INFLUENCE OF RURAL ELECTRIFICATION PROJECTS ON HOUSEHOLD CONNECTIVITY IN NANDI COUNTY:

A CASE OF KENYA POWER PROJECTS.

TANUI TIMOTHY TIROP

A RESEARCH PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF A DEGREE OF MASTER OF ARTS PROJECT PLANNING AND MANAGEMENT OF THE UNIVERSITY OF NAIROBI

2015

DECLARATION

This research project is my original work and has never been submitted for a degree or any other award in any other university.

……. ……..

Timothy Tirop Tanui Date

L50/75475/2014

This research project has the approval of the University Supervisor.

…… …….

Mr.Ochieng F. Owuor Date

Lecturer; Department of Quantitative Studies

School of Human Resource

Moi University

DEDICATION

This research project is dedicated to my mother Rachael Rutto, my father Harun Rutto and my Fiancée Valentine Rutto for their support.

ACKNOWLEDGEMENT

I wish to express my sincere gratitude to my supervisor Mr. Ochieng for his guidance in developing my research topic, conceptual framework and the entire project. I would also like to acknowledge Prof. Odundo who taught me research methods which has been instrumental in developing the research project. I appreciate all the lecturers who have assisted me so far, more so Mr. Okelo, Mr. Koringura, Mr Sakaja and Mr. Cheben . Many thanks to the University of Nairobi for initiating the programme in Eldoret Centre. I thank my colleagues in Kenya power for their support in accessing invaluable data to be used in the research. I also thank my classmates Francis, Sospeter and Njoroge for their support. I salute my research assistants Mathew and Laban for aiding in administering of questionnaires. I thank anybody not mentioned but contributed in the preparation of this project.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS AND ACRONYMS

KNBS- KENYA National Bureau of Statistics

IEA -International Energy Agency

IEG – Independent Evaluation Group

LV – Low Voltage

MV – Medium Voltage

GPOBA- Global partnership on output base aid

ABSTRACT

This study aimed at investigating the influence of rural electrification projects on household connectivity in Nandi County. Rural electrification development which can be sustained cannot be possible in today's society which is complex in such a challenging environment, without the attainment of effective learning and business support capabilities (Williams, 1998). This study adopted a descriptive survey design. Questionnaire, interview schedule and content analysis were used as the main instruments of data collection and analysis for this study. The questionnaire consisted of both open-ended and closed-ended questions and therefore both qualitative and quantitative data were collected for the study. Cronbach Alpha was tested to find out the reliability coefficient of the research instruments. A total of 1080 households were targeted. Morgan and Krejcie table was used to obtain the sample size of 278. The response rate was 73% from the total 278 sample and was deemed satisfactory. The study adopted both qualitative and quantitative analysis. Findings indicated that project design, connection cost and sensitizing greatly influences household connectivity whereas project implementation slightly influences household connectivity. Data for this study was analyzed both descriptively and inferentially with the help of SPSS v 16.0 computer package. Parametric and non-parametric correlation coefficient was computed to establish significance levels of relationships that exist between the variables of the study. The relationship was calculated at 0.05 level of significance and at 95% level of confidence. The findings of this study were presented in form of tables.

CHAPTER ONE
INTRODUCTION

1.1 Background

Household connectivity to electricity is widely considered to be a crucial prerequisite for development and the removal of barriers hampering economic growth: Electricity potentially increases the productivity of both farm and non-farm activities, facilitates household tasks, provides an efficient and clean lighting source, and enables provision of improved social services such as education and health care. There is a consensus among practitioners and donor organizations that considerable impacts in these areas might be achieved through electrification interventions (Abdullah & Markandya, 2012).

Rural electrification has been recognized as a key ingredient in poverty reduction and the enhancement of social and economic development. In the past decades, access to electricity in the rural and peri-urban areas has been a key challenge and this has in turn led to slow social and economic development (Sachs, 2005). The United States, for example, rolled out rural electrification programmes as early as 1930s as a way of improving growth rates of its suburbs and helping to create a more integrated national market (Malone & College, 2010). Similarly, it has and continues to be the intention of other governments around the world to increase the use of electricity in rural and peri-urban areas.

About 1.3 billion people around the globe lack access to electricity (IEA 2010a, 2010b), and the majority of them reside in rural areas. Sub-Saharan Africa alone accounts for almost 45 percent of that number. Across the subcontinent, less than one-third of households have electricity. In most parts of the world, urban electrification rates exceed 90 percent, but less than 60 percent of the urban population in Sub-Saharan Africa has that percentage. By 2030, the International Energy Agency (IEA) estimates that—at current levels of growth in generating capacity—access to power will just keep pace with population growth (IEA 2010b). Forty percent of Sub-Saharan Africa countries will not reach the goal of universal access to electricity by 2050.

The low rates of electrification in rural and urban Sub-Saharan Africa are serious obstacles to the region's development. Electricity is one of the necessary conditions for development (IEG 2008; World Bank 2002). These low electrification rates result in a loss of significant benefits—such as productivity gains in business, the creation of new jobs, opportunities to study at home, improvements in health, and better communication via television and radio. Because school attendance is improved by access to electricity, deficits in electricity access also may represent a loss in the development of human capital (Khandker, Barnes, and Samad 2009, 2012a, 2012b).

The distribution of electricity—whether for social or productive uses—is a capital-intensive enterprise, and the cost of providing household connection to electricity service can be quite high. When connection charges are recovered through one-time, up-front fees for new customers, they can constitute a powerful disincentive to people who wish to obtain electricity, no matter how much they might desire the service. Making it easier for households and small commercial enterprises to gain access to grid electricity without aggravating the financial problems of distribution companies is a delicate balance, but in most countries in the region, it is an achievable goal. If efforts to expand access to electricity are to be aligned with the important goal of ensuring utilities' financial sustainability and operational efficiency, they must be planned carefully (Barnes 2007; World Bank 2010a; AEI 2012). Several policy issues arise in trying to strike the appropriate balance.

Even where electricity is made available to a poor community the take up has been affected by a wide range of factors. Various models have indicated that the demand for electricity is income inelastic, as households view electricity as a basic good. This assumption is implicit in most individual country's electricity planning, for example in South Africa, and in the energy policies of international development agencies such as the World Bank. However, it has not always been the case that the poor have switched to more sophisticated forms of energy when these have become available (Howells et al. 2010). In practice, most households continue to use a combination of fuels at any one time, some of which may be advanced and others more traditional. In any event, household fuel choices are likely to be related to the size and diversity of household incomes, and other factors such as education and distance and availability of

natural resources come into play (Heltberg 2004). The cost and availability of electric appliances, such as cooking stoves, has often been a prohibiting factor in the take up of electricity.

The experience from projects has shown that where electricity becomes available the take up is variable. Sometimes it takes between 1 and 3 years for households to start using electricity, and there are still high percentages that do not connect. So a distinction can be made regarding the type of policy that ought to be used to improve connection where electricity has arrived, and towards expanding electricity to areas where it does not presently exist. The World Bank report that the emphasis is on the latter in Indonesia, (World Bank, 2003). This situation exists, despite the fact that once a community is electrified, the marginal cost of electrifying additional households is low. Marginal costs fall as more households become connected. It is therefore argued that if tariff levels are sufficient to cover operating and maintenance costs then little is lost by providing connections.

In Kenya rural electrification has been implemented by government agencies namely Kenya power and Rural Electrification Authority with a target to connect all public primary schools by July 2015. A large amount of resources is being committed toward these rural electrification projects in order to improve household connectivity with a target of 75% by 2018 (Kenya power, 2014).

1.2 Statement of the Problem

Household electricity connectivity in Kenya is about three million with that in rural areas being lower than that of urban areas. Rural areas continue to be the home to majority of the population in Kenya. The lack of electricity supply in rural areas affects close to ninety (90) percent of the population (Abdullah and Markandya, 2012). According to a recent survey by (KNBS 2013), the percentage of Kenyan household connected to electricity was 22.9% with 51.4% in urban areas and 5.2% in rural areas. In Nandi County, the connectivity was at 6.2% which is extremely low.

Kenya power has undertaken a number of rural electrification projects in a bid to improve the connectivity in rural areas. A substantial amount of resources has been spent on such projects, an average of 1.6 million each with an expectation that it would translate into increased connectivity by households. Little is known on the influence of these electrification projects' process on the household connectivity. There is need to assess how rural electrification projects translate to household connectivity. This research thus strived to fill in the gap and make recommendations to help improve connectivity of subsequent electrification projects.

1.3 Purpose of the study

The purpose of the study was to investigate the influence of rural electrification projects implemented by Kenya power on household connectivity in Nandi County.

1.4 Objectives of the study

1. To examine how the design of rural electrification projects influences household connectivity in Nandi County.
2. To investigate the influence of implementation of rural electrification projects on household connectivity in Nandi County.
3. To examine the extent to which connection cost influences household connectivity in Nandi County.
4. To identify how sensitizing on rural electrification projects influences household connectivity in Nandi County.

1.5 Research Questions

1. To what extent does design of rural electrification projects influence household connectivity in Nandi County?
2. To what extent does the implementation of rural electrification projects influence household connectivity in Nandi County?
3. To what extent does electricity connection cost influence house hold connectivity in Nandi County?

4. To what extent does sensitizing on rural electrification projects influence household connectivity in Nandi County?

1.6 Significance of the Study

The government of Kenya has a target of attaining a connectivity of 75% by the year 2018 (Kenya power). Key to this is the rural electrification projects. It is not enough to just complete projects; the targeted beneficiaries should get connected with electricity. Such projects are usually costly (approx. 1.6 million each), the amount spend should thus correspond to the household connectivity lest it becomes a white elephant. A detailed evaluation of the influence of rural electrification projects on household connectivity will thus play a role in provision of reliable data and trends in household connectivity. The findings can thus be used to make decisions on how best to implement subsequent projects so as to attain the maximum household connectivity. The outcome of this study can be used by policy makers in further formulation of rural electrification programs aimed at improving electricity connection in rural areas. The findings will also be used to address bottlenecks encountered during implementation of rural electrification projects thus speeding them up.

1.7 Assumptions of the study

The study assumed that households provided unbiased information of electricity connection.

1.8 Limitations of the study

Some of the respondents were unwilling to give information. This was mitigated by hiring and training research assistants familiar with the residents.

1.9 Delimitations of the study

Kenya power has implemented several rural electrification projects across the country. The study focused on rural electrification projects undertaken by Kenya power in Nandi County. The study did not include influence of rural electrification projects on household income and living standards.

1.10 Definition of Significant Terms

Household Connectivity: This refers to the actual number of homesteads using grid electricity.

Rural Electrification: This refers to extending grid electricity to areas initially without. It usually involves construction of MV line, LV lines and installation of transformers.

Design: This means to make drawings on how the new power line will be constructed, quantify the materials to be used, labor and damages compensation costs.

Implementation: This means to construct the power line, install and energize the transformer.

Sensitizing: This means educating the community members on the benefits of the electricity project, how to apply for electricity and available financing options. It is mostly done through barazas .

Baraza : This means a public meeting facilitated by Kenya power marketing offices to train the community on how to apply for electricity and financing options available.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This chapter highlights written material cited in order to support the study. The literature was sourced from books, journals, internet and other research studies done by various intellectuals. The literature was written in line with the objectives. The chapter also covers the theoretical and conceptual frameworks.

2.2 Household Connectivity

Sub-Saharan Africa trails other regions in the breadth of common access to electricity for household use. Anticipated population growth is expected to widen that gap (IEA 2010a, 2010b). Several factors contribute to the access deficit across the subcontinent (Zomers 2001). Conservative utilities have stuck to traditional policies that emphasized service to urban areas, in large part because providing service in urban areas is more profitable than extending it to remote and sparsely populated rural areas. In many cases, plans to extend electrification to rural areas have been subjected to political pressure that often prevents the utility from charging a cost-recovery tariff and amassing the investment capital needed to extend service, leaving it in a chronically weak financial position. Another reason for the slow rate of access expansion is the poor targeting of subsidies, which allows wealthier customers to enjoy subsidies they do not need (Komiveset al 2005; Foster and Briceño-Garmendia 2010).

The unfortunate reality in many Sub-Saharan African countries is that even when distribution lines are provided to increase access—whether because of a political commitment on the part of the government, an investment decision by the utility, or the availability of financing from donors—the percentage of consumers who are able to connect to the network remains extremely low. In many of these countries, the initial rates of connection in villages newly added to the electrical grid are as low as 10 to 20 percent of possible connections, and that number increases only very slowly over time, (World Bank, 2013).According to The Kenya Power Managing Director, the country's electricity consumer is rapidly growing with the total expected to hit three million by December 2014, (Kenya power, 2014).

2.3 Rural Electrification projects

Lack of access to energy in rural areas is of same order of magnitude as lack of access to other types of infrastructure. In fact, it is often the same rural or urban poor who lack access to modern energy services, electricity, modern telecommunications, clean water and other basic services (Reicheetal 2000).In recent years, there has been a belief that the differences in growth between the successful East Asian economies and other parts of the developing world can be explained by failure to invest sufficiently in infrastructure (Estache and Fay 2007).The electricity market involves a complex system where: economic, technical, institutional, financial, social, political and environmental factors interact to influence the demands of the different consumers. Among all these factors, the institutions for the delivery of electricity services and the provision of reliable services particularly to household customers probably exert the greatest effect on these markets,(Abdullah and Markandya, 2012).

The policy emphasis towards rural electrification has fluctuated over time and has been influenced by the World Bank. In the 1970s the World Bank thought investment in rural electrification was worthwhile reflecting the received wisdom over the previous 20 years that rural electrification would act as a catalyst for rural development (Hirschman 1970)] but would be loss-making (World Bank 1975). It was thought that the high up-front investment costs and perceived low demand in rural compared to urban areas would constrain rapid development in this direction and that developments in health and water were of higher priority. Despite the spurt to rural electrification projects in the 1980s in, for example, Malaysia and Bangladesh, an Independent Evaluation Group (IEG) found disappointing results in terms of low economic returns, low cost recovery (between 10 and 15 %) and little evidence of an impact on industrial development (IEG 1994). This finding was also reflected in wider reappraisals of its effects which began in the 1980s(Barnes 1988; Foley 1992; Pearce and Webb 1987; Kirubi et al. 2008).

Roughly 22% of the world's population still does not have access to electricity. In 2008, this represented 1.5 billion people, most of whom lived in remote areas often difficult to access and therefore to connect to national or regional grids. The International Energy Agency estimates that roughly 85% of the people without electricity live in rural areas in developing countries, mostly in peri-urban or remote rural areas (IEA, 2009b). Today, most of these people are found

in Sub-Saharan Africa and South Asia. The IEA predicts that in 2030, if no new policy to alleviate energy poverty is introduced, 1.3 billion people (some 16% of the total world population) will still be denied electricity most of whom in South Asia and Africa (IEA, 2009b).

Not all electrification policies target poor rural households. Some also target a mix of farms, big villages and small towns all of which call for different technologies. In fact, rural electrification policies are shaped according to the various energy needs, resources and target groups. Electrifying the suburb of a major Indian city obviously poses problems that are different from those of a remote village in China. As problems are far greater in rural areas than in urban settings (Barnes, 2007) we will focus our attention on electrification policies in favour of the world's rural poor.

The World Bank's approach to energy in the 1990s turned towards the promotion of utilities in the private sector. The implications for the electricity sector were spelt out in World Bank (1993a). This represented a reversal of earlier policy where the World Bank had argued, particularly for poorer countries, that privatization of utility sectors was too difficult due political reluctance and the lack of willing buyers and investors (Cook 1999). In the early 1990s the World Bank also attempted to balance efficiency with an emphasis on sustainable development with little real success (World Bank 1993b). The subsequent shift by the World Bank and other international development institutions after 1995 towards a strategy based on poverty had a more significant implication for rural electrification programmes and the ways in which they were perceived.

The link between energy and poverty was clearly laid out in a number of the World Bank's reports (World Bank 1996). By 2008 the World Bank could claim that the economic case for investment in rural electrification is proven and that the benefits to rural households are above the average long run supply costs, indicating that cost recovery tariff levels are achievable (World Bank 2008). The World Bank's coverage of rural electricity is still low in South Asia and Sub Saharan Africa and it acknowledges that it supports few projects in the countries where access to electricity is poor and rural electrification is limited, although new energy projects have recently commenced in Ethiopia, Uganda and Tanzania. The costs of a rural electrification project can be divided into investment and operating costs. Investment costs include the costs of

constructing the project itself, i.e. the costs of purchasing and installing Il-KV and .4-KV lines, transformers, (Gellerson, 1982).

2.4 Rural electrification project Design and household connectivity

If the electricity grid is available, only around 20-50% of the households in the reach of distribution lines are connected to the grid. The most important reasons for households not to connect are in-house installation costs and connection fees. Connection fees in most African countries range between 50 and 150 USD. Even the lower boundary of this range is prohibitive for many rural African households. The concrete cost of connection depends on the subsidy scheme applied by the utility. As a matter of course, the total costs of connection are significantly affected by the distance the household has to bridge to reach the village distribution grid (Peters, Harsdorff and Ziegler 2009).

The referenced IEG review considers World Bank financed rural electrification schemes in developing countries and reports on lessons learnt and conclusions. The majority of these schemes concentrate on grid infrastructure development. Significantly the report concludes that success has been measured by Outputs (infrastructure built) rather than Outcomes (impact on MDGs) and recommends that project design includes features such as financing schemes for connection charges, education of consumers and support for productive use. Typical cost-benefit analysis of rural electrification wraps all benefits within the household's 'willingness to pay'. However, in communities where 'ability to pay' is limited then the benefit of electricity supply in areas such as improved health, education, economic activity and environmental impact are much more difficult to measure. (Frame, 2000).

A 1975 paper entitled "Rural Electrification" (World Bank 1975) reviewed the rationale for Bank support to the sector. The paper argued, "There is plenty of scope for successful investments in rural electrification (RE), provided that they are properly selected and prepared" (World Bank 1975, p. 3). The paper also recognized that these investments would often be loss making, at least initially. The up-front investment costs were very high, and rural demand was considerably lower than that in urban areas, resulting in low load factors and high unit costs (World Bank 2008).

Wherever there is grid coverage, however, governments may wish to consider policies that will leverage existing infrastructure, while taking advantage of the economies of scale in supplying last-mile connections. Connecting multiple households at the same time would not only reduce transportation costs but also would allow utilities to plan local distribution networks that minimize costs. Coordinating these connections poses the collective action problem that would need to be solved through a government policy, such as a mass connection program. The idea of subsidizing last-mile electricity connections to households is, of course, nothing new. This is how many developed nations, including the United States, reached universal electrification, Sybil, (2015)

2.5 Implementation of rural electrification projects and household connectivity

The service standards of many electricity distribution companies in Sub-Saharan Africa do not address the low consumption of households in poor urban and rural areas. The cost of providing service to households that require only 25−50 kWh of electricity per month can be significantly reduced in a variety of ways, generating savings both at the level of the medium-voltage grid and at the drop line to the households. High standards and expensive materials often are not necessary for safe, effective service to low-income customers and rural communities, as amply demonstrated in many countries over recent decades (Karhammar et al. 2006; NRECA 2000, 2012a, 2012b). Some of the technologies and practices that utilities have used to reduce the cost of distribution networks include: adopting single-phase medium-voltage and minimal low-voltage network systems, as North America; using smaller transformers and smaller-gauge lines to handle small loads; minimizing the number of poles needed to carry long medium-voltage lines by using appropriate spans; employing single-wire earth-return systems; and installing so-called shield wire systems on existing transmission lines.

Upon completion of the power line, the transformer is installed and energized. Sometimes there is a shortage of transformers. The availability of materials on site is crucial for the smooth flow of activities. Al-Kharashi and Skitmore (2009) identify a lack of strategic planning for materials and labor as a major cause of delays on project delivery.

2.6 Rural electrification connection cost and household connectivity

The federal government's power sector funds direct more resources on loans to states with lower electrification rates and in greater need of investment, and fewer to regions whose rates are much higher. Initially LpT total costs were estimated at BRL 7.6 billion (USD 4.16 billion), with Energy Deelopment Accounts (CDE) and Global Reversion Reserve (RGR) funds contributing BRL 5.3 (USD 2.9 billion) or around 75% to the overall budget, and the remainder being split in equal shares between the states and the service providers (MME, 2003). According to the calculations made at the time, investments were to be particularly high in the northern and north-eastern states of the country: with BRL 1.73 billion (USD 0.94 billion) and BRL 2.64 billion (USD 1.44 billion) respectively, these states would account for over two-thirds of the total planned investments (Loureiro de Azeredo, 2004). When implementation of LpT began, however, overall costs soon increased significantly.

The most important barrier to grid connectivity has been the high price of an electricity connection. Currently, the price of a household connection is $410, which is incredibly expensive even by American standards. In a country where gross national income per capita is $1,730, this price is simply unaffordable for poor, rural households. There are several other barriers to electrification as well. For example, even if the price were lower, it may still be necessary to provide households with an option to finance their connections, so that they could pay back the principal amount over time Sybil, (2015).

2.7 Sensitizing on rural electrification and household connectivity

It is argued that electrification enables livelihoods in several ways. By stimulating employment and income generating activities, where people build assets such as the expansion of dairy milk production and achieve better cash flows. It also argued that electrification enables people to use surplus resources made possible through their entrepreneurship that contribute to the emergence of credit and savings schemes based on the newly available cash. Extra electric lighting and improved water from better pumping facilities are likely to reduce women's drudgery in fetching water and create opportunities to set up other businesses. In general, one of the underlying dilemmas of rural enterprise in developing countries is that electric machinery

potentially replaces labor that is comparatively cheap and the poorly educated fail to recognize the potential uses and benefits of motive power. In this situation the inclusion of complementary services including training becomes an important element for creating change. This is reaffirmed in the study by Peters et al. (2009) who examine the impact of developing rural electricity with complementary services as opposed to just financing hardware and civil works.

Complementary services in their study refer to advocacy to take-up and use electricity. These services comprise sensitizing campaigns to raise awareness amongst households, enterprises and social institutions of both the advantages and disadvantages of electricity. With respect to commercial electricity users, complementary services can be broadened to cover business development services, consumer and micro-finance services and other infrastructure, telecommunications and transport (Kirubi et al. 2008; Brew-Hammond 2009; Mustonen 2010). Utilities could provide complementary services as is the case in Thailand. Kenya used this approach: the Kenya Power and Lighting Company (KPLC), a national utility, put 500 rural electrification schemes covering health, schools and community water in rural Kenya costing 30 million US$ (KPLC 2007). NGOs also contribute in this area. Bastakoti (2006) in a study of rural electrification in Nepalargues that complementary service systems and policy coordination are necessary preconditions for the effective use of electricity power in rural communities

2.8 Theoretical Framework

2.8.1 Individual Agency Theory

Layder (2010) in his book ‘understanding social theory’ elaborates on Anthony Giddens understanding of what is individual agency. This paper adopts such understanding .He writes ‘all human action … implies power – the capability of producing an effect … it is the ability to make a difference in and on the social world, of transforming the circumstances in which one finds himself , that is perhaps the essential feature of human action..’ Further more Armatya Sen in his book ‘*Development as freedom*’ again reiterates the importance and pivotal role of human action. He asserts that individual agency is ultimately, central to addressing these {challenges of mankind (Sen, 1999).Availability of electricity in rural areas can increase number of households that get connected and use the electricity to uplift their standards of living. However, this can

only happen if the rural population unearths the opportunities that rural electrification brings forth.

C. Wright Mills (1990) in his book '*the sociological imagination*' uses what has come to be widely quoted analogy to explain this theory perhaps by default. He gives a hypothetical society of a given population, say 100, and then goes ahead to mention that in the entire population, only two people are unemployed. The reason for the unemployment, as he surmise, becomes the temperaments of the individuals in question (Mills, 1959). Temperaments here mean the skills, capabilities or mental dispositions etc. the said individuals possess. The gist of the matter being is that their lack of employment has nothing to do with the society but them. He goes ahead to question that if perhaps given the said population, 90 people are unemployed, where then is the problem? Perhaps as he surmises again the problem this time round is in the societal structures. What opportunities are available and to whom these opportunities are intended.

To derive C Wright Mills (1990) assertions within the context of this paper is to ask whether in the presence of rural electrification in Nandi and Uasingishu yields the same effect/impact with similar population in terms of household connectivity. To explain this further is by comparing how people in Nandi, in this case the households connect to electricity so as to utilize the rural electrification opportunity in comparison with other areas with the same opportunity. That notwithstanding, household connectivity in Nandi county can still not have desired effects among everyone. Not everyone harnesses the opportunities available.

2.8.2 Anthony Giddens' Structuration Theory

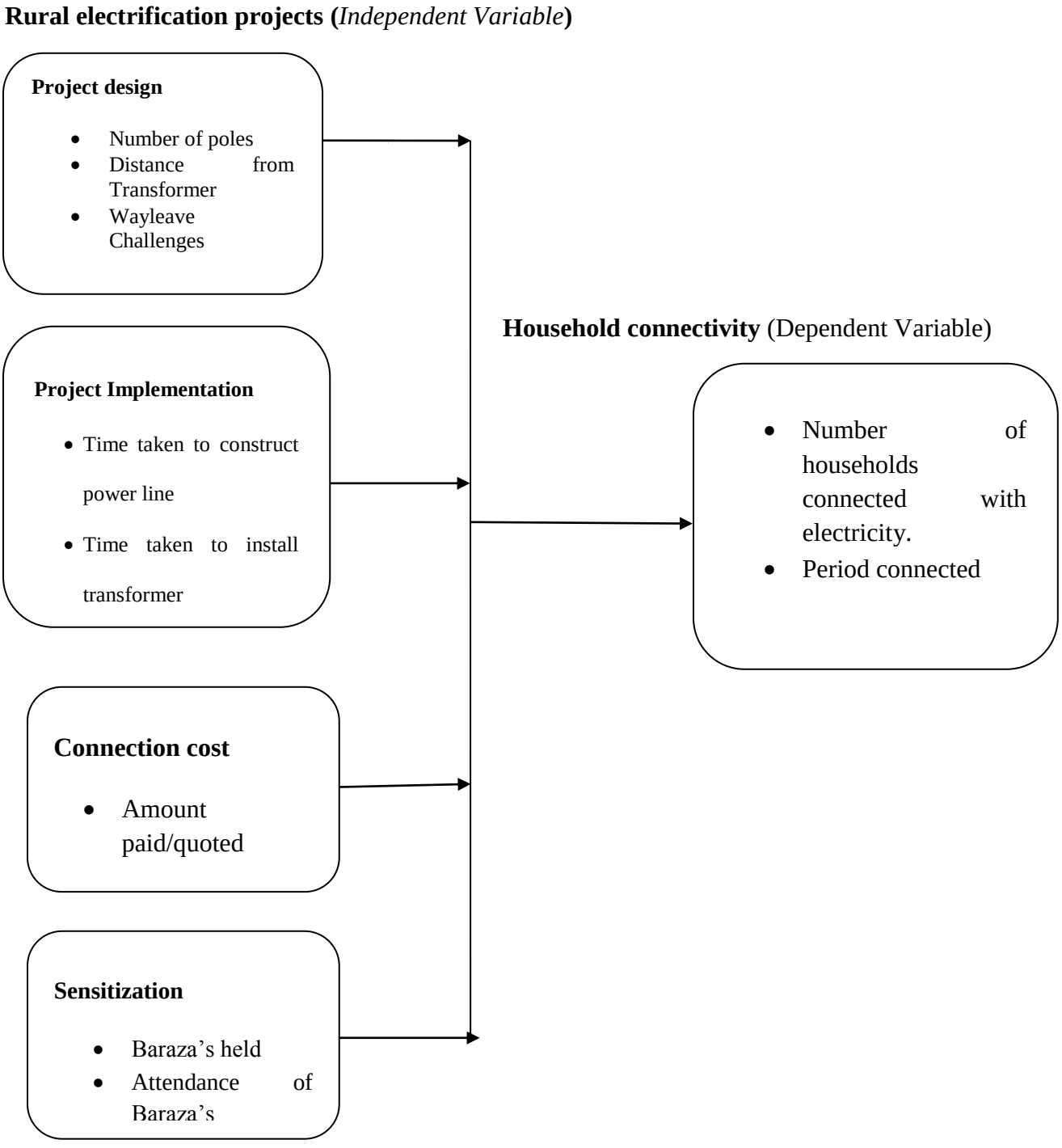
Giddens in his book '*New Rules of Sociological Method*' (1976) outlines the Structuration theory. The gist of the theory is an affirmation of both the roles of structures of society and individual agency in bringing about change. He contends, and rightly so, in the opinion of this paper, that structures alone are not sufficient to bring about the desired change (Giddens, 1976).He sees desired change as a product of the duality of structures and actions i.e. both contribute to the desired change. In the context of this paper, household connectivity offers an opportunity correlation to rural electrification program in Nandi County and are only

positively realized if the people of Nandi make a willful decision to harness such an opportunity. Willful decision to harness an opportunity cannot exist without the presence of the opportunity that the structures present.

2.9 Conceptual Framework

The independent variable is rural electrification projects whereas the dependent variable is household connectivity. The relationship is as shown in figure 2.1 .

Figure 2.1 Conceptual framework



Availability of electricity in rural areas can increase number of households that get connected and use the electricity to uplift their standards of living as illustrated in individual urgency theory by lader (2010). This is further supported by the conceptual framework as the number of poles and distance to the transformer would Influence the power supply to the residents within these areas. In the presence of structures when they are not utilized to the maximum they become useless in the eyes of the society, this is emphasized by Anthony Giddens' Structuration theory (1976). The conceptual framework sees the project implementation in place thus making no structure in place to be left hanging on the ground.

2.10 Gaps in knowledge

Thematic area	Author(s)	Method	Main findings	Knowledge Gaps
Impact of rural electrification on the growth of small and medium enterprises in Mbita Town	Raymond Ochieng Ouma (2013)	Descriptive Research Design	The consumers within Mbita were agreeing and willing to use grid power as opposed to using alternative power sources	The study did not focus on the design of power grid that supplied power to the residents of Mbita town. This study will therefore focus on the power grid and enhance the supply.
Expanding Electricity Access to Remote Area: Off Grid rural electrification in developing countries	Reichie et all (2000)	Survey Research Design	Rural electrification does improve the lively hood of the natives in the rural areas	The study did no focus on the electricity connection cost and how it affects the number of people willing to connect to the power grid. This study therefore sought it wise to undertake the connection cost into consideration wile taking the study.

2.10 Summary of literature review

From the literature reviewed, it is evident that household connectivity is still low in sub-Saharan Africa especially in the rural areas. Existing rural electrification projects have not been fully utilized. A higher connectivity would accelerate development of these rural areas. The policy emphasis towards rural electrification has fluctuated over time and has mainly been influenced by the World Bank. The dominant reason for households within reach of grid electricity not to connect to the grid has been cited as connection cost. There is therefore need to examine the extent to which it affects households in Nandi county and also on the extent to which design, implementation and sensitization of rural electrification projects influences household connectivity.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the methods that were used in the study. It explains the research design, the study population, sampling method and procedures, data collection procedures and instruments, data analysis, reporting and ethical issues.

3.2 Research Design

This research sought to assess the extent to which rural electrification projects influence household connectivity. It was studied through the use of a descriptive research design. According to Cooper and Schindler (2003) a descriptive study is concerned with finding out the what, where and how of a phenomenon. The main focus of this study was quantitative in nature. However some qualitative approach was used in order to gain a better understanding and possibly enable a better and more insightful interpretation of the results from the quantitative study.

3.3 Target population

The study targeted households in areas covered by Kenya power rural electrification projects in Nandi County. A response from project supervisors and construction contractors was sought. A total of 1080 households in 36 projects were targeted. 3 project supervisors and 10 construction contractors were also targeted.

3.4 Sample selection and sample size

The Morgan and Krejcie (1970) table (Appendix III) was used to determine the sample size for this study. With a target population of 1093, the corresponding sample size was 278 respondents distributed according to their ratio samples as shown in table 3.1 .Proportionate stratified random sampling technique was then be applied to the 274 household so as to achieve a fairly equal representaion in the six constituencies in Nandi County.

Table 3.1 sample size selection

Target group	Target population	Procedure	Sample size
Household heads	1080	1080/1093*278	274
Project supervisors	3	3/1093*278	1
Construction contractors	10	10/1093*278	3

3.5 Research instruments

Structured and semi structured Questionnaires were administered to household representatives. Dwivedi (2006) defines a questionnaire as a device for securing answers to questions by using a set of questions. The use of questionnaires offers considerable advantages in management as it presents an even stimulus to a large number of people simultaneously and provides investigator with a relatively easy accumulation of data. The use of questionnaires also allows the respondents time on questions that would require reflections to avoid nasty responses, however they require a lot of time in travelling hence a lot of expenses that inflate research cost, and some respondents do not answer all the questions.

Interviews were conducted on project supervisors and construction contractors using interview schedules. Dwivedi (2006) defines an interview as face to face interpersonal role situation in which one individual (interviewer) asks the other individual (respondent) questions designed to obtain answers relevant to the research problem. The study used an interview schedule to gather data as it permitted much greater depths than other methods of data collection.

It also provided a true picture of opinions and feelings; however they were time consuming, expensive to conduct. Direct observation was also used to collect data. Document reviews was used to collect secondary data.

3.5.1 Pretesting of research instruments

A pilot study was done by administering the questionnaire on ten households. Appropriate modifications were then made to the questionnaire before administering them to the whole sample. The interview schedule was also pre- tested on one contractor and appropriate amendments made.

3.5.2 Validity of research instruments

Validity is often defined as the extent to which an instrument measures what it purports to measure (Algina, 1986). Content validity was achieved by seeking expert opinion of the supervisor. The data collected was checked while still in the field to ensure that all questions are answered, however some respondents did not respond to some questions.

3.5.3 Reliability of research instruments

The tendency toward consistency found in repeated measurements is referred to as reliability (Carmines & Zeller, 1979).In order to determine the reliability of the research instruments, a test - retest method was used. 5 questionnaires were given to the same households after a period of two weeks. The reliability of the questionnaire was estimated by examining the consistency of the responses between the two tests. Cronbach Alpha coefficient of .798 was obtained, according to (Coopers and Schindler, 2009), if the coefficient is greater than 0.7 then the instrument is sufficiently reliable.

Table 3. 2 Reliability Statistics

Cronbach's Alpha	N of Items
.798	10

3.6 Data Collection Procedures

To implement the general objectives of a research study, methods of data collection must always be used. Kerlinger, 1978 further says that problems dictate methods to a considerate extent, but methods, their availability, feasibility and relevance influence problems. McMillan and Schumacher, 1993 argues that in order to begin the research, the researcher should formally acquire an introduction letter from the university identifying who he/she is, stating the intent of the student to conduct a research, the purpose and within what period. This enables the student secure researches permit from the relevant ministry, upon which the student provides the same to the local authorities during data collection. The letter was obtained from the university and thus assisted in getting the required data. The researcher administered the questionnaires to the respondents. Research assistants were trained and engaged to assist the researcher in administering the questionnaires. Interviews were conducted by the researcher on pre-arranged dates.

3.7 Data Analysis and Presentation techniques

Analysis of data involves examining, categorizing, tabulating or otherwise combining the evidence to address the initial propositions of a study (Yin , 2003). The collected dataedited was edited, coded, cleaned and entered into statistical Package for Socialscientists (SPSS) program for analysis. Descriptive statistics was used to describe data and examine the relationship between variables, while inferential statistics was used to examine causual relationship between

qualitative and quantitative data. Measures of cenral tendacy was computed and compared.The analysed data was presented using tables and narrations.

3.8 Ethical Consideration

The participants were guaranteed that the identifying information will not be made available to anyone who will not be involved in the study and it will remain confidential for the purposes it is intended for. The researcher sought permission to carry out the research from the project supervisor, Nandi County. The prospective research participants were fully informed about the Procedures involved in the. The participants remained anonymous throughout the study and even to the Researcher himself to guarantee privacy.

3.9 Operationalization of Variables

Operational framework is the operationalization of conceptual framework. It shows how thedependent variable and independent variables can be measured both qualitatively andquantitatively though the use of parameters as specified by the researcher.

Table 3.3 operationalization of variables

Objective	Type of variable	Indicator	Measure	Approach of analysis	Research instrument
To examine how the design of rural electrification projects influences household connectivity in Nandi County.	Independent	Physical position of transformers, power line and households	Number of households within 600m from the transformer and proximity to power line.	Percentage Frequency Inferential statistics	Questionnaire
To establish how the implementation of rural electrification projects influences household connectivity in Nandi County.	Independent	Physical power lines	Time taken to complete the project.	Percentage Frequency Inferential statistics	Questionnaire and Interview
To examine the extent to which connection cost influences household connectivity in Nandi County.	Independent	Money paid by households to connect electricity	Number of household connected to electricity grid.	Percentage Frequency Inferential statistics	Questionnaire Interview Schedule
To identify how sensitizing on rural electrification projects influences	Independent	Number of Barazas attended	Knowledge of application procedure and financing	Percentage Frequency Inferential statistics	Questionnaire

household connectivity in Nandi County.	options

CHAPTER FOUR
DATA ANALYSIS, PRESENTATION, INTERPRETATION AND DISCUSSIONS

4.1 Introduction

This chapter presents data on influence of rural electrification projects on household connectivity in Nandi County. The data was collected using questionnaires and interviews. The data was organized in broad themes as per the research objectives.

4.2 Response Rate

Of the 274 household targeted in the study 201, (73%) responded with 27 % of the targeted sample not responding. The response rate was quite high as statistical scholars including Kothari (2004) have recommended a response rate of at least 51% in an open study. Singh and Ali (2001) achieved a response rate of 63.2%, Sawe (2004) had 57.9%, Kirubi (2006) achieved 70% while Ondari (2010) managed to get a response rate of 67%. All the scholars carried out studies concerning rural electrification in different locations.

4.3 Demographic information

The distribution of respondents in an area determines usually in most cases the usage of resources and allocation of infrastructure. The study therefore sought to find out the year of connectivity to the power grid within the region as this would show the usage period of electricity in the area. Table 4.1 shows the demographic distribution according to power connection of the area.

Table 4.1 Demographic Information

		Frequency	Cumulative Frequency	Percentage	Cumulative percentage
year for connection to electricity	≤ 2004	18	18	17	17
	2004	4	22	4	21
	2005	8	30	8	29
	2006	2	32	2	31
	2007	7	39	7	38
	2008	7	46	7	45
	2009	4	50	4	49
	2010	9	59	8	57
	2011	7	66	7	64
	2012	2	68	2	66
	2013	6	74	6	72
	2014	11	85	10	82
	2015	13	98	12	94
	No response	6	104	6	100
	Total	104	104	100	

The findings reflect that fifty four 54 (56.16%) of the households with electricity were connected between 2010 and 2015, with only eighteen 18(17%) being connected in the year 2004 backwards. The study established that household connectivity has increased from 2010 onwards. From an interview with the project supervisor, most of the rural electrification projects were executed during this period. It can thus be inferred that these projects have positively contributed towards household connectivity.

4.4 Household connectivity

According to the vision 2030, Kenya hopes to achieve rural electrification by the year 2030 and this can mainly be achieved by connection of households to the power grid. The study therefore sought to find out the number of households that were connected to the power grid and came up with the results reflected in table 4.2

Table 4.2 Connection to the electricity grid

	Frequency	Percentage
connected	104	52
Not connected	97	48
Total	201	100

The findings reflect that of the 201 households who responded 104 households represented by 52% of the total respondents are already connected with electricity while 48% are yet to be connected. This data concurs with a report (World Bank, 2013) which indicated that the initial rates of connection in villages added to the grid are as low as 10 to 20 % of possible connections with the number increasing only very slowly over time. The connectivity has increased progressively over time as observed in table 4.1.

4.5 Rural electrifications project design and household connectivity

The study sought to establish the influence of rural electrification project design on household connectivity in Nandi County. The findings are discussed in the following sub – sections.

4.5.1 Lv network and household connectivity

Poles required for connectivity would determine the distance from the main line to the household. The study sought to find out the number of poles as this is directly connected to the Lv network and buildup of electricity in the area. The findings are reflected in table 4.3

Table 4.3 Number of poles used/required to connect electricity to households

		With electricity	%	Cumulative %	Without electricity	Total
Number of poles required/used	none	6	6	6	11	17
	1	13	12	18	10	23
	2	46	44	62	8	54
	3	15	14	76	12	27
	4	13	13	89	5	18
	5	5	5	94	12	17
	≥ 6	6	6	100	25	31
	No response	0	0	100	14	14
	Total	104	100	100	97	201

An inquiry on the number of poles needed or used to supply electricity to households indicated that 65(62%) of the households already connected with electricity required less than two poles. The remaining 39 (38%) required more than 3 poles. The closer the lv network is to the homesteads, the higher the connectivity. This suggests that rural electrifications projects should be designed so as to include lv network closer to the households. 41 (43%) of the households without electricity required more than four poles. When a rural electrification projects is designed such that the low voltage line is far from the customers, the household connectivity remains low.

4.5.2 Transformer positioning and household connectivity

The distance from the transformer determines the quality of power that reaches the household. The researcher therefore sought to determine the distance of the transformer to the household.

Table 4.4 Distance of households from the transformer

		Number of households				
		With electricity	%	Without electricity	%	Total
Distance from transformer	0-400m	49	47	37	40	86
	400-600m	47	45	33	36	80
	≥600m	8	8	18	19	20
	No response	0	0	5	5	5
	Total	104	100	97		201

As to whether the transformer positioning influences household connectivity, 96 (92%) of the households connected with electricity are within 600m from the transformer. The remaining 8% are beyond 600m from the transformer. This implies that a rural electrification project designed such that the targeted households are within a radius of 600m would increase connectivity. 18(19%) of those without electricity are beyond 600m radius from the transformer, a closer examination showed that they had at one time applied for electricity but were quoted greater than 350,000ksh. According to a project supervisor, a 600m radius is the permitted transformer protection distance, beyond which households would be asked to foot the bill of another transformer thus preventing them from getting electricity.

4.5.3 Wayleaves acquisition and household

The challenges that are faced in the wayleaves would influence the number of people connecting to the grid. This is because most of the new connectors would get a bad image from the users thus lowering the morale of connection. The study therefore sought to determine the wayleaves acquisition challenges faced by consumers in the region. The finding were reflected in table 4.5

Table 4.5 Wayleaves challenges faced

		Number of households			
		With electricity	%	Without electricity	Total
Way leave challenge	yes	17	16	0	17
	no	81	78	76	157
	Don't know	6	6	21	27
	Total	104	100	97	201

An examination into the relationship between wayleaves acquisition and household connectivity showed that 17 (16%) of households with electricity faced wayleaves challenges when seeking electricity among the reasons for wayleaves objection was unwillingness to have trees cut down, in some instances, it took some time to negotiate for wayleaves grant. None of those yet to get connected were in a position to anticipate whether or no they would encounter wayleaves challenges.

4.6 Rural electrification project implementation and household connectivity

The study also sought to establish the extent to which the implementation of rural electrification projects influences household connectivity. The findings are discussed in the subsections below.

4.6.1 Time taken to construct power and household connectivity

Power construction and infrastructure requirements usually take time to build. The famous quote Rome was not build in a day reflects the time needed to construct power line in the rural areas. The study therefore sought to study find out the time taken to construct the power lines in the rural area. The findings are reflected in table 4.6

Table 4.6 Time taken to construct power line

		Number of households				
		With electricity	%	Without electricity	%	Total
Affected by Transformer installation time	yes	17	16	3	3	20
	no	83	80	79	81	162
	Don't know	4	4	15	1	19
	Total	104	100	97		201

An inquiry as to whether the time taken to construct a power line up to the transformer point influenced household connectivity revealed that the time taken slightly influenced household connectivity. 17 (16%) of the respondents indicated that they were influenced by the duration taken to complete a rural electrification whereas only 3(3%) of those without electricity were of a similar opinion. Further analysis revealed a weak correlation (r=.321) between household connectivity and the time taken to construct a power line

Table 4.7 Correlations analysis.

		Household connectivity	Influence of time taken to construct power line on household connectivity
Household connectivity	Pearson Correlation	1	.321**
	Sig. (2-tailed)		.000
	N	247	201
Influence of time taken to construct power line on household connectivity	Pearson Correlation	.321**	1
	Sig. (2-tailed)	.000	
	N	201	201

**. Correlation is significant at the 0.01 level (2-tailed).

4.6.2 Transformer installation and household connectivity

The number of transformers in a network of power connection shows the amount of power that flow in that grid. The study sought to find out the connection and relationship influence between the transformer installation and household connectivity.

Table 4.8 Transformer installation and household connectivity

		Number of households			
		With electricity	Without electricity	Total	%
Affected by Transformer installation time	yes	10	13	23	11
	no	79	61	140	70
	No response	15	23	38	19
	Total	104	97	201	100

140 (70%) of the respondents were not in any way influenced by the time taken to install the transformer. This means that the rural electrification projects were completed in time. Among those who were influenced by the time taken to install a transformer, 6 (27%) were positively influenced by the short time taken to install the transformer whereas 17 (73%) were of the opinion that if the transformer was installed in time then they would have taken up electricity.

4.7 Connection cost and household connectivity

The connection cost can influence the number of consumers ready to connect to the power grid. The researcher therefore sought to find out the connection cost and how it influences the number of house hold connected. Table 4.9 show the findings

Table 4.9 Connection cost and household connectivity

		Number of households			
		With electricity	%	Without electricity	Total
Amount paid/ quoted	1160	4	4	0	4
	3000	2	4	0	2
	20000	2	2	0	2
	35000	94	90	9	103
	75000	0	0	5	5
	100000	2	2	0	2
	≥350000	0	0	7	7
	No response	0	0	76	76
	Total	104	100	97	201

As on the installation cost, 94 (90%) of the households paid 35,000 shillings. This has been a subsidized cost for a long time for customers within 600m from a transformer. 7 of the household without electricity were quoted over 350,000, this was too expensive for them, according to Kenya power; such quotations are issued to customers outside the 600m radius from the transformer. It can thus be concluded that the lower the connection cost, the higher the connectivity. 76 of the households without electricity did not respond to the question, this implies that they not likely to have applied for electricity connection thus are not aware of the connection cost. 4 (4%) of the household paid 1160 to get connected, these benefitted from that world bank funded GPOBA programme.

4.8 sensitization and household connectivity

General forums and barazas in the community is the main way of spreading new information to the society. The study therefore sought to find out the sensitization and how it affects the number of house hold connected to the electricity. The findings are reflected in table 4.10

Table 4.10 Awareness on baraza

		Number of households			
		With electricity	Without electricity	Total	%
Baraza organized	yes	45	28	73	36
	no	43	53	96	48
	Don't know	16	15	31	16
	Total	104	97	201	100

The findings reflected that of those who attended the baraza, 45 respondents had electricity connection in their households and 28 did don't. This represented a 36% of the respondents (45 with electricity and 28 without electricity). Forty eight 48% of the respondents did not attend the baraza that was called for sensitization on the connection to the power grid. Of which 43 of them did have electricity connection and 53 did not have electr4ic connection in their houses.

Table 4.11. shows that the 45 respondents with electricity and aware of the sensitization programme, 40 of them attended barazas with which 21 of them were positively influenced to apply and pay for electricity. This shows that sensitization on rural electrification a project has a positive influence on household connectivity. The turn up to these sensitization programmes is however still low. 12 of the respondents without electricity have at one time attended a baraza and 10 of them were considering installing electricity in their homes

Table 4.11 Baraza attendance by households with electricity

		Number of households			
		With electricity	Positively influenced		total
			yes	no	
Attended Baraza	yes	40	21	19	40
	no	5	0	5	5
	Total	45	21	24	45

The number of households that did not have electricity had some few representations, table 4.12 shows the findings of the households without electricity that attended the baraza

Table 4.12 Baraza attendance by households without electricity

		Without electricity	Positively influenced		total
			yes	no	
Attended Baraza	yes	12	10	2	12
	no	16	0	16	16
	Total	28	10	18	28

Asked on any other issues other than finances that have limited them from getting connected to electricity in the rural electrification projects, some of the issues raised included the distance from the transformer. Some of the households noted that they were not within reach of the transformer installed in the rural electrification projects. Other respondents found the cost of wiring to be too expensive for them while others cited lack of employment as an impediment to getting electricity.

Some of the households perceived monthly bills to be a bit expensive and were of the opinion that if lowered, they would consider getting connected with electricity. Other respondents were of the view that more marketing strategies should be employed so as to sensitize the beneficiaries on the electrification projects. As on what ought to be done to ensure that more households get connected, suggestions included reducing the connection cost.

4.9 Correlation results.

A study was conducted on the relationship between the independent variables and household connectivity. The analysis applied the statistical package for social sciences (SPSS) to compute the measurements of the correlation statistics for the study. Correlations results in table 4.14 showed a strong correlation between design of rural electrification projects and household connectivity with (r = .844).The results revealed a weak correlation (r = .321) between implementation of rural electrification projects and household connectivity. The test also showed a strong correlation (r = 0.883) between connection cost and household connectivity. The strong correlation was also observed between sensitization and household connectivity (r = .744).

Table 4.13 Correlations analysis

		Household connectivity	Influence of design of rural electrification projects on household connectivity	Influence of implementation of rural electrification projects on household	Influence of connection cost on household connectivity	influence of sensitization on household connectivity
Household connectivity	Pearson Correlation	1				
	Sig. (2-tailed)					
	N	247				
Influence of design of rural electrification projects on household connectivity	Pearson Correlation	.844**	1			
	Sig. (2-tailed)	.000				
	N	201	201			
Influence of implementation of rural electrification projects on household	Pearson Correlation	.321**	.494**	1		
	Sig. (2-tailed)	.000	.000			
	N	201	201	201		
Influence of connection cost on household connectivity	Pearson Correlation	.883**	.903**	.402**	1	
	Sig. (2-tailed)	.000	.000	.000		
	N	201	201	201	201	
influence of sensitization on household connectivity	Pearson Correlation	.744**	.860**	.382**	.738**	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	201	201	201	201	201

**. Correlation is significant at the 0.01 level (2-tailed).

CHAPTER FIVE
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter describes the summary of the findings, recommendations, and suggestions for further research, and the contribution to the body of knowledge. The recommendations and suggestions are based on the findings in the previous chapters and the study objectives which relied heavily on the study questions.

5.2 Summary of findings

The main objective of the study was to assess the influence of rural electrification projects on household connectivity in Nandi County. Accordingly, the study used interviews from the households in Nandi County to come up with data that was cleaned and summarized before being carefully analyzed to enable the conclusions and recommendations for this study. Project supervisors and contractors were also interviewed. The initial analysis showed that there has been a progressive uptake of electricity among households over years. This can be attributed to the increase in rural electrification projects.

The findings indicate that when rural electrification projects are designed such that the low voltage network is as close as possible to households then connectivity increases. The design of such projects is thus crucial for its uptake. This concurs with a word bank paper on rural electrification which argued that "there is plenty of scope for successful investments in rural electrification, provided that they are properly selected and prepared, (World Bank 1975). Findings also indicated that the transformer positioning influenced household connectivity as more households further from the transformer were yet to connect to electricity, this was also noted by Peter, Harsdorff and Ziegler (2009) who noted that the total connection cost are significantly affected by the distance the household has to bridge to reach the village distribution grid.

Analysis of the findings indicated a weak correlation between project implementation and household connectivity. This implies that the projects have been implemented with minimal

delays. This can be attributed to proper planning and availability of materials as noted by Al-Kharashi and Skitmore (2009).

Connection cost has greatly influenced household connectivity. Findings indicated that a lower connection costs results to higher household connectivity. Sybil Lewis,(2015) also notes that one of the biggest challenges in effectively connecting rural communities to power grids is the connection cost.

Sensitization has an influence on uptake of electricity among households. The research revealed that households who received training went ahead to seek for electricity connection. This findings reaffirms sentiments by Peters et al,(2009) who examined the impact of developing rural electricity with complimentary services as opposed to just financing hardware and civil works.

5.3 Conclusion

The study sought to assess the influence of rural electrification projects on household connectivity in Nandi County. It aimed at finding out the influence of design of rural electrification projects on household connectivity, whether the implementation of such projects influences household connectivity , the influence of connection cost on household connectivity and how sensitizing influences household connectivity in Nandi county.

The study found that 36% of the respondents noted that a baraza had been organized to sensitize. 16% of the household showed that wayleaves acquisition had challenges and were unwilling to cut down trees with this regard. An examination into the relationship between wayleaves acquisition and household connectivity showed that 17 (16%) of households with electricity faced wayleaves challenges when seeking electricity among the reasons for wayleaves objection was unwillingness to have trees cut down, in some instances, it took some time to negotiate for wayleaves grant. None of those yet to get connected were in a position to anticipate whether or no they would encounter wayleaves challenges.

The findings reflected that 52% had are already connected with electricity while 48% are yet to be connected. It also showed that 43% of the households without electricity required more

than four poles. This showed that the design in place will be affected incase the Kenya power was to develop further in production and supply of power to the grid in the local area. 92% of the households connected with electricity were within 600m from the transformer.

Some of the households noted that they were not within reach of the transformer installed in the rural electrification projects. Other respondents found the cost of wiring to be too expensive for them while others cited lack of employment as an impediment to getting electricity. While some of the households perceived monthly bills to be a bit expensive and were of the opinion that if lowered, they would consider getting connected with electricity. Other respondents were of the view that more marketing strategies should be employed so as to sensitize the beneficiaries on the electrification projects. As on what ought to be done to ensure that more households get connected, suggestions included reducing the connection cost.

5.4 Recommendations

Based on the findings of the study, the following recommendations are made.

The study established that the design of rural electrification projects influences household connectivity in Nandi County. In order to improve the level of electricity connectivity in such projects, future project should be designed to include reticulated low voltage network as close as possible to the homesteads. The transformer should also be positioned such that all the targeted beneficiaries within a 600 m radius from the transformer.

The study found out that the implementation stage of rural electrification projects does not influence household connectivity in Nandi County. The speedy implementation of such projects should thus be maintained. This can be achieved by ensuring availability of materials used in the construction of the projects.

Findings indicated that the connection cost influences household connectivity. Lower connection costs increases household connectivity. To lower the connection cost, financing options could be put in place to enable household pay in installments. The government could also consider subsidizing the connection cost. The government should also link up with donors like

World Bank who have already acknowledged through their own studies the need for massive injection of funds to support rural electrification projects.

The study found out that sensitizing on rural electrification projects influences household connectivity. Apart from the barazas, more marketing strategies ought to be employed such as radio and TV advertisements, use of brochures and other suitable media.

5.5 suggestions for further reading

The study recommends further research to be carried out on the influence of rural electrification projects on living standards and methods of production and also on strategies that can be employed to lower electricity connection costs without putting the utility firms at a loss.

5.6 Policy Implication

The government in its bid to have more than 70% of the households should optimize the existing rural electrification projects in order to ensure all household within such projects get connected with electricity. Future projects design should also factor in low voltage network in their designs so that the infrastructure is laid once thus lowering the cost.

REFERENCES

Abdullah, S and Markandyab, A. (2012). Rural Electrification Programmes in Kenya: Policy Conclusions from a Valuation Study. *Energy for Sustainable Development , 16*(1), 103–110.

Barnes, Douglas F. (1998). Electric Power for Rural Growth: How Electricity Affects Rural Life in Developing Countries. Boulder, CO: West view Press.

Burke, R. (2006) *Project Management Planning and Control Technique.* 5thEd. Hong Kong:Burke Publishing.

Chan, A.P.C., Scott, D. and IEG.(1994). Evaluation results independent evaluation group. Washington DC: World Bank.

Cook, P. (1999). Privatisation and utility regulation in developing countries: The lessons so far. Annals Public Cooperative Economics, 70(4), 549–587. World Bank. (1996). *Rural Energy and Development:Improving Energy Supplies for Two Billion People.* Washington,D.C: World Bank.

Cooper, D. R., and Schindler, P. S (2006).*Business Research Methods* (9th Edition).McGraw-Hill Publications. New York, United States.

Crocker L, Algina J (2011). Introduction to classical and modern test theory. Orlando, FL: Harcourt Brace Jovanovich; 1986:1-527.

Cronbach LJ (2010). 'Coefficient alpha and the internal structure of tests'. *Psychometrika.*1951; 16:297-334.

Davidson, O., &Mwakasonda, S. (2004). Electricity access for the poor: A study of South Africa and Zimbabwe. Energy Sustain Development, 8(4), 26–40.

Davidson, O., Sokona, Y. (2002). A new sustainable energy path for African development: think bigger, act faster. Cape Town: Energy and Development Research Centre, University of

CapeTown.

Estache, A., Fay, M. (2007). Current debates on infrastructure policy.Policy Research WorkingPaper 4410. Washington DC: World Bank.

Foster, Vivien, and Carmen Briceño-Garmendia. (2010). *Africa's Infrastructure: A Time for Transformation.* Washington, DC: World Bank.

Giddens, A. (1976). New Rules of Sociological Method: a positive critique of interpretive sociologies. London: Hutchinson.

Heltberg, R. (2004). Fuel switching: evidence from eight developing countries. Energy Economics, 26, 869–887.

Hirschman, A. (1970). Development prospects observed. Washington DC: Brookings Institution.

Howells, M., Jonsson, S., Kack, E., Lloyd, P., Bennett, K., Leiman, T., et al. (2010).Calabashes for kilowatthours: Rural energy and market failure. Energy Policy, 38(6), 2729–2738.

IEA (International Energy Agency). 2010a. Energy Poverty: How to Make Modern Energy Access Universal: Special Early Excerpt of the World Energy Outlook 2010. Paris.

IEG (Independent Evaluation Group). (2008). The Welfare Impact of Rural Electrification: A Reassessment of the Costs and Benefits. Impact Evaluation Report, World Bank, Washington, DC.

Kenya Power (2014).http://www.kplc.co.ke/content/item/567/Electricity-customers-to-hit-3-million-in-a-month,says-Dr.-Chumo#sthash.6qQoHeiQ.dpuf

Kirubi, C., Jacobson, A., Kammen, D., & Mills, A. (2008). Community-based electric microgrids can contribute to rural development: Evidence from Kenya. World Development, 37(7), 1208–1221.

Komives, Kristin, Quentin Wodon, Vivien Foster, and Jonathan Halpern. (2005). Water, Electricity, and the Poor: Who Benefits from Utility Subsidies? Directions in

Development. Washington, DC: World Bank.

Kothari, C.R (2004). Research Methodology: Methods and Techniques. New Delhi: New Age International (p) ltd publishers

KPLC (2007) Kenya power and lighting company annual report and accounts 2006–2007;Nairobi.

Layder D. (2005).*Understanding Social Theory*. New York: Sage

Nachmias, C.V. and Nachmias D. (1996).Research Methods in Social Sciences. 5th Edition. London: Arnold Publishers:

Mark w gellerson , the Pakistan development review vol XXI, NO 3 (1982) The Economics *of* Rural Electrification Projects: Theory and Case Study *of* Pakistan

Mills, C. W. (1959). *The Sociological Imagination.* London: Oxford University Press.

Mugenda, A. and Mugenda, O. (2003). Research Methods: Quantitative and Qualitative Approaches. Nairobi: African Center for Technology (ACTS).

Peters, J., Harsdorff, M., & Ziegler, F. (2009). Rural electrification: Accelerating impacts with complementary services. Energy Sustain Development, 13, 38–42.

Ravallion, M. (2008). Evaluating Anti-Poverty Programs. In: *Handbook of Development Economics Volume 4*. Amsterdam, Netherlands.

Ravallion, M. (2008). Evaluation in the Practice of Development.*Policy Research Working Paper No. 4547*.

Ravallion, M. and S. Chen. (2005). Hidden impact? Household saving in response to a poor-area development project. *Journal of Public Economics*, 89, p. 2183-2204.

Ravallion, M. and Q. Wodon (1998) Evaluating a Targeted Social Program When Placement is Decentralised, *World Bank Policy Research Paper No. 1945*.

Reiche at al (2000), 'Expanding Electricity Access to Remote Areas: Off-Grid Rural Electrification in developing countries' http://w.martinot.info/Reiche_et_al WP2000.pdf:

Sawe E.N, (2004). "Brief on Energy Sector in Tanzania",. Renewable Energy and Environmental News, (TaTEDO), ISSN 0856-6704.

SenA .(1999). Development as Freedom. London: Oxford University Press

Singh, K. K and Ali, S. (2001). Rural Development Strategies in Developing Countries.New Delhi: Sarup and Sons.

Squire, Lyn, and Herman G. van der Tak, (1975),*Economic Analysis of Projects.*Baltimore: Johns Hopkins University Press.

Sybil Lewis, (2015).Electrification for "under grid" households in rural kenya: five questions for ken lee

Wambugu, D. M. (2013), Determinant of successful completion of rural electrification projects in Kenya: A case study of Rural Electrification Authority, International Journal of Social Sciences and Entrepreneurship. Vol.1, Issue 2, 2013, 1 (2), 549-560

World Bank.(1975). Rural electrification. Policy paper no PUB-517. Washington DC: World Bank

World Bank.(1993). Energy efficiency and conservation in the developing world. Policy paper. Washington DC: World Bank.

World Bank. (1993b). The World Bank's role in the electric power sector: Policies for effective institutional, regulatory and fuel reform. Working Paper. Washington DC: World Bank.

World Bank, (2007). International Development Association on a Country Assistance Strategy of the World Bank for the Republic of Malawi.http://wwwwds. worldbank.org/external/default/WDSContentServer/WDSP/IB/2007/01/25/000090341_200701 25110159/Rendered/PDF/38326.pdf

World Bank, (2008). Operational Guidance for World Bank Group Staff Designing Sustainable Off-Grid Rural Electrification Projects: Principles and Practices. Working Paper 47022.http://siteresources.worldbank.org/EXTENERGY2/Resources/OffgridGuidelines.pdf

World Bank/IEG, (2008). The Welfare Impact of Rural Electrification: A Reassessment of the Costs and Benefits - An IEG Impact Evaluation. http://go.worldbank.org/ZE4B692E10

World Bank. (2003).The World Bank Annual Report 2003: Year in Review. Washington, D C: World Bank.

World Bank. (2008). The Welfare Impact of Rural Electrification:A Reassessment of the Costs and Benefits. IEG Impact Evaluation.Washington,D.C: World Bank

Zomers, Adriaan N. (2001). *Rural Electrification: Utilities' Chafe or Challenge?* Enschede, The Netherlands: Twente University Press.

APPENDIX I : Questionnaire

Dear respondent.

This questionnaire is for the purpose of research only and the information you give will be treated confidentially. Your cooperation will be highly appreciated. Do not write you name on this questionnaire. Thank you.

Instruction: please tick in the spaces provided or provide information where necessary.

1. Are you supplied with grid electricity? Yes [ ] No [ ]
2. When did you get connected to electricity? Year ……..… Month…….
3. How much did it cost you to get connected/ were you quoted

   35,000 [ ]

   Or …….(specify)
4. How many poles were erected/ are required in order to supply you with electricity

   None [ ]

   1 . [ ] 2 .[ ] 3 . [ ] 4.[ ] 5.[ ]

   6 and above [ ]
5. How far are you from the transformer

   0 – 400m [ ]

   400-600m [ ]

   Greater than 600m [ ]
6. Did wayleaves issues in any way influence you from getting electricity?

   Yes [ ] No [ ]

If yes briefly explain

……

……

……

7. Did the time taken to construct the power line upto the transformer point influence your quest to apply and pay for electricity?

   Yes [ ] No [ ]

   If yes briefly explain

   ……

   ……

   ……

   ……

8. Did the time taken to install and power the transformer after completion of the power line influence you apply and pay for electricity connection? Yes [ ] No [ ]

   If yes briefly explain

   ……

   ……

   ……

   ……

   ……

9. Has a baraza been organized to sensitize the community on the project?

   Yes [ ] No [ ] Don't Know [ ]

10. If your answer in (9) above is yes, did you attend the baraza?

Yes [ ] No [ ]

11. Did the baraza influence you in any way to apply and pay for electricity?

Yes [ ] No [ ]

12. Other than finances, what other factors have prevented you from installing electricity?

---

13. In your opininion, what do you think should be done to have more household connected to electricity

……

……

……

Thank you for taking your time to participate in this study.

APPENDIX II:Interview schedule – project supervisor

1. How many system reinforcement projects have you supervised in the past five years?
2. What challenges if any have you encountered during the implementation of these projects?
3. What is the average time taken to complete a reinforcement project?
4. How often do you encounter delays to commission these projects and what are the major setbacks?
5. In your opinion, to what extend have these projects contributed towards household connectivity?
6. What do you think should be done in subsequent projects to improve this connectivity?

APPENDIX III:Interview schedule – construction contractor

1. How many system reinforcement projects have you constructed in the past five years?
2. What challenges if any have you encountered during the construction of these projects?
3. What is the average time taken to complete a reinforcement project?
4. How often do you encounter delays to commission these projects and what are the major setbacks?
5. In your opinion, to what extend have these projects contributed towards household connectivity?
6. What do you think should be done in subsequent projects to improve this connectivity?
7. During the construction process, did the people in the area inquire anything on the project from you? If yes what kind of information did they seek and were you in a position to respond to all questions?

APPENDIX IV:Morgan and Krejcie Table for Determining Sample size

Table for Determining Sample Size for a Given Population

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	246
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	351
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	181	1200	291	6000	361
45	40	180	118	400	196	1300	297	7000	364
50	44	190	123	420	201	1400	302	8000	367
55	48	200	127	440	205	1500	306	9000	368
60	52	210	132	460	210	1600	310	10000	373
65	56	220	136	480	214	1700	313	15000	375
70	59	230	140	500	217	1800	317	20000	377
75	63	240	144	550	225	1900	320	30000	379
80	66	250	148	600	234	2000	322	40000	380
85	70	260	152	650	242	2200	327	50000	381
90	73	270	155	700	248	2400	331	75000	382
95	76	270	159	750	256	2600	335	100000	384

Note: "N" is population size
"S" is sample size.

Source: Krejcie & Morgan, 1970

APPENDIX V:INTRODUCTION LETTER