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ANDREW KARUGA MAINA, DR. GLADYS ROTICH

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DETERMINANTS OF ADOPTION OF DOMESTIC RENEWABLE ENERGY IN KENYA: A CASE SOLAR POWER IN KITUI COUNTY

[1*] Andrew Karuga Maina, [2] Dr. Gladys Rotich

[1*]Student, Jomo Kenyatta University of Agriculture & Technology (JKUAT), Kenya

[2] Lecturer, Jomo Kenyatta University of Agriculture & Technology, Kenya

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ABSTRACT

In spite of the huge efforts and investments in the domestic renewable projects to alleviate many energy pressing problems in developing countries, such as rural energy shortages, low agricultural productivity, and poor public health, the implementation of such projects has not been successful as intended due to slow uptake of the technology. In order to make the investment in the solar projects more effective and worth, success rates of uptake of these projects should be increased. The general objective of this study was to establish the determinants of adoption of renewable energy in Kenya. The study adopted descriptive survey and sample of 100 household heads were considered in this study. A simple random sampling technique method was used and data was collected through the questionnaires. On the other hand, secondary data was obtained from published documents. The data was analysed with help of SPSS version 22 and Excel. The study variables were regressed at 5% level of significance to establish the strength and direction of their relationship. The study established that all the four independent variables significantly and positively influenced the dependent variable. It is notable that there exists a strong positive relationship between the independent variables and dependent variable as shown by R value (0.708). The study recommends for a simple technology for the users which can be easily adopted in the study area which can consider for use per installation and households acquiring a solar household system if other forms of energy for lighting are not available or accessible. The investment cost affects adoption of renewable energy as there was a high level of investment in solar system; the installation cost of the technology is high and accessibility of solar technology providers in the area and the transportation cost of the solar appliances for installation should be considered. Finally, the renewable energy policy should be clear on the legislation of domestic solar technology and registration of solar service providers as high taxes levied on the solar appliances discourage the adopters in the study area. An exploratory study would enrich findings. A comparative study should be carried out to compare whether the findings and other factors which could be affecting adoption of renewable energy and also identify whether they apply to other areas in Kenya in order to validate the findings of this study.

Key Words: *Investment Cost, Government Policy, Technology, Alternative Sources of Power, Domestic Renewable Energy.*

Background of Study

Renewable energy (RE) is defined as any naturally occurring, theoretically inexhaustible source of energy, as biomass, solar, wind, tidal, wave and hydroelectric power, which is not got from fossil or nuclear fuel (Goli ,2013) . Energy is derived from a Greek word en (in) and ergon (work). Energy is the capacity labiality to do work (moving something against a force (Boyle 1990). In 1990s there was an outburst of energy policy changes around the world. Driven by economic, ecological, security and social concerns, energy regulation has been in great - flux. The world population is growing and is to reach 10 Billion people in 2050 according to Boyle, 1990 and also by end of 21st century UN projection is that the population would be between 10 and 12 Billion people.

According to Kenya National Bureau of Statistics, in 2007, the country's population stood at 35.5 million people distributed in 6.860 million households with an average size of 5.1 persons per Household. About 75 % of the households are found in rural areas average household size of 5.5 persons while some 25% households are in urban areas but with a smaller household size at 4.0. For most of this population firewood remains the predominant fuel for cooking with 68.3% households using 80% of the rural households use firewood compared with 10% urban residents. Charcoal, derived from primary biomass is the second most popular cooking fuel used by 13.3% of the households. Kerosene paraffin is ranked third predominant cooking fuel and the most common in urban areas with 44.6% reporting using it (Nairobi and Mombasa reporting 63.5% and 53.6% respectively).

Kerosene is on the other hand the most popular lighting fuel with over 75% reporting using it. This translates to 86.4% of the rural areas using kerosene for lighting. Electricity is the second most popular energy for lighting at 15.6% where 51% of the urban households connected and 4% of the rural households. It is noteworthy that 1.6% of the households are using solar photo voltaic for lighting.

According to the Kenya SWERA report, the national efforts towards meeting millennium development goals and poverty eradication are focused on increasing access to services in a holistic and pragmatic manner. The UNDP supported regional strategy for scaling access to modern energy services which is based on High Impact, Low Cost, Scalable (HILCS) interventions that are target: to address the cooking and heating practices by 50% of those who at present use traditional biomass for cooking; increase access to reliable electricity for all urban and peri-urban poor, increase access to modern energy services such as lighting and communication technology and increase access to mechanical power within the community for all heating and productive uses. Solar power is electrical power generated through the conversion of sunlight into electricity, either directly using photovoltaic (PV) arrays, or indirectly using concentrated solar power (CSP) systems. Concentrated solar power systems use lenses or mirrors and tracking 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, 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. They are an important and relatively inexpensive source of electrical energy where grid power is inconvenient, unreasonably expensive to connect, or simply unavailable (Jacobs, 2006). However, as the cost of solar electricity continues to fall, solar power is increasingly being used even in grid connected situations as a way to feed low-carbon energy into the grid

In 2030 if no new policy to change poverty is introduced 1.3Billion people (16% of world population) would have no electricity access mostly in Asia and Africa(Niez, 2010).This shows the big attention required in order to ensure people have descent life and access to electricity. 30GW the entire generation of 47 countries of sub-Saharan excluding South Africa equals that of Argentina despite the big population in Africa. Africa has a population of 820M and it's expected to reach 1,5B in 2030 according to Abeeku Brew (Hammond et al 2008). Energy is a key player to economic growth and according to UNEP 7000MW/yr needed to meet increasing demand and support economic growth.1.1.1 Global Perspective on Solar Energy

Australia has been a key player in the global solar power revolution. After World War 2,'diggers' who had experience in engineering put their knowledge and experience into the solar power industry. From this, Australia was able to lead global research and fund ideas from US inventors that were not necessarily supported in their home countries. Australia's renewable energy industry was particularly productive during the 1970s and 80s. However, in the last ten years, Australia's influence in world solar power technologies has dwindled (Jennings, 2007). Despite this decline, Australian technology and expertise have been adopted far and wide. Much of the technology that is now used by solar industry giants (Japan, Germany, China and the United States) was developed in Australia. By August 2011, more than half a million household PV solar systems were installed across Australia, representing an incredible uptake of solar panels over recent years, 35 times greater than it was in 2007.

Kenyan Perspective of Renewable Energy

Modern RE sources account for only 1/3 of RE total. The energy demand is likely to increase by 54% 1997 levels by 2020 according to IEA, 2009. RE sources could provide all the energy consumed in the world for example wind power has a potential of 20-50trillion KWh/yr which is 1.5-4 times current world wide electricity production (Howard, 2002). Kenya has a potential of 7000-10000MW of geothermal energy. Geothermal energy has an advantage over hydro as it not affected by climate change, its reliable, has no fuel costs, long plant life and it's green and available but also it should be noted that energy is needed to pump the heat up from the soil. The government has puts lot of effort to tap this potential and government commitment was indicated by the establishment of Geothermal Development Company (GDC) to undertake initial project activities through which the government absorbs the attendant risks associated with geothermal development (Howard, 2002).

According to the national energy policy of 2012 the energy sector is to be the key enabler for vision 2030. Vision 2030 is a long term development blue print aiming at transforming the country into a globally competitive, newly industrialized, middle income and prosperous country with clean and secure environment. Government targets are geothermal energy 5,110MW, hydro power 1,039MW, wind energy 2036MW, thermal energy (diesel engines) 3,615MW, coal 2420MW and import 2000MW. The government plans to replace electrical water system heaters with solar water heating systems. Approximately 20,000 institutions in Kenya approximately consume 270tonnnes of wood/year. In the whole of Africa biomass contributes 47% of total energy consumed, oil 24.8%, coal 16.5%, and gas 10.4% and RE 1.3% (Howard, 2002).

Kenya with a population of over 41million has a poor electricity supply with a supply of 1500MW compared to Finland with a population of roughly around 5.5M but with energy supply of 70.4TWh. 83% of the rural population has no electricity and the people who are connected experience power cut now and then due to reliance on hydro power which is affected by climate according to Kenya national energy policy 2012 as seen in table 1.1. Despite the challenges facing energy sector, Kenya is situated in a region which experiences strong winds of up to 11m/s and about six hours of sunshine. These potentials have not been utilized to the maximum despite the technologies been available (National energy policy Kenya, 2012).

Statement of the Problem

Approximately one fifth of the world's final energy production is consumed by electrical appliances, including lighting (World Bank 2010). Lighting alone accounts for 19% of global electricity demand (IEA 2006). In developing countries, lighting is generally thought to rank among the top three uses of energy, with cooking and entertainment (mainly television) and space heating being of even greater significance (World Bank 2010 and IEA 2006). While cooking fuel choices have been examined in a number of empirical studies, lighting fuel choices have received less attention. In addition, the adoption of renewable energy sources is typically not placed in the context of a specific fuel choice. Yet only in this specific context can adoption of renewable fuel switching be adequately understood.

According to the economic survey 2011 renewable energies account for 69% of the Kenya's overall energy mix while petroleum accounts for about 22% and electricity 9%.Though the 20 percentage seems high for RE but the majority come from hydro power which is unreliable due to its dependence on climate. Kenya deployed one million improved household stoves, 200,000 solar PVs, 1000 biogas units to meet cooking, heating and lighting needs of undeserved communities According to a study by Abdullah and Markandya, 2007 on rural electrification programmes (REP) in Kenya it indicates that the program has faced set back due to high connection costs. The wouldingness to pay (WTP) to be connected to the grid and photovoltaic services is less due to the high cost which the government should deal by reforming the energy sector by giving subsidies.

Less than 44% of the general population and 5% of the rural population in Kenya have access to electricity (World Bank, 2010). Demand is growing fast for electricity from both on- and off-grid consumers. Evidence of this includes frequent blackouts due to insufficient supply and the growing popularity of off-grid solutions such as diesel-powered generators and small-scale hydro generation units found both in Kisii and the Mount Kenya highlands that are largely illegal and poorly regulated energy wise(Ngeno,2014). Adoption of Solar Technology would provide one solution to this evident energy gap but this tends to be neglected in most developing countries like Kenya. In fact, representative data on Solar Energy use in Kenya at household level is virtually non-existent. There has also been no evident comprehensive research on the factors that influence adoption of domestic renewable energy especially solar power in Kenya.

General Objective

The purpose of this study was to explore the determinants of adoption of domestic renewable energy in Kenya.

Research Objectives

The specific research objectives of the study were to:

- Examine the influence of technology on adoption of domestic renewable energy in Kenya.
- Establish the influence of investment cost on adoption of domestic renewable energy in Kenya.

- Find out the influence of alternative power sources on adoption of domestic renewable energy in Kenya.
- Determine the influence of government policy on adoption of domestic renewable energy in Kenya.

LITERATURE REVIEW

This chapter reviews literature sources relating to research problem.

Theoretical Review

This section examines relevant theories to the study variables. According to Kombo & Tromp (2009), a theoretical framework is a collection of interrelated ideas based on theories. It is a reasoned set of prepositions derived from and supported by data or evidence and it accounts for or explains phenomena and attempts to clarify why things are the way they are based on theories. A theory is defined as a reasoned statement which is supported by evidence, meant to explain phenomena (Kombo and Tromp, 2009). It is a systematic explanation of the relationship among phenomena. Mugenda (2008) defines a theory as a framework of explaining phenomena by stating constructs and the laws that inter-relate these constructs to each other. This study is based on the Innovation Diffusion Theory (IDT), Resource Based Theory (RBT) and Theory of Reasoned Action (TRA) and Public Interest Theories of Regulation.

Innovative Diffusion Theory (IDT)

The theory of diffusion of innovation by Rogers (1995) provides perceptions that individuals may have of adopting an innovation such as renewable 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 (2006) individual's technology adoption behaviour such as solar technology is determined by his or her perceptions regarding relative advantage, compatibility, complexity and observability of an innovation. These constructs have relationship with the studied variables. This relates to attitude towards use of solar technology. Adoption of a new idea, behaviour, or product (i.e., "innovation") does not happen simultaneously in a social system; rather it is a process whereby some people are more apt to adopt the innovation than others. Researchers have found that people who adopt an innovation early have different characteristics than people who adopt an innovation later.

When promoting an innovation to a target population, it is important to understand the characteristics of the target population that would help or hinder adoption of the innovation. The stages by which a person adopts an innovation, and whereby diffusion is accomplished, include awareness of the need for an innovation, decision to adopt (or reject) the innovation, initial use of the innovation to test it, and continued use of the innovation. There are five main factors that influence adoption of an innovation, and each of these factors is at play to a different extent in the five adopter categories such as relative advantage – that is the degree to which an innovation is seen as better than the idea, program, or product it replaces; compatibility that is how consistent the innovation is with the values, experiences, and needs; of the potential adopters; complexity that is how difficult the innovation is to understand and/or use; the triability that is the extent to which the innovation can be tested or experimented with before a commitment to adopt is made; observability that is the extent to which the innovation provides tangible results.

Resource Based Theory

The 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 the firms disposal (Wernerfelt, 1984), including technology such as solar technology. According to Manoney and Pandian (1992) firm`s ability to reach competitive advantage when different resources are employed and these resources cannot be imitated by competitors. This relates to access to solar technology resources, tools and funds. From this theory when households have enough resources of funds and access to solar tools they can easily adopt solar technology in their homes.

The resource based view has been a common interest for management researchers and numerous writings could be found for same. A resource-based view of a firm explains its ability to deliver sustainable competitive advantage when resources are managed such that their outcomes cannot be imitated by competitors, which ultimately creates a competitive barrier (Hooley & Greenley 2005, Smith & Rupp 2002). RBVexplains that a firm’s sustainable competitive advantage is reached by virtue of unique resources being rare, valuable, inimitable, non-tradable, and non-substitutable, as well as firm-specific (Finney et al. 2004, Makadok 2001,). These authors write about the fact that a firm may reach a sustainable competitive advantage through unique resources which it holds, and these resources cannot be easily bought, transferred, or copied, and simultaneously, they add value to a firm while being rare. It also highlights the fact that not all resources of a firm may contribute to a firm’s sustainable competitive advantage. Varying performance between firms is a result of heterogeneity of assets (Helfat & Peteraf 2003) and RBV is focused on the factors that cause these differences to prevail (Mahoney &Lopez, 2005).

Fundamental similarity in these writings is that unique value-creating resources would generate a sustainable competitive advantage to the extent that no competitor has the ability to use the same type of resources, either through acquisition or imitation. Major concern in RBV is focused on the ability of the firm to maintain a combination of resources that cannot be possessed or built up in a similar manner by competitors. Further such writings provide us with the base to understand that the sustainability strength of competitive advantage depends on the ability of competitors to use identical or similar resources that make the same implications on a firm’s performance.

Theory of Reasoned Action

According to Brown, Massey and Burkman, (2002) the theory states that both attitude and subjective norm are important determinants of people’s intention to adopt and use technology in enterprises. Further the intention to adopt and to continue using technology is influenced by ones attitude. The theory states that an individual behaviour is influenced by his or her behaviour’s intention which is influenced by his or her attitude towards behaviour of subjective norm (Venkatesh et al, 2000).

Behavioural intention measures a person's relative strength of intention to perform behaviour. Attitude consists of beliefs about the consequences of performing the behavior multiplied by his or her evaluation of these consequences (Fishbein & Ajzen, 1975). Subjective norm is seen as a combination of perceived expectations from relevant individuals or groups along with intentions to comply with these expectations. In other words, "the person's perception that most people who are important to him or her think he should or should not perform the behaviour in question" (Fishbein & Ajzen, 1975). To put the definition into simple terms: a person's volitional (voluntary) behaviour is predicted by his attitude toward that behaviour and how he thinks other people would view them if they performed the behaviour. A person's attitude, combined with subjective norms, forms his behavioural intention.

Fishbein and Ajzen suggest, however, that attitudes and norms are not weighted equally in predicting behaviour. "Indeed, depending on the individual and the situation, these factors might be very different effects on behavioural intention; thus a weight is associated with each of these factors in the predictive formula of the theory.

Public Interest Theories of Regulation

According to the public interest theories, regulation can be explained not only by imperfect competition, unstable market processes and missing markets, but also by the need to prevent or correct undesirable market results. In a competitive market economy, participants in the economic process are rewarded according to their marginal productivity contribution. The first group of regulation theories proceeds from the assumptions of full information, perfect enforcement and benevolent regulators. According to these theories, the regulation of government or other economic actors contributes to the promotion of the public interest. This public interest can further be described as the best possible allocation of scarce resources for individual and collective goods and services in society. Equalization of prices and marginal costs characterizes equilibrium in a competitive market. If costs are lower than the given market price, a firm would profit from a further expansion of production. If costs are higher than price, a firm would increase its profits by curtailing production until price again equals marginal cost. Market equilibrium, and more generally equilibrium of all markets is thus a situation of an optimal allocation of scarce resources. In this situation supply equals demand and under the given circumstances can market players do no better. A great number of conditions have to be satisfied for an optimal allocation in a competitive market economy to exist (Boadway and Bruce, 1984). One of the methods of achieving efficiency in the allocation of resources when a market failure is identified is government regulation (Arrow, 1970, 1985; Shubik, 1970). In the earlier development of the public interest theories of regulation, it was assumed that a market failure was a sufficient condition to explain government regulation (Baumol, 1952). But soon the theory was criticized for its Nirwana approach, implying that it assumed that theoretically efficient institutions could be seen to efficiently replace or correct inefficient real world institutions (Demsetz, 1968). The public interest theory of regulation relates to government policy on adoption of renewable energy in Kenya.

Conceptual Framework

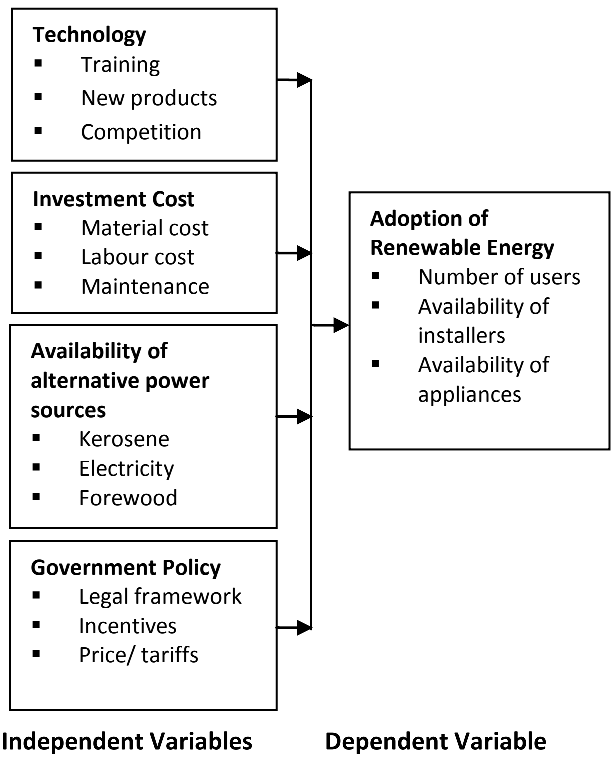

Figure 1 Conceptual Framework

Technology

Individuals are seen as possessing different degrees of wouldingness to adopt a technology and innovations, and thus it is generally observed that the portion of the population adopting an innovation is approximately normally distributed over time (Sense, 2008). Breaking this normal distribution into segments leads to the segregation of individuals into the following five categories of individual innovativeness (from earliest to latest adopters): innovators, early adopters, early majority, late majority, laggards. Those firms that are late adopters of technology tend to have trouble securing the support and participation of the stakeholders (Wallace, Keil & Rai, 2004). The innovation process in organizations is much more complex. It generally involves a number of individuals, perhaps including both supporters and opponents of the new idea, each of whom plays a role in the innovation-decision about the technology (Tabish & Jha, 2012).

Technology is important to support and promote projects development as it is responsive to local economies and results in high quality products and services (Chaminade & Vang 2006). Therefore, to support indigenous technology there should be aim to link technology specialists with the end users in order to generate an enabling environment for adoption of the technology capacity (Ngoze, 2008).This is likely to result in a great adoption, implementation and performance of solar energy projects technical services in accordance with the resources available and the market needs in the context of these projects. Technological Innovation has its sources in a wide variety of places and in activities such as research and development (R&D), quality control and marketing (Oyelaran-oyeyinka and McCormick, 2007) investment in and mastery of new equipment is still the most important way for technological learning leading to the improvement of the production process that yields the product to the market thus promoting the technology to be adopted (Tifow, 2013).

Investment Cost

According to Agarwal and Lucas (2005), renewable energy is one of the most important business driving forces of the 21st century. Renewable energy (RE) is a multi-trillion dollar industry. In 2005, Gwouldim, Dovey and Wieder (2005) suggested that global RE spending exceeds $1 trillion per annum. A study on the elusive nature of delivering benefits from IT investment by Remenyi (2000) found that RE investment offers potential for significant organizational improvement and competitive advantage. However, RE investment does not always translate into monetary rewards. Reports of project failure, budget and timescale overruns, and limited or negative returns are not uncommon. Some organizations may lack objective information regarding the benefits and costs investing in RE (Remenyi, 2000).

Further, evaluation complexity increases as RE becomes more integrated in organizational structures and processes and when different interconnected RE. Projects take place simultaneously. A study by Remenyi et al (2007) on the effective measurement and management of RE costs and benefits found that the difficulties associated with evaluating RE costs and benefits are “super challenging”. Simultaneous investment in technologies from automate, informate and transformate eras makes evaluation more difficult. Accurately determining total RE costs is often impaired by incorrect overhead allocation procedures and unclear system boundaries. Remote unanticipated effects may also arise, which decreases the chances of total costs being accounted for (Mylonopoulos et al, 2004).

Availability of Alternative Sources of Power

According to KNBS (2011), Kenya's installed electric power capacity was 1,412.2MW as at 31st December 2010. The effective installed capacity was not enough to meet demand, so the government contracted for 60MW of emergency power. This was needed in order to meet the growing demand and reduce load-shedding, particularly during peak periods. Hydropower is the main source, accounting for 51.55% of total installed capacity. 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, sustaining the level of clean electricity in the national grid.

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). Much of this activity is related to the sale of household solar systems, which account for an estimated 75% of solar equipment sales in the country (KEREA, 2009). Compared to countries such as Germany, the existing solar PV market in Kenya remains small. This market is, however, relatively well established compared to other countries in East Africa, such as Tanzania and Uganda. In 2006, the total installed base was about 250,000 units or 5MW. New installations have averaged about 25,000–30,000 units p.a (KEREA, 2009).

Further growth in the solar sub-sector is likely to be held back by market failures and other barriers. Most demand for PV systems is driven by the rural non-electrified private sector, with cash sales being the usual method of transaction. Changes in Kenya's power sector since the adoption of the Sessional Paper No. 4, 2004 on a blueprint for the country's energy policy have led to new interest in renewable energy. Recent policies have focused on geothermal, hydropower and co-generation technologies with much less emphasis on PV technology, although the government is currently implementing an electrification scheme for remote schools using solar energy (Ngigi, 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. Largescale 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. Recently, there has been growing interest in new renewable energy technologies (RET) such as wind, small hydro, and PV energy. These technologies have been developed to expand access to modern energy services, especially in rural and marginalized areas such as rural Kitengela area which is arid.

Although Kenya is well endowed with renewable energy resources, only geothermal, wind and co-generation (generation from bagasse) have been seriously exploited and connected to the national electricity grid (KNBS, 2011). Solar energy is relatively well developed and has enormous potential 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 the 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. The initial markets received donor seed money in the 1980s (Mwakubo et al., 2007), which allowed PV system components to become accepted and available. The government has recently intensified measures to increase the uptake of renewable energy by championing initiatives to adopt these technologies. Some of these initiatives include the fitting of the Ministry of Energy (MoE) offices (Nyayo House), the Office of the President (Harambee House), the Office of the Prime Minister and the Ministry of Finance (Treasury) with solar PV and natural lighting. Funds for this were factored in the National Budget 2011/2012, demonstrating government commitment to these initiatives (Ministry of Finance, 2011).

Government policy

Various policy interventions and strategies have been used to improve access, ensure security of supply of affordable energy and achieve efficiency and conservation. These have been implemented by individual countries or unions such as the European Union or even within economic blocks. The energy policy in Kenya has evolved through sessional papers, regulations and Acts of Parliament. The 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). In 1981, the National Oil Corporation of Kenya Limited (NOCK) was established by the government and incorporated under the Companies Act (Cap 486). The company's main objective then was to coordinate oil exploration (upstream) activities. In 1988 the company was mandated on behalf of the government to supply 30% of the country's crude oil requirements that would in turn be sold to oil marketing companies for refining and onward sale to consumers. The Petroleum Act (Cap 116) for a long time was used to guide operations in the sector (Ngigi, 2006). In addition to this legislation there was the Petroleum Exploration and Production Act that was enacted in 1984. It 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. It was during this period that the oil industry was deregulated and NOCK lost its mandate to supply the 30% of the country’s crude oil requirement. The company therefore had to formulate new survival strategies that saw its entry into downstream operations.

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. This policy has a number of broad objectives including 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). ERC 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. Other institutions created with the enactment of the Act were the Rural Electrification Authority (REA) and the Energy Tribunal. Recently, the government has created two other key institutions in the sector. These are the Geothermal Development Company and Kenya Electricity Transmission Company (KETRACO).

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 programme to increase the number of wells in Olkaria and other potential areas while in wind, KPLC has already signed a PPA with Lake Turkana Power Company to supply 300MW of electricity. In petroleum; there have been increased activities in exploration of hydrocarbons in Northern and Coastal regions in the country. The government has also intensified search for coal deposits in Kitui. 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.

Empirical Literature Review

To investigate lighting-fuel choices and, afterwards, specifically discuss the use of SHSs in Kenya we used data from the Kenyan Integrated Household Budget Survey (KIHBS) 2005/2006 provided by the Kenya National Bureau of Statistics (KNBS). The sample consisted of 13,430 households – with 10 households randomly drawn from each of the 1,343 clusters – stratified into 136 strata, according to Kenya's 69 districts. The clusters are drawn from a pool of 1,800 clusters with a probability, proportional to their size, based on data from the 1999 Population and Housing Census. Item non response is virtually non-existent (less than 1 percent). The KIHBS dataset contains a unique set of information for our purposes, since it includes very detailed questions about house-holds energy consumption and, furthermore, specifically asks for details on households' ownership and use of SHSs. By far the most important energy source that Kenyan households purchase is paraffin/kerosene (hereafter referred to simply as kerosene). More than 80 percent of all Kenyan households have some expenditure for this type of energy source). And (non-zero) median expenditure amounts to 160 Kenyan shillings (KES) per household. Traditional fuels, more specifically firewood and charcoal, also account for a considerable portion of household fuel expenditure. Approximately 15 percent of Kenyan households have non-zero expenditure for fire wood, and 36 percent for charcoal. With non- zero median expenditures even higher than those for kerosene (KES 200 and KES 250, respectively), these traditional sources are generally still used to a significant extent. Modern fuels are used by a smaller part of the population, 6 percent in the case of gas/LPG and 12 percent in the case of electricity. If households use these sources, their expenditure for them is much higher than for traditional or transitional fuels, with KES 780 for gas/LPG and KES 350 for electricity. Of course, these much higher costs reflect much greater energy consumption.

According to Kenya National Bureau of Statistics, in 2007, the country's population stood at 35.5 million people distributed in 6.860 million households with an average size of 5.1 persons per Household. About 75 % of the households are found in rural areas average household size of 5.5 persons while some 25% households are in urban areas but with a smaller household size at 4.0. For most of this population firewood remains the predominant fuel for cooking with 68.3% households using 80% of the rural households use firewood compared with 10% urban residents. Charcoal, derived from primary biomass is the second most popular cooking fuel used by 13.3% of the households. Kerosene paraffin is ranked third predominant cooking fuel and the most common in urban areas with 44.6% reporting using it (Nairobi and Mombasa reporting 63.5% and 53.6% respectively). Kerosene is on the other hand the most popular lighting fuel with over 75% reporting using it. This translates to 86.4% of the rural areas using kerosene for lighting. Electricity is the second most popular energy for lighting at 15.6% where 51% of the urban households connected and 4% of the rural households. It is noteworthy that 1.6% of the households are using solar photo voltaic for lighting.

According to the Kenya SWERA report, the national efforts towards meeting millennium development goals and poverty eradication are focused on increasing access to services in a holistic and pragmatic manner. The UNDP supported regional strategy for scaling access to modern energy services which is based on High Impact, Low Cost, Scalable (HILCS) interventions that are target: to address the cooking and heating practices by 50% of those who at present use traditional biomass for cooking; increase access to reliable electricity for all urban and peri-urban poor, increase access to modern energy services such as lighting and communication technology and increase access to mechanical power within the community for all heating and productive uses.

RESEARCH DESIGN AND METHODOLOGY

This chapter shows the research design, the study population, the sampling frame, sample size and sampling technique, data collection instruments and the data collection procedure to be applied in the study and pilot testing of the data collection instrument which in this case is a questionnaire. The method of processing and analysing data is included so as to determine the degree through which an effective solution could be arrived at.

Research Design

The research design for this study was a descriptive survey research design since it aimed to describe the state of affairs as exists in the organization.

Population

The population for the study comprised of the 365 households in Mutomo sub-county which had adopted the solar power technology

Sample and Sampling Technique

The study adopted a stratified random sampling method.

Data Collection Instruments and procedure

For the collection of data, a questionnaire was used. The questionnaires were self-administered and distributed to the respondents and reasonable time was given before they could be collected. Secondary data was collected by a study of academic journals, reports and literature on adoption of domestic solar projects; data that was collected concerned written records about variables understudy and reports with documentary evidence.

Data Analysis and Presentations

The data analysis involved quantitative and qualitative methods (numerical and descriptive). Qualitative data was analysed based on content analysis while quantitative data would be analysed using descriptive and inferential statistics. Data was analysed with the help of (SPSS) version 21 which has analysis tools. The findings were presented using tables and graphs for further analysis and to facilitate comparison.

DATA ANALYSIS, PRESENTATIONS AND DISCUSSIONS

This chapter presents analysis and findings of the study as set out in the research methodology.

Response Rate

A total 100 questionnaires to the sample size and 70 questionnaires were returned translating to 70% response rate. According to Babbie (2010), a response rate of 60% is good, 70% very good and 50% adequate for analysis and reporting from manual surveys.

Gender of Respondents

From the study findings, most (60%) of the respondent were male, while 40% were female. The results indicate that the two genders were not adequately represented in the study since males were more than the two-thirds. However, the statistics show that the male gender could be dominating on the adoption of solar projects in Kenya

Age Bracket

From the findings, most (41%) of the respondents were aged between 31-40 years, 31%were aged 41-50 years, 22%were aged 20-30 years, while 6%were aged over 50 years. This implied that majority of the respondents' were aged between 31-40 years. This implies that most of the solar projects being adopted in the study was by the individuals aged between 30 to 50 years.

Respondents Level of Education

47% of the respondents had a University Degree, 28% had Diploma, and 16% had Post Graduate, while 9% post graduate The results showed that on average, respondents are well educated with high academic qualifications and hence they are capable of giving reliable information with regard to the adoption of solar projects in Kenya.

Technology

The study sought to establish the extent to which respondents agreed with the statements relating to technology influence on adoption of renewable energy projects in Kenya. A scale of 1-5 was used. The scores "very small extent" and "small extent" were represented by mean score, equivalent to 1 to 2.5 on the continuous Likert scale ($1 \le$ small extent ≤ 2.5). The scores of 'Moderate' were represented by a score equivalent to 2.6 to 3.5 on the Likert scale ($2.6 \le$ Moderate ≤ 3.5). The score of "Great extent" and "Very great extent" were represented by a mean score equivalent to 3.6 to 5.0 on the Likert Scale (3.6 ≤ Good ≤ 5.0). The results were presented in mean and standard deviation. The mean was generated from SPSS version 22. From the research findings, majority of the respondents indicated to a small extent that there was a high level of solar power technology in use per installation for example. charging a phone or in any other use as a mean of 4.10; their neighbours had solar technologies installed by a mean of 3.55; there were accessible solar technology providers in the area by a mean of 2.99 and majority households would consider acquiring a solar household system to a great extent by mean of 2.10 and households use other forms of energy for lighting to a large extent such as Paraffin, Gas, Firewood, dry cells in a mean of 2.01;

Investment Cost

The study sought to establish the extent to which respondents agreed with the statements relating to investment cost influence on adoption of renewable energy projects in Kenya. A scale of 1-5 was used. The scores "very small extent" and "small extent" were represented by mean score, equivalent to 1 to 2.5 on the continuous Likert scale (1 ≤ small extent ≤ 2.5). The scores of 'Moderate' were represented by a score equivalent to 2.6 to 3.5 on the Likert scale (2.6 ≤ Moderate ≤ 3.5). The score of "Great extent" and "Very great extent" were represented by a mean score equivalent to 3.6 to 5.0 on the Likert Scale (3.6 ≤ Good ≤ 5.0). The results were presented in mean and standard deviation. The mean was generated from SPSS version 22. From the research findings, majority of the respodents indicated to a moderate extent that there was a high level of investment in solar system by a mean of 3.01 ; the installation cost of the technology is high by a mean of 3.99; there were accessible solar technology providers in the area as shown by a mean of 3.10 and the transportation cost of the solar appliances for installation is high by mean of 4.10.

Availability of Alternative Power sources

The study sought to establish the extent to which respondents agreed with the statements relating to influence on adoption of renewable energy projects in Kenya. A scale of 1-5 was used. The scores "very small extent" and "small extent" were represented by mean score, equivalent to 1 to 2.5 on the continuous Likert scale (1 ≤ small extent ≤ 2.5). The scores of 'Moderate' were represented by a score equivalent to 2.6 to 3.5 on the Likert scale (2.6 ≤ Moderate ≤ 3.5). The score of "Great extent" and "Very great extent" were represented by a mean score equivalent to 3.6 to 5.0 on the Likert Scale (3.6 ≤ Good ≤ 5.0). The results were presented in mean and standard deviation. The mean was generated from SPSS version 22. From the research findings, majority of the respondents indicated to a great extent that There is availability of electricity in my home by a mean of 4.01 ; there was a high level of usage of alternative energy sources that was available to them by a mean of 4.01; There is high accessibility of vendors who sell wood, charcoal, kerosene by a mean of 4.10 and the solar appliances for installation is not accessible by mean of 4.10.

Government Policy

The study sought to establish the extent to which respondents agreed with the statements relating to government policy influence on adoption of renewable energy projects in Kenya. A scale of 1-5 was used. The scores "very small extent" and "small extent" were represented by mean score, equivalent to 1 to 2.5 on the continuous Likert scale (1 ≤ small extent ≤ 2.5). The scores of 'Moderate' were represented by a score equivalent to 2.6 to 3.5 on the Likert scale (2.6 ≤ Moderate ≤ 3.5). The score of "Great extent" and "Very great extent" were represented by a mean score equivalent to 3.6 to 5.0 on the Likert Scale (3.6 ≤ Good ≤ 5.0). The results were presented in mean and standard deviation. The mean was generated from SPSS version 22. From the research findings, majority of the respondents indicated to a great extent that there was no clear legislation on domestic solar technology by a mean of 4.10 ; lack of registration of solar service providers has affected inexperienced adoption of the technology by a mean of 4.01 and majority of the respondents had not installed the solar power because of high taxes levied on the solar appliances by a mean of 4.10.

Inferential Statistics

The study further applied general linear model to establish the determinants of adoption of renewable energy in Kenya. This included regression analysis, the model, analysis of variance and coefficient of determination.

Multiple Regression Analysis

In the Endeavour, the study sought to determine the goodness of fit of the regression equation using the coefficient of determination between the overall independent variables and effective implementation of donor-funded projects. Coefficient of determination established the strength of the relationship. Coefficient of determination explains the extent to which changes in the dependent variable can be explained by the change in the independent variables or the percentage of variation in the dependent variable (adoption of renewable energy) that is explained by the determinants as the independent variables

Model Summary

Model summary' table, provides information about the regression line's ability to account for the total variation in the dependent variable. Table 1 illustrates that the strength of the relationship between adoption of renewable energy and independent variables. From the determination coefficients, it can be noted that there is a strong relationship between dependent and independent variables given an R^2 values of 0.501. R is the correlation coefficient which shows the relationship between the independent variables and dependent variable. It is notable that there extists strong positive relationship between the independent variables and dependent variable as shown by R value (0.708). The coefficient of determination (R^2) explains the extent to which changes in the dependent variable can be explained by the change in the independent variables or the percentage of variation in the dependent variable and the four independent variables that were studied explain 50.10% of the adoption of renewable energy as represented by the R^2. This therefore means that other factors not studied in this research contribute 49.90% to the adoption of renewable energy. This implies that these variables are very significant therefore need to be considered in any effort to boost adoption of renewable energy in the study area. The study therefore identifies variables as critical determinants affecting adoption of renewable energy in the study area.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.708[a]	.501	.021	.009

a. Dependent Variable: Adoption of renewable energy

b. Predictors: (Constant), Technology, Investment cost, availability of alternative power sources and government policy

ANOVA Results

Further, the study revealed that the significance value is 0.001 which is less that 0.05 thus the model is statistically significance in predicting technology, investment cost, availability of alternative power sources and government policy affect adoption of renewable energy. The F critical at 5% level of significance was 8.654. Since F-calculated (15.3013) is greater than the F critical (value = 8.654), this shows that the overall model was significant.

Table 2: ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Regression	7.008	4	1.752	15.3013	0.001
Residual	10.876	95	.1145		
Total	17.884	99			

NB: F-Critical value = 8.654

Regression Coefficients

The study ran the procedure of obtaining the regression coefficients, and the results were as shown on the Table 3 Multiple regression analysis was conducted as to determine the relationship between adoption of renewable energy and the four variables. According to the regression equation established, taking all factors (independent variables) into account constant at zero Adoption of renewable energy was 77.897. The data findings analyzed also shows that taking all other independent variables at zero, a unit increase in technology would lead to a 0.576 increase in Adoption of renewable energy.; a unit increase in investment cost would lead to a 0.989 increase in Adoption of renewable energy, a unit increase in availability of alternative power sources would lead to 0.654 increase in Adoption of renewable energy and a unit increase in government policy would lead to 0.581 increase in Adoption of renewable energy. This infers that technology contributed most to adoption of renewable energy. At 5% level of significance, technology had a 0.008 level of significance; investment cost showed a 0.000 level of significance, availability of power sources showed a 0.006 level of significance and government policy showed a 0.009 level of significance hence the most significant factor was investment cost.

As per the SPSS generated table below, the model equation would be ($Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \varepsilon$) becomes: $Y= 77.897+ 0.576X_1+ 0.987X_2+ 0.654X_3 + 0.587X_4$... Therefore, the Adoption of renewable energy = 77.897+ 0.576*Technology + 0.987*Investment cost + 0.654*Availability of alternative power sources + 0.487*Government policy.

Table 3: Regression Coefficients Results

Model	Unstandardized Coefficients		Standardized Coefficients	t	P-value.
	β	Std. Error	β		

(Constant)	77.897	.223	.334	4.615	.001
Technology	.576	.003	.602	5.876	.008
Investment cost	.987	.009	.554	7.987	.000
Availability of alternative power sources	.654	.017	.446	6.987	.006
Government policy	.587	.093	.443	5.009	.009

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The study sought to establish the determinants of adoption of renewable energy in Kenya. The study examined theoretical and empirically how various variables influenced adoption of renewable energy. In assessing adoption of renewable energy, the study focused on how selected factors relate to adoption of renewable energy. This chapter summarizes of findings, from which conclusions were drawn and recommendations made.

Summary of the findings

Technology

From the descriptive statistics, majority of the respondents indicated to a small extent that there was a high level of solar power technology in use per installation for example. charging a phone or in any other use; their neighbours had solar technologies installed there were accessible solar technology providers in the area, households would consider acquiring a solar household system to a great extent, households use other forms of energy for lighting to a large extent such as Paraffin, Gas, Firewood , dry cells as shown Additionally, the study revealed that the variable statistically, strongly and significantly correlated to adoption of renewable energy at 5% level of significance as it had a positive relationship with the dependent variable.

Investment Cost

From the research findings, majority of the respondents indicated to a moderate extent that there was a high level of investment in solar system; the installation cost of the technology is high ; there were accessible solar technology providers in the area and the transportation cost of the solar appliances for installation is high Additionally, the study revealed that the variable statistically, strongly and significantly correlated to adoption of renewable energy at 5% level of significance as it had a positive relationship with the dependent variable.

Availability of Alternative Power Sources

From the study findings majority of the respondents indicated to a moderate extent that there was a high level of investment in solar system; the installation cost of the technology is high ; there were accessible solar technology providers in the area and the transportation cost of the solar appliances for installation is high Additionally, the study revealed that the variable statistically, strongly and significantly correlated to adoption of renewable energy at 5% level of significance as it had a positive relationship with the dependent variable.

Government Policy

From the study findings, majority of the respondents indicated to a great extent that there was no clear legislation on domestic solar technology; lack of registration of solar service providers has affected inexperienced adoption of the technology and majority of the respondents had not installed the solar power because of high taxes levied on the solar appliances Additionally, the study revealed that the variable statistically, strongly and significantly correlated to adoption of renewable energy at 5% level of significance as it had a positive relationship with the dependent variable.

Conclusions of the Study

It was established that there was a high level of solar power technology in use per installation; households would consider acquiring a solar household system if other forms of energy for lighting to a large extent. such as Paraffin, Gas, Firewood , dry cells were not available or accessible The variable statistically, strongly and significantly correlated to adoption of renewable energy which means the more the technology advancement the more the adoption of renewable energy in the study area

The study established that investment cost affected adoption of renewable energy as there was a high level of investment in solar system; the installation cost of the technology is high there were accessible solar technology providers in the area and the transportation cost of the solar appliances for installation is high The was a correlation between investment cost and adoption of renewable energy.

The availability of alternative Power Sources in the study did influence adoption of renewable to a great extent that there was no clear legislation on domestic solar technology; lack of registration of solar service providers affected because of high taxes levied on the solar appliances Additionally, the study revealed that the correlated to adoption of renewable energy.

Recommendations of the Study

The study recommends for a simple technology for the users which can be easily adopted in the study area which can consider for use per installation and households acquiring a solar household system if other forms of energy for lighting are not available or accessible The investment cost affects adoption of renewable energy as there was a high level of investment in solar system; the installation cost of the technology is high and accessibility of solar technology providers in the area and the transportation cost of the solar appliances for installation should be considered Finally, the renewable energy policy should be clear on the legislation of domestic solar technology and registration of solar service providers as high taxes levied on the solar appliances discourage the adopters in the study area.

Recommendations for Further Studies

Since this study sought to establish the determinants of adoption of renewable energy in Kenya. Similar studies should also be conducted on the other contemporary trends in work renewable energy adoption to provide realistic and contextual solutions to the challenges affecting the adoption. An exploratory study would enrich findings because such a study would have a wide range of factors that influence adoption of renewable energy addressed other than the ones identified in this study. A comparative study should be carried out to compare whether the findings and other factors which could be affecting adoption of renewable energy and also identify whether they apply to other areas in Kenya in order to validate the findings of this study.

REFERENCES

Acker, R., and D. Kammen (1996), The Quiet (Energy) Revolution: Analyzing the Dissemination of Photovoltaic Power Systems in Kenya, in: *Energy Policy,* 24, 81–111.

AFREPREN (2001) *African Energy Data Reference Handbook*: AFREPREN Trimestrial Report,Volume IV, Nairobi: AFREPREN.

Aggarwal P., Cha T., Wilemon D. (1998) Barriers to the adoption of really-new products and the role of surrogate buyers. *Journal of Consumer Marketing*. Vol 15 (4).pp 358-371

Arora, D. S., Busche, S., Cowlin, S., Engelmeier, T., Jaritz, H., Milbrandt, A. and Wang, S. (2010) 'Indian Renewable Energy Status Report', Background Report for DIREC 2010. Washington, DC: US Department of Energy.

Babiker, H.M., J. M. Reilly, M.Mayer, S.E. Richard,I. Sue Wing, and R.C.Hyman,2001: *The MIT Emissions Prediction and Policy Analysis (EPPA) Model*: Revisions,

Sensitivities, and Comparisons of Results. MIT JPRSPGC Report 71, February, 90 p Bachou, S. and Otiti, T. (1994) *Dissemination of Photovoltaic Technology in Uganda.* Nairobi: AFREPREN.

Barney, J.B.; Wright, M.; Ketchen Jr., D.J. (2001), The resource-based view of the firm: Ten years after 1991. Journal of Management; 27 (6), pp. 625–641.

Berger W. (2001) Catalysts for the Diffusion of Photovoltaics – a review of selected programmes. *Progress in Photovoltaic: research and applications* 9 pp145-160 BERR (2008a) *UK Renewable Energy Strategy*. Available at

Bolinger M., Wiser R., Milford L., Stoddard M., Porter K. (2001) States emerge as Clean Energy

investors: A review of state support for renewable energy. *The Electricity Journal.* November pp82-95

BRECSU (2001). Solar hot water systems in new housing – a monitoring report. Energy Efficiency Best Practice Programme General Information Report 88. BRECSU Watford UK.

Brown SA., Massey AP, Weiss Montoya and Burkman JR, (2002)Do I really Have to? User Acceptance of mandated technology: European Journal of information systems 11(4), 283-295.51

Caird S., Roy R., Herring H. (2008) Improving the energy performance of UK households: Results from surveys of consumer adoption and use of low- and zero carbon technologies *Energy Efficiency* vol 1 (2) pp149-166

Caird, S. and Roy, R. with Potter, S. and Herring, H. (2007) *Consumer adoption of householdenergy efficiency measures*, Report DIG09, Design Innovation Group, The Open University, Milton Keynes, UK, November.

Chi, M & Roscoe, R (2002) The Processes and Challenges of Conceptual Change. Kluwer: Netherlands

Donald R. Cooper, Pamela S. Schindler (2003) *Business Research Methods,* McGraw Hill School Education Group.

Farsi, M., M. Filippini, and S. Pachauri (2007), Fuel Choices in Urban Indian households, in:*Environment and Development Economics*, 12, 757–774.

Fishbein, M. & Ajzen, I. (1975). *Belief, attitude, intention, and behavior: An introduction totheory and research*. Reading, MA: Addison-Wesley

Flaherty F., Pinder J. and Jackson C., *Evaluating performance of Domestic Solar ThermalSystems*, ETSU Report.

Gebreegziabher, Z., A. Mekonnen, M. Kassie, and G. Köhlin (2011), Urban Energy Transition and Technology Ad option: The Case of Tigrai, Northern Ethiopia, in: *Energy Economics*,34, 410–418.

Heltberg, R. (2004), Fuel Switching: Evidence from Eight Developing Countries, in: *Energy Economics*, 26, 869–887.

Herring H. (2006) Energy efficiency – a critical view. *Energy* 31 pp10-20

Herring, H., Caird, S. and Roy, R. (2006) Can consumers save energy? Results from surveys of consumer adoption and use of low and zero carbon technologies, In Proceedings European

Council for an Energy Efficient Economy Summer Study 2007, Volume 4, Stockholm,Sweden, pp. 188595)

Hosier, R., and J. Dowd (1987), Household Fuel Choice in Zimbabwe – An Empirical Test of the Energy Ladder Hypothesis, in: *Resource s and Energy*, 9, 347ı361.

IEA (2006), *World Energy Outlook 2006*, Paris: International Energy Agency.

Jacobs, A. (2006), Connective Power: Solar Electrification and Social Change in Kenya, in:*World Development*, 35, 14 4–162.52

Jennings, P., , 2007, *Solar energy in Australia*, Radio National

Kaplan A.W. (1999) Generating interest, generating power: commercializing photovoltaics in the utility sector. *Energy Policy* 27 pp317-329

Kapur D., Lewis J. Webb R. (2007) The World Bank: History, Brookings Instituion Press

Karekezi, Kimani, Mutiga, & Amenya, 2004, Energy Services for the Poor in Eastern African Subregional 'Energy Access Study', UNEP

Karekezi, S. and Ranja, T. (1997) *Renewable Energy Technologies in Africa*, London & Oxford: Zed Books & AFREPREN.

Karplus, V.J., S. Paltsev, and J.M. Reilly, 2010: Prospects for plug-in hybrid electric vehicles in the United States and Japan: A general equilibrium analysis.Transportation Research Part A: Policy and Practice, 44(8): 620-641.

Kenya National Bureau of Statistics (2011) *Economic Survey 2011*, Nairobi: Government Printer.

Kenya Renewable Energy Association (KEREA) (2009) *Photovoltaic systems Field Inspection and Testing Report*, Nairobi: KEREA.

Komatsu, S., S. Kaneko, R. Shrestha, and P. Ghosh (2011), Nonincome Factors behind the Purchase Decisions of Solar Home Systems in Rural Bangladesh, in: *Energy forSustainable Develop m e n t* , 15, 284–292.

Kothari C.R, 1985, *Research Methodology-Methods and Techniques*, New Delhi, Wiley Eastern Limited.

Krejcie, Robert V., Morgan, Daryle W (1970),"*Determining Sample Size for Research Activities" Educational & Psychological Measurement*.

Lai A.W. (1991) Consumption Situation and the Product Knowledge in the Adoption of a New Product. *European Journal of Marketing* 25 (10) pp55-67

Leach, G. (1992), The Energy Transition, in: *Energy Policy*, 20, 2, 116–123.

LEE, E.-J., LEE, J. and EASTWOOD, D. (2003) A Two-Step Estimation of Consumer Adoption of Technology-Based Service Innovations

Mahoney, J.T.; Pandian, J.R. (1992), The Resource-Based View Within the Conversation of Strategic Management. Strategic Management Journal; 15, (5), pp. 363–380.53

Makadok, R. (2001), Toward a Synthesis of the Resource-Based View and Dynamic-Capability Views of Rent Creation. Strategic Management Journal; 22, (5), pp. 387–401

Martinot E., Chaurey A., Lew D., Moreira J., Wamukonya N. (2002), Renewable Energy Markets in Developing Countries, Annual Report vol 27 pp 309-348

Mason Jennifer (2002) *Qualitative Researching*, SAGE Publications Ltd.

Miller, K. (2005). *Communications theories: perspectives, processes, and contexts*. New York:McGraw-Hill.

Ministry of Energy (2008) *Strategy for the Development of the Biodiesel Industry in Kenya 2008-2012*, Final Draft, Nairobi: Government Printer.

Ministry of Energy (2011) *Strategy for the Updated Least Cost Power developemetn PLan 2011-2031*, Final Draft, Nairobi: Government Printer.

Ministry of Finance (2011a) *Budget Strategy Paper, 2011*, Nairobi: Government Printer.

Ministry of Finance (2011b) *Physical Infrastructure Sector Medium Term Expenditure Framework (MTEF) Report, 2011/12 – 2013/14* Nairobi: Government Printer.

Mwakubo, S., Mutua, J. Ikiara, M. and Aligula, E. (2007) *Strategies for Securing Energy Supply in Kenya,* DP/74/200, Nairobi: Kenya Institute for Public Research and Analysis KIPPRA).

Ngigi, A. (2006) PVMTI News-Kenya.

Njong, A., and T. Johannes (2011) An Analysis of Domestic Cooking Energy Choice s in Cameroon, in: *European Journal of Social Sciences*, 20, 336–348.

Peet R. nd Watts, M. (1993) Liberation ecologies: Environment, development and Social Movements: Routledge.

Rebane, K., and B. Barham (2011), Knowledge and Adoption of Solar Home Systems in Rural Nicaragua, in: *Energy Policy*, 39, 3064–3075.

Republic of Kenya (2006a) *Energy Act*, Nairobi: Government Printer

Rogers Everett (2003), *Diffusion of Innovations, 5th Edition*, Free Press.

Susannah C., 2010, *"Guest Post: Why Is Net Metering Under Attack?*" Greentech Solar,available at http://www.greentechmedia.com/articles/read/why-is-net-meteringunder-attack

Timilsina .R., Lefevre T., Shrestha S. (2000) Financing solar thermal technologies under DSMprograms; an innovative approach to promote renewable energy. *International Journal of Energy Research* 24 pp 503-510 54

UNEP (2011) *Global Trends in Renewable Energy' Analysis of Trends and Issues in the Financing Renewable Energy*, Investment Report 2011, Nairobi: UNEP. 66

UNEP (2008) *Kenya Solar and Wind Assessment Report (SWERA)* , Kenya Country Report,Nairobi: UNEP

Wernerfelt, B. (1995), The Resource-Based View of the Firm: Ten Years After. Strategic Management Journal; 16, (3), pp. 171–174.

World Bank (2010), *World Development Report – Development and Climate Change*, Washington D.C.: World Bank.

Venkatesh V. and Davis FD, A theoretical extension of the technology acceptance model: Four Longitudinal Field Studies: Management Science 186-204

Vosnidiadou S. (1998) From Conceptual development to Science education: A psychological point of View. *International Journal of Science Education,* 20, 1213-1230.