ENERGY CONSUMPTION AND NIGERIAN ECONOMIC GROWTH: AN EMPIRICAL ANALYSIS

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Abstract

The study evaluates thecausal nexus between energy consumption andNigeria's economic growth for the period of 1975 to 2010. Secondary time-series data were analyzed using co-integration and ordinary least square techniques. Co-integration results show a long run relationship among the variables. The result shows that in the long run, total energy consumption had a similar movement with economic growth except for coal consumption. The empirical results reveal that petroleum, electricity and the aggregate energy consumptionhave significant and positive relationship with economic growth in Nigeria. However, gas consumption although positive, does not significantlyaffecteconomic growth. The impact of coal was negative but significant; therefore this is just the time to increase the use this resource to the nation's benefit. Therefore, the study recommends that government should encourage a level- playing field for all energy forms available in the country by diversifying its power-generation portfolio. Also, the government should continue to collaborate with the private sector within the context of public-private- partnership (PPP) to further exploit the opportunities in the sector in order to increase economic growth.

Keywords : Coal, economic growth, electricity, energy, oil, gas

Introduction

Energy is widely regarded as a propelling force behind any economic activity and indeed industrial production. Therefore, high grade energy resources willamplify theimpact of technology and create tremendous economic growth. High grade resources can act as facilitator of technology while low grade resources can dampen the forcefulness of new technology. Ojinnaka (1998) argued that the consumption of energy tracks with the national product. Hence, the scale of energy consumption per capita is an important indicator of economic modernization. In general countries that have higher per capita energy consumption are more developed than those with low level of consumption.

The importance of energy lies in other aspect of development - increase in foreign earnings when energy products are exported, transfer of technology in the process of exploration, production and marketing; increase in employment in energy industries; improvement of workers welfare through increase in worker's salary and wages, improvement in infrastructure and socio-economic activities in the process of energy resource exploitation. Thus in the quest for optimal development and efficient management of available energy resources, equitably allocationand efficient utilizationcan put the economy on the part of sustainable growth and development. Arising from this argument, adequate supply of energy thus becomes central to the radical transformation of the nation's economy.

In Nigeria, energy serves as the pillar of wealth creation evident by being the nucleus of operations and engine of growth for all sectors of the economy. The output of the energy sector (electricity and the petroleum products) usually consolidate the activities of the other sectors which provide essential services to direct the production activities in agriculture, manufacturing, mining, commerce etc. Nigeria is endowed with abundant energy resources but suffers from perennial energy crisis which has defied solution. The co-existence of vast wealth in natural resources and extreme personal poverty referred to as the "resource curse" or 'Dutch disease' (Auty,1993) afflicts Nigeria. The size of the economy marked by the Gross National Income per capita is put at $1,190 and ranked 162 out of 213 countries in the world development index in 2009 (The World Bank, 2011). On economic growth, the GDP per capita of Nigeria expanded by 132 percent between independence in 1960 and 1969, and rose to a peak growth of 283 percent between 1970 and 1979. The severity of this malaise led to the restructuring of the economyin 1986. In the period 1988-1997 which constitutes the period of structural economic adjustment and liberalization, the GDP responded to economic adjustment policies and grew at a positive rate of 4 percent. In 2006, the real GDP growth rate was 7 percent. The economy when measured by the real GDP, grew by 7.87% in 2010. (National Bureau of Statistics-NBS, 2010 and Central Bank of Nigeria - CBN, 2010).

The average power per capita (in watts)in USA, Japan,South Africa, China, Indiaand Nigeria were 1,363, 774, 496, 397, 85, and 12 respectively. These roughly correlate with the GDP per capita of the countries in 2008 (The World fact book, 2008). Ironically, while Nigerian energy resources, particularly oil, are exported to other countries; itspeople and economy suffer from severe shortages of the same product. This is manifested by the epileptic supply of electricity and perennialshortage of most petroleum products.

The survey of literature shows that most empirical studies focus on either testing the role of energy in stimulating economic growth or examining the direction of causality between these two variables. Although the positive role of energy infrastructure on economic growth has become a stylized fact, there are some methodological reservations about the results from these empirical studies. Some authors have used the autoregressive distributed lags bounds test, two-regime threshold co-integration models, panel data approach and multivariate models. A general observation from these studies is that the literature produced conflicting results and there is no consensus on the existence and direction of causality between energy consumption and economic growth. This paper focuses on the causality between GDP and total energy consumption on one part and each of the basic sub-components of energy consumption in Nigeria with a view to finding out if different sources of energy have varying impact on economic growth.

This rest of study is organized into five sections beginning with section two which is an overview of energy resources in Nigeria. The third section reviews some literatures in the area of study whilst sectionfour involves the methodology adopted for the study. Section five is the analysis and presentation of data. The concluding section summarizes the findings of the study and provides some policy recommendations.

Overview of Energy Resources investment in Nigeria

Nigeria with a population of over 140 million people is endowed with enormous energy resources, such as, petroleum, natural gas, coal, nuclear, tar sand. Others include solar, wind, biomass and hydro.However, development and exploitation of such energy sources have been skewed in favour of the hydro, petroleum and natural gas.At independence in 1960, agriculture was the dominant sector of the economy contributing about 70%. This trend changed with the discoveryof oil in 1970.

The exploitation of the Nigerian energy resources began with coal in 1916. There are nearly three billion tonnes of indicated reserves in seventeen identified coalfields and over

600 million tonnes of proven reserves in Nigeria (Anaekwe, 2010). Following the Nigerian civil war, many coal mines were abandoned and coal production never completely recovered. This is evident by coal production levels becoming erratic as both the resuscitation and maintenance of imported mining equipment proved troublesome (Godwin, 1980). As a result, coal production dropped insignificantly from 50% in 1960 to less than 1% in 1990. This decline in coal production was hastened by the discovery of crude oil in commercial quantities in Otuabagi / Otuogadi, Oloibiri district in Bayelsa state by Shell Darcy on 15 January, 1956. Between 1970 and 1980, petroleum products were cheap and readily available as premium motor spirit (PMS) otherwise known as petrol assumed the role of main source of energy in Nigeria. As a result, all other energy sources were neglected (Oji, Idusuyi, & Kareem, 2012

With proven oil reserves exceeding 9 billion tons, Nigeria is one of the largest hydrocarbon feedstock producers in Africa, and ranks twelfth place worldwide.The country relies heavily on its petroleum industry for economic growth, the sector accounts for about 80% of government revenues and provides 95% of foreign exchange (Iwu, 2008).Nigeria is a member of the Organisation of Petroleum Exporting Countries (OPEC). Also, the countrynatural gas reserves account for 5.2 trillion cubic metres, making it the world’s seventh biggest natural gas reserve.Although, natural gas occur in associated form with crude oil, Nigeria’s gas reserves are three times greater than its oil reserves. The government is committed to increasing gas production for domestic supply as well as for export evident by The Trans-Saharan Gas Pipeline currently in development. This will enable Nigeria to supply the continent of Europe with gas. The country provides 10% of the world’s LNG (Corporate Nigeria, 2012). Despite this potential, gas flaring has continued unabated over the years (Eboh, 1998).

Currently, the Nigerian energy crisis has stymied the socio economic activities of the country which has brought untold hardship on the people of the country. At the moment,the electricity supply in the country does not meet national demand. While the estimated daily power generation was about 3,700MW as at December 2009, the peak load forecast for the same period was 5,103MW. This is based on the existing connections to the grid which does not takeinto accountthe suppressed demand.Also, theprojected electricity demand has been translated into demand for grid electricity and peak demand on the bases of assumptions made for transmission and distribution losses, auxiliary consumption, load factor and declining non-grid generation (Energy Information Administration, 2012). The demand is projected to rise from 5,746 MW in 2005 to 297,900MW in the year 2030 which translates to construction of 11,686MW every year to meet this demand (Sambo, 2008). While the government owned monopoly company (Power Holding Company of Nigeria) has been unbundled, in its stead, three hydro and seven thermal generating, a radial transmission grid (330kV and 132kV); and eleven distribution companies (33kV and below) that undertake the wires, sales, billing, collection and customer care functions within their area of geographical monopoly have been set up. Except for the transmission function, the others have been privatized.

The epileptic nature of electricity has led to scarcity of petrol and kerosene because the citizens have resulted to using generators and kerosene powered equipment to provide energy for use at homes. Also, import content of our domestic fuel usage has grown over the years to about 75% (International Energy Agency, 2012).This has resulted in the use and overdependence on fuel-wood which has led to deforestation and attendant degradation of the environment and worsening desertification (Babanyara & Saleh, 2010).They report an average annual deforestation rate of 2.38% between 1990 and 2000 in Nigeria due in part to the change to the use of wood fuel as a result of hikes in prices of kerosene and cooking gas. Other alternative energy sources including solar, wind, wave are largely underdeveloped in the country. Furthermore, as a result of domestic fuel prices which have gone up several times with attendant upsurge in transport fare and prices of goods and services. Bamikole (2012) reports that industrial capacity utilization has plummeted from 78.7% in 1977 to 30.1% in 1987 before resurgence to 53.3% in 2007 and 53% in 2010.In the next section, a review of the literature is presented.

Literature Review

The literature is beset with studies on the relationship between energy consumption and economic growth.The results of the various test conducted by Yu and Chai (1985) in Philippines found causality from economic growth to energy consumption and from energy consumption to employment without feedback. The major findings of their study infer that economic growth have impact on total energy consumption. Further investigation indicates that economic growth also leads to growth in petroleum consumption. In the case of the gas sector, neither economic growth nor gas sector effect each other. However, in the power sector, it has been found that electricity consumption leads to economic growth without feedback. Finally, that energy consumption also directly causes employment.

Cheng and Lai (1997) applies the Hsiao'a version of the co-integration and Granger causality method, in examining the causality between energy and GNP, and energy and employment to Taiwanese data for the 1955–1993 period. The Phillips-Perron tests reveal that the series with the exception of GNP are not stationary and therefore differencing is performed to secure stationarity. The study finds causality running from GDP to energy consumption without feedback in Taiwan. It is also found that causality runs from GDP to energy but not vice versa. Aqeel and Butt (2001), conducted a study to examine the relationship between the variables in Pakistan and found significant relationship. Ebohon (1996) examines the impact and causal directions between energy consumption and economic growth (proxied by GDP) and reports a simultaneous causal relationship between energy and economic growth for Tanzania. Soytas and Sari (2003) studied the time series properties of energy consumption and GDP and reexamined the causality relationship between the two series in the top 10 emerging markets (excluding China) and G-7 countries. They discover bi-directional causality in Argentina, causality running from GDP to energy consumption in Italy and Korea, and from energy consumption to GDP in Turkey, France, Germany and Japan. Hence, energy conservation may harm economic growth in the last four countries mentioned.

Shiu and Lam (2004) applies the error-correction model to examine the causal relationship between electricity consumption and real GDP for China during 1971–2000. Their estimation results indicate that real GDP and electricity consumption for China are co-integrated and there is unidirectional Granger causality running from electricity consumption to real GDP but not vice versa. Wolde-Rufael (2005) investigates the long run relationship between energy use per capita and per capita real gross domestic product (GDP) for 19 African countries for the period 1971–2001 using Bounds co-integration and the vector autoregressions tests. The results show that there was a long run relationship between the two series for only eight countries and causality for only 10 countries. The quest for rapid industrialization in the opinion of Hall and Reynolds (2007) cannot be achieved without a strong and well developed energy resource base.Energy is a crucial element in the process of achieving sustainable economic development.

Akinlo (2008) in a study of the relationship between energy consumption and economic growth for eleven countries in sub-Saharan Africa used the autoregressive distributed lag (ARDL) bounds test. The study finds that energy consumption is co-integrated with economic growth in Cameroon, Cote d'Ivoire, Gambia, Ghana, Senegal, Sudan and Zimbabwe. Moreover, this test suggests that energy consumption has a significant positive long run impact on economic growth in Ghana, Kenya, Senegal and Sudan. Granger causality test based on vector error correction model (VECM) shows bi-directional relationship between energy consumption and economic growth for Gambia, Ghana and Senegal. However, Granger causality test shows that economic growth Granger causes energy consumption in Sudan and Zimbabwe. The neutrality hypothesis is confirmed in respect of Cameroon and Cote d'Ivoire, Nigeria, Kenya and Togo.

Jhingan (2007) states that the need to identify causal direction between energy consumption and income growth in developing countries is overwhelming because apart from providing further insights into the role of energy in economic development, it provides policy analysts with a clearer understanding of the likely impact of energy supply constraints on economic growth. Esso (2010) investigates the long-run and the causality relationship between energy consumption and economic growth for seven Sub-Saharan African countries during the period 1970–2007. Using the Gregory and Hansen testing approach to threshold co-integration, the study indicate that energy consumption is co-integrated with economic growth in Cameroon, Cote d'Ivoire, Ghana, Nigeria and South Africa. The test suggests that economic growth has a significant positive long-run impact on energy consumption in these countries before 1988; and this effect becomes negative after 1988 in Ghana and South Africa. Furthermore, causality tests suggest bi-directional causality between energy consumption and real GDP in Cote d'Ivoire and unidirectional causality running from real GDP to energy usage in the case of Congo and Ghana.

The investigation of the relationship between the consumption of crude oil,electricity and coalin the Nigerian economy (1970 to 2005) was conducted by Odularu and Okonkwo (2009). Their result obtained after applying the co-integration technique, showed that there exists apositive relationship between period energy consumption and economic growth. However, with theexception of coal,the lagged values of these energy components were negatively related to economic growth. Using a vector error correction based Granger causality test, the examination of the relationship between energy consumption and economic growth in Nigeria (1970 - 2005), Orhewere and Machame (2011) reports a unidirectional causality from electricity consumption to GDP both in the short-run and long-run. Unidirectional causality from gas consumption to GDP in the short-run and bi-directional causality between the variable in the long-run was also reported. A unidirectional causality from oil consumption to GDP is found in the long-run. However, in the short run, no causality was found in either direction between oil consumption and GDP.

Dantama, Umar, Abdullahi, Nasiru (2012) examine the impact of energy consumption on economic growth in Nigeria over the period 1980-2010 using the autoregressive distributed lag (ARDL) approach to co-integration analysis. The results indicate a long-run relationship between economic growth and energy consumption variables exist. Both petroleum consumption and electricity consumption are statistically significant on economic growth but coal consumption is statistically insignificant. Also, the speed of adjustment in the estimated model is relatively high and containsthe expected significant and negative sign.

This survey of the literature has shown diverse results, but the consensus is that the impact of energy on social, economic and welfare development in the country is manifest. The research method is presented in the next section.

Research Methodology

This study employed annual secondary data covering 1975 to 2010. The data wascollected from Central Bank of Nigeria (CBN) and National Bureau of Statistics (NBS). This research adapts the Aqeel and Butt (2001) model which examines the impact of energy consumption on economic growth in Pakistan. The model which consists of six variables (economic growth (GDP), total energy consumption (TEC), petroleum (PT), gas (GS), electricity (ELECT), coal (CO)) is set as follows:

Total Energy

$$\log GDP = \alpha + \beta_1 \log L + \beta_2 \log K + \beta_3 \log TEC \quad (1)$$

Petroleum

$$\log GDP = \alpha + \beta_1 \log L + \beta_2 \log K + \beta_3 \log PT \quad (2)$$

Gas

$$\log GDP = \alpha + \beta_1 \log L + \beta_2 \log K + \beta_3 \log GS \quad (3)$$

Electricity

$$\log GDP = \alpha + \beta_1 \log L + \beta_2 \log K + \beta_3 \log ELECT \quad (4)$$

Coal

$$\log GDP = \alpha + \beta_1 \log L + \beta_2 \log K + \beta_3 \log CO \quad (5)$$

Where:

TEC = Total Energy Consumed

GDP = Gross Domestic Product

ELECT= Electricity

PT = Petroleum

GS = Gas

CO = Coal and Briquette

L = Labour

K = Capital

GDP_t = Gross Domestic Product at time t

TEC_t = Total Energy Consumed at time t

GDP_{t-1} =Gross Domestic Product at time t-1

TEC_{t-1} = Total Energy Consumed at time t-1

The Unit root test for stationarity of the time series data isPrior to the estimation of the model, performed prior to model estimation using both the Augmented Dickey Fuller (ADF) and Phillip Perron (PP) tests in addition to the Johansen co-integration test for long run equilibrium between the variables.

Presentation and Empirical Analysis of Data

Stationary test

The result for the test of stationarity using the conventional Augmented Dickey-Fuller (ADF) and Phillips-Perron tests are presented in Table 1.

Table 1: Result of Unit Root Test

Variables	ADF		PP		Order of Integration
	Level	1st Difference	Level	1st Difference	
LGDP	0.85	-5.62 *	1.20	-5.63*	I (1)
LTEC	-1.76	-4.78 *	-1.76	-5.13 *	I (1)
LELECT	-1.88	-8.230*	-2.15	-8.31*	I (1)
LPT	-1.944	-4.56 *	-2.00	-5.70*	I (1)
LGS	-2.39	-4.92 *	-2.52	-4.89*	I (1)
LCO	-1.26	-6.14*	-1.31	-6.19*	I (1)
LL	1.82	-9.67*	1.88	-12.69*	I (1)
LK	-2.93	-6.65*	-2.85	-6.88*	I (1)

Critical Values

1%	-3.63	-3.64	-3.63	-3.64
5%	-2.95	-2.95	-2.95	-2.95
10%	-2.61	-2.61	-2.61	-2.61

Source: Author's Computation using Eviews 6.0, 2013

Note: *=1% and 5% significance level

All the variables were not stationary in levels in Table 1. This can be seen by comparing the observed values (in absolute terms) of both the ADF and PP test statistics with the critical values (also in absolute terms) of the test statistics at the 1%, 5% and 10% level of significance. But that all the variables were stationary at first difference. We therefore conclude that the variables are stationary and integrated of order one.

Co-integration test

The results obtained from the Johansen co-integration test were summarized in Table 2.

Table 2: Result of Co-integration test

	Trace Statistics				Maximum Eigen-Value Statistics			
	Null	Alternative	Statistics	5% critical values	Null	Alternative	Statistics	5%critical values
HCE(s)*	Eq1	Eq1	206.1638	159.5297	Eq1	Eq1	57.11904	52.36261
HCE(s)*	Eq2	Eq2	149.0447	125.6154	Eq2	Eq2	50.36177	46.23142
HCE(s)*	Eq3	Eq3	98.68297	95.75366	Eq3	Eq3	40.90352	40.07757
HCE(s)	Eq4	Eq4	57.77945	69.81889	Eq4	Eq4	24.43918	33.87687
HCE(s)	Eq5	Eq5	33.34027	47.55613	Eq5	Eq5	14.83579	27.58434
HCE(s)	Eq6	Eq6	18.50448	29.79707	Eq6	Eq6	10.91494	21.13162
HCE(s)	Eq7	Eq7	7.589540	15.49471	Eq7	Eq7	7.582871	14.26460
HCE(s)	Eq8	Eq8	0.006669	3.841466	Eq8	Eq8	0.006669	3.841466

Source: Author's Computation using Eviews 6.0, 2013
Note: HCE(s) = Hypothesized No. of Cointegrating Equationsn(s)
* denotes rejection of the hypothesis at the 0.05 level

As observed from Table 2, there is the possibility that a long run relationship exist between economic growth and other variables used in the model. To determine the number of the co-integrating vectors, we make use of both the Trace test and the Maximum Eigen-value test using the critical values of MacKinon-Haug-Michelis (1999). In this case, both tests identify three co-integrating vector at the 5% critical level. The co-integration in the case of all the variables is for the case where we have no deterministic trend and restricted constant in the co-integrating equation. The assumption of no deterministic trend and restricted constant in the petroleum consumption, gas consumption, electricity consumption, and among others were able to confirm the existence of long run relationships among the variables.

The Impact of Total Energy Consumption on Economic Growth

In table 3, the R-squared value of (0.72) shows that about 72% of the changes in Real Gross Domestic Product (RGDP) can be explained by total energy consumption (TEC), labour and capital.The *F*-statistic (5.13) illustrates that TEC, labour and capital are jointly significant. TEC is significant at 5% significance level in the model (P, 0.03< 0.05). Also, a one (1%) increase in TECwould bring about a 28% increase in RGDP. i.e., a unit increase in btu of energy consumption will lead to a 28% increase in RGDP. The Durbin Watson (1.75) indicates that there is no auto correlation because it is close to 2 meaning that the independent variables are truly independent.

Table 3: **Impact of Total Energy Consumption on Economic Growth**

Dependent Variable: LOG(RGDP)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(LABOUR)	0.294070	0.177511	1.656633	0.0074
LOG(CAPITAL)	0.168892	0.110694	1.525762	0.0669
LOG(TEC)	0.278451	0.129812	2.645031	0.0396
C	3.374345	3.165786	1.065879	0.2945
R-squared	0.724810			
Adjusted R-squared	0.701511			
S.E. of regression	0.412471			
Sum squared residue	5.444222			
Log likelihood	-17.08043			
F-statistic	5.131366			
Prob(F-statistic)	0.005196			
Mean dependent var	11.48826			
S.D. dependent var	0.479978			
Akaike info criterion	1.171135			
Schwarz criterion	1.347082			
Hannan-Quinn criter.	1.232545			
Durbin-Watson stat	1.756416			

Source: Author's Computation using Eviews 6.0, 2013

In table 4, the R-squared value of (0.89) shows that about 89% of the changes in Real Gross Domestic Product can be explained by petroleum consumption, labour and capital.The F-statistic (8.26) illustrates that petroleum consumption (PT), labour and capital are jointly significant. The PT is significant at 5% significance level. The Durbin Watson (1.82) indicates that the independent variables are truly independent

Table 4: **Impact of Petroleum Consumption on Economic Growth**

Dependent Variable: LOG(RGDP)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(LABOUR)	0.190166	0.165608	1.148291	0.0594
LOG(CAPITAL)	0.074049	0.105829	0.699706	0.4892
LOG(PT)	1.281353	0.372216	3.442495	0.0016
C	1.268605	2.784442	0.455605	0.6518
R-squared	0.886436			
Adjusted R-squared	0.833602			
S.E. of regression	0.376835			
Sum squared resid	4.544158			
Log likelihood	-13.82761			
F-statistic	8.260493			
Prob(F-statistic)	0.000327			
Mean dependent var	11.48826			
S.D. dependent var	0.479978			
Akaike info criterion	0.990423			
Schwarz criterion	1.166369			
Hannan-Quinn criter.	1.051833			
Durbin-Watson stat	1.822702			

Source: Author's Computation using Eviews 6.0, 2013

In table 5, about 73% of the changes in Real Gross Domestic Product can be explained by gas consumption, labour and capital. Although the F-statistic (4.66) shows that gas consumption (GS), labour and capital are jointly significant gas is not significant at 5% significance level.

Table 5: Impact of Gas Consumption on Economic Growth

Dependent Variable: LOG(RGDP)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(LABOUR)	0.292338	0.185339	1.577314	0.1246
LOG(CAPITAL)	0.195021	0.112334	1.736079	0.0922
LOG(GAS)	0.188455	0.100575	1.873776	0.0701
C	3.357707	3.243389	1.035247	0.3083
R-squared	0.734083			
Adjusted R-squared	0.708841			
S.E. of regression	0.418754			
Sum squared resid	5.611349			
Log likelihood	-17.62469			
F-statistic	4.660840			
Prob(F-statistic)	0.008198			
Mean dependent var	11.48826			
S.D. dependent var	0.479978			
Akaike info criterion	1.201372			
Schwarz criterion	1.377318			
Hannan-Quinn criter.	1.262782			
Durbin-Watson stat	2.065360			

In table 6, the electricity consumption (ELECT) is statistically significant at 5% as reported in Table 6 with a positive relationship with Real Gross Domestic Product (RGDP). A unit increase of kilowatts hours of electricity consumed will lead to a 42% increase in real gross domestic product (RGDP).As income increases, consumption of electricity increases.The Durbin Watson (1.83) indicates that there is no auto correlation because it is close to 2. The absence of auto correlation shows that the independent variables are truly independent

Table 6: Impact of Electricity Consumption on Economic Growth

Dependent Variable: LOG(RGDP)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(LABOUR)	0.158308	0.160320	0.987453	0.3308
LOG(CAPITAL)	0.194945	0.097268	2.004209	0.0536
LOG(ELECT)	0.422376	0.108105	3.907103	0.0405
C	3.920196	2.749967	1.425543	0.1637
R-squared	0.877150			
Adjusted R-squared	0.828133			
S.E. of regression	0.362968			
Sum squared resid	4.215866			
Log likelihood	-12.47784			
F-statistic	9.734359			
Prob(F-statistic)	0.000103			

Mean dependent var	11.48826
S.D. dependent var	0.479978
Akaike info criterion	0.915435
Schwarz criterion	1.091382
Hannan-Quinn criter.	0.976846
Durbin-Watson stat	1.839861

Source: Author's Computation using Eviews 6.0, 2013

In table 7, the coal consumption (CO) is significant at 5% significance level as depicted in Table 9. About 76% of the changes in RGDP can be explained by coal consumption, labour and capital.The Durbin Watson (1.90) indicates that there is no auto correlation because it is close to 2. The absence of auto correlation shows that the independent variables are truly independent. In addition, coal consumption has a negative relationship with RGDP. Indeed, a one (1%) increase in Coal Consumption (CO) would bring about a 19% decrease in real GDP. Put differently, a unit increase in a ton of coal consumed will lead to a 19% decrease in real gross domestic product. In the next section we discuss the implications of the findings.

Table 7: Impact of Coal Consumption on Economic Growth

Dependent Variable: LOG(RGDP)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(LABOUR)	0.232454	0.154707	1.502537	0.1428
LOG(CAPITAL)	0.351388	0.108205	3.247429	0.0027
LOG(COAL)	-0.194177	0.051807	-3.748082	0.0007
C	4.447284	2.825602	1.573925	0.1253

R-squared	0.763328
Adjusted R-squared	0.713015
S.E. of regression	0.367735
Sum squared resid	4.327318
Log likelihood	-12.94751
F-statistic	9.208924
Prob(F-statistic)	0.000154
Mean dependent var	11.48826
S.D. dependent var	0.479978
Akaike info criterion	0.941528
Schwarz criterion	1.117475
Hannan-Quinn criter.	1.002938
Durbin-Watson stat	1.901907

Source: Author's Computation using Eviews 6.0, 2013

Conclusion and Recommendations

This research established direct and positive relationship between the five variables (total energy consumption, petroleum consumption, gas consumption, electricity consumption, and coal consumption) and the growth of Nigeria's economy. In effect, increased energy consumption is a strong determinant of economic growth in Nigeria and should therefore be given more relevance by exploiting the opportunities in the sector to increase economic growth. From the findings in the previous section, a 1% increase in the aggregate consumption of energy, gas, electricity would lead to a rise of about 28%, 18% and 42% in the real Gross GDP. However, the relationship between consumption of coal consumption and economic growth is negative. In fact, 1% increase in coal consumption would lead to 19%reduction in real GDP.

Unarguably, the most singular impediment to the attainment of Nigeria's vision to become one of the 20 developed economies in 2020 is power because of the direct bearing it has on other economic indicators like unemployment rate and low capacity utilization in the manufacturing sector. Although, the overall picture reveals availability of enormous energy resources in the country which far exceed energy requirement of the country. However most of these resources are underutilized particularly natural gas. This suggests that Nigeria's energy problem is not a lack of it, but its development and utilization. Therefore, policy reforms should focus on encouraging a level-playing field for all energy forms. It should also in the spirit of economic liberalization fully deregulate the power sub-sector of the economyto allow for private sector participation in the generation, transmission and distribution of electricity. Also, improvement in the performance of electricity supply should be vigorously pursued. This is because it would affect energy use pattern and ultimately affect GDP when those who depend on more expensive alternatives (petrol and diesel generators) now depend on public power supply.The consensus is that the impact of energy on social, economic and welfare development in the country is manifest. However, each country is enjoined to formulate appropriate energy policies taking into cognizance of her peculiar condition in order to promote economic growth.

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