© APR 2025 | IRE Journals | Volume 8 Issue 10 | ISSN: 2456-8880

Assessing The Impact of Non-renewable Energy Consumption on The Quality of Life: The Nigerian Experience

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Abstract- The study assessing the impact of non-renewable energy consumption on the quality of life: the Nigerian experience, employed secondary time series data which was estimated with the Autoregressive Distributed (ARDL) technique. The study revealed that non-renewable energy has a negative but statistically insignificant impact on quality of life in the long run, economic growth, government health expenditure, and food production exhibit significant positive effects on quality of life. In the short-run only economic growth showed a significant positive effect on quality of life. The significant ECM term confirms a long-run equilibrium relationship, with a high speed of adjustment. Based on these findings the study recommended that Governments should reduce dependence on non-renewable energy and invest in cleaner alternatives like solar, wind and hydro in order to mitigate potential long-term negative effects on quality of life. Policymakers should focus on inclusive economic strategies (job creation, infrastructural development, technological innovation) to maintain positive growth trends that enhance living standards. Increase allocations to healthcare systems and support agricultural programs for food security.

Indexed Terms- Quality of Life, Non-Renewable Energy, Health Expenditure, Food Production, ECM, ARDL

I. INTRODUCTION

Energy can be described as the propelling force that triggers any economic activities in an economy including industrial production. Scientists defined energy as the ability to do work (IEA, 2024). Energy enables people to perform different activities because people have been able to convert it from one form to another and then apply it in work conditions. It can be used in varieties of activities ranging from walking, running, riding, cooking, powering of engines and industrial plants, refrigerating food and drugs, lighting our homes and offices, communication to mention but a few. Energy sources are classified into two broad categories which are viz; renewable and non-renewable. Renewable energy sources are those energy sources which are naturally replenished overtime. They are; solar, wind, geothermal, biomass and hydropower energy. While, non-renewable energy according to EIA, 2024 are those energy whose supply are limited to what we can mine or extract from the earth. They are; petroleum, coal, natural gas nuclear energy and hydrocarbon gas liquids.

The place of energy in human lives cannot be overemphasized. Energy is core to all aspects of economic progress, growth, and development as well as poverty eradication and security (Akinola, et al., 2017). Energy plays an important role in improving production, competitiveness, and incomes through its support of productive activities and the facilitation of investments in industry, commerce, and agriculture (World Bank, 2007). Access to modern forms of energy is therefore essential to overcome poverty, promote economic growth and employment opportunities, support the provision of social services, and generally promote sustainable human development (Karekezi, et al., 2012). Generally, household energy services are required for a variety of purposes. It is needed for lighting, heating, cooking, and for use in electrical appliances. This usage is commonly referred to as household energy consumption and is defined as the energy consumed in homes to meet the needs of households (Kadiri & Alabi, 2014).

Energy, particularly crude oil, continues to account for more than 70% of Nigeria's Federal revenue. The country's national development programs and security largely rely on these income sources. Over the last five years, energy, specifically crude oil, has contributed an average of around 25% to Nigeria's Gross Domestic Product (GDP), making it the second-highest contributor after crop production. Crude oil, which is a non-renewable resource, is typically located in underground areas known as reservoirs. It is a liquid with a yellowish-black hue and consists primarily of hydrocarbons and organic compounds. Oil prospecting scientists usually make discoveries of these resources. Although the terms petroleum and crude oil are sometimes used interchangeably, petroleum is a broader category that includes various products derived from crude oil. The term 'petroleum products' is used after crude oil undergoes refining in a facility. Crude oil can be found both deep within the Earth's crust and beneath ocean beds (Soheila, Bahman & Nikos 2013).

Oil serves as a crucial energy source in Nigeria and globally. As a cornerstone of Nigeria's economy, oil significantly influences the nation's economic and political trajectory. From a microeconomic viewpoint, economic entities such as individuals, households, companies, and industries function as decision-making units for both oil production and consumption (Isiorho, 2022). Consequently, the consumption of crude oil energy is essential for enhancing one's quality of life, as energy is a fundamental requirement for survival.

Nigeria's economy faces challenges in utilizing its abundant fossil fuel resources to alleviate the poverty that impacts around 45% of its population. Despite Nigeria generating substantial revenue from oil extraction since its discovery, this income has not effectively reached the impoverished population in terms of access to essential services like quality infrastructure, education, healthcare, and improved real income. It is not surprising that economists describe the situation in developing nations like Nigeria, where significant wealth from natural resources exists alongside extreme poverty, as the "resource curse."Nigeria has been identified as one of the major producers and consumers of fossil fuels, and energy consumption, particularly that of fossil fuels, is the main source of carbon (iv) oxide emissions that cause climate change globally (Alege, Oye & Adu, 2017).

To put it bluntly, the use of energy, particularly fossil fuels, degrades the quality of the environment, seriously endangers human health, and negatively impacts aquatic life. Degradation of the environment is the result, and this has implications for financial allocation in terms of financing health care (Balan, 2016).

In order to achieve this, this article aims to examine the connection between Nigerians' quality of life and their use of crude oil.

The objective of this paper is to analyze the long run relationship between non-renewable energy (crude oil) and quality of life in Nigeria between 1990 and 2024. The data for this study will be sourced from the CBN statistical bulletin, IEA and the WDI, using

Augmented Dickey-Fuller test and Co-integration. It is believed that the outcome of this study will be of enormous benefits to students, academics, institutions, policy makers and private individuals who may wish to sought for information about non-renewable energy and quality of in Nigeria.

II. LITERATURE REVIEW

Kabiru S.M, Tahir H.M & Yahaya H(2022) investigated the influence of crude oil prices on the standard of living in Nigeria. The study used additional variable such as crude oil income, inflation, and exchange rate for the period 1981-2019. The study found a long-run equilibrium connection among the series. The study has found that crude oil prices had a negative impact on standard if living and that crude oil revenue negatively affects standard of living of Nigerians.

Ibrahim R.L, Kazeem B & Olatunde J.O (2021) investigated the effects of non-renewable energy (NRE) on quality of life (QOL) in 43 Sub-Saharan African (SSA) economies for 1990-2017. Non-renewable energy (NRE) was disaggregated into coal, natural gas and petroleum oil are examined on three indicators of quality of life(life expectancy, mortality rate and human development index) by employing a step system generalized method of moments (SYS-GMM) with forward orthogonal, fixed effects OLS, and fully modified OLS. The study founds a significant negative impact of NRE indicators on life expectancy and HDI. NRE has positive effects on mortality rate (infant).

Gatawa & Abdullahi (2017) employed a stratified random sample technique to gather data from 42 filling stations with 400 household heads in order to examine the impact of changes in petroleum product pump prices on the welfare of households in the Zaria region of Kaduna state, Nigeria. Descriptive and inferential statistics are utilized to analyze the primary data in this study. The findings showed that rising pump costs for petroleum products like gas, kerosene, and gasoline had a detrimental effect on household welfare.

Pourali (2014) used a fixed effects model estimate over the 2007–2011 periods to examine the relationship between environmental life quality indices and energy consumption in high-energy-consuming nations such as the United States, China, Japan, India, Iran, Russia, and others. Oil consumption served as a stand-in for energy consumption, whereas CO_2 per capita, agricultural subsidies, drinking water access, sanitation, and under-5 child mortality were environmental life quality metrics. The findings demonstrated a strong positive relationship between energy use and environmental life quality metrics.

Uzoechina et al. (2024) investigated the impact of energy consumption on life expectancy in lower-middle-income West African countries between 1990 and 2021 using data compiled from the World Bank and the Central Bank of Nigeria's Statistical Bulletin. The cross-sectional auto-regressive distributed lag method's results showed that, both immediately and over time, renewable energy had a favorable and significant impact on life expectancy in lower-middle-income West African countries. However, non-renewable energy was found to have a negative and significant impact on life expectancy in the long run, while having a negative but statistically negligible effect in the near term.

3.1 Methods

The study will use data sourced from the International Energy Agency (IEA) for petroleum energy consumption, Human development index statistic of the United Nations for quality of life,federal government health expenditure and food production, statistical bulletin of the Central Bank of Nigeria (CBN) for gross domestic product.

Table: 3.1 Variable Descriptions and Source

S/N	Variable	Symbol	Measurement	Source
1	Petroleum energy consumption	PEC	Fossil fuel energy consumption (% of total)	WDI
2	Quality of life	QOL	Life expectancy at birth, total (years)	WDI
3	Real gross domestic product	RGDP	Measured at constant 2010 prices.	CBN
4	Federal Government Health Expenditure	GHE	Federal Government Health Expenditure (₦Billions)	CBN
5	Food Production	FPD	Food production index (2014-2016 = 100)	WDI

Source: Author's computation, 2025.

3.1.1 Theoretical Framework

Taking inference from the empirical findings and theories which have been derived from the theoretical exposition of the exogenous growth theories which makes energy central to the equation,

Y=F (A, K, L)

Where; Y = aggregate real output. K = stock of capital. L = stock of labour. A = Technology (or technological advancement). It is worthy to note that A (technological advancement) is based on the investment on research technology. Technology is seen as an endogenous factor which could be related to energy. Most technology as given per time is dependent on the availability of useful energy to power it. The technology referred to here is that such as plants, machinery and the likes. Without adequate energy supply (in this case crude oil or petroleum) then these technology are practically useless. Hence, a model will be drawn up to determine the effect of petroleum consumption on quality of life in Nigeria context.

3.1.2 Model specification

In specifying our model, we modified the work of Alaebo et al,(2024). In specifying the model on the relationship between petroleum energy consumption and quality of life for this study we will use life expectancy as proxy for quality of life (see Alaebo et al, 2024 and Ishioro, 2023), petroleum energy consumption (PEC) is used as a strand of non-renewable for this study. The study also included the following control variables in specifying the model which are; education (EDU), government health expenditure, food production and real gross domestic product (GDP).

The functional form of the model is:

$$Y = F(X_t) \quad (1)$$

Where;

Y = Quality of life

X = vector of individual inputs to the production functions. This could include income, energy consumption, education and health exp.

Equation (1) can be augmented to accommodate indicator of energy consumption and some other control variables so as to capture its impact on quality of life. The functional form of the model can be given as:

$$QL = f(NRE, GDP, GHE, FPD) \quad (2)$$

From equation (2) above, QL denotes that quality of life which is measured by life expectancy is a function of non-renewable energy consumption, gross domestic product per capita, health expenditure and food production. Non-renewable energy consumption is captured by a strand of non-renewable source of energy which is petroleum because the study intends to look at the impact of crude oil consumption on quality of life. Other control variables added in the model are gross domestic product per capita, health expenditure and food production.

The econometric form of the functional model can be specified as follows;

$$QL = \alpha_0 + \alpha_1 NRE + \alpha_2 GDP + \alpha_3 GHE + \alpha_4 FPD + \mu_t \quad (3)$$

From the above equation,

QL = Quality of Life captured by life expectancy at birth,
NEC = non-renewable energy consumption,
GDP = Gross domestic product per capita,
GHE =Government health expenditure,
FPD = Food production,
μ = Disturbance term/error term,
$\alpha_0 = constantterm, \alpha_1, \alpha_2, \alpha_3, \alpha_4$ = coefficients in the model.
Apriori Expectation

QL/NRE > 0, QL/GDPpc > 0, QL/GHE > 0, QL/FPD> 0. The above signifies a positive relationship and movement of exogenous variables on the quality of life.

The study will use Autoregressive distributive lags (ARDL) estimation techniques in estimating our model. To avoid spurious estimates generated by the short span of our data, we followed the observation of Narayan and Smyth (2014), Maku et al.,(2023) Ishioro (2023), Maku and Ishioro (2023) that to solve the problem of short span data, the autoregressive distributed lags (ARDL) bounds tests of Pesaran et al (2001) should be applied.

It is widely known that meaningful economic policy can barely be generated from an OLS regression involving data misalignment and non-stationary time series. As a result, pre-test analyses such as descriptive analysis, unit root test, co-integration test, will be required.

3.1.3 Estimation Techniques.

The study utilized the Autoregressive Distributed Lag (ARDL) approach as its analytical methodology. ARDL is a method of analyzing time series data that is especially effective for studying the long-term connections between variables. By utilizing ARDL, the purpose of this study is to shed light on the intricate relationship that exists between the petroleum energy consumption and quality of life.

The analysis process will involve several key steps:

i. Unit Root Test: This test evaluates whether a time series variable is stationary or demonstrates a unit root, indicating non-stationarity. Stationarity is a property of a series where the mean and variance do not change over time. This is important for modeling because it ensures accuracy.
ii. ii. ARDL Test: The ARDL test determines long-term relationships between model variables. Adding lagged data enable us assess short-term and long-term trends.
iii. Diagnostic Tests: These tests assess regression model validity. They include examining assumptions such as normality, homoscedasticity (constant variance of errors), and absence of autocorrelation (independence of errors).
iv. Stability Tests: These tests are employed to identify structural breaks or alterations in the correlation between variables over a period of time. The Cumulative Sum (CUSUM) and CUSUM Square tests assess if model coefficients are stable or deviate significantly, which may suggest model specification errors.

The Autoregressive Distributive Lag (ARDL) bound model of equation 1 above can be specified as:

$$QL = \sum_{i=1}^{p} \alpha_{1i}\, \Delta QL_{t-1} + \sum_{i=0}^{q} \alpha_{2i}\, \Delta NRE_{t=1} + \sum_{i=0}^{q} \alpha_{3i}\, \Delta GDP_{t-1} + \sum_{i=0}^{q} \alpha_{4i}\, \Delta GHE_{t-1} + \sum_{i=0}^{q} \alpha_{5i}\, \Delta FPD_{t-1} + \pi_1 QL_{t-1} + \pi_2 NRE_{t-1} + \pi_3 GDP_{t-1} + \pi_4 GHE_{t-1} + \pi_5 FPD_{t-1} + \mu_{1t} \quad (4)$$

The variables in the above equation are as defined in equation (1).

IV. ANALYSIS AND RESULTS

Table 4.1: Descriptive Statistics

	QL	NRE	LGHE	LGDP	FPD
Mean	50.78657	19.12699	4.791542	10.83926	89.69739
Median	51.35700	19.01455	5.192957	10.95973	84.66000
Maximum	53.63300	21.65634	6.081125	11.22042	119.8500
Minimum	47.19300	15.85414	2.722484	10.13339	64.33000
Std. Dev.	1.862879	1.247395	0.994952	0.347728	17.78011
Skewness	-0.464489	0.029942	-0.452797	-0.666539	0.297442
Kurtosis	2.078633	4.362268	2.065665	2.115802	1.781871
Jarque-Bera	1.640585	1.781886	1.622537	2.452283	1.761154
Probability	0.440303	0.410269	0.444294	0.293423	0.414544
Observations	23	23	23	23	23

Source: Author's computation with E-views

The descriptive features of the data used in the research are presented in table 4.1. It can be observed that QL have an average of 50.78 which indicated that the average life expectancy in the country is 51 years. NRE have an average of 19.12 showing that the level of non-renewable energy consumption is 19 percent of energy consumption in the study period. LGHE accounted for about 4.79 percent of government yearly expenditure. LGDP with an average value of 10.83 showed the economy on average record a 10.9 billion naira within the study period. All the variables are platykurtic as indicated by their kurtosis values except NRE which is leptokeurtic. NRE and FPD are positively skewed showing that most of their observations lies above their mean values, while QL, LGHE and GDP lies below their mean values as indicated by their negative skewness. All the variables are normally distributed based on their Jarque-Bera probability values.

Table 4.2: ADF unit root test

Variables	ADF Statistics (Level)	t-critical values (5%)	P-value	ADF Statistics (First Diff.)	t-critical values (5%)	P-value	Conclusion
QL	-3.079998	-3.020686	0.0445	-	-	-	I(0)
NRE	-2.292251	-3.004861	0.1829	-5.552781	-3.012363	0.0002	I(1)
GDP	-5.175981	-3.004861	0.0004	-	-	-	I(0)
GHE	-1.409121	-3.020686	0.5571	-6.314337	-3.020686	0.0000	I(1)
FPD	-0.352451	-3.020686	0.9000	-19.14983	-3.020686	0.0000	I(1)

Source: Author's computation with E-views

The Augmented Dickey-Fuller unit root test result for the variables employed in the study is presented in table 4.2. Three of the variables are stationary at first difference I(1), while two are stationary at level I(0). We therefore proceed to conduct the long-run model estimate and the error correction model.

Table 4.3: Co-integration Test

F-Bounds Test	Null Hypothesis: No levels relationship			
Test Statistic	Value	Significance level	I(0)	I(1)
		10%	2.2	3.09
F-Statistic	8.945976	5%	2.56	3.49
K	4	2.5%	2.88	3.87
		1%	3.29	4.37

Source: Author's computation with E-views

The ARDL Long Run Form and Bounds Test was used to test for co-integration among the variables of the study. The ARDL Long Run Form and Bounds Testis the most appropriate since the variables are integrated in both order one and levels, the result is presented in Table 4.3. From the result the F-statistic is 8.945976 and from a careful observation of the information presented in the Table depicting the I(0) and I(1) bound, we can conclude that there exist a co-integrating relationship among the variables of the study since the F-statistic value is greater than the I(1) bound at the 5% significance level.

Table 4.4: Long-run Estimates

Dependent Variable: QL				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
NRE	-0.063187	0.042038	-1.503084	0.1502
LGDP	2.739227	0.621893	4.404658	0.0003
LGHE	0.590752	0.219457	2.691888	0.0149
FPD	0.018404	0.006136	2.999298	0.0077
C	17.82256	6.020109	2.960505	0.0084
R-squared	0.989129	Mean dependent var		50.78657
Adjusted R-squared	0.986714	S.D. dependent var		1.862879
F-statistic	409.4609	Durbin-Watson stat		1.888680
Prob(F-statistic)	0.000000			

Source: Author's computation with E-views

Table 4.4 contains the output for the long-run estimates. In the long-run non-renewable Energy has a negative and statistically insignificant effect on effect on quality of life (QL). The coefficient of -0.063 indicated that a one percent increase in consumption of non-renewable energy reduces the quality of life by 6 percent. Economic growth (LGDP)showed a significant positive effect on quality of life (QL). A 1 percent increase in LGDP is associated with a 2.739 percent increase in quality of life (QL). Government health expenditure (LGHE) have significant positive effect on QL. A 1 percent increase in LGHE leads to a 0.591 percent increase in quality of life. Food Production have a significant positive effect on quality of life (QL). A 1-unit increase in food production (FPD) increases QL by 0.018 units. The constant value shows the quality of life when the other variables in the model are held constant. The R-square of shows that the independent variables have a very high predictive influence on the dependent variable. The Durbin-Watson stat of 1.88 showed that the model is free from serial correlation.

Table 4.5: Short-run Estimates

Dependent Variable: D(QL)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(NRE)	-0.023861	0.047196	-0.505582	0.6200
D(LGDP)	2.452377	1.343001	1.826042	0.0866
D(LGHE)	0.320745	0.222143	1.443866	0.1681
D(FPD)	-0.002609	0.011292	-0.231054	0.8202

C	0.110235	0.099282	1.110331	0.2833
ECM(-1)	-0.883551	0.326510	-2.706044	0.0156

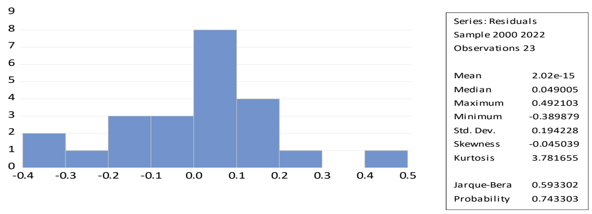
R-squared	0.418837	Mean dependent var	0.292727
Adjusted R-squared	0.237224	S.D. dependent var	0.234200
F-statistic	2.306201	Durbin-Watson stat	1.782967
Prob(F-statistic)	0.092961		

Source: Author's computation with E-views

Non-renewable energy has a negative and statistically insignificant effect on quality of life in the short run. The coefficient of -0.023861 suggest that 1 percent change will cause a 2 percent decrease in quality of life. Economic growth has a positive and significant effect on quality of life. With a coefficient of 2.452377 a 1 percent change will cause quality of life to increase by 2.5 percent. Government health expenditure has a positive and insignificant effect on quality of life. A 1 percent increase in it will cause quality of life to increase by 32 percent. Food production have a negative and insignificant influence on quality of life, a 1 unit increase will cause quality of life to decrease by 0.002609 unit. The Error Correction Term (ECM) has a coefficient of -0.883551 and is statistically significant at 5 percent. This is indicative of a strong long-run relationship between the variables. This is because about 88.4 percent of disequilibrium in quality of life corrects back each period. The R-squared showed that the model explains about 42 percent of the variation in quality of life changes. Durbin-Watson of 1.78 showed no strong evidence of autocorrelation.

Diagnostic Test

Normality Test



Source: Author's computation with E-views, Fig 1: Normality test

The Jarque-Bera statistic presented in figure 1 showed that the residuals are normally distributed. This is so since the Jarque-Bera statistic of 0.593302 have a probability value of 0.743303 which is greater than 5% level of significance.

Table 4.6: Breusch-Godfrey Serial Correlation LM Test

Null hypothesis: No serial correlation at up to 1 lag			
F-statistic	0.229048	Prob. F(1,17)	0.6383
Obs*R-squared	0.305769	Prob. Chi-Square(1)	0.5803

Source: Author's computation with E-views

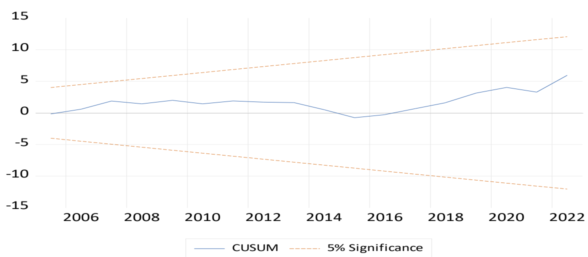
The Breusch-Godfrey Serial Correlation LM Test is presented in Table 4.6, the result showed that the model is free from serial correlation since the probability value is greater than the 5% level of significance.

Table 4.7: Heteroskedasticity Test: Breusch-Pagan-Godfrey

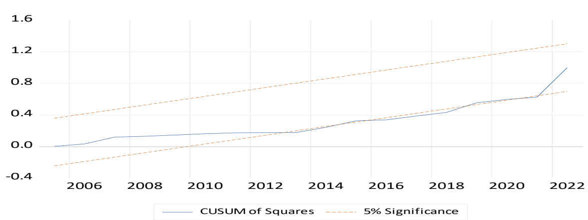
Null hypothesis: No serial correlation at up to 1 lag			
F-statistic	0.229048	Prob. F(1,17)	0.6383
Obs*R-squared	0.305769	Prob. Chi-Square(1)	0.5803

Source: Author's computation with E-views

The Breusch-Pagan-GodfreyHeteroskedasticity Testis presented in Table 4.7, the result showed that the null hypothesis of Homoskedasticity in the model is accepted since the probability value is greater than the 5% level of significance.



Source: Author's computation with E-views, Figure 2: CUSUM



Source: Author's computation with E-views, Figure 3: CUSUM of Squares

The CUSUM and CUSUM of Squares are presented in figure 2 and 3, the plot shows that the model is stable, since it lies between the 5% significance lines. Thus the results from the model can be used for policy formulation.

V. CONCLUSION AND RECOMMENDATIONS

The study reveals that non-renewable energy has a negative but statistically insignificant impact on quality of life in the long run, suggesting that reliance on such energy sources may not directly enhance well-being. In contrast, economic growth, government health expenditure, and food production exhibit significant positive effects on quality of life, highlighting their crucial roles in improving societal welfare. In the short-run only economic growth showed a significant positive effect on quality of life. The significant ECM term confirms a long-run equilibrium relationship, with a high speed of adjustment. Boosting economic growth may improve quality of life. Non-renewable energy and health spending do not show strong short-term impacts but long-run dynamics (co-integration) suggest they may matter over time.

Based on these findings the following recommendations are made; Governments should reduce dependence on non-renewable energy and invest in cleaner alternatives like solar, wind and hydro in order to mitigate potential long-term negative effects on quality of life. Policymakers should focus on inclusive economic strategies (job creation, infrastructure development, technological innovation) to maintain positive growth trends that enhance living standards. Higher allocations to healthcare systems can further improve life expectancy, reduce disease burdens and strengthen overall well-being. Agricultural support programs, sustainable farming practices and food distribution systems should be prioritized to ensure stable food production and accessibility.

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