

**DETERMINANTS THAT INFLUENCE THE IMPLEMENTATION OF  
INFRASTRUCTURE DEVELOPMENT PROJECTS IN RENEWABLE ENERGY  
SECTOR IN KENYA: A CASE OF KENYA ELECTRICITY GENERATING  
COMPANY LIMITED**

**BY**

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## **DECLARATION**

This project is my original work and has not been presented to any other examination body.

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### **Declaration by the Supervisor**

This research project has been submitted for approval with my approval as the university supervisor.

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## **DEDICATION**

I dedicate this research report to my family, my dad Kiara, mum Kathure (deceased) and friends Benedicta, Ben, Bernice, Isaac, Cyrus and Purity who stood with me and gave me courage to progress and complete my studies. I am eternally grateful.

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## **LIST OF ABBREVIATIONS AND ACRONYMS**

KenGen -	Kenya Electricity Generating Company Limited
KPLC -	Kenya Power Lighting Company
IPPs -	Independent Power Producers
MDBs -	Multilateral Development Banks
RE -	Renewable Energy
RETs -	Renewable Energy Technologies
GDP -	Gross Domestic Product
GNP -	Gross National Product
GHG -	Greenhouse gases including carbon dioxide
MW -	Mega Watt
Kw -	Kilo Watt
kWh -	Kilo Watt Hour
TWh -	Trillion Watt Hour
W/m <sup>2</sup> -	Watt per square meter
CO -	Carbon monoxide
CO <sub>2</sub> -	Carbon dioxide
PPA -	Power purchase agreement
PV -	Photovoltaic
IFC -	International Finance Corporation
WB -	World Bank
R&D -	Research and Development

PIMS - Project information management system (PIMS)  
NEMA- National Environment Management Authority

## ABSTRACT

The energy sector is one of the most important, requiring a substantive shift in energy production from fossil fuels into renewable energy (RE). The increasing global and local impact induced by fossil fuels has instigated policy and technical support towards the use of RE technologies as an alternative to reduce the threats (IPCC, 2007). Drastic changes are happening and the commercial viability of RE technologies is currently at a turning point; they are fast becoming attractive due to various environmental, social and economic reasons. Despite the importance of renewable energy there is dearth empirical evidence on the factors that influence the implementation of renewable energy development projects in Kenya. A descriptive survey research design was used to obtain data. The target population of this study was the top, middle and lower management staff of KenGen. Stratified random sampling was used to pick 30% of the target population. The sample size for the study included 72 respondents. The researcher used primary and secondary sources of data for this study. The primary data was obtained from the respondents through a structured questionnaire comprising of closed and open-ended questions. Descriptive statistics was used to analyze the data. The study concludes that KenGen's organization culture supports implementation of renewable energy development projects. The study further concludes that KenGen is striving to bring about change in its operations. It can further be concluded that KenGen finances renewable projects by use of equity and debt. The Stakeholders involvement influences the implementation of renewable energy development projects as depicted by the study. The study further concluded that KenGen has innovative edge on renewable energy as it allocates intensive resource on technology development. The study finally concludes that the cost of renewable energy in KenGen has drastically reduced because of technological advancement in efficiency under mass production. The study recommends timely release of funds as a way to ensure completion of projects within the stipulated time. The study further recommends use of asset backed securities to raise funds such as the use of steam as collateral to raise capital from the market. The study further recommends use of high level technological improvements in mega projects so as to make use of various sources to generate electricity from hydro, geothermal and wind. This can be achieved by raising financial resources from local and external sources geared towards geothermal, solar and wind. Also implement projects that are geared towards renewable energy. Further recommendation would be to invest in R&D for renewable energy studies by partnering with global institutions that design, manufacture and trade in renewable energy plants globally.

## **CHAPTER ONE**

### **INTRODUCTION**

#### **1. 1: Background of the Study**

The world energy scenario was deeply changed in the last few years due to increasing environmental concerns and the attention moved towards the environmental effects of the energy generation. A connection was sought between energy, development and sustainability (Leva and Zaninelli, 2006). There is a correlation between the quality of the living environment and energy generation, meaning that the use of fossil fuels for producing energy has generated environmental effects that negatively affect social wellbeing beyond acceptable limits. Nowadays European energy markets are confronted with the liberalization issue on one hand and the fulfillment of environmental targets on the other hand.

The European Union's use of renewable energy should be 20 percent of its energy mix by 2020 (Commission of the European Communities, 2007). According to Zervos (2007), this new target is challenging given that 6.5 percent of the European Union's energy is currently generated from renewable sources. Meeting the target is vital if the necessary reductions in import dependence and greenhouse gas emissions are to be made (Zervos, 2007). This ambitious objective cannot be met without a properly functioning energy market that could ensure the development of an effectively functioning emission trading mechanism and of a renewable energy industry (Commission of the European Communities, 2007). A single European market for renewable energy will create a

competitive environment in which renewable energy production will increase and develop in an efficient manner.

Africa is endowed with vast renewable and non-renewable sources of energy. It is estimated that the continent has 1,750TWh potential of hydropower and 14,000 MW of geothermal potential. The continent receives abundant solar radiation through the year, and recent studies have confirmed the availability of abundant wind energy resources along some of the coastal and specific inland areas of Africa. With respect to non-renewable energy, coal resources are available in abundance in Southern Africa. At the end of 2007, the continent had over 117 billion barrels of oil of proven oil reserves and over 14.6 trillion cubic meters of proven gas reserves. However, these energy endowments remain largely underutilized.

Africa is among all developing areas of the world, the continent where needs are the most urgent. In Africa, less than 7% of the hydropower potential has been developed while more than 60% of its population does not have access to electricity. This highlights the contrasts of a continent well endowed with energy resources and the deprivations of its population, industries and businesses of the minimum energy services and products that they require to face the challenges of modern lives and economic growth. Given the low energy consumption in most of African countries and the huge needs in capital to develop hydropower energy resources, ensuring the whole energy security is only possible by scaling- up regional power supply and transmission networks (World Energy Council, 2003).



In Eastern African region, this is the main mandate of the Regional Power Pools to facilitate regional energy planning and development of large energy projects on a regional basis (All Africa Energy Week, 2012). In Kenya, the infrastructure development sector is in the spotlight as the Government, companies and consumers grapple with issues such as availability, condition, security of supply, environmental impact and affordability. The sector is on a journey of major change, and holds the key to the country's economic growth as articulated in the Country's Vision 2030.

Kenya's National Energy Policy is designed "to facilitate provision of clean, sustainable, affordable, reliable and secure energy services at least cost while protecting the environment." The efforts come alongside a critical time for Kenya – economic growth and energy demand are higher than ever. The current supply, although increasing slowly, cannot keep up with demand. In response, the Kenyan government is using three policy tools to facilitate the adoption of renewable energy. The aim is to increase the country's energy supply, close the demand gap, and ultimately enable economic growth for Kenya. Less than 20% of the total population estimated at 40 million and 5% of the rural population in Kenya has access to electricity (World Bank, 2009). As mobile technology becomes a part of Kenyan culture and Nairobi positions itself as the technology hub of East Africa, demand is growing fast for electricity from both on- and off-grid consumers. Evidence of this includes frequent rolling blackouts due to insufficient supply and the growing popularity of off-grid solutions such as small-scale (<20 Watt panels) solar home systems.

The government realizes that oil dependence is unsustainable. Therefore, its long-term development strategy focuses increasing dependence through feed-in tariffs for renewables such as solar, wind, and geothermal. Kenya has several national policy documents, long-term plans, and strategic initiatives designed to promote and invest in renewable energy for the country, including: Kenya's Scaling Up Renewable Energy Program (SREP) Investment Plan, Least Cost Power Development Plan (LCPDP), Rural Electrification Master Plan, The Energy Act of 2006, The Feed-in Tariff (FiT) Policy, The Kenya National Climate Change Response Strategy and Kenya Vision 2030. The government is making a conscious effort to increase dependence on renewable energy other than hydroelectric.

### **1.1.1: The Concept of Renewable Energy**

Across the planet, different countries use different energy sources to meet consumption demands, industry and support public infrastructure (i.e. public transport, public buildings, etc.). As a result of the consequences created by the primary sources of energy fossil fuels and in order to minimize present and future contributions to climate change, there are a variety of recommendations coming from the scientific community, as well as other significant actors, who call for the development of alternative solutions (Commission Proposal COM (2000) 796 final; IPCC, 2007; Mallon, 2006). Amongst these, one mechanism by which to reduce GHG emissions and especially that of carbon dioxide is the diversification and utilization of alternative energy sources that release far less (arguably even zero) GHGs. These energy sources primarily come from solar-direct and solar-indirect (hydropower, wind and bioenergy), and non-solar power, such as tidal

and geothermal (Boyle, 2004). All of these have been exploited by humans, some for thousands of years and others only for a few decades (ibid).

However, various obstacles exist in developing such RE sources depending on energy source, implementation location, and technology available (Geller, 2003; Mendonça, 2007; McCormick, 2007). It is imperative to study how these can be overcome efficiently, since many positive impacts that can be obtained from (local) RE sources. Apart from dealing with GHG emissions, these also include improving energy supply and security, motivating local development and creating direct and indirect employment (Kelly, 2007).

### **1.1.2: The Concept of Infrastructure**

Infrastructure refers to economic services from utilities such as electricity, gas, telecommunications and water and transport works such as roads, bridges urban transit systems, seaports and airports which are central in promoting economic activities in the country. Good infrastructure helps in providing economic services efficiently, promoting economic competitiveness and supports high productivity. Poor infrastructure impedes economic growth and can be seriously detrimental to the efficient use of scarce resources (African Energy Policy Research Network, 2000).

The role of infrastructure in the economy, the essential nature of its services, the size of individual projects, and its important social dimensions call for government role in planning, promoting and ensuring independent regulation that provide a level playing field for both public and private sector enterprises. When projects are operational, the

role of the government can be determined by the ownership and the operational structure of the concerned project. Traditionally, infrastructure projects in Kenya were owned and managed by the government or a government undertaking. Given the massive investments required in infrastructure, which plays an important role in economic development, there is now broad consensus that private sector participation in this activity must be encouraged, hence, the development of Public-Private Partnerships.

Private initiative in infrastructure projects can take many forms, ranging from contracted operation of public utilities to full ownership, operation and maintenance of these facilities. Some of the principal objectives of promoting private investment in the development and operation of infrastructure projects are ensuring greater economic efficiency and better availability of the facility itself. Infrastructure projects are either more or less suitable for private participation and the level of such participation can be varied to reflect the same. Projects that are designed to provide significant social benefits such as low cost urban transportation systems may be more suited to traditional government ownership, whereas projects that have strong commercial attraction, like telecommunication, are more suited for private sector involvement.

Sustainable Infrastructure Development (SID) is making infrastructure decisions that make sense for today and tomorrow. The concept embraces using cost/benefit analysis as part of every decision, using life cycle costing, managing the use of existing resources, making appropriate finance decisions, and making intelligent product selection, embracing the use of technology and new products, supporting infrastructure technology

research and application, and creating opportunities from our investments (Khennas, 2000).

### **1.1.3: Kenya Electricity Generating Company Profile**

Kenya Electricity Generating Company (KenGen) is a limited liability company, registered under the Company Act .The Company was incorporated in 1954 as Kenya Power Company Limited (KPC) renamed KenGen in 1997 following implementation of the reforms in the energy sector. Its core business is to develop, manage and operate power generation plants to supply electric power to the Kenyan market, and in future, they also plan to supply power to the Eastern Africa region. KenGen is the leading electric power producer in Kenya accounting for over 80% of the total electric power consumed in the Country with the Independent Power Producers accounting for 20%. Until 17th May 2006, the Company was 100% owned by the government.

Through the Sessional Paper number 4 of 2004 on Energy, the Government of Kenya (GoK) resolved to undertake the first phase of divestiture from KenGen through an Initial Public Offering (IPO) on the Nairobi Stock Exchange (NSE). As at 30<sup>th</sup> June 2006, the Company had a total installed capacity of 946 MW comprising of hydropower 677.28 MW (71.28%), geothermal 115MW (12%), thermal 147 MW (16%), Isolated Power Station (IPS) 5.2 MW (1%) and Wind 0.35MW.

KenGen has a formal Interim Power Purchase Agreement (IPPA) in place with KPLC that specifies the tariff and trading arrangements under the regulation of the Electricity Regulatory Board (ERB). The preliminary tariff study report recommends a plant specific

two-tier tariff structure comprising of capacity and energy charge for KenGen plants. The capacity charge will recover all capital related costs (repayment of foreign and local loans, return on equity, taxes and duties) based on target availability and a contracted capacity of the plant. The capacity charge will also recover all fixed operation and maintenance costs. The energy charge will recover the variable operation and maintenance cost based on the energy delivered by the plant to the delivery point.

The isolated Power Stations have been faced with resource constraints coupled with high operational costs due to their locations, which have greatly limited generation capacity and network expansion at a pace consistent with growth in demand. To redress this situation, in October 2004, the Ministry of Energy (MOE) outlined the National Energy Policy in the Sessional Paper No. 4 of 2004 on Energy.

## **1.2: Statement of the Problem**

Drastic changes are happening and the commercial viability of RE technologies is currently at a turning point; they are fast becoming attractive due to various environmental, social and economic reasons. However, even though technologies to exploit RE are becoming more available, affordable and accepted, the overall process of developing them encompasses a series of challenges of which have to be addressed in order to overcome potential obstacles that might hinder their wide dispersion and implementation of renewable energy development projects (Geller, 2003; Mendonça, 2007; McCormick, 2007).

There are significant factors that determine the process of achieving renewable energy infrastructure projects. These factors revolve around the current institutional framework, modern economic reality, political circumstances and the lack of awareness from a large percentage population in developing countries (McCormick 2007). Stakeholders' involvement and participation, the technological aspect of innovation and financial resource availability are key determinant factors. Large, long-term energy infrastructure investments in resource dependent African countries with high levels of economic uncertainty and without a significant revenue collection base to cover expenses pose a real challenge. If not handled with care, using public resources (including equity investments, loans, and guarantees by MDBs) to leverage private investment could create an enormous additional debt burden in these countries (Saliem Fakir, 2012). Previous studies done local and internationally do not show factors that influence the implementation of infrastructure development projects in renewable energy sector.

Despite the importance of renewable energy there is dearth empirical evidence on the factors that influence the implementation of renewable energy development projects in Kenya. It is against this background that the researcher seeks to establish the factors influence the implementation of infrastructure development projects in renewable energy sector specifically in KenGen.

### **1.3: Purpose of the Study**

The purpose is to examine the important factors that influence the implementation of infrastructure development projects in Renewable Energy Sector specifically in KenGen

and resolve the energy question in Kenya by creating and sustaining alternative sources of power production.

#### **1.4: Objective of the Study**

The objectives are as follows;

- i. To determine how organizational strategy influence the implementation of renewable energy development projects in Kenya.
- ii. To establish how financial resources shape implementation of renewable energy development projects in Kenya.
- iii. To assess how stakeholders' involvement influences the implementation of renewable energy development projects in Kenya
- iv. To determine how technology influence the implementation of renewable energy development projects in Kenya

#### **1.5: Research Questions**

- i. To what extent does organizational strategy influence implementation of renewable energy development projects in Kenya?
- ii. How do financial resources influence the implementation of renewable energy development projects in Kenya?
- iii. How does stakeholders' involvement influence the implementation of renewable energy development projects in Kenya?
- iv. To what extent does innovation/technology influence the implementation of renewable energy development projects in Kenya?



### **1.6: Significance of the Study**

This study can be useful for any organization intending to implement renewable infrastructure projects. Implementation of RE project brings in more positive effects as they can be in a position to bridge the gap between sustainable projects and non-sustainable one that contribute to overall well-being of the economy and society in general. The highlighted issues can be used to define way forward that would enhance adopting of good project implementation strategies enhanced by the consideration of various contributing variable mentioned in this study.

Since this case study features a Government Corporation, it can enable the government to position itself and establish ways in which it can effectively implement and develop projects that are geared towards provision of power in the country and meet the current demand and plan for future growth. This can only be achieved if the government is in a position to adopt various recommendations that would be put across as contributors to implementation of RE infrastructure development projects. This study can be relevant to other organizations or government institutions in the sense that they can be in a position to use this study to come up with better approaches of implementing projects.

### **1.7: Limitation of the Study**

This study focused on RE projects undertaken in KenGen while numerous other projects have been undertaken by other organizations. Also numerous other new technologies fall within the category of renewable energy such as energy efficiency, geothermal energy, biomass energy, wind energy, solar energy, hydrogen and carbon dioxide capture and

storage. This study focuses on wind energy, geothermal energy, hydropower energy and solar energy. Particularly it addresses such RE projects such as Ngong Wind Power Station, Olkaria Power Stations, Seven Forks Hydro Power Stations and Solar Power Project in Garissa.

Economic particulars pertaining RE technologies and costs are not included. The carbon credits are not discussed despite the importance of carbon dioxide taxes at the national level of electricity. The research primarily addresses factors influencing the implementation of RE projects in order to scope the study. Particular limitations are; challenges in obtaining documentation and data, time constraint and contacting relevant persons for case study was quite difficult.

### **1.8: Delimitation of the Study**

The purpose of this study was to establish the factors influencing implementation of infrastructure development projects in Renewable Energy Sector specifically in KenGen. The location of this study was accessible as it was at KenGen head office in Parklands Nairobi. The instruments of the study are questionnaire to be formulated by the author hence making monitoring and control of the study feasible.

### **1.9: Assumptions of the Study**

This study while undertaken, assumed that accurate information gathering would be possible whereas there was need sometimes to carry out the study in technical areas for example where various sources of renewable energy are installed like in Olkaria Power Station and Ngong Wind Power Station. Also that the sample used is representative of the

entire population and that the instrument used was valid and would be reflective of study concerns.

### **1.10: Organization of the Study**

This study report featured five chapters where chapter one was introduction to the research topic. Chapter two was literature review and it expounded more about the subject. Chapter three was the research methodology that would used to collect data and chapter four focused on data analysis, presentation and interpretation. The last chapter five gave a summary of the findings, discussions, conclusions and recommendations.

### **1.11: Definitions of terms**

**Energy** is kilowatt-hours of power not firmly committed long term to a particular use or sale

**Renewable or Renewable Energy** is renewable energy sources that can be replenished by naturally occurring processes in daily cycles

**Off-peak** is periods of relatively low system demand by day or by season

**Peak** is periods of relatively high system demand by day or by season

**Photovoltaic** is a method of generating electrical power by converting solar radiation into direct current electricity using semiconductors that exhibit the photovoltaic effect

**Electrons** is a subatomic particle with a negative elementary electric charge

**Geothermal-Geothermal energy** is thermal energy generated and stored in the earth

- Renewable energy** is energy that comes from resources which are continually replenished such as sunlight, wind, rain, tides, waves and geothermal heat
- Hydroelectricity** is the term referring to electricity generated by hydropower; the production of electrical power through the use of the gravitational force of falling or flowing water
- Turbines** is a turbo machine with at least one moving part called a rotor assembly, which is a shaft or drum with blades attached
- Hydrothermal energy** is power that is generated using the earth's hot water
- Greenhouse** is a building in which plants are grown
- Biogas** refers to a gas produced by the breakdown of organic matter in the absence of oxygen
- G2 dwarf** the sun is classified as a G-type main sequence star (G2V)/spectral type class G yellow stars
- Organizational strategy** this is the match an organization makes between its internal resources and skills and the opportunities and risks created by its external environment. A strategy is an internally consistent configuration of activities that distinguishes a firm from others.
- Financial resources** this is the money available to a business for spending in the form of cash, liquid securities and credit lines. Financial resources are offered by different investors such as shareholders, lenders and debt holders in exchange for remuneration which can be dividends, interests and capital gains.

**Stakeholders' involvement** is the process by which an organization involves people who may be affected by the decisions it makes or can influence the implementation of its decisions by supporting or opposing the decisions. The stakeholders may be influential in the organization or within the community in which it operates and may hold official positions or be affected in the long term.

**New Technology /Innovation** this is the making, modification, usage and knowledge of tools, machines, techniques and systems to resolve problems or improve on a pre-existing solution and attain an ultimate objective. It is the process of translating or introducing new ideas, devices, products, services and systems that create value for end users.

## CHAPTER TWO

### LITERATURE REVIEW

#### **2.1 Introduction**

This chapter utilises the related literature to identify the main sources of renewable energy and insights into the respective projects accomplished. It provides information in regards to four main factors that influenced their implementation and help to answer the question: what are the factors that influence implementation of RE projects in KenGen?

#### **2.2: Renewable Energy Projects**

Energy is the single most important problem facing humanity today. We must find an alternative to oil the cheaper, cleaner, and more universally available this new energy technology is, the better we will be able to avoid human suffering, and the major upheavals of war and terrorism (Smalley, 2002).

Renewable energy comes from natural resources such as sunlight, wind, rain, tides and waves, and geothermal heat, which are naturally replenished. The technologies of choice are emission-free, renewable energy. Solar energy is the source of all energy on earth; it creates wind and water movement and ultimately creating plants, biomass and animals that become fossil fuels when their organic matter decays. Our sun is one of a family of stars known to astronomers as yellow dwarfs. The sun is a G2 dwarf of unremarkable stellar magnitude. It is powered by several kinds of fusion reactions that have consumed 11 billion pounds of hydrogen each second for the past 4 to 5 billion years and is expected to continue for another 4 to 5 billion years (Lund, 2006).

At its core the sun consumes 4.3 million tons of matter every second, releasing 3.89 times  $10^{26}$  joules of nuclear energy. Although the energy output of the sun in the direction of the earth is approximately  $1,300 \text{ W/m}^2$  at its source, one-third is reflected back into space by the earth's atmosphere, yielding as much as  $1,000 \text{ W/m}^2$  at the surface of the earth at noon on a cloudless day; on average over the course of a year, around  $170 \text{ W/m}^2$  of solar radiation reaches the earth's oceans and roughly  $180 \text{ W/m}^2$  reaches the land surface (Steven and Anil, 2006). Each day more solar energy falls to the earth than the total amount of energy the planet's approximately 6 billion inhabitants would consume in 26 years, While it's neither possible nor necessary to use more than a small portion of this energy, we've hardly begun to tap the potential of solar energy (Twidell et al., 1986).

Although every location on earth receives sunlight, the amount received varies greatly depending on geographical location, time of day, season and light. The desert region receives almost twice the sunlight of other regions of the country. Solar energy systems use either solar cells or some form of solar collector to generate electricity or heat for homes and buildings. The primary solar energy technologies for power generation are PVs and thermal systems (Chambers, 2004).

In contrast to fossil fuel sources, solar, wind and geothermal energy produce no emission during power generation. Their use can offset emissions of carbon dioxide and other criteria pollutants that fossil fuel-fired plants would otherwise generate (Steger, 2005). Still, solar and wind energy are intermittent resources and as such cannot be used reliably to meet base load electricity requirements without integration with electric energy storage. More traditional renewable generation resources such as hydroelectric or

geothermal power generation and biomass fuels are round-the-clock transmittable resources that can supply base load power resources.

In 2008, about 19% of global final energy consumption came from renewables, with 13% coming from traditional biomass, which is mainly used for heating, and 3.2% from hydroelectricity. New renewables (small hydro, modern biomass, wind, solar, geothermal, and biofuels) accounted for another 2.7% and are growing very rapidly. The share of renewables in electricity generation is around 18%, with 15% of global electricity coming from hydroelectricity and 3% from new renewables (Geothermal Energy Association, 2010). Renewable projects can either be implemented as on-grid (transmission) projects or off-grid projects. Unless elaborate controls are placed on the system, stand-alone dispersed off-grid systems can either provide insufficient power at peak demand or excess during off-peak hours. Off-grid renewable energy project revenues are often less secured or unsecured, increasing financial rates.

### **2.3: The Renewable Energy Technologies**

RETs are energy-providing technologies that utilize energy sources in ways that do not deplete the Earth's natural resources and are as environmentally benign as possible. These sources are sustainable in that they can be managed to ensure they can be used indefinitely without degrading the environment (Renewable Energy Association, 2009). By exploiting these energy sources, RETs have great potential to meet the energy needs of rural societies in a sustainable way, albeit most likely in tandem with conventional



systems. The decentralized nature of some RETs allows them to be matched with the specific needs of different rural areas.

RETs used to produce energy for domestic use tend to do so by exploiting modern fuels or by utilizing traditional fuels in new and improved ways (Alazraque-Cherni, 2008). RETs that generate electricity can do so either as part of a stand-alone (or off-grid) system or as a grid-based system, by way of connection to a mini-grid or the national grid. Common RET options for providing energy in rural areas utilize wind, solar, small-scale hydropower and biomass resources. Wind energy is used for pumping water and generating electricity. Solar photovoltaic (PV) systems convert sunlight into electricity and solar heaters use sunlight to heat stored water. Small-scale hydropower plants are used to generate electricity and vary in size (mini, micro and pico, in descending size).

Many small-scale hydro systems are “run-of-the-river” schemes, meaning that the main energy-carrying medium is the natural flow of water. In these cases, dams are small and there is very little storage of water. As a result, they are cheaper and less demanding on the environment, although they are less efficient and heavily dependent on local hydrological patterns. Technologies that utilize biomass include improved cook stoves for efficient burning of traditional energy sources or biogas. Biogas can also be used in small power plants to generate electricity (World Bank, 2004).

Decentralized RETs are particularly suitable for providing electricity services in rural areas. It has been argued that decentralized systems can provide local power and so can be locally designed (Havet et al., 2009). Generally they also have low up-front costs

(though often higher costs per kW installed than centralized technologies), and can help avoid the high costs associated with transmission and distribution grids (Alazraque-Cherni, 2008). They operate at smaller scales (kWh), appropriate to local needs and are accessible in remote locations as they are situated close to users (Kaundinya, 2009). Also, the possibility of adopting RETs is particularly important in the light of the limited success of conventional national grid-based rural electrification programmes to reach small, dispersed rural communities in developing countries (Goldemberg, 2000; Alazraque-Cherni, 2008).

### **2.3.1: Hydroelectric Power**

Hydroelectric power plants convert the kinetic energy contained in the falling water into electricity (Khennas, Smail & Barnett, Andrew, 2000). Hydro power is currently the world's largest renewable source of electricity accounting for 6% of worldwide energy supply or approximately 15% of the world's electricity. By the middle of the 20<sup>th</sup> century, 5,000 large dams had been constructed across the world, with 75% of these in industrialized countries; by the end of the 20<sup>th</sup> century, there were more than 45,000 large dams in more than 140 countries. Hydro power supplies more than 90% of total national electric central supply in two dozen countries and more than half of centralized electric supply in 63 countries (Steven Ferrey with Anil, 2006).

Mitigation measures can also be an opportunity emerging as renewable energy hub of north eastern Asian region. Nearly 47 percent of most African Countries are considered to have high potential for generating electricity from wind energy (Bitsch, 2002). Many

fields in the Southern and South Eastern parts of most country have been assessed to have the necessary wind speeds of 5m/s for 4,000-5,000 hours per annum. With regard to solar energy, almost the entire territories of Africa are assessed to have good potential. The southern parts of Africa are assessed to have a solar energy potential of above 1,400 kWh/square metre. Of the remainder, much of the country is assessed to a solar energy potential of between 1,200 and 1,400 kWh/ metre. The overall potential for solar energy is assessed to be  $2.2 \times 10^6$  GWh. In comparison, the total electricity generation in 2010 was  $4.575 \times 10^3$  GWh (Karekezi & Ranja 1997).

There have been already strategies by way of mitigation and adaptation measures. Increasing energy efficiency and the use of renewable energy within overall energy mix are crucial steps. Capture and storage of carbon and developing further sinks in terms of pasture as well as forests which can absorb and retain Carbon will be crucial to improving on performance with regard to carbon dioxide per capita or carbon dioxide per dollar of GDP. At present, African economy is very carbon intensive and steps are needed to de-couple economic development and carbon and promote growth (European Commission, 2001).

### **2.3.2: Solar Photovoltaic Energy**

Photovoltaic (PV) materials use the sun's energy to produce electricity and therefore result in none of the greenhouse or acid gas emissions associated with electricity generated by the combustion of fossil fuels. The amount of solar energy reaching the earth each year is many times greater than worldwide energy demand, although it varies with location, time of day, and the season. Sunlight is also a widely dispersed resource, and photovoltaics can capture energy from the sun virtually anywhere on earth (Steven and Anril, 2006).

Solar cells convert sunlight directly into electricity using semi-conducting materials similar to those used in computer chips. When sunlight is absorbed by these materials, the solar energy knocks electrons loose from their atoms, allowing the electrons to flow through the materials to produce electricity. This process of converting light (photons) to electricity (voltage) is called the PV effect (Chambers, 2004).

The basic PV building block is the photovoltaic cell. It is referred to as a cell, because it produces direct current (DC) electricity like a battery, converting energy from the sun directly into electricity. In practical applications of photovoltaics, group of cells are joined together to form a module, and modules may be connected into an array. These cells, modules and arrays can provide electricity in any quantity ranging from a few milliwatts powering a calculator to several megawatts, the size of a large power plant (Bronicki, 2002).

Using PV to supply electricity to electrical transmission grids can be accomplished either through vast arrays of PV modules in a centralised location acting in the same manner as a traditional power plant, or by decentralised arrays of photovoltaic on the roofs of houses and buildings (Arnulf, 2005). Sunlight is the fuel for photovoltaic, so the cost of manufacturing the cells is the main cost of producing electricity. Electricity storage, or using electricity immediately when it is generated, is necessary for PV cell applications because they generate electricity only when the sun is shining. The original and still the most common semiconducting material used in PV cells is single crystal silicon. PV power is now a firmly embedded part of the generation and distribution network and as such systems must play their part in providing stable voltages to ensure grid stability. Equally inverters, as the interface between generation and transmission, can provide a back-stop for tariff metering (Bronicki, 2002).

Photovoltaic inverter design is now seen as the crucial element in solar power development, despite some of the challenges that can shape PV inverter design. Over the last few years the photovoltaic (PV) market has grown enormously, driven by government feed-in tariffs (FiTs) in response to the need for economies to act smarter in terms of their energy mix (James, 2013).

When placed on existing structured, such as the rooftop of a home or office building, solar energy systems require negligible amount of land space (EPA: Non-hydroelectric Renewable Energy). Utility scale solar farms, on the other hand, do require large amounts of land to produce electricity on a commercial scale (SOLAREIS; Solar Energy Development Environmental Consideration). This fact raises concerns about the

potential impact of such projects on natural habitats. The EPA is working to address these concerns by siting renewable energy projects on contaminated lands and mine sites (Karekezi and Ranja, 1997).

Emissions associated with generating electricity from solar technologies are negligible because no fuels are combusted. There are many potential benefits to solar PV installations. Such systems can reduce energy costs, act as a price hedge against rising energy costs, reduce the amount of pollution-rich energy consumed from the grid and also reduce carbon emission. They also capitalise on under-utilised roof or ground space (The Data Centre, 2013)

### **2.3.3: Wind Power**

Wind is created because the sun heats the Earth unevenly, due to the seasons and cloud cover. This uneven heating, in addition to the Earth's rotation, causes warmer air to move toward cooler air. This movement of air is wind (McLaren, 2007).

Wind turbines use two or three long blades to collect the energy in the wind and convert it to electricity. The blades spin when the wind blows over them. The energy of motion contained in the wind is then converted into electricity as the spinning turbine blades turn a generator. To create enough electricity for a town or city, several wind turbine towers need to be placed together in groups or rows to create a "wind farm" (Cohen et al., 2001). Building and maintaining wind turbine costs money but no one pays for the wind itself since it is free fuel. Also wind power prices do not fluctuate like the fossil fuel. Advances in wind turbine technology and an abundance of regions with winds suitable

for producing power have made wind power the fastest-growing source of energy in the world (Hassing et al., 2001). Some carbon dioxide is released during manufacture and maintenance of wind turbines, but wind turbines themselves emit no carbon dioxide or other greenhouse gases while they are producing electricity. That means users of wind energy have smaller carbon footprints that is zero greenhouse gases (Cohen, 2001).

#### **2.3.4: Geothermal Energy**

Geothermal energy is the heat contained below the earth's crust. This heat brought to the surface as steam or hot water, is created when water flows through heated permeable rock. It's used directly for space heating in homes and buildings or converted to electricity. Geothermal resources come in five forms; hydrothermal fluids, hot dry rock, geo-pressured brines, magma and ambient ground heat. Only hydrothermal fluids have been developed commercially for power generation. To extract this energy, wells are drilled to tap steam and water at high temperatures (250-350°C) and pressures (600-1200 PSI) at depths of 1-3 kilometres. For electricity generation, the steam is piped to a turbine, which rotates a generator to produce electrical energy (Chambers, 2004).

Conventional steam turbines are used with hydrothermal fluids that are wholly or primarily steam. The Steam is routed directly to the turbine, which drives an electric generator, eliminating the need for the boilers and conventional fuels to heat the water (Cohen, 2001). Hydrothermal fluids that are above 4000F that are primarily water, flash steam technology is used. In these systems, the fluid is sprayed into a tank held at a much lower pressure than the fluid, causing some of the fluid to rapidly vaporize or flash, to steam. The steam is used to drive a turbine, which again, drives a generator and if some

liquid remains and it is still hot enough, it can be used in a second tank to extract even more energy for power generation. Water that has temperature less than 4000 F, binary-cycle technology is generally most cost effective.

In these systems, the hot geothermal fluid vaporizes a secondary, or working fluid which then drives a turbine and generator. Today's hydrothermal power plants with modern emissions controls have minimal impact on the environment. The plants release little or no carbon dioxide. Geothermal Power Plants are very reliable when compared to conventional power plants. Geothermal electricity is clean, reliable and cost effective. Geothermal resources represent an abundant, secure source of energy (Lund, 2000)

Geothermal power is very cost-effective in the Great Rift Valley of Kenya, East Africa. Kenya was the first African country to build geothermal energy sources. Kenya Electricity Generating Company (KenGen) has built two plants to exploit the Olkaria geothermal resource, Olkaria I (45 MW) and Olkaria II (70 MW), with a third private plant Olkaria III (48 MW). Plans are to increase production capacity by another 576 MW by 2017, covering 25% of Kenya's electricity needs, and correspondingly reducing dependency on imported oil. In Ethiopia there is another plant for geothermal power (in 2008 some experts from Iceland calculated that Ethiopia has at least 1000 MW of that energy). Hot spots have been found across the continent, especially in the Great Rift Valley (The Data Centre, 2013).



## **2.4: Factors Influencing the Implementation of Renewable Energy Development Projects**

### **2.4.1: Organizational Strategy**

Strategy has been defined as the ‘match an organization makes between its internal resources and skills and the opportunities and risks created by its external environment (Mitchel, 1997). The examples of this focus are Michael Porter’s analysis of industry structure and competitive positioning and the empirical studies undertaken by the project information management system (PIMS) project.

At another level a strategy is simply the consistency of the actions the business takes, the fact that it sells a particular range of products to a definite customer group. The way in which businesses develop an edge in the market place is its strategy. Ultimately a strategy must dictate the way the business behaves; it must become a plan to succeed in the market place. A firm’s competitive advantage is the basis on which the performance of the business is built. A competitive advantage is something that the firm possesses, creates value for its customers, unique and competitors find hard to imitate. (Wickham, 2008)

#### **2.4.1.1: Competitive Advantage**

Michael Porter originally identified three basic types of competitive advantage, namely cost (lower cost advantage), differentiation (deliver benefits that exceed those of competitors) and focus (on a particular buying group). Competitive advantage introduces the concept of value chain, a framework of thinking strategically about the activities

involved in any business and assessing their relative cost and role in differentiation. The value chain creates a rigorous way to understand the sources of buyer value that will command a premium price, and why one product or service or project will substitute for another. A strategy is an internally consistent configuration of activities that distinguishes a firm from others. Competitive advantage explores the role of complementary products or services in competition and competitive advantage in some industries as well as the organizational challenges of cross business collaboration (Michael, 1998).

The ability to add value through competing in multiple businesses can be understood in terms of sharing activities or transferring proprietary skills across activities. This also offers powerful framework for examining international strategy and competing across locations. A firm must have resources and capabilities that are collectively superior to those of its competitors.

#### **2.4.1.2: Change Management**

"Change is the only constant."– Heraclitus, Greek philosopher. Without doubt, today's ever-quickenning cycle of change is unprecedented. Change today is faster, more erratic, and more elemental than ever before. Navigating successfully through change is probably the most difficult task facing today's business leaders. 41% of change projects fail and of the 59% that "succeed" only half meet the expectations of senior management. The most difficult aspects of business change, such as engaging staff in the cause and changing behaviors and outcomes are critical to sustainable success. To understand this, there's a globally- model for planning, implementing, managing and sustaining change (Charlesmore Partners International, 2013).

Organizations undergo continual change and most of the time the change is incremental. It takes place in a gradual way with small steps. At intervals, though, the change is more radical and is manifest as a specific management project. Change is often forced upon an organisation by factors such as; being loss making, or facing other financial difficulties, large new competitors successfully entering the marketplace, new regulations or other restrictions on trade, changes in purchasing habits of major customers, new technologies that change the way business operates, growth driven through delivering new products or serving new markets and new managerial approaches that are often associated with political manoeuvring (Wickham, 2008).

Radically new strategic approach aims to put the organization back on a growth track. This demands major structural or cultural change that is characterised by multiple objectives and projects, resulting in a complex and dynamic situation that is difficult for participants to follow. Leadership and change management guru, John Kotter emphasises the importance of leadership, as opposed to management of change. Leadership establishes direction, aligns people, motivates and inspires to create change. Kotter suggests that for change to be, 75 percent of a company's management needs to "buy into" the change (Biegaa, 1997).

Management in a period of change is about planning, organizing, and problem solving to produce some degree of order and coherence during the change episode. You have to work hard to change an organization successfully. When you plan carefully and build the proper foundation, implementing change can be much easier, and you'll improve the chances of success. If you're too impatient, and if you expect too many results too soon,

your plans for change are more likely to fail. Create a sense of urgency, recruit powerful change leaders, build a vision and effectively communicate it, remove obstacles, create quick wins, and build on your momentum. If you do these things, you can help make the change part of your organizational culture (Boyle, 2004). That's when you can declare a true victory and sit back and enjoy the change that you envisioned so long ago.

#### **2.4.1.3: Organization Design**

Effective organizations deliver outputs that meet defined strategies. A number of techniques are available that are designed to help identify and evaluate options for development. The best known framework for deciding upon strategies for growth is the Ansoff Matrix which offers strategic choices for achieving the company's objective using four main categories (Bolinger, 2001).

Market penetration is the category where the organization markets its existing products to the existing customers and means that to increase revenue, repositioning of brand and promoting the product is required. Market development is when the organisation markets its existing product range to new market by either exporting or selling to new region. Product development is when a new product is to be marketed to existing customers and the firm develops and innovates new product offerings sometimes to replace existing ones. Diversification is the last category where a firm markets completely new products to new customers. Related diversification means that the firm remains in a market or industry it is familiar with. Unrelated diversification is where the firm has no previous industry or market experience (Wickham, 2008).

Another framework for organizational development or growth is the Boston Consulting Group (BCG) Matrix which is a four celled matrix developed by BCG, USA. It is the most renowned corporate portfolio analysis tool. It provides a graphic representation for an organization to examine different businesses in its portfolio on the basis of their related market share and industry growth rates. It is a two dimensional analysis on management of Strategic Business Units (SBU's). In other words, it is a comparative analysis of business potential and the evaluation of environment. According to this matrix, business could be classified as high or low according to their industry growth rate and relative market share (Colombo, 2004). The analysis requires that both measures be calculated for each SBU.

The dimension of business strength, relative market share, will measure comparative advantage indicated by market dominance. The key theory underlying this is existence of an experience curve and that market share is achieved due to overall cost leadership. Resources are allocated to the business units according to their situation on the grid. The four cells of this matrix have been called as stars, cash cows, question marks and dogs. Each of these cells represents a particular type of business (European Commission, 2001).

Stars- Stars represent business units having large market share in a fast growing industry. They may generate cash but because of fast growing market, stars require huge investments to maintain their lead. Cash Cows represent business units having a large market share in a mature, slow growing industry. They require little investment and generate cash that can be utilized for investment in other business units. These SBU's are

the corporation's key source of cash, and are specifically the core business. They are the base of an organization. These businesses usually follow stability strategies. When cash cows lose their appeal and move towards deterioration, then a retrenchment strategy may be pursued (European Union, 2001).

Question Marks represent business units having low relative market share and located in a high growth industry. They require huge amount of cash to maintain or gain market share and require attention to determine if the venture can be viable. Usually they are generally new goods and services which have a good commercial prospective. There is no specific strategy which can be adopted. If the firm thinks it has dominant market share, then it can adopt expansion strategy, else retrenchment strategy can be adopted. Most businesses start as question marks as the company tries to enter a high growth market in which there is already a market-share (Friedman & Miles, 2006). If ignored, then question marks may become dogs, while if huge investment is made, and then they have potential of becoming stars.

Dogs represent businesses having weak market shares in low-growth markets. They neither generate cash nor require huge amount of cash. Due to low market share, these business units face cost disadvantages. Generally retrenchment strategies are adopted because these firms can gain market share only at the expense of competitor's/rival firms. These business firms have weak market share because of high costs, poor quality, ineffective marketing, etc. Unless a dog has some other strategic aim, it should be liquidated if there are fewer prospects for it to gain market share. Number of dogs should be avoided and minimized in an organization (Friedman & Miles, 2006).

#### **2.4.1.4: Culture development**

The culture that organizations can change is simply by declaring new values. Deep beliefs and assumptions can only change as experience changes, and when this happens, culture changes. A culture aligned with strategic objectives is one of the most powerful tools that a project team can wield, and research has clearly demonstrated that strong and strategy-aligned cultures achieve significantly better business results (Mitchel et al., 1997). Organizations assess the cultural profile of their business, and develop and implement strategies that build cultural bench-strength and strategy-alignment into their organization (Vig et al., 2004)

#### **2.4.1.5: General Strategies for Renewable Energy Promotion**

In general, the new strategies should address and remove maximum of existing barriers in renewable project development. At the resource development stage, new strategies should primarily address the high up-front costs of renewable projects. In order to cope with risk mitigation, which is acute at this early stage, smart optimization of input from both public and private sources should be initiated. What is needed is active governmental or multilateral agency participation in the initial project development. Governments should contribute to project creditability by appropriate renewable legislation (renewable “set-asides”, carbon taxes, emissions trading, tax credits) to meet private and banking sector expectations (Tomer & Reshef, 2001).

Multilateral and bilateral agencies should provide support to decrease exploration costs and risk perception. Governments should prepare laws, rules and regulations to enable a quicker introduction of renewable energy, to ease the efforts for promotion of energy diversification. Furthermore, governments should focus on the preparation of a legal environmental and regulatory framework, which supports private ownership in the energy domain, including transfer (repatriation) of private investors' rights. Enforceability of international arbitration is another element required to support a potential renewable project (Kelly & Geoff, 2007).

Provided that the basic project framework is insured by the public sector, the area of “technology” can be covered by the private sector. The coordinated public-private partnership should focus on creating confidence in the current and future performance of renewable technologies. Expanding markets for renewable projects will bring down the costs of the appropriate technologies (Reddy, 2004). Renewable energy projects are generally small and often located in rural areas, far from the decision makers. From the financing point of view, a “small” project can be seen as a “thin” project: the one that cannot bear all of the transaction costs and financial hurdles resulting from some of the traditional project finances.

This problem can be mitigated by “bundling” together prospective projects to achieve economies of scale. This can be done mainly under two different structures. The first, by the entity issuing the project by taking separate facilities and “binding” them into one project, under one set of documents, with joint structure (duration, tariff, securities, etc.). The second structure can be created by the sponsor by taking a few separate facilities,



with no, or a limited, relationship between them, and “bundling” them into one project to be financed by one financing scheme (Monroy & Hernandez, 2007).

Net metering can be an important incentive for small renewable systems. In net metering a customer uses a meter that can run in both directions, depending on whether he is purchasing electricity from or feeding it back to the grid. Therefore, net metering allows the customer “to bank” excess generation for later use. Depending on the details of each net metering programme, if net energy production is greater than consumption from the grid for each billing period, the customer may be paid for excess generation (typically at the utility’s avoided cost), and allowed to carry the amount forward to offset consumption in future periods, or required to forfeit or “grant” the excess electricity to the utility. Net metering will have an important role in future decentralized energy supply systems based on the contribution of several renewable and non-renewable sources (Leak et al., 2006).

Financing structures, contract reviews, costs, procedures, timetable and review standards are usually geared toward large-scale projects. For “small” projects not all traditional “project financing” elements are a “must” and therefore, adjustment of the financing package is required in order to fit the specific nature and structure of “small” projects. Lenders to small projects should show flexibility by keeping their requirements at a reasonable level. The implementation of small projects can be accelerated by reducing the expenses and time delays required to arrange and close financing. Financing of renewable projects should be processed on a fast track, utilizing experience with similar projects, standardized procedures and increased reliance on the historical background of the project participants. The financing requirement should be identified at the beginning

of the review period to keep the financing process on a smooth fast track (Bronicki, 2000).

Apart from the strategies initiated from the supply-side, renewables have lately been promoted by important demand-side initiatives. Voluntary commitments by large and small customers from the large multinationals down to private customers to procure and use renewable energy are becoming more common in developed markets. Innovative solutions to reward green customers with smart subsidies initiated by governments contribute to the success of such schemes. To promote renewable projects a concerted effort to broaden the base of energy project evaluation should be adopted. It should take into account the full societal costs of a project, to promote inclusion of “externalities” (that is GHG emission reduction accountability, avoided fossil fuel costs,) into power tariffs and cost evaluations. The life cycle cost evaluation of energy projects in the future will enable “fair” competition in the energy market and broaden the chances for enlarging the stake for renewables (Monroy & Hernandez, 2007).

#### **2.4.2: Financial Resources**

The classical project financing models focuses on equity and debt. In this case security is of paramount importance. This means that the basis of funding a project is dependent on shareholders ability to invest own funds or borrow on the basis of security alone. Since 1990's new trends are emerging that constitute what is referred to as contemporary. The emerging trends constitute project financing that utilized the structure of the project company called special purpose vehicle (SPV), venture capital and other forms. This

practice has enhanced funds mobilization for project investment (World Geothermal Congress, 2000).

A classical project financing is structured to provide for the project company to accrue revenue on a daily basis with payment being made in arrears. This revenue structure is however by no means of universal application and it is not now uncommon for a project's revenue to include receipts under options of forward sales (Charlier & Finkl, 2009). Project finance can be raised from a variety of sources that may be classified in different ways. The various forms of financing can be described as internal accruals, securities, term loans, working capital advances, miscellaneous sources, bonds and debentures. All these can be categorised into either equity or debt.

The rationale for project financing includes how to prepare the financial plan, assess the risks, design the financial mix and raise the funds. This is different from public financing which is based on tax revenue and government funding. Project finance require knowledge regarding contractual arrangements to support project financing, host government legislative provisions, public/private infrastructure partnerships, public/private financing structures, credit requirement of lenders, how to determine the project's borrowing capacity, how to prepare cash flow projections and use them to determine expected rates of return; tax and accounting considerations and analytical techniques to validate the project's feasibility (World Energy Council, 2000). Project financing, the financier usually has little or no recourse to the non-project assets of the borrower or sponsors of the project. In a no recourse or limited recourse project financing, the risks for a financier are great. The loan undertaken can only be repaid

when the project is operational and if a major part of the project fails, the financiers are likely to lose substantial amounts of money (Bronicki, 2000). It is therefore not surprising that financiers go to great lengths to ensure that the risks associated with projects are minimized or eliminated as far as possible. Also due to the risks involved, the cost of such finance is generally higher and more time consuming for such finance to be provided (Bolinger, 2001).

The World Bank Group has committed more than US\$11 billion to renewable energy and energy efficiency in developing countries since 1990. Together, the World Bank and the International Finance Corporation (IFC) constitute a major financier of solar photovoltaics (PV) in developing countries with projects valued at more than US\$600 million, serving about 1.3 million households and public facilities in about 30 countries in Africa, Asia, and Latin America. World Bank Group energy efficiency investments since 1990 amount to US\$3.1 billion in about 120 projects in 40 countries with a significant concentration in Europe, Central Asia, and East Asia and Pacific. Building on this experience, there has been increasing support for the implementation of the World Bank Group's Renewable Energy and Energy Efficiency Action Plan - including the target of a 20 percent average annual growth in renewable energy and energy efficiency commitments - and the Clean Energy and Development Investment Framework. (The World Bank Group, 2013)

The African Development Bank has estimated at US\$ 547 billion the total investment required to implement its scenario of universal access to reliable and increasingly cleaner electric power in all the 53 countries in Africa by 2030. This averages out at over US\$ 27

billion per year, yet total funding to the energy sector in Sub-Saharan African has averaged only about US\$ 2 billion every year (Wilkins, 2002). Therefore, the energy sector in general faces serious challenges with respect to mobilizing financing. Many economies in Africa are performing badly and this only makes the situation more difficult when seen in the context of ongoing financial crisis. Due to weak government support, the private sector, banks and lending facilities are not yet interested in enhancing their investments in renewable energy systems.

The private sector remains a small player overall, and more prevalent in small-scale renewable energy systems. The bulk of the private sector financing is non-local and mostly on-led from international financing organizations and thus guaranteed by beneficiary governments (Monroy & Hernandez, 2007). It is therefore critical that experiences from international financing organizations in dealing with private sector be used to catalyze local private sector participation in renewable energy projects. Closely related is the lack of support from financial institutions that promote the business and market environment of technologies. These include insurance companies and broker institutions that assist to reduce the very high transaction costs of clean technologies in African countries. Lack of suitable advertising media also affects the marketing of renewable technologies.

The capital costs of building renewables projects are a significant barrier to their implementation, especially for newer technologies that are more costly and that have less of a track record in implementation for example photovoltaics (Arnulf, 2005). Finance may be provided from either public or private sources: public support can be made

available for renewable energy projects through grants or loans: grants; low-interest loans usually through national or regional financial institutions with public subsidy support; loan guarantees again, usually provided with public subsidy support. Private sector funding of renewable projects from banks and other financial institutions such as venture capital is of vital importance to the long-term commercialization of renewables (Bronicki, 2002). It can be provided either in conjunction with or without public funds, depending on the financial viability of the project.

The economic barriers are both real and perceived. The real ones are influenced by uneven (therefore “unfair”) competition with robust conventional energy projects. The renewable projects suffer from high up-front capital requirements, high interconnection costs, and lack of adequate financing structures for small projects. They are perceived as high economic risk, their entire economy structure is viewed as poor, with long amortization (Bolinger, 2001).

#### **2.4.2.1: Preferential Financing for Renewables**

The cost of raising capital is a major factor in all investment projects. This is particularly the case for infrastructure projects like power generation which often involve large up-front costs, and long construction lead times and operating lifetimes. Thus, improved financing terms such as lowered interest rates or longer repayment horizons can significantly reduce project costs. Governments such as Germany and India have created special funding agencies to provide loans for renewable energy projects at below-market interest rates. Furthermore, development organizations including the World Bank provide

loan guarantees which reduce risks for commercial lenders and thus lower interest rates (Tomer, 2001).

Financing terms are particularly important to RETs because renewables are often capital intensive, and therefore require a greater degree of up-front debt and equity than power plants with lower capital costs. A number of additional factors make it more difficult for renewables to obtain financing at reasonable costs than for more mainstream generation technologies: many RETs are perceived by the financial community to have high resource and technology risks (Wiser, 1997). Most financial institutions do not have significant experience evaluating renewable energy resource risks (Wohlgemuth, 2000). Many RETs are also perceived as unproven, with large performance risks. Institutional memory of past project failures makes raising capital difficult and costly for many renewables developers. These real and perceived risks generally result in financing that is more costly than that available to more traditional generation sources. Wiser and Kahn (1996), for example, estimate that if wind developers received financing terms and costs similar to gas-fired IPPs, the nominal levelised cost of wind power might decrease by 25%.

Policies may have unintended negative impacts on the financing process and on financing costs, reducing the overall effectiveness of these policies (Wiser and Pickle, 1998). An example provides the production tax credit on the renewables project capital structure currently granted by the United States federal government in the form of a 10-year, 1.5 kWh production tax credit to qualified wind power and biomass facilities (Sissine, 1999). Although this incentive is capable to stimulate the development of renewable energy

projects, it inadvertently raises financing costs because of its impact on the capital structure (that is the mix of debt and equity used to finance a particular project) of renewable energy projects. This secondary impact has reduced its effectiveness moderately. Although, by providing a return to equity investors, the production tax credit allows a reduction in the wind power sales price, unless the capital structure changes, an energy price reduction can result in a violation of the minimum debt service coverage requirement (that is operating income is not sufficiently high to service the full debt payments). To combat this problem, the project developer must increase the fraction of higher-cost equity in the capital structure, therefore also increasing the contract price from what it would be under an equivalent cash incentive (which can be used to service debt).

Direct capital investment subsidies can be provided per kW of rated capacity or as a percentage of total investment cost. Such direct subsidies are the most straightforward incentive and are attractive for their simplicity, but they must be strictly monitored against abuse and to ensure that project costs are not artificially inflated. Investment tax credits are similar to investment subsidies and serve to lower capital costs by allowing developers to reduce their taxes by the amount invested in qualifying projects. They can be useful in enticing profitable enterprises or high income individuals to enter the renewable energy market to reduce their tax liabilities, but they can be inefficient if investors are more interested in maximizing their tax shelter than in achieving actual electricity production (Wiser., 1998; Righter, 1996).



A wide variety of other investment incentives exist. For example, import duty exemptions or reductions have been used in developing countries such as India and China to lower the cost of imported equipment. Other tax incentives include accelerated equipment depreciation, property tax reductions, and value-added tax rebates. Reliable power purchase contracts/agreements are perhaps the single most critical requirement of a renewable energy project (Monroy, 2007). The vast majority of renewable energy projects have been implemented by IPPs. The only possibility for such facilities to sell their power is to have access to the utility's transmission and distribution grid and to obtain a contract to sell the power either to the utility or to a third party by wheeling through the utility grid. Because renewable energy projects are generally considered risky by financial institutions (Delphi International, 1997), a reliable, stable and hence credible long-term revenue stream is extremely important for obtaining finance at a reasonable cost.

Like capital investment incentives, operating incentives are subsidies to reduce the cost of producing electricity from renewable sources. As with investment incentives, operating incentives can be paid from the general tax base or through a surcharge on customer utility bills. However, unlike investment incentives, which are paid on the basis of initial capital costs, operating incentives are paid per kWh of electricity generated (Tomer, 2001).

### **2.4.3: Stakeholder Involvement**

Energy stakeholders must have trustworthy mechanisms to constructively discuss concerns and viewpoints in dealing with the challenges of an increased use of renewable

energy resources. For example, a forum to allow groups to reach common ground from which to devise concrete actions for increased use of renewable energy resources. The forum would have to deal with the uncertainty issues and regional variations mentioned earlier. The forum would also have to manage trust problems that might exist among groups that have traditionally had contentious relationships (Mitchel, 1997). Any stakeholder engagement mechanism requires some form of common, transparent way of providing timely information to all sectors before policy decisions are final. This is especially true considering that many energy decisions are usually made based on hierarchal, top-down approaches.

The key challenges for project management and stakeholder involvement vary according to technology and geographic context. However, more generic factors pertaining to the kinds of social networks that builds up around new energy projects and to the negotiation and alignment of expectations. These networks were naturally different for different projects, but could involve experts and technology providers, other businesses (as project partners, suppliers or competitors), authorities and politicians at the national and local level, non-governmental organizations and other interest groups, local residents and users. Moreover, it is important to note that stakeholders' positions often evolved during the course of the negotiations: stakeholders are thus not monolithic and their positions are not static.

Stakeholders' expectations that required negotiation pertained to a range of factors. Some of them can be termed "genuine differences of interest", such as the distribution of costs and benefits (the distribution of economic costs among actors, the balance between local

and global environmental benefits). There were also sometimes fundamental value conflicts, for example about the instrumental versus intrinsic or amenity value of nature, or different views on desirable future economic and social development. Moreover, fundamental limits to knowledge and certainty were also present, such as genuine uncertainties about the performance, impacts and relevance of different new energy technologies. Other kinds of issues can more readily be termed “organizational problems”, such as creating trust when there was a lack of precedents or poor earlier experiences, communication problems such as articulating the vision of the project or understanding local concerns, culture and communication patterns, or negotiation problems, such as finding suitable procedures for negotiation and arbitration or defining roles and responsibilities (Mitchel, 1997).

#### **2.4.3.1: Stakeholders Theory**

Stakeholder concept suggests that the purpose of a business is to create as much value as possible for stakeholders. In order to succeed and be sustainable over time, executives must keep the interests of customers, suppliers, employees, communities and shareholders aligned and going in the same direction. In the traditional view of the firm, the shareholder view, the shareholders or stockholders are the owners of the company, and the firm has a binding fiduciary duty to put their needs first, to increase value for them (Phillips, 2007). However, stakeholder theory argues that there are other parties involved, including governmental bodies, political groups, trade associations, trade unions, communities, financiers, suppliers, employees, and customers. Sometimes even competitors are counted as stakeholders - their status being derived from their capacity to

affect the firm and its other morally legitimate stakeholders. The nature of what is a stakeholder is highly contested (Miles, 2012), with hundreds of definitions existing in the academic literature (Miles, 2011).

#### **2.4.4: New Technology/ Innovation**

Renewable energy would require intensive resource allocation into to sustain their innovative edge in order to stay competitive in the evolving sector. For instance, solar energy ventures need continuous technological innovation so as to make solar energy as a viable solution under the current technological regime of the electricity market. The cost of solar panels could be drastically reduced within the next generation of solar energy through technological advancement in efficiency under mass production (Dhere, 2007).

Moreover, the combination of other emerging renewable energy sources as well as complementarity of national energy policy and technological infrastructure could perplex the landscape (Johnson and Suskewicz, 2009). As studied by Holburn et al., (2010), investors of REVs when making their investment decisions would evaluate the risks and returns associated with the supporting policy as there could be uncertainty caused by any changes of such policy by the government. This encompasses a whole range of issues, including insufficient resource data; substandard product quality; inadequate research and development activity; limited human and manufacturing capacities.

There are currently no accurate records of solar, wind, hydro and biomass resource availability in the world. The few data collection stations that exist are furnished with obsolete measuring equipment which is several decades old. Engineers are not well

trained in renewable energy technology and thus are not conversant with the best applications and limitations of different technologies (Reddy, 2004). Lack of skilled labour to operate and maintain renewable energy equipment is another major deterrent to their widespread adoption, especially in rural areas. Particularly in remote areas with restricted access, on-hands maintenance is needed since frequent visits by repair and maintenance staff is difficult. Failure to provide regular maintenance of the equipment when it is required leads to their complete breakdown, thereby defeating the purpose of the initial investment (Wilkins, 2002).

Furthermore there is a general lack of knowledge among the people about acceptable quality and standards of technology. This means that users and installers alike are not likely to be able to distinguish between good and bad equipment and make informed choices, translating into potentially high occurrences of sub-standard installations (Lewis, 2007). Renewable energy education has not been incorporated into the academic curriculum of universities and other tertiary institutions in many countries. The application of renewable energy to fields such as engineering, geography and architecture is not being taught, and as such these professionals are not aware of the value that renewable energy can add to their work (Pernick & Wilder, 2010).

Support for research and development (R&D) plays a vital role in the progression from research and technological development through demonstration to final full-scale commercialization of a new technology. All renewable energy technologies benefit from R&D support to ensure the continued development of a strong and competitive industry. Support is especially important where renewable energy technologies are still at early

stages of development for example photovoltaics. Technological support focuses not only on R&D, but also on demonstration and implementation of new technologies as they mature. For a Member State to build up its indigenous capabilities in a developing market such as the renewables market, it is important for the emerging industry to be given consistent and targeted support for demonstration and implementation projects (Wilkins, 2002).

#### **2.4.4.1: New Technology Theory**

The line between exhaustible resources and renewable resources is not always clearly drawn. Exploration and technical change can, for a time at least, “renew” exhaustible resources by making possible production from new deposits and low-grade materials. Most renewable energy comes either directly or indirectly from the sun. Sunlight, or solar energy, can be used directly for heating and lighting homes and other buildings, for generating electricity, and for hot water heating, solar cooling, and a variety of commercial and industrial uses (Solanki, 2011). The sun's heat also drives the winds, whose energy, is captured with wind turbines. Then, the winds and the sun's heat cause water to evaporate (Hemami, 2012). When this water vapor turns into rain or snow and flows downhill into rivers or streams, its energy can be captured using hydroelectric power.

Along with the rain and snow, sunlight causes plants to grow. The organic matter that makes up those plants is known as biomass. Biomass can be used to produce electricity, transportation fuels, or chemicals. The use of biomass for any of these purposes is called

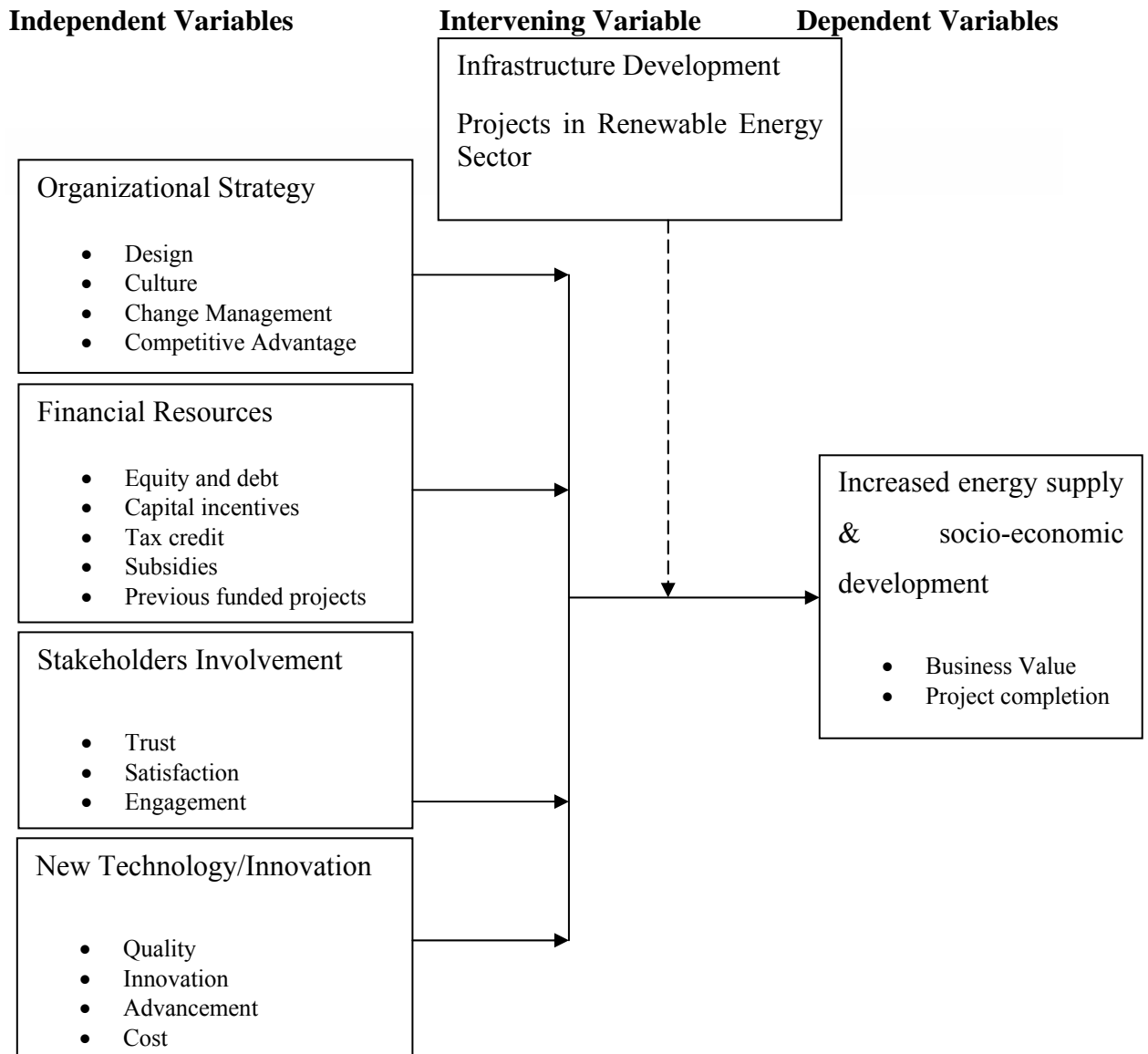
bioenergy. Hydrogen also can be found in many organic compounds, as well as water. It's the most abundant element on the Earth. But it doesn't occur naturally as a gas. It's always combined with other elements, such as with oxygen to make water. Once separated from another element, hydrogen can be burned as a fuel or converted into electricity (Rand, 2008). Not all renewable energy resources come from the sun. Geothermal energy taps the Earth's internal heat for a variety of uses, including electric power production, and the heating and cooling of buildings (Gleason, 2008). And the energy of the ocean's tides come from the gravitational pull of the moon and the sun upon the Earth.

In fact, ocean energy comes from a number of sources. In addition to tidal energy, there's the energy of the ocean's waves, which are driven by both the tides and the winds. The sun also warms the surface of the ocean more than the ocean depths, creating a temperature difference that can be used as an energy source (Charlier & Finkl, 2009). All these forms of ocean energy can be used to produce electricity.

## **2.5: Conceptualization of the Study**

This section relate to various independent variables that is financial resources, organizational strategies, stakeholders involvement and innovation as a result of implementation of RE projects with dependent variable increased energy supply and socio-economic development in Kenya. Developing countries offer unique opportunities for cultivating sustainable energy in large part because the bulk of their energy demand and investments still lie before them. The World Bank Group has committed to nothing less than an evolution in the rate and scale with which sustainable clean energy services

are expanded to those who lack them, and the new dimension in global partnerships that is needed to bridge the modern energy divide. (The World Bank Group, Renewable Energy for Development, 2007). This study will examine the concepts associated with variables identified for implementation of RE projects such as financial resources, organizational strategies, stakeholders' involvement and innovation.



**Figure 2.1: Conceptual Framework**



### **2.5.1: Variables**

The above framework shows the relationship between the four independent variables that is financial resources, organizational strategy, new technology and stakeholders' involvement with the intervening variable which is infrastructure development projects so as to arrive at increased energy supply and socio economic development being the dependent variable.

### **2.6 Summary of the Chapter**

The review of existing literature reveals that there are several important research topics in the study of determinants that influence the implementation of infrastructure development projects in renewable energy sector. This section identifies a number of research gaps that this study tries to address to contribute to current theoretical base. However the literature did not have a study which addressed variables like organizational strategy, financial resources, stakeholders' involvement and technology influence in the implementation of renewable energy development projects

This study will examine the determinants that influence the implementation of infrastructure development projects in renewable energy sector. It will also investigated the concept of organizational strategy, financial resources, stakeholders' involvement and technology influence in the implementation of renewable energy development projects. There are only few studies that looked into the determinants that influence the implementation of infrastructure development projects but there is non that has been carried out concerning determinants that influence the implementation of infrastructure

development projects in renewable energy sector in specific KenGen, despite the availability of such studies in the western world. The need is felt to have a research in this field.

## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

#### **3.1: Introduction**

This chapter presents the research methodology that was used in the study. It covers the research design, target population, sample design, data collection, validity and reliability of data collection instruments, data analysis techniques, and ethical considerations.

#### **3.2: Research Design**

A research design is the general plan of how one goes about answering the research question (Saunders, 2007). A descriptive survey research design was used to obtain data. This design is considered appropriate for the type of objective of this study and the analysis to determine the factors that influence the implementation of infrastructure development projects in renewable energy sector in Kenya. This research was both explanatory and descriptive. It is explanatory in the sense that the problem is examined with an aim of establishing the casual relationships between variables. On the other hand, it qualifies as descriptive since it sought to portray the phenomenon through describing events, situations and processes.

The emphasis in this study was to examine a situation or problem in order to explain the relationships between variables (Saunders, Lewis & Thornhill, 2000). This study largely relied on a qualitative approach since it depended on peoples experience and detailed descriptions of events.

### 3.3: Target Population

According to Isidor (1982), a population can be defined as an entire set of relevant units of analysis or data. The target population of this study was the top and middle management staff from the Kenyan Parastatal in the energy sector, namely Kenya Electricity Generating Company (KenGen). The target population was drawn from a group of individuals who are actively involved in the implementation of infrastructure development projects in renewable energy sector in the organization as Project team members.

Cooper and Schindler (2003) describe a population as the total collection of elements whereby references have to be made. The population of interest for this study was the KenGen Limited employees in functional departments who had the relevant information. The research targeted top level managers, middle level employees and low level employees who work at KenGen Limited headquarters who make a total of 240 respondents.

**Table 3.1: Target Population**

<b>Category</b>	<b>Population</b>	<b>Percentage</b>
Top level managers	30	12.5%
Middle level employees	90	37.5%
Low level employees	120	50%
Total	240	100%

### 3.4: Sampling Strategy

Stratified random sampling was used to pick 30% of the target population. According to Mugenda & Mugenda (2008), a sample size of 30% of the population is representative of the population and economical viable. The sample size was 9 top level management 27 middle level employees and 36 low level employees. The sample size for the study included 72 respondents. The advantage of this method is that there in an increase in a sample's statistical efficiency and enables different research methods and procedures to be used in different strata (Cooper & Schindler, 2003). The sample from the population is selected on the basis of suitability for the objective research, as a matter of convenience.

**Table 3.1: Sample Population**

Category	Sample size	Percentage
Top level managers	9	12.5
Middle level employees	27	37.5
Low level employees	36	50
Total	72	100

### 3.5: Data Collection Methods

The researcher used primary and secondary sources of data for this study. The primary data was obtained from the respondents through a structured questionnaire comprising of closed and open-ended questions. The questionnaire was divided into 2 parts: - Part A – designed to obtain general demographic data of the respondents. Part B – consisted of

questions focusing on factors influencing the implementation of renewable energy projects.

### **3.6: Reliability of Study Tools**

The most popular methods used in estimating reliability were the use of measures of internal consistency. The questionnaire was pre-tested through a pilot test with individuals from the same organization previously involved in renewable energy project but not part of the sample population in the study to avoid double inclusion of pre-test participants in the main study. Their feedback helped in making vital adjustments to enhance reliability and validity of the study findings. To ascertain the reliability of the data collection instrument was examined by professionals who include researchers, supervisors and modifications was done based on the responses obtained.

### **3.7: Validity of Study Tools**

Data quality was incorporated in the entire study process especially at the data collection point to include completeness of questionnaires, legibility of records and validity of responses. At the data processing point, quality control include; data cleaning, validation and confidentiality. There were no statistical tests to measure validity, thus subjected to opinions based on the judgment of the researcher. Nevertheless, there were three types of validity that were addressed and stated; Face validity with pre-testing of survey instruments will be a good way used to increase the likelihood of face validity. Content validity the use of expert opinions, literature searches, and pretest open-ended questions helped to establish content validity.

### **3.8: Data Analysis**

Data was collected, examined and checked for completeness and clarity. Descriptive statistics was used and it integrated both the qualitative and quantitative techniques in the data analysis. Part A and B were analyzed using frequency tables, while part C was analyzed using frequencies, mean scores, and standard deviations. Statistical Package on Social Sciences (SPSS) was used in statistical analysis. A multivariate regression model will be applied to determine the correlation coefficients from the regression will show the effect (whether positive or negative) of the independent variables on the dependent variable.

#### **3.8.1: Regression Model**

A multivariate regression model was applied to establish the relative importance of each of the four variables in relation to the study which sought to understand the factors that influence the implementation of infrastructure development projects in Renewable Energy Sector specifically in KenGen. The regression model was as follows:

$$y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \epsilon$$

**Where:**

Y = Increased energy supply & socio-economic development

$\beta_0$  = Constant Term

$\beta_{1,2,3,4}$  = Beta coefficients

$X_1$  = Organizational Strategy

$X_2$  = Financial Resources

X<sub>3</sub>= Stakeholders Involvement

X<sub>4</sub>=New Technology/Innovation

### **3.9: Operational Definition of Variables**

The operational definition is drawn to ensure consistent data collection that eliminates ambiguity. To operationalize the questionnaire on factors influencing implementation of renewable energy projects, each critical variable was expounded as indicated in Table 3.3 below. Relevant questions on all key issues was developed and indicated against each dimension



### 3.10: Operationalization

**Table 3.3: Operational Definitions of Variables and Measuring Indicators**

<b>Variables</b>	<b>Operational definition</b>	<b>Measurements</b>	<b>Measurements Scales</b>	<b>Study Designs</b>	<b>Tools of Analysis</b>
<b>Research Objective 1</b>	To establish whether financial resources influence the implementation of renewable energy development projects in Kenya.				
<b>Independent Variables</b> Financial Resources	Skillful drive of project (seek to answer the questions Who? What? When?)	1) Equity and Debt 2) Capital Investment Incentives 3) Subsidies 4) Tax Credit 5) Loan	Nominal  Interval	Qualitative and Quantitative	Descriptive statistical analysis by computing the means, standard deviation of responses to questionnaire items.
<b>Research</b>	To determine how organizational strategy influence the implementation of renewable energy development				

<b>Objective 2</b>	projects in Kenya.				
<b>Independent Variables</b>	Level of top management commitment and involvement	<ul style="list-style-type: none"> <li>• Organization Culture</li> <li>• Organization Design</li> <li>• Organization Competitive Advantage</li> <li>• Organization Change Management</li> </ul>	Ordinal  Interval	Qualitative and Quantitative	Descriptive statistical analysis by computing the means, standard deviation of responses to questionnaire items.
Organizational Strategy					
<b>Research Objective 3</b>	To determine how technology influence the implementation of renewable energy development projects in Kenya				
<b>Independent Variable</b>	Technological support in the implementation of renewable energy projects	<ul style="list-style-type: none"> <li>• Technological Innovation</li> <li>• Cost of Renewable Energy</li> <li>• Technological</li> </ul>	Nominal  Interval	Qualitative and Quantitative	Descriptive statistical analysis by computing the means, standard deviation of
Technology					

		<p>Advancement</p> <ul style="list-style-type: none"> <li>• Sufficient Resource</li> <li>Data</li> <li>• Product Quality</li> <li>• Research &amp; Development</li> <li>• Human and Manufacturing Capacities</li> </ul>			<p>responses to questionnaire items.</p>
<p><b>Research Objective 4</b></p>	<p>To determine whether stakeholders' involvement influence the implementation of renewable energy development projects in Kenya</p>				
<p><b><i>Independent Variables</i></b> Stakeholders'</p>	<p>Dissemination of project information to all stakeholders</p>	<p>1) Stakeholders Trust</p> <p>2) Number of Stakeholders</p>	<p>Nominal</p> <p>Interval</p>	<p>Qualitative and Quantitative</p>	<p>Descriptive statistical analysis by computing the means, standard</p>

Involvement		Forum 3) Stakeholder Engagement Mechanism			deviation of responses to questionnaire items.
<b><i>Dependent Variable</i></b>  Renewable Energy Project Implementation	Ability of project implementation to deliver the desired results	<ul style="list-style-type: none"> <li>• Business Value (increased effectiveness, efficiency and cost savings)</li> <li>• Completion of Project within Time and Budget</li> <li>• Budget Overruns and Abandoned projects</li> </ul>	Nominal  Interval	Qualitative and Quantitative	Descriptive statistical analysis by computing the means, standard deviation of responses to questionnaire items.

### **3.11 Ethical Considerations**

The study embraced a high degree of confidentiality. The researcher first sought consent of the respondents before administering questionnaires or conducting the interviews. Respondents did not write or say their names and the information obtained from them was not passed to any other third party. The information was only meant for the purpose of the study. The researcher had to identify herself first to the respondents.

## CHAPTER FOUR

### DATA ANALYSIS, PRESENTATION AND INTERPRETATION

#### 4.1 Introduction

This chapter discusses the interpretation and presentation of the factors that contributes to implementation of infrastructure development projects in renewable energy sector in Kenya. The research made use of frequency tables, percentages, mean and standard deviation to present data.

#### 4.2 Background Information

The respondents to the research study were categorized in order of the gender, level of education and their level of engagement at KenGen.

#### Response Rate

The questionnaire return rate is shown in the Table below

**Table 4.1: Response Rate**

	Top Level Managers		Middle Level Managers		Low Level Managers	
	Frequency	% response rate	Frequency	% response rate	Frequency	% response rate
<b>Non response</b>	1	11.1%	2	7.4%	3	8.3%
<b>Actual respondents</b>	8	88.9%	25	92.6%	33	91.7%
<b>Targeted respondents</b>	9	100%	27	100%	36	100%

In Table 4 the response rate for top level managers, middle level employees and low level employees were 88.9%, 92.6% and 91.7% respectively. This was found satisfactory for the study to draw valued conclusion. It was found to be consistent with widely held rule of thumb which commends a sample of 50% respondents and above as adequate for application of statistical tools proposed for this study. This commendable response rate was actualized after the researcher made personalized visits to the participants to explain the importance of participating in the study.

#### **4.2.1 Gender of respondents**

The gender of respondents was listed as either male or female as demonstrated below.

**Table 4.2: Gender**

Gender	Frequency	Percent
Male	30	90.9
Female	3	9.1
Total	33	100.0

From the above table male respondents dominated the study by having a percentage of 90.9% while female respondents had a percentage of 9.1%.

#### **4.2.2 Level of Education**

Respondents' level of education was categorized from a Masters degree to Tertiary college level

**Table 4.3: Level of Education**

Education Level	Frequency	Percent
Master's degree	19	57.6
Bachelor's degree	13	39.4
College Level	1	3.0
Total	33	100.0

The highest number of respondents had a Master's degree and bearing 57.6% followed by Bachelor's degree respondents which had 39.4%. Respondents who had College education had the least percentage of 3%.

#### **4.2.3 Level of engagement in the company**

Respondents' of the study would be at various levels from the top to lower level as demonstrated

**Table 4.4: Level of engagement in the company**

Level of engagement	Frequency	Percent
Top level management	3	9.09
Middle level management	22	66.67
Lower level management	8	24.24
Total	33	100.0

The table shows that majority of the respondents were in the middle level management having a percentage of 66.67% followed by low level management which had 24.24% and lastly the top level management which comprised of 9.09%. Majority of the respondents worked in middle level management positions.



### **4.3 Organizational Strategy and implementation of projects**

The respondents indicated the following as the overall KenGen's business strategies: to achieve 3000MW of installed capacity by the year 2018 from the current 1240 MW. To enhance growth, efficient operations, innovation and human resource readiness profile. To expand the geothermal power generation resource and to generate competitively priced electricity in the most environmental friendly manner using state of art technology. To lead in the market in the provision of reliable, safe, quality and competitively priced electric energy in the Eastern Africa region. To lead in the country in meeting the country's energy demands through accelerated projects such as geothermal, wind, solar and hydro. Its strategies have been built in three main key pillars that is expansion, optimization of cost through reduction of operation and maintenance cost. Another strategy is to maintain and improve its competitive advantage through human resource management and using modern technology. KenGen's overall business strategy is based on the three key areas of capital planning and execution, regulatory management and operational excellence and aims to achieve organizational health through performance management, promotion and succession planning and proper structure and governance policies.

#### **4.3.1 Strategies to implementation of renewable energy development projects**

The existence of the organization's strategies was portrayed as follows;

**Table 4.5: Strategies to implementation of renewable energy development projects**

Strategies	Frequency	Percent
Yes	33	100.00
No	0	0
Total	33	100.00

From Table 8 above 100% of the respondents agreed that KenGen had strategies to implementation of renewable energy development projects.

#### **4.3.2 Strategy Used**

The respondents chose amongst four strategies that KenGen applied in its projects

**Table 4.6: Strategy Used**

Type of Strategy	Mean	Std deviation
Organization Design	1.24	1.330
Culture Development	1.61	1.306
Change Management	1.52	1.289
Competitive Advantage	1.36	1.157

From the above table organization design was the most used strategy having a mean of 1.24 followed by competitive advantage which had a mean of 1.36. There was however a disparity on the use of change management and culture development as they had a mean of 1.52 and 1.61 respectively.

This showed that organization design was the most preferred strategy by the company in its implementation of renewable energy projects.

### **4.3.3 Innovative Strategies**

The respondents specified the following as the innovative strategies that KenGen can use to enhance implementation of renewable energy development projects. Raising financial resources from local and external sources geared towards geothermal, solar and wind energy. They suggested implementation of projects that make use of renewable energy and partnering with global institutions that design, manufacture and trade in renewable energy plants. They also recommended conversion of municipal waste into electricity especially in urban areas. They further suggested enhancement of a strong capital base and engagement of development partners and strategic alliances due to capital intensive nature of renewable energy development projects. Participation in carbon credit and pursuing green and renewable energy were also suggested as innovative strategies. Acquisition of modern technology such as efficient machines, training of staff on how to operate machines and knowledge exchange programmes with countries which implement similar projects were also mentioned as innovative strategies. Others suggested strategies were: public private partnership, hybrid sources between wind, solar, geothermal and hydropower generation and pumped storage of hydropower water from dams downstream to those upstream using alternative sources such as wind power and solar.

### **4.3.4 Influence of Organizational Strategies**

The influence of various organizational strategies was rated using the ordinal scale based on the respondent's feedback

**Table 4.7: Organizational strategies on the implementation of renewable energy developments in Kenya**

Organizational Strategies	Mean	Std. Deviation
KenGen organization culture support implementation of renewable energy development projects	2.35	1.112
KenGen organization design/structure supports implementation of renewable energy development projects	2.06	1.294
KenGen has competitive advantage for implementation of renewable energy development projects compared with other organization in Kenya	1.72	1.350
KenGen is striving to bring about change in its operations	2.03	1.150
KenGen efficiently manage change	3.09	1.174

From the above table the respondents seemed to be undecided on whether KenGen efficiently managed change with a mean of 3.09. However they agreed that KenGen organization culture supported implementation of renewable energy development project having a mean of 2.35. A further mean of 2.06 showed that the respondents agreed that KenGen organization design/structure supported implementation of renewable energy development projects. This was closely followed by a mean of 2.03 that indicated that the respondents agreed that KenGen was striving to bring about change in its operations. They further agreed that KenGen had competitive advantage for implementation of renewable energy development projects compared with other organization in Kenya.

#### **4.4 Financial Resources and Implementation of Renewable Energy Development Projects**

Preferred financing options were rated using ordinal scale based on the respondents' feedback as below;

**Table 4.8: Financing renewable projects**

Financing options	Mean	Std. Deviation
Financing renewable project by equity and debt	1.06	.246
Financing renewable project by capital incentives	1.69	.471
Financing renewable project by tax credit	1.72	.457
Financing renewable project by subsidies	1.69	.471

From the above table equity and debt was ranked first as the form of financing renewable project with a mean of 1.06. They however disagreed on use of capital incentives and subsidies as a form of financing its renewable project from the mean of 1.69 each. They further disagreed on use of tax credit to finance renewable project as a mean of 1.72 was obtained.

##### **4.4.1 Effect of method of financing renewable projects on project implementation**

Respondents chose either yes or no on if the method of financing had an effect on implementation.

**Table 4.9: Effect of method of financing renewable projects on project implementation**

Effect	Frequency	Percent
Yes	30	90.9
No	3	9.1
Total	33	100.00

It is clearly shown from the above table that 90.9% of the respondents agreed that the method of financing renewable projects chosen by KenGen affected implementation of the project while 9.1% disagreed. They gave the following reasons concerning the same: that in case of delay in funding that the period of project implementation also increased. That investors preferred investing in renewable energy and for that KenGen attracted financiers more easily than if it were to invest in non-renewable projects. They further suggested that projects were mainly funded through credit facilities and since KenGen had a healthy capital base and being governed by the government it was able to attract sizeable levels of funding. Delays in releasing funds in timely manner to support completion of projects within the stipulated time was also given as a reason as to why the methods of financing renewable projects affected their implementation.

#### **4.4.2 Yearly Turnover in Renewable Energy Projects**

The yearly turnover in renewable energy projects was rated using interval scale as follows;

**Table 4.10: Yearly Turnover in Renewable Energy Projects**

Yearly turnover (In millions)	Frequency	Percent
Between KShs 100 to 200	1	3.0
Between KShs 300 to 400	2	6.1
KShs 500 and above	30	90.9
Total	33	100.0

90.9% indicated that KenGen’s yearly return was more than 500 million. A lesser percentage of 6.1 voted for amount between KShs 300 to 400 million. Further respondents having 3% indicated that the annual income was between KShs 100 to 200 million. This showed that the company had an annual turnover of more than KShs 500million.

#### **4.4.3 Whether methods of financing renewable projects by KenGen were sustainable**

Sustainability of financing methods was queried and respondents’ responses are detailed below.

**Table 4.11: Whether methods of financing renewable projects by KenGen were sustainable**

Sustainability	Frequency	Percent
Yes	24	72.7
No	9	27.3
Total	33	100.0

Of the total respondents, 72.7% agreed that the methods used by KenGen in financing their renewable energy projects were sustainable while 27.3% disagreed. Those who agreed gave the following reasons: clean development mechanism payments are being earned from most new renewable projects. The credit facilities are advance based on KenGen's equity and therefore the company only borrows the much it can service. All projects start pre-agreed power purchase agreements and only economically viable projects are undertaken. That since the credit facilities were advanced based on KenGen's equity, this limited the amount to borrow. That with long-term strategies and fixed interest rates which would cushion any currency fluctuations there would be sustainability. The financing method of bonds is sustainable financially economically and in management terms. The strategies are long term and interest rates are fixed cushioning any currency fluctuations hence its sustainability. Those who disagreed gave the following reasons: that they were not sustainable as risks were higher due to externalities beyond the company's control and that they were best if internally generated funds. That there was increased debt burden due to high costs of projects and that transfer of technology is not well addressed in project implementation.

#### **4.4.4 How financial resources influence implementation of renewable energy development projects**

The financing options used to implement the renewable energy projects were rated using ordinal scale as per the respondents' feedback.



**Table 4.12: Financial resources influence implementation of renewable energy projects**

	Mean	Std. Deviation
Financing Options		
KenGen finance renewable project by use of equity and debt	1.94	1.263
KenGen gets capital investment incentives for renewable energy projects	2.65	1.330
KenGen gets tax credit for renewable energy projects	2.47	1.306
KenGen gets subsidies for renewable energy projects	2.83	1.289
Previous funded projects have been successful	1.84	1.157
Financial resources influence the implementation of renewable energy development projects	1.59	1.266

From the study a mean of 2.83 was obtained which indicated that the respondents were unsure whether KenGen got subsidies for renewable energy projects. A further mean of 2.65 was obtained showing indecision on whether KenGen got capital investment incentives for renewable energy products. They however agreed that KenGen got tax credit for renewable projects showing a mean of 2.47. From yet another mean of 1.94 it indicated that they agreed that KenGen financed renewable project by use of equity and debt. They agreed that Kengen’s previous funded projects had been successful from a mean of 1.84. An additional mean of 1.59 indicated that they agreed that financial resources influenced the completion of renewable energy development projects.

## **4.5: Stakeholders Involvement and Implementation of Renewable Energy Development Projects**

The ownership of the case study organization was detailed as shown below.

### **4.5.1 Distribution of ownership**

**Table 4.13: Distribution of ownership**

Ownership	Frequency	Percent
Partially government owned	30	93.9
Solely government owned	1	1.5
Privately owned	2	4.6
Total	33	100.0

From the Table 16, 93.9% of the respondents agreed that KenGen was partially government owned while 4.6% indicated that it was privately owned and still 1.5% said it was solely government owned. This meant that KenGen was partially owned by the government. The respondents indicated that the private shareholders had 30% stake while the rest, 70% was owned by the government.

#### 4.5.2 Involvement of stakeholders

Were stakeholders engaged in the decision making activities undertaken by the organization? Their level of involvement was informed by the respondents' responses as shown.

**Table 4.14: Involvement of stakeholders**

Stakeholders involvement	Frequency	Percent
Yes	30	92.4
No	3	7.6
Total	33	100.0

The table above shows that 92.4% of the respondents agreed that KenGen involved its stakeholders in the implementation of renewable energy development projects while 7.6 disagreed with the statement. This implied that the stakeholders were involved in implementation of renewable energy development projects.

Those who agreed highlighted the following as the ways in which they involved the stakeholders. Through its annual general meeting where financial/investment resolutions were passed. By hosting communities through social corporate responsibility programs where local communities were involved throughout project stages. Through financiers who worked closely with them to fulfill all their conditions. The Local communities are sensitized about the benefits of the project in Media coverage through documentation. The government is involved in the whole process of project design and implementation. Stakeholders are also involved through environmental impact assessment studies and stakeholder project committees where

environment and social impact issues are addressed. The government secures credit for projects while NEMA limits environmental impact of the project and clean development mechanism.

**4.5.3 How stakeholders are involved in implementation of renewable energy development projects**

This section aimed at investigating stakeholder’s involvement in implementation of renewable energy development projects

**Table 4.15: Stakeholders involvement in implementation of energy**

Stakeholders Involvement	Frequency	Percent
Capital Contribution	38	57.6
Policy Formulation	13	19.7
Community Resource Sharing	15	22.7
Total	66	100.0

The table above shows that the stakeholders who were involved in KenGen’s energy implementation project through capital contribution was 57.6% followed by community resource sharing with 22.7% and finally policy formulation with 19.7%. This showed that stakeholders were mainly involved in energy implementation through capital contribution.

The following ways were given by respondents as the ways in which stakeholders’ involvement influenced the implementation of renewable energy development projects by KenGen: the government may sometimes raise objections thus delaying project implementation. The Government and other regulatory agencies may ask for

approvals such as smooth roll outs of projects before implementation. They also influence as they are involved in providing resources such as funds. The money they offer is used to acquire resources on time. The market they offer for electricity helps in revenue generation. The government policies help in regulating the markets for electricity. Sharing of technical knowledge keeps KenGen abreast in terms of information. They ensured that projects are implemented on time and within budget and all socio-environmental concerns were addressed.

#### **4.5.4 How stakeholders’ involvement influences completion of renewable energy development projects**

This section aimed at ascertaining stakeholders’ involvement and its influence on completion of projects

**Table 4.16: How stakeholders’ involvement influences completion**

Level of Stakeholders involvement	Std. Mean Deviation
Stakeholders have trust with KenGen	2.16 1.167
KenGen frequently hold stakeholders forum	2.13 1.129
Stakeholder are happy with KenGen engagement mechanism	2.58 .992
Stakeholders involvement influence the implementation of renewable energy development projects	1.69 1.230

The respondents were undecided of whether the stakeholders were happy with KenGen engagement mechanism from a mean of 2.58 obtained. They however agreed that stakeholders had trust with KenGen from a mean of 2.16 obtained from the study. A further mean of 2.13 indicated that the respondents agreed that KenGen frequently held stakeholders forum. They also agreed that stakeholders' involvement influenced the implementation of renewable development projects as depicted by a mean of 1.69.

#### **4.6 Technology and Implementation of Renewable Energy Development Projects**

##### **4.6.1 Influence of technology**

Respondents were requested to indicate their level of agreement on technology and impact on implementation of renewable energy development projects

**Table 4.17: Influence of technology**

Influence of technology	Frequency	Percent
Yes	32	97.0
No	1	3.0
Total	33	100.0

It can be seen that 97% of the respondents agreed that technology had influence on implementation of renewable energy development projects in Kenya as obtained from the study. A further 3% disagreed with the statement. They gave the following reasons: acquisition of state of art technology plants in research and development. Progress monitoring such as MS project program in the implementation stages was also given as a reason why technology influenced implementation. The other reason was through research on sites (location) of sources of renewable energy.

#### 4.6.2 Factors considered in renewable energy infrastructure projects

On investigating respondents view in relation to factors considered in renewable energy infrastructure projects, the following was found

**Table 4.18: Factors considered**

External factors	Mean	Std. Deviation
KenGen considers social factors	1.37	.492
KenGen considers environmental factors	1.09	.296
KenGen considers economic factors	1.16	.369
KenGen considers legal factors	1.41	.499

The respondents highlighted that the most common factor considered in renewable energy technology adoption by KenGen was environmental factors with a mean of 1.09 followed by economic factors with 1.16 and social factors with 1.37. The least factor to be considered was legal factors with a mean of 1.41. This was interpreted to mean that KenGen mainly considered environmental factors in adoption of renewable energy technology

#### 4.6.3 Technologies Applied

The study aimed at investigating how Technologies was applied in KenGen

**Table 4.19: Technologies Applied**

Types of Technologies	Std.	
	Mean	Deviation
KenGen applies geothermal technology	1.00	.000
KenGen applies wind power technology	1.06	.246
KenGen applies hydroelectric power technology	1.19	.397
KenGen applies solar photovoltaic energy technology	1.59	.499

The use of geothermal development having a mean of 1.00 meant that the respondents agreed that it was the main technology applied by KenGen in renewable energy projects. Wind power technology had a mean of 1.06 still indicating that it was applied in renewable energy projects followed by hydroelectric power with a mean of 1.19. The respondents however disagreed on the use of solar photovoltaic energy technology as it garnered a mean of 1.59. This meant that KenGen mainly applied geothermal technology for enhancing its renewable energy projects.

#### **4.6.4 Rate of level of technology**

Table 4.20 tabulates the findings as gathered from the respondents on the rate of level of technology in KenGen



**Table 4.20: Rate of level of technology**

Level of technology	Frequency	Percent
Exceptional	2	6.1
Very Good	26	78.8
Good	2	6.1
Average	3	9.1
Total	33	100.0

From the study 78.8% of the respondents rated the level of technologies adopted by KenGen in implementation of renewable energy as very good. 9.1% thought it was average and those that believed it was exceptional and good bore a percentage of 6.1 each. This was an indication that the rate of technology at KenGen was appealing to many and the reason they thought it was very good.

They however unanimously opinionated that the level of technology used needed further improvements.

#### **4.6.5 How technology influences implementation of renewable energy development projects**

This section aimed at establishing respondents view on how technology influences implementation of renewable energy development projects in KenGen

**Table 4.21: How technology influences implementation**

Influence of technology	Mean	Std. Deviation
KenGen has innovative edge on renewable energy as it allocates intensive resource on technology development.	2.26	1.043
KenGen has continuous technological innovation so as to make renewable energy as a viable solution	2.39	1.114
KenGen cost of renewable energy has drastically reduced because of technological advancement in efficiency under mass production	2.43	1.218
Kenya has the right technological infrastructure	2.84	1.051
There is general lack of knowledge among the people about acceptable quality and standards of technology	4.15	0.982
KenGen lack skilled labour to operate and maintain renewable energy equipment	4.22	.832
KenGen is well equipped to carry out research and development on renewable energy	2.94	1.162

From the study the respondents disagreed that KenGen lacked skilled labour to operate and maintain renewable energy equipment as shown by a mean of 4.22. The respondents also disagreed that there was general lack of knowledge among the people about acceptability of quality and standards of technology from a mean of 4.15 obtained. A further mean of 2.94 indicated that the respondents were unsure as to whether KenGen was well equipped to carry out research and development on

renewable energy. They were also unsure as to whether Kenya had the right technological infrastructure with a mean of 2.84. From the mean of 2.43 obtained it indicated that the respondents thought that the cost of renewable energy had drastically reduced because of technological advancement in efficiency under mass production. The study further indicated respondents agreed that KenGen had a continuous technological innovation that made renewable energy a viable solution having a mean of 2.39. With a mean of 2.26 the respondents had agreed that KenGen had innovative edge on renewable energy as it allocated resource on technology development.

#### 4.7 Regression Analysis of the Findings

The researcher conducted a multiple linear regression analysis so as to determine the relationship between the factors affecting increased energy supply and socio-economic development and the four independent factors namely: organizational strategy, financial resources, stakeholder’s involvement and new technology/innovation.

**Table 4.22 Model Summary**

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
1	0.738	0.611	0.724	0.3215

- a) Predictors: (Constant), organizational strategy, financial resources, stakeholders involvement, and new technology/innovation.

b) Dependent variable: Increased energy supply and socio-economic development

The study used the R square. The R Square is called the coefficient of determination and tells us how the increased energy supply and socio-economic development varied with organizational strategy, financial resources, stakeholder’s involvement, and new technology/innovation. The four independent variables that were studied explain 61.1% of the factors that lead to increased energy supply and socio-economic development as represented by R Squared (Coefficient of determinant). This therefore means that other factors not studied in this research contribute 38.9% of the factors affecting increased energy supply and socio-economic development in KenGen.

**Table 4.23: ANOVA**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11.72	8	1.302	44.231	.000(a)
	Residual	3.432	25	0.066		
		15.152	33			
	Total					

a) Predictors: (Constant), Organizational strategy, financial resources, stakeholders involvement, and new technology/innovation

b) Dependent Variable: Increased energy supply and socio-economic development

The study used ANOVA to establish the significance of the regression model from which an f-significance value of p less than 0.05 was established. The model is statistically significant in predicting how organizational strategy, financial resources,

stakeholders involvement and new technology/innovation affect increased energy supply and socio-economic development in KenGen. This shows that the regression model has a less than 0.05 likelihood (probability) of giving a wrong prediction. This therefore means that the regression model has a confidence level of above 95% hence high reliability of the results.

**Table 4.24 Coefficients Results**

	Unstandardized		Standardized	t	Sig.
	Coefficients		Coefficients		
	B	Std. Error	Beta		
(Constant)	0.116	.186		0.623	.535
Organizational strategy	0.577	.068	.559	8.478	.000
Financial resources	0.157	.043	.257	3.676	.036
Stakeholders involvement	0.082	.042	.301	2.252	.020
New technology/innovation	0.021	.002	.245	6.906	.001

a) Predictors: (Constant), organizational strategy, financial resources, stakeholders involvement, and new technology/innovation

b) Dependent Variable: Increased energy supply and socio-economic development

The established regression equation was

$$Y = 0.116 + 0.577X_1 + 0.157X_2 + 0.082X_3 + 0.021X_4 + \varepsilon$$

The regression equation above has established that holding all factors (Organizational strategy, financial resources, stakeholders' involvement and new technology/innovation) constant, factors affecting increased energy supply and socio-economic development in KenGen will be 0.116. The findings presented also shows that taking all other independent variables at zero, a unit increase in organizational strategy will lead to a 0.577 increase in the scores of increased energy supply and socio-economic development in KenGen. A unit increase in financial resources will lead to a 0.157 increased in energy supply and socio-economic development. On the other hand, a unit increase in stakeholders' involvement will lead to a 0.082 increase in the scores of energy supply and socio-economic development; and a unit increase in new technology/innovation will lead to a 0.021 increase in the scores of energy supply and socio-economic development. This infers that organizational strategy influences the increase of energy supply and socio-economic development most followed by stakeholder's involvement, financial resources and then new technology/innovation. The study also established a significant relationship between increased energy supply and socio-economic development and the independent variables; organizational strategy ( $p=0.00<0.05$ ), board financial resources ( $p=0.036<0.05$ ), stakeholders involvement ( $p= 0.20<0.05$ ) and new technology/innovation ( $p=0.001<0.05$ ) as shown by the p values.

#### **4.7.1 Non-parametric correlation**

A Spearman correlation is used when one or both of the variables are not assumed to be normally distributed. The values of the variables were converted in ranks and then correlated. The study correlated organizational strategy, financial resources,

stakeholder's involvement and the new technology/innovation under the assumption that both of these variables are normal and interval.

**Table 4.25 Correlations**

			Organizational strategy	Financial resources	Stakeholders involvement	New technology/innovation
Spearman's rho	Organizational strategy	Correlation	1.000	.617	.547	.667
		Coefficient	.	.000	.000	.000
		Sig. (2-tailed)	.61	.61	.61	.61
		N				
	Financial resources	Correlation	.617	1.000	.437	.235
		Coefficient	.000	.	.000	.001
		Sig. (2-tailed)	.61	.61	.61	.61
		N				
	Stakeholders involvement	Correlation	.547	.437	1.000	.441
		Coefficient	.000	.000	.	.002
		Sig. (2-tailed)	.61	.61	.61	.61
		N				



New	Correlation	.667	.235	.441	1.000
technology/innovation	Coefficient	.000	.000	.000	.
	Sig. (2-tailed)	.61	.61	.61	.61
	N				

The results suggest that the relationship between organizational strategy and financial resources ( $\rho = 0.617$ ,  $p = 0.000$ ) is statistically significant. Organizational strategy and stakeholders' involvement had a  $\rho$  of 0.547 and a  $p$  value of 0.000 therefore denoting statistical significance. Similarly, the organizational strategy and new technology/innovation posted a  $\rho$  of 0.667 with a  $p$  value of 0.000 therefore providing a statistical significance. Financial resources and stakeholders involvement had a  $\rho$  of 0.437,  $p=0.000$  further pointing to a statistical significance. On the same note, the financial resources and new technology/innovation correlated at  $\rho=0.235$  and  $p=0.001$ . This therefore is statistically significant. Finally, the stakeholders involvement and new technology/innovation stood at a correlation of  $\rho=0.441$  and  $p= 0.002$  revealing statistical significance.

**CHAPTER FIVE**

**SUMMARY OF FINDINGS, DISCUSSION, CONCLUSION AND  
RECOMMENDATION**

**5.1 Introduction**

This chapter presents the summary of findings, discussions, conclusions drawn from the findings and recommendations made. The conclusions and recommendations drawn focus on the purpose of the study.

**5.2 Summary of Findings**

The study findings indicates that KenGen had strategies for implementation of renewable energy development projects and further pinpointing that the main strategy was organization design as the most preferred form of strategy in implementing renewable energy projects in KenGen.

The findings revealed that KenGen mostly used equity and debt in financing its renewable projects. From the study it can be deduced that the method of financing renewable project by KenGen had an effect on its project implementation. It is also evident that KenGen had a yearly turnover of over 500 million Kenya shillings from its renewable energy projects. The study further indicated that the methods of financing renewable energy projects by KenGen were sustainable.

The study findings also showed that KenGen was partially owned by the Kenyan government as it had 70% shares. The study findings also showed Kenyan government involved its stakeholders in the implementation of renewable energy development projects. Further from the study findings it was revealed that the

stakeholders mostly influenced the implementation of energy development projects through capital contribution.

The study findings showed that technology had influence on completion of renewable energy development projects in Kenya. Environmental factors were highlighted as the major factor considered in adopting renewable energy technology. The findings also clearly depicted the use of geothermal development in KenGen's renewable energy projects. The study findings further disclosed that the technologies adopted by KenGen in implementation of renewable energy as being very good.

### **5.3 Discussions**

As discussed earlier, the culture that organizations can change is simply by declaring new values. A culture aligned with strategic objectives clearly demonstrates achievement of significantly better business results. The results findings show that KenGen is striving to bring about change in its operations. Michael E. Porter, 1998 suggested that for change to be, 75 percent of a company's management needs to "buy into" the change. The strategies employed by an organization will be dependent on the nature of its business, the corporate vision it has and the niche it strives to achieve in the market place. To create value for its customers the organization will restructure the way it does business by venturing into new market segments (expansion strategy), introducing new products (differentiation), improving on existing ones (new innovation or product development) and completely phasing out outmoded products (retrenchment strategy).

The strategic approach basically puts the organization on a growth track. By aligning the strategies to overall business objectives, the organization is able to evaluate the

progress achieved in as far as cost optimization is concerned, innovation and increase in production say for this case installed capacity to meet the Country's Vision 2030 towards economic transformation. In addition, to cope with the high risky nature of infrastructure development projects especially in renewable energy, new strategies should be employed such as forging partnership with private investors, multilateral and bilateral agencies. Conducive legislative environment should be propagated by lobbying the Government to contribute and support RE projects undertakings through appropriate renewable legislation and regulatory policy framework. Innovative solutions should also be considered from the customers and consumers end and reward schemes such as subsidies initiated to encourage the achievement of the RE projects. Research findings detail that some of the innovative strategies used are conversion of municipal wastes into electricity, participation in carbon credit in pursuit of green solutions or energy, hybrid sources between wind, solar, geothermal and hydropower generation amongst others.

The capital costs of building renewable projects are determinant factors to the implementation of the same in time and within the allocated budget. Financial resources will be availed either from the public or private enterprises. The research findings are that KenGen finances renewable projects by use of equity and debt. The classical project financing models focuses on equity and debt which comprise internal accruals, securities, term loans, working capital advances, bonds, debentures and miscellaneous sources. The basis of funding the infrastructure projects being the shareholders ability to invest their funds or borrow on the basis of security alone. The debt undertaken can only be repaid when the project is operational and is able to accrue revenue on a daily or regular basis with payment being made in arrears. Hence

the rationale of project financing is how to prepare the financial plan, assess the risks, design the financial mix and finally raise the funds.

There has been constitution of project companies' namely special purpose vehicle (s), venture capitals and others to mobilize funds for project investment. The contrast is that the bulk of the financing is non-local and is mostly from international financing organizations guaranteed by beneficiary governments. Private sector funding from institutions such as banks and other financial institutions such as venture capital are important to the long-term commercialization of renewable projects as evidenced by the yearly turnover rate of above Kenya shillings five hundred million for KenGen RE infrastructure development projects.

The method of financing the project has an effect on project implementation for example where development organizations including the World Bank provide a loan guarantee which reduces the risks for commercial lenders and subsequently the interest rates. Investors preferred investing in renewable energy projects and benchmarked their investments to the other capital intensive investments. Investment incentives (subsidies, import duty exemptions, direct capital investment subsidies, investment tax credits) and pre-existing power purchase contracts enables the sustainability of renewable energy development projects. Credit facilities are advanced based on the organizations equity limited the amount borrowed. The financing option such as bonds is critical to ensure sustainability, reliability, stability and credible long-term revenue stream. Past project performance, real and perceived risks could make financing RE development projects difficult or more costly than that available to conventional generation sources.

The organization has trustworthy mechanism that factor in the energy stakeholders in decision making. In the norm, the shareholders' views, the shareholders or stockholders are the owners of the company. The research findings indicate that KenGen is 30% privately owned and 70% government owned. According to Phillips (2007) the firm has a binding fiduciary duty to put stakeholders' needs first, to increase value for them. However, the nature of what is a stakeholder is highly contested. They could involve experts and technology providers, other businesses (as project partners, suppliers or competitors), authorities and politicians at the national and local level, non-governmental organizations and other interest groups, local residents and users. Stakeholders' positions evolve and hence they are not static. Other stakeholders involved include governmental bodies, political groups, trade associations, trade unions, communities, financiers, employees and customers.

Stakeholders are engaged to address emerging and prevailing concerns of the projects that would affect them in the short-term and in the long-term. The engagement mechanisms are negotiations meetings, annual general meetings, corporate social responsibility programs, resettlement action plans and stakeholder committees as seen in the research study. The project teams communicate the project vision and mission to the stakeholders to facilitate the implementation and execution of the same. The stakeholders consequently weigh in the socio-economic, environmental benefits versus concerns they may have such as possibilities of displacement from settlement areas, environmental degradation, and conflict of cultural practices amongst others. Objection to RE project implementation by stakeholders' may delay timelines and strain set resources for the same. The research study portrayed capital contribution as

the main involvement that stakeholders have in regards to renewable energy development infrastructure projects.

As detailed earlier, renewable energy requires intensive resource allocation to sustain innovative edge and in order to stay competitive in the evolving sector. Wilkins (2002) in his book cited that renewable energy technologies benefit from research and development support to ensure the continued development of a strong and competitive industry. Technological support focuses not only on research and development, but also on demonstration and implementation of new technologies as they mature. The influence of new technology or innovation hence cannot be underestimated since there are increasing emerging solutions to the electricity market. There are solar energy ventures, coal exploration, geothermal expansion, wind energy, liquefied natural gas exploration, biomass technology, energy efficiency, hydrogen and carbon dioxide capture and storage. Sometimes the lack of knowledge and skills to adapt the new technology may inhibit the quick adoption and implementation of renewable energy based projects. Many factors need to be considered in regards to technology adoption and these would be environmental, social, economic and legal factors. The research findings show that environmental factors followed by economic factors are major determinants for implementation of renewable energy development projects. To achieve renewable energy development projects, innovation is key or continuous improvement of existing quality, training or skill/technology transfer, research and development and the right technological infrastructure.

## **5.4 Conclusions**

The study concludes that KenGen organization culture supports implementation of renewable energy development projects. Its organization design/structure supported implementation of renewable energy development projects and it has competitive advantage for implementation of renewable energy development projects compared with other organizations in Kenya.

It can further be concluded that KenGen finances renewable projects by use of equity and debt. Its previously funded projects have been successful and its financial resources influences implementation of renewable energy development projects.

The study additionally concludes that stakeholders have trust with KenGen as it frequently holds stakeholders forum. The stakeholders' involvement influences the implementation of renewable energy development projects as depicted by the study.

The study further concluded that KenGen has innovative edge on renewable energy as it allocates intensive resource on technology development. The study also concludes that it has continuous technological innovation so as to make renewable energy as a viable solution. The study concluded that the cost of renewable energy in KenGen has drastically reduced because of technological advancement in efficiency under mass production.

## **5.5 Recommendations**

The study recommends the following;

1. Timely release of funds as a way to ensure completion of projects within the stipulated time.



2. That KenGen ought to borrow more money so as to fund its renewable development projects.
3. Use of asset backed securities to raise funds such as the use of steam as collateral to raise capital from the market.
4. The study further recommends use of high level technological improvements in mega projects so as to make use of various sources to generate electricity from hydro, geothermal and wind. This can be achieved by raising financial resources from local and external sources geared towards geothermal, solar and wind.
5. Implementation of projects that are geared towards renewable energy.
6. Investment is done in R&D for renewable energy studies by partnering with global institutions that design, manufacture and trade in renewable energy plants globally.

## **5.6 Suggestions for further study**

The study recommends the followings as the suggestions for further study;

1. That a similar study should be undertaken by future researchers in a different infrastructure development projects in different sectors so as to compare and contrast results.
2. More research on the individual variable that is organizational strategy, financial resources, stakeholders' involvement and new technology or innovation to enhance deep and through understanding of influences of each variable on renewable energy developments projects.

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## APPENDICES

### Appendix I: Introduction Letter

#### Appendix 1: Letter of Introduction

Caroline Kinya Kiara  
P.O Box 2574, 00100  
Nairobi – Kenya.  
Cell phone 0722831005

The Managing Director  
Kenya Electricity Generating Company Limited  
P.O Box 47936, 00100  
Nairobi.



19<sup>th</sup> March 2013

Dear Sir,

**RE: APPLICATION TO CONDUCT RESEARCH PROJECT**

I am Caroline K. Kiara, a Master of Arts student from the University of Nairobi and wish to carry out a project to identify the determinants that influence the successful implementation of infrastructure development projects in renewable energy sector in Kenya; a case of Kenya Electricity Generating Company Limited.

In my schedule, I would be visiting your organization for a face-to-face interview and a questionnaire with the staff members who will be sampled for this purpose to represent your organization. This therefore is to kindly request your approval to carry out the survey in your esteemed organization to enable successful completion of the project.

Yours Sincerely,

  
Caroline K. Kiara

L50/68591/2011

**Appendix II: Questionnaire**

**Section A: Background Information**

1. What is your Gender?

Male [ ]

Female [ ]

2. What is your highest level of education?

Master's Degree [ ]

Bachelor's Degree [ ]

College level [ ]

3. What is your level engagement in the company?

Top level management [ ]

Middle level management [ ]

Lower level management [ ]

**Section B: Organizational Strategy**

4. What are the overall KenGen business strategies?

.....  
.....  
.....  
.....

5. Does KenGen have strategies to implementation of renewable energy development projects?

Yes [ ]

No [ ]

b) If yes explain the strategies it uses

Organization Design [ ]

Culture Development [ ]

Change Management [ ]

Competitive Advantage [ ]

c) Others Specify .....

.....  
 .....

6. Explain which are the innovative strategies that KenGen can use to enhance implementation of renewable energy development projects?

.....  
 .....

7. To what extent do you agree with the following statement on how organizational strategies influence the implementation of renewable energy development projects in Kenya?

Key: 1 strongly agrees, 2 agree, 3 undecided, 4 disagree, 5 strongly disagree

(please put an X as appropriate)

	1	2	3	4	5
KenGen organization culture support implementation of renewable energy development projects					
KenGen organization design/structure supports implementation of renewable energy development projects					



KenGen has competitive advantage for implementation of renewable energy development projects compared with other organization in Kenya					
KenGen is striving to bring about change in its operations					
KenGen efficiently manages change					

**Section C: Financial Resources**

8. How does KenGen finance its renewable project?

Equity and Debt            [   ]

Capital Incentives        [   ]

Tax Credit                    [   ]

Subsidies                    [   ]

Others

Specify.....

9. Do the methods of financing renewable projects by KenGen affect its project implementation?

Yes                            [   ]

No                              [   ]

b) Give reason for your answer

.....

.....

.....

.....

10. What is KenGen’s yearly turnover in renewable energy projects in terms of Millions of Kenya Shillings

Between Kshs.100Million to Kshs.200 Million [ ]

Between Kshs.300Million to Kshs.400 Million [ ]

Kshs.500Million and above [ ]

11. Are the methods of financing renewable energy projects by KenGen sustainable

Yes [ ]

No [ ]

Give reason for your answer

.....

.....

.....

12. To what extent do you agree with the following statement on how financial resources influence the implementation of renewable energy development projects in Kenya?

Key: 1 strongly agrees, 2 agree, 3 undecided, 4 disagree, 5 strongly disagree

(please put an X as appropriate)

	1	2	3	4	5
KenGen ly finance renewable project by use of equity and debt					
KenGen gets capital investment incentives for renewable energy projects					
KenGen gets tax credit for renewable energy projects					
KenGen gets subsidies for renewable energy projects					

Previous funded projects have been					
Financial resources influence the implementation of renewable energy development projects					

**Section D: Stakeholders' Involvement**

13. How is KenGen's ownership distributed?

Partially government owned [ ]

Solely government owned [ ]

Privately owned [ ]

14. Does KenGen involve stakeholders' in implementation of renewable energy development projects?

Yes [ ]

No [ ]

If yes, explain how it involves the stakeholders?

.....

.....

.....

15. How does the Stakeholders' involvement influence the implementation of energy development projects in KenGen?

Capital contribution [ ]

Policy formulation [ ]

Community resource sharing [ ]

Others Specify .....

16. Explain how stakeholders' involvement influences the implementation of renewable energy development projects by KenGen?

.....

.....

.....

17. To what extent do you agree with the following statement on how stakeholders' involvement influences the implementation of renewable energy development projects in Kenya? Key: 1 strongly agrees, 2 agree, 3 undecided, 4 disagree, 5 strongly disagree (please put an X as appropriate)

	1	2	3	4	5
Stakeholders have trust with KenGen					
KenGen frequently hold stakeholders forum					
Stakeholder are happy with KenGen engagement mechanism					
Stakeholders involvement influence the implementation of renewable energy development projects					

**Section E: Technology**

18. Does technology influence the implementation of renewable energy development projects in Kenya?

- Yes [ ]
- No [ ]

Give reason for your answer

.....

.....

.....  
.....

19. What factors does KenGen consider in renewable energy technology adoption?

- Social factors [ ]
- Environmental factors [ ]
- Economic factors [ ]
- Legal factors [ ]

20. What technologies are applied by KenGen in renewable energy projects?

- Geothermal Development [ ]
- Wind Power [ ]
- Hydroelectric Power [ ]
- Solar Photovoltaic Energy [ ]

Other Specify

.....  
.....

21. How would you rate the level of technologies adopted by KenGen in implementation of renewable energy?

- Exceptional [ ]
- Very good [ ]
- Good [ ]
- Average [ ]

Below average [ ]

22. What is your opinion on the level of technology in KenGen for renewable energy?

.....  
 .....  
 .....

23. To what extent do you agree with the following statement on how technology influences the implementation of renewable energy development projects in Kenya?

Key: 1 strongly agrees, 2 agree, 3 undecided, 4 disagree, 5 strongly disagree

(please put an X as appropriate)

	1	2	3	4	5
KenGen has innovative edge on renewable energy as it allocates intensive resource on technology development.					
KenGen has continuous technological innovation so as to make renewable energy as a viable solution					
KenGen cost of renewable energy has drastically reduced because of technological advancement in efficiency under mass production					
Kenya has the right technological infrastructure					
There is general lack of knowledge among the people about acceptable quality and standards of technology					
KenGen lack skilled labour to operate and maintain renewable					

energy equipment					
KenGen is well equipped to carry out research and development on renewable energy					

**THANK YOU**