ENERGY USE AND ECONOMIC PERFORMANCE IN NIGERIA: AN EMPIRICAL STUDY FROM PETROLEUM, ELECTRICITY AND DRY NATURAL GAS

Samson Adeniyi Aladejare*

Emmanuel Ameh Ojiya

ABSTRACT

Arguably, energy plays a vital role in economic and social development. Hence, many studies have attempted to test for the direction of causality between energy use and economic performance; however, no consensus has emerged. This research, therefore, tests for causal relationship between energy use and economic performance proxied by GDP(Gross Domestic Product) in Nigeria using systematic econometric techniques. Empirical literature on causality is examined by the study. The study found that there is a bi-directional causality between economic performance and energy use in the short run. However, in the long run, the relationship between the variables is unidirectional; flowing from energy use to economic performance. The policy implications derived from this study are that: before policy makers adopt any strategy to conserve, or to promote energy consumption, the role of energy use should not be neglected in the relationship between energy use and economic performance. Otherwise, such a policy may be detrimental to economic growth. Also any negative shock to energy use in the short run would inversely affect economic performance and vice versa.

* Department of Economics, Federal University Wukari, Nigeria

1. INTRODUCTION

Today, its no debate as to the level of reliance of world economies on energy use of which Nigeria is not an exception. As Alam (2006) puts it, “energy is the indispensable force driving all economic activities.” Put differently, the higher the energy consumption, the more the economic activity in the nation and as a result a greater economy emerges. Today, Nigeria is seen as one of the greatest developing nations in Africa with highly endowed natural resources including potential energy resources; and an ambition of becoming one of the twenty most industrialized nations in the world by 2020. However, increasing access to energy in Nigeria has proved to be not only a continuous challenge but also a pressing issue with the international community. An example was the nation wide protest that met the 2012 oil subsidy attempted removal by the government. Which shows the high level of sensitivity energy matters can generate from the common man. Economic growth is a prerequisite for a nation to move from a third world country to a developed country. For a developing country like Nigeria, the greater the economic performance, the better its chances to become more developed. With adequate utilization of energy potentials to meet the demand, the nation would experience high levels of economic performance.

2. Background to the study

Petroleum Energy

Nigeria is the 8th largest oil exporting country in the world, with oil revenue accounting for about 74% of total government revenue and 16% of GDP. The operational and investment activities are dominated by multinational oil companies, a few large domestic players, the Nigeria Government and many budding firms along the entire value. The key multinationals such as Chevron, Total, ExxonMobil and Shell however dominate upstream activities. The operational structure of these activities is largely through Joint Venture Agreements (JVA) and/or Production Sharing Contracts (PSC) between the International Oil Companies (IOCs) and the Nigerian Government.

The place of oil in the mind of the average Nigerian in particular, has become more profound since the deregulation of the downstream segment of the Nigerian oil industry in 2003. The contradiction is more glaring now with the recent rise in crude oil prices at the global markets, which meant more external earnings for Nigeria, but also increased the expense burden on imported refined petroleum products! It is such contradictions that make the Nigerian economy appear strange at times, as policies seem to ignore what appears obvious to do. As such, policies designed to address the deficiencies and defects in the structure end up being poorly articulated and/or implemented because of regional, political or rent-seeking selfish interests.

Current Electricity Situation in Nigeria

Just like in India, the electricity sector in Nigeria is presently characterized by chronic power shortages and poor power quality supply. With an approximated installed capacity of 6000MW (EPIC, 2004), it was stated that the country consumes about half its capacity. With an increased population coupled with diversification of economic activities, energy demand is rising but yet, electricity supply is relatively stagnant. It is therefore obvious that electricity demand is way above its supply thereby showing signs of potential economic growth.

The inefficiency as well as inadequate facilities to boost electricity supply has also been a major cause of the increasing gap between demand and supply of electricity. This could be due to the fact that there are only 9 working generating stations in Nigeria (3 hydro and 6 thermal). Out of the approximated 6000MW of installed capacity in Nigeria, not more than 4500MW is ever produced. This is due to poor maintenance, fluctuation in water levels powering the hydro plants and the loss of electricity in transmission. It could be also due to the 80MW export of electricity, each to the republic of Niger and Benin. "Apart from serving as a pillar of wealth creation in Nigeria, electricity is also the nucleus of operations and subsequently the engine of growth for all sector of the economy" (Sesan Ayodele, 2004). He has indirectly re-echoed the electricity consumption is positively related to economic growth and that the former is a cause factor of the latter. This means that electricity consumption have diverse impact in a range of socio economic activities and consequentially the living standards of Nigerians.

Natural Gas Energy in Nigeria

Gas utilisation is a primary goal of Nigeria's petroleum and energy policies. This is because, with a proven reserve of 260 trillion cubic feet of natural gas, Nigeria's gas reserve is triple the nation's crude oil resources. The reserve is estimated to last for more than a century as a domestic fuel as well as a major foreign income earner to the economy. Nigeria's gas profile makes her the largest natural gas reserves owner in Africa and as well placed among the top ten in the world. However, associated gas encountered during the normal course of oil production has been largely flared. Nigeria is reputed to be the largest gas-flaring country in the world. Due to the poor utilization infrastructure, Nigeria is believed to be flaring about 40 percent of the natural gas it produces; which also account for about 20 percent of all gas being flared worldwide. By not fully harnessing its gas resources, Nigeria loses an estimated 18.2 million U.S. dollars daily. The current trend in which 75 percent of the associated gas with crude oil exploration in Nigeria being flared, has shown the level at which natural resources that could have helped boost supply of electricity and also raise the foreign reserves earnings of the country from the sales of this resource is being wasted away on a daily bases.

2. Empirical literature

Economist interest in studying the relationship between energy use and economic performance dates back to a pioneering study done by Kraft and Kraft (1978). Their study provides evidence to support a unidirectional causality from GNP to energy consumption; using the case of USA over the period 1947-1974, by using the Sims Granger methodology. The results obtained indicated that energy conservation might be pursued with no adverse impacts on economic growth. However, Akarca and Long(1980) in their own study concluded that there was no causal relationship between the two variables. Though the period covered was shorter than the Kraft-Kraft's period. In support of their conclusion, Akarca and Long argued that Kraft-Kraft's study might suffer from temporal time period instability.

Several studies have since been conducted on the subject, with some studies confirming or contradicting Kraft-Kraft's conclusion. Glasure (2002), uses a five-variable vector ECM to study the (Granger) causality between economic growth and energy consumption for South Korea. Government expenditure is used as a substitute for government activity, money supply is used as a substitute for monetary policy and prices of oil are also included as an important factor in explaining the causality. The period 1961 to1990 is covered in the study. He provides evidence to support a bi-directional causation, and the oil price is found to have the most significant impact on GDP and energy use. Oh and Lee (2004), also study the relationship between the variables in South Korea, but they covered the period 1970 to1999 in their study. They adopted a system that is more based in the classic production function literature, which is also supported by Stern (1993). Besides energy, labour and capital are also considered to be important factors of production for generating economic growth. They correct for quality improvements in energy by using a mean price weighted log Divisia index to establish the level of energy consumption in the economy. Following Glasure (2002), they also use a vector ECM and provide evidence to support a bi-directional causation between energy and GDP.

Many economists agree that there is a strong correlation between electricity use and economic development. Morimoto .R. and Hope .C. (2001) have discovered, using Pearson correlation coefficient, that economic growth and energy consumption in Sri Lanka are highly correlated. Paul Breshin (2004), said that electricity is vital for driving growth in the energy, manufacturing and social sector. He went further to say that a parallel (positive) growth trend existed between electricity demand and gross domestic product (GDP). According to Simpson E. S (1969), "it is electricity rather than Steam engine, which is driving the developing industries in modern Africa". By implication, He re-emphasizes the fact that electricity drives economic growth. Ageel .A. and Mohammad S.B. (2001), ran a cointegration test on energy and its relationship with economic growth in Pakistan, a developing nation like Nigeria and found that increase in electricity consumption leads to economic growth. Sanchis M. T. (2007), stated that "electricity as an industry is responsible for a great deal of output". She went on to say that electricity had effects not only on factors of production but also on capital accumulation.

Alam M. S. (2006), agrees that there is a departure from neoclassical economics which include only capital, labour and technology as factors of production to one which now includes energy as a factor of production. He went further to say that energy drives the work that converts raw materials into finished products in the manufacturing process. Sanchis M. T. (2007), added that increase in electricity production will avoid the paralysation of the industrial production. This is because increase in industrial production will eventually increase output. Thus, this implies that electricity production should become an economic policy high-priority objective which should be urgently responded to. Energy efficiency is also called ‘efficient energy use’. It is not just about reducing utility bills of energy. It also involves boosting revenue through greater productivity.

Today, economists like Alam M. S. (2006), found out in his work on ‘Economic Growth with Energy’ that not only does energy serve as a factor of production; it also acts as a booster to growth of a nation. Birol (2007), argues that the demand for energy has been on the increase and the unrelenting increase has helped fuelled global economic growth. Yu and Choi (1985), found a positive relationship between energy consumption and economic growth in the Philippines. They went further to define that relationship as a unidirectional one where economic growth served as the dependent variable and energy consumption was the independent variable. There are studies which examine energy by separating it into its sub components such as: electricity and petroleum. Ghosh (2002), examined economic growth and electricity consumption for India between 1950 and 1997. As a result of the study, he found a unidirectional causal relationship from economic growth to electricity consumption. Jumbe (2004), examined the relationship between electricity consumption and GDP for Malawi for the period between 1970 and 1999 and found a bidirectional causal relationship. However, when he examined the relationship between non agriculture GDP and electricity consumption, he found a unidirectional causal relationship from GDP to energy consumption.

Olatunji (2009), conducted an empirical finding on the relationship between energy consumption and economic growth for Nigeria. The study found that there is a unidirectional causality that runs from GDP to electricity consumption. The study also found that GDP granger causes gas consumption. However, the analyses reveal no causality between oil consumption and GDP. In aggregate, the study reveals that energy consumption granger causes economic growth in Nigeria.

Yusuf et al (2012), applied a bound test analysis in investigating the empirical relationship between energy consumption and economic growth in Nigeria. The study examined the impact of energy consumption (electricity, petroleum and coal) on economic growth in Nigeria over the period 1980-2010. The short-run and long-run relationship between energy consumption variables and economic growth were estimated by using the newly developed autoregressive distributed lag (ARDL) approach to cointegration analysis. The results indicated a long-run relationship between economic growth and energy consumption variables. Although, the coefficient of coal consumption was positive but statistically insignificant, while both petroleum consumption and electricity consumption were positive and statistically significant on economic growth. Moreover, the coefficient of error correction model in the study suggests that the speed of adjustment in the estimated model is relatively high and had the expected significant and negative sign.

Harrison (2012), tested the relationship between energy consumption and economic growth for Nigeria and South Africa The paper examined the causal relationship between energy consumption disaggregated into coal, hydro and oil, and economic growth in Nigeria and South Africa. The study adopted the Hsiao's Granger causality analysis. The estimated results reveal that economic growth causes total energy consumption in South Africa while energy consumption causes economic expansion in Nigeria.

Olusanya (2012), examined the long run relationship between energy consumption and economic growth for Nigeria from 1985 to 2010, via ordinary least square method of multiple regression analysis. His results revealed that Petroleum, Electricity are positively related to Nigeria economic growth while coal and Gas shows that there is a negative relationship with Nigerian economic growth. However, the study concluded that increased energy consumption is a strong determinant of economic growth having an implicit effect in lagged periods and both an implicit and explicit effect on the present period in Nigeria.

3. Analytical Framework

3.1 Vector Error Correction Model (VECM)

Due to the properties of most time series, it is customary to perform unit root test on the series in the VAR model. If the series are stationary, then the results obtained from the VAR model are valid. However, if the series are non-stationary, then it becomes imperative to carry out cointegration test to verify whether the series in the VAR model are cointegrated or not. The prominent cointegration test for VAR model is the Johansen System Cointegration test. If the Johansen Cointegration test indicates the existence of cointegration in the model, then the VAR model gives the long run causality which is analogous to the long run relationship in a single-equation model. Similarly, the short run dynamics of the VAR model are captured with the Vector Error Correction Model which is similar to the short run adjustment.

We can therefore specify a quadri-variate VECM model as follows:

$$\Delta RGDP_t=\alpha_1+\sum_{i=1}^{p=2}a_i^{RGDP}\Delta RGDP_{t-i}+\sum_{j=1}^{p=2}\beta_j^{RGDP}\Delta PETC_{t-j}+\sum_{k=1}^{p=2}\gamma_k^{RGDP}\Delta ELEC_{t-k}+\sum_{m=1}^{p=2}\Psi_k^{RGDP}\Delta DNGC_{t-m}+ \varphi_1 ECM_{1-1} + e_{1t} \quad (2)$$

$$\Delta PETC_t=\alpha_2+\sum_{i=1}^{p=2}a_i^{PETC}\Delta RGDP_{t-i}+\sum_{j=1}^{p=2}\beta_j^{PETC}\Delta PETC_{t-j}+\sum_{k=1}^{p=2}\gamma_k^{PETC}\Delta ELEC_{t-k}+\sum_{m=1}^{p=2}\Psi_k^{PETC}\Delta DNGC_{t-m}+ \varphi_2 ECM_{2t-1} + e_{2t} \quad (3)$$

$$\Delta ELEC_t=\alpha_3+\sum_{i=1}^{p=2}a_i^{ELEC}\Delta RGDP_{t-i}+\sum_{j=1}^{p=2}\beta_j^{ELEC}\Delta PETC_{t-j}+\sum_{k=1}^{p=2}\gamma_k^{ELEC}\Delta ELEC_{t-k}+\sum_{m=1}^{p=2}\Psi_k^{ELEC}\Delta DNGC_{t-m}+ \varphi_3 ECM_{3t-1} + e_{3t} \quad (4)$$

$$\Delta DNGC_t=\alpha_4+\sum_{i=1}^{p=2}a_i^{DNGC}\Delta RGDP_{t-i}+\sum_{j=1}^{p=2}\beta_j^{DNGC}\Delta PETC_{t-j}+\sum_{k=1}^{p=2}\gamma_k^{DNGC}\Delta ELEC_{t-k}+\sum_{m=1}^{p=2}\Psi_k^{DNGC}\Delta DNGC_{t-m}+ \varphi_4 ECM_{4t-1} + e_{4t} \quad (5)$$

Where:

RGDP = Real Gross Domestic Product

PETC = Petroleum Consumption

ELEC = Electricity Consumption

DNGC = Dry Natural Gas Consumption

ECM = Error Correction term from a cointegrating equation

α = Constant term

a, β, γ, Ψ = represent the slopes of variables

φ = Speed or rate of adjustment

Δ = is the first difference operator

p = lag length for the Unrestricted Error-Correction Model (UECM)

e = white noise disturbance error term

4. INTERPRETAION AND PRESENTATION OF RESULTS

4.1 Test for Stationarity

The variables for our analysis are subjected to two types of unit roots test to determine their order of stationarity. The tests employed are the Augmented Dickey Fuller test (ADF) and the Phillips-Perron test (PP) test. The null in both the ADF and PP test is the presence of unit root.

Table 1: Unit Root Test Applied to Variables

ADF TEST	PP TEST
ADF TestADFAAADF **Constant** **Constant & Trend**	PhPillips- Perron Test **Constant** **Constant & Trend**
Variable **Coefficient t Decision t Decision** **Statisitc Rule Statisitc Rule**	**t Decision t Decision** **Statisitc Rule Statisitc Rule**
RGDP -0.526331 -	-1.38.953 I(1) -4.942889***

2.378190 **PETC** -3.323327** I(1) - 3.221728*** I(1) **ELEC** -6.838520*** I(1) - 6.738557*** I(1) **DNGC** -6.743776*** I(1) - 6.862218*** I(1)	I(1) -3.383821*** I(1) - 3.088985 I(1) -6.773473*** I(1) - 6.695934*** I(1) -6.743776*** I(1) - 6.841597*** I(1)

Source: Computed by Author

Note: Three, Two and One asterisk denote rejection of the Null hypothesis of a unit root at 1%, 5% and 10% respectively based on MacKinnon critical values.

The ADF and PP results in table 1 show that energy variables in this study and rgdp which is proxied for economic performance are all stationary at first difference. This therefore makes the use of VECM in the study appropriate. This is because for us to run a VECM model, the variables of interest must show stationarity at first difference and be cointegrated in the long run (see table 3 for cointegration). In other words, we can say that the VECM model is only valid if the variables are stationary at first difference. We can then conclude based on the unit root test to a reasonable extent, that the variables are integrated of order 1.

4.2 The Cointegration Analysis of Results

Since the results of the unit root tests above confirm the stationarity of the variables at first difference, we can then apply Johansen methodologies in testing for cointegration. According to the procedure, we must first determine the lag length of the VAR which must be small enough to allow estimation and high enough to ensure that errors are approximately white noise. Using five different information criteria. Based on the VAR lag order selection criteria result presented in table 2, we conclude that the optimal lag length for the variables is one. The uniformity of the conclusions from the Information Criteria in each of the models is worthy of note due to the sensitivity of the Johansen procedure to lag length selection.

Table 2: VAR Lag Order Selection

Criteria

Endogenous variables: RGDP PETC ELEC

GASC

Exogenous variables: C

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Sample: 1980 2010

Included observations: 29

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1022.028	NA	6.32e+25	70.76052	70.94911	70.81958
1	-904.7996	194.0324*	5.96e+22*	63.77928*	64.72225*	64.07461*
2	-890.6345	19.53805	7.26e+22	63.90583	65.60316	64.43741

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

To determine the number of the cointegrating vectors, we make use of both the Trace test and the Maximum Eigenvalue test using the more recent critical values of MacKinon-Haug-Michelis probability value (1999). In the case of the four variables of interest in this study, both tests identify one cointegrating vector at the 5% critical level as presented in table 3. The cointegration in the case of all the variables shows the existence of a long run relationship between the variables.

Table 3: Johansen Co-integration Test

Trace Test	Max-eigenvalue Test

Hypothesized No of CE(s)	Eigenvalue	Trace Statistic	0.05 CV	Prob.	Hypothesized No of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 CV	Prob.
None*	0.722831	64.88458	47.85613	0.0006	None*	0.722831	37.21069	27.58434	0.0022
At most 1	0.471851	27.67388	27.79707	0.0862	At most 1	0.471851	18.51295	21.13162	0.1118
At most 2	0.250598	9.160928	15.49471	0.3507	At most 2	0.250598	8.365902	14.26460	0.3427
At most 3	0.027042	0.795025	3.841466	0.3726	At most 3	0.027042	0.795025	3.841466	0.3726

Source: Computed by Author

Note: *denotes rejection of the hypothesis at the 0.05 level.

From table 3, the trace and Max-eigenvalue test both indicate the presence of one cointegrating equation at the 0.05 level of significance. This therefore means that the VECM approach as adopted in this study is appropriate. This is because for the VECM model to be valid there must be long-run cointegration between the variables; which is very imperative for the determination of a long-run relationship.

4.3 Vector Error Correction Test

Table 4: VECM Result

T statistics in ()

	D(RGDP)	D(PETC)	D(ELEC)	D(DNGC)
D(RGDP(-1))	0.638001	4.62E-05	0.000160	5.35E-05
	(0.37354)	(2.7E-05)	(6.8E-05)	(2.0E-05)
D(RGDP(-2))	1.046144	2.72E-05	0.000103	6.42E-05
	(0.33264)	(2.4E-05)	(6.1E-05)	(1.8E-05
D(PETC(-1))	5360.232	0.338169	-0.136663	0.257960
	(2980.86)	(0.21233)	(0.54408)	(0.15790)
D(PETC(-2))	1482.905	-0.473788	-0.574104	0.108712

	(2014.64)	(0.14351)	(0.36772)	(0.10672)
D(ELEC(-1))	294.364 (1118.12)	-0.038112 (0.07965)	-0.291548 (0.20408)	0.193589 (0.05923)
D(ELEC(-2))	1581.886 (1147.04)	0.052165 (0.08171)	-0.038951 (0.20936)	-0.028080 (0.06076)
D(DNGC(-1))	-20759.90 (8903.05)	0.001179 (0.63418)	-2.819738 (1.62502)	-1.926457 (0.47159)
D(DNGC(-2))	-14380.36 (10228.4)	-0.800331 (0.72858)	0.143690 (1.86693)	-0.782284 (0.54180)
C	-442859.3 (467380.)	-63.01956 (33.2922)	-152.9302 (85.3081)	-93.64478 (24.7570)
ECM	-0.140032 (0.09963)	-1.66E-05 (7.1E-06)	-4.30E-05 (1.8E-05)	-2.35E-05 (5.3E-06)
	D(RGDP)	**D(PETC)**	**D(ELEC)**	**D(DNGC)**
R-squared	0.825123	0.830401	0.446769	0.742595
Adj. R-squared	0.737685	0.745601	0.170153	0.613893
F-statistic	9.436642	9.792522	1.615124	5.769858

Source: Author's Computation.

The VECM model result as shown in table 4, gives the numerical values to the earlier specified equations 2, 3, 4 and 5. From the table, it is obvious that the four models showing the relationship between the variables have a very significant negative intercepts (-α). This means for each of the model, the dependent variables in each equation responds negatively to changes in the lagged explanatory variables at their zero levels in a very significant manner. For the purpose of analysis, the results for model 2 would be analysed. This is because of the significance of the result of the model when compared with the results for other models. Thus, suggesting a unidirectional long run relationship between the variables. Therefore, the intercept for model 2 which shows the dependence of economic performance on energy use has a value of -442859.3. This illustrate that, when lagged rgdp (economic performance) and lagged energy use (petroleum, electricity and dry natural gas consumption) are at zero level, current growth of the economy would be significantly retarded by 442859.3.

The coefficients for the four models show both positive and negative behaviours. Analysing equation 2 coefficients from table 2 shows that, current economic performance is being positively related to its performance in the previous year and the year before. Although this result may not be significant enough, judging from the t-statistics. Furthermore, when economic performance is dependent on energy use; the coefficient shows that energy use such as: petroleum and electricity, for the lagged year and two year lag, significantly affect economic performance in the current period. This result is true since virtually there is rarely no economic activity in the economy that does not depend on electricity and petroleum consumption for its survival. However, use of dry natural gas in the year before and previous two year show a significantly negative relationship with current economic performance. This behaviour can be said to be true because, dry natural gas is the remains after the liquefiable hydrocarbon portion has been removed from the gas stream; and any volume of nonhydrocarbon gases have also been removed where they occur in sufficient quantity to render the gas unmarketable. Thus, dry natural gas is also known as consumer-grade natural gas which is commonly used for cooking.

The lagged ecm values for the four models turn out a general negative coefficient as expected. The negative coefficient of the ecm is necessary because a stable dynamic system must exhibit negative feedback. The error correction mechanism developed by Engle and Granger is a means of reconciling the short-run behaviour of an economic variable with its long-run behaviour. Therefore, for model 2, about 14% distortion is being corrected annually until equilibrium is being attained in the system. Which means it would take about 7 years and 1 month for long run equilibrium to be restored in the system.

Table 5: Short run Causality Wald Test

Dependent variable: D(RGDP)				
Excluded	Chi-sq	D.f	Probability	Conclusion
D(PETC)	5.195733	2	0.0744	Reject null hypothesis*

D(ELEC)	5.723701	2	0.0572	Reject null hypothesis*
D(DNGC)	5.470841	2	0.0649	Reject null hypothesis*
ALL	11.56050	6	0.0725	Reject null hypothesis*
Dependent variable: D(PETC)				
Excluded	Chi-sq	D.f	Probability	Conclusion
D(RDGP)	3.281878	2	0.1938	Do not reject null hypothesis
D(ELEC)	0.984047	2	0.6114	Do not reject null hypothesis
D(DNGC)	2.152476	2	0.3409	Do not reject null hypothesis
ALL	33.73452	6	0.0000	Reject null hypothesis***
Dependent variable: D(ELEC)				
Excluded	Chi-sq	D.f	Probability	Conclusion
D(RGDP)	6.261025	2	0.0437	Reject null hypothesis**
D(PETC)	3.086735	2	0.2137	Do not reject null hypothesis
D(DNGC)	5.684194	2	0.0583	Reject null hypothesis*
ALL	13.52309	6	0.0354	Reject null hypothesis**
Dependent variable: D(DNGC)				
Excluded	Chi-sq	D.f	Probability	Conclusion
D(RGDP)	15.26239	2	0.0005	Reject null hypothesis***
D(PETC)	5.368395	2	0.0683	Reject null hypothesis*
D(ELEC)	13.76884	2	0.0010	Reject null hypothesis***
ALL	33.41889	6	0.0000	Reject null hypothesis***

Source: Computed by Author

Note: Three, Two and One asterisk denote rejection of the Null hypothesis at 1%, 5% and 10% respectively.

Table 5 gives the direction of causality of the variables in the short run. The result is a mixture of individual causality and aggregate causality behaviour for the variables. In the first section, it shows a unidirectional causality from the independent variables to the dependent variable at both the individual and aggregate level. Thus, suggesting a causality flow from energy use to economic performance. The second section shows that even though there is no causality flowing from each explanatory variable to the dependent variable; when the explanatory variables are being taken aggregately, we then have causality from the independent variables to the dependent variable. This correlation can also be applied to the third and fourth sections, but with the addition that the explanatory variables individually granger causes the dependent variables in the third and fourth sections. We can therefore conclude that, there exist bi-directional causality flow between energy uses and economic performance in the short run.

5. CONCLUSION AND POLICY IMPLICATIONS

From the results of the VECM and causality test, we conclude that there is a long run relationship between energy use and economic performance. However, in the short run, a bi-directional causality between economic performance and energy use exist. The result of the short run analysis, runs contrary to submissions in previous studies for the country as shown in the empirical literature of this study.

The policy implications derived from this study are that: before policy makers adopt any strategy to conserve, or to promote energy consumption, the role of energy use should not be neglected in the relationship between energy use and economic performance. Otherwise, such a policy may be detrimental to economic growth. Also any negative shock to energy use in the short run would inversely affect economic performance and vice versa. Infrastructural development that would enhance economic growth and promote efficient energy use should be encouraged. Finally, energy policy aimed at the conservation of energy, should be implemented to promote more efficient use of energy and a reduction in the amount of energy wasted.

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