THE RELATIONSHIP BETWEEN GOVERNMENT INVESTMENT IN ENERGY INFRASTRUCTURE AND ECONOMIC GROWTH IN KENYA

BY

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DECLARATION

I declare that this project is my original work and has never been submitted for a degree in any other university or college for examination/academic purposes.

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

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DEDICATION

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and encouragement to keep on working hard in furthering my education.

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LIST OF ABBREVIATIONS AND ACRONYMS

ANOVA   Analysis of Variance

CBK   Central Bank of Kenya

EIA   Energy Information Administration

EU   European Union

FDI   Foreign Direct Investment

GDP   Gross Domestic Product

GoK   Government of Kenya

MDGs   Millennium Development Goals

OECD   Organization for Economic Cooperation and Development

PPP   Public-Private Partnership

SPSS   Statistical Package for Social Science

UNCTAD   United Nations Conference on Trade and Development

UNECA   United Nations Economic Commission for Africa

R&D   Research and Development

ABSTRACT

Energy Infrastructure investment is one of the main preconditions for enabling developing countries to accelerate or sustain the pace of their development and achieve the Millennium Development Goals. Although nature has endowed Kenya with an array of energy resources such as wind, coal, water, oil, wood and solar, a large number of these resources have remained unexploited for decades. The inadequate rate of public investment in the past 30 years has resulted in the deficiency and obsolescence of infrastructure in Kenya. To the best of the researcher's understanding, none of these studies has focused on the effect of government investment in energy infrastructure on economic growth in Kenya. The purpose of this study is to establish the effects of government investment in energy infrastructure on economic growth in Kenya. A descriptive research design was applied in this study. In this study emphasis was given to secondary data which was obtained from the Government development in energy infrastructure obtained from the Kenya National Bureau of Statistics. Quantitative analysis was used through descriptive statistics. In order to test the relationship between the variables the inferential tests including the regression analysis was used to determine the effect of government investment in energy infrastructure on economic growth. The study found that the four variables contribute to 67.3% of economic growth and that a unit increase in government investment in energy infrastructure lead to a 0.137 increase in economic growth. The conclusion is that government investment in energy infrastructure development had a positive and significant affect economic growth in Kenya for the period of this study. The study recommends that adequate funding should be directed towards energy infrastructure projects preparation, implementation and maintenance. The study also recommend expanding and diversifying existing modern energy use and creating sufficient awareness and supplying better technologies at affordable prices so as to sustain the economic growth with better living standards. The study further recommends the energy sector to have an independent and autonomous research center or institution that appropriately design and implement research works in relation to energy, growth, and the environment.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Infrastructure is a profound determinant of nationhood, a measure of a country's success on the world stage. Adequate and well maintained infrastructure is a necessarily condition for economic growth and poverty reduction. Access to roads, water, sewer, communication technologies, and electricity are all essential to the economy (Garcia-Mila, McGuire, and Porter, 1996). Energy infrastructure investment can boost productivity by enhancing the productivity of existing infrastructure resources and by increasing the resource base of an economy. Although the government is the major investor in this sector, other capital intensive services compete for limited local resources.

The need for investment in energy infrastructure and other public goods as a strategy for increasing urban and rural productivity and national economic growth and development has remained a subject of renewed attention in most developing economies. Several studies have been carried out to ascertain the direction of association between expenditure on infrastructure and economic growth of several developed and developing countries. Among these early studies include Ratwongwirun (2000) and Agenor and Dodson (2006). This chapter introduces the concept of energy infrastructure and the role it plays in economic growth.

1.1.1 Government Investments in Energy Infrastructure

Most econometric analyses of the growth impact of energy infrastructure investment use public capital figures as a proxy for infrastructure. Energy infrastructure development funding varies according to a country's circumstances. To generate

sustainable funding streams for projects, developing nations must trade successfully on the world market and attract private finance. Countries' robust economy is only successful in attracting international investment with its attendant financial flows into public coffers if it has well established infrastructure and free-enterprise economy, and generally pro-investment policies. A study conducted in Thailand by MOF established that RTG relies on taxation for approximately 90 per cent of its revenue, the majority of which is indirect tax (65%). Hence, if the government wishes to increase infrastructure investments without reducing other government expenditures, it will need to increase revenue through taxation or borrowing. For infrastructure investment, further sources of finance are retained income and domestic and external debt (domestic and foreign borrowings). However, the revenue generated from all these sources is insufficient for the scale of infrastructure development that the government desires (MOF, 2005).

Energy Infrastructure investment is one of the main preconditions for enabling developing countries to accelerate or sustain the pace of their development and achieve the Millennium Development Goals (MDGs) set by the United Nations in 2000. Furthermore, the future investment needs of developing countries in energy infrastructure far exceed the amount being spent by the governments, the private sector and other stakeholders, resulting in a significant financing gap. According to a World Bank estimate, on average, developing countries currently invest annually 3-4% of their GDP in infrastructure; yet they would need to invest an estimated 7-9% to achieve broader economic growth and poverty reduction goals (UNCTAD, 2008).

Later, Holtz-Eakin and Schwartz (2005) developed an econometric growth model in an attempt to explicitly incorporate infrastructure, thus enabling further in-depth analysis of the empirical effects of public infrastructure investment on productivity.

The authors found that raising the rate of infrastructure investment during the period 1971–1986 had little or no effect on productivity. Moreover, Garcia-Mila, McGuire, and Porter (1996) also investigated output and public capital relationship at state level in the USA. Again using first difference estimation to eliminate the non-stationary problem, they found that public capital has an insignificant negative elasticity on level of output. In Thailand, Ratwongwirun (2000) studied the effects from 1971 to 1996 of government expenditure on economic performance to estimate the optimal size of government expenditure. The empirical results showed that the marginal productivity of real government investment is negative and insignificant. This finding reflected the fact that most government investments are large infrastructure projects that take years in construction time. Further, government investment can be accounted as unproductive if it is used for the purpose of maintenance or expansion of the existing facilities, and not for economic improvement. The results of this discussion are therefore inconclusive, despite the view of a majority of researchers who find for a significant and positive result for infrastructure expenditure on economic growth. The outcomes of studies to determine infrastructure investment on GDP are dependent on factors in the subject environment, and on the methodology of the researchers. There appears a trend among studies that emerging economies may benefit from infrastructure investment in stable economic and political conditions; however, such an analysis is beyond the scope of this literature analysis.

This section presented government investments in energy infrastructure. The study discussed various government approaches to energy investment and how their investment in energy infrastructure has impacted in their economy.

1.1.2 Economic Growth

Economic growth is the percentage increase in real national output in a given time period or a sustained increase in the productive potential of an economy. Countries grow at different rates. Partly this is the simple fact that they are at different stages of their economic cycle (Ratwongwirun, 2000). Economic growth is concerned with the long-run trend in production due to structural causes such as technological growth and factor accumulation. The business cycle moves up and down, creating fluctuations around the long-run trend in economic growth. Economic growth has traditionally been attributed to the accumulation of human and physical capital, and increased productivity arising from technological innovation.

During the first few years of independence, Kenya achieved high economic growth of 6%, which declined to less than 4% in the subsequent decades. In the 1990s, its GDP experienced enormous inconsistency, ranging between negative figures to 4%. After the millennium, the country started producing higher growth rates which peaked in 2007 with 7%. Following the post-election violence in early 2008, the effects of the universal financial crisis on remittance and exports, reduced GDP growth to 1.7% in 2008. The economy however rebounded in 2010-11 with the growth rates higher than 5%. The 2013 economic performance was incredible as growth dips during election years due as a result of political risk and uncertainty. The economy grew to 5% in 2013 and was expected to accelerate to 5.7% in 2014. If the positive trend continues, Kenya is projected to be the first East African country to move from low-income status to middle-income status (Gemmell and Kneller, 2001).

In 2006 Kenya's GDP was about US$17.39 billion. Per capita GDP averages somewhat more than US$450 annually. Adjusted in purchasing power parity (PPP) terms, per capita GDP in 2006 was about US$1,200. The country's real GDP growth

picked up to 2.3 percent in early 2004 and to nearly 6 percent in 2005 and 2006, compared with a sluggish 1.4 percent in 2013 and throughout President Daniel ArapMoi's last term (2007–2002). Real GDP is expected to continue to improve, largely because of expansions in tourism, telecommunications, transport, and construction and a recovery in agriculture. The Kenya Central Bank forecast for 2007 is between 5 and 6 percent GDP growth. GDP composition by sector, according to 2004 estimates, was as follows: agriculture, 25.7 percent; manufacturing, 14.0 percent; trade, restaurants, and hotels, 13.8 percent; transport and communications, 6.9 percent; government services, 15.6 percent; and other, 24.0 percent (Gemmell and Kneller, 2001).

The Gross Domestic Product (GDP) in Kenya expanded by 0.50 percent in the first quarter of 2013 over the previous quarter. GDP Growth Rate in Kenya is reported by the Kenya National Bureau of Statistics. Kenya GDP Growth Rate averaged 1.15 Percent from 2005 until 2013, reaching an all-time high of 3.50 Percent in March of 2010 and a record low of -2.40 Percent in March of 2008. Kenya is one the most developed countries in East Africa. Agriculture and Fishery (including coffee and tea cultivation) is the largest sector of the economy and accounts for about 25 percent. The fastest growing segments are Wholesale and Retail Trade and Transport and Communication. Together they account for almost 27 percent of total output. Manufacturing is the third largest sector and represents 11 percent of the GDP. Other sectors include: Real Estate, Renting and Business Services and Financial Intermediation (10.8 percent), Education (6.7 percent), Other Services (7 percent), Construction (4 percent), Public Administration (3.7 percent), Electricity and Water (2.6 percent), Hotels and Restaurants (1.5 percent). Fishing and Mining and Quarrying account for the remaining 1 percent (Gemmell and Kneller, 2001). This

section reviewed the concept of economic growth and its impact on the GDP. The literature reviewed the economic trend in Kenya from 2005 to the present.

1.1.3 Effect of Government Investment in Energy Infrastructure on Economic Growth

The Energy Information Administration forecasts that electricity use will increase by 29 percent by the year 2030 (EIA, 2009). New capital investments in electricity production, transmission, and distribution systems are needed to meet this demand. More importantly, capital investments are needed to improve energy economic growth and to reduce greenhouse gas emissions. Per capita consumption of electricity is not expected to change much over the next two decades, largely due to expected improvements in economic growth and conservation (EIA, 2009). Without infrastructure improvements, increased energy demands will generate sizeable economic and environmental challenges. Natural gas currently represents the second most important source of energy for Kenya after petroleum. As part of a green energy transformation, we may not want to invest this heavily in the natural gas industry. However, any reduction in natural gas infrastructure will need to be at least matched by further investments in renewable energy and a smart-grid electrical transmission system.

Both the public and private sectors are involved in maintaining electricity infrastructure, although private utility companies generally provide the largest share of investment. New investments are also essential to promote the advance of renewable sources of electrical energy as an alternative to fossil fuels. According to the Energy Information Administration, 63 percent of electricity generators rely on fossil fuels — petroleum, coal, or natural gas. Renewable sources of energy currently

account for only 7 percent of total energy consumption. But an overall increase in energy infrastructure investments could be the vehicle to also accelerate the use of renewable energy sources. Moreover, investments in modernizing the transmission and distributions systems—i.e. building smart grid transmission and distribution systems—would make decentralized production of power from renewable resources much more viable (Barro, 2013).

The inadequate rate of public investment in the past 30 years has resulted in the deficiency and obsolescence of energy infrastructure in Kenya. The Government of Kenya is seeking to extend and deepen its partnership with the private sector to raise more private investment and expertise to accelerate infrastructure capital formation (Barro, 2013). The new initiative, through the recently approved Public-Private Partnership (PPP) Policy, will increase private participation in Kenya's energy infrastructure market across sectors to support national economic growth and employment creation. Kenya spends about US$1.6 billion a year on energy infrastructure but requires a sustained expenditure of US$4 billion a year, or about 20 percent of its Gross Domestic Product (GDP), over the next decade, according to the Africa Infrastructure Country Diagnostic Report 2010 produced by the World Bank in collaboration with the African Development Bank and other development agencies.

Government investment in infrastructure is very vital for economic growth in any nation. This chapter discussed the relationship between government investment in energy and how it affects the economy. The study also looked at the mechanisms that the governments take to deepen their investment such as through PPP and foreign direct investments.

1.1.4 Investments in Energy Infrastructure in Kenya

Kenya's Vision 2030 is the national development blueprint, initiated to transform the country into a newly industrializing, middle-income economy by the year 2030.The Vision is founded on three pillars of economic, social and political development. The economic pillar is aimed at improving the living standards for all Kenyans through an economic development program, through which the country is expected to achieve an average Gross Domestic Product (GDP) growth rate of 10%by the year 2030 (Government of Kenya(GoK), 2007). The level of economic growth determines the intensity of energy use; as economic systems in developing countries expand, so is the demand for energy to power production activities (Winkler, 2005; UN-Energy/Africa, 2011). The Kenya Vision 2030 identifies energy as one of the key infrastructural enablers, necessary for the realization of its objectives (GoK, 2007).

In view of this, the economic development program mooted in the Vision is expected to increase demand on Kenya's energy supply. Currently, energy shortages and supply disruptions coupled with high cost remain serious obstacles to the manufacturing sector (GoK, 2007). Energy and its contribution as a separate factor input in the production process have been neglected until recently because the cost of energy accounts only for small proportion to Gross Domestic Product. Recent studies, however, have attempted to highlight the importance of Governments investment in the energy since it is a vital input for economic and social development of any nation because it improves productivity and enhances the living standard (Lee and Chang, 2007). The significant energy use is related to the nature of energy services in different sectors in an economy, environmental constraint as well as the economic situation (Phdungsilp, 2006). This section reviews different studies conducted in both developed and developing countries regarding the relationship between economic

growth and energy consumption, i.e. co integration and causality between the two. In this section, the researcher reviewed the energy investment trend in Kenya and whether the investments will meet the vision2030 which is the country's development blueprint.

1.2 Research Problem

Investment is vital for the efficient running of the economy. The need for much of the government investment arises from the fact that some goods and services cannot be provided at all by a free market economy and that others may be under-provided. This has attracted the interest of many economists to establish the extent to which government investments affect the economic growth of a country. In fact, such an interest emanates from the inherent policy implications. Nevertheless, there is an element of risk involved for government policy makers who depend on such research to predicate economic outcomes from various strategies. Despite the growing volume of literature on government investment in energy infrastructure, and economic growth including Sub-Saharan African countries, the evidences are mixed and there is no consensus yet. Kessides (2005) and Tatom (2013) found that government investment in infrastructure positively impact on economic growth while Aschauer (2009) and Fedderke and Luiz (2005) disagree.

Energy Infrastructure investment is one of the main preconditions for enabling developing countries to accelerate or sustain the pace of their development and achieve the Millennium Development Goals. Aschauer (2009) expressed that infrastructure is a profound determinant of nationhood, a measure of a country's success on the world stage. Adequate and well maintained infrastructure is therefore a necessarily condition for economic growth and poverty reduction and that the

government being the major investor in this sector, it is crucial to establish the effect of the government investment in energy infrastructure. Jumbe (2004) established that the inadequate rate of public investment in the past 30 years has resulted in the deficiency and obsolescence of infrastructure in Kenya and the government and policy makers should seek to extend and deepen their understanding on how such investments affect the country's economy.

Although nature has endowed Kenya with an array of energy resources such as wind, coal, water, oil, wood and solar, a large number of these resources have remained unexploited for decades. For example, Jumbe (2004a) posited that the country's economy is energy dependent and, hence, more energy investment is compulsory for sustained economic growth. Mudaki and Masaviru (2012) in their study on whether the composition of government investment matter to the economic growth of Kenya established that there were contradictory to their priori expectations; M' Amanja and Morrisey (2005) tried to relate economic growth to investment and foreign aid and found significant negative impact on long run growth. Many other contextual studies have been carried out to examine various components of economic growth. Similarly in Kenya, Mburu (2013) conducted a study on the relationship between government investment in infrastructure and economic growth while Rimberia (2012) did a study on the determinants of sustainability of water projects in Kieni East Division, Nyeri County. To the best of the researcher's understanding, none of these studies has focused on the effect of government investment in energy infrastructure on economic growth in Kenya. Therefore, the main research question that the study seeks to address is: what is the effect of government investment in energy infrastructure on economic growth in Kenya?

1.3 Objective of the Study

To establish the effects of government investment in energy infrastructure on economic growth in Kenya

1.4 Value of the Study

This study will be resourceful to the policymakers who have a perverse incentive to invest in energy infrastructure projects. However, the economic impacts of annual operations and maintenance spending should not be forgotten. Additionally, indirect impacts from some types of investment, especially benefits from ecosystems services, should be considered.

To the government of Kenya, the study provides information that can be used in the formulation of policies related to sustainability of energy infrastructure projects in Kenya. The findings of this study can also be used by the government to promote development projects in rural and urban areas by increasing the sustainability of energy infrastructure.

The finding is important to academics and researchers as basis for further researches. The study provides the background information to research organizations and scholars who may want to carry out further research in this area. The study can facilitate individual researchers to identify gaps in the current research and carry out research in those areas.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

In this second chapter, relevant literature information that is related and consistent with the objectives of the study is reviewed. Important issues and practical problems are brought out and critically examined so as to determine the current facts. Section 2.2 will present theoretical review, section 2.3 will present the determinants of economic growth, section 2.4 will review the relevant empirical studies and finally section 2.5 will present the summary of the chapter and the knowledge gap.

2.2 Theoretical Review

The study will be underpinned in game theory, development theory and endogenous growth theory.

2.2.1 Game Theory

Game theory highlights the rational mechanisms underpinning individual decision-making in a collective action contributing to the common good. In this case, the game theory can help to understand how participation in, or exclusion from a community project occurs (Cooke and Kothari, 2001). The options (voluntary or involuntary) for the government in which a development project is introduced are either to be excluded (not to participate), or to be included (to participate).

The attraction of game theory lies in its simple representation of a variety of situations in a single table. "The actions of the first player form the rows and the actions of the second player the columns, of a matrix. The entries in the matrix are two numbers representing the utility or payoff to the first and second player respectively" (Levine, 2000). A second feature of game theory is that it shows how decision-making at the

individual level is supported by a rational calculus of personal gains (or capabilities) against the pursuit of the common good.

Game theory can be adapted to the analysis of any process, provided that relevant variables feed into it. In our case, choice government investment in energy infrastructure project variables give shape to game theory and ensure a more comprehensive analysis of the economic development (Munnell, 2008). Thus, growth does not slow as capital accumulates, but the rate of growth depends on the types of capital a country invests in especially in the public infrastructure. This theory is relevant to this study helps to understand how participation of various stakeholders in or exclusion from a community project occurs.

2.2.2 Development Theory

In order to explore institutional theory's relationship to current international development practice, it is necessary to first understand the theoretical and practical foundations of the type of development undertaken by modern development agencies. Development theory as a field evolves continually, and past theory and practice have bearing on how agencies currently develop and enact policy (Gramlich, 2004).

Within development literature there is a strong focus on institutions: building institutions, fortifying institutions, ensuring projects' integration with existing institutions, etc. (Lepenies, 2008). Thus, the government and the various agencies dealing with energy infrastructure investments should consider the developmental effect of the investments. Development theory is concerned with how government and development agencies interact to understand the type of development to undertake. This theory therefore brings into light the approach the government should adopt when dealing with other stakeholders in energy investments.

2.2.3 Endogenous Growth Theory

The deficiencies in the neoclassical growth model led to the development of endogenous growth theory. The incorporation of R&D variables and imperfect competition into the growth framework began with Romer (2010). Other significant contributors include Aghion and Howitt (2012) and Grossman and Helpman (2011). In the endogenous growth model, technological advances result from R&D activity, and technological progress and knowledge accumulation are treated as endogenous variables, thus it is also termed the endogenous growth theory. According to the model, the long-run growth rate depends on a stable business environment: government policies and actions on taxation, law and order, provision of infrastructure services, protection of intellectual property rights, and regulation of international trade, financial markets, and other aspects of the economy. Hence, the government guides long-term growth (Barro, 2007).

Under endogenous growth theory and despite the law of diminishing returns, marginal factor productivity can be increased. For example, technical progress that is funded by capital investment increases productivity. Similarly, new skills through improved education and training, and better health, tends to increase the productivity of labour. Also, the endogenous growth approach argues that there is a role for government institutions that can overcome any market failures associated with the various types of investment. Hence, investment is crucial to economic development and growth. Further, endogenous growth theory states that the improved technology accessed by investment drives growth; thus, investment may contribute to a long-run rate of economic growth (Economic Planning Advisory Commission (Australia), 2005). Endogenous growth theory links technology with economic growth. This theory

points at the technical progress, skills through improved education and training, and better health that is funded by capital investment increases labor productivity

2.3 Determinants of Economic Growth

This section will review how energy infrastructure, interest rates, inflation and foreign direct investment affect the economic growth.

2.3.1 Energy Infrastructure

The importance of energy infrastructure in economic development dates from Adam Smith's era, although its influence diminished over time. In the modern era, the status of energy infrastructure was reasserted after World War II and, since the 1960s it has emerged as a fundamental element of economic growth. It was used in many countries to address war damage, when the World Bank and other organisations financed energy infrastructure renovation programs. Later, these programs were used to install technological advances in emerging economies for both humanitarian and economic purposes, the former for social benefits and the latter to permit trade with developed countries (Lepenies, 2008).

Energy Infrastructure investment affects economic growth by increasing private sector productivity. It differs from other growth factors in as much as it is indirect; a facilitator in the production process. As a contributor to economic development, energy infrastructure development can assist by reducing production costs, diversifying production into higher return activities, and raising the population's standard of living and wellbeing (Lepenies, 2008). Raising finance for public energy infrastructure investment is a priority for governments. Public finance occurs through taxes or borrowing; in the latter, government debt may crowd out private companies

and individuals from money markets through raising interest rates and impacting inflation and thus productivity.

Funds flows necessary to finance infrastructure investment programs can also constrain public investment elsewhere within society; reducing resources available for more teachers or defense personnel. The modes of financing infrastructure investment, operations and maintenance can also contribute to internal and external imbalances. With program financing that is a measurable percentage of a country's GDP, investment in public infrastructure projects may result in a greater indirect effect on an economy than the measured direct socio-economic effects (Romer, 2010).

A government focus on energy infrastructure, to the detriment of other funding priorities, can thus cripple developing economies, outweighing the positive direct and indirect socio-economic effects. These views are of concern to economists who state that financing of infrastructure has important implications on the macroeconomic stability of a country (Kessides 2005, Romp and De Haan 2005). Energy Infrastructure is not a direct factor in economic growth; however, it facilitates productivity by providing adequate utilities and networks. It has a social role as well, contributing to the well-being of citizens. Energy Infrastructure development has a strong social role in ameliorating poverty, assisting income redistribution; and mitigating against environment degradation.

2.3.2 Interest Rate

A key signal of the economic growth is the level of interest rates and the arbitrage opportunities to which they give rise. This is ultimately an issue of global savings availability and liquidity policies. Miles and Ezzell (2010) discuss the Modigliani and

Miller which presented the classical study on governments investments, showing that in perfect capital markets, the value of a bank is unaffected by its capital structure.

In essence, their theorem states that in markets with no taxes, no bankruptcy costs and with perfect information, the way a bank is financed does not determine its value, i.e. bank value is determined by its real assets and not by the securities it issues. In spite of much less than perfect capital markets real life presents, this pioneering work has provided a fundamental understanding of optimal capital structures (Mebratie and Bedi, 2013).

2.3.3 Inflation Rate

Inflation refers to the general increase in the price of commodities over a given duration. Inflation tends to push up the price of commodities without a corresponding increase in their real value. Government investments are adversely affected by inflation since they tend to hold investment over duration of time which negatively impacts on economic growth (Nielsen, 2011). Inflation has an adverse effect on the exit returns when governments divest or dispose their stake in an investment (Mebratie and Bedi, 2013). IPOs form a favoured channel for banks when they choose to disinvest or sell their investments and stake in companies they have previously acquired. Gilson and Black (2007) established a relationship between the degree of development of a country's stock market and the overall volume of bank investments.

Basically the rate of economic growth depends primarily on the rate of capital formation and the rate of capital formation depends on the rate of savings and investment (Datta and Kumar, 2011). World economic growth and inflation rates have been fluctuating. Likewise, inflation rates have been dominating to compare with growth rates in virtually many years (Madhukar and Nagarjuna, 2011) and

relationship between inflation and the economic growth continued to be one of the most macroeconomic problems. Similarly, Ahmed (2010) maintains that this relationship has been argued in various economic literatures and these arguments shown differences in relation with the condition of world economy order. In accordance with these policies, increases in the total demand caused increases in production and inflation too. However, inflation was not regarded as a problem in that period rather considered as a positive impact on the economic growth which was widely accepted. Amid these views, Phillips first introduced hypothesizes that high inflation positively affects the economic growth by lowering unemployment rates.

2.3.4 Foreign Direct Investment

Foreign direct investment (FDI) has been recognized as an important resource for economic growth. Many people argue that the flows of FDI could fill the gap between desired energy investment and domestically mobilized finance. It also may increase tax revenues and improve management, technology, as well as labour skills in host countries (Todaro and Smith, 2003).

Many scholars widely believe that FDI in energy infrastructure may contribute to economic growth (Jenkins and Thomas, 2002). Developing countries in Asia, Africa and Latin America have, increasingly, come to see FDI as a source of economic growth, modernization, income growth and employment. This is apparently reflected by their currently pursued economic policies, which explicitly intended to improve domestic conditions in order to attract FDI and to maximize the benefits of the presence of FDI in their domestic economies. Over the past few decades these countries have implemented broad ranging economic reforms, including the liberalization of their foreign trade and investment regimes and domestic markets and

privatization of state companies, which has had an effect on the flow and nature of foreign investment (Todaro and Smith, 2003).

FDI is seen by countries, especially transition countries, as a way to boost the national economy and generate jobs and economic development (Carlin and Landesmann, 2007; Jensen, 2006). Two kinds of empirical studies on the impact of foreign direct investment on the host country's economic exist: Studies on the firm level and studies on the national level. While the former studies usually examine the effects of FDI on firm productivity, and only sometimes on growth and employment (Mebratie and Bedi, 2013; Mebratie and van Bergeijk, 2013), most of the latter studies examine the effects of FDI on economic growth (Iwasaki and Tokunaga 2014).

2.4 Empirical Literature Review

Although earlier studies were generally conducted in developed countries, the findings suggest that energy infrastructure capital has positive and significant effects on economic growth (Kessides, 2005). The later theoretical research of Hemming, Kell and Mahfouz (2002) did not wholly agree with these findings. The empirical argument supporting energy infrastructure development's positive effects on growth in developed economies was also relevant for emerging economies.

2.4.1 International Studies

Hulten and Schwab (2001) estimated the relationship between public infrastructure and economic performance at the state and local levels in USA using sources of growth analysis. The study used a consensus survey design during the study. The collected data were then analysed with the help of SPSS and excel. The result was that public infrastructure does not significantly impact on economic performance. The authors further pointed out that the effects of increases in public capital are greater

during the early stages of a country's development; when the stock of public capital is still relatively low, than are exhibited by mature societies.

A similar study was conducted in South Africa by Hulten and Schwab (2001). The study employed a descriptive research design. The data collected were analyzed using statistical package for social sciences (SPSS) version 21. The study also used F-tests to identify the directions of association between economic infrastructure and economic growth. They identified long-run forcing relationships from public-sector economic infrastructure investment and fixed capital stock to gross domestic product (GDP), from roads to GDP and from GDP to a range of other types of infrastructure. They also found that the relationship between economic infrastructure and economic growth run in both directions.

Herranz-Loncán (2007) analyzed the impact of infrastructure investment on Spanish economic growth between 1850 and 1935. Using new infrastructure data and VAR techniques, he shows that the growth impact of local-scope infrastructure investment was positive, but returns to investment in large nation-wide networks were not significantly different from zero. On the one hand, public intervention and the application of non-economic growth investment criteria were very intense in large network construction while on the other hand, returns to new investment in large networks might have decreased dramatically once the basic links were constructed

Canning and Fay (2013) in their study on the relationship between infrastructure and economic growth in developing countries established that infrastructure variable is significant in developing countries and positively correlated with economic growth. They investigated the contribution to economic growth from transportation networks, measured as aggregated kilometers of paved roads, and of railway lines. The study

showed that output elasticity of transportation infrastructure is 0.10, implying a relatively high rate of return for developing countries. These findings of positive and significant relationships were not universally shared.

2.4.2 Local Studies

Locally, Mburu (2013) investigated the relationship between government investment in infrastructure and economic growth in Kenya. The study adopted a descriptive research design. In this study emphasis was given to secondary data which was obtained from the Government development expenditure in infrastructure obtained from Economic Survey reports published by the Kenya National Bureau of Statistics. The data included the government investments in infrastructure and also economic growth data from CBK covering a period of ten years between 2005 and 2014. The study found that, government investment in infrastructure development had a positive and significant effect on economic growth in Kenya for the period of this study. The study recommends that adequate funding should be directed towards infrastructure projects preparation, implementation and maintenance.

Ndonga (2014) conducted research on the effects of government spending on economic growth in Kenya. The study employed descriptive research design which involved quantitative analysis of data. The study used Secondary data to analyze the effect of government expenditure on economic growth in Kenya. Data for economic growth was obtained from World Bank and IMF data bank from 2007 to 2012 where by the Data for government spending on health, infrastructure, security and education was converted into calendar years since economic growth obtained were in calendar year. Granger Causality Test was used to determine whether one time series is useful in forecasting another (Enders, 1995). The VAR equations were used to perform

Granger causality tests. The study findings indicated that; there is a significant influence of the government spending on education, infrastructure, health and defence.

Kariuki (2014) sought to establish the effect of financing infrastructure projects using public private partnership on physical infrastructure development in Kenya. The study used a descriptive survey and the population for this study included all the physical infrastructure projects conducted in Kenya. The estimated number of physical infrastructure projects carried out in Kenya for the last ten years was more than 15,000. The study conducted a cluster sampling of 60 infrastructure projects from the list obtained from PPP unit and Medium term expenditure framework report, 2013.. The study used 40 points (forty quarters in a period of ten years). Data was analyzed with the help of a multiple regression model. The results of the regression analysis showed that there was a direct relationship.

2.5 Summary of Literature

The study was underpinned on game theory, development theory and endogenous growth theory. Game theory highlights the rational mechanisms underpinning individual decision-making in a collective action contributing to the common good. In this case, the game theory can help to understand how participation in, or exclusion from a community project occurs, Development theory on the other hand is concerned with how government and development agencies interact to understand the type of development to undertake and finally endogenous growth theory argues that there is a role for government institutions that can overcome any market failures associated with the various types of investment.

The study also reviewed that energy infrastructure investment affects economic growth by increasing private sector productivity and that the government should focus on energy infrastructure for the benefit of the nation. It was further reviewed that the rate of economic growth depends primarily on the rate of capital formation which also depends on the rate of savings and investment. FDI as a source of economic growth, modernization, income growth and employment has been reviewed to boost the national economy and generate jobs and economic development.

The chapter reviewed relevant studies conducted both locally and internationally. Researchers such as Kell and Mahfouz (2002), Hulten and Schwab (2001) and Herranz-Loncán (2007) identified long-run forcing relationships from public-sector economic infrastructure investment and fixed capital stock to gross domestic product (GDP), from roads to GDP and from GDP to a range of other types of infrastructure. They also found that the relationship between economic infrastructure and economic growth run in both directions. Locally, Mburu (2013) and Kariuki (2014) agree that, government investment in infrastructure development had a positive and significant effect on economic growth in Kenya for the period of this study.

Although literature has been reviewed on effect of government investment in energy infrastructure on economic growth, most of these studies have been done in other countries whose strategic approach and financial footing is different from that of Kenya. None of them therefore focused on how these apply in the Kenyan case. It is evident therefore that a literature gap exists on effect of government investment in energy infrastructure on economic growth. This study therefore seeks to fill this gap by focusing on effect of government investment in energy infrastructure on economic growth in Kenya.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

This chapter includes the various stages that were followed to complete the study. The chapter therefore comprise of the following subsections: research design, target population, data collection and data analysis and presentation.

3.2 Research Design

Research design is the general plan of how one goes about answering the research questions (Mugenda and Mugenda, 2003). From the objectives, it is evident that the research is both of a quantitative and qualitative nature. A descriptive research design was applied in this study. Descriptive research gives researchers the opportunity to use both quantitative and qualitative data in order to find data and characteristics about the population or phenomenon that is being studied (Yin, 2004). The method was chosen since it is more precise and accurate as it involves description of events in a carefully planned way (Babbie, 2004).

A descriptive research design determines and reports the way things are (Yin, 2004). Mugenda and Mugenda (2003) observe that a descriptive research design is used when data are collected to describe persons, organizations, settings or phenomena. The data collection for descriptive research presents a number of advantages since it can provide a very multifaceted approach using interviews, observations, questionnaires and participation.

3.3 Data Collection

In this study emphasis was given to secondary data which was obtained from the Government development in energy infrastructure obtained from the Kenya National

Bureau of Statistics. The data included the government investments in energy infrastructure and also economic growth data from CBK covering a period of thirty years between 1985 and 2014.

3.4 Data Analysis

Mugenda and Mugenda (2003) assert that data obtained from the field in raw form is difficult to interpret unless it is cleaned, coded and analyzed. The data collected was therefore cleaned, coded and systematically organized in a manner that facilitates analysis using the Statistical Package for Social Sciences (SPSS version 21). Quantitative analysis was used through descriptive statistics such as measure of central tendency to generate relevant percentages, frequency counts, mode, and median and mean where possible. Inferentially, a regression analysis was conducted to establish the correlation coefficients of each variable of interests. In order to make the data more user friendly and attractive to the readers, graphic interactive tables were generated using the computer spreadsheet to present the data.

3.4.1 Analytical Model

In order to test the relationship between the variables the inferential tests including the regression analysis was used to determine the effect of government investment in energy infrastructure on economic growth. The following regression model was used to establish the relationship between the variables: $Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon$

Whereby   Y = Economic Growth as measured by GDP Growth Rate

α = Constant to be estimated

$\beta_1, \beta_2, \beta_3, \beta_4$ = Coefficient of determination

$X1$ = Investment in energy infrastructure (growth rate of annual investments in energy infrastructure)

X_2 = Interest rates (nominal interest rate)

X_3 = Inflation (Consumer Price index (CPI))

X_4 = Foreign direct investment (natural log of FDI)

ε = Error Term

3.4.2 Test of Significance

The model's test of significance was measured on how well the regression model fits the data by comparing explanatory variables that proposed actually explain variations in the dependent variable. Quantities known as goodness of fit statistics are available to test how well the sample regression function (SRF) fits the data how or how close' the fitted regression line is to all of the data points taken together. The most common goodness of fit statistic is known as R^2 (Brooks, 2008). To test for the strength of the model and the relationship between government investment in energy infrastructure and economic growth, the researcher conducted an Analysis of Variance (ANOVA). The fitness was tested at 95% confidence level and 5% significant levels. If the significance number found is less than the critical value (α) set, then the conclusion was that the model is significant in explaining the relationship.

CHAPTER FOUR

DATA ANALYSIS, RESULTS AND INTERPRETATION

4.1 Introduction

This chapter presents the information processed from the data collected during the study on the relationship between government investment in energy infrastructure and economic growth in Kenya.

4.2 Descriptive Statistics

This section focuses on the description of the data distribution characteristics for all the study variables including inflation, interest rates, energy infrastructure, economic growth and FDI.

Table 4. 1: Descriptive Statistics of the Study Variables

	N	Min	Max	Mean		Std. Dev	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic	Std. Error	Statistic	Std. Error
Inflation	72	3.18	19.72	8.26	0.545	4.62	1.023	.283	-.057	.559
Interest rates	72	13.46	20.53	16.04	0.272	2.31	.652	.283	-.857	.559
Energy infrastructure	33	.27	2.24	0.96	0.081	0.47	1.249	.409	1.584	.798
Economic Growth	72	2.60	7.70	5.08	0.138	1.17	-.364	.283	-.530	.559
FDI	38	6.03	8.86	7.58	0.108	0.67	-.005	.383	-.326	.750

Source: Research Findings

The results in Table 4.1 showed that inflation had a mean score of 8.26, interest rates had a mean score of 16.04, energy infrastructure had a mean score of 0.96, economic growth had a mean score of 5.08 while FDI had a mean score of 7.58. Analysis of skewness shows that Inflation, Interest rates and Energy infrastructure are asymmetrical to the right around their mean while Economic Growth and FDI are skewed to the left.

4.3 Inferential Statistics

The study conducted a correlation Analysis and multiple regression analysis to establish the relationship between government investment in energy infrastructure and economic growth in Kenya.

4.3.1 Correlation Analysis

The data presented before on government investment in energy infrastructure, foreign direct investment, inflation rate and interest rate were computed into single variables per factor by obtaining the averages of each factor. Pearson's correlations analysis was then conducted at 95% confidence interval and 5% confidence level 2-tailed. The table 4.2 indicates the correlation matrix between the factors (government investment in energy infrastructure, foreign direct investment, inflation rate and interest rate) and economic growth.

Table 4. 2: Correlation Matrix

		Economic growth	Government investment in energy infrastructure	Foreign direct investment	Inflation rate	Interest rate
Economic growth	Pearson Correlation	1				
	Sig. (2-tailed)	.				
Government investment in energy infrastructure	Pearson Correlation	.318	1			
	Sig. (2-tailed)	.029	.			
Foreign direct investment	Pearson Correlation	.764	.523	1		
	Sig. (2-tailed)	.017	.016	.		
Inflation rate	Pearson Correlation	-.214	-.143	-.597	1	
	Sig. (2-tailed)	.031	.012	.028	.	
Interest rate	Pearson Correlation	.529	.533	.720	-.531	1
	Sig. (2-tailed)	.047	.009	.002	.014	.

Source: Research Findings

According to the table, there is a positive relationship between economic growth and

government investment in energy infrastructure, foreign direct investment, inflation

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rate and interest rate of magnitude 0.318, 0.764, 0.214 and 0.529 respectively. The positive relationship indicates that there is a correlation between the government investment in energy infrastructure, foreign direct investment and interest rate and the economic growth while inflation rate had a negative effect. This infers that foreign direct investment has the highest effect on economic growth, followed by government investment in energy infrastructure, then inflation rate while interest rate having the lowest effect on the economic growth although the effect of inflation was negative.

4.3.2 Regression Analysis

Coefficient of determination explains the extent to which changes in the dependent variable can be explained by the change in the independent variables or the percentage of variation in the dependent variable (economic growth) that is explained by all the four independent variables (government investment in energy infrastructure, foreign direct investment, inflation rate and interest rate).

Table 4.3: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.845[a]	.714	.673	1.02301

Source: Research Findings

The four independent variables that were studied explain 67.3% of the economic growth as represented by the adjusted R^2. This therefore means the four variables contribute to 67.3% of economic growth , while other factors not studied in this research contributes 32.7% of economic growth . Therefore, further research should

be conducted to investigate the other (32.7%) factors influencing economic growth in Kenya.

Table 4.4: Regression coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	19.489	9.266		2.103	.045
	Energy infrastructure	.137	.417	.012	1.088	.031
	FDI	.406	.376	.182	1.179	.024
	Inflation	-.118	.047	-.082	-2.515	.018
	Interest rates	.343	.609	.074	.564	.027

Source: Research Findings

The coefficient of regression in table 4.4 above was used in coming up with the model below:

$$Y = 19.489 + 0.137 X_1 + 0.406 X_2 - 0.118 X_3 + 0.343 X_4$$

From the model, taking all factors (government investment in energy infrastructure, foreign direct investment, inflation rate and interest rate) constant at zero, economic growth was 19.489. The data findings analyzed also shows that taking all other independent variables at zero, a unit increase in government investment in energy infrastructure lead to a 0.137 increase in economic growth; unit increase in foreign direct investment will lead to a 0.406 increase in economic growth; a unit increase in inflation rate will lead to a -0.118 decrease in economic growth while a unit increase in interest rate will lead to a 0.343 increase in economic growth. According to the

model, all the variables were significant as their P- value was less than 0.05. All the variables were positively correlated with economic growth.

4.3.3 ANOVA

Table 4.5: Summary of One-Way ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	35.262	4	7.052	6.739	.0001[a]
	Residual	28.257	27	1.047		
	Total	63.519	32			

Source: Research Findings

From the ANOVA statistics in table 4.5, the processed data, which are the population parameters, had a significance level of 0.0001 which shows that the data is ideal for making a conclusion on the population's parameter. The F calculated at 5% Level of significance was 6.739. Since F calculated is greater than the F critical (value = 2.7278), this shows that the overall model was significant i.e. there is a significant relationship between government investment in energy infrastructure.

4.4 Interpretation of the Findings

According to the correlation findings, there is a positive relationship between economic growth and government investment in energy infrastructure, foreign direct investment, inflation rate and interest rate of magnitude 0.318, 0.764, 0.214 and 0.529 respectively. The positive relationship indicates that there is a correlation between the government investment in energy infrastructure, foreign direct investment and interest

rate and the economic growth while inflation rate had a negative effect. This infers that foreign direct investment has the highest effect on economic growth, followed by government investment in energy infrastructure, then inflation rate while interest rate having the lowest effect on the economic growth although the effect of inflation was negative.

From the above regression model, the study found out that government investment in energy infrastructure, foreign direct investment and interest rate influencing the economic growth in Kenya while inflation rate had a negative effect. The study found out that the intercept was 19.489 for all years. The four independent variables that were studied (government investment in energy infrastructure, foreign direct investment, inflation rate and interest rate) explain a substantial 67.3% of economic growth in Kenya as represented by adjusted R^2 (0.701). This therefore means the four variables contribute to 67.3% of economic growth, while other factors not studied in this research contributes 32.7% of economic growth. The findings of this study agree with the findings of EIA (2009) that without infrastructure improvements, increased energy demands will generate sizeable economic and environmental challenges. Natural gas currently represents the second most important source of energy for Kenya after petroleum. As part of a green energy transformation, we may not want to invest this heavily in the natural gas industry. However, any reduction in natural gas infrastructure will need to be at least matched by further investments in renewable energy and a smart-grid electrical transmission system.

The study established that the coefficient for government investment in energy infrastructure was 0.137, meaning that government investment in energy infrastructure positively and significantly influenced the economic growth in Kenya.

This correlates to Barro (2013) who posits that government investment in energy infrastructure is very vital for economic growth in any nation. in addition, Jumbe (2004a) posited that the country's economy is energy dependent and, hence, more energy investment is compulsory for sustained economic growth. Energy Infrastructure investment is one of the main preconditions for enabling developing countries to accelerate or sustain the pace of their development and achieve the Millennium Development Goals. Aschauer (2009) expressed that infrastructure is a profound determinant of nationhood, a measure of a country's success on the world stage. Munnell (2008) also indicated public infrastructure investment can also contribute to economic growth through the expenditures associate with purchasing, installing, operating, and maintaining the infrastructure itself.

The study also established that the coefficient for Foreign direct investment (FDI) was 0.406, meaning that Foreign direct investment positively but significantly influenced the economic growth in Kenya. This is in line with Todaro and Smith (2003) who argue that the flows of FDI could fill the gap between desired energy investment and domestically mobilized finance. It also may increase tax revenues and improve management, technology, as well as labour skills in host countries. Many scholars widely believe that FDI in energy infrastructure may contribute to economic growth (Jenkins and Thomas, 2002). Developing countries in Asia, Africa and Latin America have, increasingly, come to see FDI as a source of economic growth, modernization, income growth and employment. FDI is seen by countries, especially transition countries, as a way to boost the national economy and generate jobs and economic development (Carlin and Landesmann, 2007; Jensen, 2006).

The study also established that the coefficient for inflation rate was -0.118, meaning that inflation rate negatively but significantly influenced the economic growth in

Kenya. This agrees with Mebratie and Bedi (2013) who observes that inflation has an adverse effect on the exit returns when governments divest or dispose their stake in an investment. Inflation rates have been dominating to compare with growth rates in virtually many years (Madhukar and Nagarjuna, 2011) and relationship between inflation and the economic growth continued to be one of the most macroeconomic problems. However, the findings contradicts Ahmed (2010) who indicated that inflation was not regarded as a problem in that period rather considered as a positive impact on the economic growth which was widely accepted.

The coefficient for level of Interest Rate was 0.343; this shows that level of Interest Rate significantly and positively influences the economic growth in Kenya. This is in line with Miles and Ezzell (2010) who indicated that a key signal of the economic growth is the level of interest rates and the arbitrage opportunities to which they give rise. This is ultimately an issue of global savings availability and liquidity policies.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

The energy industry fuels the economy, and steady availability of reasonably priced energy is a crucial to economic growth. In countries with energy resources, the industry can be an engine of economic recovery and development. The inadequate rate of public investment in the past 30 years has resulted in the deficiency and obsolescence of infrastructure in Kenya. To the best of the researcher's understanding, none of these studies has focused on the effect of government investment in energy infrastructure on economic growth in Kenya.

The purpose of this study is to establish the effects of government investment in energy infrastructure on economic growth in Kenya. A descriptive research design was applied in this study. In this study emphasis was given to secondary data which was obtained from the Government development in energy infrastructure obtained from the Kenya National Bureau of Statistics. Quantitative analysis was used through descriptive statistics. In order to test the relationship between the variables the inferential tests including the regression analysis was used to determine the effect of government investment in energy infrastructure on economic growth.

The study found that the four variables contribute to 67.3% of economic growth and that a unit increase in government investment in energy infrastructure lead to a 0.137 increase in economic growth. From the study findings and discussion, the study concludes that government investment in energy infrastructure development affect the level of economic growth in Kenya. The conclusion is that government investment in

energy infrastructure development had a positive and significant affect economic growth in Kenya for the period of this study. The study also recommends that adequate funding should be directed towards energy infrastructure projects preparation, implementation and maintenance. The study recommend expanding and diversifying existing modern energy use and creating sufficient awareness and supplying better technologies at affordable prices so as to sustain the economic growth with better living standards.

5.2 Conclusions

Energy Infrastructure investment is one of the main preconditions for enabling developing countries to accelerate or sustain the pace of their development and achieve the Millennium Development Goals (MDGs) set by the United Nations in 2000. The energy industry fuels the economy, and steady availability of reasonably priced energy is a crucial to economic growth. In countries with energy resources, the industry can be an engine of economic recovery and development. From the study findings and discussion, the study concludes that government investment in energy infrastructure development affect the level of economic growth in Kenya. The conclusion is that government investment in energy infrastructure development had a positive and significant affect economic growth in Kenya for the period of this study. Infrastructure development supports various kinds of economic activity, including as an input into production and also raises the marginal product of other capital used in the production process. This concur with Kessides (2005) and Tatom (2013), Barro (2013), Jumbe (2004a), Aschauer (2009) who found that government investment in energy infrastructure positively impact on economic growth while the findings contrandicts those by Fedderke and Luiz (2005) and Aschauer (2009).

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The study also established that FDI positively but significantly influenced the economic growth in Kenya. This is in line with Bernoth, Colavecchio and Sass (2010) that there is positive relationship between economic growth and GDP growth. Gompers and Lerner (1998) established that higher GDP growth implies higher attractive opportunities for entrepreneurs, which in turn lead to a higher need for venture fund. In addition, Bernoth, Jenkins and Thomas (2010) established that during period of high GDP growth and increase in aggregate demand, financial institutions experiences solid performance and easily obtain funds to fund their acquisitions. This translates to a larger and more diversified portfolio for financial institutions which subsequently are more likely to post good results and enhance economic growth.

The study further concludes that inflation rate positively and significantly influences the economic growth in Kenya. This correlates with Metrick and Yasuda (2007) did a study on causal relationship between inflation rates and banks economic growth and established that fluctuations affects the profits repatriated to banks foreign investors.

The study finally concludes that level of Interest Rate significantly and positively influences the economic growth in Kenya. This is in line with Miles and Ezzell (2010) who stated that the classical study on firm capital structures, shows that in perfect capital markets, the value of a firm is unaffected by its capital structure. In essence, their theorem states that in markets with no taxes, no bankruptcy costs and with perfect information, the way a firm is financed does not determine its value, i.e. firm value is determined by its real assets and not by the securities it issues.

5.3 Recommendations for Policy and Practice

From the study, it was clear that energy is the lifeblood of the economy and a crucial input for nearly every good and service. Affordable and stable energy prices are a

boon for economic growth. Regardless of their energy endowments, countries are turning to renewables and green technology as sound investments. Particularly in developing nations, reliable and affordable energy supplies are crucial. Unreliable electricity takes a heavy toll on GDP. Bridging the supply gap offers a major development opportunity. Investment and innovation clusters around renewable energy are bringing about advances in related technologies and providing solutions to environmental and energy security problems.

Since it was clear that government investment in energy infrastructure development affect the level of economic growth in Kenya, the study recommends that adequate funding should be directed towards energy infrastructure projects preparation, implementation and maintenance. Policy makers should critically examine energy conservation measures that have an adverse effect on growth. In addition to the prevailing policy direction of the government in expanding and diversifying energy use, it should work a lot on demand side interventions such as improving efficiency of using both traditional and modern sources of energy. The study recommend expanding and diversifying existing modern energy use and creating sufficient awareness and supplying better technologies at affordable prices so as to sustain the economic growth with better living standards.

The study recommends the energy sector to have an independent and autonomous research center or institution that appropriately design and implement research works in relation to energy, growth, and the environment. The study also recommends the need for government and it agencies to monitor the expenditure on infrastructure, adhere strictly to due process in accordance with the enabling fiscal policy and the Millennium Development Goal (MDG) blue prints. Specifically, these can be

achieved through openness of the economy had a significant and positive effect on expenditure on infrastructure, therefore, policies that would engender the openness in the economy especially in the long-run is recommended. There is also need for government to use the external reserves to finance energy infrastructural development, given the negative relationship between external reserve and expenditure growth on infrastructure.

The study suggests that proper reform policy should be complemented with the availability of necessary energy infrastructures that are important for the economic development in the country. Global experiences with reforms of government infrastructure have already established the major parameters of the policy changes required to secure greater private sector participation. The government should establish a clear strategy for the reform of the sector, based on structuring profitable investments opportunities. Regulations should be refocused on providing an enabling environment that serves to contain risk. There should be established Initiative focusing on the political championing and sponsoring of specific infrastructure projects with potential impact on economic integration. This high level initiative should focus on sponsoring catalytic energy infrastructure projects, through political leadership and championing. Significantly, this would provide a much needed platform to mobilize domestic and foreign resources for development impact

Emphasis should also be given on developing public-private partnerships (PPPs) and encourage increased joint-venture project development between multinational firms and local enterprises for energy infrastructure development. The leaders should be motivated by the common desire to promote a Kenyan-led and owned development agenda, pursued a value-driven partnership premised on selected sector priorities with

energy infrastructure as a core target. The leaders should act as champions which will bring visibility to the infrastructure projects, facilitate the unblocking of bottlenecks and any political impasse, provide leadership in resource mobilization for the projects, and subsequently, the champions will support and ensure speedy project implementation, and through a progress reporting mechanism. Further, there should be an effective and inclusive partnership with the international community including the private sector which will support the country's commitment in this regard and help realize the desired impact.

5.4 Limitations of the Study

The main limitations of this study are three-fold. First, with regard to data availability, the data can be traced back only for the past five years, possibly not long enough to capture the market cycle. Further, the data was tedious to collect and compute as it was in its very raw form. The short time span of the data used in this research posed serious drawbacks in drawing clear cut conclusion from the results since it limits the number of lags that can be used. Another limitation of the data is that since most public investments are based on long-term contracts with single or limited number of investors, the country will see the same amount of investments being invested every year, and when such investments are included in regression to explain GDP which has more variation over the years, then no correlation will be found.

Second, time and resources allocated to this study could not allow the study to be conducted as deeply as possible in terms of other predictor variables for economic growth in Kenya. Another challenge is limited data availability and the uncertain quality of the data used. Despite the fact that energy infrastructure is one of the most

important factors for economic development of a nation, reliable data of water and all infrastructure related activities is very hard to find.

The quality of the data may be a weakness of this study. It is not possible to tell from this research whether the results are simply due to the nature and quality of data used or whether it is the true picture of the situation. Actually the use of the data from the various sources like the KNBS is based on the assumption that the data are accurately captured.

The strength of this research lies in its time limit. The scope of this research was for the 20 years ending and including the year 2012. It is not known whether the results would hold if a longer period would have been researched upon. Further it is not possible to tell whether the same findings will hold for the period after 2014.

5.5 Suggestions for Further Studies

For further studies, it will be interesting to investigate the effect of private sector investment in energy infrastructure development on the level of economic growth in Kenya since the private developers operate from a different strategic and financial footing from the government. Also, comparing the effect of government and private sector investment in energy infrastructure development on the level of economic growth in Kenya could be another line of study that would be interesting to engage in.

This study focused on the empirical historical data only. Economic growth is also affected by non empirical factors within the countries where the investment is to be done. There is need to complement the findings of this research using a qualitative approach to find out the current behavioural issues affecting energy infrastructural

investment and therefore economic growth such as environmental concerns, leadership and governance.

Another study should also look on the effect of investment in renewable energy infrastructure development on economic development. This is because the there is a lot of interest in renewable energy such as solar and wind energy. The study recommends that further studies should be undertaken to establish the relationship between macroeconomic variables and investment in energy infrastructure.

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APPENDICES

Appendix I: Energy Sector Institutional Framework

The major players in Kenya Energy sector include:

1. Ministry of Energy (MoE) – Policy

2. Energy Regulatory Commission (ERC) – Regulation

3. Rural Electrification Authority (REA)

4. Geothermal Development Company (GDC) – Established in 2009. Its role include exploration of geothermal fields, appraisal, drilling, development and management of proven steam fields and enter into sale agreements with KENGEN and IPPs

5. Kenya Electricity Generating Company (KENGEN) – Main generating company (70% - Government, 30% - Public

6. Independent Power Producers (IPPs) and Emergency Power Producers (EPPs)

7. Kenya Electricity Transmission Company (KETRACO) – Transmission. (established in 2009 and therefore will develop its own new transmission lines)

8. Kenya Power and Lightning Company Limited (KPLC) – Distribution. However, until 2009, the organization was doing both transmission and distribution. The current transmission lines will continue to be owned by KPLC.

9. Others include development partners: World Bank, GTZ, Africa Development Bank, UNDP, GEF e.t.c

10. Private investors (both local and international) and public

Source: Energy Regulation Commission

Appendix II: Investments in energy infrastructure

Year	Kshs " Millions"	Growth Rate
1980/81	558.3	
1981/82	621.2	0.899
1982/83	341.0	1.822
1983/84	562.9	0.606
1984/85	453.5	1.241
1985/86	426.7	1.063
1986/87	399.9	1.067
1987/88	577.4	0.693
1988/89	1,089.8	0.530
1989/90	1,423.4	0.766
1990/91	1,293.1	1.101
1991/92	820.2	1.577
1992/93	626.8	1.309
1993/94	776.6	0.807
1994/95	1,696.2	0.458
1995/96	2,261.0	0.750
1996/97	2,057.8	1.099
1997/98	1,708.2	1.205
1998/99	777.8	2.196
1999/00	347.7	2.237
2000/01	1,297.7	0.268
2001/02	1,343.1	0.966
2002/03	1,494.5	0.899
2003/04	2,689.2	0.556
2004/05	5,751.0	0.468
2005/06	8,397.6	0.685
2006/07	8,471.9	0.991
2007/08	17,904.4	0.473
2008/09	30,872.8	0.580
2009/10	29,551.6	1.045

2010/11	22,897.3	1.291
2011/12	28,076.0	0.816
2012/13	40,638.6	0.691
2013/14	63,201.1	0.643

Source: Kenya National Bureau of Statistics

Appendix III: Inflation rate - Consumer Price index (CPI)

	2009	2010	2011	2012	2013	2014
Jan	13.2	6.0	5.4	18.3	3.7	7.2
Feb	14.7	5.2	6.5	16.7	4.5	6.9
March	14.6	4.0	9.2	15.6	4.1	6.3
April	12.4	3.7	12.1	13.1	4.1	6.4
May	9.6	3.9	13.0	12.2	4.1	7.3
June	8.6	3.5	14.5	10.1	4.9	7.4
July	8.4	3.6	15.5	7.7	6.0	7.7
Aug	7.4	3.2	16.7	6.1	6.7	8.4
Sep	6.7	3.2	17.3	5.3	8.3	6.6
Oct	6.6	3.2	18.9	4.1	7.8	6.4
Nov	5.0	3.8	19.7	3.3	7.4	6.1
Dec	5.3	4.5	18.9	3.2	7.2	6.0

Source: Kenya National Bureau of Statistics

Appendix IV: GDP Growth Rate

GDP	2009	2010	2011	2012	2013	2014
Jan	3.6	4.9	5.4	4.2	6.4	6.2
Feb	3.8	5.2	5.2	4.3	6.7	6.6
March	2.6	5.1	5.5	3.9	5.8	5.5
April	2.7	5.4	6.3	5.1	6.1	6.0
May	3.3	5.3	5.7	4.8	5.2	4.6
June	2.9	6.1	7.7	4.2	6.4	6.1
July	4.1	5.6	6.2	5.3	4.6	4.0
Aug	3.2	5.8	6.8	3.6	5.1	4.6
Sep	2.6	6.1	6.9	3.6	5.1	4.5
Oct	2.8	6.2	5.8	4.3	6.6	6.2
Nov	3.9	5.7	6.4	4.7	5.4	4.7
Dec	3.5	5.4	5.9	4.2	6.1	5.7

Source: Kenya National Bureau of Statistics

Appendix V: Level of Interest Rate

Years	2009	2010	2011	2012	2013	2014
January	14.78	14.98	14.03	19.54	18.13	17.03
February	14.67	14.98	13.92	20.28	17.84	17.06
March	14.87	14.8	13.92	20.34	17.73	16.91
April	14.71	14.58	13.92	20.22	17.87	16.7
May	14.85	14.46	13.88	20.12	17.45	16.97
June	15.09	14.39	13.91	20.3	16.97	16.36
July	14.79	14.29	14.14	20.15	17.02	16.91
August	14.76	14.18	14.32	20.13	16.96	16.26
September	14.74	13.98	14.79	19.73	16.86	16.04
October	14.78	13.85	15.21	19.04	17	16
November	14.85	13.95	18.51	17.78	16.89	15.94
December	14.76	13.87	20.04	18.15	16.99	15.99

Source: Central Bank of Kenya

Appendix VI: FDIs

YEAR	FDI (CURRENT US $)	Log 10
1977	1,064,781.47	6.027
1978	5,090,506.51	6.707
1979	6,524,413.69	6.815
1980	5,945,930.08	6.774
1981	13,831,398.77	7.141
1982	6,938,345.30	6.841
1983	49,677,447.82	7.696
1984	21,238,596.78	7.327
1985	41,562,764.76	7.619
1986	88,723,640.32	7.948
1987	4,242,098.35	6.628
1988	28,934,419.50	7.461
1989	24,750,533.71	7.394
1990	20,566,647.93	7.313
1991	18,830,976.84	7.275
1992	6,363,133.14	6.804
1993	145,655,517.11	8.163
1994	7,432,412.60	6.871
1995	42,289,248.46	7.626
1996	108,672,931.62	8.036
1997	62,096,809.78	7.793
1998	26,548,245.97	7.424
1999	51,953,455.95	7.716
2000	110,904,550.40	8.045
2001	5,302,622.94	6.724
2002	27,618,447.06	7.441
2003	81,738,242.64	7.912
2004	46,063,931.45	7.663
2005	21,211,685.40	7.327
2006	50,674,725.18	7.705

2007	729,044,146.04	8.863
2008	95,585,680.23	7.980
2009	116,257,608.99	8.065
2010	178,064,606.75	8.251
2011	335,249,880.28	8.525
2012	325,816,778.78	8.513
2013	554,561,824.08	8.744
2014	623,306,869.38	8.795

Source: Kenya National Bureau of Statistics