EFFECT OF COMMERCIAL ELECTRICITY CONSUMPTION ON ECONOMIC GROWTH IN KENYA (1965-2014)

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BY

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DECLARATION

This research project is my original work and has not been presented for a degree or any other award in any other University or Institution. Where studies of others have been used, they have been duly cited.

Kiambuthi Nigel Kung'u …….. ……

X50/80693/2015 Date Signature

This project has been submitted for examination with my approval as the University supervisor.

……..... ……

Signature Date

Dr. George Ruigu

School of Economics

The University of Nairobi

DEDICATION

This study is dedicated to my parents: Mr Benjamin Kiambuthi and Mrs Susan Kiambuthi and to my sister Maureen Kiambuthi for their support and encouragement during the entire period of study.

ACKNOWLEDGEMENT

I would like to thank my supervisor Dr. George Ruigu for his guidance, leadership, support, criticisms and supervision which has made my project a remarkable success.

I extend my gratitude to the School of Economics of The University of Nairobi for providing me with the facilities which were instrumental in making this research a success.

I also express my gratitude to the almighty God for enabling me to prepare and successfully complete my project.

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ACRONYMS AND ABBREVIATIONS

GDP:	Gross Domestic Product
GNP:	Gross National Product
KWHs:	Kilowatt Hours
IEA:	International Energy Agency
FDI:	Foreign Direct Investment
SMEs:	Small and Medium Sized Enterprises
GNP:	Gross National Product
ARDL:	Autoregressive Distributed Lag
ASEAN:	Association of Southeast Asian Nations
GCC:	Gulf Cooperation Countries
OECD:	Organization for Economic Co-operation and Development
WDI:	World Bank Development Indicators
GFCF:	Gross Fixed Capital Formation
ADF:	Augmented Dickey-Fuller
OLS:	Ordinary Least Squares
UAE:	United Arab Emirates
VAR:	Vector Autoregressive
VECM:	Vector Error Correction Model

ABSTRACT

This study set out to investigate the effect of commercial electricity consumption on economic growth in Kenya over the period 1964-2014. With large commercial sales and small commercial electricity sales as the key variables of interest; annual time series data was analysed using ordinary least squares (OLS). From the analysis, the study solely focused on variables which were statistically significant at 1% and 5%. The study findings on the variables of interest showed that an increase of 1% in small commercial electricity consumption caused a 0.03% increase in real GDP on average. The synergy between the control independent variables with commercial electricity consumptions independent variables showed that in the long run; gross fixed capital formation, per capita GDP human capital, foreign direct investment and trade openness positively influenced economic growth. Dummy variables showed that commercial electricity consumption during the period 1979-2001 and 2002-2013 had positive growth spurring effects on overall GDP in Kenya. The Dummy for period 2002-2001 showed a slightly positive growth spurring effect on overall GDP compared to the Dummy for period 1964-1978. Given the above findings, it was established that commercial electricity consumption and specifically small commercial electricity consumption positively influences economic growth in Kenya. As such, the study recommended that Kenya should strongly focus on increasing the small commercial electricity consumption from 1,244,700 Kw to 3,675,876 Kw so as to trigger economic growth and improved living standards. Kenya should embrace infrastructure development for current existing small commercial electricity consumers and extensive network modification for large commercial electricity consumers. The government should also expedite the implementations of programs such as Energy Sector Reform and Power Development Project, Kenya - Energy Sector Recovery Project, Kenya Electricity Modernization Project and Energy Sector Reform and Power Development Project among many other programmes so as to increase commercial electricity consumption in the country.

CHAPTER ONE

1.0 INTRODUCTION

This section orients the reader to the study backdrop and further delves into presenting the research problem, research objectives, reasons why it is important to do the research and an outline of the research paper.

1.1 Background Information

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Petroleum and electricity account for 20% and 10% of total national energy consumption thus making them the main sources of commercial energy in Kenya (Kwame, 2015). Electricity is vital for economic growth, improved standards of living and national security. Consequently, the uptake of electricity has been on the rise over the years.

The growing demand has been hampered with low access rates in both rural and urban areas in Kenya. Only 26% of the rural population and 68% of the urban population are connected to the electricity grid (WDI, 2014). The government has made tremendous efforts in addressing the challenge by embarking on the 5000+ MW power generation, street lighting and last mile projects (Kwame 2015).

Since the period after industrial revolution; the demand for electricity has been increasing among households, industries and service sector (Masuduzzaman, 2012). The electricity is specifically used for cooking, lighting as well as a source of motive to power machines and vehicles (Gurgul and Lach, 2012). In the globalizing world, the demand for electric energy is increasing as it is clean, practical to use and easily transformable into other energy sources (Korkut and Yurtkuran, 2017). This increasing demand and consumption shapes economic growth. According to World Bank (2017), a country's economic and social well-being is associated with electricity consumption.

Ashraf et., al. (2013) stressed that the commercial electricity consumption determines a country's' economic growth levels. Similarly, Solarin (2011) presented that commercial electricity consumption is positively related to national product. He further revealed that increased electricity consumption signifies economic well-being characterized by high quality of life in terms of improved health, education and standards of living. According to Onakoya et., al (2013), the quest for rapid economic growth is impossible in the absence of energy. Hence, commercial electricity consumption per capita is directly proportional to economic advancement. There exists a strong relationship between a country's economy and its electricity consumption (Karanfil and Li, 2015). Developing countries record lower levels of per capita electricity consumption as compared to their developed counterparts. A country's total and per-capita electricity consumption is considered as a measure of welfare (Korkut and Yurtkuran, 2017).

According to (Korkut and Yurtkuran, 2017), disruption in energy consumption can cause significant economic problems for countries. The 1973 oil crisis and the post-energy crisis of 1981-2000 taught economists that similar to other live phenomena, an economy needs energy in order to live and grow. The crisis had detrimental effects on economic growth, production and employment capacities. Today, efforts are exerted to reduce the effect of oil on the national economies by encouraging the use of electricity.

Just like capital and labor, energy is a key input in any economic activity (Saatci and Dumrul, 2013). Despite its importance, energy has been ignored in many growth models which have been dominated by labor and capital as the only determinants of economic growth (Ashraf et., al. 2013). It was also proven by biophysical models that capital, labour and natural resources are necessary but not sufficient alone to complete the production process without energy (Korkut and Yurtkuran, 2017).

Commercial electricity consumption-economic growth dynamic dependencies is up to date a contentious subject matter among scholars and therefore the need to reexamine the same in the Kenyan context is necessary. The direction of causality determines the

energy policies adopted by a country (Bildirici et., al. 2012). If commercial electricity consumption is a pre requisite for economic growth, then electricity conservation policies can have serious implications on the pace of growth. The reason for choosing Kenya is because of its shift from being an agriculture intensive economy to an industry intensive economy (characterized by rapid urbanization, higher incomes and an increasing population) in which commercial electricity takes an explicit role in economic growth.

1.1.1 Kenya's Commercial Electricity Consumption

During the period 1969-2014, large commercial electricity sales increased by 4.1 times up from 943,978 KWh in 1969 to 3,891,500 KWh In 2014. On the other hand, small commercial electricity sales increased by 162.3 times up from 7,666 KWh in 1969 to 1,244,700 KWh in 2014. Total commercial electricity consumption increased by 951,644 KWh in 1969 to 5,136,200 KWh in 2014. Table 1.1 depicts Kenya's Commercial Electricity Consumption from 1969-2014.

Table 1.1 Kenya's Commercial Electricity Consumption from 1969-2014.

'000 KWh.

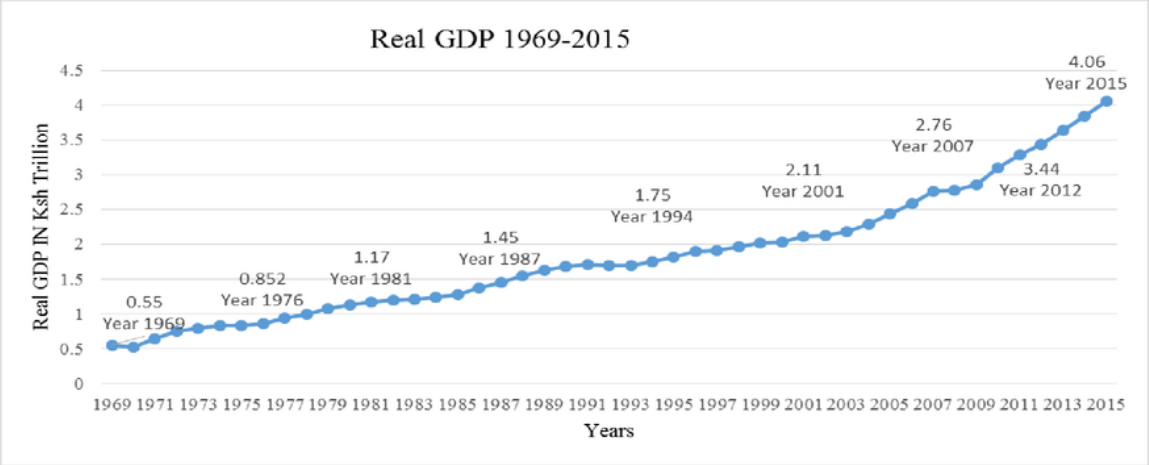
Consumption Type	1969	1979	1989	1999	2009	2010	2011	2012	2013	2014
Large Commercial electricity sales	943,978	888,070	1,556,176	1,513,000	3,058,100	3,204,900	3,440,300	3,409,200	3,585,300	3,891,500
Small Commercial electricity sales	7,666	-	270,4 1 0	466,000	960,200	823,000	914,568	902,500	1,155,800	1,244,700
Total	951644	888,070	1,826,586	1,979,000	4,018,300	4,027,900	4,354,868	4,311,700	4,741,100	5,136,200

Source: KNBS (2015)

1.1.2 Economic Growth Trends in Kenya

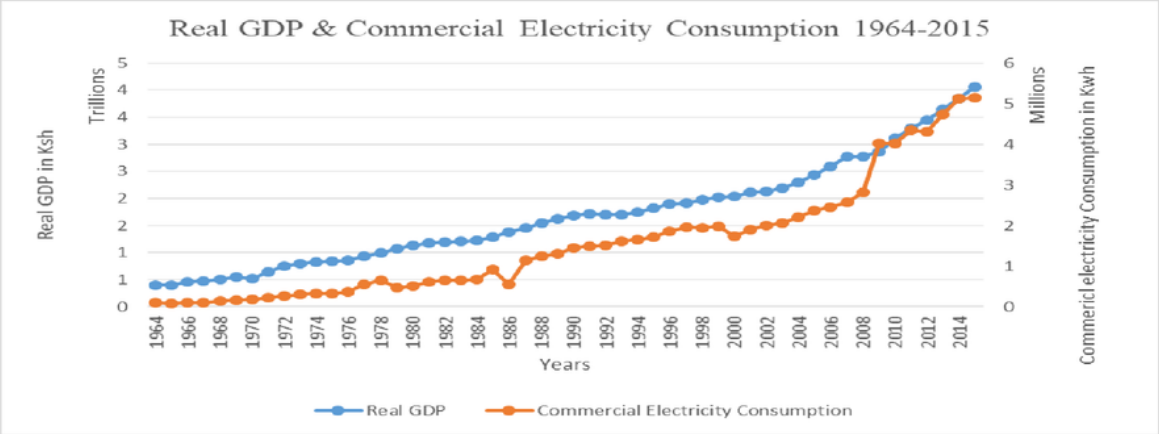
Kenya has real GDP has been recorded a tremendous increase from Ksh 550 billion in 1969 to slightly over Ksh 4.060 trillion in 2015. Despite this increase, fluctuations over the same period are noticed varying from -4.7% in 1970, 0.9% in 1975, 5.6% in 1980,

4.3% in 1985, -0.7% in 1990, 4.4% in 1995, 0.6% in 2000, 5.9% in 2005, 5.8% in 2010 and 5.6% in 2015. Figure 1.1 and Figure 1.2 show Kenya's Real GDP and Commercial electricity consumption from 1969-2015.



Source: World Bank (2015)

Figure 1.1: Real Gross Domestic Product: 1969-2015



Source: KNBS (2015)

Figure 1.2: Real GDP & Commercial electricity consumption: 1969-2015

From the above, it is evident that from 1964-2014 Kenya's commercial energy consumption has been on the rise whereas real GDP has been fluctuating. Negative growth rates were recorded during the same period as well.

1.2 Statement of the Problem

According to Kwame (2015); unlike in Egypt and South Africa, the Kenyan electricity grid cover has not been at par with the rising consumer base and this has caused a decline in electricity consumption over the last eight years.

Inconsistent power supply has made production expensive especially among SMEs which have to install stand-by generators. Nationally the cost of power interruptions has been estimated at 2% of the Gross Domestic Product (Kwame, 2015). This situation has been grave such that businesses have been forced to move their operating base to other countries within the region where electricity supply is stable (Ogundipe and Akinyemi, 2014).

The expansion of the electricity grid in Kenya has mainly focused on poor urban and rural households at the expense of other consumers who have a real demand for the electricity; over and above just cooking, lighting and powering devices. (Kwame, 2015).

Most studies on the subject matter take into account both commercial and non-commercial electricity consumption when analyzing electricity consumption- economic growth dependencies. Abosedra et., al. (2009) using 1995-2005 yearly data from Lebanon investigated the cause and effect electricity consumption - economic growth relation. Ghosh (2009) using data over the period 1970-2006 in India, applied ARDL bounds testing approach to determine whether electricity consumption is an economic growth catalyst. Using 1975 to 2006 yearly data from seven South American Yoo and Kwak (2010) examined economic growth - electricity usage dependences.

The effect of commercial electricity consumption on economic growth has been marginalized across scholarly contributions and therefore the need to investigate more on the relation between the two.

1.3 Research Question

1. How does commercial electricity consumption affect economic growth in Kenya?

1.4 Objectives of the Study

The main objective of this study is to establish the effect of commercial electricity consumption on economic growth in Kenya.

Specifically:

1. To determine the effect of commercial electricity consumption on economic growth in Kenya.
2. To provide policy recommendations based on the study findings.

1.5 Significance of the Study

Commercial electricity is an essential ingredient in economic development. It enhances production of goods and services thus creating employment, reducing poverty levels and ultimately bringing forth social prosperity. Therefore, this study will be of importance to policy makers, existing body of literature and energy institutions.

The findings of the study will provide insightful information that can be adopted by policy makers when shaping revenue allocations policy for the commercial electricity sector. This study will add value and fill a literature gap on the impact of commercial energy consumption on economic growth which is a sparsely examined subject matter. Locally, this study opens up the space for further research whereas internationally, this study findings may be relied upon when conducting comparative studies.

Energy institutions and other key stakeholders, can use the study findings to assess the effects of commercial electricity consumption. The different types of commercial electricity consumption influence economic growth differently bringing benefits to trade, industry and agriculture development among others. Thus investment in commercial electricity consumption has different economic effects. The cause and effect commercial electricity consumption and economic growth relation that will be affirmed, will shed light on whether or not to invest in commercial electricity consumption.

1.6 Organization of the rest of the Paper

Following the above introduction, chapter two presented both the theoretical literature review and empirical literature review based on past studies. Chapter three presented the theoretical and methodological framework.

CHAPTER TWO

2.0 LITERATURE REVIEW

This section covered theoretical literature, empirical literature and concluded by giving a recap of the two.

2.1 Theoretical Literature Review

Since the inaugural 1978 USA Kraft and Kraft empirical study which established that economic growth which was measured by GNP causes energy consumption; a multifold of studies within both developed and developing countries context have investigated the electricity consumption-economic growth connection. The studies apply different econometric models based on different theoretical approaches including the production function approach. Dogan (2015) argued that disruption in energy consumption affects producers' productivity and peoples' welfare thus causing significant economic problems for countries.

2.1.1 Production Function Approach

Altaee et., al (2013) and Ameyaw et., al (2016) separately used Cobb Douglas production function approach to establish whether electricity consumption positively influenced economic growth. The results established that impact of economic growth on electricity consumption was positive. These results were in tandem with Ogundipe and Akinyemi, (2014) findings which implied that economic growth is a necessary pre-cursor in electricity consumption.

Sbia et., al (2014) study using a generic production function: $Y(t) = \omega EC(t)^{\delta_1} FDI^{\delta_2} K(t)^{\alpha} L(t)^{\alpha}$;where Y is output, EC is electricity consumption, FDI is foreign direct investment, K is capital stock and L is labor; revealed a feedback electricity consumption economic growth relation. Similar findings were also reported by Kasperowicz (2014) study in Poland.

Applying the neo-classical production function $Y_t = f(E_t, TR_t, K_t, L_t)$; where E_t is electricity consumption, TR_t is trade openness, K_t is capital and L_t is labor; Saleheen et., al (2012) study on Kazakhstan revealed how electricity consumption causes an increase Real GDP. Akin findings were observed by Solarin (2011) as well as Atif and Siddiqi (2010). Therefore, from the findings it can be concluded that countries should adopt policies in favor of electricity consumption as opposed to electricity conservation.

Using a generic production function of the form yt = α + ßelct + φtrt + yfdit + et; Where y is real GDP per capita, elc is electric power consumption per capita, tr is trade openness (%), fdi is FDI and εt is the error term; (Acaravci et., al. 2015) study on Turkey revealed that electricity consumption per capita positively influences real GDP per capita.

Michieka and Idris (2015) applied the function form:

$$\Delta elec_t = \alpha_1 + \sum_{i=1}^{l} \beta_{1i} \Delta elec_{t-i} + \sum_{i=1}^{m} \gamma_{1i} \Delta fd_{t-i} + \sum_{i=1}^{n} \alpha_{1i} \Delta gdp_{t-i} + \sum_{i=1}^{o} \delta_{1i} \Delta ind_{t-i} + \sum_{i=1}^{p} \mu_{1i} \Delta trade_{t-i} + \xi_{1i} ECT_{t-1} + u_{1t}$$

Where elec is electric power consumption (kWh), tr is trade openness (%), fd is financial development, gdp is GDP (constant 2005 US$), ind is industry and tr is trade openness. The results of the study in Cote D'Ivioire and Zambia reveled that in the long term, all variables positively influence on electricity consumption. In Cote D'Ivioire and South Africa; financial development and GDP have a positive impact on electricity consumption in the transitory.

Applying the function $EC_t = f(Y_t, C_t, P_t, F_t)$ where EC, Y, C, P and F represent electricity consumption, gross domestic product, consumption expenditure, consumer price index and FDI respectively; Bekhet, (2011) study revealed electricity consumption is a necessary impetus for economic growth. Employing the functional form: INDP = f (ELEC, IQ, GFCF, HCD, TOP, TGAP) where INDP represents industrial output, ELEC represents electricity consumption, IQ represents institutional quality, GFCF represents gross fixed capital formation, HCD represents human capital development, TOP

represents trade openness, and TGAP represents technological gap; Ugwoke et., al. (2016) study revealed that industrial production is negatively influenced by trade openness and electricity supply.

Employing the production function $GR_t = K_t L_t RELC_t, NRELC_t$, where, GRt represents economic growth, $RELC_t$ represents renewable energy consumption and $NRELC_t$ is energy consumption from non-renewable sources; Dogan (2015) examined the electricity consumption-economic growth dynamic dependency in Turkey. The findings revealed that in the transitory, the economy is energy independent whereas the contrary was observed in the long-term. On the other hand, Nadeem and Munir (2016) undertook a sector analysis in Pakistan on the causal tie therein energy consumption and economic growth adopting $Yt = AK_t L_t MS_t EC_t$ production function. Economic growth is Y_t, AK_t is technology, K_t is capital, L_t is labor force, EC_t is energy consumption. The outcome of the research revealed as the economy grows so does the consumption of energy grow.

2.2 Empirical Literature Review

Since the inaugural Kraft and Kraft (1978) examination of energy consumption and economic growth cause and effect relation, many scholars have emerged specifically investigating the electricity consumption-economic growth dynamic dependency though up to date; there has been no consensus amongst scholars on the direction of causality. Electricity consumption-economic growth dynamic dependency can be explained by either growth, conservation, neutral or feedback supposition (Nondo and Kahsai, 2009).

The growth hypothesis also known as, electricity consumption-led growth, affirms that electricity consumption is a critical determinant of economic growth. On the supply side of the economy, electricity is a production input, hence, an impetus to economic growth and development (Dantama and Inuwa, 2012). On the demand side of the economy, consumers see electricity as a consumable product through which utility is maximized (Abalaba and Dada, 2013). Policies promoting electricity consumption increase

economic growth, whereas energy conservation policies damage the economy (Nondo and Kahsai, 2009).

The conservation hypothesis also known as growth-led electricity consumption, hypothesis proclaims that as the economy grows so does the consumption of electricity grow. This suggests that rate of growth of the economy is independent of electricity consumption. In such an economy, the government is not keen on adopting policies in favor of electricity consumption (Odhiambo, 2010). The growth-led electricity consumption, hypothesis holds that increasing gross domestic product also increases electricity consumption, thus policies promoting electricity consumption have no positive ramifications on the growth of an economy (Nondo and Kahsai, 2009).

The neutral hypothesis contends that electricity consumption has no impact on economic and the converse also holds. Therefore, the two variables are entirely independent from one another and there is no relationship between the two (Nondo and Kahsai, 2009). In countries where neutral hypothesis hold; policies in favor of or against uptake of electricity have in-consequential effect on the rate of growth (Omri, 2014).

The feedback hypothesis postulates increased electricity consumption per capita spurs economic growt and the converse also holds. The hypothesis presupposes electricity consumption-economic growth complementarity. According to Nondo and Kahsai (2009), countries experiencing bidirectional causality can adopt policies that stimulate both electricity consumption and economic growth.

This paper focused on research conducted in single country as well as a combined set of countries to discuss electricity consumption - economic growth cause and effect relationship. Applying the Toda and Yamamoto (1995) procedure, Adom (2011) analysed the electricity consumption-economic growth dynamic dependency Ghana. Findings established that economic growth positively influences electricity consumption. Similarly, Ghosh (2009) using data over the period 1970-2006 in India applied ARDL bounds testing approach to determine the GDP-electricity consumption cause effect

relation. Research findings revealed that in the short and long term growth of the economy is independent of electricity consumption.

Binh (2011), examined the electricity consumption-economic growth dynamic dependency. Utilizing the Vector Error Correction Model and 1976-2010 data, he established that Real GDP has an impact on electricity consumption. The research findings were consistent with previous literature as illustrated by Ciarreta and Zarraga (2010).

Pata and Terzi (2017) utilizing 1971-2008 time series data investigated the causal ties there exists between economic growth and electricity consumption in Turkey. Research results inferred that in both, electricity consumption plays a crucial role in economic growth. Further, Georgantopoulos (2012) investigated the electricity consumption-economic growth causal link in Greece over 1980-2010. Study findings revealed that electricity consumption is imperative for economic growth.

Abosedra et., al. (2009) using 1995-2005 yearly data from Lebanon and employing bivariate vector auto regression framework, investigated the cause and effect electricity consumption - economic growth relation. Research findings revealed that electricity consumption spurs economic growth. Identical findings were observed in Apergis (2010) study.

Applying VECM, Ogundipe and Apata (2013) examined the cause and effect electricity consumption- gross domestic product relation. The study used 1971 to 2008 time series data from Nigeria. It was observed that for the economy to grow there must be energy consumption and the converse was also true. Similar results were observed by Tang and Tan (2013) investigation on electricity consumption-economic growth dynamic dependency in Malaysia.

Applying Pedroni (2004) panel cointegration analysis, Işık (2015) utilized 1980-2010 yearly data from OECD countries to examine energy consumption-economic growth

cause and effect relation. Study results revealed that energy consumption is a necessary impetus to economic growth. Hamrita and Mekdam (2016) sought to establish electricity consumption-economic growth dynamic dependency the among Gulf Cooperation Council (GCC) members. Study outcomes established different causality directions across the six countries under study. Oman, Saudi Arabia and Kuwait recorded no causal relation. In Qatar and UAE the economy is not dependent on energy consumption. Finally, in Bahrain electricity consumption has an impact on economic and the converse also holds.

Applying panel ARDL boundary approach, Yasar (2017) investigated the energy consumption - economic growth dynamic dependency. Employing 1970 to 2015 panel data from 119 countries, it was observed that in upper and lower middle income nation; energy consumption doesn't determine economic growth in both transitory and distant future. In the short run there was no causality in low income countries and lower middle countries though in contrary, in upper-middle income and high-income nation's energy consumption had an impact on economic and the converse held true.

Employing bootstrapped causality approach, Narayan & Prasad (2008) analyzed Real GDP and electricity consumption dependencies for 30 OECD nations. Czech Republic, Korea, Australia, UK, Iceland, the Slovak Republic, Portugal and Italy reported that electricity consumption is central to the growth of Real GDP. Therefore the aforementioned countries can adopt policies in favor of electricity consumption. However, in the remaining OECD member state countries, electricity consumption doesn't foster economic growth.

Using 1975 to 2006 yearly data from seven South American countries and employing Hsiao's (1979) Granger causality techniques, Yoo and Kwak (2010) examined economic growth and electricity usage dependences. Study findings revealed policies in favor of electricity consumption spur economic growth in Ecuador, Chile, Argentina, Colombia

and Brazil. In Venezuela economic growth caused electricity consumption whereas in Peru electricity consumption had an impact on economic and the converse also held true. Applying Pedroni (2004) panel co-integration analysis, Bayar (2014) in a recent study considered annual data from 21 emerging economies for the period 1970-2011 in examining electricity consumption-economic growth dynamic dependences. Research findings revealed that economic growth causes electricity consumption and vice versa.

2.3 Overview of Literature

It is evident that different scholars employed different theoretical approaches in analysing the electricity consumption - economic growth dynamic dependencies. Some academic papers reviewed used the Cobb-Douglas whereas as other studies have employed the use of VAR analysis approaches. These studies have generated mixed results with Ogundipe and Apata (2013) and Tang and Tan (2013) revealing an electricity consumption-economic growth feedback relation. Studies by Pata and Terzi (2017), Georgantopoulos (2012), Abosedra (2009) and Apergis (2010) revealed electricity consumption is imperative for a country to record economic growth, whereas investigations Adom (2011), Ghosh (2009), Binh (2011), Ciarreta and Zarraga (2010) revealed that causality economic growth causes electricity consumption.

From the above, we can deduce that commercial electricity consumption-economic growth research have been insufficient. Most studies which have analysed the Kenyan scenario such as Onuonga (2015), have investigated the causal dependence of electricity and petroleum on economic growth. Consequently, there is need to explore the ties of commercial electricity consumption-economic growth dependencies in Kenya. The academic paper will therefore significantly add to the existing thin literature by examining the effect of disaggregated commercial electricity in terms of large commercial electricity sales and small commercial electricity sales on economic growth.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

This section addressed the following: theoretical framework, empirical model specification, definition and measurement of variables, data types and sources, model estimation approach and technique adopted by the study.

3.1 Theoretical Framework

The model of the study was founded on the Cobb-Douglas production function. It uses physical capital to measure economic growth. Electricity infrastructure on the other end is viewed as a capital good that facilitates the day to day production of goods and services. The following neoclassical two factor Cobb-Douglas production function was employed:

$$Y = AL^{\alpha}K^{\beta} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where:

Y is aggregate output, A represents total factor productivity, L represents labor input and K denotes capital stock. α and β represent output elasticity of labor and capital respectively. Summation of α and β elasticity output equals to one.

'A' which is total factor productivity represents that part of output growth that cannot be explained by capital and labor i.e. variations in technology and other factors which improve aggregate productivity (Kholi, 2015). Given that commercial electricity consumption is considered an economic growth and productivity pre-requisite, A was presented as follows:

$$A = F(El, Es) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where E_l and Es represent large commercial electricity sales and small commercial electricity sales respectively. The study categorized commercial electricity consumption into large commercial electricity sales and small commercial electricity sales so as to

measure their distinct effects on economic growth. Consequently, equation 1 is adjusted as:

$$Y = El, Es, (L, K) \ldots \ldots \ldots \ldots \ldots \quad (3)$$

Where Y is output, El is large commercial electricity sales, Es is small commercial electricity sales, L is labour and K is gross fixed capital formation. In addition, the study factored in other variables that affect economic growth. Human Capital (HC), Foreign Direct Investment (FDI) and Trade openness (TR) were introduced as control variables into equation three. The following was observed.

$$Y = F(El, Es, L, K, HC, FDI, TR) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (4)$$

The function in (4) above was specified to show the link between the variables and real GDP growth. Dummy variable "D" was also introduced so as to take cognizance of the effect of regime changes during the period under review. Each government regime shapes national policy for the period it's in office.

$$RGDP = F(El, Es, L, K, HC\ FDI, TR, D) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (5)$$

3.2 Empirical Model Specification

The empirical counterpart of function (5) was specified as follows:

$$RGDP = B_0 + B_1El + B_2Es + B_3L + B_4K + B_5HC + B_6FDI + B_7TR + B_8D \ldots \ldots \ldots \quad (6)$$

Where:

RGDP- Real Gross Domestic Product

El- Large commercial electricity sales

Es- Small commercial electricity sales

L- Per Capita GDP (proxy for Labour)

K- Gross Fixed Capital Formation (proxy for capital stock)

HC- Enrollment in secondary education (proxy for human capital)

FDI- Foreign Direct Investment

TR- Trade Openness

D – Regime Change Dummies – Dummy Variable capturing effect of regime change during the period under review.

The Regime Change Dummy variable is broken down into three periods representing three government regimes i.e. 1964-1978 (Kenyatta Regime), 1979-2001 (Moi Regime) and 2002-2013 (Kibaki Regime). This was necessitated by the need to understand the effect of change in government regime on commercial electricity consumption on economic growth connection. Kenyatta Regime was selected as the base year since it was the first government regime post-independence. Being the base year or reference base; it was dropped from the model to fend off the dummy variable trap that arises when independent variables are multicollinear (highly correlated) and therefore OLS cannot identify the parameters of the model.

$$RGDP = B_0 + B_1El + B_2Es + B_3L + B_4K + B_5HC + B_6FDI + B_7TR + B_8D_1 + B_9D_2 \ldots \ldots \quad (7)$$

Where:

D_1- Regime Change Dummy capturing effects of Moi Regime (1979-2001) on commercial electricity consumption on economic growth nexus.

D_2- Regime Change Dummy capturing effects of Kibaki Regime (2002-2013) on commercial electricity consumption on economic growth nexus.

B_{0-9} – represents coefficients estimate at period t which share the assumption of non-negativity.

By taking the exponential of model (7) shown above we get the equivalent form:

$$RGDP_t = e^{B_0 + B_1El + B_2Es + B_3L + B_4K + B_5HC + B_6FDI + B_7TR + B_8D_1 + B_9D_2} \ldots \ldots . \quad (8)$$

Model (8) above can be expressed as a power regression model of form:

$$RGDP = E_t^{B_0} * E_l^{B_1} * E_s^{B_2} * L^{B_3} * K^{B_4} * HC^{B_5} * FDI^{B_6} * TR^{B_7} * D_1^{B_8} * D_2^{B_9} \ldots (9)$$

Since any positive constant 'a' can be expressed as $e^{\ln a}$, we can re-express model (9) above as:

$$RGDP = e^{B_0} * e^{lnEl^{B_1}} * e^{lnEs^{B_2}} * e^{lnL^{B_3}} * e^{lnK^{B_4}} * e^{lnHC^{B_5}} * e^{lnFDI^{B_6}} * e^{lnTR^{B_7}} * e^{lnD_1^{B_8}} * e^{lnD_2^{B_9}} \ldots\ldots\ldots\ldots\ldots\ldots(10)$$

Since $\ln b^a = a\ln b$, we can re-express model (10) above as:

$$RGDP = e^{B_0} * e^{B_1 lnEl} * e^{B_3 lnL} * e^{B_4 lnK} * e^{B_5 lnHC} * e^{B_6 lnFDI} * e^{B_7 lnTR} * e^{B_8 lnD_1} * e^{B_9 lnD_2} \ldots(11)$$

Model (11) above can be expressed as a power regression model of form:

$$RGDP_t = E_t^{B_0 + B_1 lnEl + B_2 lnEs + B_3 lnL + B_4 lnK + B_5 lnHC + B_6 lnFDI + B_7 lnTR + B_8 lnD_1 + B_9 lnD_2} \ldots (12)$$

By taking log on both sides of Model (12), the linearized function form of the equation is presented as the double-log econometric model shown below. E_t is introduced to represent the Stochastic/Disturbance/Error Term of the model

$$lnRGDPt = B_0 + B_1 lnEl + B_2 lnEs + B_3 lnL + B_4 lnK + B_5 lnHC + B_6 lnFDI + B_7 lnTR + B_8 D_1 + B_9 D_2 + E_t \ldots(13)$$

3.3 Definition and Measurements of Variable

Following empirical model (8), the variable definition, measurement, expected signs as well as data sources are presented in Table 3.1

Table 3.1: Definition, Measurement of Variable and Expected Sign of Variables

Variable	Measurement	Expected Sign	Data Source
Dependent Variable			
lnRGDPt	Real GDP in Ksh		World Bank (WDI)
Independent Variables			
lnE_l	Large Commercial electricity sales in KWH	Positive	KNBS
lnEs	Small Commercial electricity sales in KWH	Positive	KNBS
Control Variable			
lnL_t	Per-Capita GDP in Ksh	Positive	World Bank (WDI)
lnK_t	Gross fixed capital formation in Ksh	Positive	World Bank (WDI)
lnHC	Enrolment in Secondary Education	Positive	World Bank (WDI)
lnFDI	Foreign Direct Investment	Positive	World Bank (WDI)
lnTR	Trade Openness	Positive	KNBS
Dummy Variables			
D_2=*1 if Moi Regime* D_2=*0, if otherwise*	Regime Change Dummy capturing effects of Moi Regime (1979-2001) on commercial electricity consumption on economic growth connection.		
D_3=*1 if Kibaki Regime* D_3= *0, if otherwise*	Regime Change Dummy capturing effects of Kibaki Regime (2002-2013) on commercial electricity consumption on economic growth connection.		

Source: Author

Dependent Variable

Real Gross Domestic Product is the sum total of goods and services produced in a country during a particular time span. It measured in Kenya Shillings.

Independent Variables

Large commercial electricity sales is the total electricity sold to large commercial users. It is measured in KWH.

Small commercial electricity sales is the total electricity sold to small commercial users. It is measured in KWH

Control Independent Variables

Per-Capita GDP is a measure of the total output of a country that accounts for the populace. It is computed as gross domestic product /total population during a specific time period. Per-Capita GDP indicates productivity of a country's workforce in efficiently producing goods and services. It is measured in Kenya Shillings.

Human Capital is a measure of economic value of skills and capacities possessed by citizenry. The skill set influence their productive capacity and earning potential.

GFCF It is the net increase in investment in physical capital over a given time period. The measure does not account for depreciation of fixed capital as well as purchases of land.

Foreign Direct Investment is cross-border investment in which an investor amasses lasting interests and long-term relationship in an enterprise operating outside of the economy of the investor. It is measured in Ksh.

Trade Openness is the level of an economy's trade intensity calculated as (exports + imports)/GDP. It is measured in Ksh.

3.4 Data Types and Sources

The study employed 1964-2014 annual time series data available from: Kenya Statistical Abstracts; Kenya Economic Survey (various issues), Kenya Population Census Reports and World Bank World Development Indicators

3.5 Model Estimation

3.5.1 Pre Estimation Test

3.5.1.1 Unit Root Test

Augmented Dickey-Fuller method will be applied to check stationary properties of commercial electricity consumption and real GDP series. Augmented Dickey-Fuller (ADF) test is an augmented version of the DF test that rectifies any serial correlation that might lie in the residual by adding the lagged difference terms of the dependent variable (Bekhet and Yusop, 2009). The hypothesis was tested using the following form:

$$\Delta Y_t = \beta_1 + \beta_{2t} + \delta Y_{t-1} + \mu_t$$

Ho: $\mu = 0$ (Meaning non-stationarity or presence of unit root)

Ho: $\mu < 0$ (Meaning stationarity or absence of unit root)

3.5.1.2 Co-integration test.

As suggested by Souhila and Kourbali (2012), co-integration implies relationship between two series in the long term. If a set of series is nonstationary at level but stationary after differencing, then they are said to be cointegrated. Essentially this addresses the trouble of spurious regression and checks if the independent variables can predict the dependent variable both in the transitory and long-run (Saibu, 2015). Spurious regression gives a false impression that variables are statistically significant related and yet they are unrelated. (Ssekuma, 2015). The study will perform Co-integration using the Johansen's trace statistic estimated at 1% and 5%.

3.5.2 Model Estimation Technique

After carrying out pre-estimation tests, the study will proceed to estimate the coefficients of the regression model specified in model seven (8) using Ordinary Least Squares

Method (OLS). The method best fits because the model to be estimated is linear in its parameters. The same method of estimation was applied by Dogan (2015) and Ghosh (2009). The study used STATA Version 14 to carry out pre-estimation tests and model specification.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSIONS

With an aim of determining the effect of commercial electricity consumption on economic growth, this chapter addressed descriptive statistics, pre-estimation tests and model estimation technique. An empirical analysis was performed using STATA V 14.

4.1 Descriptive Statistics

From Table 4.1 we observed that Real GDP had the highest mean value of Ksh 879 billion followed by Gross fixed capital formation at Ksh 172 billion, foreign direct investment at Ksh 11 billion, Human capital at 1,556,592.00 students, Large Commercial Electricity sales at 1,225,328.00 Kw, Small Commercial Electricity sales at 311,514.70 Kw and Per Capita GDP at Ksh 23,714.36. Kurtosis statistics shows that all the variables have non-normal distributions with only Human Capital and Gross fixed capital formation having a near normal distribution since its value was close to 3.0 and 7.0 respectively. As illustrated by 'N', data was distributed across 50 years ranging from 1965-2014.

Table 4. 1: Descriptive Statistics

Variable	N	Mean	Max	Min	Skewness	Kurtosis
Real GDP	**50**	879,000,000,000.00	5,400,000,000,000.00	7,130,000,000.00	1.89	5.71
Large Commercial Electricity Sales	**50**	1,225,328.00	3,891,400.00	81,296.00	1.08	3.47
Small Commercial Electricity Sales	**50**	311,514.70	1,244,700.00	5,633.00	1.10	3.57
Gross Fixed Capital Formation	**50**	172,000,000,000.00	1,240,000,000,000.00	914,000,000.00	2.16	7.05
Per Capita GDP	**50**	23,714.36	117,381.80	749.94	1.57	4.54
Human Capital	**50**	1,556,592.00	4,424,905.00	160,516.00	0.80	3.01
Foreign Direct Investment	**50**	11,100,000,000.00	129,000,000,000.00	7,000,000.00	3.06	11.15

Source: Author's Computation

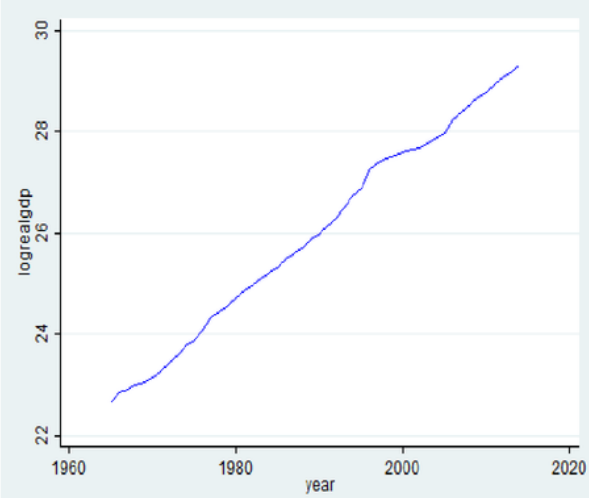
4.2 Pre-Estimation Tests

4.2.1 Unit Root Test

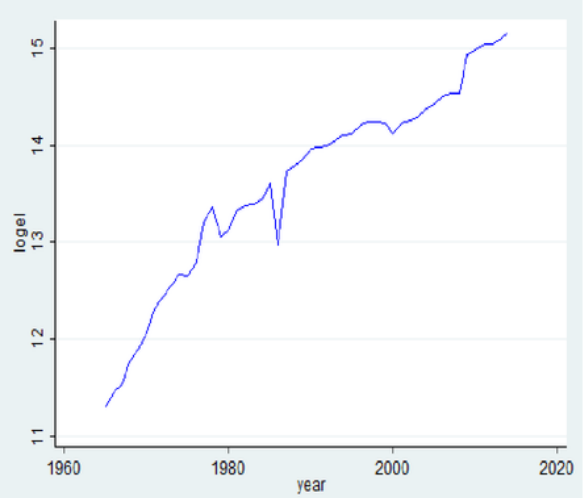
Unit root test for stationarity will be performed using the Augmented Dickey Fuller (ADF) test. The test involves performing a regression of the first difference of the series against the Lagged differenced terms of the dependent variable and employing a constant and a time trend. Lagged difference terms are added to remove serial correlation in the residual.

As shown in Figure 4.1, all the variables were non-stationary possessed some trend.

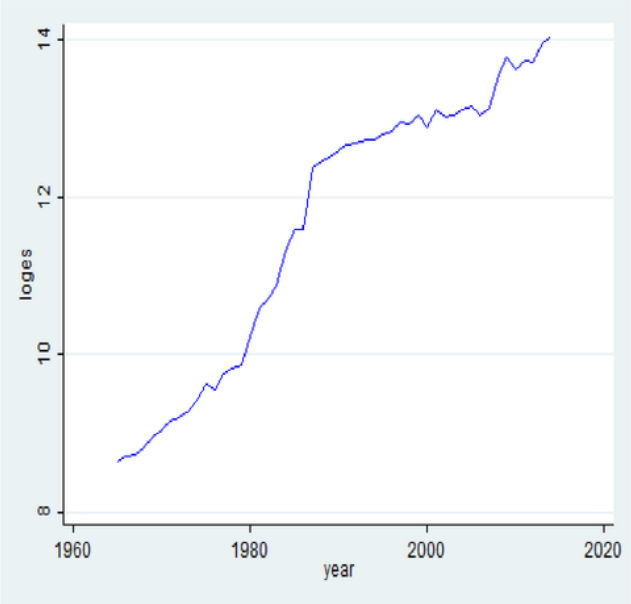
Figure 4. 1: Line Plot Graphs



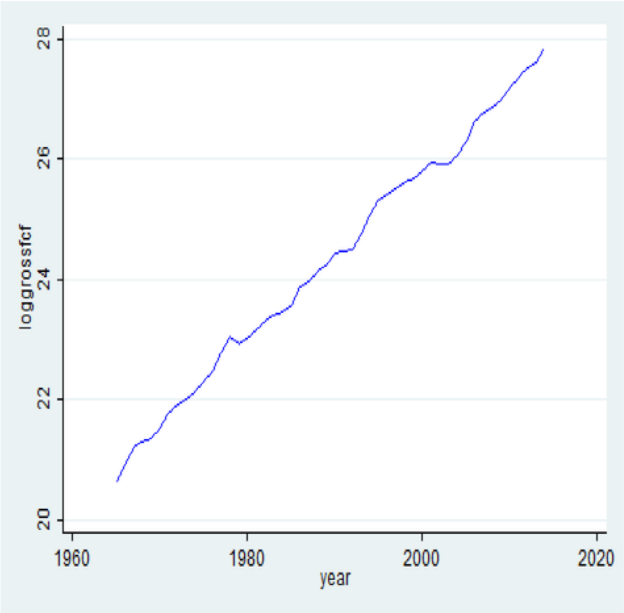
Log of Real GDP Plot



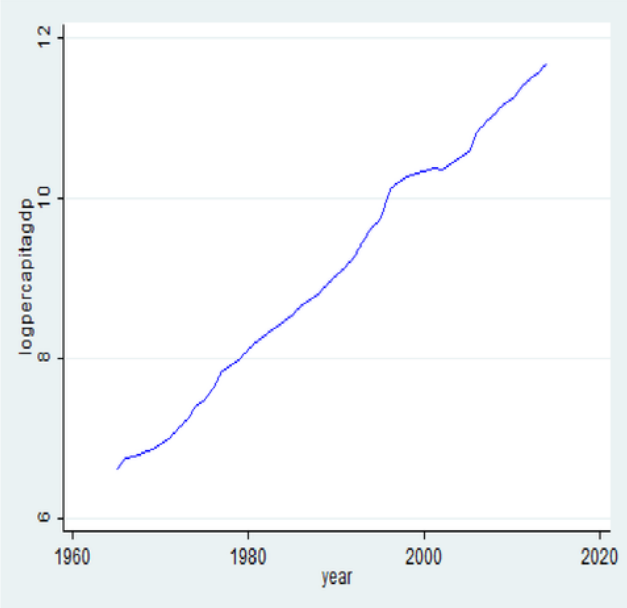
Log of Large Commercial Electricity Sales (KWH)



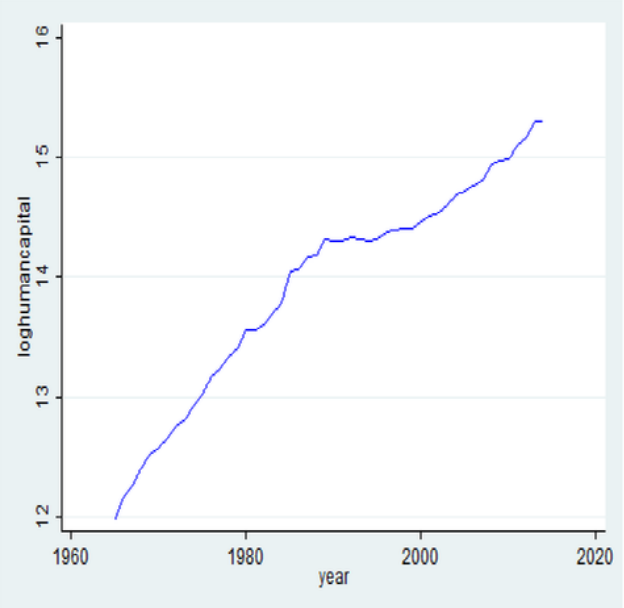
Log of Small Commercial Electricity Sales (KWH)



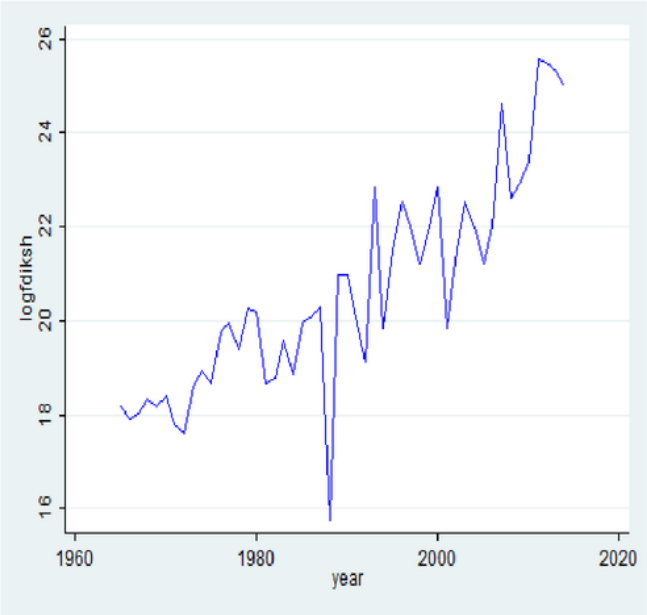
Log of Gross Fixed Capital Formation (Ksh)

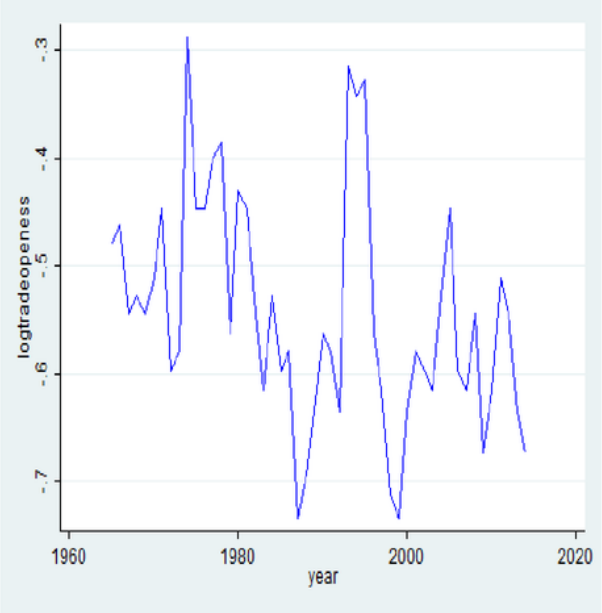


Log of Per Capita GDP (Ksh)



Log of Human Capital (No. of sudents)





Log of Foreign Direct Investment

Log of Trade Openness

All the line plots excluding Trade Openness.as illustrated in Figure 4.1 showed a positive slope with an upward trend line running from left to right. Trade Openness depicted a fluctuating trend over the years

The study determined the appropriate order of lags on all variables before performing unit root test. Table 4.2 below shows the lag selection order output

Table 4. 2: Lag Selection Order Output

Lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	76.4177				8.0e-12	-2.85074	-2.73288	-2.53887
1	590.973	1029.1	64	0.00	5.8e-20	-21.6239	-20.5632	-18.8171
2	781.075	380.2*	64	0.00	3.8e-26*	-26.8781*	-24.8746*	-21.5764

Source: Author's Computation

AIC- Akaike's information criterion. HQIC- Hannan-Quinn information criterion. SBIC- Schwarz-Bayesian information criterion

As illustrated in Table 4.2, SBIC information criterion showed that the appropriate lag selection order was 2.

Using 1965-2014 annual time series data on the natural logs of Real GDP, Large Commercial Electricity Sales, Small Commercial Electricity Sales, Gross Fixed Capital Formation, Per Capita GDP, Human Capital, Foreign Direct Investment and Trade Openness. Table 4.3 and Table 4.4 illustrates unit root tests at level and after differencing respectively.

Table 4. 3: Result of Unit Root Test at Level

Variable	ADF Test Stat	1% Critical Value	5% Critical Value
Log Real GDP	-1.866	-4.159	-3.504
Log Large Commercial Electricity Sales	-3.143	-4.159	-3.504
Log Small Commercial Electricity Sales	-0.913	-4.159	-3.504
Log Gross Fixed Capital Formation	-3.443	-4.159	-3.504
Log Per Capita GDP	-2.188	-4.159	-3.504
Log Human Capital	-2.463	-4.159	-3.504
Log Foreign Direct Investment	-6.156	-4.159	-3.504
Log Trade Openness	-4.173	-4.159	-3.504

The findings presented in Table 4.2 above show the level unit root test results. The level ADF test statistics for all the variables; apart from Foreign Direct Investment and Trade Openness, were observed to be less negative compared to the critical values at 1% and 5% level of significance. Accordingly the study showed that all variables apart from Foreign Direct Investment and Trade Openness were non stationary at level.

Following above stated results, all the variables; apart from Foreign Direct Investment and Trade Openness were differenced and subjected to unit root test again as exhibited in Table 4.4.

Table 4. 4: Result of Unit Root Test after First Differencing

Variable	ADF Test Stat	1% Critical Value	5% Critical Value	Order of Integration
Log Real GDP	-5.231	-4.168	-3.508	I(1)
Log Large Commercial Electricity Sales	-9.794	-4.168	-3.508	I(1)
Log Small Commercial Electricity Sales	-6.907	-4.168	-3.508	I(1)
Log Gross Fixed Capital Formation	-5.515	-4.168	-3.508	I(1)
Log Per Capita GDP	-5.287	-4.168	-3.508	I(1)
Log Human Capital	-6.535	-4.168	-3.508	I(1)
Log Foreign Direct Investment	-11.072	-4.168	-3.508	0(0)
Log Trade Openness	-8.297	-4.168	-3.508	0(0)

The test results in Table 4.4 show that the non-stationary variables attained stationarity after the first differencing showing that they contained one unit root and were integrated of order one I(1) at 1% and 5%.

4.2.2 Cointegration Test

As depicted in Table 4.5; applying the Johansen's test statistics, cointegration analysis was performed to establish presence whether the independent variables have an impact on the dependent variable in the long run.

Table 4. 5: Johansen Maximum Statistic Result

Max Rank	Parms	LL	eigenvalue	Max Statistic	5% Critical Value	1% Critical Value
0	4	161.50397		40.5694	31.46	36.65
1	12	171.78865	0.34281	18.5900	25.54	30.34
2	18	181.08365	0.31572	4.9799	18.96	23.65
3	22	183.5736	0.09664	1.4981	12.52	16.26
4	24	184.13374	0.03011			

Source: Author's Computation

The outcome of the Johansen test for co-integration analysis brought fourth that at 5% and 1% respectively; r=0, was rejected in favour of r=1. The Johansen maximum-eigenvalue statistic at r=1 of 18.5900 was less than its critical value of 25.54 at 5% and

30.34 at 1%. Therefore, the study failed to reject the null hypothesis that there is one or fewer cointegrating equations and concluded that natural logs of real GDP, large commercial electricity sales, small commercial electricity sales, gross fixed capital formation, foreign direct investment and trade openness in Kenya from 1965-2014 contained one or fewer cointegrating equation at 1% and 5% level of significance. This showed independent variables can predict dependent variable in transitory and long-run thus making the OLS results to be estimated empirically robust and efficient.

Given that all the variables are integrated of order one I(1), the study estimated the Error Correction Model (ECM) so as to capture transitory adjustment effects. The study first estimated the cointegrating regression model and obtained the residuals. The residual was lagged by one time period and was used to represent the error correction term (ECT) which represented the equilibrium speed of convergence once there is a shock in the model. The study estimated the ECM using OLS regression with the ECT as an independent variable to capture the short-run dynamics as shown below.

Table 4. 6: Error Correction Model Results

Variable Name	Coefficient	P>ItI (P Value)	Significance
Log Large Commercial Electricity Sales	0.12	0.044	(*)
Log Small Commercial Electricity Sales	0.03	0.001	(*)
Log Gross Fixed Capital Formation	0.08	0.004	(*)
Log Per Capita GDP	1.11	0.000	(*)
Log Human Capital	0.17	0.004	(*)
Log Foreign Direct Investment	0.91	0.063	(**)
Log Trade Openness	0.02	0.089	(**)
Dummy 1	0.01	0.036	(*)
Dummy 2	0.06	0.001	(*)
ECT	-1.66	0.000	(*)
R-Squared	0.887	Adjusted R-Squared	0.869

* Statistically Significant at 1% and 5% ** Statistically Significant at 10%,
Dependent Variable: Log of Real GDP

Source: Author's Computation

In the short-run large commercial electricity sales and small commercial electricity sales were significant at both 1% and 5% respectively. Control variable Foreign Direct Investment and Trade Openness were only significant at 10% and insignificant at 1% and 5%. The coefficient of ECT in the short-run had a negative sign as expected with a magnitude of -1.66 and was statistically significant at both 1% and 5%. This implied that 16.6% of any disequilibrium in the short-run real GDP adjusts to changes in explanatory variables in the subsequent period.

4.3 Model Estimation and Discussion of Results

The study utilized Ordinary Least Squares (OLS) regression method to estimate the model and capture the effects of commercial electricity consumption on economic growth in Kenya in the long-term. To capture long run relationship between the variables; long run research model elasticities coefficients were interpreted.

Table 4. 7: OLS Regression Test Results

Variable	Coefficient	P>ItI (P Value)	Significance
Log Large Commercial Electricity Sales	0.010	0.578	(**)
Log Small Commercial Electricity Sales	0.033	0.005	(*)
Log Gross Fixed Capital Formation	0.214	0.020	(*)
Log Per Capita GDP	1.155	0.000	(*)
Log Human Capital	0.107	0.009	(*)
Log Foreign Direct Investment	0.066	0.026	(*)
Log Trade Openness	0.045	0.013	(*)
Dummy 1	0.015	0.038	(*)
Dummy 2	0.044	0.066	(*)
No. of Observations	50		
R-Squared	0.899		
Adjusted R-Squared	0.856		
Prob>F	0.0000		

* Statistically Significant at 1% and 5% ** Statistically Significant at 10%,
Dependent Variable: Log of Real GDP

Source: Author's Computation

The coefficient for large commercial electricity sales was insignificant at 1% and 5% but significant at 10% and thus was not interpreted. The following variables were observed to be statistically significant at 1% and 5%: Small commercial electricity sales, gross fixed capital formation, per capita GDP, human capital and foreign direct investment and trade openness. The first variable was an independent variable whereas the latter variables were control variables.

From the results, it was observed that increasing small commercial electricity sales by 1% increases real GDP by 0.03% on average holding other factors constant. This accordingly implied that ultimately; small commercial electricity sales positively influences economic growth in Kenya. This outcome was in tandem with the research conclusions of Pata and Terzi (2017) (0.194%), Georgantopoulos (2012) (0.018%) and Abosedra et., al. (0.582%).

As regards gross fixed capital formation, 1% increase was observed to increases real GDP by 0.21% on average holding other factors constant. This accordingly implied that, ultimately, gross fixed capital formation positively influences economic growth. The finding are consistent with Ugwoke et., al. (2016) (0.097%) study.

As regards real Per-capita GDP, 1% increase was observed to increases real GDP by 1.15% on average holding other factors constant. This accordingly implied that, in the long run, Per-capita GDP positively influences economic growth in Kenya. The finding are consistent with Barro (2001) (0.107%) study.

As regards human capital, 1% increase was observed to increases real GDP by 0.10% on average ceteris paribus. Accordingly, in the long run; an increase in human capital positively influences economic growth in Kenya. Similar results were observed in Bekhet, (2011) (1.059%) study.

As regards foreign direct investment, 1% increase was observed to increases real GDP by 0.06% on average holding other factors constant. This accordingly implied that, in the long run, the more foreign direct investment Kenya receives, the more it will grow economically. Similar results were observed in Bekhet, (2011) (0.01%) study.

As regards trade openness, 1% increase was observed to increases real GDP by 0.45% on average holding other factors constant. This accordingly implied that, ultimately, an increase in trade openness positively shocks economic growth in Kenya. Similar results were observed in Saleheen et., al (2012) (0.24%) study.

Dummy (2) for the period 2002-2013 had a slightly positive growth spurring effect of 0.066% on overall GDP. During the period under review, small commercial electricity consumption in the country increased by 792, 620,375,000 Kw from 178,466,000,000 Kw in 2002 to 976,086,375,000 Kw in 2013.

4.3.1 Overall OLS Regression Test Statistics

The overall test statistics showed that the F-Statistic was equal to 60901.77 with a P-Value of 0.000. This showed that all variables in the regression model were jointly

statistically significant in explaining the factors that influence economic growth in Kenya.

R- Squared (0.899) implied that 89.9% of the variation in overall economic growth was explained by the changes in the study explanatory variables with only 10.01% of the total changes being determined by factors beyond the regression model. The adjusted coefficient of determination was observed to be lower than the coefficient of determination as it should always be. Therefore, Adjusted R-Squared (0.856) implied that 85.6% of the variation in overall economic growth was explained by the explanatory variables in the model with only 14.4% of the total variation being explained by variables outside the regression model. The high R-Squared in the study could be attributed to the historical variability of real GDP values which tend to have a robust time trend as explained by Leamer (1999).

Using the predicted residuals from the regression results in Table 4.5, the study tested for the presence of serial correlation by employing the Breusch-Pagan test. The result from the test was presented as follows:

4.3.2 Post Estimation Test

To establish if estimated model best fits the data, the study employed the Breusch-Pagan to test for the presence of serial correlation in the residuals from the model. The following results were obtained:

Breusch-Pagan / Cook-Weisberg test for Heteroskedasticity

Ho: Constant Variance

Variables Fitted: Log of Real GDP

Chi2 (1) = 4.99

Prob (P-Value) = 0.0254

Given the P-Value (0.02540 >0.05 (5%), the study concluded that there was presence of homoscedasticity (no presence of heteroskedasticity). Homoscedasticity means that variance of the residuals is constant.

CHAPTER FIVE

5.0 SUMMARY OF STUDY FINDINGS

This chapter addressed: summary of the study, study conclusions and policy implications.

5.1 Summary of the Study

Utilizing 1965 to 2014 annual time series data; the study analysed the effect of commercial electricity consumption on economic growth in Kenya. This research paper was prompted by the fact that that commercial electricity consumption is vital for economic growth and improved standards of living. Commercial electricity consumption is positively related to national product. It signifies economic well-being characterized by high quality of life in terms of improved health, education and standards of living. Therefore, commercial electricity consumption per capita is directly proportional to economic advancement.

The study investigated how commercial electricity consumption influences economic growth in Kenya. This was done by specifically by taking into account both large commercial electricity consumption and small commercial electricity consumption. Most studies on the subject matter take into account both commercial and non-commercial electricity consumption when analyzing electricity consumption- economic growth dependencies. The effect of commercial electricity consumption on economic growth has been marginalized across scholarly contributions and therefore the need to investigate more on the relation between the two. This research undertaking sought to fill this gap. Commercial electricity consumption was categorized into large commercial electricity sales and small commercial electricity sales to measure their distinct effects on economic growth.

The synergy therein other variables with commercial electricity consumption that affect economic growth was also examined. These variables included Per-capita GDP, gross fixed capital formation, human capital, foreign direct investment, and trade openness.

5.2 Summary of Findings

From the study it is evident that economic growth in terms of real GDP growth was significantly responsive to commercial electricity consumption in the country. The study solely focused on variables which were significant at 1% and 5%. An increase in small commercial electricity consumption by 1% increases real GDP by 0.03% on average holding other factors constant. This accordingly implied ultimately, small commercial electricity consumption positively influences economic growth in Kenya.

The synergy between control independent variables with commercial electricity consumptions independent variables showed that ultimately; gross fixed capital formation, per capita GDP, human capital, foreign direct investment and trade openness positively influence economic growth by 0.21, 1.15%, 0.10%, 0.06% and 0.45% respectively. This showed that the control variables were significantly important in determining and influencing economic growth positively in the country.

Dummy (2) for the period 2002-2013 had a slightly more positive growth spurring effect of 0.066% on overall GDP. During the period under review, small commercial electricity consumption in the country increased by 792, 620,375,000 Kw from 178,466,000,000 Kw in 2002 to 976,086,375,000 Kw in 2013. Dummy (1) for the period 1979-2001 had a positive growth spurring effect of 0.38% on overall GDP compared to Dummy (2) for the period 2002-2013.

The overall test statistics showed that `F-Statistics result had a P-Value of P=0.000 showing that all the regression model variables were jointly statistically significant in explaining the factors that influence economic growth in Kenya. The adjusted coefficient of determination was observed to be lower than the coefficient of determination as it should be.

5.3 Policy Implication

Important policy implications can be drawn from the research conclusions. The positive influence of commercial electricity consumption on real GDP is crucial when it comes to formulating electricity sector improvement policies. Study findings hold that Kenya

heavily relies on both large and small commercial electricity consumption in production of goods and services. As such, Kenya should focus on increasing the small commercial electricity consumption from 1,244,700 Kw to 3,675,876 Kw as a means of promoting economic growth and improved standards of living. This should embrace infrastructure development for current existing small commercial electricity consumers and extensive network modification for large commercial electricity consumers. The government should also expedite the implementations of programs such as Energy Sector Reform and Power Development Project, Kenya - Energy Sector Recovery Project, Kenya Electricity Modernization Project and Energy Sector Reform and Power Development Project among many other programmes so as to increase commercial electricity consumption in the country.

Though only significant at 10% level of significance, the positive impact of large commercial electricity sales on economic growth is vital for policy formulation. Electricity sector policies should continue focusing on enhancing customer centricity, loss reduction initiatives and network modernization through allocation of funds.

The study therefore suggests for more research to focus on the following areas: The influence of commercial electricity consumption on sectoral economic growth in Kenya; The commercial electricity consumption and trade causal link and: The commercial electricity investment-economic dynamic dependencies in Kenya. The above areas of further study will facilitate the formulation of the best robust policies in the electricity sub-sector thereby deriving maximum results from electricity consumption growth.

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