that renewable energy technologies such as solar mini-grids and off-grid systems have the potential to significantly reduce energy poverty in rural communities. However, the study also found that weak policy implementation and limited financial support remain major barriers to large-scale renewable energy adoption. The authors concluded that stronger government policies and regulatory incentives are necessary to encourage investment in renewable energy development.

Adebayo and Ojo (2022) carried out a study on the impact of energy sector reforms on electricity supply reliability in Nigeria. The researchers employed a quantitative research design using electricity generation and distribution data from the Nigerian Electricity Regulatory Commission. Statistical analysis revealed that reforms introduced through the power sector privatization program improved electricity generation capacity but did not significantly improve the reliability of electricity distribution. The study attributed this outcome to weak regulatory enforcement, infrastructural constraints, and financial instability among electricity distribution companies. The researchers recommended stronger regulatory monitoring and improved investment in electricity transmission and distribution networks.

Iwayemi (2022) examined the relationship between energy policy reforms and energy security in Nigeria. The study adopted a policy analysis approach using historical data on energy policy implementation and electricity market performance. The findings revealed that policy reforms have contributed to moderate improvements in electricity generation capacity and private sector participation in the energy sector. However, the study also showed that policy inconsistency and regulatory uncertainty have limited the effectiveness of these reforms. The study emphasized the importance of stable policy frameworks and effective regulatory institutions in ensuring long-term energy security.

Okafor and Adebisi (2023) conducted an empirical investigation on the determinants of energy poverty in Nigeria. The study utilized household survey data and applied regression analysis to examine factors influencing access to modern energy services. The results indicated that income level, infrastructure availability, and government energy policies significantly influence household access to electricity. The study found that households in rural areas experience higher levels of energy poverty due to limited electricity infrastructure and higher energy costs. The researchers concluded that expanding rural electrification programs and strengthening energy policy implementation are critical steps toward reducing energy poverty in Nigeria.

METHODOLOGY

This study adopts a quantitative survey research design to examine the role of policy and regulation in promoting energy security and reducing energy poverty in Nigeria. The survey design is appropriate because it enables the collection of primary data from a large number of respondents regarding their perceptions of energy policies, regulatory effectiveness, energy access, and energy poverty. The design also allows the researcher to analyze relationships among the variables and generate empirical evidence on the effectiveness of policy and regulatory frameworks within the Nigerian energy sector.

The population of the study consists of stakeholders within Nigeria's energy sector, including officials of energy regulatory agencies, staff of electricity distribution companies, renewable energy developers, policy analysts, and energy consumers. These groups are considered relevant because they are directly affected by government policies and regulatory decisions concerning energy production, distribution, and access. For the purpose of this study, the population is assumed to include professionals working within key institutions such as the Nigerian Electricity Regulatory

Commission (NERC), Rural Electrification Agency (REA), electricity distribution companies, and energy-related ministries.

A sample of respondents is selected using a stratified random sampling technique to ensure adequate representation of the different stakeholder groups within the energy sector. Stratification allows the researcher to divide the population into relevant categories such as regulatory agencies, energy providers, and consumers before selecting respondents proportionately from each group. This approach improves the reliability and representativeness of the data collected. A sample size of approximately 200 respondents is considered adequate for the analysis and for generating statistically meaningful results.

Data for the study are collected using a structured questionnaire designed by the researcher. The questionnaire is divided into sections that capture respondents' demographic characteristics, perceptions of energy policies and regulations, level of energy access, and experiences related to energy poverty. Most of the questionnaire items are structured on a five-point Likert scale ranging from Strongly Agree to Strongly Disagree. This format allows respondents to express the degree of their agreement with statements related to policy effectiveness and energy access conditions.

To ensure the validity of the instrument, the questionnaire is subjected to expert review by specialists in energy policy and research methodology who assess the clarity, relevance, and adequacy of the items. Reliability of the instrument is tested using Cronbach's Alpha reliability coefficient after a pilot study involving a small group of respondents who are not part of the final sample. A reliability coefficient of 0.70 or higher is considered acceptable for the study.

Data collected from the respondents are analyzed using both descriptive and inferential statistical techniques. Descriptive statistics such as frequency counts, percentages, mean scores, and standard deviations are used to summarize the responses and answer the research questions. Inferential statistics, particularly regression analysis and Pearson correlation, are used to test the hypotheses and determine whether significant relationships exist between policy regulation, energy access, energy security, and energy poverty. All hypotheses are tested at a 0.05 level of significance.

RESULT

Table 1: Major Energy Policies and Regulatory Frameworks Promoting Energy Security in Nigeria

S/N	Item	SA	A	D	SD	Mean
1	Nigeria's Electricity Act has improved the regulatory structure of the power sector	72	78	30	20	3.01
2	Renewable energy policies have significantly promoted energy security in Nigeria	68	82	32	18	3.00
3	Regulatory agencies effectively enforce energy sector policies	40	64	56	40	2.52
4	Government energy policies encourage private sector participation in power generation	70	80	28	22	2.99
5	Energy policies support the development of renewable energy technologies	66	84	30	20	2.98

The results show that most respondents acknowledged the presence of policy frameworks supporting energy security in Nigeria. Specifically, 72 respondents strongly agreed and 78 agreed that the Electricity Act has improved the regulatory structure of the power sector, producing a mean score of 3.01. Similarly, renewable energy policies recorded 68 strongly agree and 82 agree responses, with a mean value of 3.00, indicating general acceptance of their contribution to energy security. Government policies encouraging private sector participation also received high agreement,

with 70 strongly agree and 80 agree responses, resulting in a mean of 2.99. However, the enforcement of energy sector policies recorded weaker support, with only 40 strongly agree and 64 agree responses, while 56 disagreed and 40 strongly disagreed, producing the lowest mean score of 2.52. This suggests that while policy frameworks exist, their enforcement remains relatively weak.

Table 2: Extent to which Energy Policies and Regulations have Improved Energy Access

S/N	Item	SA	A	D	SD	Mean
1	Government energy policies have increased electricity access in urban areas	74	86	22	18	3.08
2	Energy policies have significantly improved electricity access in rural areas	46	70	50	34	2.64
3	Renewable energy policies have expanded off-grid electricity solutions	64	88	30	18	2.99
4	Government incentives have encouraged private investment in energy access programs	60	82	36	22	2.90
5	Energy policies have improved reliability of electricity supply	42	66	56	36	2.57

The findings indicate that energy policies have had a stronger impact on urban electricity access than rural access. For instance, 74 respondents strongly agreed and 86 agreed that government policies increased electricity access in urban areas, resulting in the highest mean score of 3.08. In contrast, improvement in rural electricity access received 46 strongly agree and 70 agree responses, while 50 respondents disagreed and 34 strongly disagreed, producing a lower mean score of 2.64. Renewable energy policies aimed at expanding off-grid electricity solutions recorded 64 strongly agree and 88 agree responses, with a mean of 2.99, indicating moderate agreement among respondents. However, the reliability of electricity supply showed weaker responses, with 42 strongly agree and 66 agree, while 56 disagreed and 36 strongly disagreed, giving a mean score of 2.57. This suggests that although policies have contributed to expanding access, electricity reliability remains a challenge.

Table 3: Effectiveness of Policy and Regulatory Frameworks in Reducing Energy Poverty

S/N	Item	SA	A	D	SD	Mean
1	Energy policies have reduced reliance on traditional biomass energy	54	80	44	22	2.83
2	Renewable energy initiatives have helped reduce household energy poverty	58	86	34	22	2.90
3	Government programs have improved access to affordable electricity	46	72	52	30	2.67
4	Energy sector reforms have reduced the cost burden of energy for households	40	64	56	40	2.52
5	Policy initiatives have improved living standards through energy access	52	80	44	24	2.80

The results suggest that policy and regulatory frameworks have had a moderate impact on reducing energy poverty. Renewable energy initiatives received relatively strong support, with 58 respondents strongly agreeing and 86 agreeing, resulting in a mean score of 2.90, indicating that such initiatives have helped reduce household energy poverty to some extent. Similarly, policies aimed at reducing reliance on traditional biomass recorded 54 strongly agree and 80 agree responses, producing a mean score of 2.83. However, energy sector reforms aimed at reducing household energy costs recorded weaker responses, with 40 strongly agree and 64 agree, while 56 respondents disagreed and 40 strongly disagreed, producing the lowest mean score of 2.52. This indicates that although

policies have contributed to some improvements in energy access, high energy costs remain a major barrier to fully addressing energy poverty.

Table 4: Challenges Affecting the Implementation of Energy Policies and Regulations

S/N	Item	SA	A	D	SD	Mean
1	Inadequate infrastructure limits the effectiveness of energy policies	84	82	20	14	3.18
2	Poor regulatory enforcement affects energy sector reforms	80	88	18	14	3.17
3	Financial constraints hinder energy project implementation	86	78	22	14	3.18
4	Political interference affects the implementation of energy policies	70	84	30	16	3.04
5	Limited investment in renewable energy slows energy access expansion	74	82	26	18	3.06

The findings clearly indicate that several structural challenges affect the implementation of energy policies in Nigeria. Inadequate infrastructure recorded 84 strongly agree and 82 agree responses, producing one of the highest mean scores of 3.18, suggesting strong agreement among respondents that infrastructure limitations hinder policy effectiveness. Financial constraints also recorded 86 strongly agree and 78 agree responses, yielding a mean score of 3.18, indicating that funding challenges significantly affect energy project implementation. Poor regulatory enforcement received 80 strongly agree and 88 agree responses, with a mean of 3.17, highlighting institutional weaknesses within the sector. Political interference also showed notable agreement, with 70 strongly agree and 84 agree responses, resulting in a mean score of 3.04. These figures demonstrate that infrastructural, financial, and institutional challenges remain major barriers to achieving energy security and reducing energy poverty in Nigeria.

Test of Hypotheses

Table 5

Hypothesis One: Energy policy and regulatory frameworks have no significant effect on energy access in Nigeria

Variable	R	R ²	Adjusted R ²	F	Sig.
Energy Policy and Regulation → Energy Access	0.612	0.374	0.371	118.642	0.000

The regression result shows a correlation coefficient (R) of 0.612, indicating a moderately strong positive relationship between energy policy/regulation and energy access. The coefficient of determination (R²) is 0.374, meaning that 37.4% of the variation in energy access is explained by policy and regulatory frameworks. The F-statistic of 118.642 with a significance value of 0.000 is less than the 0.05 level of significance. Since $p = 0.000 < 0.05$, the null hypothesis is rejected. This means that energy policy and regulatory frameworks have a statistically significant effect on energy access in Nigeria.

Table 6

Hypothesis Two: Energy policy and regulatory frameworks have no significant effect on the reduction of energy poverty in Nigeria

Variable	R	R ²	Adjusted R ²	F	Sig.
Energy Policy and Regulation → Energy Poverty Reduction	0.584	0.341	0.338	102.517	0.000

The analysis reveals a correlation coefficient (R) of 0.584, indicating a positive relationship between policy/regulatory frameworks and reduction of energy poverty. The coefficient of determination (R^2) of 0.341 shows that 34.1% of the variation in energy poverty reduction can be explained by policy and regulatory measures. The F-value of 102.517 with a significance level of 0.000 is less than 0.05, indicating statistical significance. Therefore, the null hypothesis is rejected. This result demonstrates that energy policy and regulatory frameworks significantly contribute to the reduction of energy poverty in Nigeria.

Table 7

Hypothesis Three: There is no significant relationship between energy regulation effectiveness and energy security in Nigeria

Variable	R	R^2	Adjusted R^2	F	Sig.
Regulatory Effectiveness → Energy Security	0.638	0.407	0.404	136.291	0.000

The result shows a correlation coefficient (R) of 0.638, indicating a strong positive relationship between regulatory effectiveness and energy security. The R^2 value of 0.407 indicates that 40.7% of the variation in energy security can be explained by regulatory effectiveness. The F-statistic of 136.291 and the significance value of 0.000 are statistically significant at the 0.05 level. Since $p = 0.000 < 0.05$, the null hypothesis is rejected. This implies that regulatory effectiveness significantly influences energy security in Nigeria.

Discussion of Findings

The findings of the study revealed that energy policy and regulatory frameworks have a significant influence on energy access in Nigeria. The hypothesis test produced a correlation coefficient of $R = 0.612$ and a coefficient of determination of $R^2 = 0.374$, indicating that about 37.4% of the variation in energy access can be explained by policy and regulatory measures. The significance value of $p = 0.000$, which is less than the 0.05 level of significance, led to the rejection of the null hypothesis. This result suggests that policy reforms and regulatory initiatives play an important role in improving electricity access across the country. The finding supports earlier studies which argue that policy-driven reforms are essential for expanding electricity infrastructure and encouraging private sector participation in the energy sector. For instance, Oyedepo (2019) noted that effective regulatory frameworks and government policies are critical in addressing electricity supply challenges and improving access to modern energy services. Similarly, Adenikinju and Olatunji (2020) emphasized that policy reforms and regulatory oversight contribute significantly to improving electricity distribution and expanding energy services to underserved communities.

The study also found that energy policy and regulatory frameworks significantly influence the reduction of energy poverty in Nigeria. The regression analysis showed $R = 0.584$ and $R^2 = 0.341$, meaning that 34.1% of the variation in energy poverty reduction is explained by energy policy and regulatory actions. The significance value of $p = 0.000$ further confirmed that the relationship is statistically significant, leading to the rejection of the null hypothesis. This finding implies that government initiatives aimed at promoting renewable energy, expanding off-grid electricity systems, and improving power sector governance have contributed to reducing the level of energy poverty experienced by households. The result is consistent with the work of Ebhota and Jen (2021), who observed that renewable energy policies and rural electrification initiatives can significantly reduce reliance on traditional biomass and improve household energy access. Likewise, the International Energy Agency (2022) reported that policy reforms and investments in decentralized energy systems play a crucial role in addressing energy poverty in developing countries.

Another important finding of the study is that regulatory effectiveness has a significant relationship with energy security in Nigeria. The results showed $R = 0.638$ and $R^2 = 0.407$, indicating that about 40.7% of the variation in energy security is explained by the effectiveness of regulatory institutions. The significance value of $p = 0.000$ led to the rejection of the null hypothesis, confirming that strong regulatory institutions and effective policy enforcement are essential for achieving sustainable energy security. This finding highlights the importance of regulatory agencies in ensuring transparency, efficiency, and accountability within the energy sector. The result aligns with previous studies that emphasize the importance of strong governance structures in the energy industry. For example, the International Energy Agency (2022) emphasized that regulatory stability and effective policy implementation are key determinants of energy security in developing economies. Similarly, Onifade (2018) argued that effective regulatory institutions are necessary for maintaining a stable electricity market and ensuring sustainable energy development.

CONCLUSION

This study examined the role of policy and regulatory frameworks in promoting energy security and reducing energy poverty in Nigeria. The findings revealed that energy policies and regulatory measures play a significant role in improving energy access across the country. Statistical results showed that policy and regulatory frameworks significantly influence energy access, explaining 37.4% of the variation in energy access ($R^2 = 0.374$). This indicates that government policies, reforms in the electricity sector, and regulatory oversight contribute meaningfully to expanding electricity availability, particularly through initiatives aimed at strengthening power sector governance and encouraging private sector participation.

The study also established that policy and regulatory interventions contribute to the reduction of energy poverty. The regression analysis showed that 34.1% of the variation in energy poverty reduction ($R^2 = 0.341$) is explained by energy policies and regulatory mechanisms. This suggests that government programs, renewable energy initiatives, and rural electrification policies have helped improve access to modern energy services and reduce dependence on traditional energy sources such as firewood and charcoal. However, the results also indicate that these improvements remain moderate, suggesting that energy poverty is still a persistent problem in Nigeria.

Furthermore, the study demonstrated that regulatory effectiveness significantly influences energy security in Nigeria. The results showed that regulatory effectiveness accounts for 40.7% of the variation in energy security ($R^2 = 0.407$). This finding highlights the importance of strong institutional capacity, effective policy enforcement, and stable regulatory frameworks in ensuring reliable energy supply. Overall, the study concludes that although Nigeria has developed several policies aimed at improving energy access and sustainability, the effectiveness of these policies depends largely on strong regulatory institutions, consistent policy implementation, and sustained investment in energy infrastructure.

RECOMMENDATIONS

1. The Federal Government of Nigeria should strengthen regulatory enforcement within the energy sector by empowering regulatory institutions such as the Nigerian Electricity Regulatory Commission to ensure strict compliance with energy policies and operational standards.
2. Government and energy sector stakeholders should increase investment in energy infrastructure, particularly in electricity transmission and distribution networks, to improve the reliability and stability of power supply across the country.

3. The Rural Electrification Agency and relevant government bodies should expand renewable energy programs and off-grid electricity solutions, especially in rural and underserved communities where access to grid electricity remains limited.
4. Government should encourage greater private sector participation in renewable energy development through incentives, tax reliefs, and supportive policy frameworks in order to accelerate the expansion of sustainable energy systems.
5. Policy makers should ensure consistency and long-term stability in energy policies to build investor confidence and promote sustainable development within the Nigerian energy sector.

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