

**AN EMPIRICAL INVESTIGATION OF THE
CAUSAL RELATIONSHIP BETWEEN ENERGY
CONSUMPTION AND ECONOMIC GROWTH IN
NIGERIA (1975 – 2004)**

BY

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ZARIA.**

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DEDICATION

This work is dedicated to my daughter little **Angel**, my lovely wife, **Constance Iyoha** and to the **ALMIGHTY GOD THE ANCIENT OF DAYS**. Amen.

DECLARATION

I declare that this thesis entitled **AN EMPIRICAL INVESTIGATION OF THE CAUSAL RELATIONSHIP BETWEEN ENERGY CONSUMPTION AND ECONOMIC GROWTH IN NIGERIA (1975 – 2004)** has been carried out by me in the Department of Economics under the supervision of Doctor(s) Mike C. Duru and Peter P. Njiforti. The Information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this thesis was previously presented for another degree or diploma at any University.

Name of Student

Signature

Date

CERTIFICATION

This thesis titled **AN EMPIRICAL INVESTIGATION OF THE CAUSAL RELATIONSHIP BETWEEN ENERGY CONSUMPTION AND ECONOMIC GROWTH IN NIGERIA (1975 – 2004)** meets the requirement governing the award of the degree of **MASTER OF SCIENCE IN ECONOMICS**, of **AHMADU BELLO UNIVERSITY, ZARIA**, and is approved for its contribution to knowledge and literary presentation.

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ABSTRACT

This thesis investigated the causal relationship between energy consumption and economic growth in Nigeria (1975-2004). This study was inspired from the series of contradictions obtained in the literatures as regards the possibility of energy consumption and economic growth to have a relationship. This thesis investigated whether it is energy consumption that causes growth or economic growth that causes energy consumption in Nigeria.

The methodology adopted for the study was the use of Granger causality test statistics to test for the causal relationship between economic growth and energy consumption in Nigeria. Sequel to that, a trend analysis was carried out. The trend parameter (R^2) was used to determine the magnitude of energy consumption and the trend strength of the energy consumption variable within the study period.

Based on the results of the findings, the Granger statistical f value obtained was 10.2 which are greater than the f critical value of 4.2 at lag 2. This result was significant at 5 percent probability level. This result rejected the null hypothesis and accepted the alternate hypothesis that Economic growth Granger causes energy consumption in Nigeria.

This one-way causality may be explained by the nature of the production structure of Nigeria which is dominated by services and agricultural activities that are less energy intensive. Sequel to this, the level of industrialization that demands more energy resources is still very low and as such energy consumption at this stage may not be able to make any significant impact to the growth of the Nigeria economy.

The result of the trend analysis showed that there was a strong positive upward movement in the consumption of the different energy types in Nigeria except for coal that showed a downward trend. The trend parameter R^2 for energy consumption in the pre-SAP period was 67 percent while it was 70 percent for the post-SAP period.

The study therefore recommended that all efforts must be geared towards the attainment of the overall growth of the economy. Investment opportunity must be enhanced on a level playing ground, the private sector particularly the banking sector should be encouraged to invest into the real sector of the economy rather than just commercial activities. This will go a long way in repositioning the Nigerian economy while boosting energy consumption and production in the country. This is with the view of attaining sustainable development.

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CHAPTER ONE

1.0. INTRODUCTION

1.1. BACKGROUND TO THE STUDY

In Nigeria, there are two sources of energy, namely the non-renewable energy sources which comprises petroleum, natural gas, coal and fuel wood, and the renewable energy resources which include hydro-power, solar, biomass and wind energy.

Among these energy sources, the major energy resource consumed in Nigeria are hydropower, petroleum, natural gas and coal. Over the years, the consumption of these energy resources has triggered the growth and development of the Nigerian economy. This is evident from the contribution of energy consumption to the growth of the nations Gross Domestic Product (GDP).

The demand for energy resource and its consumption has continued to increase over time as its consumption is dominant in all sectors of the economy ranging from manufacturing, mining, transportation and distribution, communication and the service sector to mention but few.

Energy consumption plays two major roles in the Nigerian economy. First, as in all economies – developed and developing-energy fuels economic growth because it is an input to all economic activities. As a result, energy

consumption has grown step by step with economic growth as measured by the growth in the Gross Domestic Product of the country. Secondly, energy is the major source of revenue to the government, and this revenue has been used for developmental purposes.

Although, the relationship between energy consumption and Gross Domestic Product is complex, an examination of the historic growth pattern of the two variables over the years ranging from 1970 to 1990 shows clearly that the two variables are highly correlated (Adegbulugbe, 1993).

Petroleum product which dominates the total commercial energy consumption in Nigeria is used in transportation, namely road vehicles, aircraft and sea vessels, including powered boats, household and industrial consumers are the major end-users of petroleum products in Nigeria.

Although gas accounted for a negligible proportion of total energy consumption in the 1970s and 1980s, its importance has continued to grow since the 1990s as the numerous advantages of gas over other forms of fuel energy becomes evident. Consequently, gas is being increasingly utilized in power generation and industries. Gas is being supplied to the major users such as NEPA (PHCN) via Afam, Ughelli, Sapele and Egbin thermal plants. Other major users include Fertilizer Companies, the Nigeria Glass Industry

in Port Harcourt, the Delta Glass Company in Ughelli and other industries and manufacturing organizations.

Before the advent of crude oil and natural gas, coal and hydroelectricity were the dominant forms of energy in Nigeria. In the early 1950s through the 60s and 70s coal was predominantly used in the transportation sector. It is reported that coal was even supplied to the Ghana transport system within this period. Hydroelectricity was the main stay of the industrial sector during this time. But gradually the importance of coal as a form of energy gave way to the exploration of crude oil and natural gas. This era was called the era of the “black gold”, as crude oil took over the centre stage of energy consumption in Nigeria. Today, it is pertinent to note that petroleum, natural gas, coal and hydropower are the major source of energy being consumed in Nigeria. This form of energy is the pivot in which economic growth and development rest.

The use and conservation of energy resources had its origin in the “limit to growth” literature of the early 1970s where sustainable development referred not only to the survival of the human species but also to maintaining the productivity of natural, produced and human resources from generation to generation. A key requirement of sustainable development will thus necessitate bringing the growth and well-being of

present generation in such a way that the ability of the future generations to meet their own needs will not be jeopardized. The availability of safe and sound energy as a factor of production in such developmental process cannot be overemphasized. And as noted by Eleri (1996), the contribution of energy in furthering development aspirations would be judged by its compatibility with the goal of advancing growth, equity, environmental integrity and inter temporal justice.

The Nigerian economy has witnessed two significant oil shocks in recent times. The first oil shock, which occurred in the early 1970s, was positive and induced a sharp increase in inflation through excessive increase in money supply and reckless government spending. For example, while money supply increased by 49 percent in 1974 over the 1970 figure of 23 percent, inflation soared at 33 percent over the same period as against 13.8 percent in 1970. Government expenditure increased by more than 1000 percent in 1974 over the 1970 figures of 150 percent (Babatunde and Francis, 2001).

The second oil shock was negative and it introduced several structural imbalances (unemployment, debt over-hang, poverty, balance of payment deficits etc) in the economy, as the country found it difficult to control the import culture she had acquired during the boom years. The era of the

Structural Adjustment Programmes had its own ups and downs as the exchange rate rigidities had its effects on the prices of energy in the country and the revenue base of the Nigerian nation.

1.2. STATEMENT OF THE PROBLEM

The abundance of energy resources in Nigeria notwithstanding acute shortages of energy services and failure of energy infrastructure has excessively increased the cost of doing business in the country (see DPC, 1999). This has been exacerbated by the poor performance of utilities, waste and political patronage. All these have rendered energy management ineffective and have increased the pace of inequality between the rural and urban areas as the former has suffered more neglect.

Many factors are responsible for the problems associated with the production and consumption of energy resource. Among these are; inadequate funding of capacity expansion of infrastructures to cater for expanding demands and to ease the pressure on the facilities that were built during the petrodollar boom years; inadequate funding of maintenance of the existing facilities, leading to a gradual but effective erosion of installed capacity with time, and poor management and administration of the facility.

All this decay has contributed to the declining economic growth of Nigeria as well as the erosion of the social welfare of Nigerians.

This failure of energy services and energy infrastructure have made the supply of energy inadequate, electric power supply is unreliable, from an installed generating capacity of about 6000mw only 2200mw has been used by year 2002. Sporadic petroleum product shortages exist, despite an estimated production capacity of 385,000 bpd, less than 200,000 was demanded locally all these affects the consumption of energy and they also constitute a huge drain to the national economy.

Energy supplies to all sectors of the Nigerian economy have been very unreliable over the years. For example, most manufacturing, industrial and communication companies operating in Nigeria had to have in place active power generation facilities to compliment the very unreliable power supplies from the national grid. As such, manufacturing companies operating in the country have had to channel a significant portion of investible funds, available to them to provide on site standby power supplies, thus diverting the resources needed to fund their core manufacturing business. This has negative ramification for domestic productivity, not to talk of the ability to compete internationally in a continuously changing global market.

These alternative sources of power supply have greatly increased the cost of production and subsequently an increase in the prices of goods and services. The increase in the prices of goods and services only reduce the standard of living of the people and this poses a serious problem to the economy. It is worth noting that firms that could not meet these rising cost of production had to close down thus worsening the unemployment situation of the country. Available data from the CBN statistical bulletin showed that unemployment rate increased from 99934 in 1990 to about 190328 in the year, 2000.

The continual increase in the prices of petroleum products had its own turn on the economy; this has generated inflation and high cost of transportation and distribution of goods and services. The society is always at the receiving end when such rigidities are dominant in the economy as the country's poverty level rises.

Besides the above economic losses, the financial resources required (mostly in foreign exchange) to maintain existing capital stock of the energy supply system (power plants, refineries, coal mines, transmission and distribution net work, pipelines etc) and expansion is a serious problem to contend with. Secondly, depending on the composition of future energy

consumption mix, increased level of energy consumption may create a conflict between the two roles played by energy in the national economy.

In view of the above situation, it is observed that the inadequate supply of energy resource and its low consumption has led to a decline in economic activities which also translates into poor economic growth and development. Will it then, not be out of place to state that it is impossible for energy consumption and growth to have a relationship? Sequel to that is it the growth of the economy that causes increase in energy consumption or is it energy consumption that causes growth?

Nevertheless, the need to establish the relationships between the use of energy resource and economic growth or output has occupied a central place in the literature (see Kraft and Kraft, 1978). The need to establish this relationship is evident in the contradictory results of some studies (see Akarca and Long, 1979; Yu and Choi, 1985). While some studies aptly demonstrate that development of energy resources can lead to economic growth through the multiplier effect and by providing the infrastructure to facilitate economic growth, others (e.g. Yu and Hwang, 1984; Cheng, 1996) found no evidence of causality between growth and energy consumption.

The implication is that when such relationships are not established, conservation of energy resources has the tendency to hamper meaningful

growth efforts. Considerable efforts have been made to establish the demand function for energy or subsidizing domestic energy consumption in Nigeria (Ikporukpo 1978; Adenikinju 1996). The present study hopes to fill the gap by using Nigerian data to establish the causal relationship between growth and energy consumption make an impact analysis of energy consumption on economic growth or otherwise as well as undertake a trend analysis for energy consumption and growth. Energy consumption will also be disaggregated to estimate the impact of each component of energy on economic growth.

1.3. OBJECTIVES OF THE STUDY

The objectives of the study are:-

- a) To undertake a trend analysis of energy consumption vis-à-vis economic growth (1975-2004).
- b) To establish the causal relationship between energy consumption and economic growth.
- c) To examine the impact of energy consumption on the growth of the Nigerian economy from 1975 to 2004.

1.4. RESEARCH HYPOTHESIS

Three research hypotheses derived directly from the research objectives were tested. These hypotheses are:

1. H_0 : Energy consumption does not granger causes economic growth.

H_a : Energy consumption granger causes economic growth.

2. H_0 Economic growth does not granger causes energy consumption.

H_a : Economic growth granger causes energy consumption.

3. H_0 : There is no significant relationship between energy consumption and economic growth.

H_a : Alternatively, there is a significant relationship between energy consumption and economic growth.

These hypotheses are stated symbolically as follows:

$$H_0: B_0 = 0$$

$$H_a: B_1 \neq 0$$

The t-statistics and f-test were used to test the individual and combined statistical significance of the estimated parametric coefficients respectively.

1.5. SCOPE OF THE STUDY

The study covered the period 1975 to 2004. The period has been chosen principally because as at 1975, the importance of agriculture to the economy gradually gave way to crude oil exploration. The study period also witnessed the aftermath effects of the first oil price shock which generated a substantial increase in oil exploration, prices and consumption all over the world. The study period 1975 – 2004 was also broken into two, the pre-SAP (1975 to 1985) period and the post-SAP (1986-2004) periods. This was used to x-ray the effects of SAP policies on energy consumption in Nigeria.

1.6. JUSTIFICATION OF THE STUDY

The justification of this study is premised on the importance of energy to the economy of Nigeria most especially in the present circumstance of energy paradox – scarcity in the midst of plenty which the nation has been facing for sometime now.

Based on the series of contradictory results obtained from some studies as regards the relationship between energy consumption and growth and the causal effect between the two variables which some study found no evidence of causality between them, the need to conserve energy for future

use as the activity of man revolves round energy made it imperative to establish a relationship between energy consumption and economic growth.

The importance of energy to any economy cannot be over emphasized. Energy is used in almost all sectors of the economy ranging from mining, transport, agriculture, manufacturing industry, electricity generation and so on. Energy use has in one time or the other accelerated the growth of the economy. The establishment of a causal relationship between energy consumption and growth which this study hope to achieve will go a long way in repositioning the economy towards the conservation of the energy resource so as to ensure the continuous functioning of the different sectors of the economy and the attainment of sustainable development. This will also ensure that citizens will continue to have a steady flow of income, improvement in the standard of their living and the overall development of the economy.

1.6.1. LIMITATIONS OF THE STUDY

The main limitation of the study will relates to the usual limitations with official data, namely, reliability. Data to be used are official data published by the Central Bank of Nigeria (CBN) which diverge significantly

from those published by World Bank and International Monetary Fund (IMF) and OPEC. This discrepancy in data constitutes a problem.

1.7. IDENTIFICATION, DEFINITION AND MEASUREMENT OF VARIABLES

1.7.1. Concept of Growth

There is need for us to distinguish between growth and development. Growth refers to an increase in an economy's capacity to generate more goods and services. It results in an outward shift of the economy's production possibility frontier. Development on the other hand is growth plus structural shift. Therefore, growth is part of development.

Growth can be measured using the Gross Domestic Product (GDP) of a country. However, growth in nominal GDP does not constitute real growth. Nominal GDP at factor cost has to be deflated by the Consumer Price Index (CPI) to obtain real GDP. This study applies real GDP as a proxy for growth.

1.7.2. CONCEPT OF ENERGY CONSUMPTION

Energy has been conceived as a source of power such as fuels, diesel, gas, electricity etc. which can be used to drive machines for production and manufacturing purposes. It is the ability of energy to drive machines which is used for productive purposes makes it imperative for it to be conserved,

since its conservation will ensure that production, manufacturing, transport and distribution will be sustained over time.

The sustainability of energy is fundamental to the economic growth of a nation since energy is the driving force for increased output of goods and services and the overall welfare of the individuals in a country. Therefore, any energy form that is used up for such purposes is said to be consumed.

Total energy consumption which is a combination of total coal, hydropower, petroleum and natural gas consumed within the study period is measured in tones of coal equivalent. This is further deflated by the consumer price index to obtain real energy consumption.

1.7.3. Concept of Causality

The nature of econometrics is to look at the cause and effects of two or more variables. The correlation coefficient is used in assessing the relationship between variable and not the cause and effect. Therefore causation is not the same with correlation. Causation is a central problem in econometrics.

In 1969, C.W.J. Grange in his study titled “Investigating causal relations by econometric methods and cross-spectral methods”, he tried to establish some mechanism in looking at the causal relationship between

variables i.e. Does in looking at the causal relationship between variables i.e. Does X causes Y or Does Y causes X? He used his name to qualify his work by using X Granger causes Y or Y Granger causes X.

Granger causality or non causality is concerned with whether lagged values of Y do or do not improve on the explanation of X obtainable from only lagged values of X itself. A simple test is to regress X on lagged values of itself and lagged values of Y, to show if Y Granger causes X or not. Therefore, causality deals with the relationship between two variables where one causes the other to happen.

1.8. STRUCTURE OF THE WORK

The study is structured as follows; Chapter I is an introductory chapter, it comprises of background to the study, research problem, the objective of the study, justification of the study, the research hypothesis, scope and limitations of the study and the definition and measurement of variables. Chapter II appraises the relevant literatures, the theoretical framework, the energy profile of the Nigerian economy, the structure of energy consumption and government policies on energy production and consumption in Nigeria. Chapter III is the research methodology, the model specification and estimation technique, the source of data, the test for

stationarity and the model for causality test. Chapter IV is results and discussion. It begins with the trend analysis of energy consumption and economic growth, the result on stationarity and causality test and the impact of GDP on energy consumption. Chapter V is the summary, recommendations and conclusions.

CHAPTER TWO

2.0. LITERATURE REVIEW

2.1. EMPIRICAL LITERATURE

The contribution of energy to growth had its origin in the “limit to growth” literature of the early 1970s where the capability of the environment to meet present and future needs rests on the limitations imposed by the state of technology and social organization. This is one of the tenets of “sustainable development”, which requires that the growth and well-being of present generations are brought about in such ways that the ability of future generations to meet their own needs will not be compromised.

The conventional energy and development paradigm note that the level of energy consumption is an indicator of welfare (see for example Bergesen et al, 1991). This implies that every analysis and planning should make projections of future energy demands to determine the quantity and mixes to meet such demands. The consequences of this paradigm are that the pumping of energy becomes an end in itself, rather than an instrument for achieving development. In his own submission Eleri (1996) opines that sustainability of growth in any economy would depend on what energy is used for and who benefits from it. He suggests that the choice of instruments for promoting the role of energy in the development process

would need to be assessed in terms of its ability to promote growth in economic activities and in the spread of economic equity and social tranquility. It will also depend on the safety it guarantees the environment and the welfare of generations to come.

In trying to investigate the causal relationship between energy consumption and growth, Kraft and Kraft (1978) found a unidirectional causality from Growth to energy consumption. In their pioneering work for the United States, they used Gross National Product (GNP) as growth variable. Further studies in the United States however, revealed contrasting and conflicting results as regards the possibility of energy and growth to have a relationship. For instance, Akarca and Long (1979), Yu and Hwang (1984), Yu and Choi (1985), Erol and Yu (1987) all have a common thread running through their results; they found that no relationship existed between energy and economic growth. While Abosedra and Baghestani (1989) in their own study found that a relationship existed between the two variables. Stern (1993) using the multivariate approach, found no relationship, but submitted that a measure of final energy consumption adjusted for changing fuel composition Granger causes economic growth. In his analysis, he used Gross Domestic Product (GDP) as the measurement of growth.

Adenikinju and Alaba (1999) in their study of Nigeria in which they used total factor productivity growth, they establish that energy consumption plays a crucial role in productivity growth in the Nigerian manufacturing sector. Babatunde and Francis (2001) in their study used a multivariate model in looking at the effects of some key economic variables like government expenditure, exchange rate, money supply, energy pricing on energy consumption and the growth of the Nigerian economy. Their model was specified by vector autoregressive models as follows:

lrgdp = log of real GDP

lrexr = log of real exchange rate

lrenp = log of real energy price

lrencp = log of real energy consumption

lrm2 = log of real money supply (M_2)

lrgex = log of real government expenditure

This multivariate model was transformed into a multi-cointegration equation as shown below:

$$A(L) \Delta X_t = B \delta^{-1} X_{t-1} + d(L) \varepsilon_t$$

Where X is the n -vector of model variables, Δ is the first difference operator, in an $n \times r$ matrix of coefficients, δ in the $n \times r$ matrix cointegrating vectors. $A(L)$ and $d(L)$ are matrix polynomials in the lag operator L with A

$(0) = 1$ and ε_t is the Zero-mean n -vector of white noise disturbances. At the end of their study, they found a unidirectional causality between energy consumption and economic growth. In their study they used Gross Domestic Product (GDP) as the measurement of growth, while energy consumption data was obtained from the OPEC Statistical bulletin.

Concluding from this composite picture, Eleri (1996) says that, making economic growth and energy resource to be responsive to each other and, hence, the overall growth of the economy requires that two basic issues be addressed. First the appropriate pricing and internalization of domestic energy consumption so as to cater for production, distribution, environmental impact and inter-temporariness of some of these resources, secondly, that the proceeds from energy sector (e.g. crude oil) should be channeled towards researches and the development of the Liquefied Natural Gas (LNG) as well as the other renewable energy resources. In this manner energy may serve as a bridge to future economic growth and development.

2.2. THEORETICAL FRAMEWORK

Economists have attempted to explain how and why growth occurs in economies. Economic growth can be defined as a change in the real gross domestic product (GDP) of a country over time. This change must be

sustained over a long period of time to distinguish it from mere cyclical fluctuations or a large harvest or transient phenomena (Kuznet, 1969). The theory of economic growth explains the level of output at any point in time and how each stages generates forces that propels the economy to the next stage according to Hellar, (1971) with emphasis on the importance of an economy's factors of production (land, labour, capital and entrepreneurship) and their rate of change as being the main determinant of each stage of economic growth.

Among these theories, the Harrod-Dommar model seems to be at the centre of the argument. The model stresses the importance of saving and investment, as well as growth in population as the main determinant of economic growth. The model rests on a production function that relates output to available capital stock through the capital output ratio.

$$\frac{K}{Y} = R$$

where K = capital stock, Y = output and R = capital output ratio. Thus since savings (S) equal to investment (I), an increase in savings leads to an increase in investment and hence growth, depending on the capital output ratio. The theory assumes constant rate of savings from the output.

$$S = sY$$

Hence growth in output ($\Delta Y/Y$) is a function of the ratio of savings and capital output ratio. This model attaches great importance to capital as an engine of growth. Solow's growth models assumes basically two factors of production namely, capital and labour. The production function is subject to constant returns to scale using two inputs. Hence, output increases proportionately to changes in input. The theory also assumes proportionate savings from output.

$$S = sY = \text{Investment}$$

W.W. Rostow on the other hand, attempts a historical approach in explaining the nature and causes of economic growth. He said that there are basically five stages of growth and that all economies of the world lie in one of these stages. These stages are:

- a) The traditional society
- b) The precondition for take-off
- c) The take off stage
- d) The drive towards maturity and
- e) The stage of high mass consumption of durable goods.

According to Rostow, all economies must pass through these stages for them to attain the highest level of development. By Rostow's classification all developing countries of Africa, Asia and Latin America still

fall within the traditional stage or the precondition for take off stage. At this stage he argued that what is important for the take off of an economy is the mobilization of savings in order to generate sufficient investment for economic growth. This investment includes among others a viable agricultural sector, a vibrant mining and industrial sector, a good transport sector and so on.

Theoretically, energy resources are expected to be influenced by the presence of abundant natural resources which a country is endowed with. This is the case of Nigeria with huge deposits of crude oil and other forms of energy. These resources have triggered the inflow of foreign direct investment in the energy sector taking into consideration the size of the market that is available for the product and the higher profit rates in the energy sector.

The availability of crude oil in the energy sector as well as electricity form the basis in which most industrial and manufacturing firms operate. Adequate power or the availability of power or energy is one of the factors that influence the location of an industry in a particular area. The full utilization of these energy sources will lead to a reduction in the cost of production and apparently an increase in output in the economy leads to the growth of the economy.

Therefore, the availability of adequate power supply through crude oil and its products, electricity supply is the hinge in which extraction production and manufacturing, transportation and distribution of goods and services in the country rest. And as such to sustain these activities, such energy sources need to be conserved.

The demand for energy resource (energy consumption) is an indirect one because it is not for consumption, but rather, it serves as an input for the production of final goods and service. The demand curve is, therefore a derived demand curve since it is the outcome of the relationship between the input of crude oil and the resulting output of final products and services as valued by the customers.

Having noted that the demand for energy is an indirect one and it is an input for the production of goods and services which leads to economic growth and development. It is to this effect that energy needed to be conserved to meet future economic growth and development – and the needs of future generations.

Crude oil, natural gas and coal which form the major percentage of energy source consumed in Nigeria are non-renewable resources and as such it is said to be exhaustible. It is on this basis that the study is hinged on the exhaustible resource theory which is based, in part, on the work of Hotelling

(1931) who advocated the need to price oil and other fossil resources in a way that recognizes the temporariness of their availability. According to this school of thought, the price becomes a user cost, or depletion charge which compensates for the fact that future generations are denied access to the commodity.

Professor Hotelling (1931) further argued that the nature of exhaustible assets has led to demands for their regulated exploitation. Otherwise, the present generation could consider the asset too cheap and so wastefully consume it. In the light of this argument, the appropriate pricing of petroleum and energy resource must consider the future generation. This can be done in either of two ways, either the exploitation of energy resources is spread over as many generations as possible, or the revenues are saved in cash or in kind for future generations. Hotelling further argued that the resultant social revenue should be spent in such a way as to preserve the interest of future generations.

According to Hotelling (1931), formal analysis of non-renewable resource depletion views exhaustible resources as assets generating returns over time and whose opportunity cost of current extraction and consumption imply less stock for future consumption. The Hotelling's model examines the inter-temporal allocation of a known, finite stock of a non-renewable

resource. In it, the decision-maker chooses a time path for resource extraction that maximizes the present value of the stream of net benefits from extraction, subject to the constraint that cumulative extraction is not greater than the initial resource endowment. As shown in Krautkraemer (1998), the optimal control problem is to choose $q(t)$ as to:

$$\text{Maximize } \int_0^a e^{-\sigma t} [B(q(t), S(t)) - C(q(t), S(t))] dt \dots\dots\dots(1)$$

Subject to:

$$S(t) = S_0 - \int_0^t q(t) dt \dots\dots\dots(2)$$

$$S(t) \geq 0; q(t) \geq 0; S(0) = S_0 \dots\dots\dots (3)$$

Where $q(t)$ = time path for resource extraction; S_0 = initial resource endowment.

$B[q(t), S(t)]$ = the gross benefits;

$C[q(t), S(t)]$ = extraction costs; $S(t)$ = resource endowment at

time t ; and σ = rate of discount

It is generally agreed in natural resource exhaustion theory that the optimal rate of extraction is determined at the point where marginal productivity of the resource in its entire uses is equalized (see Hotelling 1931; Devarajan and Fisher, 1981). The expected rate of oil price inflation represents the marginal productivity of oil if left underground, whereas the

rate of return on financial assets (or the interest rate) represents the marginal productivity of the resource if invested in financial assets (Vaez-Zadeh, 1989). Therefore, the optimal rate of extraction is the rate of oil price inflation equal to the interest rate. In contrast, if expected oil prices inflation is higher than the rate of interest, then the optimal or best policy dictates keeping the resources underground and vice versa. (Hartwick 1990; Malar 1991).

2.3. ENERGY PROFILE OF THE NIGERIAN ECONOMY

The significance of natural resource endowment in a developing country such as Nigeria cannot be overemphasized. This is because the lives of people in these countries that are endowed with these resources revolve largely around the exploitation and utilization of these resources in agriculture, mining, industry, transport, electricity generation and so on. Thus, Nigeria is well endowed with agricultural and mineral resources and the exploitation and utilization of these resources has at one time or the other contributed significantly to economic growth and development with attendant consequences on the environment (Magbagbeola, 1999).

In Nigeria, the impact of crude oil production and export is very significant on the level of economic development and the environment. This

is because crude oil production has provided employment opportunities and income for many Nigerians. The output of crude oil, particularly petroleum products, have been put into various uses (lighting, cooking, sources of power or energy for vehicles and other industrial equipment and machinery), which have enhanced household and industrial activities. In short, it has promoted economic activities in Nigeria and this has had positive impact on the welfare of the people and output of the economy.

Furthermore, the production of crude oil for export has been generating substantial revenue in the form of foreign exchange receipts for Nigeria since the late 1950s. Thus, export of crude oil has risen overtime; accounting for about 90 percent of total export of Nigeria in recent times (Adeolu, 2001). Therefore, crude oil export has been the engine of growth of the Nigerian economy since the late 1960s.

The Nigerian economy, which is blessed with vast and varying primary energy resources, revolves round the following types of energy; crude oil, hydro power, natural gas, coal, fuel wood, solar energy etc. Crude oil is the most vital of all the energy resources in the Nigerian growth process (Eleri, 1996). This has been ascribed to two main reasons. First, crude oil is the most pronounced of the energy resources, accounting for over 70 percent of energy consumption. Secondly, it is the major source of

government revenue, which represents over 95 percent of foreign exchange earnings and about 40 percent of the Gross National Product (GNP). (Eleri, 1996). Despite these huge revenues, which inadvertently drive the money supply via the government expenditure or spending pattern in the economy. Okogu, (1993) observes that the fate of economic growth has been on the downward trend. The author notes further that inefficiencies and ineffectiveness in the management of the energy sector and the revenue derived from it have constrained the growth of the oil sector and the nation, Nigeria in general.

The resultant effect of the mismanagement and price fluctuations in the world oil market is the fall in the GDP from \$99.5 billion in 1980 to \$27 billion in 1990. This is coupled with the debt toll, which rose from about \$500 million in 1970 to about \$34 billion in 1997. With the inception of the Obasanjo's administration in 1999, the Economic Intelligent Unit (EIU) estimates that Nigeria has earned over \$280 bn from oil during the past 30 years. The World Bank reports that inspite of this huge revenue, about 66% of the population now falls below the poverty line of about a dollar a day, compared to 43% in 1985, (World Bank, 2001). Until recently, i.e. between 2003 and 2004, the present administration has sought for debt forgiveness from her creditors. It is worth mentioning that Nigeria may have been

through with Paris Club following the series of successful negotiations between the country and the club. It is also important to note that the debt toll of the country following the successful negotiations with the Paris club has reduced.

In spite of the increased revenue from crude oil, the Nigerian economy has not witnessed any significant push. An investigation into selected socio-economic indicators shows the precarious growth position of the economy, see Table 2.1.

Table 2.1: Selected Socio-Economic Characteristics of Nigeria

S/No .	Indicator/Year	1991	'92	'93	'94	'95	'96	'97	'98	'99	2000	2001	2002	2003	2004
1.	Real GDP growth (%)	2.2	3.0	2.7	1.3	2.1	3.4	3.2	3.2	2.8	3.9	4.2	4.1	3.8	4.2
2.	Inflation rate (%)	13.0	44.6	57.2	57.0	72.8	29.3	8.5	10.0	0.6	6.9	16.5	16.1	11.3	10.0
3.	Capacity utilization (%)	39.4	38.1	37.2	30.4	29.3	32.5	30.4	32.4	34.6	36.1	32.7	44.3	41.1	43.5
4.	Manufacturing employment (% change)	23.11	11.4	-	4.11	4.67	-	8.96	6.74	5.64	3.83	4.21	3.81	3.82	3.64

Source: CBN: Annual Report and Statement of Accounts (various issues).

Table 2.1 shows that at a time when there was decline in economic activities, as shown by the decline from 3.0 to 2.2 per cent, inflation rate increased from 44.6 to 72.8 percent between 1992 and 1995. The data also showed that there was considerable growth in the economy from a growth rate of 2.2 percent in 1991 to 4.2 percent in 2004. Capacity utilization in the manufacturing sector fluctuated throughout the review period and the average annual growth in manufacturing employment witnessed decline for most of the period under review. On the average capacity utilization increased from 39.4 to 43.5 while manufacturing employment fell drastically from 23.11 in 1991 to 3.64 in 2004.

An investigation into the performance of the energy sector shows that the sector has fallen victim of varying forms of problems ranging from acute shortages of energy source of production, high costs, and conflicts due to partial or total neglect as the case may be. The World Bank report (1995) rates Nigeria as the worst performer in the power sector out of 20 developing nations. The rating shows Nigeria as having the highest percentage system losses; lowest generation capacity factor and average collected revenue as well as lowest return on investment. The report further notes that although successive governments in Nigeria have been inclined towards political rather than economic motivated investment in the energy sector, such that instead of promoting economic growth

excessive indebtedness have been incurred. This is particularly pronounced in the petroleum/refining sector.

Availability and the provision of energy have been characterized by acute scarcity, with the most worrisome being petroleum products and the electric power supply. In addition to these two is the natural gas, the scarcity of which is detrimental to the services of thermal power generating plants. Available data reveals that inspite of the 5980mw generating capacity of the National Electric Power Authority (NEPA, now Power Holding Company of Nigeria (PHCN)) only 2200 mw has been used. (NEPA Annual report, 1997). This has accounted for the frequent outages that have led to the parallel private supply capacity that has been found to be quite as large as the official utility peak load. The generation of electricity between 1993 and 2003 is presented in Table 2.2

Table 2.2: Electricity Generation and Consumption (Million kph) 1993 - 2003

YEAR	INSTALLED CAPACITY	TOTAL GENERA- TION (million kph)	ELECTRI- CITY GENERA- TION GROWTH RATE (%)	TOTAL ELECTRI- CITY CONSUM- PTION	ELECTRI- CITY CONSUMP- TION GROWTH RATE (%)
1993	4548.6	14,504.6	-2.2	9998.3	0.2
1994	4548.6	15,531.0	7.1	9593.9	-0.04
1995	4548.6	15,586.6	2.1	9435.9	-0.02
1996	4548.6	16,242.8	2.4	9051.7	-0.04
1997	4548.6	16,116.9	-0.8	8843.7	-0.02
1998	4548.6	15,110.0	-6.3	8521.2	-0.04
1999	4548.6	16,088.7	6.5	8576.3	0.006
2000	4548.6	14,727.0	-8.5	8688.9	0.01
2001	4548.6	15,463.0	5.0	9034.6	0.04
2002	4548.6	21,544.0	39.0	9079.7	0.005
2003	4548.6	20,183.2	-6.3		

Source: Computed from the Central Bank of Nigeria Statistical bulletin (2004).

From the Table 2.2, it can be deduced that electricity generation between 1993 and 2003 increased, though not quite significantly while total consumption fell. Total electricity generation increased from 14,504.6 kph in 1993 to 20183.2 kph in 2003, while total electricity consumption fell from 9998.3 in 1993 to 9079.7 in 2003.

This annual increase in electricity generation is not quite appreciable. In 1993 the annual percentage increase was -2.2 which a decline is. It appreciated to 7.1 in 1994 and by 1998 it declined by -6.3. 2001 and 2003 witnessed an

appreciable increase from 5.0 in 2001 to 39.0 in 2002. It finally fell to –6.3 in 2003. The growth rate in electricity consumption generally was negative, from 0.2 increases in 1993 to a decrease of 0.005 in 2003. This shows that electricity consumption has been on the downward trend within this period.

The decline in electricity generation and consumption is traceable to thermal generation which decreased by 16.9 percent below the level in 2002, although hydro-generation increased by over 20 percent. The lower output of thermal plants as recorded between 1993 and 2003 was attributed to shutdowns for rehabilitation, vandalization of NEPA cables as well as communal unrests in the gas/oil producing areas which disrupted gas transportation through pipelines to the plants. The NEPA (PHCN) accounted for 99.5 percent of the total electricity generated. The performance in electricity generation in 2003 was also attributed to a decline in the funding of the power sector by the Federal government. Moreover, NEPA's functional plants especially, 6 units of the Kainji plant, 5 units of Jebba plant and 6 units of Egbin plant were over-used in an effort to meet the nation's power needs. Another factor that contributed to the fall in electricity generation was the closure of the 50mw Geometric power plant at Abuja during the year.

Apart from the national electric utility problem, there are also persistent shortages of petroleum products, particularly the premium motor spirit (PMS). Despite the estimated production capacity of 385,000 barrels per day expectedly

from four refineries in Warri, Kaduna and PortHacourt, the estimated domestic demand was below 300,000 barrels per day (b/d). Following the estimations above, a capacity surplus of 100,000 b/d is to serve as exports. The irony, however is that above 25 percent of PMS consumption was imported into the country between 1997 and 1998. The imports were as a result of the constant closures of the refineries resulting from either technical failures or sabotage. A comparison of commercial energy use in Nigeria with some selected African countries show that average growth in energy use 1980 and 1996 was 2.9 percent which put the country behind Morocco, Ghana etc. This is indicated in Table 2.3 below. While per capita energy use also witnessed a negative decline of -0.1 percent in Nigeria, while Ghana and Morocco witnessed positive growth rates.

Table 2.3: Commercial Energy Production, use per capital and Average annual growth

Country	Commercial Σ^0 Production	Commercial Σ^0 Use (average annual growth %)	Per Capita Σ^0 (average annual growth %)	Net energy imports (% of Commercial Σ^0 Use)
Year	1996	1980 – 1996	1980 - 1996	1996
Nigeria	170453	2.9	-0.1	-106
Morocco	868	4.2	2.1	90
Ghana	5604	3.6	0.4	16
Cameroon	10,016	1.7	-1.1	-100
Benin	1,951	2.1	-1.0	-2.0
DRC	13,689	3.1	-0.2	1.0

Source: World Development indicators, World Bank, 1999.

Energy intensity, however, varied dramatically in the country especially within the industrial sector. Adenikinju and Alaba, (1999) observed that energy use dropped on all fronts – electricity, diesel, gasoline, fuel oil and average fossil fuel. These reductions in the use of energy were attributed to capacity utilization effects and the dramatic rise in the energy product prices in recent times. Energy use drop affects to a large extent capacity utilization in the manufacturing sector which leads to a drop in total output. If this is sustained over a period of time the

manufacturing sector will be heading towards closure. This will invariably affect the growth of the economy vis-à-vis the living standard of the citizens.

2.4. THE STRUCTURE OF ENERGY CONSUMPTION AND DEMAND IN NIGERIA

Nigeria is the most populous country in Africa with an estimated population of about 121.8 million. The average annual growth rate as recorded by the African Development Bank (ADB) 1999 is 2.8 percent making it one of the fastest growing nations in the world. A major proportion of these population lives in the rural areas and depend heavily on agricultural products for their livelihood. It is important to note that the drift towards the urban centres is quite growing among the young people particularly in search of white collar jobs which are not available. The average living standard of Nigerians, as measured by the level of per capita real income is quite low (real GNP per capita was only \$260 in the late 1990s). Of greater significance is the fact that average real per capita income is less than the poverty threshold of \$1 a day as stipulated by the World Bank. This was despite the fact that the country has earned over 200 billion of scarce foreign exchange from oil export during the previous three decades. With the advent of civil rule in 1999 after nearly twenty years of military rule, the country is under serious pressure to raise her standard of living.

Nigeria is richly blessed with energy resources. These include coal, tar sand, oil, petroleum, natural gas, hydroelectricity, solar and oil shale. Nuclear deposits (thorium) also exist. The energy sector is, however, dominated by petroleum and natural gas both of which jointly accounts for 71 percent of domestic average resources.

Domestic consumption of commercial energy has been on the increase. Between 1980 and 1994, energy consumption increased at an average annual rate of 4.8 percent per annum, compared to the average annual growth rate of 0.2 percent of energy production over the same period. By 2003, at 165.9 (1985 = 100), the aggregate index of energy consumption increased by 0.3 percent in 2003, compared with an increase of 0.9 percent in 2002. The aggregate energy consumed increased from 56.1 million tonnes of coal equivalent (tce) in 2002 to 58.4 million tce in 2003. The increase was accounted for by increases in the consumption of petroleum products (5.8 percent), natural gas (3.0 percent) and hydro-power (0.2 percent). However, the consumption of coal declined by 9.2 percent in 2003. (CBN Annual Report and statement of accounts. 2003).

In spite of this apparent imbalance in the growth rates of energy consumption and production, Nigeria remains a net energy exporting country with energy imports constituting a mere 4 percent of merchandise exports in 1990. The growth rate recorded in domestic energy consumption between 1980 and 1994 is, however,

lower than historical trends for instance, in the period 1965 – 80, the annual growth rate was 12.9 percent per annum. This downward trend reflects a combination of poorer economic performance and higher energy prices (Iwayemi 1991). The increasing growth in energy intensity and the declining trend in productivity is an indication of inefficiency in domestic energy use.

An analysis of energy consumption mix in Nigeria shows the dominance of petroleum products, even though this has been declining over time. In recent times, however, natural gas has taken over the lead. The increasing domestic use of natural gas instead of flaring it as was the case in the past has induced a dramatic shift in the structure of energy consumption. Thus, the share of petroleum products in energy consumption declined from 74.6 percent in 1970 to 46.5 percent in 1992 and further to 37.7 percent in 1999. On the other hand, the share of natural gas has increased from about 5 percent to 29.3 percent in 1992 and to 53.2 percent in 1999. The production of natural gas increased by 11.3 percent in 2003, the improvement was attributable mainly to the expansion in oil production and associated gas. Also, the quantities of gas utilized and flared increased by 14.3 and 7.5 percent respectively. Gas flared accounted for 42.7 percent of total output, compared with 47.8 percent in 2002. The reduction in the proportion of flared gas was attributed to the expansion in gas utilization, as gas sold to industries for energy increased by 61.6 percent, out of which 64.1 percent was sold to the

Nigerian Liquefied Natural Gas (NLNG). Gas re-injected into the wells for conservation decreased by 15.4 percent below the level in the previous year, while gas converted to natural gas liquids (NGL) declined by 53.7 percent. (CBN Annual Report and statements of accounts).

In comparison, however, the profile of coal declined considerably as source of primary energy consumption. In the 1950s, coal accounted for over two-thirds of commercial energy consumption. It was used mainly in rail transportation, power generation, and cement plants. During this period, Nigeria also supplied coal to the Ghana Railway Corporation. But by 1970, coal had become the least important commercial energy source, giving way to cheaper, cleaner and more efficient energy forms. Currently, the coal industry (which is state-owned) is in a state of near paralysis, suffering from lack of effective investment and poor management (Iwayemi 1984). It is worthy to note also that coal consumption declined by 9.2 percent in 2003, owing to increased usage of other forms of energy, especially petroleum products and natural gas, as well as the environmental hazards of raw coal utilization. However, construction work at the first phase of coal carbarnization/Briqueting/pelletization plants by the Nigerian Coal Corporation, Enugu for the production of 100,000 tonnes per annum of smokeless coal had reached 95 percent completion by the end of 2003. (CBN Annual Report and Statement of Accounts).

Petroleum products, which constituted 31 percent of local energy consumed in 1950, had replaced coal as the largest energy source by 1960. Coal currently accounts for about 0.04 percent of total commercial energy consumption in Nigeria. Hydroelectricity rose from 1 percent in 1950 to 19.6 percent in 1970, following the completion of the 960 MW Kainji Dam. The completion of Shiroro Dam in 1990 further pushed its share to 22.8 percent in 1992. Nevertheless, the increasing prominence of natural gas in electricity generation, an area previously dominated by hydro, has led to a sharp fall in hydro electricity share in energy consumption. By 1999, its share was as low as 9.0 percent (CBN Annual Report and Statements of Accounts).

Improvements in the electricity sub sector had been sluggish. Electricity consumption increased by 0.2 percent in 2003, compared with an increase of 0.6 percent in 2002. The rise in consumption was accounted for by an increase of 7.3 percent in commercial/street lighting, as industrial and residential consumption declined by 9.3 and 0.6 respectively. The fall in industrial consumption reflected a switch to private provisioning by industrial consumers as a result of the on going rehabilitation of NEPA (PHCN) plants. Residential consumption accounted for 59.6 percent of total electricity consumption, while commercial and street lighting and industrial consumption accounted for 27.5 and 12.9 percent of the total respectively (CBN Annual Report and Statement of Accounts).

The transport sector is the largest consumer of energy products in Nigeria. These comprise essential petroleum products such as gasoline and diesel. This sector's share of total demand grew from 59.7 percent in 1970 to 62.6 percent in 1980, but declined to 55.7 percent in 1989 and 5.4 percent in 1999. Two major factors contributed to this pattern. First was the relative affluence of Nigerians arising from the oil boom of the 1970s, which provided the country with substantial revenue to sustain large importation of motor vehicles to supplement output of local assembly plants? The second reason is the current economic recession in the country coupled with a relatively liberalized trade policy regime that encourages the importation of a large number of highly fuel inefficient used cars from Europe. This has led to preponderance of old and not-well-maintained automobiles in the stock of vehicles (Adegbulugbe 1994). The huge expansion in the consumption of petroleum products was also fuelled by the rapid increase in urbanization and the urban sprawl that accompanied the urban bias of government expenditures. Urban population, as a proportion of total population, rose from 17 percent in 1965 to 42 percent in 1998. This corresponds to an average growth rate of 6.1 percent per annum.

Perhaps, the most crucial factor is the previous pricing policies of the government, which contributed to the observed trends in every consumption in Nigeria. The promotion of wrong energy pricing over the years has fostered on the

economy inefficient utilization pattern by the various segments of the economy. This is because price has not been allowed to traditional role of signaling the real cost of energy use to consumers. For instance, nominal prices of petroleum products changed only once between 1973 and 1986 (i.e., 1978), although in recent times there have been more frequent changes in light of binding government financial constraints. The real price of gasoline declined from 70k in 1973 to 36k in 1980 and 17k in 1990. The sharp increase in 1978 and 2000 led to a trend reversal to 58.4k in year 2000. Kerosene prices, in real terms, also fall from 13k in 1973 to 5k in 1990 before rising to 45k in year 2000. The trend is similar for other products. The federal government administratively fixes prices of most commercial energy prices in Nigeria. And quite often these prices are substantially below their opportunity costs or shadow prices. The World Bank estimates that about \$4.2 billion per year is lost in the energy sector above as a result of inappropriate pricing, overinvestment, neglect of maintenance, wrong policies and corruption. Of these, inappropriate pricing of petroleum products accounts for a colossal amount of \$3.3 Billion (World Bank 1993). The appropriate pricing of petroleum product is still a topic of great discuss in Nigeria today where people and scholars have argued that the pricing should contain elements of subsidy while others are of the opinion that subsidy should be removed. This is still subject to debate and proper research to justify individual claims.

The trend in energy prices in Nigeria shows a period of stable nominal prices, punctuated by sudden price changes. The reluctance of successive governments to increase energy pricing is primarily because they are considered economically and politically sensitive. A vivid illustration of the political sensitivity of energy prices was the riot that welcomed government announcement of marginal increase in gasoline prices in May 1989 and the various labour unrests that followed government announcement of higher gasoline prices between 2000 and 2004. Nigerians continue to view cheap energy prices as part of their share of a national resource.

Firewood consumption remains the dominant component of energy consumption in Nigeria. Nevertheless, its sourcing and marketing take place largely in the informal sector. Also, the share of non-commercial energy sources, including fuel wood in total energy consumption has been declining primarily because of inter-fuel substitution from fuel wood and charcoal to kerosene and liquefied petroleum gas (LPG) for cooking and heating of water (Adegbulugbe 1994).

Finally, the structure of the economy is currently skewed towards energy intensive sectors of agriculture and industry at 43 and 32 percent respectively. The services sector which is relatively less energy intensive, accounts for 25 percent of

GDP. Thus, the urge to hasten the pace of development would continue to exert a pull effect on energy consumption (Iwayemi and Aderikinju, 2001).

2.5 GOVERNMENT POLICIES ON ENERGY PRODUCTION DISTRIBUTION AND CONSUMPTION IN NIGERIA.

The federal government since the discovery of energy has put in place several policy measures to ensure the continuous production and consumption, among these policy measures includes the petroleum product pricing subsidy, the deregulation of the downstream sector and the establishment of the Nigerian Liquefied Natural Gas (NLNG).

The petroleum product subsidy was a policy instrument put in place by the government to ensure that all its citizens are able to have easy access to the petroleum product by subsidizing the prices of petroleum product. This is aimed at making the product cheaper and thus increases the consumption of the petroleum product. This policy measure has met several criticism, some have argued that petroleum subsidy has led to the scarcity of the product. The debate is still on whether to remove subsidy or not. The deregulation of the downstream sector was aimed at increasing energy production both for domestic and export purpose. To a large extent Energy production has increased over time from a total energy production of 31908713 tce in 2000 to 56843037.1 tce in 2004 (CBN Bulletin, 2004).

The establishment of the liquefied natural gas made another turning point for energy production in Nigeria. Prior to the establishment of the LNG, Gas flare was very high which was a colossal waste of energy. With the coming of the LNG such gas was converted into useable energy both for domestic and export purposes. The continuous turn around maintenance of the nation's refinery was a measure put in place to ensure that energy production is sustained.

The consumption of coal has over time continued to decline owing to the increased usage of other forms of energy ranging from petroleum products and natural gas. However, the government has started the construction work at the first phase of coal carbonization/Briqueting/pelletization plants by the Nigerian coal corporation, Enugu for the production of 100,000 tonnes per annum of smokeless coal. This construction work has reached 95 percent completion by the end of 2003. It is hoped that the production of 100,000 smokeless coals will increase energy production in Nigeria.

The nation's hydropower sector which was in a state of near paralysis before the advent of the new administration has also received serious attention. With a total generation capacity of less than 3000 MW to serve the nation before 1999. Electricity generation has increased to about 5150 MW in 2004. This has made a positive impact on the energy sector in the country.

Apart from the increase in electricity generation, the federal government (post 1999) enacted two policies targeted at obtaining private sector participation. The federal government introduced the “Emergency power project” policy, whereby upstream oil and gas companies operating in Nigeria will use the surplus gas resources which they are producing in association with oil to produce power under a power purchase agreement (PPA) with NEPA. While many proposals have been considered up to now, one is at advanced stages of planning. The Shell Petroleum Development Company (SPDC) proposal to take over Afam power plant will add about 750 MW to the national grid. The second ENI/AGIP proposal to construct a 450 MW plant, in Kwale, Delta State, became the first privately owned power generation facility in Nigeria when it commenced operation in late March 2005. The second policy which has also yielded some dividends in the independent power project (IPP) with notable current ones being: the Geometric Power Company’s facility being built in Aba, and the first IPP plant in Nigeria, the AES Barge plant in Lagos, which started with a capacity of 90 MW expandable to 270 MW. These programmes have opened up the door for private sector participation in power generation in Nigeria.

The myriad of problems that have bedeviled the nation’s energy sector cannot be overemphasized. Among these problems include acute shortage of petroleum products and its increasing cost. This is evident in the long queues

observed on the nation's petrol stations. Coupled with the quota regimes meted on the country by the organization of petroleum exporting countries, this has hampered the, quantity of crude oil the country can produce for export. The continuous vandalization of the oil pipelines and the NEPA cable wires by hoodlums poses serious problems to the Energy sector. The Militant activities of youths in the Niger/Delta areas can only be imagined etc. These problems made the government to seek for an alternative source of Energy to help ease the problems in the energy sector.

The alternative source of energy is hinged on the production of solar energy that is the conversion of energy from the sun into domestic use and the production of ethanol as a source of energy. Ethanol is proposed to be produced from plants such as cassava, sugar cane, potatoes, wheat etc. Ethanol through available research has proved to be a perfect replacement for fuel energy and the attendant effect on the environment is less as compared to crude oil production. A refinery is proposed to be build in Western Nigeria to commence the production of ethanol as an alternative source of energy.

CHAPTER THREE

3.0 METHODOLOGY

3.1 RESEARCH METHODOLOGY

The methodology employed in this study consisted of a bivariate and a multivariate model which handles both the relationship between energy consumption and economic growth and the impact of each components of energy consumed in Nigeria (coal, petroleum, hydropower and Natural gas) on the growth of the economy. The use of OLS is adopted because of its properties of BLUE. The bivariate model which was later changed to a lagged dependent variable of GDP and energy consumption was used to determine the direction of causality between energy consumption and economic growth. In order to be able to achieve the said direction of causality GDP was modeled as a function of energy consumption as well as modeling energy consumption as function of GDP. A stationarity test was carried out on the series in order to avoid spurious regression which may arise from regressing two or more non-stationarity time series.

The disaggregating of energy consumption was useful is that it pointed out the component that exerts greater impact on economic growth and it also serves as a pointer on the future energy demand and consumption in the country.

The methodology adopted for the trend analysis is the use of a line graph to show the movement of energy consumption and economic growth and how each variable has appreciated over time. The appreciation of energy consumption and economic growth was ascertained within two periods, the pre-SAP (1975-1985) and the post SAP (1986-2004) era. This is particularly necessary because of the importance of SAP in the political and socio-economic life of the country with this trend analysis, the impact of SAP policies on energy consumption and economic growth was also x-rayed. The growth in energy consumption and economic growth also showed that the two variables are strongly correlated which invalidates the assertion of some school of thought that it is impossible for energy consumption and growth to have a relationship.

3.1.1 DATA SOURCES

Secondary data was used for the study. Information was gathered mostly from the Central Bank of Nigeria (CBN) Statistical Bulletin, Annual Reports and Statements of Account, Energy journals – different issues and textbooks etc. Real GDP which is a proxy for growth will be obtained by deflating nominal GDP at factor cost by the consumer price index, while real energy consumption was obtained from the Annual Report and Statement of Account (CBN). Energy

consumption measured in tones of coal equivalent was also deflated by the CPI to obtain real energy consumption.

3.2. MODEL SPECIFICATION AND ESTIMATION PROCEDURE

Generally, various approaches have been used in the literature in the modeling and estimation of the relationship between economic variables particularly energy consumption and economic growth depending on the objective at hand. The estimation period for this study is from 1975 to 2004. The ordinary least square technique (OLS) of estimation was used to estimate the coefficients.

The model is therefore stated as follows:

$$\text{GDP} = F(\text{Energy consumption}) \dots\dots\dots (4)$$

This can be stated in a linear function as

$$Y_t = \alpha + \beta X_t \dots\dots\dots (5)$$

We then have to include the disturbance term U_t to capture other variables not specified in the model.

$$Y_t = \alpha + \beta X_t + U_t \dots\dots\dots (6)$$

Where:

Y_t = Gross domestic product which represents economic growth

α = the intercept.

β = the slope coefficient

X_t = energy consumption for the estimated period

U_t = error or disturbance term.

The disaggregating of energy consumption gives us the model

$$Y = f(\text{Coal, Hydro power, Natural Gas, Petroleum product}) \dots \dots \dots (7)$$

This can also be stated in a linear function as

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 \dots \dots \dots (8)$$

The inclusion of the error term captures other variables not included in the model. Thus

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + U \dots \dots \dots (9)$$

where

Y = Gross domestic product (GDP)

α = The intercept.

β_1 to β_4 = the coefficients

X_1 == Coal

X_2 == hydropower

X_3 = Natural gas

X_4 == Petroleum product

U = error term

The estimation of this model showed which of the energy component that exerts the greater impact on economic growth.

3.3. TEST FOR STATIONARITY

For a guide to an appropriate specification of the regression equation, the characteristics of the time series data used for the estimation of the model was examined. Broadly speaking, a stochastic process is said to be stationary if its mean and variance are constant over time and the value of covariance between two time periods depends only on the distance or lag between the two time periods and not on the actual time at which the covariance is computed.

In regressing a time series variable on another time series variable, one often obtains a very high R^2 although there is no meaningful relationship between the two. This situation exemplifies the problem of spurious regression. If both time series exhibit strong trends, the high R^2 observed is due to the presence of the trend not to a true relationship between the two. If a series is non-stationary, its means, variance and auto covariance (at various lags) will not remain the same no matter the time we measure them.

THE UNIT ROOTS TEST: The unit root test is one of the methods used in testing for stationarity. Consider the model:

$$Y_t = \rho Y_{t-1} + U_t$$

Where U_t stochastic error term which has zero mean, constant variance σ^2 and is non autocorrelated. If we regressed Y at time t on its value at time $(t-1)$, if the coefficient of Y_t is equal to 1, we say the series is non-stationary, but if the coefficient lies between -1 and +1 we say the series is stationary.

If we state our null hypothesis that $\rho = 0$ or $\sigma = 1$ using the Augmented Dickey fuller (ADF) test, it shows that a unit root exist (i.e. Y is non stationary) but if $\rho \neq 0$ it shows that Y is stationary.

To test for stationarity, this study adopted the Augmented Dickey Fuller (ADF) test

.

3.5. CAUSALITY TEST

The hallmark of this study lies in establishing the causal relationship between energy consumption and economic growth. GDP is modeled as function of energy consumption as well as modeling energy consumption as function of GDP. This is with the view to determining the direction of causality between energy consumption and GDP. Thus a GDP – energy consumption and energy consumption – GDP is formed and specified by the model:

$$RGDP = f(RENCP) \dots\dots\dots (10)$$

$$RENCP = f(RGDP) \dots\dots\dots (11).$$

Where $RGDP$ = Real GDP also denoted as Y and

RENCP = Real energy consumption denoted as X.

This is further expressed in a linear function as follows:

$$Y_t = \alpha + \beta X_t + U_t \dots\dots\dots (12)$$

$$X_t = \alpha + \beta Y_t + U_t \dots\dots\dots (13)$$

In equation 12 GDP is a linear function of energy consumption while energy consumption is a function of GDP in equation 13.

In analyzing the causal relationship between the two variables we use the Granger causality test by specifying our model as a lagged dependent variable in both equation 12 and 13. Thus our model becomes:

$$Y_t = \alpha Y_{t-1} + \beta X_{t-1} + \varepsilon_t \dots\dots\dots 14 - RSS_{UR}$$

$$X_t = \lambda Y_{t-1} + KX_{t-1} + U_t \dots\dots\dots 15 - RSS_{UR}$$

The order of precedence between X and Y becomes; X causes Y or Y causes X.

In equation 14 previous values of Y help in predicting current Y and previous values of X help in predicting current Y. In equation 15 previous values of Y help in predicting current X and previous values of X help in predicting current X.

We shall therefore state our hypothesis as follows:-

equation 14: H_0^1 “X does not granger causes Y” i.e. $\beta_1 = 0$

H_a^1 “X Granger causes Y” i.e. $\beta_1 \neq 0$

equation 15: H_0^2 “Y does not granger causes X” i.e. $\lambda = 0$

H_a^2 “Y Granger causes X” i.e. $\lambda \neq 0$

To compute our f statistics we run both equation 14 and equation 15 to obtain the restricted equations

$$(14^1) \quad Y_t = \alpha Y_{t-1} + \varepsilon_t \dots \dots \dots \text{RSS}_R$$

$$(15^1) \quad X_t = KX_{t-1} + U_t \dots \dots \dots \text{RSS}_R$$

Both equations 14 and 14^1 , 15 and 15^1 can be paired to obtain our F statistics which is given by

$$F = \frac{(N - K)(RSS_R - RSS_{UR})}{q(RSS_{UR})}$$

If computed F is greater than the critical value we reject H_0 , also if computed F is less than the critical value we accept H_0 .

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 ENERGY CONSUMPTION TRENDS BETWEEN 1975-2004.

In looking at the trends in the consumption of the various energy types within the study period (1975-2004), the study period was broken into two 1975-1985 and 1986-2004. One cannot overlook the structural changes of 1986 which brought about a drift and any form of description or modeling of time series data for Nigeria must take the two periods into account.

The 1986-2004 periods are the SAP period. SAP was an economic instrument that changed the course of economic growth and development in Nigeria through deregulation, liberalization, exchange rate, money supply etc. This study has brought to light how energy consumption has fared within this period. Line graphs have been used to describe the trend in the consumption of the energy resources within the study periods. Furthermore, the linear trend lines superimposed on the various curves and which have been numerically captured by the linear trend parameter (R^2) have been used to evaluate the strength in the trends of the energy types. The data used in the trend analysis is presented in appendix A below.

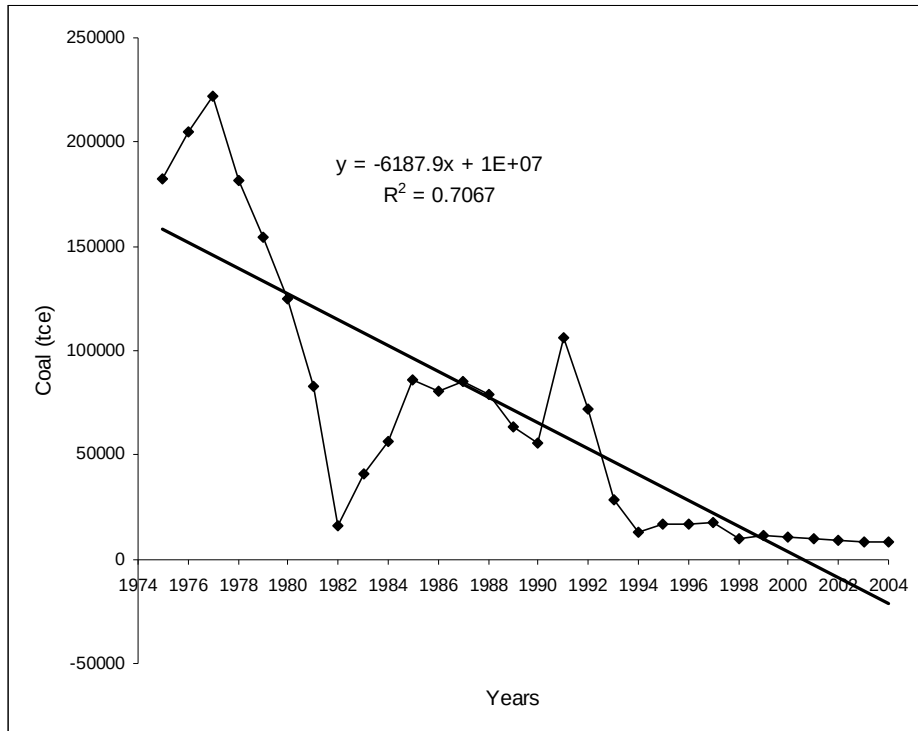


Figure 4.1a: Trend of Coal Consumption in Nigeria (1975-2004)

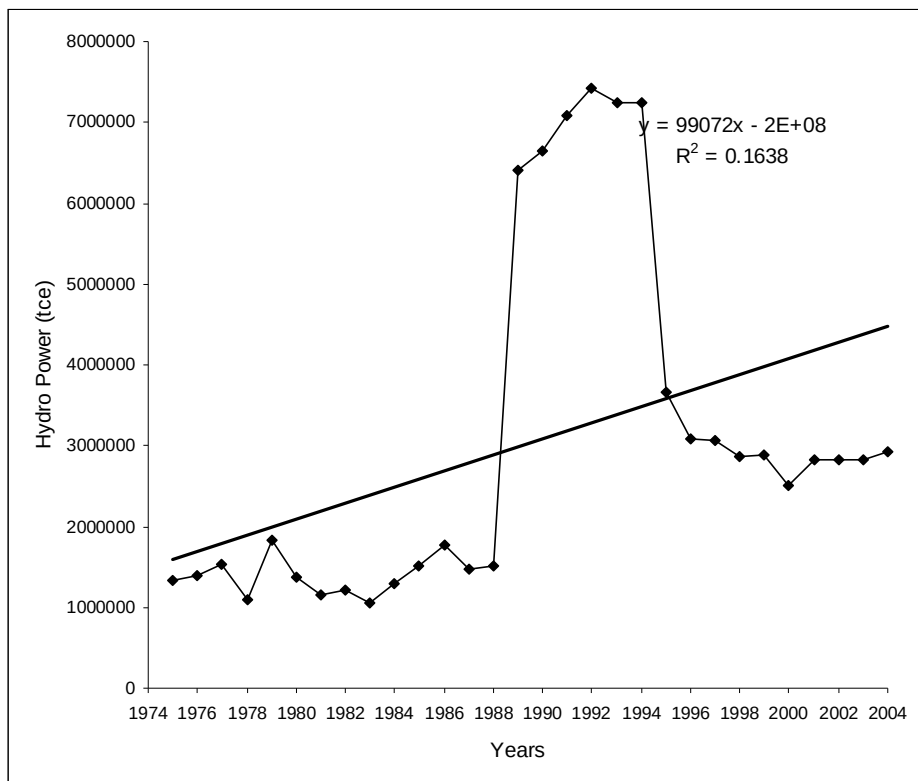


Figure 4.1b: Trend of Hydropower Consumption in Nigeria (1975-2004)

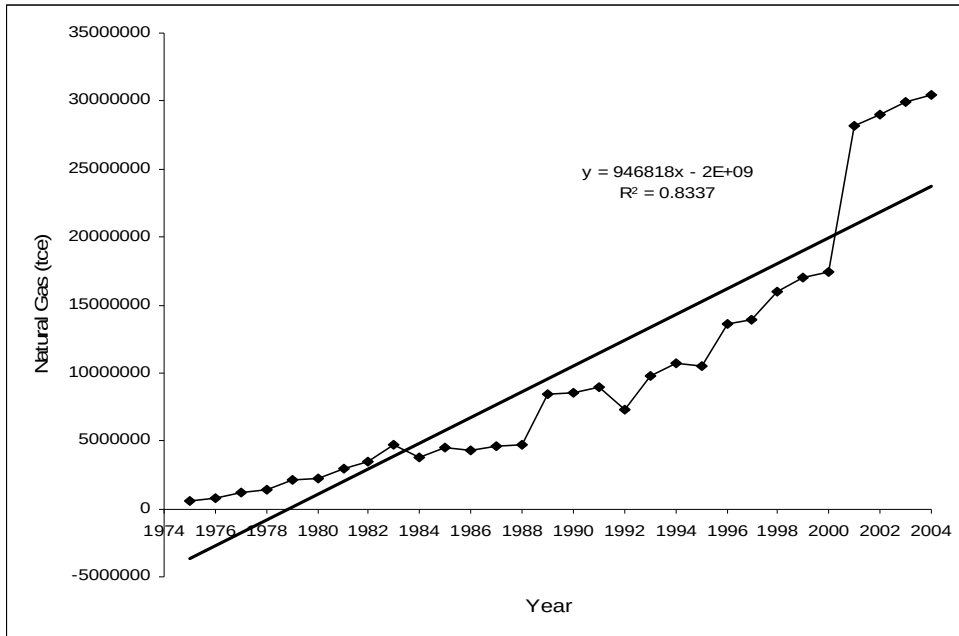


Figure 4.1c: Trend of Natural Gas Consumption in Nigeria (1975-2004)

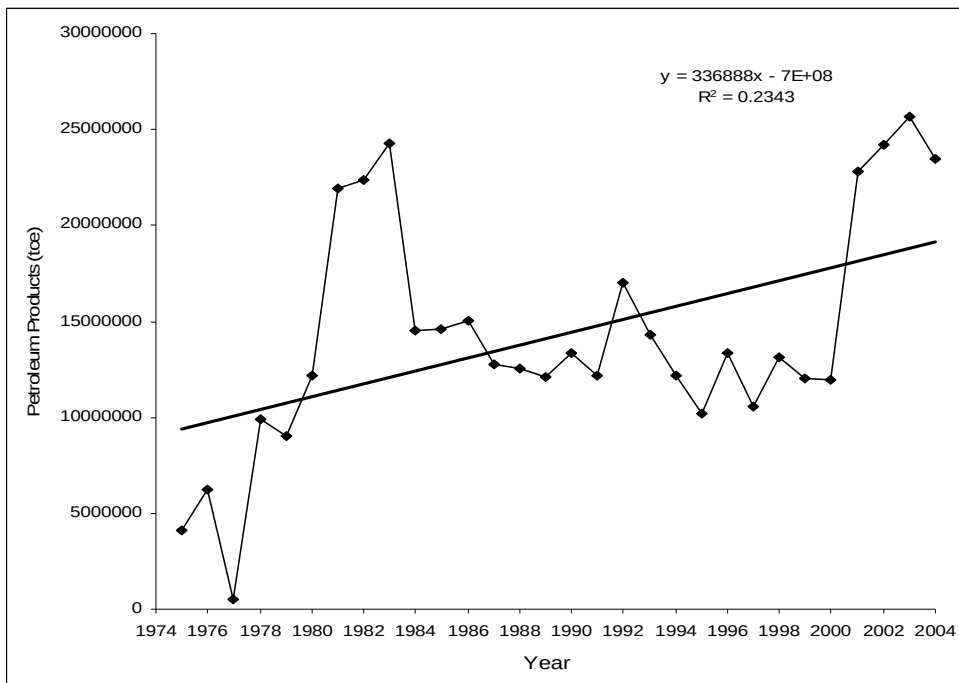


Figure 4.1d: Trend of Petroleum Products Consumption in Nigeria (1975-2004)

Figures 4.1a-c describes the trends in the consumption of the major energy types (Coal, HEP, Natural Gas and Petroleum products) in Nigeria. From figure 4.1a, coal consumption increased from 1975 up to 1977 and after this period it

declined continuously up to 2004. The increase in coal consumption in the 1970s was attributed mainly to its importance in the railway corporation and its exportation to the Ghana railway corporation. Its importance gradually gave way with the dominance of petroleum products; this led to a drastic fall in its consumption. The R^2 of 0.71 showed that the strength of the trend is very strong and this shows constancy in its fluctuations.

In the consumption of hydropower, fluctuation was noticed within 1975 to 1988 as shown in figure 4.1b. Major increase in its consumption was noticed within 1989 to 1994. The astronomical increase in hydropower consumption within 1989 to 1994 was attributed mainly to the rural electrification programme of the then government of Ibrahim Babangida. After this period, hydropower consumption declined continuously up to 2004. Major reasons attributed to this decline in hydropower consumption are the failing hydropower infrastructure which succeeding government could not address and the lack of policy continuity, this has made sustainable development difficult in Nigeria. The R^2 of 0.16 showed a weak strength in the trend.

The trend of natural gas consumption as depicted in figure 4.1c showed a steady upward movement in the energy resource. The steady and continuous increase in the consumption of natural gas is attributed mainly to the reduction in gas flared. This was achieved with the establishment of the Nigerian Liquefied

Natural Gas in the 1990s in Port Harcourt and Lagos. Natural gas is increasingly used by manufacturing companies and in the generation of electricity. The R^2 of 0.83 showed a high trend strength justifying its continuous and gradual increase in its consumption.

Figure 4.1d presents the trend of petroleum product consumption. The trend showed that petroleum consumption increased from 1975 to 2004. Three major phases can be observed in the trend, the first phase records a rise in petroleum consumption within 1975 to 1983, a fall in between 1986 to 1998 and a steady rise from 1999 to 2004.

The first oil shock in the 1970s was the major reasons for the increase in petroleum product consumption. This also led to an increase in inflation and reckless government spending. The second phase is the era of the effects of SAP policies on petroleum product consumption. Among these policies includes exchange rate flexibility, deregulation, liberalization and the removal of oil subsidy. This led to its decline. The third phase showed the effects of the present administration's policy on petroleum consumption. These policies tend to be positive on the consumption of the resource as shown on the graph (figure 4.1d)

The R^2 of 0.23 showed a low trend strength which is an inconsistent growth. Although, this trend strength also revealed that its importance is gradually giving way to the consumption of natural gas which has the highest trend strength of

0.83 showing consistent growth in its consumption. On a comparative note, natural gas and coal consumption have the highest trend strength of 0.83 and 0.71 respectively.

4.2 PRE AND POST-SAP DESCRIPTION OF ENERGY CONSUMPTION IN NIGERIA.

The trends of the two periods are presented in the figures below.

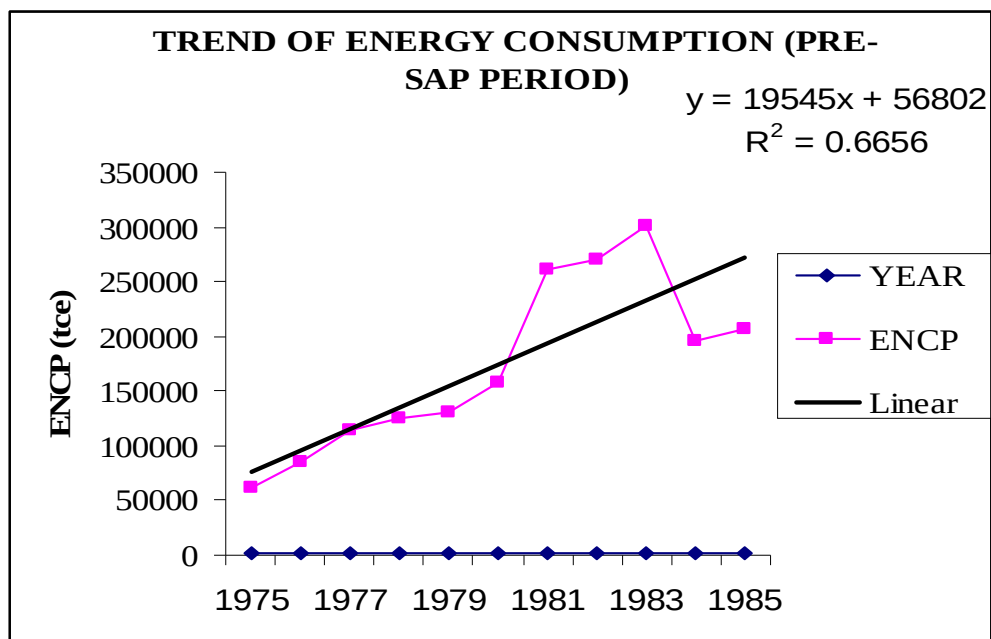


Figure 4.2a: Trend of Energy Consumption (Pre-SAP Period)

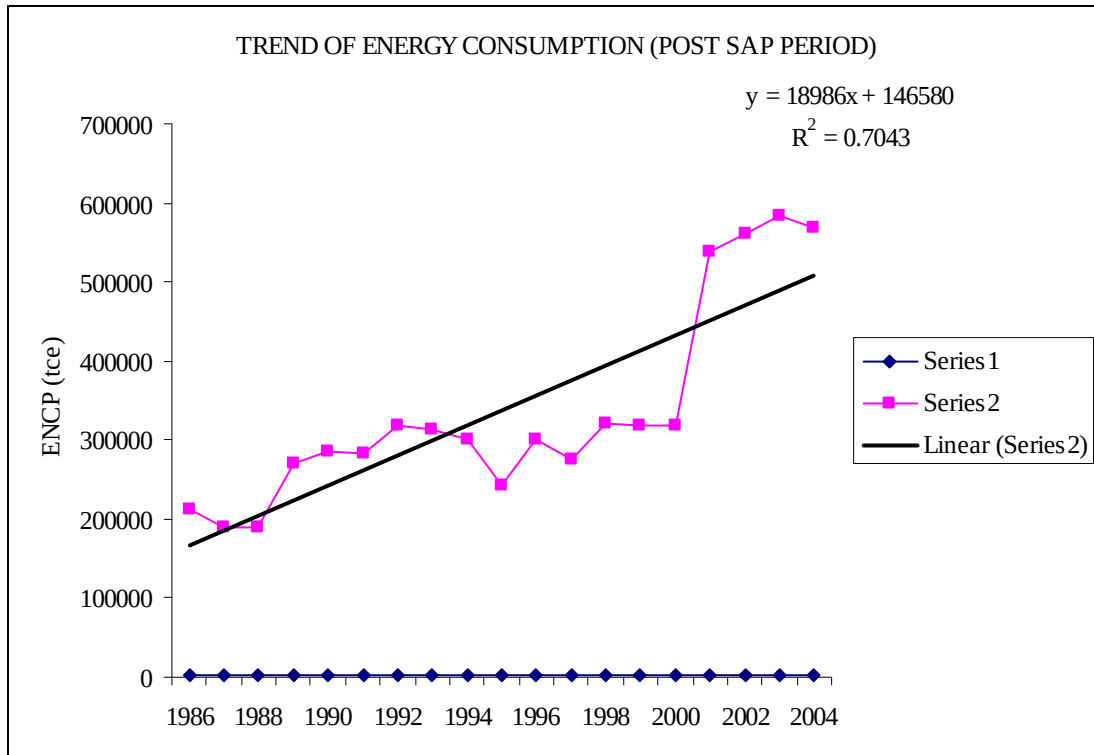


Figure 4.2b: Trend of Energy Consumption (post-SAP Period)

A. 1975-1985

Figure 4.2a showed the trend of energy consumption in Nigeria in the pre-SAP era. In this period, energy consumption showed a gradual and steady increase with high trend strength of 67 percent as shown by the R^2 of 0.67. The period showed an upward movement which later declined towards the end of the pre-SAP period. This upward movement in the trend is due to the oil shock of the early 1970s.

B. 1986-2004

In the post SAP period as shown in figure 4.2b, the trend showed more steady upward movement than in the pre SAP period, thus suggesting that there

were economic stability within the post SAP period. The strength of the trend in the post SAP period was higher than that of the pre SAP period as shown in the different R^2 of 67 percent for the pre SAP period and 70 percent for the post SAP period. The major fluctuations were noticed between 1986 and 1988; this period records the peak of the effects of SAP policies on energy consumption.

The major SAP policies that affected energy consumption within the SAP periods are the deregulation of the upstream and downstream sector of the petroleum industry, this brought in increase in the production of the energy resource and consequently its consumption. The era of exchange rate flexibility showed that the prices of petroleum product became cheaper as the country had to devalue its currency to make exports cheaper. This also influenced the consumption of energy resource in Nigeria.

4.3 STATIONARITY RESULTS

Most time data series are often non-stationary, and regressing two or more non-stationary series could results to spurious regressions. The data used in this study were tested for stationarity, this is because of the structural break between the pre-SAP and the post SAP era and other rigidities in the economy. Testing for stationarity will thus guide against spurious regression and to obtain a stable and constant movement in the series.

This study adopted the Augmented Dickey Fuller (ADF) test (Dickey and Fuller, 1981). The ADF was used in preference to the alternative non-parametric test proposed by Philips and Perron (PP) (1988) as the PP has been found to have poor size properties (i.e. the tendency to over reject the null hypothesis when it is true). The unit root test results using the ADF test is presented below.

Table 4.3a UNIT ROOT RESULT

Augmented Dickey fuller (ADF) unit root test result 1975-2004									
Test at	Included in Test equation	ADF Test statistics for the variables						Critical values	
		RGDP	RENCP	RCOAL	RHYP	RNGAS	RPET	1%	5%
Level	Intercept	-4.9843*	-1.1260	-4.2822*	-2.7911	-0.5051	-1.3041	-3.6852	-2.9705
	Intercept and trend	-2.4508	-2.3273	-3.4559	-2.4802	-2.8982	-2.5318	-4.3226	-3.5796
	None	-5.7588*	-1.4662	-4.5264*	-3.6112*	-0.8284	-1.4568	-2.6486	-1.9535
1 st difference	Intercept	-2.2230	-3.8272*	-1.6565	-3.7194*	-3.3434**	-3.9476*	-3.6959	-2.9750
	Intercept and trend	-4.3828*	-2.3273	-2.4001	-4.1364**	-3.2621	-3.8487**	-4.3382	-3.5867
	None	-1.9607	-3.6151*	-1.6232	-3.2968	-3.2780*	-3.8354*	-2.6522	-1.9540
2 nd difference	Intercept	-10.609*	-4.5923*	-6.4284*	-7.6009*	-5.8311*	-4.6508*	-3.7076	-2.9798
	Intercept and trend	-10.655*	-4.4899*	-6.6902*	-7.5641*	-5.5729*	-4.5548*	-4.3552	-3.5943
	None	-10.265*	-4.6945*	-6.2169*	-7.6546*	-5.9455*	-4.7564*	-2.6560	-1.9546

* Significant at both 1percent and 5 percent level of significance.

** Significant at only 5 percent level of significance.

From the result presented in table 4.3a above, RGDP and RCOAL were stationary at level (including test with intercept and none) where the ADF statistics of -4.9843 and -5.7588 (RGDP) and -4.2822 and -4.5264 (RCOAL) were greater than the critical values of -3.6852 and -2.9705 at both 1percent and 5 percent respectively. All the other variables (RENCP, RNGAS and RPET) were

not stationary at the level of the series. RHYP on the other hand was stationary at level (including test with none i.e. no intercept and trend). The ADF statistics of -3.6112 was greater than the critical values of -2.6486 and -1.9535 at both 1 percent and 5 percent respectively.

On differencing the series once, RGDP was stationary at first difference (including test with intercept and trend). The ADF statistics of -4.3828 was greater than the critical values of -4.3382 and -3.5867 at both 1 percent and 5 percent. RENCp was also stationary at first difference (including test with intercept and none). The ADF statistics of -3.8272 and -3.6151 were both greater than the critical values of -3.6959 and -2.6522 at both 1 percent and 5 percent respectively. However, RCOAL was not stationary at the first difference of the series. RHYP was also stationary at first difference (including test with intercept and trend). The ADF statistics of -3.7194 (intercept) was greater than the critical values of -3.6959 and -2.9750 at both 1 percent and 5 percent, but the ADF statistics of -4.1364 (intercept and trend) was only significant at 5 percent. RNGAS was stationary at first difference (including test with intercept and none). The ADF statistics of -3.3434 was only significant at 5 percent while the statistics -3.2780 was significant both at 1 percent and 5 percent respectively. RPET was also stationary (including test with intercept, intercept and trend and none). The ADF statistics of -3.9476 and -3.8354 (intercept and none) were significant at

both 1 percent and 5 percent level. However, the value of -3.8487 (intercept and trend) was significant at only 5 percent as shown by the double asterisks

In the second difference of the series, all the variables under consideration were significant both at 1 percent and 5 percent significant level. The ADF statistics of all the variables were greater than the critical values.

4.4 CAUSAL RELATIONSHIP BETWEEN ENERGY CONSUMPTION AND ECONOMIC GROWTH

The Granger causality test statistics was used to estimate the causal relationship between economic growth and energy consumption in Nigeria within 1975 to 2004. The Granger statistics summarized by the F-statistics at 5 percent probability level presented at lags two and three is shown on table 4.4a below.

Table 4.4a GRANGER CAUSALITY TEST RESULT

Pair wise Granger causality test.								
Null hypothesis (H_0)	Lags 2			Lags 3			Critical values	
	Obs	f-stat	prob	Obs	f-stat	prob	Lags	5%
RENCP does not Granger cause RGDP	28	1.6583	0.2096	27	2.9122	0.0755	Lags2 f(2:28)	3.34
RGDP does not Granger cause RENC		10.2228	0.00374		4.2917	0.0267	Lags 3f(3:27)	2.96

In the first test carried out the test statistical value of 1.6583 and 2.9122 at 5 percent level was not significant at lags two and three. This is because the f critical values of 3.34 and 2.96 are greater than the f statistics. This indicates that real energy consumption (RENC) does not Granger cause economic growth (RGDP). Hence we accepted the null hypothesis (H_0) at lags two and three. That

is to say, real energy consumption is not significant in explaining fluctuations in growth over the sample period. This result was obtained when real gross domestic product was a function of real energy consumption. Thus, energy consumption is not a source of growth in Nigeria. This result tends to confirm the results obtained in some previous studies (for example Choi et al 1979; Long et al 1980; Kraft and Kraft 1992), which show that energy consumption is not a cause of growth.

But, when real energy consumption was the dependent variable, growth in the Nigerian economy contained information on the fluctuation of energy consumption. This is evident from the f – statistics value of 10.2228 and 4.29176 at lags two and three which is greater than the f critical values of 3.34 and 2.96 at 5 percent significant level. In terms of causality between real GDP and energy consumption, the study found a unidirectional (one way) causality between growth and energy consumption. This also confirmed the unidirectional causality of growth to energy consumption, as found in other studies (Babatunde and Francis, 2001).

This one-way causality can be explained by the domination of oil in the energy use in Nigeria whose demand is unresponsive to changes in both monetary and fiscal policies. The implication of this finding is that energy consumption is not significant in explaining the fluctuation of growth in the Nigeria economy. This may be attributed to the production structure of Nigeria, which is dominated

by services and agricultural activities that are less energy intensive. Sequel to this, within the realm of economic theories, an increase in economic growth (output) would lead to an increase in money supply and consequently income. This increase in income will make available more funds, thus increasing the level of investment in the economy. When such income is invested into the different sectors of the economy, it is also expected that energy consumption will also increase. An empirical evidence of this finding is hinged on the fact that from 1999 to 2004, the Nigerian economy witnessed significant economic growth which led to an increase in the general income. This increase in income has made more Nigerians to be able to buy more vehicles thus increasing the level of energy consumption in the country. The service sector, agricultural and industrial sectors etc. have also been affected positively as expansion in these sectors have also increased the level of energy consumption, since energy is a major source of input. Thus economic growth is the major driving force of energy consumption in the Nigerian economy. Therefore, as economic growth increases, energy consumption will also increase.

4.5 ESTIMATION OF THE IMPACT OF RGDP ON ENERGY CONSUMPTION

The Granger causality test result indicated that RGDP causes energy growth; therefore, this section estimates the impact of RGDP on energy consumption within the study period by the use of the regression analysis.

Table 4.5a REGRESSION RESULT

Dependent variable: RENCN				
Method: Least squares				
Sample (adjusted): 1975 2003				
Variable	Coefficient	Std. Error	t-statistics	prob.
C	723.8847	266.5836	2.715413	0.0114
RGDP	1.088290	0.1827935	5.953657	0.0000

$R^2 = 0.567627$, Adjusted $R^2 = 0.551613$, f-statistics = 35.44603.

Source: Computed.

The result of table 4.5a presents the aggregated regression result of RGDP on energy consumption. The $\bar{R}^2$ of 55 percent is an indication of fitness of the regression line. This is ascertained by the high F-value of 35.4. The coefficient for GDP is positive and significant at 1 percent level of probability. This result confirms the fact that RGDP is an impetus to growth of energy consumption in Nigeria.

The study went further to estimate the impact of RGDP on each components of energy consumption namely, coal, hydropower, natural gas and petroleum products. The regression results are presented below in table 4.5b.

Table 4.5b IMPACT OF RGDP ON EACH COMPONENTS OF ENERGY CONSUMPTION

Independent variable: RGDP

Dependent variables	C	Coefficients	t stat	Prob	F stat	$\bar{R}^2$
RCOAL	-308.3461	0.017469	9.103815	0.0000	82.879	0.7451
RHYP	4109.309	0.145739	13.31722	0.0000	177.34	0.8629
RNGAS	19284.11	0.091927	3.215269	0.0021	10.338	0.2500
RPET	48779.26	0.830007	5.214069	0.0000	27.186	0.5032

Source: Computed

Table 4.5b above presents the estimated regression results. These results were obtained by regressing the RGDP against each of the energy types (COAL, RHYP, RPET, etc.). The $\bar{R}^2$ indicated statistical goodness of fit for all the equations (i.e. 75 percent, 86 percent and 50 percent) for RCOAL, RHYP and RPET. This was further ascertained by the high F statistics for the equals (i.e. 82, 177, and 27).

All the regression coefficients for all the equations were positive. The coefficients which were significant at 1 percent probability as denoted by all the t statistics of 9.1 for coal, 13.3 for hydropower, 3.21 for natural gas and 5.21 for petroleum products. Sequel to that, a 1 percent increase in RGDP will lead to a

more than 17, 145, 91, and 830 increase in RCOAL, RHYP, RNGAS, and RPET respectively. This was an indication that RGDP positively influences the growth in the various energy types. In other words, increase in GDP which gives rise to increase in aggregate demand and income, would lead to increase investment (I). These would both give rise to increase in demand for the different types of energy.

The entire coefficients were statistically significant at 1 percent level of probability. This is an indication that GDP not only positively affect the growth in energy sector but significantly and positively affects the energy sector.

4.6 IMPLICATIONS OF THE FINDINGS

Our findings from the trend analysis revealed that there is a positive upward movement in the consumption of the different energy types in Nigeria except for coal that showed a downward trend. This steady upward increase in the consumption of the energy of resources showed that there was stability in the economy despite the effects of SAP policies. The downward trend in coal consumption might not be sustained if the construction works at the Nigeria coal corporation Enugu is completed. The corporation is expected to produce 100,000 tonnes per annum of smokeless coal. This will change the trend in coal consumption.

The data used for the analysis in the study proved to be stationary after differencing the series. This stationarity showed that the regression results is not spurious, thus the R^2 obtained reflects a true degree of association or correlation between the variables and not due to the presence of the trend in the series.

The investigation of the impact of RGDP on RENCPC showed that RGDP contributed positively to the growth in energy consumption in Nigeria. That is 57 percent of the total variation in RENCPC is explained by RGDP. This implies that RGDP is a pull factor for energy consumption in Nigeria.

In terms of the causal relationship between energy consumption and economy growth, the study found a unidirectional causality from growth to energy consumption, that is; economic growth granger causes energy consumption. This finding is in line with other studies in the literature (Babatunde and Francis, 2001). The implication here is that as the economy expands or grows, there will be an increase in economic activities which will lead to an increase in income and output. As income increases, the level of investment and Urbanization will also increase in almost all sector of the economy. This general increase in economic activities will invariably affects the level of energy consumption in the domestic economy.

It is also expected that if the increase in energy consumption is sustained overtime through increase in economic growth, there will eventually be bi-

directional causality between growth and energy consumption since energy is a vital input to the growth in output in the economy.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSION, AND POLICY RECOMMENDATIONS

5.1 SUMMARY

This work has examined energy consumption in Nigeria and its impact on economic growth as well as determining the causal relationship between energy consumption and economic growth from 1975 to 2004.

In the course of this work, it was highlighted that the major energy resource in Nigeria includes coal, hydropower, natural gas and petroleum product. We also saw how the country gradually changed from the consumption of coal and hydropower as the major source of energy consumption to the consumption of petroleum products. It was also noted that the consumption is also changing from petroleum product to natural gas and this (natural gas) might become in the near future the major foreign exchange earner for the country if the sector is properly harnessed and exploited. This might be the major source of economic growth in the future.

A review of the literatures on energy consumption and economic growth both foreign and local literatures showed on one hand that there is no relationship between energy consumption and economic growth, while other studies showed that a relationship existed between the two variables. This contradiction has inspired this study. Apart from establishing that energy consumption and

economic growth have a relationship, the study also went further to establish the causal relationship between energy consumption and economic growth using purely Nigeria data published by the Central Bank of Nigeria.

The study also traced the structure of energy consumption in Nigeria right from the early 1970s to the present time. We noted that the structure has changed and is still changing from coal consumption to petroleum product and this is gradually changing to Natural gas. The study through careful examination showed that coal consumption has declined drastically while natural gas has continued to appreciate steadily.

The study also presented the different components of energy consumption using a trend analysis (line graphs), from the trends, the study showed the energy type that has the greatest trend strength using the R-square value of the trend. The trend analysis of total energy consumption and economic growth also exhibited a strong positive relationship. Energy consumption was also viewed within the pre SAP and the post-SAP period. Energy consumption grew or appreciated more in the post SAP period than in the pre SAP period. This is evident from the R-Square shown that is 0.70 for post SAP greater than 0.67 for pre SAP period.

In terms of the causal relationship between energy consumption and economic growth, the study found a unidirectional causality from growth to energy consumption as found in other studies. It also showed the impact of RGDP

on each components of energy consumption in Nigeria. The impact of RGDP on Coal and Hydropower consumption were more significant, although RGDP exerted positive impact on each component of energy consumption in the economy. This situation was shown by the regression analysis results.

5.2 CONCLUSION

In conclusion, within the realms of the theories, it is acknowledged that, Nigeria being a developing country consumes different energy types and it was established that the growth of the economy is the major driving force of energy consumption. Although, most of the resources it depends on are non-renewable energy resources except hydropower. And to attain sustainable development, these energy resources will have to be conserved or consumed in such a way that the ability of future generations to meet their own needs and well-being will not be jeopardized. This was properly highlighted by Professor Hotteling (1931).

Along this line, it is affirmed that there should be a diversification of the energy source in Nigeria and the existing energy infrastructure should be refurbished and maintained to ensure a continuous flow of the resource for sustainable development since without the energy resources in Nigeria, growth of the economy is hampered. Sequel to this, all avenues that will enhance economic growth should be explored and maintained, this is with the view to increasing

energy consumption in Nigeria since economic growth is the major driving force of energy consumption.

5.3 POLICY RECOMMENDATIONS.

Having shown that there is a significant relationship between energy consumption and economic growth and also established the fact that economic growth granger causes energy consumption, the positive impact of economic growth on energy consumption needs to be sustained in order to attain sustainable development and the growth of energy consumption in the economy. To this end, the study at this level wishes to proffer some policy recommendations.

First, the investment level of the economy should be increased through increased activities on all the sectors of the economy. These increases will ginger the consumption of more energy resources at the domestic level.

Government should also encourage a level playing ground and also make the investment climate friendly to foreign investors; this will further increase the inflow of foreign direct investment into the country thus, increasing energy consumption in Nigeria.

The private sector participation in economic activities should also be encouraged through task relief or holidays, making investment funds available at low interest rate and the removal of administrative rigidities in governance. The

financial sectors should also be encouraged to invest into the real sector of the economy. This will enhance economic growth and energy consumption in Nigeria.

The study also discovered that failure of energy infrastructure has impeded the production and consumption of energy resources in Nigeria and as such the government should ensure that a reasonable portion of revenue earned from the development of this resource is utilized in the provision of infrastructure needed to catalyse the development of the energy sector. Aging infrastructure should be replaced while dilapidated ones should be upgraded and refurbished. In addition to this; government should increase flaring penalty charged the oil companies. This will reduce the rate at which gas is flared and consequently increase the consumption of the energy resources.

In addition to these recommendations, the ongoing independent power project of the Federal Government should be sustained and continued. Government should also introduce new capacity additions from IPPS and other private sector investors will ensure that the vintage of existing power infrastructure in Nigeria is improved from current old aged plants. Vandalizing activity is a social phenomenon, therefore proper policing of facility through regular inspection should be done.

Last but not the least, government should encourage renewable sources of power generation, for example and solar power generation, fuel cells from agro-allied waste and generation of power from gases generated from sanitary land fills. Efforts should also be geared towards the use of ethanol from crops like cassava, sugarcane, potatoes etc for the generation of power. This will go a long way in ensuring sustainable development and the continual growth of the economy. In such fashion, the needs and wellbeing of future generations will be conserved.

REFERENCES

- Abosedra S. and H. Baghestani. (1989). New evidences on the causal relationship between United States energy consumption and gross national product. The journal of energy and Development, spring, pg. 285 – 92.
- Adegbulugbe, A.O. (1993). Economic Efficiency and equity, criteria for energy pricing in Nigeria. Paper presented at the Conference on energy pricing and national development Lagos, Nigeria.
- Adegbulugbe, A.O. (1993). Energy Supply and Demand Balance in Nigeria: Issues and options. Energy Policy Agenda for Nigeria. Conference proceedings.
- Adegbulugbe, A.O. (1944). Energy – Environmental issues in Nigeria. International Journal of Global energy issues 6 (1 & 2).
- Adenikinju A.F. (1996). Subsidizing domestic energy consumption. Implications for the Nigerian economy. OPEC Review XX (3).
- Adenikinju A. F. and B.O. Alaba. (1999). Energy use and productivity performance in the Nigerian manufacturing sector (1970 – 1990): OPEC Review: September.
- Adeolu, O.Adewuyi. (2001). The implications of crude oil exploitation and Export on the environment and level of economic growth and development in Nigeria. Paper presented at the annual conference of the NES, 2001.
- Akarca A.T. and T.V. Long. (1979). Energy and employment. A time series analysis of the causal relationship. Resource and Energy: July, pp 151 - 162.
- Ayodele Sesan. A. (ed) (1987). Energy development and utilization in Nigeria; Ibadan, Nigeria Institute of Social and Economic Research.
- Babatunde. A. and E. Francis. (2001). The macroeconomic effects of government expenditure, money supply, exchange rate and energy price on economic growth and energy consumption in Nigeria. Paper presented at NES 2001 Annual Conference.

C.B.N. Annual reports and Statement of accounts, various issues.

CBN Statistical bulletin, 2004.

Demodar, N. Gujarati. (1975). Basic Econometrics. Third Edition, McGraw-Hill Inc.

Dennis Odije (1984). Structural Adjustment and Economic revolution in Nigeria. Heinemann Educational Books (Nigeria) Limited.

Deverajan S and A. Fisher (1981). Hotellings Economics of Exhaustible resources. Fifty years later. Journal of Economic Literature 19 (March, pp 65 – 73

Development policy centre. (1999). Petroleum crisis in Nigeria. Economic Intelligence 18(7) pg. 2 – 6.

Eleri E.O. (1996). Nigeria: Energy for sustainable development. The journal of Energy and Development 19 (1), pp 97 – 121.

Eric C. Eboh (ed) (2005). Promoting Nigeria's Non-oil private sector; Evidence and Recommendations. African Institute for applied Economics for the better business, initiative.

Erol, U. and E.S.H. Yu (1987). Time series analysis of the causal relationships between its energy and employment. Resources and Energy. April pp 75 – 89.

Hartwick, J.M. (1990). Natural resources, national accounting and economic depreciation. Journal of Public Economics 43 (3), pp 291 – 304.

Heller, P.A. (1971). Economic growth and Development. John willey and sons.

Hotelling, H. (1931). The economics of exhaustible resources, Journal of political economy 39 (April), pp 137 – 75.

- The economics of exhaustible Resource as in Samii, M.V. oil revenues and Absorptive capacity of an exporting country: A case of Iran OPEC Review Vol. iv No. 2. 1980.
- Ikporukpo, C.O. (1978). The Structure of demand for gasoline in Nigeria. The Nigerian journal of Economic and social studies 20(2), pp 253 – 72.
- Iwayemi, A. (1991). Petroleum product pricing: analysis of public policy in Nigeria paper presented at CEAR Staff Seminar series, 16 July.
- Iwayemi, A. (1984). Nigeria's internal petroleum problems perspectives and choices. The Energy Journal 5 (4).
- Iwayemi, and Aderikinu (2001). Energy – Environment – Economy linkage in Nigeria. Paper presented at Nigerian Economic Society 2001 annual conference.
- Johnson and Dinardo (1997). Econometric methods, fourth edition. The McGraw-Hill Companies, Inc.
- Koutsoyiannis. A. (1997). Modern Econometric, Vijay Printers.
- Kraft, J and A. Kraft. (1978). On the relationship between energy and GNP. The journal of energy and Development Spring, pp. 401 – 3.
- Krautkraemer, J.A. (1998). Non-renewable resource scarcity. Journal of Economic Literature. xxxvi: Dec. pp 2065 – 2107.
- Kula, E. (1992). Economics of natural resources and the environment. London; Chapman and Hall.
- Kuznet, S. (1969). Lectures on Economic Growth. The free press.
- Magbagbeola O.N. (1999). Economic growth and Environmental development in Nigeria: Impact of climatic change, The Nigerian Journal of Economic and Social studies 41(2): July.
- Malar, K.G. (1991). National accounts and Environmental resources. Environmental and Resource Economics 1.

- Okogu, B. (1993). Management of energy crisis in Nigeria. Goals and conflicts. Paper presented at the international conference of Energy policy agenda for Nigeria Abuja, Nigeria: April, pp. 20 – 2..
- Vaez-Zadah, R. (1989). Oil Wealth and Economic behaviour. The case of Venezuela. 1965 – 81. IMF Staff papers 36 (2): June.
- World Bank (1983). Nigeria. Issues and options in the energy sector. Report (11672 UNI) Washington, D.C. World Bank. 1995. Adjustment in Africa, Reforms, Results and Road Ahead. World Bank Policy Research Report, Oxford University Press, UK.
- Yu, E.S.H and J.Y. Choi. (1985). The causal relationship between energy and GNP: An international comparison. The journal of Energy and Development: Spring, pp. 113 – 22.
- Yu, E.S.H. and B.K. Hwang. (1984). On the relationship between energy and GNP: Further results: The journal of Energy and Development: Spring, pp 186 – 90.

APPENDIX A

NOMINAL ENERGY CONSUMPTION IN NIGERIA (1975 – 2004) BY ENERGY TYPES (TONNES OF COAL EQUIVALENT) (1985=100) METRIC TONNES' 000

YEAR	COAL	HYDRO POWER	NATURAL GAS	PETROLEUM PRODUCTS
1975	182709	1342859	581525	4115786
1976	205020	1383700	736700	6234382
1977	2218976	1538985	1160705	5291007
1978	181706.4	1089802	1380430.8	9875556.8
1979	154224.1	1839266.5	2119407.2	9026564.8
1980	124629	1376776	2206863	12157744
1981	82827	1157498	2969720	21908328
1982	16176	1209624	3522703	22336705
1983	41259	1049332	4756091	24313090
1984	56701	1298035	3740398	14527484
1985	86072	1504126	4518781	14618818
1986	80310	1775379	4296384	15060891
1987	84934	1476840	4609234	12755792
1988	7931 4.4	1504235	4763994	12514973
1989	63471.0	6406550.0	8485008	12121175.8
1990	55642.5	6646900	8511579	13350820.5
1991	106173.8	7083300	8927053	12164536.3
1992	71839.7	7416844.4	7318165	16994461
1993	28646.8	7252315.5	9763234.3	14329990.2
1994	12965.5	7237810.9	10671215.1	12166161.7
1995	16510.8	3667862.5	10492700	10204500
1996	17006.1	3076229	13612900	13317667.9
1997	17709.8	3063950	13936100	10576123
1998	9853.9	2857600	15973600	13143401
1999	11246.8	2877603.2	16994708	12057096.6
2000	10502.9	2500057.1	17413925	11984228
2001	9826.2	2825071.3	28184100	22811867
2002	9008.1	2830100.3	29054571.4	24228249.4
2003	8182.1	2835100.6	29925042.8	25644631.8
2004	8065.7	2922377.9	30426199	23486394.5

Source: Computed from the CBN Annual Report and Statement of Account
(1975 – 2004)

APPENDIX B

REAL ENERGY CONSUMPTION IN NIGERIA (1975 – 2004) BY ENERGY TYPES (TONNES OF COAL EQUIVALENT) (1985 = 100) METRIC TONNES' 000

YEAR	COAL (X ₁)	HYDRO POWER (X ₂)	NATURAL GAS (X ₃)	PETROLEUM PRODUCTS (X ₄)
1975	8826.52	64872.42	28092.99	198830.24
1976	8008.59	54050.78	28777.34	243530.55
1977	749.49	51992.74	39213.01	288145.51
1978	5266.85	31588.46	40012.49	286248.02
1979	4005.82	47773.16	55049.54	234456.23
1980	2946.31	32547.90	52171.70	287417.12
1981	1617.71	22607.38	58002.34	427897.03
1982	293.58	21953.25	63932.90	405384.85
1983	607.64	15454.08	70045.52	358072.02
1984	598.11	13692.35	39455.68	153243.50
1985	860.72	15041.26	45187.81	146188.18
1986	761.95	168.44.20	40762.66	142892.70
1987	731.56	12720.41	39700.55	109869.01
1988	437.72	8301.52	26291.36	69067.18
1989	232.75	23493.03	31114.81	44448.76
1990	189.78	22670.19	29029.94	45534.86
1991	320.86	21406.17	26978.10	36761.97
1992	150.17	15503.44	15297.17	35523.54
1993	38.10	9645.32	12984.75	19058.37
1994	10.98	6130.10	9038.04	10304.19
1995	8.09	1797.62	5142.47	5001.23
1996	6.45	1166.08	5160.12	5048.20
1997	6.19	1070.08	4867.15	3693.68
1998	3.13	907.41	5072.27	4173.57
1999	3.35	857.04	5061.56	3590.99
2000	2.93	696.30	4850.00	3337.76
2001	2.30	661.92	6603.58	5344.86
2002	1.87	587.43	6030.67	5028.90
2003	1.49	516.10	5447.55	4668.35
2004	1.31	473.75	4932.43	3807.41

Source: Computed from the CBN Annual Report and Statement of Account (various issues)

APPENDIX C:

REAL ENERGY CONSUMPTION AND GROSS DOMESTIC PRODUCT IN NIGERIA. (1975-2004).

YEAR	RENCP METRIC TONNES' 000	RGDP #' 000
1975	300622.17	386418
1976	334367.27	347087
1977	386847.74	324657
1978	363115.83	258032
1979	341284.74	236860
1980	375083.03	227391
1981	510124.47	137492
1982	491564.57	127483
1983	444179.26	97140
1984	206989.64	65901
1985	207277.97	68286
1986	201261.52	67179
1987	163021.53	61322
1988	104094.77	42899
1989	99289.35	30502
1990	97424.77	31459
1991	85467.77	28478
1992	66474.31	20280
1993	41726.54	13247
1994	25483.32	8549
1995	11949.41	5052
1996	11380.84	4041
1997	9637.09	3841
1998	10156.38	3604
1999	9512.94	3474
2000	8886.98	3376
2001	12612.67	2960
2002	11648.87	2729
2003	10633.49	2484
2004	9214.90	2305

Source: Computed from Federal Office of Statistics, Annual Abstract of statistics (1970), CBN Annual Report and Statement of Account various issues and the Central Bank of Nigeria Statistical Bulletin (2005).

APPENDIX D

ADF Test Statistic	-12.66124	1% Critical Value*	-3.6959
		5% Critical Value	-2.9750
		10% Critical Value	-2.6265

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(RCOAL,2)

Method: Least Squares

Date: 03/05/07 Time: 14:54

Sample(adjusted): 1978 2004

Included observations: 27 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RCOAL(-1))	-1.677425	0.132485	-12.66124	0.0000
D(RCOAL(-1),2)	0.164291	0.079107	2.076822	0.0487
C	-233.5817	129.5322	-1.803271	0.0839
R-squared	0.943700	Mean dependent var	268.8489	
Adjusted R-squared	0.939008	S.D. dependent var	2583.008	
S.E. of regression	637.9149	Akaike info criterion	15.85873	
Sum squared resid	9766449.	Schwarz criterion	16.00271	
Log likelihood	-211.0928	F-statistic	201.1422	
Durbin-Watson stat	0.598285	Prob(F-statistic)	0.000000	

ADF Test Statistic	-13.28112	1% Critical Value*	-4.3382
		5% Critical Value	-3.5867
		10% Critical Value	-3.2279

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(RCOAL,2)

Method: Least Squares

Date: 03/05/07 Time: 14:56

Sample(adjusted): 1978 2004

Included observations: 27 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RCOAL(-1))	-1.811966	0.136432	-13.28112	0.0000
D(RCOAL(-1),2)	0.231954	0.079147	2.930668	0.0075
C	-858.6227	303.0844	-2.832949	0.0094
@TREND(1975)	36.44329	16.23150	2.245220	0.0347
R-squared	0.953821	Mean dependent var	268.8489	
Adjusted R-squared	0.947797	S.D. dependent var	2583.008	
S.E. of regression	590.1623	Akaike info criterion	15.73463	
Sum squared resid	8010706.	Schwarz criterion	15.92660	
Log likelihood	-208.4175	F-statistic	158.3534	
Durbin-Watson stat	0.759470	Prob(F-statistic)	0.000000	

ADF Test Statistic	-12.21351	1% Critical Value*	-2.6522
		5% Critical Value	-1.9540
		10% Critical Value	-1.6223

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(RCOAL,2)

Method: Least Squares

Date: 03/05/07 Time: 14:57

Sample(adjusted): 1978 2004

Included observations: 27 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RCOAL(-1))	-1.601263	0.131106	-12.21351	0.0000
D(RCOAL(-1),2)	0.125447	0.079472	1.578511	0.1270
R-squared	0.936071	Mean dependent var	268.8489	
Adjusted R-squared	0.933514	S.D. dependent var	2583.008	
S.E. of regression	666.0245	Akaike info criterion	15.91172	
Sum squared resid	11089716	Schwarz criterion	16.00770	
Log likelihood	-212.8082	F-statistic	366.0609	
Durbin-Watson stat	0.552939	Prob(F-statistic)	0.000000	

ADF Test Statistic	-3.827233	1% Critical Value*	-3.6959
		5% Critical Value	-2.9750
		10% Critical Value	-2.6265

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(RENCP,2)

Method: Least Squares

Date: 03/06/07 Time: 10:33

Sample(adjusted): 1978 2004

Included observations: 27 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RENCP(-1))	-0.967470	0.252786	-3.827233	0.0008
D(RENCP(-1),2)	0.136082	0.195785	0.695060	0.4937
C	-13421.17	11290.92	-1.188669	0.2462
R-squared	0.451451	Mean dependent var	-1996.261	
Adjusted R-squared	0.405739	S.D. dependent var	73594.49	
S.E. of regression	56732.78	Akaike info criterion	24.83453	
Sum squared resid	7.72E+10	Schwarz criterion	24.97851	
Log likelihood	-332.2662	F-statistic	9.875897	
Durbin-Watson stat	2.061096	Prob(F-statistic)	0.000742	

ADF Test Statistic	-3.755123	1% Critical Value*	-4.3382
		5% Critical Value	-3.5867
		10% Critical Value	-3.2279

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(RENCP,2)

Method: Least Squares

Date: 03/06/07 Time: 10:35

Sample(adjusted): 1978 2004

Included observations: 27 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RENCP(-1))	-0.965012	0.256985	-3.755123	0.0010
D(RENCP(-1),2)	0.131235	0.199253	0.658636	0.5167
C	-24374.69	25507.72	-0.955581	0.3492
@TREND(1975)	686.0475	1426.786	0.480834	0.6352
R-squared	0.456910	Mean dependent var	-1996.261	
Adjusted R-squared	0.386073	S.D. dependent var	73594.49	
S.E. of regression	57663.88	Akaike info criterion	24.89860	
Sum squared resid	7.65E+10	Schwarz criterion	25.09058	
Log likelihood	-332.1311	F-statistic	6.450094	
Durbin-Watson stat	2.073513	Prob(F-statistic)	0.002494	

ADF Test Statistic	-3.615059	1% Critical Value*	-2.6522
		5% Critical Value	-1.9540
		10% Critical Value	-1.6223

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(RENCP,2)

Method: Least Squares

Date: 03/06/07 Time: 10:36

Sample(adjusted): 1978 2004

Included observations: 27 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RENCP(-1))	-0.891081	0.246491	-3.615059	0.0013
D(RENCP(-1),2)	0.101497	0.195203	0.519957	0.6077
R-squared	0.419157	Mean dependent var	-1996.261	
Adjusted R-squared	0.395923	S.D. dependent var	73594.49	
S.E. of regression	57199.40	Akaike info criterion	24.81766	
Sum squared resid	8.18E+10	Schwarz criterion	24.91365	
Log likelihood	-333.0384	F-statistic	18.04087	
Durbin-Watson stat	2.006924	Prob(F-statistic)	0.000262	

ADF Test Statistic	-2.251317	1% Critical Value*	-3.6959
		5% Critical Value	-2.9750
		10% Critical Value	-2.6265

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(RGDP,2)

Method: Least Squares

Date: 03/06/07 Time: 10:39

Sample(adjusted): 1978 2004

Included observations: 27 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RGDP(-1))	-0.543285	0.241319	-2.251317	0.0338
D(RGDP(-1),2)	-0.323634	0.189407	-1.708668	0.1004
C	-5641.372	5131.223	-1.099421	0.2825
R-squared	0.463858	Mean dependent var	824.1111	
Adjusted R-squared	0.419179	S.D. dependent var	27032.25	
S.E. of regression	20601.71	Akaike info criterion	22.80857	
Sum squared resid	1.02E+10	Schwarz criterion	22.95256	
Log likelihood	-304.9158	F-statistic	10.38213	
Durbin-Watson stat	2.213946	Prob(F-statistic)	0.000564	

ADF Test Statistic	-4.325493	1% Critical Value*	-4.3382
		5% Critical Value	-3.5867
		10% Critical Value	-3.2279

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(RGDP,2)

Method: Least Squares

Date: 03/06/07 Time: 10:41

Sample(adjusted): 1978 2004

Included observations: 27 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RGDP(-1))	-1.441280	0.333206	-4.325493	0.0003
D(RGDP(-1),2)	0.134901	0.208242	0.647810	0.5235
C	-55830.46	15440.71	-3.615796	0.0015
@TREND(1975)	2379.008	703.1818	3.383204	0.0026
R-squared	0.642012	Mean dependent var	824.1111	
Adjusted R-squared	0.595318	S.D. dependent var	27032.25	
S.E. of regression	17196.46	Akaike info criterion	22.47875	
Sum squared resid	6.80E+09	Schwarz criterion	22.67072	
Log likelihood	-299.4631	F-statistic	13.74934	
Durbin-Watson stat	1.623206	Prob(F-statistic)	0.000024	

ADF Test Statistic	-2.001098	1% Critical Value*	-2.6522
		5% Critical Value	-1.9540
		10% Critical Value	-1.6223

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(RGDP,2)

Method: Least Squares

Date: 03/06/07 Time: 10:42

Sample(adjusted): 1978 2004

Included observations: 27 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RGDP(-1))	-0.375234	0.187514	-2.001098	0.0564
D(RGDP(-1),2)	-0.412349	0.172073	-2.396364	0.0244
R-squared	0.436856	Mean dependent var	824.1111	
Adjusted R-squared	0.414330	S.D. dependent var	27032.25	
S.E. of regression	20687.53	Akaike info criterion	22.78364	
Sum squared resid	1.07E+10	Schwarz criterion	22.87963	
Log likelihood	-305.5791	F-statistic	19.39361	
Durbin-Watson stat	2.369894	Prob(F-statistic)	0.000175	

ADF Test Statistic	-3.374850	1% Critical Value*	-3.6959
		5% Critical Value	-2.9750
		10% Critical Value	-2.6265

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(RHYP,2)

Method: Least Squares

Date: 03/06/07 Time: 10:43

Sample(adjusted): 1978 2004

Included observations: 27 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RHYP(-1))	-1.119280	0.331653	-3.374850	0.0025
D(RHYP(-1),2)	-0.217162	0.194560	-1.116168	0.2754
C	-2058.149	1595.512	-1.289961	0.2094
R-squared	0.728685	Mean dependent var	74.65519	
Adjusted R-squared	0.706076	S.D. dependent var	13627.50	
S.E. of regression	7388.120	Akaike info criterion	20.75757	
Sum squared resid	1.31E+09	Schwarz criterion	20.90156	
Log likelihood	-277.2272	F-statistic	32.22906	
Durbin-Watson stat	1.944203	Prob(F-statistic)	0.000000	

ADF Test Statistic	-3.711605	1% Critical Value*	-4.3382
		5% Critical Value	-3.5867
		10% Critical Value	-3.2279

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(RHYP,2)

Method: Least Squares

Date: 03/06/07 Time: 10:45

Sample(adjusted): 1978 2004

Included observations: 27 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RHYP(-1))	-1.325652	0.357164	-3.711605	0.0011
D(RHYP(-1),2)	-0.110507	0.205481	-0.537796	0.5959
C	-6910.155	3806.424	-1.815393	0.0825
@TREND(1975)	275.0220	196.6849	1.398288	0.1754
R-squared	0.749942	Mean dependent var	74.65519	
Adjusted R-squared	0.717326	S.D. dependent var	13627.50	
S.E. of regression	7245.344	Akaike info criterion	20.75006	
Sum squared resid	1.21E+09	Schwarz criterion	20.94204	
Log likelihood	-276.1258	F-statistic	22.99293	
Durbin-Watson stat	1.861700	Prob(F-statistic)	0.000000	

ADF Test Statistic	-3.089301	1% Critical Value*	-2.6522
		5% Critical Value	-1.9540
		10% Critical Value	-1.6223

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(RHYP,2)

Method: Least Squares

Date: 03/06/07 Time: 10:46

Sample(adjusted): 1978 2004

Included observations: 27 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RHYP(-1))	-0.925503	0.299583	-3.089301	0.0049
D(RHYP(-1),2)	-0.316247	0.181113	-1.746129	0.0931
R-squared	0.709874	Mean dependent var	74.65519	
Adjusted R-squared	0.698269	S.D. dependent var	13627.50	
S.E. of regression	7485.592	Akaike info criterion	20.75053	
Sum squared resid	1.40E+09	Schwarz criterion	20.84652	
Log likelihood	-278.1322	F-statistic	61.16945	
Durbin-Watson stat	2.044477	Prob(F-statistic)	0.000000	

ADF Test Statistic	-3.343426	1% Critical Value*	-3.6959
		5% Critical Value	-2.9750
		10% Critical Value	-2.6265

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(RNGAS,2)

Method: Least Squares

Date: 03/06/07 Time: 10:50

Sample(adjusted): 1978 2004

Included observations: 27 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RNGAS(-1))	-0.993352	0.297106	-3.343426	0.0027
D(RNGAS(-1),2)	-0.174191	0.192435	-0.905192	0.3744
C	-1272.084	1566.579	-0.812014	0.4248
R-squared	0.631825	Mean dependent var	-405.5848	
Adjusted R-squared	0.601143	S.D. dependent var	12724.26	
S.E. of regression	8036.016	Akaike info criterion	20.92569	
Sum squared resid	1.55E+09	Schwarz criterion	21.06968	
Log likelihood	-279.4969	F-statistic	20.59317	
Durbin-Watson stat	2.035548	Prob(F-statistic)	0.000006	

ADF Test Statistic	-3.262063	1% Critical Value*	-4.3382
		5% Critical Value	-3.5867
		10% Critical Value	-3.2279

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(RNGAS,2)

Method: Least Squares

Date: 03/06/07 Time: 10:51

Sample(adjusted): 1978 2004

Included observations: 27 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RNGAS(-1))	-1.027260	0.314911	-3.262063	0.0034
D(RNGAS(-1),2)	-0.156790	0.201015	-0.779993	0.4433
C	4.350690	3659.812	0.001189	0.9991
@TREND(1975)	-81.55730	210.4642	-0.387511	0.7019
R-squared	0.634213	Mean dependent var	-405.5848	
Adjusted R-squared	0.586502	S.D. dependent var	12724.26	
S.E. of regression	8182.186	Akaike info criterion	20.99326	
Sum squared resid	1.54E+09	Schwarz criterion	21.18524	
Log likelihood	-279.4090	F-statistic	13.29270	
Durbin-Watson stat	2.016248	Prob(F-statistic)	0.000031	

ADF Test Statistic	-3.278019	1% Critical Value*	-2.6522
		5% Critical Value	-1.9540
		10% Critical Value	-1.6223

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(RNGAS,2)

Method: Least Squares

Date: 03/06/07 Time: 10:53

Sample(adjusted): 1978 2004

Included observations: 27 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RNGAS(-1))	-0.954891	0.291301	-3.278019	0.0031
D(RNGAS(-1),2)	-0.193047	0.189723	-1.017519	0.3187
R-squared	0.621710	Mean dependent var	-405.5848	
Adjusted R-squared	0.606578	S.D. dependent var	12724.26	
S.E. of regression	7981.082	Akaike info criterion	20.87872	
Sum squared resid	1.59E+09	Schwarz criterion	20.97471	
Log likelihood	-279.8628	F-statistic	41.08680	
Durbin-Watson stat	2.019634	Prob(F-statistic)	0.000001	

ADF Test Statistic	-4.025958	1% Critical Value*	-3.6959
		5% Critical Value	-2.9750
		10% Critical Value	-2.6265

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(RPET,2)

Method: Least Squares

Date: 03/06/07 Time: 11:03

Sample(adjusted): 1978 2004

Included observations: 27 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RPET(-1))	-0.977285	0.242746	-4.025958	0.0005
D(RPET(-1),2)	0.214559	0.192890	1.112336	0.2770
C	-9972.005	10195.26	-0.978102	0.3378
R-squared	0.444300	Mean dependent var	-1684.293	
Adjusted R-squared	0.397991	S.D. dependent var	66996.00	
S.E. of regression	51981.66	Akaike info criterion	24.65961	
Sum squared resid	6.49E+10	Schwarz criterion	24.80359	
Log likelihood	-329.9047	F-statistic	9.594376	
Durbin-Watson stat	2.126467	Prob(F-statistic)	0.000867	

ADF Test Statistic	-3.936968	1% Critical Value*	-4.3382
		5% Critical Value	-3.5867
		10% Critical Value	-3.2279

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(RPET,2)

Method: Least Squares

Date: 03/06/07 Time: 11:04

Sample(adjusted): 1978 2004

Included observations: 27 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RPET(-1))	-0.974137	0.247433	-3.936968	0.0007
D(RPET(-1),2)	0.209739	0.196951	1.064934	0.2980
C	-17472.23	23363.34	-0.747848	0.4621
@TREND(1975)	470.0016	1311.460	0.358380	0.7233
R-squared	0.447386	Mean dependent var	-1684.293	
Adjusted R-squared	0.375306	S.D. dependent var	66996.00	
S.E. of regression	52952.04	Akaike info criterion	24.72811	
Sum squared resid	6.45E+10	Schwarz criterion	24.92009	
Log likelihood	-329.8295	F-statistic	6.206782	
Durbin-Watson stat	2.132453	Prob(F-statistic)	0.003019	

ADF Test Statistic	-3.914485	1% Critical Value*	-2.6522
		5% Critical Value	-1.9540
		10% Critical Value	-1.6223

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(RPET,2)

Method: Least Squares

Date: 03/06/07 Time: 11:05

Sample(adjusted): 1978 2004

Included observations: 27 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RPET(-1))	-0.931880	0.238059	-3.914485	0.0006
D(RPET(-1),2)	0.196093	0.191798	1.022393	0.3164
R-squared	0.422149	Mean dependent var	-1684.293	
Adjusted R-squared	0.399034	S.D. dependent var	66996.00	
S.E. of regression	51936.61	Akaike info criterion	24.62462	
Sum squared resid	6.74E+10	Schwarz criterion	24.72061	
Log likelihood	-330.4324	F-statistic	18.26371	
Durbin-Watson stat	2.088493	Prob(F-statistic)	0.000245	

APPENDIX E

Dependent Variable: RENCP(-1)

Method: Least Squares

Date: 03/05/07 Time: 13:09

Sample(adjusted): 1976 2004

Included observations: 29 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	72388.36	26658.36	2.715409	0.0114
RGDP(-1)	1.088290	0.182794	5.953658	0.0000
R-squared	0.567627	Mean dependent var		170417.9
Adjusted R-squared	0.551613	S.D. dependent var		168608.9
S.E. of regression	112903.4	Akaike info criterion		26.17292
Sum squared resid	3.44E+11	Schwarz criterion		26.26722
Log likelihood	-377.5074	F-statistic		35.44604
Durbin-Watson stat	0.334806	Prob(F-statistic)		0.000002

Dependent Variable: RCOAL(-1)

Method: Least Squares

Date: 03/05/07 Time: 13:13

Sample(adjusted): 1976 2004

Included observations: 29 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-308.3461	279.8456	-1.101844	0.2803
RGDP(-1)	0.017469	0.001919	9.103815	0.0000
R-squared	0.754276	Mean dependent var		1265.207
Adjusted R-squared	0.745175	S.D. dependent var		2347.855
S.E. of regression	1185.201	Akaike info criterion		17.05968
Sum squared resid	37926934	Schwarz criterion		17.15398
Log likelihood	-245.3654	F-statistic		82.87944
Durbin-Watson stat	2.202442	Prob(F-statistic)		0.000000

Dependent Variable: RHYP(-1)

Method: Least Squares

Date: 03/05/07 Time: 14:46

Sample(adjusted): 1976 2004

Included observations: 29 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4109.309	1596.005	2.574747	0.0158
RGDP(-1)	0.145739	0.010944	13.31722	0.0000
R-squared	0.867873	Mean dependent var		17236.98
Adjusted R-squared	0.862979	S.D. dependent var		18260.58
S.E. of regression	6759.395	Akaike info criterion		20.54173
Sum squared resid	1.23E+09	Schwarz criterion		20.63602
Log likelihood	-295.8550	F-statistic		177.3485
Durbin-Watson stat	1.205119	Prob(F-statistic)		0.000000

Dependent Variable: RNGAS(-1)

Method: Least Squares

Date: 03/05/07 Time: 14:51

Sample(adjusted): 1976 2004

Included observations: 29 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	19284.11	4169.654	4.624871	0.0001
RGDP(-1)	0.091927	0.028591	3.215269	0.0034
R-squared	0.276875	Mean dependent var		27564.62
Adjusted R-squared	0.250093	S.D. dependent var		20392.47
S.E. of regression	17659.31	Akaike info criterion		22.46239
Sum squared resid	8.42E+09	Schwarz criterion		22.55668
Log likelihood	-323.7046	F-statistic		10.33796
Durbin-Watson stat	0.236294	Prob(F-statistic)		0.003368

Dependent Variable: RPET(-1)

Method: Least Squares

Date: 03/05/07 Time: 14:53

Sample(adjusted): 1976 2004

Included observations: 29 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	48779.26	23215.47	2.101153	0.0451
RGDP(-1)	0.830007	0.159186	5.214069	0.0000
R-squared	0.501721	Mean dependent var		123543.5
Adjusted R-squared	0.483266	S.D. dependent var		136778.4
S.E. of regression	98322.08	Akaike info criterion		25.89636
Sum squared resid	2.61E+11	Schwarz criterion		25.99065
Log likelihood	-373.4972	F-statistic		27.18652
Durbin-Watson stat	0.377846	Prob(F-statistic)		0.000017