Golden Sun-Rise
International Journal of Multidisciplinary on Science and Management
ISSN: 3048-5037/ Volume 2 Issue 4 Oct-Dec 2025/ Page No: 309-318
Paper Id: IJMSM-V2I4P132/ Doi:10.71141/30485037/V2I4P132

Research Article

Effect of Energy Consumption on Economic Growth: Lessons from Nigeria

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Received: 20 December 2025 Revised: 22 December 2025 Accepted: 25 December 2025 Published: 30 December 2025

Abstract - *This study investigates the effect of energy consumption on economic growth in Nigeria over the period 1990–2022 using annual time series data. The Augmented Dickey-Fuller (ADF) and Phillips-Perron unit root tests were employed to examine the stationarity properties of the variables, while the Autoregressive Distributed Lag (ARDL) model was used for estimation. Model robustness was confirmed through post-estimation diagnostic tests, including the correlogram of squared residuals, Breusch-Pagan-Godfrey heteroskedasticity test, histogram normality test, and CUSUM stability test. The ARDL estimates reveal a negative but statistically insignificant relationship between fossil fuel energy consumption (FOFEC) and Gross domestic product growth rate (GDPGR), while GDP per unit of energy use (GPUEU) exhibits a positive yet insignificant effect on GDPGR. Similarly, Renewable energy consumption (REECC) shows a positive, though statistically insignificant, impact on GDPGR. Based on these findings, the study recommends that the government should gradually reduce reliance on fossil fuels by diversifying the energy mix and investing more in greener energy alternative.*

Keywords - *Economic Growth, energy consumption, energy finance, fossil fuels, non-renewable energy, Renewable energy.*

JEL Classification: *Q43, Q47.*

I. INTRODUCTION

The oil and gas sector remains one of the most vital, complex and expansive industries in Nigeria. Its products and by-products are utilized not only within the country but also across the globe. Amongst the major energy outputs of this industry are fossil fuels, which are refined into jet fuel, diesel, gasoline, liquefied petroleum gas, natural gas and heating oil (Gbanador, 2018). Consequently, the consumption of these energy resources is expected to have a significant impact on Nigeria's economic growth giving that they constitute a major share of the nation's production. As in Odularu and Okonkwo (2009), in developing countries such as Nigeria, energy consumption has attracted considerable attention due to its strong relationship with urbanization, industrialization, and improved living standards.

Over the years, the Nigerian energy sector has largely relied on non-renewable fossil fuels, with petroleum and natural gas forming the backbone of the nation's energy supply. Nonetheless, after many decades of dependence on these exhaustible resources, the country is gradually shifting towards renewable energy alternatives. Renewable sources such as wind, solar and biomass are gaining momentum, offering sustainable and environmentally friendly options to meet the country's growing energy needs. This transition marks a notable move away from Nigeria's long-term dependence on fossil fuels (Adeshina et al., 2024; Aderinto et al, 2025). According to Xiong et al. (2014), energy resources have always been a fundamental driver of economic growth and development. Energy plays a crucial role in fostering economic development, serving as a key input in the production, distribution, and consumption of goods and services (Asghar, 2008). The financing of both fossil fuel and renewable energy projects-referred to as energy finance-has been essential to the economic advancement of developed and emerging economies alike (Rahman et al, 2024; Elie et al, 2021; Donovan, 2015). As Kareem et al.

(2016) note, energy functions as an engine of growth in every economy, whether advanced or developing. Similarly, Akinlo (2008) highlights that energy is pivotal to stimulating productive economic activities and promoting economic growth across countries. Therefore, it remains a vital input for production, transportation, and other sectors of the economy.

The efficiency and extent of energy utilization are widely viewed as key indicators of a nation's economic development. Nonetheless, Nigeria continues to experience significant challenges in providing an adequate, reliable, and sustainable energy supply, even though it is abundantly endowed with various renewable and non-renewable energy resources, including oil, natural gas, coal, hydropower, and solar energy (World Bank, 2023). Energy consumption is generally believed to influence economic growth in Nigeria. However, empirical evidence presents mixed outcomes regarding the direction of this relationship. Some studies reveal that energy consumption supports economic growth in Nigeria (Oyinlola, 2020; Ajah et al, 2024). Conversely, other studies argue that energy consumption does not necessarily drive economic growth (Aderinto et al, 2025; Egbichi et al., 2018). Moreover, most existing empirical studies in Nigeria have relied on variables that are indirect or moderating in nature, such as financial development, inflation, gross fixed capital formation, oil price, and population growth rather than focusing on core energy consumption indicators with direct relevance to economic activity. Additionally, previous findings remain inconclusive due to mixed evidence on the growth effects of renewable and non-renewable energy. This gap in the literature motivates the present study, which employs Fossil fuel energy consumption, GDP per unit of energy use and Renewable energy consumption as independent variables, with GDP growth rate (GDPGR) as the dependent variable. The objective is to examine the effect of energy consumption on economic growth in Nigeria.

II. LITERATURE REVIEW

The Solow-Swan Neo-classical Growth Model forms the theoretical framework for this study. Developed by Robert Solow and Trevor Swan in 1956, the model explains that economic growth depends on capital accumulation, technological innovation, and growth in the labour force. In this regard, the theory is suitable for this study because, energy consumption is expected to enhance economic growth via capital accumulation, technological progress and labour force expansion. Atoyebi et al. (2024) employed the Autoregressive Distributed Lag (ARDL) model to examine the effect of renewable energy sources, financial development, and economic growth in Nigeria using annual data from 1980 to 2022. The study adopted an ex-post facto research design with GDP as a proxy for economic growth, while access to electricity (AE), foreign direct investment (FDI), renewable energy consumption (REN), and domestic credit to the private sector (DCPS) served as the independent variables. The findings indicate that renewable energy sources and financial development influence economic growth only in the short run. Specifically, FDI, REN, and DCPS exert positive but insignificant effects on GDP, whereas AE has a negative but insignificant long-run impact. The study therefore recommends that government strengthen regulatory frameworks, create an enabling policy environment, and promote public awareness to promote the alignment of financial resources with renewable energy initiatives, thereby stimulating long-term growth.

Aderinto et al. (2025) investigated the relationship between financial development, energy consumption, and economic growth in Nigeria using annual data from 1990 to 2023. GDP served as the dependent variable, while renewable and non-renewable energy consumption (EN), financial development index (FNDEV), gross fixed capital formation (GFCF), inflation (INF), and population growth (POP) were used as the explanatory variables. Using the ARDL technique, the study found that financial development exerts a strong positive and significant effect on economic growth in both the short and long run. Non-renewable energy consumption positively influences growth, reflecting Nigeria's continued dependence on fossil fuels. Conversely, renewable energy consumption has a negative effect on growth, suggesting inefficiencies or high transition costs. Inflation negatively affects economic growth, whereas GFCF and population growth have no significant long-run effect. Based on the findings, the study recommend strengthening financial sector policies to support growth.

Okoye et al. (2021) examined the effect of energy utilization and financial development on economic growth in Nigeria using annual data from 1981 to 2018. GDP growth rate was used as the dependent variable, while oil price, energy utilization, private sector credit, gross fixed capital formation, and inflation served as the independent variables. Using the Dynamic Ordinary Least Squares (DOLS) technique, the study reports that electricity consumption, inflation, and financial development positively influence economic growth, while oil price and gross fixed capital formation exert negative effects. The study concludes that strong financial and energy sectors are crucial drivers of economic growth, and recommends the strengthening of supportive policies in both sectors. Egbichi et al. (2018), using a symmetrical ARDL model for the period 1986–2016, examined the effect of energy consumption on economic growth in Nigeria. Their findings show significant lag effects (lag 1 and lag 4) of GDP growth, while current electricity consumption does not significantly affect current economic performance. However, the first and third lags of electricity consumption positively enhance growth. The study also reveals that petroleum production and gas consumption both current and lagged negatively influence economic output. Kareem et al. (2016), employing the Generalized Method of Moments (GMM), investigated the relationship between energy use, financial development, and economic growth in Nigeria. Their results indicate that increased energy consumption stimulates economic growth, while financial sector expansion enhances energy demand. The study recommends the formulation of effective policies to strengthen the power sector and boost long-run growth. Belk et al. (2010) studied 25 OECD countries from 1981–2007 to examine causality among energy consumption, energy prices, and economic growth. Their findings show that energy prices significantly influence energy consumption, implying that higher energy prices may suppress economic growth. The results further reveal that economic activity drives energy prices, as increased output raises energy demand.

Oyinlola (2020) applied the ARDL technique to assess the influence of financial development on energy consumption in Nigeria from 1981 to 2018. Findings show that financial development significantly affects energy consumption in both the short and long run, suggesting that improvements in the financial sector increase energy demand. The study recommends promoting efficient energy use as financial systems deepen. Ajah et al. (2024) utilized the Vector Error Correction Model (VECM) and Granger causality tests to analyze the effect of energy consumption on economic growth in Nigeria (1990–2022). Using GDP growth rate as the dependent variable and renewable energy, non-renewable energy, labour force, and gross fixed capital formation as explanatory variables, the study finds evidence of a long-run relationship between energy consumption and economic growth. The study recommend increased government investment and budgetary allocation to the energy sector. Hamit and Korkmaz (2018) employed co-integration and ARDL techniques to analyze the relationship between renewable energy consumption and economic growth in Bulgaria using data from 1990–2016. The study finds no long-run relationship between renewable energy consumption and economic growth.

Overall, empirical findings on the effect of energy consumption on economic growth remain mixed. Several studies show that energy consumption promotes economic growth (Oyinlola, 2020; Ajah et al., 2024), while others indicate that energy consumption does not significantly support growth or may even constrain it (Aderinto et al., 2025; Egbichi et al., 2018). These inconsistencies may be attributed to differences in methodology, sample periods, energy types, and proxy variables used across studies. Most empirical studies conducted in Nigeria have relied on moderating or indirect variables such as financial development, inflation, gross fixed capital formation, oil price, and population growth rather than focusing on core energy consumption indicators with direct relevance to economic activity. Additionally, previous findings remain inconclusive due to mixed evidence on the growth effects of renewable and non-renewable energy. This study intends to bridge this gap by using direct energy indicators, namely; Fossil fuel energy consumption, GDP per unit of energy use, and Renewable energy consumption, while employing GDP growth rate (GDPGR) as the dependent variable. This approach offers a more direct assessment of how different forms and efficiencies of energy use influence economic growth in Nigeria.

III. METHODOLOGY

The study employed the ex-post facto research design to examine the effect of energy consumption on economic growth in Nigeria. Time series data (1990-2022) were sourced from the CBN Statistical Bulletin and World Bank Development Indicators. The models are formulated based on the Solow-Swan Neo-classical Growth Model (Solow & Swan, 1956). The Gross Domestic Product Growth rate was used as an indicator for economic growth while Fossil fuel energy consumption, GDP per unit of energy use and Renewable energy consumption were used as proxies for energy consumption. The study's model aligned with the model specified by previous studies with some modifications (Aderinto et al, 2025; Atoyebi et al, 2024; Hamit & Korkmaz, 2018; Egbichi et al. 2018).

A. Model Specification

The functional specification of the model is given as:
GDPGR = f (FOFEC, GPUEU, REECC) (1)

Where;
GDPGR = Gross domestic product growth rate
FOFEC = Fossil fuel energy consumption
GPUEU = GDP per unit of energy use
REECC = Renewable energy consumption (% of total consumption)

The econometric model is specified as follows:
$GDPGR = \beta_0+\beta_1 FOFEC+\beta_2 GPUEU + \beta_3 REECC + \mu_t$ (2)

GDPGR, FOFEC, GPUEU and REECC are as specified in equation (1) while;
β0 = Constant
β1, β2, β3 = Coefficients.
μt = Error term
A priori expectations
$\beta_1, \beta_2, \beta_3, > 0$

IV. RESULTS AND DATA ANALYSIS

This section presents the statistical analyses conducted and the corresponding findings. The analysis follows a systematic approach beginning with pre-estimation tests to determine the characteristics of the data before estimating the model.

A. Pre-Estimation Tests

To examine the stationarity properties of the variables, the study employed two widely used unit root tests: the Augmented Dickey–Fuller (ADF) test (Dickey & Fuller, 1979) and the Phillips–Perron (PP) test (Phillips & Perron, 1988). These tests were applied to determine the order of integration of each series. The outcomes from both the ADF and PP tests revealed that the variables are integrated of mixed orders, specifically I(0) and I(1). This mixture of stationarity levels makes the Autoregressive Distributed Lag (ARDL) modelling technique appropriate for the study. The ARDL approach, initially introduced by Pesaran and Shin (1999) and later advanced by Pesaran, Shin, and Smith (2001), is particularly suitable for handling variables with such mixed integration orders without requiring pre-testing for cointegration at the same level. Based on these results, the ARDL framework was adopted for the multiple regression analysis, and the empirical findings are presented in the subsequent subsections.

Table 1. Unit Root (Stationarity) Test

Variables	Augmented Dickey-Fuller (ADF)Test Statistic	Mackinnon's Critical Values at 1% and 5% respectively		Order of Integration	Prob.
GDPGR	-3.683300	-3.653730	-2.957110	I(0)	0.0093
FOFEC	-5.502982	-3.670170	-2.963972	I(1)	0.0001
GPUEU	-6.385303	-3.661661	-2.960411	I(1)	0.0000
REECC	-5.883802	-3.661661	-2.960411	I(1)	0.0000

Source: Researcher's computation using Eviews 10

The Augmented Dickey-Fuller test results in Table 1 show that most variables are stationary at first difference [I(1)], while the GDP growth rate is stationary at level [I(0)], supporting the suitability of the ARDL approach.

Table 2. Unit Root (Stationarity) Test

Variables	Phillips-Perron (PP)Test Statistic	Mackinnon's Critical Values at 1% and 5% respectively		Order of Integration	Prob.
GDPGR	-3.809980	-3.653730	-2.957110	I(0)	0.0068
FOFEC	-6.587842	-3.661661	-2.960411	I(1)	0.0000
GPUEU	-6.700712	-3.661661	-2.960411	I(1)	0.0000
REECC	-5.892723	-3.661661	-2.960411	I(1)	0.0000

Source: Researcher's computation using Eviews 10

The Phillips-Perron test results, as shown in Table 2, reveal that most of variables are stationary at first difference [I(1)], whereas the GDP growth rate is stationary at level [I(0)], thereby validating the use of the ARDL methodology.

Table 3. ARDL Bounds Test for Cointegration

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	**Value**	**Signif.**	**I(0)**	**I(1)**
F-statistic	4.627887	10%	2.01	3.1
k	3	5%	2.45	3.63
		2.5%	2.87	4.16
		1%	3.42	4.84

Source: Researcher's computation using eviews 10

The study conducted a cointegration test to examine the long-run relationship between Energy consumption and economic growth in Nigeria. The F-statistic (4.627887) exceeded both the lower bound (2.45) and upper bound (3.63) at 5% significance level, indicating a long-run equilibrium relationship between the variables. This suggests that Energy consumption and economic growth are cointegrated, supporting a long-run relationship between Energy consumption and economic growth in Nigeria.

Table 4. ARDL Short Run Error Correction Model

ECM Regression				
Case 1: No Constant and No Trend				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(GDPGR(-1))	0.089015	0.154861	0.574810	0.5729
D(GDPGR(-2))	0.329111	0.115091	2.859578	0.0109
D(FOFEC)	1.032605	0.266937	3.868342	0.0012
D(FOFEC(-1))	0.095408	0.156870	0.608199	0.5511
D(FOFEC(-2))	0.542617	0.172805	3.140059	0.0060
D(GPUEU)	3.033731	0.657239	4.615869	0.0002
D(REECC)	0.200260	0.378487	0.529105	0.6036
D(REECC(-1))	0.236048	0.395406	0.596976	0.5584
D(REECC(-2))	0.958996	0.346126	2.770654	0.0131
CointEq(-1)*	-0.676574	0.144978	-4.666722	0.0002
R-squared	0.773410	Mean dependent var		-0.045984

Adjusted R-squared	0.671445	S.D. dependent var	3.507865
S.E. of regression	2.010698	Akaike info criterion	4.496043
Sum squared resid	80.85815	Schwarz criterion	4.963109
Log likelihood	-57.44064	Hannan-Quinn criter	4.645461
Durbin-Watson stat	2.148688		
* p-value incompatible with t-Bounds distribution.			

Source: Researcher's computation using eviews 10

The ARDL Short-run error correction model results in Table 4 reveal that Fossil fuel energy consumption (FOFEC) impacts Gross domestic product growth rate (GDPGR) differently across periods. Current FOFEC has a positive and significant effect on GDPGR (prob =0.0012), with a 1% increase in FOFEC leading to a 103.26% increase in GDPGR (coefficient = 1.032605). FOFEC lagged 1 period shows a positive but insignificant relationship (prob = 0.5511), with a 1% increase in FOFEC resulting in a 9.54% increase in GDPGR (coefficient = 0.095408). Meanwhile, FOFEC lagged 2 periods has a positive and significant effect (prob = 0.0060), with a 1% increase in FOFEC boosting GDPGR by 54.26% (coefficient = 0.54267). GDP per unit of energy use (GPUEU) has a positive and significant effect on GDPGR at a 5% significant level (prob = 0.0002). A 1% increase in GPUEU leads to a 303.37% increase in GDPGR (coefficient = 3.033731).

Renewable energy consumption (REECC) has varying effects on GDPGR. At the current period, REECC has a positive but insignificant impact on GDPGR (prob = 0.6036), with a 1% increase in REECC leading to a 20.03% increase in GDPGR. Similarly, REECC lagged 1 period shows a positive but insignificant relationship (prob = 0.5584), with a 1% increase in REECC resulting in a 23.60% increase in GDPGR. However, REECC lagged 2 periods has a positive and significant effect in GDPGR (prob = 0.0131), with a 1% increase in REECC boosting GDPGR by 95.90%. The ARDL short-run error correction model results (Table 4) shows speed of adjustment coefficient of -0.676574 (prob = 0.0002), indicating that 67.66% of any disequilibrium is corrected annually, with the model adjusting to long-run GDPGR levels at this rate. The R-Squared value of 77.34% suggests a strong combined correlation between the independent variables (FOFEC, GPUEU, REECC) and GDPGR. The adjusted R-Squared 67.14% confirms that the independent variables explain a significant portion of the variation in GDPGR.

Table 5. ARDL Long Run Results

Levels Equation				
Case 1: No Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
FOFEC	-0.173304	0.209679	-0.826521	0.4200
GPUEU	0.160337	0.388688	0.412508	0.6851
REECC	0.118499	0.080759	1.467329	0.1605
EC = GDPGR - (-0.1733*FOFEC + 0.1603*GPUEU + 0.1185*REECC)				

Source: Researcher's computation using eviews 10

The ARDL long-run estimates (Table 5) shows that Fossil fuel energy consumption (FOFEC) has an insignificant (p = 0.4200) negative effect (-0.173304) on GDPGR, with a 1% increase in FOFEC leading to 17.33% decrease in GDPGR. Additionally, GDP per unit of energy use (GPUEU) has a positive (0.160337) but insignificant (p = 0.6851) effect on GDPGR, with a 1-unit increase in GPUEU leading to a 16.03% unit increase in GDPGR. Finally, Renewable energy consumption (REECC) has a positive (0.118499) but insignificant (p = 0.1605) effect on GDPGR, with a 1% increase in REECC leading to an 11.85% increase in GDPGR.

B. Post-Estimation Diagnostic Tests

To evaluate the model's performance, several post-estimation diagnostic tests were carried out, such as the Correlogram of squared residuals, the Breusch-Pagan-Godfrey heteroskedasticity test, the CUSUM of squares test and the histogram normality test. These tests offer insights into the model's overall reliability.

Table 6. Correlogram of Residuals Squared

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
. | . |	. | . |	1	-0.022	-0.022	0.0163	0.898
. |**. |	. |**. |	2	0.318	0.318	3.4806	0.175
. | . |	. |* . |	3	0.057	0.076	3.5951	0.309
.*| . |	.**| . |	4	-0.116	-0.239	4.0943	0.393
.*| . |	.*| . |	5	-0.096	-0.175	4.4510	0.486
.*| . |	. | . |	6	-0.086	0.025	4.7485	0.576
.*| . |	.*| . |	7	-0.182	-0.076	6.1339	0.524
.*| . |	.*| . |	8	-0.080	-0.090	6.4099	0.601
.*| . |	.*| . |	9	-0.165	-0.134	7.6478	0.570
. | . |	. | . |	10	-0.044	-0.010	7.7396	0.654
. | . |	. | . |	11	-0.004	0.065	7.7403	0.736
. | . |	.*| . |	12	-0.065	-0.098	7.9668	0.788
. | . |	.*| . |	13	0.044	-0.071	8.0758	0.839
. |* . |	. |* . |	14	0.167	0.206	9.7548	0.780
. | . |	. | . |	15	0.007	0.032	9.7578	0.835
. | . |	.*| . |	16	0.058	-0.186	9.9894	0.867
*Probabilities may not be valid for this equation specification.						

Source: Researcher's computation using Eviews 10

Table 6 displays the results of the Correlogram of squared residuals test, which show no evidence of autocorrelation, thereby reinforcing the validity of the model's performance.

Table 7. Heteroskedasticity Test: Breusch-Pagan-Godfrey

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	1.921478	Prob. F(13,16)	0.1080
Obs*R-squared	18.28674	Prob. Chi-Square(13)	0.1469
Scaled explained SS	8.758824	Prob. Chi-Square(13)	0.7909

Source: Researcher's computation using eviews 10

The Breusch-Pagan-Godfrey test indicates that the model exhibits homoskedasticity, as the p-values for both the F-statistic and the Observed R-Squared exceed 0.05, implying that the residuals have constant variance.

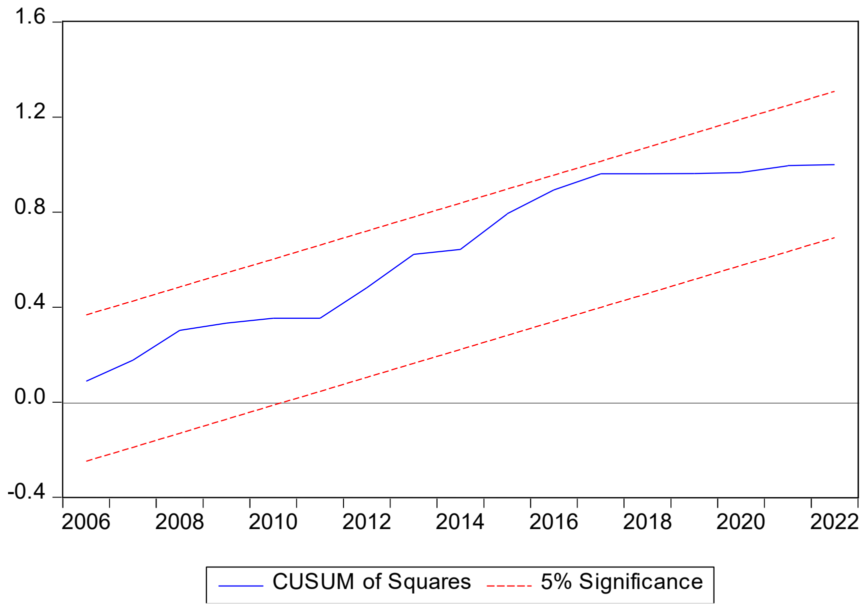

Figure 1. Cusum Test

Source: Researcher's computation using eviews 10

The CUSUM of squares test was performed to assess the model's stability. The results suggest that the model is both appropriate and well-specified. A visual examination of Figure 1 provides further insight into this conclusion.

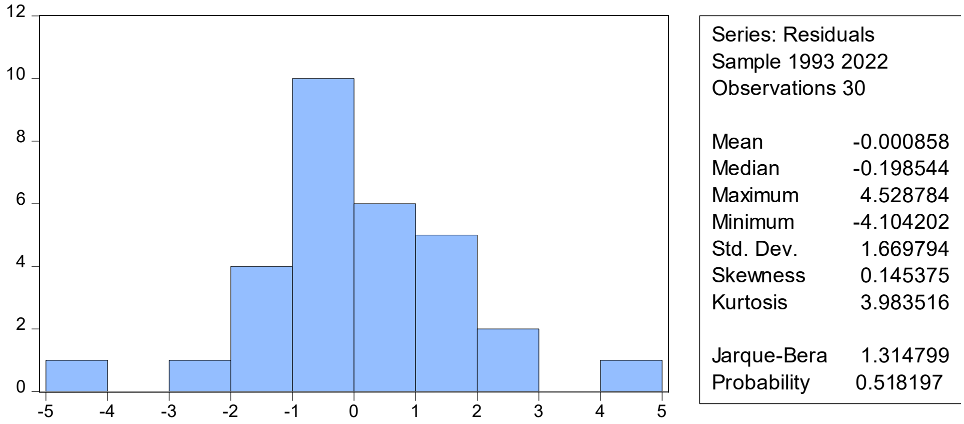

Figure 2. Histogram-Normality Test

Source: Researcher's computation using eviews 10

The Histogram normality test shown in Figure 2 was performed to assess whether the residuals follow a normal distribution. The results indicate that the residuals are normally distributed, as the Jarque-Bera Probability exceeds 0.05.

Table 8. Pairwise Granger Causality Test Result

Null Hypothesis:	Obs	F-Statistic	Prob.
FOFEC does not Granger Cause GDPGR	31	1.32840	0.2823
GDPGR does not Granger Cause FOFEC		0.96085	0.3957
GPUEU does not Granger Cause GDPGR	31	0.41201	0.6666
GDPGR does not Granger Cause GPUEU		0.51527	0.6033
REECC does not Granger Cause GDPGR	31	1.33814	0.2798
GDPGR does not Granger Cause REECC		0.10081	0.9045
GPUEU does not Granger Cause FOFEC	31	4.28045	0.0247
FOFEC does not Granger Cause GPUEU		2.75655	0.0821
REECC does not Granger Cause FOFEC	31	1.23767	0.3066
FOFEC does not Granger Cause REECC		1.09651	0.3490
REECC does not Granger Cause GPUEU	31	2.19835	0.1312
GPUEU does not Granger Cause REECC		1.46933	0.2486

Source: Researcher's computation using eviews 10

Table 8 shows the pairwise Granger causality test result. The pairwise granger causality test indicates the cause-and-effect relationship between the dependent and independent variables. This does not necessarily implies a relationship between the variables. The Granger causality test results indicate a unidirectional causal relationship between GDP per unit of energy use (GPUEU) to fossil fuel energy consumption (FOFEC), while all other variables as statistically insignificant within the study period. Additionally, the reverse causality from FOFEC to GPUEU is statistically insignificant, implying no feedback relationship between the two variables.

V. CONCLUSION AND RECOMMENDATIONS

This study investigated the impact of energy consumption on Nigeria's economic growth using the ARDL framework. The results reveal a 67.66% speed of adjustment, indicating that deviations from short-run shocks correct substantially within one period. The model's explanatory power is strong, with the R-squared (77.34%) and adjusted R-squared (67.14%) showing that more than half of the variations in GDP growth are accounted for by fossil fuel energy consumption (FOFEC), GDP per energy use (GPUEU), and renewable energy consumption (REECC). However, the long-run estimates indicate an insignificant and negative relationship between FOFEC and GDPGR.

This suggests that Nigeria's overdependence on fossil fuels does not support long-term development. GPUEU indicated a positive and insignificant impact on GDPGR. The positive but insignificant effect of GPUEU on GDPGR implies that improvements in energy efficiency have the potential to drive economic growth, though the current impact remains weak. Additionally, REECC showed a positive, though statistically insignificant effect on GDPGR. This underline the need for greater investment in renewable energy infrastructure, efficient technologies, and energy-sector reforms to enhance sustainable growth. Finally, the findings highlights the potential role of renewable energy in driving sustainable economic development. This result is consistent with previous studies (Atoyebi etal (2024); Hamit & Korkmaz, 2018). Based on the findings, the study suggests the following policy recommendations:

i. The government should gradually reduce reliance on fossil fuels by diversifying the energy mix and investing more in greener energy alternative.
ii. The government should promote policies that improve energy efficiency across all sectors by encouraging the adoption of modern energy-savings technologies.
iii. The government and private sector should increase investment in renewable energy infrastructure and technology.

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