FACTORS INFLUENCING IMPLEMENTATION OF SOLAR ENERGY PROJECTS IN HOMA-BAY COUNTY, KENYA

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DECLARATION

This research project report is my original work and has not been submitted to any other university or institution for examination.

Signature ……………………………….. Date..

Patrick Otieno Otuoma

L50/70386/2013

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

Signature…………………………… Date……………………………….

Mrs. Joyce Kiruma

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DEDICATION

This project is dedicated to my wife Carolyne Otieno, your kind and hearty sacrifices would not go unnoticed. To the memory of my late father- Mr. Charles O. Ndege, whose abrupt and untimely demise, at a critical stage of my project report preparations all but strengthened my resolve and not forgetting my doting mother Mrs. Mary C. Ouko whose belief in me I have always cherished. Your trust in me has counted for so much more!

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ABBREVIATIONS AND ACRONYMS

CSP:	Concentrated solar power
DPMC:	Department of Price and Monopoly Control
ERB:	Electricity Regulatory Board
GHG:	Green House Gas
GJ:	Gigajoules
IDT:	Innovation Diffusion Theory
IDT:	Innovative Diffusion Theory
KPLC:	Kenya Power Limited Company
MDG:	Millennium Development Goals
MWh:	Megawatt-hours
PPA:	Power Purchase Agreement
PV:	Photovoltaic
RBT:	Resource Based Theory
REP:	Rural electrification program
SPSS:	Statistical Package for Social Sciences
TV:	Television

ABSTRACT

This study sought to examine the factors influencing the implementation of solar energy projects in Homa-bay County, Kenya. From the outset, as detailed in the background, the value proposition of renewables, especially solar energy systems are well covered. The study sought to examine four objectives which are: to determine the extent to which government policy influences the implementation of solar energy projects; to investigate how cost of installation influences the implementation of solar energy projects; to examine how availability of markets influence the implementation of solar energy projects and to investigate how level of technological awareness influences the implementation of solar energy projects. These four themes developed from the study were advanced and explored to a greater extent. The literature reviewed was organized according to study themes. It is hoped that the findings of this study would be important to solar energy projects financiers, policy makers' and stakeholders in the energy environment as they will be equipped with key environmental conscious dimension of energy use in rural households. The study might also provide alternative futures of household solar energy financing models through scenario analysis which is very useful in policy formulation. The study is grounded on Resource Based Theory (RBT) and Innovative Diffusion Theory (IDT) which advance the parameters in this study. Descriptive survey design was used in this study. The population for the study comprised of 1,100 contractors and technicians licensed by energy regulatory commission for photovoltaic solar systems and hot water solar systems installations in Homa-bay County. The sample size was 110 contractors/ technicians determined by the use of Krejcie and Morgan Table for sample size determination. The study adopted simple random sampling technique to sample installers of home solar systems. Primary data was collected by means of questionnaires and analyzed using descriptive statistics. Collected data has been analyzed by means of SPSS, and presented in tables and bar graphs. From these analysis, discussion on the various objective questions has been undertaken and recommendations made thereof. Among the findings of this study are that government policy, Level of technological awareness, availability of markets and costs of installation considerably influence the implementation of solar energy projects in Homa-bay County.

CHAPTER ONE
INTRODUCTION

1.1 Background of the Study

Globally, solar energy is a vast and largely untapped resource that has not been greatly utilized to date. According to World Energy Council (2009), solar energy currently accounts for a very small share of world primary energy consumption, but its use is projected to increase strongly over the outlook period to 2030. It further states that the world's overall solar energy resource potential is around 5.6 gigajoules (GJ) (1.6 megawatt-hours (MWh)) per square metre per year. The highest solar resource potential per unit land area is in the Red Sea area. Australia also has higher incident solar energy per unit land area than any other continent in the world. However, the distribution of solar energy use amongst countries reflects government policy settings that encourage its use, rather than resource availability.

Solar energy can be defined as energy generated from the sun (sunlight) and converted into electricity or used to heat air, water, or other fluids. The electrical power is generated through the conversion of sunlight into electricity, either directly using photovoltaic (PV) arrays, or indirectly using concentrated solar power (CSP) systems. Lenses or mirrors and tracking systems are used by concentrated solar power systems to focus a large area of sunlight into a relatively small beam. Photovoltaic cells and arrays convert light into electric current using the photoelectric effect. Photovoltaic arrays were initially, and still are being used to power small and medium-sized applications, from the calculator powered by a single solar cell to off-grid homes powered by a photovoltaic array. Jacobs (2006) argues that they are an important and relatively inexpensive source of electrical energy where grid power is inconvenient, unreasonably expensive to connect, or simply unavailable.

In England, solar energy contributes only a small proportion to the population's primary energy needs, although its share is comparable to the world average. While solar energy accounts for only around 0.1 per cent of world primary energy consumption, its use has been increasing at an average rate of 10 per cent per year from 2000 to 2007 (Ishengoma, 2012). Increased concern with environmental issues surrounding fossil fuels, coupled with government policies that encourage solar energy use, have driven increased uptake of solar technologies, especially PV. From 1985 to 1989, world solar energy consumption increased at an average rate of 19 per cent per year. From 1990 to 1998, the rate of growth in solar energy consumption decreased to 5 per cent per year, before increasing strongly again from 1999 to 2007 (Jacobson, 2004).

Other developed countries such as China and Japan have set renewable energy goals or targets through 2015 and 2020 that are reliant on belligerent and successful expansion of the electricity transmission grid. According to Rebane and Barham (2011), China aims to install 30 gigawatts of grid-connected solar power by 2020, compared with less than 1 GW currently installed. The country's adoption of solar energy prior to wind power stems from a combination of relatively high costs, the geographic remoteness of resource-rich regions and a lack of transmission to those areas. According to Babiker (2001), the introduction of a feed-in tariff, rooftop and grid-scale solar in recent years have clearer policy support than traditional capital cost subsidies offered, although distributed rooftop is slow to grow. Furthermore, prominence on renewable energy is also projected to stimulate China and Japan's effectiveness as prominent global providers of clean, low cost renewable energy technologies.

Africans currently consume only one quarter of the global average energy per capita, using a mix of hydropower, fossil fuels and biomass – mostly in traditional uses. Access to energy is a pre-requisite of economic and social development because virtually any productive activity needs energy as an input. Basic levels of electricity access (e.g. lighting, communication, healthcare, and education) provide substantial benefits for communities and households (World Bank, 2012). Providing a basic level of electricity access with renewable sources is increasingly economically feasible (e.g. kerosene lighting systems at USD 4–15 per month cost households significantly more than the USD 2 per month to run a solar lighting systems). However, sustained economic development requires a definition of electricity access, which asserts that energy levels should provide for basic services as well as for productive uses. If these services are based on renewable energy sources, positive environmental impacts can also be achieved (World Bank, 2012).

In South Africa, most companies that provide energy generation are struggling to meet the energy demands especially in the winter months when heat is needed. Continued power outages affect the country's mining industry, which is a large part of the economy, and threaten platinum and gold production as well as the strength of the currency. Not only does the country lack enough energy to support its growing economy, it also relies heavily on coal. This natural resource provides 77% of the nation's energy. Because of this, South Africa is the 14th largest emitter of greenhouse gasses in the world. On the other hand, Egypt has a high solar availability. The total capacity of installed photovoltaic systems is about 4.5 MW. These are used in remote areas for water pumping, desalination, lighting of rural clinics, powering telecommunications, rural village electrification, etc. Egypt has seen investment in renewable energy rise by US$800 million to just over US$1.3 billion as a result of just two deals, a 100MW solar thermal project in Kom Ombo and a 220MW onshore wind farm in the Gulf of El Zeit (Babiker, Reilly, 2001).

In Kenya, more rural households get their electricity from solar energy than from the official rural electrification program (REP) as a result of vast renewable energy resources such as solar, wind, biomass, bio-fuel, geothermal and hydropower although their exploitation has been limited. The spread of the photovoltaic systems has been recent, rapid and market driven (Robert, 2014). The service is as good as the grid for the low power loads that prevail in many rural areas, and the price is competitive with other options for low loads. Expansion of the renewable energy sector is being catalyzed by the growing demand for and cost of electricity, increasing global oil and gas prices and environmental pressure (Robert, 2014). Since most rural households do not have their homes connected to the electricity grid in the foreseeable future, photovoltaic systems will often be the next best alternative. This remains true only so long as householder appetite for electricity remains limited to a few light points plus a radio and/or TV connection. Solar energy is therefore important in meeting the increasing demand of power across the country.

Setting up solar energy projects for poor people in Homa-bay County is thought to bring both social and economic development. The basic human needs can be fulfilled and productivity can increase, hence it is seen as a crucial factor to fulfill many of the Millennium Development Goals (MDG) (GNESD, 2007). Kenyan government has implemented renewable energy projects as a means to poverty prevention as well as in meeting the basic needs of the people (Bhattacharya, S. & Jana, C., 2009; REN21, 2009). There are several experiences and lessons that can be learned from the implementation of national governmental schemes and programs along with regional initiatives concerning solar energy technology. Except from techno-economic aspects there are also barriers and challenges concerning marketing and dissemination, institutional and financial approaches and productive and economic applications (Chaurey, A. & Kandpal, T, 2010).

Powerpoint systems is a solar power company that undertakes the installation of projects in the electrical and solar systems sectors to offer design, importation, distribution and installation of complete solar solutions. It partners with developmental partners such as world vision, KenGen and JICA to bring reliable energy solutions to communities. In Homa-bay County, Powerpoint Systems is one of the firms that have carried out installation of solar systems for clients among other installations over the years. Among the projects currently installed are in the islands in Lake Victoria. Takawiri dispensary is located in Mbita constituency, in Homa-bay County, Kenya. This dispensary in Takawiri Island has been installed with solar lighting and solar power for the laboratory. In Ngodhe Island of Homa-bay County, Powerpoint Systems have installed Ngodhe dispensary and Ngothe primary school with solar lighting for the classrooms and the medical facility, as well as solar power for the laboratory. In Mfangano Island of Homa-bay County, Powerpoint Systems have connected both Wakula dispensary and Sokoro dispensary with solar lighting and solar power for their laboratories.

1.2 Statement of the Problem

While there is little doubt about the size and growth rate of the Kenyan solar energy market, there is still an ongoing debate about how to interpret the significance of the current factors influencing the implementation of solar energy projects, with emphasis to economic and environmental relevance. According to (Demographics and Surveys, 2010), Kenya's population as at 2011 was estimated to be 41 million inhabitants with projected growth rate of 2.7% per annum. This growth is accompanied by increased household demand for energy leading to an energy deficit of about 3,000 MW notwithstanding its current production of 1,100 MW. Owing to this deficit, the current policy document of Kenya, the Vision 2030, highlights a search for alternative means of providing sustainable energy to meet both its rural and urban development aspirations (Amos, 2010).

Despite the high rate of urbanization in the country, the rural sector still retains over 70% of the total population, who depend mainly on wood fuels and paraffin to meet their basic energy needs. These sources are known to reduce rate of carbon sequestration and increase Green House Gas (GHG) emission. The advent of solar energy technology seems to be changing this energy use pattern by displacing household dependence on paraffin, with about 20% growth rate in the number of solar energy projects installed each year.

The record of the solar energy projects in Homa-bay County is very poor, with only 0.94% of rural households connected in 2002 [Karekezi et al, 2004]. Hence, the rate of renewable energy use is far below the rate of increase in potential customers, despite government programs to fund it. Innovative approaches to offer education and finances are helping to make up for the lack of solar energy projects. It was therefore useful to evaluate the factors influencing the implementation of solar energy projects in Homa-bay County, Kenya. The factors that were evaluated were government policy, cost of installation of solar technology, availability of markets for the solar technology and level of technological awareness of the technology.

1.3 Purpose of the Study

The purpose of this study is to investigate factors influencing implementation of Solar Energy projects in Kenya, with emphasis on Homa Bay County.

1.4 Objectives of the Study

This study was guided by the following objectives:

1) To determine the extent to which government policy influence implementation of solar energy projects in Homa-bay County, Kenya.
2) To assess how cost of installation of solar technology influence the implementation of solar energy projects in Homa-bay County, Kenya.
3) To establish how the availability of markets for solar technology influence the implementation of solar energy projects in Homa-bay County, Kenya.
4) To examine how level of awareness on solar technology influence implementation of solar energy projects in Homa-bay County, Kenya.

1.5 Research Questions

This study sought to answer the following research questions:

1) To what extent does government policy influence the implementation of solar energy projects in Homa-bay County, Kenya?
2) How does the cost of installation influence the implementation of solar energy projects in Homa-bay County, Kenya?
3) To what extent does availability of markets influence the implementation of solar energy projects in Homa-bay County, Kenya?
4) How does level of technological awareness influence the implementation of solar energy projects in Homa-bay County, Kenya?

1.6 Significance of the Study

It is hoped this study will provide critical information on factors influencing the implementation of solar energy projects especially in rural areas in Kenya. The study findings are also important to solar energy projects financiers, policy makers' and all stakeholders who play a role in the energy or environment framework as they will be equipped with the environmental consciousness of energy use in rural households. These include organizations tackling the climate change agenda and environmentalists such as the United Nations Environmental Program, African Conservation Foundation, and

Intergovernmental Panel on Climate Change. This information will help them to advocate for greener energy alternatives in their push to dissuade an over-reliance on fossil fuels. It is also hoped that the findings of this study will similarly benefit would- be solar energy contractors by providing them with critical information concerning of degree of need for solar energy, possible challenges they might encounter in their quest to fill that gap as well as possible ways to mitigate these challenges. The findings from this study will also provide alternative prospects for solar energy projects financing through scenario analysis which is very useful in policy formulation and decision making. The end result will see formulation of useful energy laws to safeguard the nascent solar energy development process.

Finally, it is also hoped that the study findings will add to the pool of scholarship on solar technology as well as provide the Government of Kenya with information that will enhance the country's response to solar energy projects.

1.7 Delimitation of the Study

This study was confined to solar energy projects in Homa-Bay County, exploring both solar lighting and power projects installed. The respondents were installation contractors operating in Homa-bay County. This was because they were expected to have satisfactory information on factors influencing implementation of solar energy projects in Homa-bay County, Kenya. The researcher had complete knowledge of the geographical area under which the study was undertaken. As a result, financial costs involved in conducting the research were kept low hence resulting in greater data input, application and accuracy of the study.

The study was used to draw lessons and make recommendations concerning factors influencing the implementation of solar energy projects. Issues demanding attention were government policy, availability of markets, Cost of installation and level of technological awareness. While these issues have been addressed descriptively in policy, their treatment in the academic literature on assessment of factors influencing the implementation of solar energy projects is largely underdeveloped

1.8 Limitations of the Study

The proposed study encountered some limitations. Some of these constraints included resource inadequacies such as time and financial limitations. The researcher took annual leave from duty to create time and organized for financial support through savings and stakeholders. The other challenge included unwillingness of some respondents to answer the questionnaire due to lack of trust on how the research findings were to be utilized. The researcher overcome this by offering the respondents confidentiality.

1.9 Assumptions of the Study

The study was undertaken on a number of assumptions, one, it was assumed that the respondents remained in the area of study throughout the study duration. It was also assumed that the study respondents would be cooperative, factual and trustworthy to provide unbiased information. Again the researcher assumed that the respondents were available to respond to the research instruments in time and they would fill the study questionnaires administered precisely and without biasness.

1.10 Definition of Significant Terms used in the Study

Implementation of Solar Energy Projects: Refers to adoption and execution of projects involving solar energy systems such as lighting and hot water systems among the population.

Availability of Markets for Solar Technology: Refers to the degree to which the demand for solar system or equipment among the population is obtainable and appeared randomly.

Level of solar technology awareness: refers to the ability to perceive or become conscious of the solar innovation and its technical aspects.

Refers to set energy-policy initiatives by the regime of the day as means to direct course of action with an intention of meeting its energy needs as well as conserve the environment.

Amount of investment needed to acquire/install solar equipment.

Electrical power generated through the conversion of sunlight to electricity, either directly using (PV) arrays, or indirectly using (CSP).

1.11 Organization of the Study

This study is organized in five chapters. Chapter one covers the background of the study, statement of the problem, objectives, research questions, significance, delimitations, limitations, assumptions and definition of significant terms. Chapter two outlines the theoretical underpinnings of the study as well as the review of relevant literature. The chapter also contains conceptual framework which outlined the association of study variables.

Chapter three outlines the study methodology that is followed in the course of answering the research questions. The chapter outlines the research design and sampling techniques that are adopted, the target population, the data collection instruments and procedures as well as the data analysis methods to be adopted and ethical issues. Chapter Four covers the analysis of data collected from the field. Data is analyzed using means, standard deviation and other info graphics in representing the analyzed data. The analyzed data is presented in tables. Further, the chapter has interpretation of the findings in write up to explain the tables.

Chapter five details the summaries of findings with regards to the objectives of the study. Main findings are discussed at length with linkages to existing knowledge. The chapter finally has a conclusion of the study and suggested possible recommendation of the study problem.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This chapter presents a review of relevant literature based on thematic areas with respect to solar energy projects: government policy, cost of installation, availability of markets and level of technological awareness. It will also cover the conceptual framework for the study. Implementation of domestic solar energy projects has been on the rise for the past several decades as a result of perfect characteristics of self-control, self-protection, needing no attention, compact structure, elegant outline and convenience. However, solar power system still remains unattractive to communities worldwide as a result of high costs. Timilsina (2000) argues that solar power systems are attractive at a national or policy level as a means of reducing carbon emissions, they remain unattractive to individual householders. Ishengoma (2012) also contends that the two main obstacles against using solar energy are the high initial capital costs and the very low PV cell conversion efficiency.

World over, there exists a perennial energy problem in most rural settlements, where close to 30-40% of populations live in Africa. In these rural areas, most villages do not have access to the stark benefits of energy. It is not possible for successive regimes to satisfy the energy requirements in most areas because the low demand for energy and its geographical distribution make it impossible to satisfy that demand by centralized systems.

2.2 The Concept of Implementation of Solar Energy Projects in Kenya

Kenya has a great potential to hitch solar energy, as a result of its location which is near to the equator, with 4-6KWh/m^2/day. It is estimated that 200,000 photovoltaic solar home systems, most of which are rated between $10W_e$ and $20W_e$ estimated at a cost of Ksh.1000/W_e are currently in use in Kenya. Over the last four years, the number of solar home systems installed has grown at an average of 20,000 units per annum whereas the demand is projected to reach 22GWh annually in the year 2010. (ERC, 2014/2015). Much of this is attributable to the installation of PV systems in schools and health program in arid and semi- arid areas by the Ministry of Energy and Petroleum and the REA under the Rural Electrification Program.

Energy Regulatory Commission is a division under the Ministry of Energy, and is in the forefront in fast tracking Renewable energy as one among other energy sources. As at 6th February 2017, less than 1,000 technicians and contractors were fully licensed by the ERC to carry out both solar PV and solar hot water installations in Kenya, which is a far cry especially stretched against the existing solar potential in Kenya. (ERC, 2014/2015)

Solar photovoltaic (PV) technology is one of the categories of direct solar energy and represents the most promising alternative energy sources in the world (Jacobson, 2007). It emerged as an important tool for rural electrification at a time when neo-liberal policies dominated mainstream development thinking. In the late 1980s and 1990s, a period that some have called the age of 'market triumphalism' (Peet and Watts, 1993), mainstream development policies emphasized economic liberalization, privatization, and market-based approaches to service provision (Jacobson 2007). In 2007 grid-connected photovoltaic electricity was the fastest growing energy source, with installations of all photovoltaics increasing by 83% in 2009 to bring the total installed capacity to 15 GW (AEI, 2010). Nearly half of the increase was in Germany, which is now the world's largest consumer of photovoltaic electricity followed by Japan. PV technologies are seen as an affordable technology at a commercial level, but are incompatible with personal priorities and unfortunately, ‘compatibility’ is a basic criterion of a consumers ‘willingness to pay’ for the technology (Berger 2001).

The efficiency of PV technology has improved considerably over the years through research and this has reduced the cost of installation (AEI, 2010). They found that barriers to adoption of renewable technologies are mostly financial, as well as practical issues regarding installation and general levels of knowledge. However, it is not clear that even if the costs were reduced and information made more available that adoption levels would increase. Neither is it clear that if an increase in adoption were to occur that it would lead to reductions in carbon emissions due to the effect known as the ‘Rebound’ effect (Caird et al 2006). The rebound effect describes the phenomenon where individuals divert their spending to equally carbon rich activities as soon as they have saved money on another; for example by spending money that has been saved as a result of energy saving in one area, on energy intensive appliances that might be perceived as improving their quality of life, for example a larger more energy intensive Television (Herring, 2006).

Since time immemorial, solar energy has been used for drying animal skins and clothes, preserving meat, drying crops and evaporating seawater to extract salt. There has been substantial research on how to exploit this huge resource. Today, solar energy is used at the household level for lighting, cooking and water heating. Medium-scale applications include water heating in hotels and irrigation. At the community level, solar energy is used for vaccine refrigeration, water pumping and purification and electrification of remote rural communities. Industries use solar energy for preheating boiler water and power generation, detoxification, municipal water heating, telecommunications, and, more recently, transport (solar cars) (Karekezi and Ranja, 1997; Ecosystems, 2002).

In Kenya, some of these uses are still a distant dream. BERR (2008) argues that in spite of the disparagements of domestic level solar power technologies, implementation of the technology is increasing amongst some householders. However, his argument does not provide factors that can influence implementation of solar energy projects. Hence, a broader review of the literature concerning the factors that can influence implementation of the technology of innovations will be undertaken and is introduced in the following section.

2.3 Government Policy and Implementation of Solar Energy Projects

The interest in clean energy has spread to every corner of the globe, undermining the long-held assumption that a strong economic future is reliant on fossil fuels, particularly in the developing world. The technology evolution that dropped the cost of solar modules by around 75% between 2009 and 2014 is now being followed by political and financial initiatives that are further driving down costs. South Africa, Brazil, China and India have developed new policy approaches for auctioning off power concessions. Today, those mechanisms are spreading to Europe. Meanwhile, America’s big banks are bundling thousands of rooftop solar systems into Wall Street-friendly investment opportunities. On the other end of the economic spectrum, crowd sourcing and community financing is also taking hold and driving growth at the grassroots level (Republic of Kenya, 2006a).

Most countries in the world have been using different policies and strategies to guarantee security of supply of inexpensive energy and attain efficacy. These have been implemented by individual countries or unions such as the European Union or even within economic blocks. In many ways, Denmark has started the transition well. The government has presented a package of new energy-policy initiatives. These include a broad and ambitious range of energy policy measures, which has resulted in increased efficiency and electrification as well as more renewable energy in the short term up to 2020, and further ahead towards 2050. Therefore, widespread commitment as well as good information and opportunities to take action have been essential. This has been done through initiatives that enhance incentives for enterprises and households to implement energy-efficiency improvements and to change to renewable energy.

In addition, there are initiatives to promote research, development, demonstration and innovation within green technologies to prepare for the next phase in the transition by developing and improving the technological solutions. At the same time this will enhance Denmark's leading position within clean tech solutions. The government also proposes a number of new analyses to establish the required knowledge base for the important decisions (Moreira and Wamukonya, 2002). In Kenya, the energy policy has evolved through sessional papers, regulations and Acts of Parliament whose main focus in the past has been on the electricity and petroleum subsectors. The Sessional Paper No. 10 of 1965 dwelt on the Electric Power Act (CAP 314) that was used to regulate the sector. This was followed by the Sessional Paper No. 1 of 1986, which however, did not focus much on the power sector. The Sessional paper called for the establishment of the Department of Price and Monopoly Control (DPMC) within the Ministry of Finance, under new legislation, to monitor action in restraint of trade and to enforce pricing in the various sectors. This also included the petroleum sub-sector (Karekezi and Ranja, 1997).

The Petroleum Act (Cap 116) for a long time has been used to guide operations in the sector (Ngigi, 2006). The Act which was enacted in 1984 gave NOCK the mandate to oversee oil exploration activities in the country. In 1994, there was further implementation of policies to liberalize most of prices and sectors in the country such as removal of exchange rate controls; interest rates decontrol and price decontrol that included petroleum products among other goods in the consumer basket. The energy sector witnessed further developments in policy which saw the unbundling of the Kenya Power and Lighting Company into three entities with the enactment of the Electric Power Act No. 11 of 1997. These were the Kenya Power and Lighting Company that was to carry out transmission and distribution functions, the KenGen to carry out the generation function and the Electricity Regulatory Board (ERB) to regulate the power sector in 1998. The Act aimed at facilitating private sector participation in the provisions of electricity services. The Act also allowed Independent Power Producers (IPPs) to enter into Power Purchase Agreements (PPAs) with KPLC to add more power into the grid. In 2004, the Ministry of Energy in consultation with stakeholders in the sector developed the Sessional Paper No. 4 of 2004 (Ngigi, 2006).

Therefore, these policies aim at ensuring adequate, quality, cost effective and affordable supply of energy to meet development needs, while protecting and conserving the environment. The specific objectives of the energy policy are to: provide sustainable quality energy services for development; utilize energy as a tool to accelerate economic empowerment for urban and rural development; improve access to affordable energy services; provide an enabling environment for the provision of energy services; enhance security of supply; promote development of indigenous energy resources; and promote energy efficiency and conservation as well as prudent environmental, health and safety practices (Moreira and Wamukonya, 2002).

ERB is mandated by the Energy Act, 2006 to carry out the following functions: regulate the electrical energy, petroleum and related products, renewable energy and other forms of energy; protect the interests of consumer, investor and other stakeholder interests; maintain a list of accredited energy auditors as may be prescribed; monitor, ensure implementation of, and the observance of the principles of fair competition in the energy sector, in coordination with other statutory authorities; Provide such information and statistics to the Minister as he may from time to time require; and Collect and maintain energy data; prepare indicative national energy plan; and Perform any other function that is incidental or consequential to its functions under the Energy Act or any other written law (Republic of Kenya, 2006a). The future of the energy sector in Kenya is bright. In the electricity sector, green electricity is going to be the energy of the future. Government efforts to increase power generation are in geothermal and wind sources of electricity. GDC has embarked on an ambitious program to increase the number of wells in potential areas while in wind, KPLC has already signed a PPA with Homa-bay County to supply 300MW of electricity (Farsi et al., 2007). In petroleum; there have been increased activities in exploration of hydrocarbons in Western regions of Kenya. The government has also intensified search for coal deposits in Homa-bay County. Lastly, future government policy in energy is leaning towards improvement of the working modalities with Public Private Partnerships (PPPs). All these initiatives are aimed at ensuring security of energy in the country in order to meet increased energy demand as envisaged in vision 2030 (Farsi et al., 2007).

2.4 Cost of Solar Equipment and Implementation of Solar Energy Projects

The cost of installing solar equipment such as Photovoltaic and hot water systems is one of the main factors determining the investment in solar energy options. This is because solar energy projects often involve a relatively large upfront investment in equipment, which limits local contractors and technicians from effectively engaging in installations due to lack of initial capital. In addition, the implementation of these solar energy projects may require technical knowledge and a certain level of specialized education which is obviously unaffordable to the majority. Moreover, renewable energy equipment such as solar collector panels, batteries, inverters, booster heaters and thermostats are not locally manufactured thereby raising operation costs incurred by the equipment importers. These costs are transferred further down and effectively make renewable projects implementation an expensive affair.

This explains why access to markets for solar energy equipment may suffer major encumbrances. All these factors may explain why several contractor are prevented from installing the solar systems to low income households thereby keeping them from ascending the energy ladder. For this reason, majority of households use firewood, charcoal, kerosene or electricity, with the specific mix varying depending on the setting (Heltzberg, 2004; Hosie, R. & Dowd, J., 1987; Farsi et al., 2007; Njong, A., and T. Johannes, 2011). Each household faces a number of mutually exclusive options for cooking fuels and chooses the fuel that maximizes its utility. As a result, a single option can be a combination of different fuels. Fuel stacking is therefore addressed in some cases by using typical fuel combinations as choices (Heltzberg, 2004) and ignored in other cases by considering only the main fuel used by the household (Farsi et al. 2007).

A study by (Gebreegziabher, Z., A. Mekonnen, M. Kassie, and G. Köhlin, 2011) assess the determinants of the demand of electric *mitad* cooking appliances for baking bread, among other energy uses, in Northern Ethiopia and the effects of this adoption on urban energy transition. The authors analyze the factors that explain urban households' choice of fuel among five options: wood, charcoal, dung, kerosene and electricity. Furthermore, fuel choices more generally are found to be determined by the prices of substitutes, household expenditure, age and education of household head, and family size, with the probability of using transitional and modern fuels positively correlated with the price of wood and charcoal, household expenditure, the age and education of the household head (Gebreegziabher et al., 2011).

Often, the installation costs take up the greater component of the non-modular costs of a PV system. On the other hand, the cost price of PV systems has dropped below parity in large parts of the world. This essentially means that on average, during the lifetime of the PV system, the PV generated electricity is by far cheaper than electricity generated from the grid. Home owners can generate at least a part of their needed electricity from solar, thus making them partially or totally independent of the electricity market. It is further projected that the demand for solar is strongly stimulated by the decreasing cost price of PV technology. (Klaus et al., 2014).

2.5 Availability of Markets and Implementation of Solar Energy Projects

With the expansion of the global solar market, equipment shortages are likely to ease in the near future. And given the maturity of the technology, the costs of solar energy will be known with a high degree of certainty. Solar energy in South Africa for example, has the advantages of comprising a well understood, low risk and mature technology, subject to developing appropriate local skills and infrastructure. The opportunities for competing on a cost basis in manufacturing are minimal at present, and an extensive program would initially be implemented with imported equipment and using international expertise. After a series of successful experiments, solar plants were built in the 1980s in the US and no further investment was forthcoming until 2004, at which point global installed capacity was less than 300 MW. Since then, about 100 MW of new capacity has been completed, and favorable policy regimes in Spain and the USA have led to an explosion of new orders with around 8,000 MW of new capacity were under planning in 2009 (Spellmann, 2009). The IEA's Energy Technology Perspectives identifies solar thermal technology as a very promising option for areas of the world with extremely good solar resources, which includes about half the land area of South Africa (IEA, 2008).

While the technology is relatively new commercially, which entails significant risks and uncertainties; it is technically proven, ideally matched to South African conditions, and has the potential to develop on a massive scale globally. The lack of market maturity also implies that there would be opportunities for South Africa to develop a competitive advantage in design and manufacture of the technology, particularly if it were able to prove the technology at scale. South Africa has an excellent solar regime, with ample resource to provide significant future electricity generation, and potentially has the right mix of skills and manufacturing capabilities to create a competitive advantage in this market (Edkins, 2009). In addition, because CSP plants are most suitably located in areas with a very high incidence of solar radiation, there is little competition for alternative land use.

In Kenya, the installation of these solar energy plants- either as heaters or for lighting industrial and domestic activities continues to rise. Kenya's installed electric power capacity was 1,412.2MW as at 31 December 2010 (KNBS, 2011). Hydropower is the main source, accounting for 51.55% of total installed capacity while petrol thermal, geothermal, cogeneration and wind account for 33.2%, 13.38%, 1.84% and 0.36% respectively. Renewable energy accounts for about 67.1%, which means that power generation in

Kenya is now largely 'green'. Although installed capacity in hydropower has not seen much growth in the last decade, there have been increased initiatives in geothermal exploitation due to its availability. The solar market in Kenya is among the largest and its usage per capita is the highest among developing countries. Cumulative solar sales in Kenya (since the mid-1980s) are in excess of 200,000 systems, and annual sales growth has regularly topped 15% over the past decade (Jacobs, 2006). In addition to its energy policy, interest in renewable energy in Kenya has risen due to renewed initiatives in rural electrification and environmental concerns about global warming and air quality. The previous focus on renewable energy responded to two main orientations. Large scale renewables, such as large hydropower and geothermal projects, were developed in order to improve the security of supply through diversification and reduced exposure to external shocks such as high oil prices.

Due to a ten-fold increase in the prices of imported oil, the cost of oil based energy imports is now putting a crippling burden on Kenya's economy (Asplund, 2008). Further, these fossil based sources are finite and are therefore likely to be depleted with time. The uncertainty regarding the future availability of oil based products (fossil fuels) as well as the negative impacts of their utilization on the environment have therefore led to a growing need to search for cheaper, renewable and environmentally friendly alternative energy sources (KNBS, 2011). The country has therefore turned to solar energy which is relatively well available due to the country's proximity to the equator. Kenya is the third largest market for domestic solar systems after India and China. In fact, Kenya and China are fastest growing markets, with annual growth rates of 10%–12% in recent years, with private dealers providing most solar systems (Arora et al., 2010) although the government has also taken measures to increase uptake of these technologies.

2.6 Technological Awareness and Implementation of Solar Energy Projects

One of the most important factors hindering the penetration of the energy market by solar energy technology is the lack of technical awareness and confidence among the general public who use the technology, decision makers and the limiting numbers of trained installation technicians. As at February 2017, a total of 995 registrations had been completed for solar technicians and contractors for both PV and hot water systems. This is a relatively small number of well trained and licensed professionals considering how much potential exists in the country. This lack of technological awareness results in the loss of potential installers. Therefore, decision to grow and expand a new innovation often starts with awareness. It's difficult for one to implement solar energy projects without knowing about the innovation. The decision making process is aided by communication channels; either mass-media communications or by local channels such as word-of-mouth.

Rogers (2003) theorizes that the process of demand commences with an individual driven by precedent conditions such as a felt need to adopt an innovative product or service. He further indicates that the individual will pass along an innovation decision process at a pace that is influenced by their own level of innovativeness and by the perceived characteristics of the innovation. Within such stages, several factors which could either encourage or discourage adoption of an innovation may arise or may be experienced by the intending adopter, which could affect the final decision to adopt, not adopt or reverse decision (Rogers, 2003). Adoption of innovations could be done by an individual, a company or a group or people. The innovation decision process consists of five key stages which include: knowledge, persuasion, decision, implementation and confirmation.

In regard to knowledge, decision to adopt a new innovation often starts with knowledge gathering through the media such as TV, newspaper, radio or a peer, colleague or mentor. Persuasion involves showing interest in the technology and seeks information about the technology for example cost, user review, features, how it works. It is at this stage that a person begins to consider himself/herself a potential adopter of such technology and active consideration is being made as to whether to adopt the technology or not (Palys and Atchison, 2008). The choice to adopt or reject a technology is made at the decision stage. This process often involves weighing the benefits, cost, trade-offs advantages and disadvantages. During this stage, the choice to reject a technology could also be made. The decision stage is one of the most important for understanding technology adoption and probably one of the most difficult to study.

As noted by Rogers, the process of deciding happens silently and invisibly to the outside researcher; the precise moment of decision can rarely be captured (Rogers, 2003). The implementation stage involves integrating the technology into use. For the adopter, this could mean change from usual habit or practices, sometimes it is slow and takes a lot of time. During this time the technology is evaluated to see if it meets the adopters' expectations and probably more information about the technology is sought at this stage to enhance usability of the technology. The confirmation stage is reached after the technology has been integrated and put into full use by the adopter. At this point the adopter seeks reinforcement for the innovation decision already made. However a change in original choice to use the technology may occur if exposed to conflicting messages about the innovation. A situation where an adopter chooses to stop the usage of a technology he/she adopted (Reddy and Painuly, 2004).

2.7 Theoretical Framework

The study was be guided by Resource Based Theory (RDT) and Innovative Diffusion Theory (IDT) that related to implementation of solar energy projects.

2.7.1 Resource Based Theory

According to Wernerfelt (1984), resource based theory states that the basis for competitive advantage of a firm lies primarily in the application of the bundle of valuable resources at firm's disposal including technology such as solar technology. It suggests that the resources possessed by a firm are the primary determinants of its performance, and these may contribute to a sustainable competitive advantage of the firm (Wenerfelt, 1984). According to (Barney, 2002) the concept of resources includes all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. controlled by a firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness (Barney, 2002).

If the resources possessed by a firm can easily be replicated by competitors, even though the resources are the source of competitive advantage of the firm, then the advantage will not last long. (Dierickx, I., & K. Cool, 1989) Describe how the sustainability of a firm's asset position hinges on how easily its resources can be substituted or imitated, and imitability is linked to the characteristics of the asset accumulation process: i.e., time compression diseconomies, asset mass efficiencies, inter-connectedness, asset erosion and casual ambiguity. In the same way, several other characteristics have been explored such as unique historical conditions, causal ambiguity (Reed & DeFillippi, 1990), social complexity, isolating mechanism and so on (Barney, 2002).

2.7.2 Innovative Diffusion Theory (IDT)

Research on the diffusion of innovation has been widely applied in disciplines such as education, sociology, communication, agriculture, marketing, and information technology (Agarwal, Sambamurthy, & Stair, 2000). The theory of diffusion of innovation by Rogers, (1995) provides perceptions that individuals may have of adopting an innovation such as solar technology. The theory explains, predicts, and accounts for the factors which influence adoption of an innovation. This is in line with the studied variables. According to Rogers (2003), individuals' technology adoption behavior such as solar technology is determined by his or her perceptions regarding relative advantage, compatibility, complexity and observability of an innovation, (Hikmet 2007).

IDT includes five significant innovation characteristics: relative advantage, compatibility, complexity, trialability and observability (Bennett, J. & Bennett, L., 2003). Relative advantage is defined as the degree to which an innovation is considered as being better than the idea it replaced. This construct is found to be one of the best predictors of the adoption of an innovation. Compatibility refers to the degree to which innovation is regarded as being consistent with the potential users' existing values, prior experiences, and needs. Complexity is the end-users' perceived level of difficulty in understanding innovations and their ease of use. Trialability refers to the degree to which innovations can be tested on a limited basis. Observability is the degree to which the results of innovations can be visible by other people. These characteristics are used to explain end-user adoption of innovations and the decision-making process. These constructs have relationship with the studied variables. This relates to attitude towards use of solar technology.

2.8 Conceptual Framework

The interrelationships between various variables under study are conceptualized as shown in Figure 1. Key variables include; Government Policy, cost of installation, availability of markets and level of technological awareness. It is expected that the above mentioned variables greatly influenced the implementation of solar energy projects. This has been modelled in Figure 2.1:

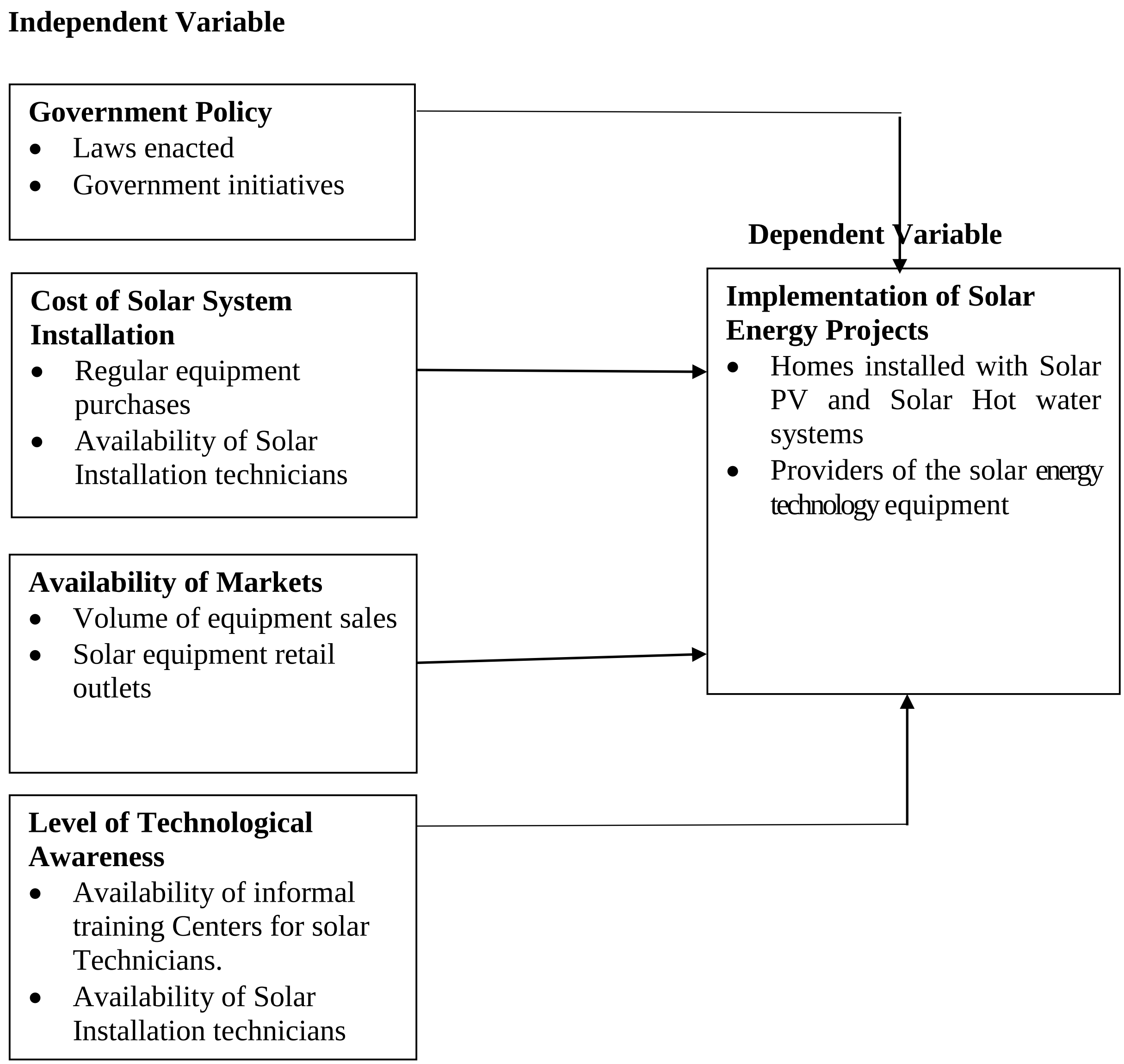

Figure 2.1: Conceptual Framework of Factors Influencing Implementation of Solar Energy Projects

2.9 Research Gap

Renewable energy projects are often nipped in the bud by several false steps. These drawbacks are often encountered in the implementation of solar energy projects- that most often collapse even before take-off. Some of these failures have been attributed to among other reasons state sponsored alternatives- the hydro-power option and the much touted rural electrification program being obvious casualties that have been rolled out to most rural areas. A viable renewable energy plan to the rural areas will however spur unprecedented economic growth and vibrancy in those areas. No such study has been carried out on the factors influencing the implementation of solar energy projects in Kenya: A case of solar energy projects in Homa-bay County. This study will significantly fill this research gap by investigating these factors. By and large, the literature review looked very closely at these factors and shed light on Government policy, Availability of markets, Cost of installation as well as level of technological awareness.

2.10 Summary of Literature Reviewed

This Chapter is divided into nine sections. The first section is a brief introduction, offering a glimpse of the chapter. The second section delves into the theoretical framework looking into both Resource based theory and Innovation diffusion theory. Solar energy projects in Kenya and its evolution is tackled in the third section, and this eases into the section on how government policy, cost of installation, availability of markets and level of technological awareness influences the implementation of solar energy projects in Kenya, with Homa-bay County at its very center. Section eight and nine captures the conceptual framework and research gap respectively.

Organization of the Study

This study is organized in five chapters. Chapter one discusses the background to the study including the statement of the problem, the purpose of the study, objectives of the study, research questions and hypotheses, significance of the study, limitations and delimitations of the study and definitions of significant terms.

Chapter two entails empirical and theoretical literature organized according to study themes, the theoretical underpinnings, theoretical and conceptual frameworks and a matrix on research gap identified after the review of literature. Chapter three covers research methodology that includes the research design, target population, sampling procedure, research instruments, data analysis techniques and operationalization of variables.

Chapter Four has analysis, presentation, interpretation and discussion of findings while Chapter Five has summary of findings, conclusions, recommendations for theory, policy and practice, contribution of the study to knowledge and suggestions for further research.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

This chapter provides information about the applied research process during the study. It includes research design, sample and sampling procedure method, target population and sample size. It also focusses on validity, sampling design, data collection instruments, data collection procedure, data analysis techniques, operational definition of variables, reliability of instruments as well as on ethical issues surrounding the research.

3.2 Research Design

Research design is the way a study is planned and conducted, the procedures and techniques employed to address research problems or questions (Saunders et al., 2007). Descriptive survey design was used in the study. Descriptive survey allows the researcher to describe, record, analyze and report conditions that exist or existed (Kothari, 2008). This research design was therefore instrumental in drawing inferences about the factors influencing the implementation of solar energy projects in Homa-bay County, Kenya. Descriptive survey was chosen due to its ability to fulfill the research objectives.

3.3 Target Population

Target population is the entire group of people, events and things of interest to be investigated by the researcher (Sekaran and Bougie, 2011). The population for the study comprised all licensed contractors and technicians registered by the Energy regulatory commission and who undertake installation of solar systems in Homa-bay county. According to the Kenya Energy Regulatory Commission, as at January 2017 there were 1100 registered contractors and technicians licensed to undertake installation of Photovoltaic solar systems as well as solar hot water systems in the county. Therefore, the population of the study was 1100 technical entities and their involvement in Homa-bay County.

3.4 Sample size and Sampling Procedure

Due to feasibility and cost constraints involved in the study of entire populations, it is extremely cumbersome to study entire populations. For this reason, it was ideal to select a representative sample from the population of interest for observation and analysis. It was therefore prodigious that a population was defined, from which a representative sample was then chosen.

3.4.1 Sample Size

From the population, the required number of subjects, respondents or elements were selected in order to make a sample. In order to determine the sample size, Mugenda and Mugenda (2003) recommends that a sample size of 10% to 30% is appropriate for a population of less than 10,000 employees. Babbie (2004) recommends that when the target population is small (less than 10,000 members), a minimum sample of 10% is adequate for educational research. Based on this, the study sampled 10% of contractors and technicians that install solar systems in Homa-bay County. This comprised a sample size of 110 contractors and technicians.

3.4.2 Sampling Procedure

According to Cooper and Schindler (2011), a sampling procedure is a complete and correct list of all population elements from which the sample is drawn from. It is a complete and correct list of population members only. The study employed simple random sampling technique to sample firms installing solar systems for heating and lighting in Homa-bay County. In a simple random sampling, every respondent will be chosen from a larger set (a population) randomly and entirely by chance, such that each firm has the same probability of being chosen at any stage during the sampling process. This sampling technique gives everyone an equal opportunity or the same probability of being chosen.

3.5 Data Collection Instruments

Primary data was gathered directly from respondents for this study using a questionnaire. The questionnaire consisted of close and open-ended questions separated into two sections. The first part contained background information, which was; Number of Years in Operation, Number of staff in the technical team, Type of Solar Installations undertaken;

Whether PV, Hot water or Both, age and marital status of the respondent. This was to shed light on the nature of the firm, while the second part focused on factors affecting implementation of solar energy projects. The questionnaire employed a 4-point Likert scale. A Likert scale is made up of several Likert items. A Like item is a statement to which a participant responds to by indicating his/ her degree of agreement or disagreement. The research instrument is attached under Appendix 3.

3.5.1 Piloting of Research Instruments

A pilot study is a small scale preliminary study conducted in order to evaluate feasibility, time, cost, adverse events, and effect size (statistical variability) in an attempt to predict an appropriate sample size and improve upon the study design prior to performance of a full-scale research project. The researcher administered a set of structured and unstructured questionnaires through a pilot study to appraise the questionnaire soundness of the items and to estimate time duration appropriate to answer the items.

Mugenda and Mugenda (2003) recommends that 10% of the sample size is ideal for pilot study. Based on this, a pilot study involved 10 firms which were not be in the sampled population. Results of the pilot study were discussed with the respondents to make the required adjustments. The aim was to test the instrument reliability and validity.

3.5.2 Validity of the Research Instrument

Validity refers to the degree to which evidence and theory support the interpretation of the test scores entailed by use of tests (SaundersBarne, 2009). It is simply an indicator as to whether the research instrument measures what it is intended to measure or not. The instrument's content and construct validity were ensured through the help of expert judgment (the supervisor) who assessed the instrument to find out if it answered the phenomenon under study. Bias in the research instrument was thereafter removed by constructing it in line with the objectives of the study.

3.5.3 Reliability of the Research Instrument

Reliability is a measure of a research instrument that ensures it yields consistent results or data after repeated trials (Mugenda and Mugenda, 2003). This is to ensure that the questionnaire produces stable and consistent results. Reliability estimates provide researchers with an idea of how much variation to expect. According to Fraenkel and Wallen (2000), reliability can be accepted if the alpha is within a range of between 0.70-0.99 for Social Science Research, as this indicates a strong relationship between the items of the test.

Split-half reliability was used to assess the reliability of the instruments, where consistency between two halves of a construct measure was established. To each half of the construct, the entire instrument was administered to a sample of respondents, and the total score for each half for each respondent is calculated and the correlation between the total scores in each half is a measure of split-half reliability. Pearson correlation coefficient, PPMC was used to measure the correlation in linear relationship between two sets of data, thereby finding how well they relate.

3.6 Data Collection Procedure

Ahead of the data collection, a letter of introduction was requested from the University of Nairobi and presented to NACOSTI for permit issuance. Soon afterwards, the permit was handed to the County Commissioner Homa-bay County and the County director of Education so as to ask for permission to conduct research. These questionnaires were issued to the solar contractors and technicians in person during the subsequent visits. During the research visit, the contractors and technicians in Homa-bay County were administered the questionnaires and observations made which were recorded in the observation schedules. The questionnaires were collected as soon as they were filled by the respondents.

3.7 Data Analysis

Data analysis is the whole process, which starts immediately after data collection and ends at the point of interpretation and data processing. It is a way to process data so that what is learnt can be communicated to others (Leech and Onwuegbuzie, 2007). Quantitative methods were employed in data analysis. Quantitative data was analyzed using the Statistical Package for the Social Sciences (SPSS) computer software. SPSS came in handy in organizing and summarizing the data by means of descriptive statistics such as measures of central tendency (mean) and measures of dispersion (standard deviation).

3.8 Ethical Issues

All the participants and respondents were given a free will to participate and contribute voluntarily to the study. Necessary research authorities were consulted and permission sought before commencement of the study. The respondents were debriefed on the objectives of the study before commencing to fill the questionnaires. The research was conducted within the confines of the necessary regulations prohibiting plagiarism and adherence to copyright obligations. Moreover, interviewees especially those within government structures were afforded the opportunity to choose anonymity due to the sensitive nature of the subject matter. All findings (expected and unexpected) were disclosed. This was regardless of whether they put into question the design of the research.

3.9 Operationalization of Variables

This section dealt with the operational definition of study variables, along with other components of the conceptual framework. The independent variables included government policy, costs of installation, availability of markets and level of technological awareness. The dependent variable was solar energy projects implemented. These are tabulated in the Table 3.1:

Tables 3.1: Operationalization of Variables

Objective	Type of variable	Indicators	Level of Scale	Data Collection	Data Analysis
To investigate factors influencing implementation of solar energy projects in Homa-bay County, Kenya	Dependent variable Solar energy projects Implementation	• Homes installed with Solar systems • Availability of providers of the solar equipment	4 Point Likert Scale	Questionnaire	Descriptive Regression Correlation
To determine the extent to which government policy influences implementation of solar energy projects in Homa-bay County, Kenya.	Independent variables Government Policy	• Laws enacted • Government initiatives	4 Point Likert Scale	Questionnaire	Descriptive Regression Correlation
To investigate how cost of installation influences implementation of solar energy projects in Homa-bay County, Kenya.	Costs of Installation	• Regular solar equipment purchases • Availability of Solar technicians	4 Point Likert Scale	Questionnaire	Descriptive Regression Correlation
To find out how availability of markets influences implementation of solar energy projects in Homa-bay County, Kenya.	Availability of markets	• Equipment sales • Equipment retail outlets	4 Point Likert Scale	Questionnaire	Descriptive Regression Correlation
To investigate how level of technological awareness influences implementation of solar energy projects in Homa-bay County, Kenya.	Level of technological awareness	• Availability of Solar Installation technicians • Informal training on solar technology	4 Point Likert Scale	Questionnaire	Descriptive Regression Correlation

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

This chapter presents collected data on the Factors Influencing Implementation of Solar Energy Projects in Homa-Bay County, Kenya in a manner that gives logical interpretation of research findings. These findings have also been compared with expected findings. This section includes the demographic information, presentation of findings and data analysis as per the study objectives. The data collected using questionnaires was analyzed, presented and interpreted according to the individual objectives of the study. Descriptive and inferential statistics were employed.

4.2 Questionnaire Response Rate

Out of the 110 questionnaires that were administered, 107 questionnaires were returned fully filled representing 97.3% response rate. Mugenda and Mugenda (2003), states that a response rate of 50% is adequate, whereas a response rate of more than 70% is very good. Hence the response rate was satisfactory as indicated in Table 4.1.

Table 4.1: Questionnaire Response Rate

Response	Frequency	Percent (%)
Responded	107	97.3%
No Response	3	2.7%

4.3 Demographic Information

The study sought to gather general information that related to the factors influencing implementation of solar energy projects in Homa-Bay County, Kenya. The information included the number of years within which the respondents have been undertaking installation of solar energy projects, whether the firms have contracted dealers across the country, whether companies undertake installation of PV and hot water systems, whether the firms run awareness campaigns on solar energy and its merits, number of technicians in their teams, clientele composition, solar installation jobs and whether the firms would recommend solar business to new entrants.

4.3.1 Descriptive Findings

The study sought to establish for how long the respondents had undertaken the installation of solar energy projects. From the findings, majority of the respondents, 60(56.1%) indicated that they had undertaken the installation of solar energy projects for a period of 6-10 years, followed by those who had undertaken installation for over 10 years, who were 36 representing 33.6%. The findings also indicated that 11(10.3%) of the respondents had been involved in installing the solar energy projects for under 5 years. These study findings therefore indicate that most of respondents had adequate experience in the implementation of solar energy projects. According to the study findings, majority of the firms that were under study, 93(87%) indicated that they had contracted dealers across the country while 14(13%) indicated that they did not have country wide contracted dealers.

The findings indicate that majority of the firms were in a position to install their solar energy projects in most parts of the country. The study sought to establish whether the companies under study installed PV systems, Hot water systems or both. According to the findings, majority of the companies, 37(35%) indicated that they installed only PV systems, 11(10%) indicated they installed only Hot water systems while the majority 59(55%) indicated that they installed both the PV and Hot water systems. The study sought to establish whether the companies under study held awareness campaigns on solar energy and its merits. From the findings, majority of the companies that were studied, 101(94%) indicated that they held awareness campaigns on solar energy and its merits while 6(6%) indicated that they never held any awareness campaigns on solar energy and its merits.

The findings indicate that through the awareness campaigns most people were made aware on solar energy projects. The study also sought to find the number of technicians that were present in the respondents' team. The findings are shown in Table 4.2.

Table 4.2: Number of Technicians in a Team

	Frequency	Percent
1-10	33	30.8
11-20	46	43
21 and above	28	26.2
Total	107	100

According to the findings, majority of the respondents, 46(43%) indicated that there were 11-20 technicians present in their teams, 33(31%) indicating 1-10 technicians in their teams and 28(26%) indicating over 20 technicians present in their teams. The findings indicate that there were a large number of technicians in most teams. From the findings, most of the firms indicated that their clientele composition was mostly made up of both home owners and corporate firms, 79(74%), and 8(8%) of the companies had their clientele made up of Corporate firms. However, 20 companies representing 19% indicated that their clientele were drawn from both Home owners.

4.3.2 Means to Securing Solar Installation Jobs

The study sought to establish how the different companies under study landed solar installation jobs. The findings are shown in Table 4.4

Table 4.3: Means to Securing Solar Installation Jobs

	Frequency	Percent
Customer referrals	35	32.71
Contract Bids	10	9.35
Both	62	57.94
Total	**107**	**100**

From the findings, most of the firms indicated that they landed their solar installation jobs through customer referrals, 35(32.71%), and 10(9.35%) of the companies landed their jobs of solar installation through contract bids. However, 62 companies representing 57.94%

indicated that they landed solar installation jobs both through customer referrals and contract bids.

4.3.3 Chance of recommending of Solar Business to New Entrants

The study sought to establish whether the respondents would recommend the solar business to other new entrants. The responses are shown in Table 4.5

Table 4.4: Chance of recommending of Solar Business to New Entrants

	Frequency	Percent
Yes	102	95.3
No	5	4.7
Total	**107**	**100.0**

According to the findings, majority of the respondents, 102(95%) indicated that they would recommend the solar installation business to other new entrants while 5(5%) were of the contrary opinion.

4.4 Government Policy and Implementation of Solar Energy Projects

The study sought to find out information on government policy and implementation of solar energy projects.

4.4.1 Influence of Government Regulations and Legislation on Implementation of Solar Energy Projects

The study sought to establish whether the government regulations and legislation influenced the implementation of solar energy projects. The findings are indicated in Table 4.6

Table 4.5: Influence of Government Regulations and Legislation on Implementation of Solar Energy Projects

	Frequency	Percent
Yes	105	98.1
No	2	1.9
Total	**107**	**100.0**

According to the findings, most of the respondents, 105(98.1%) concurred that government regulations and legislation influenced the implementation of solar energy projects. However, 2(1.9%) respondents indicated that government regulations and legislation did not influence the implementation of solar energy projects. The Energy Regulatory Commission instituted a law requiring residential premises, cafeterias, restaurants, hotels, health and educational institutions within jurisdiction of local authorities with hot water requirements with a capacity in excess of 100 liters daily to install the use of solar heating systems. Furthermore, electric power distributors are prohibited to supply power when solar water heating systems have not been installed. These regulations and legislations therefore influence the implementation of solar energy projects.

4.4.2 Statements on Government Policy and Implementation of Solar Energy Projects

The study sought to find out the extent to which the respondents agreed with the statements on Government Policy and Implementation of Solar Energy Projects. On a Likert scale of 1-4 (where 1= disagree, 2= Agree to a small extent, 3= Agree to a high extent, 4= strongly agree). The findings are presented in Table 4.7 in form of means and standard deviations.

Table 4.6: Statements on Government Policy and Implementation of Solar Energy Projects

Statements	Mean	Std. Dev
There are sufficient government incentives to adopt solar energy technologies	2.2710	.59193
The level of taxation levied on importation of solar equipment has been significantly lowered.	2.3084	.67867
Government policy requirement for rooftop solar heating installation for commercial establishments is a bold step toward enhancing solar use.	3.5607	.56930
There are alternative renewable energy technologies that can be made available to the Homa- bay residents other than solar energy	2.6262	.70742

From the findings, majority of the respondents agreed to a small extent with the statement that the level of taxation levied on importation of solar equipment has been significantly lowered and to a high extent that government policy requirement for rooftop solar heating installation for commercial establishments is a bold step toward enhancing solar use with mean scores of 2.3084 and 3.5607 respectively. Still, majority of the respondents agreed to a small extent with the statement that there are sufficient government incentives to adopt solar energy technologies as well as that there are alternative renewable energy technologies that could be made available to the Homa-Bay residents other than solar energy with mean scores of 2.2710 and 2.6262 respectively. The findings therefore show that most respondents agreed that the government regulations and legislation influenced the implementation of solar energy projects.

4.5 Cost of Installation and Implementation of Solar Energy Projects

The study sought establish the Cost of Installation and Implementation of Solar Energy Projects in Homa-Bay County.

4.5.1 Regular Monthly Income

The study sought to find out how many respondents had a regular monthly income. The findings are indicated in Table 4.8

Table 4.7: Regular Monthly Income

Response	Frequency	Percent
Yes	95	88.8
No	12	11.2
Total	107	100.0

From the findings, majority of the respondents, 95(88.8%) indicated that they had regular source of monthly income while 12(11.2%) had irregular monthly income.

4.5.2 Monthly Income Category

The study sought to establish the income monthly category of the respondents. The findings are shown in Table 4.9

Table 4.8: Monthly Income Category

	Frequency	Percent
0-10,165	20	18.7
10,165-19,741	24	22.4
19,741-29,317	18	16.8
29,317-38,893	22	20.6
38,893-above	23	21.5
Total	107	100.0

From the findings, majority of the respondents, 24(22.4%) indicated that their monthly income was Kshs. 10,165-19,741; 22(20.6%) with an income range of Kshs. 29,317-38,893; 20(18.7%) with an income range of Kshs. 0-10,165; 18(16.8%) with an income range of Kshs. 19,741-29,317. 23 respondents representing 21.5% however indicated that they had an income range of Kshs. 38,893 and above. The results indicate that most of the respondents had a regular income.

4.5.3 Effect of Clients' Income on Implementation of Solar Energy Projects

The study sought to know how the income of the respondents affected the implementation of solar energy projects. The findings are shown in Table 4.10

Table 4.9: Clients' Income and Implementation of Solar Energy Projects

Response	Frequency	Percent
Yes	99	92.5
No	8	7.5
Total	107	100.0

According to the findings, majority of the respondents, 99(92.5%) indicated that the income of their clients had an effect on the implementation of solar energy projects while 8(7.5%) of the respondents did not concur that the income of their clients affected the implementation of the solar energy projects. The respondents who reported that income affected the implementation of the solar energy projects explained that fast payments by the clients facilitated the completion of the projects in a short period of time. On the other hand the delays in settling the cost of installation resulted the installation taking a longer period of time than usual.

4.5.4 High Clients' Income on Implementation of Solar Energy Projects

The study sought to get the opinion of the respondents on the effect of High Clients' income on the implementation of solar energy projects. Majority of the respondents indicated that clients with high incomes generally met the cost of installations of the projects in a short period of time hence facilitating faster installation. In addition, the High clients' income invested more in large capacities of the solar installation projects.

4.5.5 Cost of Installation and Implementation of Solar Energy Projects

The study sought to find out the extent to which the respondents agreed with the statements on Cost of Installation and Implementation of Solar Energy Projects on a Likert scale of scale of 1-4 (where 1= disagree, 2= Agree to a small extent, 3= Agree to a high extent, 4=

strongly agree). The findings are presented in Table 4.11 in form of means and standard deviations.

Table 4.10: Cost of Installation and Implementation of Solar Energy Projects

Statement	Mean	Std. Dev
There is a high level of investment in PV and hot water solar systems	3.4860	.55567
Solar energy technology is a largely expensive energy option	1.3084	.69243
There is increasingly high level of people on regular income who install solar systems	3.1495	.54606
There are favorable means to financial facilities such as bank loans to solar contractors	2.1028	.76398
There is considerable financial support such as bank loans to clients who install solar systems.	1.8037	.69281

From the findings, majority of the respondents agreed to a high extent with the statements that there is increasingly high level of people on regular income who install solar systems with a mean score of 3.1495. Majority of respondents agreed to a small extent with the statement that there are favorable means to financial facilities such as bank loans to solar contractors with a mean of 2.1028. Majority of respondents disagreed that there is considerable financial support such as bank loans to clients who install solar systems with mean scores of 1.8037. However, majority of the respondents agreed to a high extent with the statement that there is a high level of investment in PV and hot water solar systems with mean score of 3.4860. The respondents disagreed with the statement that solar energy technology is a largely expensive energy option with a mean score of 1.3084. The findings therefore show that most respondents agreed that there is increasingly high level of people on regular income who install solar systems and that there are favorable means to financial facilities such as bank loans to solar contractors. Moreover, most respondents agreed that there are considerable financial support such as bank loans to clients who install solar systems and which determine implementation of solar projects.

4.6 Availability of Markets and Implementation of Solar Energy Projects

The study sought to find out information on Availability of Markets and Implementation of Solar Energy Projects.

4.6.1 Influence of Availability of Solar Technology on Implementation of Solar Energy Projects.

The study sought to establish whether availability of solar technology influences the implementation of solar energy projects. The findings are indicated in Table 4.12

Table 4.11: Solar Technology & Implementation of Solar Energy Projects

Response	Frequency	Percent
Yes	85	79.4
No	22	20.6
Total	107	100.0

According to the findings, most of the respondents, 85(79.4%) concurred that the availability of solar technology influenced the implementation of solar energy projects. However, 22(20.6%) respondents indicated that the availability of technology does not influence the Implementation of solar energy projects.

4.6.2 Statements on Availability of Markets and Implementation of Solar Energy Projects.

The study sought to find out the extent to which the respondents agreed with the statements on Availability of Markets and Implementation of Solar Energy Projects on a Likert scale of scale of 1-4 (where 1= disagree, 2= Agree to a small extent, 3= Agree to a high extent, 4= strongly agree). The findings are presented in Table 4.13 in form of means and standard deviations.

Table 4.12: Statements on Availability of Markets and Implementation of Solar Energy Projects

Statements	Mean	Std. Dev
There are alternatives to solar energy technologies in Homa-bay County through schemes like REA (Rural Electrification authority)	2.9907	.50461
There is a high level of usage of Solar energy technology in Homa-bay county	3.2336	.42514
There is ready market in Homa- bay county for solar PV and solar hot water systems.	3.2710	.44658
Your clients are in close proximity to Grid electricity	1.7196	.71102
Clients you often install with solar technologies are equipped with Knowledge of available renewable substitutes	2.8318	.69345

From the findings, majority of the respondents agreed to a small extent with the statements that there were alternatives to solar energy technologies in Homa-bay County through schemes like REA (Rural Electrification authority) and that the clients that they often install with solar technologies were equipped with knowledge of available renewable substitutes with mean scores of 2.9907 and 2.8318 respectively. However, majority of the respondents agreed to a high extent with the statements that there was ready market in Homa- Bay County for solar PV and solar hot water systems and there was a high level of usage of solar energy technology in Homa-bay County with mean scores of 3.2710 and 3.2336 respectively. The respondents disagreed with the statement that their clients were in close proximity to Grid electricity with mean scores of 1.7196. The findings therefore show that most respondents agreed that availability of markets for solar energy technologies in Homa-bay County played a critical role in the implementation of solar energy projects. They nonetheless disagreed that their clients were in close proximity to Grid electricity.

4.7 Statements on Level of Technological Awareness and Implementation of Solar Energy Projects

The study sought to find out information on level of technological awareness and implementation of solar energy projects.

4.7.1 Influence of level of technological awareness of solar technologies on implementation of solar energy projects

The study sought to establish whether the level of technological awareness of solar technologies influenced the implementation of solar energy projects. The findings are indicated in Table 4.14

Table 4.13: Level of Technological Awareness of Solar Technology on the Implementation of Solar Energy Projects

Response	Frequency	Percent
Yes	77	72.0
No	30	28.0
Total	107	100.0

According to the findings, most of the respondents, 77(72%) concurred that the level of technological awareness of solar technologies influenced the implementation of solar energy projects. However, 30(28%) respondents indicated that the level of technological awareness of solar technologies did not influence the implementation of solar energy projects.

4.7.2 Statements on Level of Technological Awareness and Implementation of Solar Energy Projects.

The study sought to find out the extent to which the respondents agreed with the statements on Level of Technological Awareness and Implementation of Solar Energy Projects on a Likert scale of scale of 1-4 (where 1= disagree, 2= Agree to a small extent, 3= Agree to a high extent, 4= strongly agree). The findings are presented in Table 4.15 in form of means and standard deviations.

Table 4.14: Statements on Level of Technological Awareness and Implementation of Solar Energy Projects.

Statements	Mean	Std. Dev
There is a high level of awareness of solar PV and solar Hot water technologies among the population in Homa- bay County	3.4860	.58864
Installation technicians have adequate formal training on Solar systems	3.4486	.49969
The providers of solar technologies are accessible in Homa-bay County	3.2710	.54201
Most of your clients are inclined to installation of solar energy systems	3.4206	.56697
Most residents of Homa- bay County use alternative forms of energy for lighting and heating to a large extent	2.7570	.59623

From the findings, majority of the respondents agreed to a high extent with the statements that Installation technicians have adequate formal training on solar systems, that there was a high level of awareness of solar PV and solar Hot water technologies among the population in Homa-Bay County, that most of their clients were inclined to installation of solar energy systems and that providers of solar technologies were accessible in Homa-Bay County with mean scores of 3.4486, 3.486, 3.4206 and 3.2710 respectively. However, most respondents agreed to a small extent with the statements that, most residents of Homa-Bay County used alternative forms of energy for lighting and heating to a large extent with mean scores of 2.757. The findings therefore show that most respondents agreed to a high extent that the level of technological awareness of solar technologies influenced the implementation of solar energy projects.

4.8 Improving Solar Energy Projects to Suit the Needs of the Locals

The study sought to establish from the respondents on how solar energy projects could be improved to meet the needs of the locals in Homa-bay County. The respondents pointed out that one of the critical aspects of improving solar energy projects with an objective of meeting the needs of the locals is the development of cost-friendly yet effective solar energy technologies. Currently, the County government of Homa-bay has taken steps to subsidize the cost of renewable solar lamps to the senior members of the community. In every Ward, the County government provides 18 solar lamps at a subsidized cost of Kshs. 300 while meeting the rest of the cost. However, the respondents feel that more of the lamps should be provided not only to the old members of the community but to all family households. The respondents also praised the solar street lighting locally referred to as Okonyo Welo at the market centers to allow business premises and business people to sell their wares into dusk hours as well as beefing up security.

The interviewees noted that even with the efforts that have been made, there was quite a delay in maintaining the security lights when they get spoilt. The respondents further reported that improving solar energy technologies can be achieved through initiating and implementing various programs coupled with promoting policy changes that will facilitate the creation of an environment where all stakeholders will flourish. Ensuring that all infrastructure and necessary incentives to boost investors, contractors and lending institutions. All these incentive structures can meet the solar energy needs of the rural folks. The respondents noted with concern that current consultations with stakeholders did not include everyone concerned with only a few people being involved hence the appreciation of any initiatives is not felt by everybody. This situation has to change so as to meet the needs of every resident in the County.

4.9 Attractiveness of Solar Energy Technology

The study asked the respondents on what made solar technology attractive. The respondents reported that solar technology was attractive since it does not require any fuel when it is used in the production of electricity hence making it a cheaper option in comparison to other forms of electricity generation. Initially, the cost of installation can be quite costly, but the moment it is installed, there are little maintenance costs involved making it a cheaper option in the long-term mostly for the rural population who have limited means in terms of finances. Certainly, most rural areas have not had access to electricity until most recently. The absence of power cables provides a challenge cost wise but solar energy technology does not require the power cable networks.

4.10 Experiences in Installation of Other Forms of Energy

The study asked the interviewees about their experiences in installation of other forms of energy. Most of the respondents had little to no experience installing other forms of energy. This was attributed to the rural setting of Homa-bay County, whose larger population have little or no access to alternative sources of renewable energy options, with which to power their small radios and domestic lighting. In the near absence of grid electricity, most residents rely on dry cells or Lead-acid car batteries which are frequently used in providing small quantities of electrical energy for the rural folk in the county. Besides, the slow growth of alternative renewable technologies like wind power and Geothermal resources in the County of Homa-bay has not afforded most of the respondents opportunities to install other forms of energy.

4.11 Preferred Alternative Form of Renewable Energy

The study sought to establish from the respondents what their preferred form of renewable energy was apart from the solar energy. The respondents indicated that their preferred form of renewable energy in their County was anything that was both cost effective and easily available to large part of the population. The County has other renewable energy sources such as wind, bio gas and geothermal energy in places such as Homa Hills but which need development.

CHAPTER FIVE
SUMMARY, DISCUSSION OF FINDINGS AND CONCLUSIONS

5.1 Introduction

This chapter provides a summary, discussion of findings and conclusion drawn from the study. The major objective of the study was assessment of the factors influencing implementation of solar energy projects in Homa-Bay County, Kenya.

5.2 Summary of Findings

The study findings established that government policy influenced the implementation of solar energy projects in Homa-bay County. The study findings revealed that the level of taxation levied on importation of solar equipment has been significantly lowered and government policy requirement for rooftop solar heating installation for commercial establishments is a bold step toward enhancing solar use. The findings therefore revealed that government regulations and legislation influenced the implementation of solar energy projects.

The study found that level of cost of installation influenced the implementation of solar energy projects in Homa-bay County. The study revealed that income affected the implementation of the solar energy projects. Fast payments by the clients facilitated the completion of the projects in a short period of time. On the other hand the delays in settling the cost of installation resulted the installation taking a longer period of time than usual. Considerable financial support such as bank loans assist clients to fund the installation of solar systems hence determining the implementation of solar projects. The study also established that solar energy clients with high levels of income generally met the cost of installations of the projects in a short period of time hence facilitating faster installation. In addition, the High clients’ income invested more in large capacities of the solar installation projects.

The study found out that availability of markets had an influence on the implementation of solar energy projects in Homa-bay County. There was a ready market in Homa-bay County for solar PV and solar hot water systems. The study further established that there were alternatives to solar energy technologies in Homa-bay County through schemes like REA (Rural Electrification authority) and clients were in close proximity to Grid electricity. The study established that the availability of solar technology influenced the implementation of solar energy projects. The findings further revealed that there were alternatives to solar energy technologies in Homa-bay County through schemes like REA (Rural Electrification authority) and their clients were in close proximity to Grid electricity.

The study found out that level of technological awareness influenced the implementation of solar energy projects in Homa-bay County. The study revealed that installation technicians had adequate formal training on solar systems and most residents of Homa-Bay County used alternative forms of energy for lighting and heating. The providers of solar technologies were not very accessible in Homa-Bay County. The findings therefore revealed that to some extent the level of technological awareness of solar technologies influenced the implementation of solar energy projects.

5.3 Discussion of Findings

The study found out that government policy had considerable influence on implementation of solar energy projects in Homa-bay County. It established that government regulations and legislation such as level of taxation levied on solar equipment imports influenced the implementation of solar energy projects. These findings concur with Moreira and Wamukonya (2002) who state that the specific objectives of the energy policy in Kenya are; provision of sustainable quality energy services for development; utilization of energy as a tool to accelerate economic empowerment for urban and rural development; improving access to affordable energy services; provision of an enabling environment for the provision of energy services; enhancing security of supply; promoting development of indigenous energy resources; and promotion of energy efficiency and conservation as well as prudent environmental, health and safety practices. The study found that income affected the implementation of the solar energy projects. It found that the cost of installation of the solar energy technology and availability of qualified technicians affected the implementation of solar energy technology. These findings agree with Johannes (2011) who postulate that because solar energy projects often involve a relatively large upfront investment in equipment, it limits local contractors and technicians from effectively engaging in installations due to lack of initial capital. They further argue that some of the equipment such as thermostats are not locally manufactured thereby raising operation costs incurred by the equipment importers. These costs are transferred further down and effectively make solar energy projects implementation an expensive affair considering the fact that most of the rural population have low incomes.

The study established that availability of markets influence the implementation of solar energy projects in Homa-bay County. There is a ready market in Homa- Bay County for solar PV and solar hot water systems. These findings agree with Jacobs (2006) who state that the solar market in Kenya is among the largest and its usage per capita is the highest among developing countries. Cumulative solar sales in Kenya (since the mid-1980s) are in excess of 200,000 systems, and annual sales growth has regularly topped 15% over the past decade.

The study found out that the level of technological awareness had an influence on implementation of solar energy projects in Homa-bay County. The study revealed that there was a generally high level of awareness of solar PV and solar Hot water technologies among the population in Homa-Bay County. The findings agree with Rogers (2003) who theorized that the process of demand commences with an individual driven by precedent conditions such as a felt need to adopt an innovative product or service. The lack of technological awareness results in the loss of potential installers. Therefore, decision to grow and expand a new innovation often starts with awareness. It's difficult for one to implement solar energy projects without knowing about the innovation. The findings therefore show that most respondents agreed that the level of technological awareness of solar technologies influenced the implementation of solar energy projects.

5.4 Conclusion

Regarding the first objective, the researcher sought to determine the extent to which government policy influenced implementation of solar energy projects in Homa-bay County, Kenya. The study established that government regulations and legislation such as level of taxation levied on importation of solar equipment influenced the implementation of solar energy projects. The study concludes that there is need for the County government working with the Kenyan national government and other stakeholders to draft more policies and legislate laws that will facilitate the implementation of solar energy projects in the county.

Regarding the second objective, the researcher sought to investigate how the cost of installation of solar technology influenced implementation of solar energy projects in Homa-bay County, Kenya. The study concludes that income affected the implementation of the solar energy projects. It found that the cost of installation of the solar energy technology and availability of qualified technicians affected the implementation of solar energy technology. Majority of the rural population in Homa-bay County have low income and when the cost of installing the solar energy projects is high, then the implementation is affected.

In regard to the third objective, the researcher sought to find out how availability of markets for solar technology influenced implementation of solar energy projects in Homa-bay County, Kenya. The study also concluded that the availability of markets influenced the implementation of solar energy projects in Homa-bay County. In Homa-Bay County there is a ready market for solar PV and solar hot water systems. In regard to the last objective in the study, it was established that that the level of technological awareness had an influence the implementation of solar energy projects in Homa-bay County. The study revealed that there was a generally high level of awareness of solar PV and solar Hot water technologies.

5.5 Recommendations

The study recommends that Homa-bay County government should organize training workshops and seminars with the aim of disseminating information on solar technology thereby raising awareness among the residents of the County. This will facilitate growth and expansion of solar energy technologies and thereby enhance innovation. The Homa-bay County government working should provide incentives such as tax waivers and import duty waivers to encourage individuals to engage in sales, installation and implementation of solar energy technologies. These initiatives will reduce the cost of implementation of the solar energy technology hence catering for the needs of the low income earners in the County.

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APPENDIX I

RESEARCH AUTHORIZATION

UNIVERSITY OF NAIROBI
COLLEGE OF EDUCATION AND EXTERNAL STUDIES
SCHOOL OF CONTINUING AND DISTANCE EDUCATION
DEPARTMENT OF EXTRA-MURAL STUDIES
NAIROBI EXTRA-MURAL CENTRE

Your Ref:
Our Ref:
Telephone: 318262 Ext. 120

Main Campus
Gandhi Wing, Ground Floor
P.O. Box 30197
N A I R O B I

REF: UON/CEES/NEMC/26/218

22nd June, 2017

TO WHOM IT MAY CONCERN

RE: PATRICK OTIENO OTUOMA - REG NO L50/70386/2013

This is to confirm that the above named is a student at the University of Nairobi College of Education and External Studies, School of Continuing and Distance Education, Department of Extra- Mural Studies pursuing Masters of Art in Project Planning and Management.

He is proceeding for research entitled "**factors influencing implementation of solar energy projects in Homa-Bay County, Kenya**.

Any assistance given to him will be highly appreciated.

UNIVERSITY OF NAIROBI C.E.E.S. P.O. Box 30197 22 JUN 2017 NAIROBI EXTRA MURAL CENTRE

CAREN AWILLY
CENTRE ORGANIZER
NAIROBI EXTRA-MURAL CENTRE

APPENDIX II:

LETTER OF TRANSMITTAL OF DATA COLLECTION INSTRUMENTS

MBITA

(D) (81)

Patrick Otieno Otuoma

P. O Box 7466-00200

Nairobi.

Dear (***Respondent***)

I am a master of arts in project planning and management student at the university of Nairobi Kenya. I am currently undertaking a research project on: **'Factors influencing the implementation of solar energy projects in Homa-bay County'** as a partial fulfilment of the requirements for the award of the Master of Arts Degree in Project Planning and Management of the University of Nairobi.

You have been randomly selected to participate in this research by volunteering information on the factors influencing the implementation of solar energy projects in Kenya: a case of solar energy projects in Homa-bay County. This is a request for you to participate by responding to the attached questionnaire.

Your truthful response will help facilitate this study. Please, be assured that any personal information given will be treated with utmost confidentiality and will be purposely used for this study.

Your participation will be highly appreciated.

Best Regards.

Patrick Otieno Otuoma.

L50/ 70386/ 2013

3

APPENDIX III:

RESEARCH PERMIT

NACOSTI

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone: 020 400 7000,
0713 788787,0735404245
Fax: +254-20-318245,318249
Email: dg@nacosti.go.ke
Website: www.nacosti.go.ke
When replying please quote

NACOSTI, Upper Kabete
Off Waiyaki Way
P.O. Box 30623-00100
NAIROBI-KENYA

Ref. No. **NACOSTI/P/18/50931/21494**

Date: 22nd **February,2018**

Patrick Otieno Otuoma
University Of Nairobi
P.O.Box 30197
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Factors influencing implementation of solar energy projects in Homa-Bay County, Kenya"*** I am pleased to inform you that you have been authorized to undertake research in **Homa-Bay County** for the period ending **22nd February, 2019.**

You are advised to report to **the County Commissioner and the County Director of Education, Homa-Bay County** before embarking on the research project.

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit **a copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

G.P. Kalerwa

GODFREY P. KALERWA MSc., MBA, MKIM
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Homa-Bay County.

The County Director of Education
Homa-Bay County.

APPENDIX IV

COUNTY COMMISSIONER AUTHORIZATION LETTER

THE PRESIDENCY

MINISTRY OF INTERIOR & CO-ORDINATION OF NATIONAL GOVERNMENT

Telephone: Homa Bay 22104 or 22105/Fax: 22491
E-mail-cc_homabay@yahoo.com
When replying please quote

THE COUNTY COMMISSIONER
HOMA BAY COUNTY
P. O. BOX 1 – 40300
HOMA BAY

REF: ED.12/1/VOL.III/107

27th APRIL, 2018

TO WHOM IT MAY CONCERN
HOMABAY COUNTY

RE:RESEARCH AUTHORIZATION: PATRICK OTIENO OTUOMA

This is to confirm that the above named person has been authorized to carry out research on ***'Factors influencing implementation of Solar energy projects in Homa Bay County,Kenya'*** for a period ending 22nd February,2019 as per permit No.NASCOSTI/P/18/50931/21494 of 22nd February,2018.

The purpose of this letter is therefore to ask you to assist him where necessary

Thank you.

TOM M. AKETCH
FOR:COUNTY COMMISSIONER
HOMA BAY COUNTY

CC

The County Director Education
HOMA BAY

APPENDIX V

COUNTY DIRECTOR OF EDUCATION AUTHORIZATION LETTER

HARAMBEE

MINISTRY OF EDUCATION

STATE DEPARTMENT OF BASIC EDUCATION

Telegrams: "SCHOOLING" Homa Bay
Telephone + 254722767574
When replying please quote
cdehomabay@gmail.com

COUNTY DIRECTOR OF EDUCATION
HOMA BAY COUNTY
P.O BOX 710
HOMA BAY
DATE: 27TH APRIL, 2018

REF: MOE/CDE/HBC/ADM/11/VOL.2/41

Patrick Otieno Otuoma
University of Nairobi
P.O Box 30197
NAIROBI.

RE: RESEARCH AUTHORIZATION.

Following your application to carry out research on ***"Factors influencing implementation of solar energy projects in Homa Bay County, Kenya"*** You are hereby authorized to undertake research in **Homa Bay County** for the period ending **22nd February, 2019**.

Please note that as an applicant who has been licensed under the Science, Technology and Innovation Act 2013 to conduct research in Kenya, you shall deposit a copy of the final research report to the **County Director of Education Office Homa Bay** within **one year** of completion. The soft copy and the hard copy.

COUNTY DIRECTOR OF EDUCATION
HOMA BAY COUNTY
P. O. Box 710 - 40300, HOMA BAY
Email: cdehomabay@gmail.com

SHEM OMBONYO
FOR: COUNTY DIRECTOR OF EDUCATION
HOMA BAY
CC

1. **County Commissioner**
   Homa Bay County.

ISO 9001
BUREAU VERITAS
Certification
1828
UKAS

APPENDIX VI

RESEARCH QUESTIONNAIRE

The research instrument has been formulated to collect data for the purpose of the research meant to create greater understanding on factors influencing implementation of solar energy projects in Kenya. Please note that your response to these questions will be confidential and shall be used for the purpose of this research only.

INSTRUCTIONS

please tick (√) where appropriate, and for further explanation, be brief

PART 1: Demographic Information

1. For how long have you been undertaking installation of solar energy projects?

Below 5 years ( )

6- 10 years ( )

Over 10 years ( )

2. Has your firm contracted dealers across the country?

Yes ( )

No ( )

If so, Specify………………………………………………..

3. Does your company install PV Systems, Hot water systems or both?

PV ( )

Hot Water ( )

Both ( )

4. Does your company hold awareness campaigns on solar energy and its merits?

Yes ( )

No ( )

5. How many technicians do you have in your team?

…………………………………………………

6. What is the main composition of your clientele?

Home Owners ( )

Corporates firms ( )

Both ( )

7. How do you land solar installation jobs?

Customer referrals ( )

Contract bids ( )

Both ( )

8. Would you recommend the business of solar installations to other entrants?

Yes ( )

No ( )

Section Two: **Cost of Installation and Implementation of Solar Energy Projects**

9. Do most of your clients have a regular monthly income?

Yes ( )

No ( )

10. If Yes to the above question, in which Monthly income category (Kshs.) do they fall in? Tick one.

0 – 10,165 ( )

10,165- 19, 741 ( )

19,741- 29, 317 ( )

29,317- 38, 893 ( )

38, 893 and Above ( )

11. Does the income of your clients affect your Implementation for solar energy projects?

Yes ( )

No ( )

12. If yes to the above, explain briefly how

…………………………………………………………………………………………
…………………………………………………………………………………………
……………………………………………………………………..
.....................………

13) In your own opinion, how would you explain high clients' incomes on the implementation of solar energy projects?

…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………
……………………….....

14) To what extent do you agree with the following statements? (Tick as appropriate) Give your ratings in the scale of 1-4 (where 1= disagree, 2= Agree to a small extent, 3= Agree to a high extent, 4= strongly agree

	1	2	3	4
There is a high level of investment in PV and hot water solar systems				
Solar energy technology is a largely expensive energy option				

There is increasingly high level of people on regular income who install solar systems				
There are favorable means to financial facilities such as bank loans to solar contractors				
There is considerable financial support such as bank loans to clients who install solar systems.				

Section Three: Availability of Markets and Implementation of Solar Energy Projects

15) Does availability of solar technology influence your implementation of solar energy projects? Explain briefly.……………………………………………….………

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16) To what extent do you agree with the following statements? (Tick as appropriate) Give your ratings in the scale of 1-4 (where 1= disagree, 2= Agree to a small extent, 3= Agree to a high extent, 4= strongly agree

	1	2	3	4
There are alternatives to solar energy technologies in Homa- bay County through schemes like REA (Rural Electrification authority)				
There is a high level of usage of Solar energy technology in Homa- bay county				
There is ready market in Homa- bay county for solar PV and solar hot water systems.				
Your clients are in close proximity to Grid electricity				
Clients you often install with solar technologies are equipped with Knowledge of available renewable substitutes				

Section Four: Level of Technological Awareness and Implementation of Solar Energy Projects

17) Does your level of technological awareness of solar technologies influence your implementation of solar energy projects

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18) To what extent do you agree with the following statements? (Tick as appropriate) Give your ratings in the scale of 1-4 (where 1= disagree, 2= Agree to a small extent, 3= Agree to a high extent, 4= strongly agree

	1	2	3	4
There is a high level of awareness of solar PV and solar Hot water technologies among the population in Homa- bay County				
Installation technicians have adequate formal training on Solar systems				
The providers of solar technologies are accessible in Homa- bay County				
Most of your clients are inclined to installation of solar energy systems				
Most residents of Homa- bay County use alternative forms of energy for lighting and heating to a large extent				

Section Five: Government Policy and Implementation of Solar Energy Projects

19) Does government regulations and legislation influence your implementation of solar energy projects?

Explain…………………………………………………………………………

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20) To what extent do you agree with the following statements? (Tick as appropriate) Give your ratings in the scale of 1-4 (where 1= disagree, 2= Agree to a small extent, 3= Agree to a high extent, 4= strongly agree

	1	2	3	4
There are sufficient government incentives to adopt solar energy technologies				
The level of taxation levied on importation of solar equipment has been significantly lowered.				
Government policy requirement for rooftop solar heating installation for commercial establishments is a bold step toward enhancing solar use.				
There are alternative renewable energy technologies that can be made available to the Homa- bay residents other than solar energy				

21) How could solar energy projects be improved to suit the needs of the locals?

22) What do you find most attractive about solar energy technology?

23) What is your experience installing any other forms of energy?

24) Apart from solar energy, what is your preferred alternative form of renewable energy?