Energy Sector is critical to Nigeria Growth and Development: Perspective to Electricity Sub-sector in Nigeria

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ABSTRACT

This study explored empirically the 'Energy Sector as a Critical Sector to Nigeria Economic Development: With Perspective to Electricity Subsector' the study covers the period of 1981 2011. The study is borne out of the curiosity to determine the importance of electricity to the socio-economic development in Nigeria having relegated its role as "electricity is just an intermediate input". The research takes analytical/quantitative dimension; the quantitative technique is used in analyzing times series data on per capita GDP of Nigeria, Gross Capital formation as proxy of Capital, Post Secondary School Enrolment as proxy of Labour and Electricity consumption. Restricted Error Correction model (VAR) is used with the aid of Econometrics View Package (E- view). The study reveals that the long run relationship that exists between real gross domestic product (PCGDP) a proxy of economic growth/development and electricity consumption is not significant, while, there is existence of short run causality between electricity consumption and economic growth. Further investigation using Granger causality analysis reveals that the two variables granger causes one another. Attempt was made to analyse the Electricity Transmission Mechanism with respect to different subsectors of the economy as it is translated to economic development in the long run, if the sector is properly harnessed. This then bring the study to the conclusion that electricity is not just an intermediate input or resources of satisfying domestic needs alone but it is 'a critical sector to economic development most especially to developing country like Nigeria'. Therefore necessary recommendations were made as a way forward to achieve the impressive, sustainable growth and inclusive development.

1 INTRODUCTION

Access to modern energy is assumed to be a precondition for poverty alleviation, sustainable development and the attainment of the millennium development targets. According to Salam (2006) energy is the indispensable force driving all economics activities. Ekpo (2013) stressed that the positive multiplier effect of constant power supply cannot be overemphasized

Furthermore, the need to determine the relationship and the impact of electricity on economic growth derives from the increasing realization of the importance of energy to the economic development of a nation. This has led many to question the conventional neoclassical production function analysis where land, labour, capital are recognized as the main factors of production. This analysis has been extended to include an energy variable (Romer, 2009). However, the magnitude of energy influence in the economy has been hotly debated by the macro economists. Consequently, efforts have been made to discover the exact relationship between energy and the other factors of production as to whether energy complements or substitutes other factors of production.

The benefits of energy to commercial, transportation, industrial and household cannot be over emphasized. Hence, an impressive performance of Gross Domestic Product (GDP) is driven by the effective supply and consumption of energy. As a key component of national sector, energy (electricity) is the major sources of advancement and improvement in the standard of living of the people by stimulating other sectors like health, education, agriculture, commerce, transportation and industries etc. Emphasis has been shifted to energy (electricity) as factor input with the economic important of stimulating economic growth which if sustained with the manifestation of desirable changes will bring about socio-economic development of Nigeria. At individual level, increased in energy consumption is likely to be one of the most important causes of improvement in welfare of the people. At national Level, in this period of the digital economy, it is not possible to envisage development without the use of modern energy (Worlde Rufael, 2006).

It is important to note that electricity energy is vital for economic growth and quality of life not only because it enhances productivity of Labour, Capital and other factors of production. But, the fact that increased in energy consumption indicates the high social - economic status of the nation’s concern (Adebola, 2011). In Nigeria reverse is the case, where for instance the estimated population of 160 million rationing between 3000 MW to 6000 MW of electricity supply, while the country with estimated population of 5.5 million like Libya has generating capacity of 4600 MW, United Arab Emirate (UAE) with the estimated population of 4 million has generating capacity of 4740 MW, and South Africa of estimated population of 44million with electricity generating capacity of 46000MW. (Adenikinju, 2010)

Despite the efforts of Federal Government of Nigeria to generate power capacity that will sustain the economy having recognized its importance to drive the economy to acme level, electricity supply in Nigeria is yet to be consistent i.e. it remains epileptic despite the unbundling. This has constituted a great impediment to the electricity consumption which is required to drive the economy. Electricity as a key infrastructure plays crucial role in advancing the development in economy by interacting with the other sectors. It is significant to note that any shock in the energy sector affects the level of productivity, profitability, income and employment opportunity and this is inadvertently link with national security, citizen safety, social order and health of the people who live in Nigeria (Uduma, 2009). As a result of this, Ekpo (2013) emphasized that government should redouble its efforts in ensuring that power failure become history; no economy develops with generating sets.

The latest giant stride by FGN to ensure adequate energy consumption to run the economy is indicated by the Federal Government investing $3.7 billion to improve the power transmission so as to wheel 20,000 MW (Punch, May 2013).

However, it is instructive to note that those huge investments have not improved the situation of power supply in Nigeria. Rather than witness any improvement the power generation capacity is worsening. For instance official records showed recently that power generation capacity suffered a significant decline from 4517 MW recorded last December 2012, to a miserable level of 3300 MW in the middle of April 2013 before the 6 private generation and 9 private distribution company took it up on October 2013. The broad objective of this study is to determine how critical the energy sector (electricity) is to development in Nigeria. This will be done through the analysis of the impact of electricity consumption on economic growth (GDP) in Nigeria. This research is significant because it tries to determine the impact of energy sector, electricity to be specific on economic development in Nigeria in a multivariate framework that includes the conventional determinants of economic growth which are capital and labour. So, this will have economic implications that will be useful for policy making.

In the light of the above, policy makers will benefit largely from the study in their quest to determine the nature of relationship between energy consumption and development in Nigeria. Accordingly, this work is vital because it will assist institutions like NERC, new private generation & distribution companies and governments to ensure pro active measures in the supply of electricity to promote higher productivity and improved welfare which will engender economic development. The study will cover the period between 1980 and 2012. The time frame chosen for the analysis is based on the availability of data from various sources. The study is structured into five sections: Chapter two deals with literature review which reviews the relevant existing literature on the research topic and electricity contribution to the development of the economy. Chapter three consists of research methodology used for the research study. Chapter four presents the result obtained from estimation and also the interpretation of the result. Chapter five deals with the summary, conclusion of the research study and policy recommendation is also provided.

2 LITERATURE REVIEW

The objective of this section is first, to examine systematic review of some of the empirical studies on electricity and economic development in Nigeria which has elicited a wide variety of analytical perspective among researchers, academics and policy makers.

2.2 Empirical Review

The pioneer study of the relationship between energy consumption and economic growth was the seminal work of Kraft and Kraft (1978). As noted by Alero and Ibrahim (2012); Akinlo (2008) Adebola (2011); Mohammed et al. (2011); Saibu and Jaiyeola (2013); Soytas (2009); Mustafa Balat (2008); Akinlo (2008); Ebohon (1996), most of these works have several similarities, but with conflicting results. The obvious similarities are the utilization of time series and causality test to investigate the relationship and the impact of electricity sector to economic development.

Kraft and Kraft (1978) in the study of energy consumption and economic growth of USA which covered from 1947-1974 employed standard granger causality test and discovered that there exists unidirectional relationship running from GDP to energy consumption. Another time series study by Ebohon (1996) on energy consumption, economic growth and causality in developing countries which has Nigeria and Tanzania as its scope with data from 1960 - 1984, employed regression and granger causality test found that complementary relationship exist between energy consumption and economic growth. It stated further that causality between energy consumption and economic growth is not instantaneous but the causality between economic growth and energy is instantaneous. Furthermore, Mohammad et al. (2011) in their study on dynamic modeling of causal relationship between energy consumption, CO_2 emission and economic growth in India with the data covering 1971 to 2006 confirmed the existence of bidirectional granger causality between energy consumption and income in any direction in the long run.

Investigative study of Soytas and Ramazan (2007) on energy consumption, economic growth and carbon emissions: challenges faced by an EU candidate member. Turkey was focused on in the study. And the investigation employed the long run granger causality perspective in a multivariate framework uncovered that carbon emissions seems to granger cause energy consumption, but the reverse is not true. The lack of long run causal link between income and emissions implying that to reduced carbon emissions, Turkey does not have to forgo economic growth.

Similar study of Saibu and Jaiyesola (2013) on the energy consumption carbon emission and economic growth in Nigeria: implication for energy policy and climate protection in Nigeria. The study adopted a dynamic methodology of the form of granger causality and dynamic regression model which came up with the conclusion that there is causal relationship between oil production, carbon emission from gas flaring and economic growth in Nigeria, more importantly carbon emission contributed an impediment to sustainable economic growth in Nigeria.

Apergis and Payne (2009) in the study of the relationship between energy consumption and economic growth, conducted on group of common wealth of independent state, employed panel cointegration and panel causality test unfold that both energy consumption and economic growth cause carbon dioxide emission in the short run. In the long run there appears to be a bidirectional causality running between energy consumption and carbon emission. Tsani (2010) worked on the energy consumption and economic growth: a causality analysis. Has Greece as the scope of study employed the Toda and Yamamoto (1995) granger causality test. Then investigation revealed that at aggregate level of energy consumption empirical findings suggest the presence of unidirectional causal relationship running from total energy consumption to real GDP at disaggregated level.

Presely and Babette (2012) in causal relationship between energy consumption and economic growth in Liberia engaged parametric and non parametric granger causality approach, and the study found the evidence of distinct bidirectional granger causality between energy consumption and economic growth. Further work covering the region was the investigative study on energy consumption and economic growth: evidence from the economy of 15 ECOWAS countries conducted by Nadia (2012) employed the 3 stage approach consist of panel unit root test, panel cointegration and granger causality. The result shows that GDP and energy consumption as well as GDP and electricity moves together in the long run. Testing the causality using panel based error correction models, it revealed that causality is running from GDP to energy consumption in the short run and from energy consumption to GDP in the long run.

Wolde – Rufael (2005) documented from the research study on energy demand and economic growth: African experience, which covered the period between 1971 and 2001 with 19 African countries using the bound test approach, the evidence of a long run relationship for only 8 of the 19 countries and causality for 12 countries. It shows that past values of economic growth have a predictive ability in determining the present value of energy consumption. And, past value of energy consumption have a predictive ability in determining the present value of economic growth. There were feedback income African countries while there was a lack of causal relationship for others.

Similar study in Africa, Eggoh (2011) in his study of energy consumption and economic growth: revisited in Africa countries with 21 African countries as the scope of study covering the period 1970 to 2006, using the panel analysis points out that there is long run equilibrium relationship between GDP, energy consumption. It was found that decreasing energy consumption decrease growth and vice versa.

It is revealed from the empirical review so far that there are four possible relationships on the link between energy consumption economic growths. A unidirectional causality running from real economic growth and energy consumption interpreted to mean that the country is not entirely depend on energy consumption for its economic growth. And unidirectional relationship running from energy consumption to economic growth denotes an Energy-Dependent Economy such that energy consumption is a prerequisite for economic growth. In such a case inadequate provision and consumption of energy may limit economic growth or lead to poor economic performance. The situation where there is no relationship or causality between energy consumption and economic growth known as Neutrality Hypothesis implies that policies to promote reduction in energy consumption would not have effects on economic growth. Finally, the Feedback Hypothesis suggests that energy consumption and growth are interrelated and complement each other. The condition that is applicable to Nigeria will be revealed by systematic and scientific investigation of this discourse before going ahead to discuss how the sector is critical to the economic development of Nigeria in section 4 of this study.

Having empirically reviewed the related work, it is worthwhile to point out that the studies so far provide mixed and conflicting evidence with respect to energy consumption and economic growth. This divergent can be attributed to different factors i.e variable choices, estimation techniques, time frame with quantity and quality of data used and developmental stage of different economies. It is also relevant to observe that the majority of the past work in the area of analysis of impact of energy (electricity) on economic growth neglected the conventional or prime determinant of economic growth in the estimation model there by leading to the bias result due to the omission of variables.

2.3 Electricity Power Sector in Nigeria

It is important to know that electric generation in Nigeria began in 1898 when the first generating plant was install in Lagos, under jurisdiction of public works and transport, though the Nigeria electricity supply company (NESCO) commenced operations as an electricity company in Nigeria in 1929 with the construction of hydro electric power station at Kura near Jos, plateau state. Since then it has undergone many reforms in trying to connect every part of the country to the national transmission grid. In 1972, it was renamed Nigeria Electricity Power authority (NEPA).

The law that established NEPA gave her the power to develop and maintain an efficient, coordinated economic system of electricity supply throughout the country. As part of the restructuring, the electricity power sector reform Act 2005 was enacted.

The reform Act paved way for the unbundling of PHCN into 18 companies: 1 Transmission Company, 6 generating companies, and 11 distributing companies. The generating company are made up of 2 hydro and 4 thermal (gas based) stations. Of recent, PHCN has an installed capacity of about 6000 MW through a number of hydro (Kainji, Jebba and Shiroro) and thermal stations (Egbin, Ughelli, Afam, Sapele). The transmission voltage levels are 330 KV for the grid transmission: 132KV for the transmission lines, whilst the 33KV, 11 KV and lower voltage constitute the distribution networks. The system normal frequency is 50Hz. Most of these electricity plants are underutilized or not functioning (Emeka 2010).

This is in supported of the view of Okafor (2007); Adeoghe (2010); Iwayemi (2008), to mention a view that only 40% of Nigeria has access to electricity. However, majority of the electricity is supplied to the urban areas. It was stated that the country consumes less than 20 per cent of its required capacity. With an increased in and diversification of economics activities, energy demand is rising but yet, electricity supply is relatively stagnant. It is therefore obvious that electricity demand is far above its supply which is an indicator of potential economic growth.

The essence of electricity in a nation is one so pertinent that generating set is owned by most Nigeria where electricity is in short supply, rational use of energy has been professed as a measure to enhance consumption of electricity. In recognition that the problem of power supply is a challenging one scuttling socio-economic activities across the country, the civilian administration in Nigeria since its advent in 1999 started making huge investments in the energy sector However, existing power stations and their installed capacities as shown on Table are: Oji Thermal Station, Enugu State (30MW); Delta thermal, Delta state (900MW); Ijora Thermal Lagos state (60MW); Sapele Thermal, Delta State (1020MW); Kainji hydro, Niger state (969MW); Egbin Thermal, Lagos State (1320MW) and Shiroro Hydro, Niger state (600MW). Whit the installed capacity of about 6000megawatts, the country's electricity generation hovers between 3000 to 4000 megawatts. Available records show that the government has set 10000 megawatts targets to be achieved by the end of 2015 as it has invested in new power projects that has been privatized to six generation companies and nine distribution companies with the existence of Nigeria Electricity Regulation Commission (NERC) in October, 2013. The Distribution Companies are:

1) Sahelian - Kano

2) Kahn Consortim - Abuja Disco

3) Aura Energy - Jos

4) West Power Gas – Eko

5) 4 Power Consortium – Port Harcourt

6) Intergrated Energy - Ibadan & Yola

7) NEDC/KEPCO – Ikeja

8) Interstate – Enugu

9) Vigeo - Benin

The Generation Companies are

1) Mainstream Energy – Kainji & Jebba Gencos
2) North South – Shiroro
2) Transcorp – Ughelli
4) Wood Rock – Ughelli
5) Amperion – Geregu
6) NEDC/KEPCO – Ikeja.

Table 1: Old power plants and generation capacities.

Station	Type	Inauguration Date	Installed Capacity MW	Current Output MW
Oji	Thermal	1956	30 MW	-
Delta	Thermal	1966-1999	900 MW	366 MW
Ijora	Thermal	1978	60MW	-
Sapele	Thermal	1978-1981	1020 MW	62 MW
Kainji	Hydro	1968-1978	760 MW	445 MW
Jebba	Hydro	1983-1984	578.4 MW	339 MW

Afam	Thermal	1978-1982	969 MW	85 MW
Egbim	Thermal	1985-1987	1320 MW	241 MW
Shiroro	Hydro	1989-1990	600 MW	281 MW

Source of: Okafor (2007) citing Aster and Agbor (2007)

Table 2: Seven New Federal government power projects in the Niger Delta

S/N	Power station	State location	Units	Total output	Commissioning dates
1	Odukpani, Cal	Cross River	3	561 MW	July 2007-Nov. 2007
2	Egbema	Imo	3	238 MW	July 2007-Dec. 2007
3	Ihovobor	Edo	4	451 MW	June 2007-sept.2007
4	Gbarian/ubie	Bayelsa	2	225 MW	June 2007-sept.2007
5	Sapele	Delta	4	457 MW	May 2007-Dec.2007
6	Omoku	Rivers	2	230 MW	December 2007
7	Ikot Abasi	Akwa Ibom	3	300 MW	Yet to be awarded
	Total Output			2562 MW	

Source: Agbo and Aster (2007) in Okafor (2007)

Table 2 depicts the Nigeria's National Integration power plant (NIPP). These projects (Mambilla Plateau Hydropower station inclusive awarded in 2007) by the Federal government are directed towards establishing a sustainable electric power industry, develop capacity to reliable transmit and distribute the increase generation and develop a medium term investment plan for the sector.

2.4 The Nigeria Power Reform Act (2005)

Ishola (2005) explicitly explains that power sector reforms is being pursued in many countries on the promise that a reformed system would be more efficient and effective in addressing power demand and meeting the sustainable development agenda. According to the World Bank (1994) power sector reform seeks to improve performance, supply side efficiency and demand side efficiency. Considering the usefulness of electricity which is the ability to improve the social status through facilitates provision of basic needs such as health, education, food and water source of employment, yet many developing countries enjoy significantly low levels of electrification. In view of this electricity status in Nigeria, a successful reform needs to ensure universal access to reliable electricity.

Prior the year 2000, electricity sector has experienced no meaningful reforms in the sector since 1896, the first recorded electricity generation in Nigeria, and 1972, the period of amalgamation of electricity company of Nigeria (ECN) and Niger Dams Authority (NDA) into National Electricity Power Authority (NEPA.). Electricity reform in Nigeria is the critical approach to realization of effective generation, transmission and distribution of power. Immediately after the inauguration of the democratically elected civilian administration in 1999 led by President Olusegun Obasanjo, Electric Power Sector Reform Implementation Committee (EPIC) was inaugurated by National Council on Privatization (NCP) to recommend measures for sector reforms, promote policies goals of liberalization, competition and private sector led growth (Banwo and Ighodalo, 2006).

The Federal Government reforms agenda was informed by the following objectives:

I. To reduce the business operation cost in order to attract new investment through provision of quality and dependable power supply to the economy for industrial, commercial, and socio- domestic activities in Nigeria
II. To meet the growing demand for stable and reliable power required in small and medium business sectors.
III. To meet the desires and needs to be up to global standard in power generation and power consumption.

Reform is seen as the best option to change this poor power sector status in recognition of its importance to the development of Nigeria.

Disaggregation of Electricity Consumption

Table 3 shows that the total electricity consumption in megawatt per hour and the various sectoral decompositions. Electricity utilization by the industrial sector has been fairly static because of the unreliability nature of the public electric supply system in the country. As a result many companies have found solution to the persistent power failure by acquiring their private generating set as a source of electricity supply leading to a huge transfer costs on their products and their services. It is important to point out that except for the periods between 1970 and 1977 where industrial sector was leading in electricity consumption, residential sector had remained the largest consumer of electricity in Nigeria. Chuks (2011), observe for many years now electricity consumption by industrial sector has been decreasing while electricity consumption by residential sector is increasing.

Table3 Electricity Consumption (Mega watts per Hour)

Year	Total consumption	Industrial	% ind.	Commercial	% Comm.	Residential	Total %
1970	145.3	91.4	62.9	-		53.9	37.1
1971	181.1	114.9	63.5	-		66.2	36.5
1972	211.1	138.2	65.5	-		72.9	34.5
1973	232.7	146.1	62.8	-		26.6	37.2
1974	266.7	163.2	61.1	-		103	38.7
1975	318.7	200.4	62.9	-		118.3	37.1
1976	369.8	214.6	58	-		155.2	42
1977	435.7	253	58.1	-		182.7	41.9
1978	504.4	157.7	34.8	95.5	18.5	253.2	77.9
1979	460.1	190.3	37.2	77.9	16.9	221.9	48.2

1980	538.9	199.7	38.4	94.1	17.5	243.1	45.3
1981	333.9	121	30.2	21.3	21.3	193.6	48.4
1982	685.6	262	38.4	79.1	11.6	344.5	50.6
1983	696.7	254.4	36.3	84.3	12.1	358.	51.4
1984	625.5	217.2	34.7	81.7	18.1	326.6	56.6
1985	717.4	259.8	36.2	85.6	11.9	472	54.9
1986	841.8	280.8	33.3	84.7	10.1	476.6	52
1987	852.9	294.1	34.5	90.2	10.6	468.6	53.6
1988	853.5	391.1	34.1	118.6	11.9	443.8	50.7
1989	976.8	257.9	26.4	195.3	20	523.6	48.5
1990	896.5	230.5	25.6	217.6	24.2	450.8	48.5
1991	946.6	253.7	26.8	254.1	26.8	459.3	51.9
1992	993	245.3	24.7	266.1	27.3	481.6	52.5
1993	1141.4	237.4	20.8	311.6	28	572.4	51.9
1994	1115	233.3	21.3	306.7	26	575	52.5
1995	1050.90	218.9	20.3	279.6	27.1	552.6	51.3
1996	1033.30	235.3	22.8	200	26.2	518	50.1
1997	1009.60	236.6	23.5	264.5	26.1	508	51.4
1998	972.6	218.9	22.6	253.9	26.1	500	51.5
1999	883.7	191.8	21.7	236.8	26.8	455.1	51.5
2000	1017.30	223.8	22	274.7	27	518.8	51
2001	1104.7	241.9	21.9	298.3	27	565.5	51.1
2002	1271.60	146.2	11.5	372.6	29.3	752.8	59.2
2003	1519.50	196	12.9	417.9	27.5	905.8	59.6
2004	1825.80	398.	21	459.3	26	938.5	51.4
2005	1873.1	182.3	9.7	496.6	26.5	11994.5	63.8

Source: CBN statistical Bulletin, 2009

Comparative Analysis of Generation of Electricity in Nigeria with selected countries

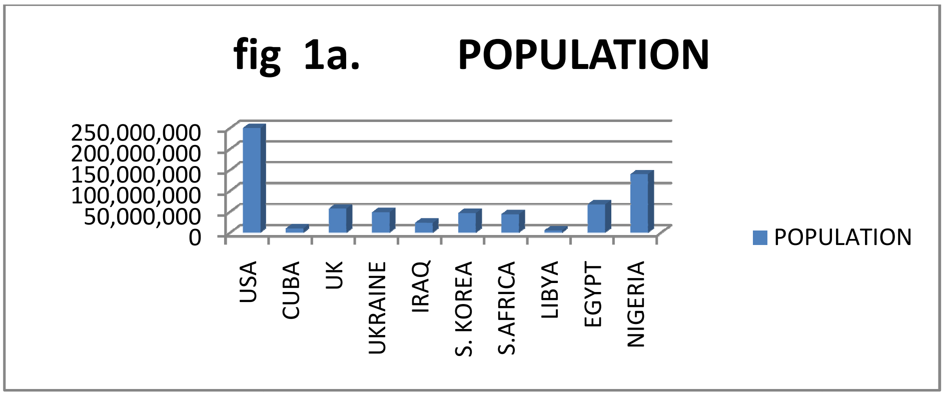
The information in the tables and graphs shows a comparative analysis of consumption of electricity worldwide. It is glare from the graph that Libya with population of only 5.5 million has generating capacity of 4600 MW approximately the same with Nigeria which has population of over 140,000,000 (Okafor, 2007). South Africa with population of 44.3 million has a generating capacity of 44,000MW almost eleven times of Nigeria that has almost three times population of South Africa. Study has shown that electricity consumption in Nigeria is among the lowest in the world and lower than other African countries. The rule of thumb according to Jonathan (2010) is that for any country that wants to industrialize, there is need for at least 1000 MW of electricity generation and consumption is required for every 1 million head of population. From this fact the approximations of Electricity required by Developing country like Nigeria can be made by this method of international Comparison.

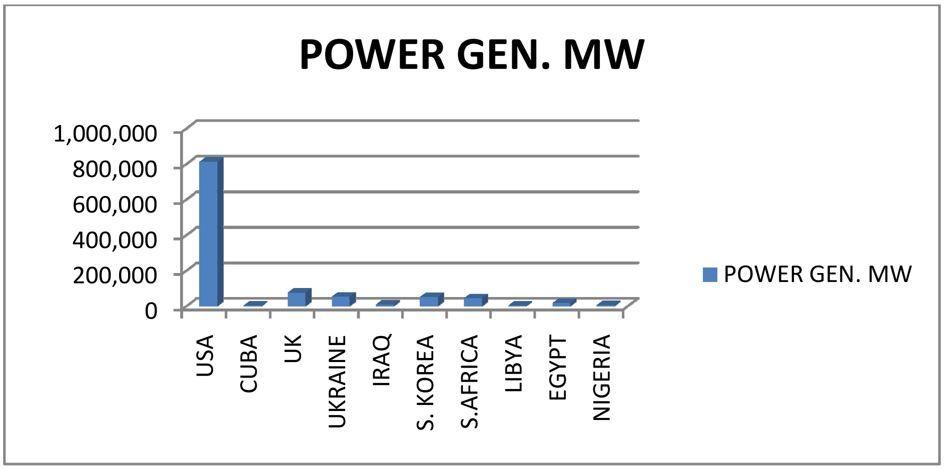
Energy required in Nigeria = $\frac{\text{140,000,000 POPULATION}}{\text{1000MW}}$ = 140,000 MW

Table 4 Comparative Analysis of Generation of Electricity in Nigeria with Selected Countries.

Country	Population	Power Generation	Per capita Consump.
United States	250 Million	813,000 MW	3.20 KW
Cuba	10.54 Million	4000MW	0.38 KW
United Kingdom	57.5 Million	76,000MW	1.33KW
Ukraine	49 million	54,000MW	1.33KW
Iraq	23.6 Million	10,000MW	0.42KW
South Korea	47 Million	52,000MW	1.09 KW
South Africa	44.3 Million	45,000MW	1.015KW
Libya	5.5 Million	4000MW	1.015 KW
Egypt	67.9 Million	18,000MW	0.265KW
Nigeria	140 Million	4000MW	0.03KW

Source: Okafor, 2007.





Source: Constructed by researchers

3 Methodology

This section discussed the theoretical framework of the study, model estimation procedure, technique and specification, sources, scope of the study on the electricity and economic growth in Nigeria.

3.1 Theoretical Framework

This study is anchored on the theoretical framework of Robert Solow (1956) who in his celebrated work of the core factors influencing economic growth isolated a key exogenous factor which significantly impact growth potential among economies. The Solow model focuses on four variables: Output (Y), Capital (K), labour (L), and “knowledge” or the effectiveness of labour (A). At any point, the economy has some of amount of capital, labour and knowledge Romer (2009). These are combines to produce output. The production function takes the form:

$$Y(t) = f(K(t), A(t), L(t)) \qquad \textbf{(3.1)}$$

Y (t) = output at time t, K (t) = capital at time t, L (t) = labour at time t, A(t) = knowledge at time t.

The intensive production function assumed that Inada condition is satisfied.

$f'(K_{(t)}) > 0$ and $f''(K_{(t)}) < 0$

Hence, the specific example of production function is the Cobb Douglas function

$$Y = f(K_{(t)}, A_{(t)} L_{(t)}) = K_{(t)}^{\alpha} A_{(t)} L_{(t)}^{1-\alpha} \qquad 0 < \alpha < 1$$

$Y/AL = K/AL^{\alpha} (AL/AL)^{1-\alpha}$ $\qquad$ $Y/AL = y$ and $K/AL = k$.

Therefore, $y = k^{\alpha}$ $\qquad$ $y_t = f(k_t)$

This production function is very useful for the framework of the research at hand and shall be adapted to incorporate the variables of analysis in this study.

Movement of Labour / knowledge, Capital over time

$\Delta K = K_{(t)} - K_{(t-1)}$ $\quad$ $\Delta K/K$ = growth rate of Capital.

$\Delta L = L_{(t)} - L_{(t-1)}$ $\quad$ $\Delta L/L$ = growth rate of Labour. Labour is growing at the rate **n**

$\Delta A = A_{(t)} - L_{(t-1)}$ $\quad$ $\Delta A/A$ = growth rate of knowledge. Knowledge is growing at the rate **g**

Therefore, $$k = K_{(t)} / A_{(t)}L_{(t)} \qquad \textbf{(3.2)}$$

Using Quotient Rule to derive the fundamental Solow equation model from equation 3.2

Hence, $$k = \frac{\Delta K_{(t)}(A_{(t)}L_{(t)}) - (\Delta A_{(t)}L_{(t)}) K_{(t)} - (A_{(t)} \Delta L(t)) K_{(t)}}{(A_{(t)}L_{(t)})^2}$$

$$\Delta k(t) = \frac{\Delta K_{(t)}}{A_{(t)}L_{(t)}} - \frac{\Delta A_{(t)}\, K_{(t)}}{A_{(t)}\,(A_{(t)}L_{(t)})} - \frac{\Delta L(t))\, K_{(t)}}{L_{(t)}(\,A_{(t)}L_{(t)})}$$

Note: $\Delta Kt = sY_{(t)} - dK_{(t)}$, $\frac{\Delta A_{(t)}}{A_{(t)}} = \mathbf{g}$, $\frac{\Delta L_{(t)}}{L_{(t)}} = \mathbf{n}$ and given that Y/AL = f(k)

$$\Delta k(t) = \frac{sY_{(t)} - dK_{(t)}}{A_{(t)}L_{(t)}} - k_{(t)}\mathbf{g} - k_{(t)}\mathbf{n} \qquad = sf(k_{(t)}) - dk_{(t)} - g(k_{(t)}) - n(k_{(t)})$$

$\Delta k(t) = sf(k_{(t)}) - (n+g+d)k_{(t)}$ (Solow model) **(3.3)**

f(k(t)) is output per unit of effective labour

$sf(k_{(t)})$ is actual investment per unit of effective labour

$(n+g+d)k_{(t)}$ is breakeven investment.

A Baseline Case: Economic Growth and Electricity

The analysis is extended to incorporate electricity as it serves as one of the growth determinant.

Thus the production function 3.1, becomes

$\boldsymbol{Y(t) = K_{(t)}^{\beta}\ (A_{(t)}L_{(t)})^{\gamma}\ EC_{(t)}^{\lambda}}$. **(3.4)**

$Y_{(t)}$ is economic growth proxy by GDP Per Capita Constant 2000 US Dollar

$A_{(t)}$ and $L_{(t)}$ enter the model multiplicatively, hence $A_{(t)}\ L_{(t)}$ is effective Labour

Labour is proxy by Post-Primary School Enrolment

$K_{(t)}$ is Capital at period *t* proxy by Gross Capital Formation

$EC_{(t)}$ is Electricity Consumption at period *t* proxy by Electricity Power Consumption (KW Per Capita)

Log both sides of the equation 3.3

$\ln Y(t) = \beta \ln K_{(t)} + \gamma (\ln A_{(t)} + \ln L_{(t)}) + \lambda \ln EC_{(t)}$ **(3.5)**

Differentiating both sides with respect to time, we obtain the following:

$gy = \beta gk + \gamma (n+g) + \lambda gEC$ **(3.6)**

At the balance Growth Path (BGP) rate of growth of Y and growth of K is the same.

Hence, $gy = \beta gk$, Therefore, $gy = gk = \beta gk$.

$gy - \beta gy = \lambda EC + \gamma (n+g)$

$$\frac{gy(1-\beta)}{1-\beta} = \frac{\lambda}{1-\beta}(gEC) + \frac{\gamma}{1-\beta}(n+g) \quad \textbf{(3.7)}$$

Therefore, the extended version of the Solow growth model indicates that growth rate of Electricity Consumption is determinant of Economic growth real GDP.

The Functional Form of the Model

For the purpose of the research work the relationship among the dependent and independent variables is presented as follows:

RGDP = f (GCF, ENR, EC) **(3.8)**

Model Specification

The study employed the Vector Error Correction Model (Restricted VAR model). It should be noted that we can determine the long run and short run causality from the VECM. Therefore, for simplicity, on the basis of the above functional relationship the study specify multivariable VECM model as follows:

$$\Delta RGDP_t = \alpha_1 + \sum_{J=1}^{P=1} a_i^{RGDP} \Delta RGDP_{t-i} + \sum_{k=1}^{p=1} \beta_j^{PCGDP} \Delta GCF_{t-j} + \sum_{l=1}^{p=1} \gamma_k^{PCGDP} \Delta ENR_{t-k} + \sum_{m=1}^{p=1} \lambda_l^{PCGDP} \Delta EC_{t-l} + \phi_1 ECM_{1t-1} + e_{1t}$$

Where:

PCGDP = Gross Domestic Product per capita 2000 US Dollar

GCF= Gross Capital Formation

ENR= Post Primary School Enrolment

EC = Electricity power Consumption (KW Per Capita)

α = Constant term, a= RGDP coefficient, β = GCF coefficient, γ = ENR coefficient.

ϕ = Speed or rate of adjustment

p = lag length for the Vector Error Correction Model

e = White Noise Disturbance Error Term.

Sources of Data

Data for this research study consists of secondary data sparing 1981-2011. These data include per capita real GDP, electricity power consumption (KWH per capita), capital proxy by gross capital formation (GCF) source from WDI, 2012 and labour proxy by Post Primary School Enrolment generated from CBN Statistical Bulletin.

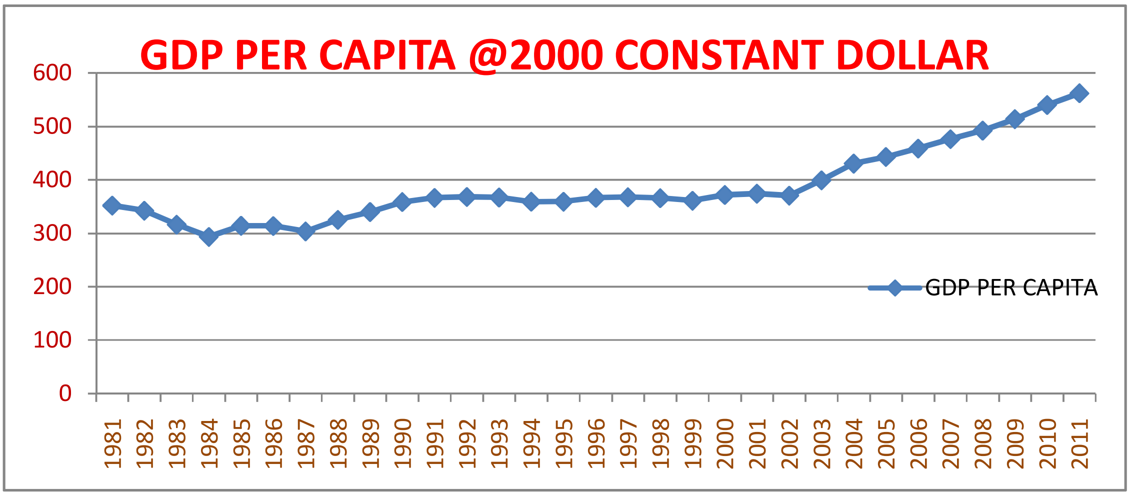
4 DATA PRESENTATION AND ANALYSIS

This study is based on times series data which covers 1981 to 2011. The variables of interest in the study are Real GDP, Electricity Consumption, the conventional economic growth variables are included, capital is proxy by gross capital formation and labour is proxy by Post Primary School Enrolment. Descriptive analysis is slightly used to examine the trend of the times series data and Restricted Vector Auto Regressive (VAR) is employed for the analysis.

4.1 Trend Analysis

The trend of the Per capita GDP shows that there has been a continuous increase of the variable in Nigeria. But, critical observations of the table revealed that the value decreased from $352.08 in1981 the year which the study begins to $293.60 in 1984. The GDP per capital also increased in 1985 from $314.17 and decreased slightly in 1987 to $303.66 before it finally continue to increase at a small rate to $430.60 in 2004 when it begins to increase to the observable rate of $561.90 in the last year of the observation, 2011.

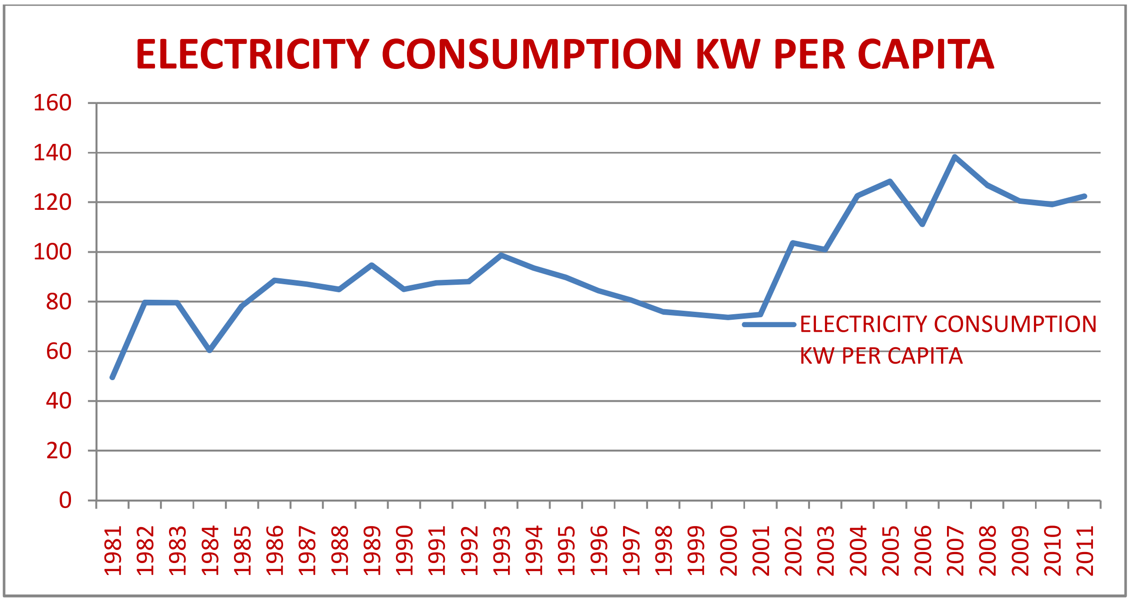
Fig 4.1 Real GDP



Source: Author; WDI 2012

Electricity consumption per capita in Nigeria is nothing to write home about as indicated in the fig 4.4 that per capita consumption of electricity is 49.48KW in 1981 and it increased substantially in 1982 to 79.64 KW in 1982. It also fall to 60KW in 1984, from then it started rising within the range of 84.99 KW and 94.68 KW between 1986 and 1990 this may be due to the deregulation of the sector during the Structural Adjustment Programme in 1986. From the year 1990 to 1995 there was substantial increment in the electricity consumption as the country consumed between the range of 84.9 and 98.74 KW, this might be as a result of addition to the existing more power plants having realised the needs to improve the electricity consumption in Nigeria.

Fig 4.4 Electricity Consumption KW per Capita in Nigeria.



Source: Author; WDI 2012.

The information in the table 4.1 shows the summary statistics of the variables of study. Mean, median and standard deviation of per capital GDP were found to be 386.21, 366.46 and 69.80 respectively with minimum value of 293.5969 and maximum value of $561.9044. These values were actually low compare to other developing countries like NICs and Asian Tigers. The similar statistics for Electricity Consumption were found to be 96.67KW, 88.05KW and 21.22KW respectively with minimum value of 49.48KW and maximum value of 138.33KW. The figures for this are outrageously low and this is due to poor electricity supply in the country which has forced people to source for other means of electricity consumption. Energy Use Kt of oil equivalent statistics is moderate at 83225.11kt, 8266.02Kt and 17995.77kt with minimum value of 54861.03 Kt and maximum value of 110872.4 Kt. Electricity consumption is expected to promote economic growth as it serves as the mechanism for fuelling the engine of growth but our observations from this analysis does not support the expectation.

Table 4.1: Summary Statistics of the Variables

	PCGDP	GCF	ENR	EC
Observations	31	31	31	31
Mean	386.2097	566476.1	5462868	93.67220
Median	366.4613	204047.6	5389619	88.04744
Std. Dev.	69.80295	784970.2	2363743	21.22733
Maximum	561.9044	2442704.	10245760	138.3314
Minimum	293.5969	8799.480	2473673	49.48188
Skewness	1.065255	1.332524	0.333838	0.333792
Kurtosis	3.248912	3.226740	1.757223	2.518023

Source: author computation

PCGDP - GDP Per Capita Constant 2000 US Dollar

GCF - Gross Capita Formation

ENR – Post Primary School Enrolment

EC - Electricity Power Consumption (KW Per Capita)

4.2 Econometrics Analysis of the Study

Due to the properties of most time series, it is important to carry out the Unit root test on the series in the Vector Autoregressive (VAR) model. If the series are stationary, the results obtained from the VAR model are valid. However, if the series are non stationary, it is important to conduct Cointegration test to verify whether the time series are cointegrated or not.

4.2.1 Test for Stationarity

This section presents the Unit root test conducted on the variables. As the first step, to diagnose the stationarity status of the variables in order to determine the appropriate test and estimation model to employ. Augmented Dickey- Fuller (ADF) test is used. According to Gujarati and porter (2009), it is conducted by augmenting the following:

Random walk: $\Delta Y_t = \delta\, Y_{t-1} + u_t$

Random walk with drift: $\Delta Y_t = \beta_1 + \delta Y_{t-1} + u_t$

Random walk with drift around a deterministic trend: $\Delta Y_t = \beta_1 + \beta 2_t + \delta Y_{t-1} + \sum \alpha_i \Delta Y_{t-i} + \varepsilon_t$

Table 4.2: Unit Root test applied to variables

Variables	ADF TEST Critical Values	ADF Test Statistic	Prob- Values	Decision Rules
LNGDP	1% -3.679322	-3.596894	0.0122	I(1)
	5% -2.967767			
LNGCF	1% -3.711457	-4.048571	0.0045	I(1)
	5% -2.981038			
LNENR	1% -3.984974	-3.984974	0.0047	I(1)
	5% -3.679322			
LNEC	1% -3.679322	-7.680077	0.0000	I(1)
	5% -2.967767			

The unit root test conducted on the variables, the variables found to be non stationary at level. A further test of stationarity by first level of difference shows the variables attained stationarity. LNGDP, LNGCF, LNER and LNEC attained the stationarity by first level of differencing at one percent level of significance. The results of this test necessitate the performance of Cointegration test in order to confirm the existence of long run associationship among the variables.

4.2.2 Cointegration Test

There are number of methods for testing cointegration, the Johansen test for cointegration has been found more reliable. Hence, the study used the Johansen test for cointegration

Table 4.3: Presentation of Johansen Test of Cointegration

Hypotheses: Number of Cointegrating Equations	Eigen Value	Max-Eingen Stat	0.05 Critical Value	Prob. Value	Trace Statistic	0.05 Critical Value	Probability Value
0*	0.987644	31.76948	27.58434	0.0136	56.01915	47.85613	0.0071
1	0.848764	19.14268	21.13162	0.0928	24.24967	29.79707	0.1901
2	0.699388	4332289	14.26460	0.8227	5.106990	15.49471	0.7974
3	0.635473	0.774702	3.841466	0.3788	0.774702	3.841466	0.3788

Source: computed by author; see appendix

Trace test and Max-Eingen test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinn-Haug-Michelis (1999) p-values

There is 1 cointegrated equation at the 0.05 level. The implication of this is that there is long run relationship or associationship among the variables; consequentially, this necessitates the use of restricted VAR i.e. Vector Error Correction Model.

4.2.3: Vector Error Correction Analysis

Presentation of the Result: Vector Error Correction model:

D(LNGDP) = - 0.110152047632*(LNGDP(-1) - 0.458636230243*LNGCF(-1) + 1.51763416899*LNENR(-1) - 0.380911981647*LNEC(-1) - 22.1398903728) - 0.131083189423*D(LNGDP(-1)) - 0.218229918985*D(LNGDP(-2)) - 0.0123909282399*D(LNGCF(-1)) - 0.0232019546263*D(LNGCF(-2)) - 0.259045666295*D(LNENR(-1)) - 0.0459639074503*D(LNENR(-2)) - 0.0399873310464*D(LNEC(-1)) - 0.01512288336*D(LNEC(-2)) + 0.0455750450642

The VECM estimated values of the coefficients for Error Correction Equations is as follows:

D(LNGDP)= 0.045575 + (-0.218230)D(LNGDP(-2)) + (-0.023202)D(LNGCF(-2)) + (-0.045964)D (LNENR(-2)) + (-0.015123)D(LNEC(-2)) - 0.110152 ecm1t-1 + e1t

See Appendix iii

4.2.4 VECM Long Run Causality

LNGDP error correction equation was chosen to test and confirm the long run causality as reflected in table 4.5 below, the C(1) is 1-period lag residual of the cointegrating equation. This is the error correction term. The C(1) is positive, this is against our expectation, and it is not significant with the prob. Value of 0.2391 (24%) which is greater than 0.05 level (5%). Hence, there is no long run causality from the explanatory variables Electricity Consumption to Economic Growth (GDP).

Table 4.4 Presentation of VECM Long Run Causality Model

Dependent variable: LNGDP		Included observations: 28 after adjustments		
D(LNGDP) = - 0.110152047632*(LNGDP(-1) - 0.458636230243*LNGCF(-1) + 1.51763416899*LNENR(-1) - 0.380911981647*LNEC(-1) - 22.1398903728) - 0.131083189423*D(LNGDP(-1)) - 0.218229918985*D(LNGDP(-2)) - 0.0123909282399*D(LNGCF(-1)) - 0.0232019546263*D(LNGCF(-2)) - 0.259045666295*D(LNENR(-1)) - 0.0459639074503*D(LNENR(-2)) - 0.0399873310464*D(LNEC(-1)) - 0.01512288336*D(LNEC(-2)) + 0.0455750450642				
	Coefficient	Std. Error	t.-statistic	Prob.
C(1)	2.706423	0.175914	1.095594	0.2391
C(2)	-0.103781	0.266374	-0.389606	0.7031
R-squared	0.663944			
Log likelihood	71.45893			
F-statistic	1.975693			
Prob(F-statistic)	0.116420			
Durbin-Watson stat	1.911644			

Source: author; see appendix 4.4

4.2.5 Short Run Causality Test

To check the short run causality between the Economic Growth (LNGDP) and Electricity (LNEL) the study employed the Wald test by using chi- square value of Wald statistics.

Short run causality from LNEC to LNGDP

Null hypothesis: There is no short run causality from LNEC of Lag 2 to LNGDP

H_0: C(11)=C(12)=C(13)=0

Table 4.6: Presentation of the Wald Test

H0: C(11)=C(12)=C(13)=0	VARIABLE: LNEC	
Test statistic	Value	Probability
Chi-square	7.919759	0.0477

Source: author; see appendix 4.6

Analysis of Short Run causality from Electricity Consumption to Economic growth.The chi square value is 7.919759 with probability value of 0.0477 which is less than 0.05, therefore, rejection of null hypothesis which states that no short run causality from Electricity (LNEL) to Economic Growth (GDP).

From the model it is indicated that C(11), C(12), C(13) are not zero. This implies that this variable, Electricity has short run causality to GDP.

Conclusively, there is no long run causality from the variables - Electricity consumption (LNEC), to Economic growth (RGDP) due to the fact that error correction term C (1) is positive and not significant. And, there is short run causality from this variable to Economic growth (RGDP) in Nigeria.

4.3 Granger Causality Test

The test involves the estimation of the following pair of regressions:

$$LNGDP_t = \sum \alpha_i LNEC_{t-i} + \sum \beta_I LNGDP_{t-i} + u_{1t}$$

$$LNEC_t = \sum \lambda_i LNEC_{t-i} + \sum \delta_I LNGDP_{t-i} + u_{2t}$$

The critical *F*-value is 2.47 (for 6 and 25 df) at 5 percent level, against which the tabulated or estimated F-statistics would be compared. If tabulated f-stat is greater than critical f-stat the study reject the Null Hypothesis and if tabulated f-stat is lesser than critical f-stat the study accept the Null Hypothesis.

Table 4.7 Presentation of Granger Causality

Models & hypothesIS	f- stat	Decision
H0: LNGDP doesn't Granger cause LNEC & LNEC doesn't Granger cause LNGD		
LNGDP vs LNEC	3.72281	LNGDP ↔ LNEC
LNEC vs LNGDP	5.96897	
Critical f –stat (6 & 25 df) at 0.05 level	2.47	Feedback Causality

Source: author: see appendix 4.7

4.3.1 Analysis of the Granger Causality

1) H_0: LNGDP doesn't Granger cause LNEC

LNEC doesn't not granger cause LNGDP

The table shows that estimated F-stat which are 3.72281 and 5.96897 are greater than the critical f-stat of 2.47 at 0.05 level, hence rejection of the null hypotheses and acceptance of alternative hypotheses that LNGDP granger cause LNEC and LNEC granger cause LNGDP respectively. This is feedback hypothesis which implies that electricity consumption granger cause Economic Growth and Economic Growth granger cause Electricity Consumption. Therefore, electricity consumption has significantly cause on economic growth and Economic growth also has significant cause on Electricity Consumption (Feedback Hypothesis)

4.4 Diagnostics Test on Residual

4.4.1 Test for Residual Auto-Correlation

This is the test for serial correlation in the model. The Breusch -Geofrey Serial correlation LM test is used to test the existence of serial correlation in the model.

Breusch-Godfrey Serial Correlation LM Test

Null Hypothesis (Ho): there is no serial correlation

Observation included: 31	Dependent Variable: Residuals		H_0: no serial correlation
F-statistic	1.119621	Prob. F(2,11)	0.3609
Obs* R-squared	4.566691	Prob. Chi-Squared	0.1019

Source : author; see appendix 4.7

From the table, considering the prob. Chi-Square value of 0.1019 (10.2%) which is greater than 0.05 (5%) level. And, the decision rule is to accept the Null hypothesis (Ho) if the prob. Value is greater than 0.05; hence acceptance of the null hypothesis which stated above that there is no serial correlation in the model.

4.4.2 Heteroscedasticity Test

According to Gujarati and Porter (2009), Autoregressive conditional heteroscedasticity (ARCH) may have an autoregressive structure, in that heteroscedasticity may be observed over different periods, hence it is needful to conduct the test for this study.

H_0: there is no ARCH effect
H_1: there is ARCH effect

Observation included: 31	Dependent Variable: RESID^2		H_0: no ARCH effect
F-statistic	0.844001	Prob. F(2,22)	0.4434
Obs* R-squared	1.781495	Prob. Chi-Squared	0.4103

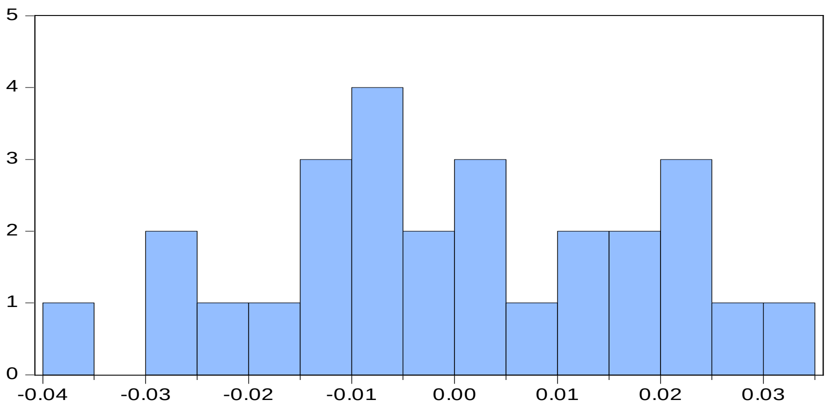
Source: author; see appendix 4.7

The table above shows that the Probability chi-Squared value of 0.4103 (41%) which is greater than 0.05 levels (5%), hence acceptance of the null hypothesis that there is no ARCH effect. This is desirable for the study, because it signify that there is no heteroscedasticity problem in the causality model.

4.4.3 Normality Test

Test for Normality of the Residual

H_0: Null hypothesis: Residual is multivariate normal



Series: Residuals	
Sample 1985 2011	
Observations 27	
Mean	9.77e-18
Median	-0.003246
Maximum	0.030563
Minimum	-0.035525
Std. Dev.	0.017480
Skewness	-0.039310
Kurtosis	2.175260
Jarque-Bera	0.772173
Probability	0.679712

Consideration of Jacque-Bera statistic with value 0.772173 and Prob. value of 0.679712 (37%) which is greater than 0.05 levels (5%). Hence, we accept the H_0 that the residual is normally distributed. Conclusion is that the residual of the model is normally distributed.

From the diagnostic tests we have conducted, the result shows that the causal model is free of serial correlation problems, the model has no ARCH effects and the residual is normally distributed. This gives us assurance that the results from the model are reliable, efficient and will be suitable for forecasting and policy and decision making.

4.5 Electricity Sector is Critical to Nigeria's Socio - Economic Development

Having carried out investigative study of the relationship and the impact of Electricity on the economic growth and found that electricity sector plays significant role in engendering the socio-economic growth and development in Nigeria it is needful of this study to discuss the critical roles plays by the electricity sector in the development process in Nigeria. The electricity sector is of significant strategic importance to Nigeria Economy, it plays an essential role in modern society, bringing benefits and progress in various fields, including Agriculture, Industry, Commercial, Health, and Communication technologies. For all human activities, electric power is vital for economic growth and development (quality of life). Electricity remains the backbone of not only the Nigeria economy but the world's largest economies.

Electricity is treated as an intermediate input in the production process. This treatment of energy's role degrades its importance and contribution to industrial development which is an agent of economic growth and development. All industrial activities and processes require some form of electricity usage. This effectively makes energy a critical primary factor of production. Meanwhile, this role is relegated to the background in the conventional production factors identified in the literatures. The so called conventional input (Capital and labour) add little or nothing to production without energy-electricity. In a nutshell, electricity propels economic development by serving as the spring-board for industrial growth.

4.5.1 The Electricity Transmission Mechanism

The Electricity Transmission in Industrial Sector.

EL ↑ → PC ↓→WAGE ↓→ PROFIT ↑→ GCF ↑→ EG↑ + DSC = ECONOMIC DEVELOPMENT

EL = Electricity supply

PC = Production Cost

GCF = Gross Capital Formation

EG = Economic Growth

DSC = Desirable Social Changes.

Competitively priced, efficient and reliable electricity supplies also attract foreign investment - a very important factor to boosting economic growth. The availability of this encourages investment by reducing the cost of production. It is important to note that, the poor performance of electricity sectors in term of reliable supply has driven away many firms to other countries where the supply of electricity is relatively reliable. In other words, reliable electricity supply attracts green field investment. This is capable of translating the economy to the prosperous one and catalyzes socio-economic development of Nigeria as experienced by China in the recent years.

EL ↑ → PC ↓→ PROFIT ↑→FI ↑ OUTPUT ↑→ EG↑ + DSC = ECONOMIC DEVELOPMENT

EL ↑ → F ↓ → AG. P ↓→ WAGE ↓→ PROFIT ↑→ GCF ↑→ EG↑ + DSC = E. DEVELOPMENT

FI = Inflow of foreign Investment.

F = Food/ Agric Output

AG.P = Agricultural Output Price.

On agriculture sector, electricity facilitates production of agricultural output through effective storage facility to the marketable surplus level, i.e. beyond the subsistence level. This will bring about higher agriculture output per labour, hence fall in agriculture products' price, thereby increasing the quantity of labour available for industrial sector which in turn lower the real wages and cause increase in profit which will lead to higher Gross Capital Formation and in turn bring about economic growth which if sustained alongside desirable social changes will emanate to economic development.

The Electricity Transmission Mechanism in Communication sector.

Communication sector services have nothing to offer without electricity, the functioning of communication network is back up with electricity supply. It is undeniable fact that without communication the whole system will become dormant and leads to paralysis of the business communication which is not augur well for business survival. The fast-growing telecommunication sector is yet to approach its maximum potential in terms of service delivery because the major input to the sector is electricity. In order words, electricity is the mast of telecommunication industry, there cannot be any meaningful contribution by communication sector to the growth objective.

EL ↑ →COM↑ → BCOM↑→ G&S ↑→ OUTPUT↑→ EG↑ + DSC = E. DEVELOPMENT

COM = Communication Service

BCOM = Business/commercial communication and correspondence

G&S = Good and services.

The Electricity Transmission Mechanism in Health sector.

Health sector relies on electricity services to carry out the health services delivery. The process of bringing up pre-mature baby cannot be achieved without electricity supply. Surgical operations services by the hospitals cannot be carried out without electricity. There is need for preservations of medications by cooling. Electricity is useful for different strategic functions in hospital to facilitate their objectives of delivering perfect wellfare services to people which will go a long way in improving life and increase labour or population participation rate in economic activities that will contribute immensely towards achieving the goal of socio-economic development of the country.

EL ↑ → HS ↓→MOR ↓→ LE ↑→ LP ↑→ OUTPUT↑→ EG↑ + DSC = E. DEVELOPMENT

HS = Health Services

Mor = Mortality Rate

LE = Life Expectancy

LP = Labour Participation.

Education sector rely to some reasonable extent on electricity on delivery of their services. Educational Sector can hardly carry out research which is needed to proffer solution to the various political, socio-economic challenges we are facing in Nigeria. The internet which can only function with the support of electricity has turn the economy to global village whereby researchers can access research products on line that would be useful for formulating policies which will facilitate the accomplishment of various socio-economic objectives. The employment of various teaching aids in the process of imparting knowledge, required reliable electricity supply to accomplish the educational objectives.

Employment generation in the informal sector, the effort of the informal sector in the contribution to the economic growth objectives has been recognized by ILO, local, multilateral and international agencies. Majority of the participants in this sector require electricity as their major input in the productive activities, printing works, bakery service, commercial (business) centres, laundry services, pepper grinder, petrol filling stations, shoe making, block making, ice block making, cool room running, to mention a few. This sector provides jobs for over 59,000 Nigerians (ILO, 2012) which are directly and indirectly depends on electricity for their productive activities.

Findings

The result of our investigative study through Econometrics analysis of Long and Short run Causality indicates that Electricity only determine economic growth in the short run. And, the existence of long run relationship between electricity and economic growth as indicated by the Cointegration test is not significant. Further findings through Granger Causality analysis also indicates that there is existence of causality in both direction between electricity and economic growth and development, that is, Electricity causes Economic growth and economic growth also causes electricity.

Conclusion and Recommendation

Furthermore, the study exposed the capability of electricity consumption to move the nation from this undesirable state to better and more desirable state by being able to catalyze the so called economic growth and socio-economic development. The study captured the present electricity status in Nigeria viz a viz the economic growth. Further consideration of strong granger causality shows its capability to turn the nation's economy around. This is due to the fact that Sunlight, Wind, Rain, Tides and Geothermal heat (renewable(s)) are abundant in Nigeria and should be exploited to generate electricity required to spur the development in Nigeria. The unbundling of the PHCN which has been taken over by private individuals is a right action in the right direction, the establishment of National Electricity Regulation Commission as institutional framework that is saddled with monitoring and regulation of the sectors is in line with the best practices and the body must be strengthened and made to be independent in decision making as far as this privatization is concern in order to avoid the situation where public monopoly would be turned to private monopoly.

The sector is a promising one, which is capable of bringing about the success story to Nigeria if it is properly harnessed. In the light of this, Federal government should continue to partnership with the private operators in the area of funding as we all know that the project concern is capital intensive and a very long gestation period. Hence, Government should go extra mile to assist the operators in acquisition of loan to finance the project by guarantee the security of loan required by the operators to fund the projects in order for the whole process of unbundling and privatization not to become a ruse.

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