International Journal of Development and Economic Sustainability
Vol.7, No.6, pp. 27-41, October 2019
Published by **ECRTD- UK**
ISSN: 2053-2199 (Print), ISSN: 2053-2202(Online)

RELATIONSHIP BETWEEN KENYA POWER LAST MILE CONNECTIVITY PROGRAM AND RURAL HOUSEHOLD LIVELIHOODS IN KAPSERET CONSTITUENCY, UASIN GISHU COUNTY, KENYA

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ABSTRACT: *The main purpose of this study was to investigate the relationship between Kenya Power Last Mile Connectivity Program and rural household livelihoods in Kapseret Constituency, Uasin Gishu County, Kenya. The study was based on Theory of Change. Correlation Research Design was used to examine the study questions. The study targeted 272 respondents who were the connected customers of the Kenya Power Last Mile Connectivity Program in Kapseret Constituency, Uasin Gishu County. A sample size of 161 respondents was selected for the study using simple random sampling. A self-administered questionnaire was used in this study to collect data from each respondent. Content validation method was also used in the research to measure the validity of the instrument. Data collected were analyzed by using both descriptive and inferential statistical methods. The finding revealed that patterns in the distribution of electricity ($\beta 1 = 0.546$, $p<0.05$), and electricity usage ($\beta 2 = 0.283$, $p<0.05$) had a positive and significant effect on rural household livelihoods. Therefore, there is need for Kenya power to raise awareness on the modalities to be made to access electricity in the rural areas. Also, the electricity connection needs to be designed in such a way that it can easily be adapted to both domestic and commercial uses in order to improve rural household livelihoods.*
KEYWORDS: *Last Mile Connectivity Program, Livelihood, Household, electricity usage, Distribution*

INTRODUCTION

Household livelihoods perspectives have been central to rural development thinking and practice in the past decade (Bhandari, 2013). Households' economic activities both inside and outside the home benefit a lot from electricity (Sharif & Mithila, 2013). For example, crop productivity can be increased by the application of electric irrigation pumps,

businesses can be operated longer hours in the evening, electric tools and machinery can impart efficiency and productivity to industrial enterprises, and so on. Thus, electrical energy is a critical facet to a country's socio-economic development as well as rural household livelihoods (Brossmann, 2013). However, in 2014, 1.06 billion people still live without access to electricity—about 15 percent of the global population— and about 3.04 billion still relied on solid fuels and kerosene for cooking and heating (IEA and World Bank 2017). The electricity access deficit is overwhelmingly concentrated in Sub-Saharan Africa (62.5 percent of Sub-Saharan Africa population) and South Asia (20 percent), followed by East Asia and the Pacific (3.5 percent), and Latin America (3 percent) and the Middle East and North Africa (3 percent). In Sub-Saharan Africa, 609 million people (6 out of 10) do not have access to electricity, and in South Asia, 343 million people do not have access to electricity (World Bank, 2017).

Rural electrification projects are often justified because they are intended to promote household welfare by providing a better quality of life or more productivity. This view −along with the significance of other sources of modern energy − has resulted in modern energy being recognized as essential to fulfilling the Millennium Development Goals (United Nations, 2015). Recently, Wolde-Rufael, (2009) has shown that in 11 out of 17 countries studied in Africa rural energy contributes to rural household livelihoods. It ought to be noted that transport costs also generally form a higher proportion of a firm's total costs than energy. Studies at the country level, however, do find more in favor of a relationship running from electricity consumption to rural household livelihoods (Ozturk, 2010). This implies that a policy to halt or slow down electricity capacity growth will adversely affect rural household livelihoods.

Regarding patterns in electricity distribution, the methodology of approach in the first phase of the initiative, funded by the AfDB and the Kenyan Government is to maximize the existing 5,320 earmarked distribution transformers in all the 47 of counties. All customers within reach of 600m radius from these transformers will be connected in this phase (AfDB, 2017). In Kapseret constituency alone there were 14 transformers selected and were located in different project zones. As part of this effort, "Kenya's LMCP II", an energy project that provides access to electricity in Kenya, aims to provide power to 1.5 million people mainly from low-income groups and micro-enterprises that improve living standards and support economic growth," the bank said in a statement (AfDB, 2017). The second phase of the LMCP is expected to cost about Sh18.5 billion. The LMCP seeks to help the government and Kenya Power meets increased demand by expanding the country's distribution network through the extension of the low-voltage network from existing distribution transformers to reach households located within a 600-metre radius (Ngugi, 2010). Rural electrification is seen as a key mechanism to: improve living standards; increase income through 'income generating activities'; and improve community services such as agriculture, education and healthcare. However, to date, mechanisms to implement rural electrification projects are far from perfect as problems with dissemination and sustainability in rural areas have not abated.

Statement of the Problem

Rural areas of developing countries are often at a disadvantage in terms of access to electricity. The high cost of providing this service in low populated, remote places with difficult terrain and low consumption result in rural electricity schemes that are usually more costly to implement than urban schemes. In addition, low rural incomes can lead to problems of affordability, and the long distances mean greater electricity losses and more expensive customer support and equipment maintenance (Torero, 2015). Despite this, rural electrification programs are essential, since they are also planned and justified to maintain the well-being of households by increasing the best quality of life and increasing productivity (UN-Energy, 2015).

Rural electrification programs have been an important energy strategy in developing countries and in Kenya, it became a public priority in 1973, with the establishment of the rural electrification program, a government plan to subsidize the cost of electricity supply in rural areas (Lee, 2016). Despite the fact that rural electrification programs, such as the Last Mile Connectivity Program, have been extended to all regions of Kenya to provide economic and social benefits to rural communities, their relationships with rural household livelihoods have not been explored exhaustively.

Despite the existence of many energy strategies such as subsidized connectivity that ensures universal energy access, other unconnected households still view the cost of connectivity is high. Kapseret constituency, just like other regions of Kenya, has experienced, limited distribution capacity, limited reach in rural areas, low investment in the power sector by private investors, increase in connection costs, fluctuating energy tariffs, limited capacity during peak demand, Grid-system losses and also omission of customer interest, resulting in among other things, low development, low household income and food insecurity. These project challenges outline a research baseline with which it is possible to relate with the livelihoods of rural households. Therefore, without an analysis of electrification programs in rural areas, the state of education, food production, health, employment, and security are likely to remain unknown.

Studies on rural electrification projects have been conducted, for example Marete (2016), studied the factors that influence the electrification of rural households in Kenya: a case of the sub-county of Meru South, in Kenya. Kageni (2017), studied an assessment of the dynamics of the adoption of rural electrification in the sub-county of Meru-South, in Tharaka-Nithi County, Kenya. Ouma (2016), studied the effects of rural electrification on the growth of small and medium-sized enterprises in Mbita town. However, none of these studies have thoroughly evaluated the relationship between rural electrification programs and socio-economic development. Therefore, the study sought to investigate the relationship between Kenya Power Last Mile Connectivity Program and the livelihoods of rural households in the Kapseret Constituency in Uasin Gishu County, Kenya.

Ho_1: *There is no significant relationship between patterns in the distribution of electricity and rural household livelihoods in Kapseret Constituency.*

Ho_2: *There is no significant relationship between usage of electricity and rural household livelihoods in Kapseret Constituency.*

Theoretical framework

The study was based on Theory of Change by Weiss (1995). Theory of Change emerged from the field of program theory and program evaluation in the mid-1990s as a new way of analyzing the theories motivating programs and initiatives working for social and political change (Brest, 2010).Theory of Change is focused not just on generating knowledge about whether a program is effective, but also on explaining what methods it uses to be effective (Chris, 2011). This study applied Theory of Change in discussing rural electrification theory of change based on stimulating the cycle of rural economic development, which in turn would support long term rural electrification. If rural communities have access to electricity, are connected and use it appropriately then local socioeconomic development is possible, then jobs are created and the average income of the community increases, then the attractiveness of the community increases, so trade grows, so poverty and rural exodus retreats and supports long term rural electrification resulting to changes in rural household livelihoods .

Empirical Review

Patterns in the Distribution of Electricity on Rural Household Livelihoods

Khandker et al. (2010), used econometric analysis to examine the relationship between patterns in the distribution of electricity and educational outcomes in rural India. Using the Annual Status of Education Report (ASER) from 2009-2011, this study finds that students whose households are electrified are more likely to complete grade-appropriate tests successfully as compared to their counterparts whose households are not electrified. The findings, which are consistent with prior research on this topic, suggest that additional investment in India's energy sector can yield improved educational outcomes.

Oda and Tsujita, (2010), analysed the disparities in distribution of electricity and determinants of rural electrification at the village level in Bihar state, India. Taking into consideration governance systems, livelihoods potential, caste composition, and population size, the authors find that only distance from the capital is a significant predictor of whether a village is or is not electrified. Remote villages are less likely to be electrified, because of "cost ineffectiveness" and technical barriers to grid connection. Khandker, Samad, Ali, and Barnes (2010), found that an additional hour of electricity access at the village level is associated with a 2.7 percent increase in household adoption of electricity and a 14.4 percent increase in household electricity consumption.

Gyamfi, Samuel & Modjinou, Mawufemo & Djordjevic, Sinisa. (2015), in their qualitative research, case study method was used to examine the potential socio-economic and environmental impacts of the distribution of solar PV mini-grid project on the local communities, specifically Pediatorkope and Atigagorme. Three research questions were answered using qualitative content analysis approach. Generally, the findings show that the

solar PV mini-grid electricity is an ideal energy alternative for the island communities on the Volta Lake in Ghana. However, there are variations regarding the socio-economic and environmental impacts of the project on the communities. In terms of economic impact, given the energy level or capacity provided, the electricity fulfils the provision of light to boost and extend hours of petty trading and selling activities at night in the communities.
Chakrabarti and Chakrabarti, (2002), conducted a study on 'Sagar Dweep' island in India considering the environmental and socio-economic factors and found that distribution of electricity through solar PV was beneficial from a sociological perspective, which led to a substantial progress in trade and education as women received wider involvement in community activities and additional work. The study further concluded that in an attempt to calculate the actual cost of electricity generated by solar energy also require equal analysis of how and in what ways availability of electricity impacts the social and economic life of rural dwellers, most importantly isolated areas where grid-connection is impractical. It is important to understand that for any development to progress, all forms of resources must be utilized and one of them being energy. Additional investment in a country's energy sector can yield improved outcomes. Electricity energy distribution infrastructure has been attributed to bring socioeconomic developments to communities when properly designed and equitably accessed.

Usage of Electricity on Rural Household Livelihoods

Ghaemi and Brauner (2010), investigated user behavior and patterns of electricity use for energy saving. In this study patterns of domestic electricity consumption for 51 houses in Austria were studied. In these samples although type of house, its location, floor area, household size, electrical appliances, occupant's job, age and occupancy patterns are different, have significant influence on annual electricity consumption. A clear correlation was found between average annual consumption and daily base load. Energy consumption varies with the house type. Detached and terraced dwellings have more noticeable consumption during winter days. During the day the difference between peak and minimum consumption per floor area varies between 9.9 and 3.8 Wh/m² according to house type. During one-year difference between peak and minimum consumption per floor area varies between 7.1 and 1.1 KWh/m²according to dwelling type. Terraced houses have highest difference and apartment stands at last position. As the annual energy consumption per person decreases, the number of occupants increases (Ghaemi and Brauner 2010).

Jedemann (2011), examined the socioeconomic and environmental changes occurred after the installation and consumption of the solar home system. Using a recall method, household survey was conducted for collecting the primary data through questionnaire and focus group discussions. The data was analyzed through Regression model as well as through descriptive statistics. The results discovered that solar system has provided direct and indirect benefits to the plotted households. The study hours of the students were getting improved after the lightning source availability. The consumption of kerosene oil and LPG, which were used for lighting have been subtracted from their consumption baskets. This resulted in less indoor pollution and more saving due to cut off of expenditure on these resources. The impact on business activities was negligible, however it added a little bit to

the income because of the extended working hours at evening. Information and communication appliances along with other electrical equipment were found which were not available before the installation. There was significant improvement in social activities which were earlier limited to day time. Thus solar system has improved the livelihoods capitals of the rural households and it is a viable system and should be extended to such other remote communities. Kageni (2012), evaluated of rural electrification consumption dynamics in Meru-South sub-county, Tharaka-Nithi County, Kenya. Determinants of electricity adoption, assess the socio-economic benefits and challenges of electricity adoption, assess the effect of rural electrification on development of public facilities and examine spatial distribution of electricity adopters, non-adopters and transformers in Meru-South Sub-County. To achieve these, household interviews were conducted from 150 randomly selected households using closed and opened ended questionnaire. In-depth interview guide was used to collect information from two Rural Electrification officials, two from Kenya Power and two local administration officers. A GPS set was used to geo-code adopter, non-adopter and transformer points.

Data collected was statistically analyzed using descriptive statistics. Chi-square and t-test were used to test the magnitude of the association between dependent and independent variables. Logistic regression was used to predict the socio-economic factors influencing electricity adoption in households using statistical package for social sciences (SPSS) programme version 19.0. Data from GPS sets was organized into a compatible file and imported into ArCGIS 10.2 to generate maps. Results showed that 36% and 64% of the respondents in the study area were electricity adopters and non-adopters respectively. Possible predictor factors that significantly influenced adoption were found to be distance from the transformer ($p=0.000$), education status ($p=0.020$), gender ($p=0.045$), household size ($p=0.009$), and income ($p=0.011$). Besides low electricity adoption, electricity benefits and potentials among the adopters including improved quality of life through lighting (100%) and businesses (38.8%) among others were revealed. Results revealed a significant difference ($p<0.05$) in quality of service provision in electrified and non-electrified schools, hospitals, market centers and factories. Kageni (2012), Findings indicated the greatest prior challenges to electricity connection were accessibility (proximity of the transformer) and cost of connection. The transformers were revealed to be in the upper and middle areas compared to lower areas. Adopters were mainly in upper zones while non-adopters were distributed in lower and upper zones. As discussed above, consumption may increase with time because of increased tertiary desires such as TV or refrigerator. The IEA has recognized that energy levels are dynamic. Once an initial connection has been made, energy consumption increases to the regional average within 5years. For rural electrification the accessibility can refer to the technology itself or to the ability to access suitable equipment or appliances, with the latter being more crucial to the success of the scheme. However, the accessibility to electric appliances remains low with only 20% of the poor people globally able to benefit (Stephanie and Heather, 2014).

Knowledge Gap

Several researchers and academics have sought feasible rural electrification projects for the

economic and social development of rural households. For example, the study done by Yadoo (2012), indicated that the community made a contribution to rural electrification, but did not reveal how timely the contributions were. Regardless of the benefits of electrification, finding economically sustainable ways to provide access remains a major challenge. Low and dispersed electricity consumption, low household income, and the isolation of rural populations are among the obstacles faced by policymakers. To some extent, these factors explain why the observed process of electrification is strongly associated with the path of economic growth (Jimenez, 2016). The review of the literature on challenges and problems in the field of rural electrification shows that development work generally focuses on the economic and physical aspects of development and often neglects the needs of the local communities that are interested in it. This study provides an in-depth literature review. Related studies in Kenya and other countries have been analyzed and reveal that there exists a knowledge gap in understanding how exactly electricity is used for domestic and commercial consumption in rural parts of the world in order to improve livelihoods. Expanding on previous research, this study then bridged the gap when examining the relationship between Kenya Power Last Mile Connectivity Program and rural household livelihoods in Kapseret constituency, Uasin Gishu County, Kenya.

MATERIAL AND METHODS

The study used correlational research design since it pursued households' opinions in order to establish consumer behavior after accessing electricity. The research targeted a population of 272 connected customers of the Last Mile Connectivity Program obtained from the KPLC's old Integrated Customer System (ICS, 2017) and the current Integrated Customer Management System (InCMS, 2018). The connected customers only involved the first phase beneficiaries of the program where connectivity begun in April 2017 up to May 2018 in Kapseret Constituency. Using Yamane (1967:886) simplified formula to calculate sample of 161 respondents. Simple random sampling was used. Simple random sampling procedure was used to pick the sample size in the 14 project zones covered by the Last Mile Connectivity Program in Kapseret Constituency. Self-administered questionnaires were used in this study to collect data which were pilot tested to remove confusing words and to improve upon the clarity of the questions items to strengthen its reliability. Reliability values of 6.0 to 0.70 and above are considered by many researchers as acceptable (Cooper & Schindler, 2006; Malhotra & Birks, 2006). The responses were ascertained by using the Cronbachs' alpha reliability coefficient (α) of the data gathered from the pilot study. Field (2014), contended that Cronbach's alpha value that is at least 0.70 is for a reliable research instrument.

Table 1 Reliability Test Results

No	Constructs	Coefficient alpha	Comments
1	Patterns in the distribution	0.934	Accepted
2	Usage of electricity	0.945	Accepted
3	Livelihoods	0.867	Accepted

The collected data was analyzed using Pearson Correlation and multiple regression analysis. A correlation analysis was used to measure the degree of relationship between the two variables. Kothari (2004), says the coefficients assume that there is linear relationship between the two variables and that the two variables are casually related which means that one of the variables is independent and the other is dependent. The regression equation applied in the study is as shown below;

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$$

Where, Y = household livelihoods
α = Constant
$\beta_1 \ldots \beta_4$= the slope representing degree of change in independent variable by one-unit variable.
X_1= patterns in the distribution of electricity
X_2= usage of electricity
ε = error term

RESULTS AND DISCUSSION

4.1 Household characteristics

Table 2 Household characteristics

		Frequency	Percentage %
Gender of Household Head	Male	118	91.5
	Female	11	8.5
	Total	129	100
Household Members	1	31	24
	1-3	54	41.9
	4-7	44	34.1
	Total	129	100
Roof	Tiles	5	3.9
	Iron sheets	118	91.5
	Grass	6	4.7
	Total	129	100
Wall	Concrete	59	45.7
	Grass	0	0.0
	Mud	55	42.6
	Timber	7	5.4
	Iron sheets	8	6.3
	Total	129	100
Floor	Cemented	81	62.8
	Earthen	48	37.2
	Total	129	100

This section of the analysis highlights the results on household characteristics. The findings are as presented in table 2. With respect to the gender of the household head, the study revealed that 91.5% (118) of the respondents confirmed that the household head is male while 8.5% (11) noted that the household head is female. Evidently, in majority of the

households, the household head is male and hence reflecting that most household activities are consented by the males as per the respondents' answers. Regarding the number of people that live in a household, 24% (31) of the respondents noted that there is only one member in the household, 41.9% (54) between one to three members and 34.1% (44) of the respondents stated that there are between four to seven members in a household. On average, most of the households have more than one member thus indicating the need for connectivity to serve multiple household activities. The respondents were also asked what their roof is made of. For a clear majority (91.5%) of the respondents, their roof is made of iron sheets followed by those that have roofs made of grass (4.7%) and the least being those with roofs made of grass (3.9%). Majority of the households have roofs made of iron sheets. This could be because it is the most convenient mode of roofing and it is relatively cheaper and also safer when connected with electricity. Furthermore, 45.7% (59) of the respondents stated that their walls are made from concrete, 42.6% (55) from mad,5.4% (7) from timber, none from grass and 6.3% (8) from iron sheets. Overall, most walls are made from concrete and mad as noted by the respondents. Finally, 62.8% (81) of the respondents stated that their floor is cemented and 37.2% (48) earthen. These results indicate that the households were appropriate shelter that can be connected to electricity.

Correlation Statistics

Table 3 Correlation Results

	Mean	Std. Dev	Liveli-hood	Pat-terns	Usage
Livelihood	3.99	0.77	1		
Electricity distribu-tion	4.19	0.73	.876**	1	
Usage	3.73	1.01	.824**	.716**	1

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

The results on electricity distribution summed up to a mean of 4.19 and standard deviation of 0.73. The implication is that the respondents concurred with most items on electricity distribution. On the other hand, there were fewer variations in the responses as indicated by the standard deviation. In line with the results, Khandker et al. (2010), study on the relationship between patterns in the distribution of electricity and educational outcomes in rural India established that students whose households are electrified are more likely to complete grade-appropriate tests successfully as compared to their counterparts whose households are not electrified. The results on electricity usage summed up to a mean of 3.73 and standard deviation of 1.01 meaning that the respondents were agreeable on most of the items on electricity usage. On the other hand, the standard deviation indicates that there is less variation in the responses.

The study has indicated that connection to electricity has led to the increase in the use of electricity appliances and its subsequent use for both domestic and commercial use. However, compared to global standards, the use of electricity appliances in the rural households is still low. Cognate to the results, Stephanie and Heather (2014), posited that

the accessibility to electric appliances remains low with only 20% of the poor people globally able to benefit. The results summed up to a mean of 4.09 and standard deviation of 0.88 meaning that the crime rate has reduced in the vicinity since the neighborhood, roads and the market centers have functioning security lights. Table 3 also illustrates Pearson correlation results of the study dependent and independent variables to assess the association of the variables. Findings revealed that the patterns in the distribution of electricity was positively and significantly correlated with rural household livelihoods ($r = 0.876$ $\rho<0.01$). Further, usage of electricity was positively and significantly correlated with rural household livelihoods ($r = 0.824$, $\rho<0.01$). This implies that patterns in the distribution of electricity and electricity usage relate to the rural household livelihoods.

4.3 Test of hypothesis (Regression analysis)

Table 4 Multiple Regression Results (Hypothesis Results)

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	0.576	0.161		3.576	0.001
patterns	0.505	0.055	0.546	9.236	0.000
Usage	0.227	0.064	0.283	3.550	0.001
Summary Statistics					
R	*0.906*				
R Square	*0.82*				
Adjusted R Square	*0.814*				
Model Fitness Statistics					
F	*140.098*				
Sig.	*.000b*				

a Dependent Variable: livelihood

Table 4 illustrates the model summary of multiple regression model, the results showed that all the four predictors (patterns in the distribution of electricity, and electricity usage) explained 82 percent variation of rural household livelihoods (R squared =0.82). Study findings in table 4 indicated that the above discussed coefficient of determination was significant as evidence of F ratio of 140.098 with p value 0.000 <0.05 (level of significance). Thus, the model was fit to predict rural household livelihoods using patterns in the distribution of electricity and electricity usage.

The first hypothesis of the study stated that there is no significant relationship between patterns in the distribution of electricity and rural household livelihoods in Kapseret Constituency. However, research findings showed that patterns in the distribution of electricity had coefficients of estimate which was significant basing on $\beta1= 0.546$ (p-value = 0.000 which is less than $\alpha = 0.05$) implying that we reject the null hypothesis is refuted. Consequently, an increase in patterns in the distribution of electricity by 0.546 units results to an improvement in the rural households' livelihoods by the same unit. Furthermore, the

effect of patterns in the distribution of electricity was stated by the t-test value = 9.236 which implies that the standard error associated with the parameter is more than the effect of the parameter. Thus, Patterns in the distribution of electricity have exhibited a significant influence on rural household livelihoods. The implication is that electricity is distributed according to the interests of the customers. Specifically, the household don't need to incur huge installations as before hence they get to save on installation costs. As well, the electricity is installed according to their interests hence they can use it both for domestic and commercial use. Their overall wellbeing also improves since they utilize clean energy as opposed to the use of charcoal and kerosene. The results are in line with that of Oda and Tsujita (2010), that established distance from the capital is a significant predictor of whether a village is or is not electrified in Bihar state, India. Further support to the study findings is by Chakrabarti and Chakrabarti (2002), who conducted a study on 'Sagar Dweep' island in India which established that the distribution of electricity through solar PV led to a substantial progress in trade and education as women received wider involvement in community activities and additional work. Evidently, the findings of the study are in tally with that of the existing literature. The study has filled the gap in the literature since most of these studies were conducted in India. None of it was conducted in Kenya.

The second hypothesis of the study stated that there is no significant relationship between electricity usage and rural household livelihoods in Kapseret Constituency. Nonetheless, the findings showed that electricity usage had coefficients of estimate which was significant basing on $\beta 2 = 0.283$ (p-value = 0.001 which is less than $\alpha = 0.05$) hence the null hypothesis is rejected. This implies that for each unit increase in electricity usage, there is up to 0.283-unit improvement in the rural household livelihoods. Also, the effect of electricity usage is shown by the t-test value of 3.550 which implies that the effect of electricity usage surpasses that of the error. The results suggest that with the connection to electricity, the households had an opportunity to improve on their lives. Specifically, they were able to use electrical appliances that were previously difficult to use. This made the households more informed in such a way that a significant portion of them have utilized the electricity for commercial purpose. Their children have also benefited since they can study during the night. Besides, they have not been burdened by the cost of electricity as the lion's share of the households pay as less as Ksh. 500 monthly. There is therefore a win-win situation for both the households and Kenya Power. Consistent with the results, Jedemann (2011), in a study that delved on the socioeconomic and environmental changes brought about by the installation and consumption of the solar home system indicated that the installation of solar had a direct and indirect benefit on the households. Precisely, the study hours of the students improved because they had light source availability. As well, there was a little more income added to the households as they could work during the evening hours. Similarly, the results agree with that of Kageni (2012) which established that distance from the transformer (p=0.000), education status (p=0.020), gender (p=0.045), household size (p=0.009), and income (p=0.011) were significant predictors of the adoption of electricity among rural households in Meru-South sub-county. Undoubtedly, electricity usage has improved the livelihoods of the rural households.

Justification of the Study

Rural electrification programs are promoted globally to ensure universal access to affordable, reliable, sustainable and modern energy for all and are often justified because they intend to promote the welfare of households by providing a better quality of life or greater productivity. Three-quarters of Rural Electrification projects have objectives related to improving energy supply, and the same proportion has objectives related to institutional development. However, only 7 percent of dedicated Rural Electrification projects and energy sector projects have an explicit poverty-reduction objective. Hence, poverty has not become a central concern of Rural Electrification projects, and there is rarely any explicit consideration either of how the poor will be included or of any poor-specific activities (World Bank, 2008). This study is significant for stakeholders such as the energy service providers, government agencies, academics, and researchers.

The research will be significant to the global donor community on how the concept of output-based aid is indeed impacting on people's livelihoods in the provision of clean and safe electricity for domestic and commercial use.

For the government energy service providers such as Kenya Power and Lighting Company (KPLC), the study provides information that can be used in the formulation of policies and applications for the correct implementation of rural electrification programs. The results of this study can also be used by the government, and the Ministry of Energy to promote livelihoods centered electrification projects in rural or urban areas and ensure its adoption by acting on recommendations.It is expected that the results and recommendations of the study will constitute a reference point for the development of evidence-based policies, and for the strengthening of institutional frameworks developed for the energy sector. This further contributes to the achievement of both the United Nations'-Sustainable Development Goals (SDGs) and Kenya's Vision 2030, whose critical driver is universal energy access.

It is also important for researchers and academics, as it is a useful guide for future researchers interested in conducting a study on the relationship between rural electrification programs and its socioeconomic changes in other parts of Kenya and the word.

CONCLUSIONS

The patterns in the distribution of electricity positively influence the rural household livelihoods. Rural households, which were previously without electricity, have access to electricity at an affordable cost. Distribution of electricity has been facilitated by affordable installation costs that are uniform. In fact, payment can be made on a monthly basis which made it a better alternative for the rural households. The resulting outcome is that there is equitable power distribution to all targeted household in line with their specific interest.

Also, electricity usage has improved the livelihoods of the rural households. With electricity, the households have been able to buy electrical appliances such as television sets which have made them more informed. Also, their children can study more and do their assignments since they have access to light source. Despite the improvement in

livelihoods, a few of the households have been able to capitalize on the electricity and use it for commercial purpose. As such, the electricity consumption among the households is low as most of them pay less than Ksh. 500 on a monthly basis. It is anticipated that in the coming years, more households would be able to use electricity for both domestic and commercial purposes. As such, to improve further the livelihoods of those in the rural areas, there is need for Kenya power to raise awareness on the modalities to be made to access electricity. Efforts need to be made by Kenya power to facilitate equitable distribution of power across all households. Other than that, the electricity distributed should be in accordance with the customers' interests.

Electricity usage has improved the livelihoods of the rural households and it is a viable system and should be extended to such other remote communities. Also, the electricity connection needs to be designed in such a way that it can easily be adapted to both domestic and commercial uses. Moreover, it is important the usage of electricity in the Last Mile Connectivity Program is well spread among all household activities.

Recommendations

The following recommendations are made for further research. First, the selection of the respondents was limited to rural households in Kapseret Constituency. Further research is needed to determine whether the results obtained from this study could be generalized to other rural areas within the country. Also, the study established no significant relationship between connection cost and rural household livelihoods, there is thus need for further studies to ascertain the validity of the results.

REFERENCES

African Development Bank (AfDB), (2017). Annual Development Effectiveness Review 2017: Chapter 2—Light Up and Power Africa, AfDB, Abidjan

Bhandari, P.B. (2013). Rural livelihood change? Household capital, community resources and livelihood transition. *J. Rural Stud. 32*, 126–136.

Boissiere, M. (2004). Rationale for public investments in primary education in developing countries. Background paper for the evaluation of the World Bank's support to primary education. The World Bank, pp 1-30. Retrieved from: http://ieg.worldbank.org/Data/reports/education_public_investments_wp.pdf

Brest, Paul (2010). The Power of Theories of Change in *Stanford Social Intervention Review*, Spring 2010 (retrieved from https://ssir.org/articles/entry/the-power-of-theories-of-change

Brossmann, M. (2013). *Off-grid Rural Electrification and Fighting Poverty. A Comparative Impact Assessment of Solar Home Systems and Small Solar Home Systems in Rural Bangladesh*. Global Studies Working Papers. [online]University of Tübingen

Chakrabarti, Indranil & R. Chakrabarti, Sheila. (2002). Have We Been Too Successful in Making Corporations Organism-Like. 5. 10.3917/mana.051.0089.

Chakrabarti, S., Chakrabarti, S. (2002) _Rural electrification programme with solar energy in remote region—a case study in an island, *Energy Policy* 30(1), pp. 33–42

Cooper, D. R., & Schindler, P. S. (2006). *Business research methods* (9th ed., p. 744). New York, NY: McGraw-Hill International Edition.

Ghaemi, S., Brauner, G. (2010). User behavior and patterns of electricity use for energy saving. Internationale Energiewirtschaftstagung an der TU Wien, IEWT (2009).

Gyamfi, Samuel & Modjinou, Mawufemo & Djordjevic, Sinisa. (2015). Improving electricity supply security in Ghana—The potential of renewable energy. Renewable and Sustainable Energy Reviews. 43. 1035 – 1045. 10.1016/j.rser.2014.11.102.

Helene, A. & Linus, H. (2011). Drivers and Barriers to Rural Electrification in Tanzania and Mozambique – Grid Extension, Off-grid and Renewable Energy Sources. *World Renewable Congress.* Linkoping, Sweden

IEA (International Energy Agency), (2017a). Energy Access Outlook: World Energy Outlook Special Report, OECD/IEA, Paris.

IEA [International Energy Agency], (2010). World Energy Outlook 2009. International Energy Agency (IEA) 9 rue de la Fédération, 75739 Paris Cedex 15, France. Viewed on March, 2018

IEA and the World Bank, (2017). Sustainable Energy for All 2017: Progress toward Sustainable Energy, World Bank, Washington D.C. License: Creative Commons Attribution CC BY 3.0 IGO

IEA, (2017b). World Energy Outlook, OECD/IEA, Paris.

Jedemann M., (2011). The Impact of Decentralized Renewable Energy on Livelihoods s: A Survey on Solar Home Systems for Villagers in the East Pamirs/ Tajikistan [Master's thesis]. Cologne, Germany: University of Cologne

Jimenez, R. (2016). Rural Electricity Access Penalty in Latin America: Income and Location. doi: 10.18235/0000339

Kageni M.C (2012). An Evaluation of Rural Electrification Adoption Dynamics in Meru-South Sub-County, Tharaka-Nithi County, Kenya. Master's Thesis, Kenyatta University

Khandker, S., Samad, H. A., Ali, R., & Barnes, D. F. (2010). *Who benefits most from rural electrification? Evidence in India* (Policy Research Working Paper No. 6095). Washington, DC: World Bank

Kothari, C. K. (2004). *Research Methodology: Methods and Techniques.* Kolkata, India*:* New Age International (P) Limited Publishers.

Malhotra, N. K. & Birks, D. F. (2006). *Marketing Research: An applied Approach* (3rd Ed.), Prentice Hall, Incorporated

Marete E.K (2016). Factors Influencing Electrification of Rural Households in Kenya: A Case of Meru South Sub-County, Kenya. (Master's Thesis) University of Nairobi

Oda, H. and Tsujita, Y. (2010). 'The Determinants of Rural Electrification in Bihar, India'. Discussion Paper 254. Chiba: IDE. Practical Action (2010) *Poor People's Energy Outlook 2010*. Rugby: Practical Action

Ouma C.O. (2011). Assessment of The Post Drought Recovery Strategies Among Pastoralists in Turkana Central District (Master's Thesis). Kenyatta University

Ozturk, I. (2010). A literature survey on energy-growth nexus. Energy Policy, 38, 340–349

Sharif, I., Mithila, M., (2013). Rural electrification using PV: the success story of Bangladesh. Energy Procedia 33, 343–354.

Stephanie Hirmer and Heather Cruickshank, (2014). The user-value of rural electrification: An analysis and adoption of existing models and theories Centre for Sustainable Development, Department of Engineering, University of Cambridge, Trumpington Street, Cambridge CB21PZ, UK

Torero, M. (2015). *The Impact of Rural Electrification Challenges and Ways Forward*. [online] Agence française de développement.

United Nations. (2015). *Energy Services for Sustainable Development in Rural Areas in Asia and the Pacific: Policy and Practice.* New York: United Nations Publications

Weiss, A., (1995). Cracks in the Foundations of Stakeholder Theory. *Electronic Journal of Radical Organizational Theory*.

Wolde-Rufael, Y. (2009). Electricity Consumption and Economic Growth: A Time Series Experience for 17 African Countries. *Energy Policy,* 34: 1106-1114.

World Bank, (2008). *The welfare impact of rural electrification: a reassessment of the costs and benefits - an IEG impact evaluation (English)*. Washington, DC: World Bank.

World Bank, (2017). *State of electricity access report 2017 (Vol. 2): full report (English)*. Washington, D.C.: World Bank Group.

Yadoo, A. (2012). *Delivery Models of Decentralized Rural Electrification.* Case Studies of Kenya, Nepal and Peru. PhD Thesis University of Cambridge

Yamane Taro (1967). *Statistics, An Introductory Analysis*,2nd ed, New York: Harper and Row