The Relationship between Urban and Rural Household Electricity Use and Adoption

Bbuye Martin

School of Science, Nkumba University, P.O. Box 237, Entebbe Uganda

Introduction

This study introduces the relationship between the urban and rural household electricity use and its adoption. It further entails the electricity use and adoption at the three regional study areas, electricity connections, electricity bill payments and finally by adopting the observation technique it considers the relationship between urban and rural household electricity use and adoption.

Access to electricity in Uganda is limited for most of the population. The Ugandan census of 2002 reported that 7.7% of households used electricity for lighting (37% of urban households and 2.6% of rural households) this was up from 5.6% in 1991. In contrast, 74.8% of households (33.3% of urban and 88.2% of rural) were using *"Tadooba"*, a form of paraffin candle, for lighting. The use of electricity has, despite setbacks in supply, reaching a rising number of people, and the number of electricity users, is reported to be up by 50% since 2002. Most tourist and developed areas rely on backup generators. In 2002, the network provided power to only 33 of the 54 districts of Uganda.

Study Objective:

The study was to find out the relationship between urban and rural household electricity use and adoption. The specific objective for the study to share knowledge with the other researchers or consumers who need environmental conservation related information

The data was collected under two categories. The first called primary data were Questionnaires, Observations, Focused group discussions and Photography. The second approach was secondary data where the data were collected from Journals, Newspapers and electricity production agency books or write-ups.

Results

1) Comparison of Urban to Rural Households electricity use at regional levels

The study covered Western, Central and Eastern regions. One major town in each region was taken as an urban area and one district represented the rural set up (Table 1).

Table 1: Electricity use and adoption at the Regional Level

Households' Responses	Region					
	Western		Central		Eastern	
	Urban	Rural	Urban	Rural	Urban	Rural
	Kyenjojo T/C	Kabarole District	KCCA	Mukono District	Jinja Municipality	Iganga District
Electricity users	18%	55%	86%	46%	82%	19%
Non electricity users	65%	38%	13%	51%	15%	76%
Not aware	17%	7%	1%	3%	3%	5%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

The results in Table 1 originate from the question where it was required for the respondents to answer whether their houses were connected to electricity supply. Three options were given and these included either yes or no or not aware.

Electricity use and adoption in the Western Region putting emphasis on Kyenjojo Town Council as an urban area and Kabalore District as a rural area, Kyenjojo Town Council had the highest number of non-electricity users with 65% responses well as 18% responses as accounted for the electricity users while 17% accounted for those responses who were not properly aware that they had electricity. Kabarole District had the highest number

of electricity users totaling to 55% responses followed by 38% responses for non-electricity users and finally 7% responses of those who were not aware. This implied that the non-electricity users were more than the electricity users in the entire Western Region as in Table 1.

The situation was interesting in the Eastern Region where Jinja Municipality as an urban area and Iganga District as a rural area were analyzed. Jinja Municipality had the highest number of electricity users accounting for 82% responses and this was followed by 15% responses of non – electricity users and lastly 3% of the responses of not aware. Iganga District accounted for 76% responses of non – electricity users followed by 19% responses of electricity users. The reason for the big percentage of electricity users in Jinja Municipality was because hydroelectric power was being generated from the Owen Falls Dam in Jinja as shown in Table 1.

Lastly, the Central Region which was represented by KCCA as an urban area and Mukono District as a rural area, presented 86% responses of electricity users for KCCA and 46% responses for Mukono District. The non-electricity users were represented by 13% responses for KCCA and 51% responses for Mukono District. Respondents who were not aware accounted for 1% responses for KCCA and 3% responses for Mukono District.

2) Type of electricity used by households

The study addressed the issue of electricity the respondents were connected to. Among the options sited within the study area included UMEME, solar, thermal and none of the three mentioned above and this was illustrated in Table 2 and classified into the study regions.

Table 2: Electricity connections

Type of electricity used by households	Region					
	Western		Central		Eastern	
	Urban	Rural	Urban	Rural	Urban	Rural
	Kyenjojo T/C	Kabarole District	KCCA	Mukono District	Jinja Municipality	Iganga District
UMEME	11%	55%	81%	44%	80%	18%
Solar	11%	0%	6%	9%	1.6%	5%
Thermal	0%	0%	0%	0%	0%	0%
None	78%	45%	11%	47%	18.4%	77%
Other	0%	0%	2%	0%	0%	0%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

The type of electricity used per household varied from region to region. Critical analysis of the results from the Western Region showed that Kyenjojo T/C had 11% respondents using UMEME and had no response towards solar and thermal energy sources but shot up to 45% for those who had no electricity at all. However, Kabarole District had the highest percentage of households that used UMEME electricity with 55% responses but had no response towards solar and thermal energy sources but shot up to 75% responses who had no any electricity within their homesteads as shown in Table 2.

The Eastern Regions as shown in Table 2, had 80% responses using UMEME electricity in Jinja Municipality but lowered down for solar and thermal energy which were 5% and 0% respectively. Iganga District had 18% responses of UMEME users but shot up to 77% responses for non-electricity users. This big variation did not show any progress in the distribution and usage of electricity but only showed just UMEME concentrating in urban areas while leaving out the rural areas.

In the Central Region (Table 2) where the rates of urbanization and development are high, 81% responses of KCCA and 44% responses for Mukono District use UMEME electricity. They both share the non-existence of thermal electricity with 0% response. The overall reason why there was no indicator for having thermal energy in all the three regions under study despite the existence of thermal power plants within the country, i.e. AGGREKO in Mutumdwe Kampala, JACOBSEN Thermal Power Plant at Namanve, is that the electricity generated by these plants was not connected to individual households but it was connected to the National Grid and later on it was UMEME to distribute to the consumers/households.

Another interesting scenario was the high percentages for 'None' which implied that these households had no electricity of any form at all and this was the majority within our communities. An electric pole could be sighted

within a household's plot / courtyard but that particular household had no electricity connection despite the harbouring of the electric pole.

3) Payment of electricity bills

The study intended to establish whether respondents were paying for electricity. The expected responses were either 'yes' or 'no' but to a certain extent though the researcher could physically observe an electric cable connected from a pole to a house, the respondent could respond as not aware as illustrated in Table 3.

Table 3: Response towards electricity bill payments

Payments to electricity	Region					
	Western		Central		Eastern	
	Urban	Rural	Urban	Rural	Urban	Rural
	Kyenjojo T/C	Kabarole District	KCCA	Mukono District	Jinja Municipality	Iganga District
Yes	6%	49%	80%	44%	71%	20%
No	6%	8%	6%	9%	3%	0%
Do not know	88%	43%	14%	47%	26%	80%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

In order to simplify the collected data for easy understanding, the study area was split into urban and rural settlements. The urban areas included Kyenjojo T/C, KCCA and Jinja Municipality as shown in Table 3 yet the rural areas included Kabarole, Mukono and Iganga Districts. The responses from KCCA with 80% had the highest in as far as payment towards electricity bill is concerned. This was followed by Jinja Municipality with 71% responses and lastly Kyenjojo T/C with 6% responses. The reason for KCCA having the highest respondents was because most of the households within KCCA had at least a job to generate an income and the strictness of UMEME within KCCA was too tight for a consumer to dodge paying the bills. Kyenjojo T/C and KCCA both scored 6% responses each while Jinja Municipality had 6% responses who said no towards payment of electricity bills. Unfortunately, Kyenjojo T/C had 88% responses for those who did not know which could be connected to the highest illiteracy levels and lack of exposure. In KCCA the responses accounted to 14% and 26% responses for Jinja Municipality. The deviation from 88% responses to 14% or 26% was too big and could not be differentiated from the equivalent of the distance between Kampala and Kyenjojo hence the farther the distance, the higher the level of illiteracy.

The analysis of respondents in the rural areas revealed that 49% of the respondents represented Kabarole District, followed by Mukono District with 44% responses and Iganga District with 20% responses. This showed that those responses were connected to electricity. Likewise, Kabarole District with 8% responses, Mukono District with 9% responses represented those who were aware and Iganga District had 0% response. When it came to responses of those who answered 'no' whether they were paying for electricity bills or not, Iganga District had the highest 80% responses followed by Mukono District with 47% responses and finally 43% responses for Kabarole District as in Table 3. The reason for the 80% of those who answered 'do not know' also contributed to the high illiteracy level within the district and lack of exposure.

4) Amount of money paid for using electricity per month

The study addressed the issue of amount of money paid for using electricity per month. The purpose of this question was to get details from the respondents of how much money a household spends on electricity and how he/she responded to the bill for a given month as illustrated in Table 4.

Table 4: Response towards amount of money paid per month

Amount of money used per month [Ug. Shs.]	Region					
	Western		Central		Eastern	
	Urban	Rural	Urban	Rural	Urban	Rural
	Kyenjojo T/C	Kabarole District	KCCA	Mukono District	Jinja Municipality	Iganga District
Below 50,000/= p.m	25%	36%	10%	56%	58%	74%
Between 50,000 to 100,000/= p.m	8%	31%	32%	22%	13%	0%
Between 100,000 to 150,000/= p.m	17%	17%	13%	9%	6%	0%
Between 150,000 to 200,000/= p.m	0%	6%	7%	0%	5%	0%
200,000/= + p.m	8%	2%	0%	6%	3%	0%
Not aware	6%	8%	38%	7%	17%	26%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

The study area was divided into Western, Eastern and Central as shown in Table 4. The monies were broken into five classes and room for those who were not aware was provided. The classes were below Shs. 50,000/-, between Shs. 50,000 and Shs. 100,000/-, between Shs. 00,000 and 150,000/-, between Shs. 150,000 and Shs. 200,000/-, Shs. 200,000/- plus per month and not aware. Kabarole District had the highest number 36% of respondents paying below Shs. 50,000/- p.m. followed by 31% responses representing those paying between Shs.50,000 to 100,000/- p.m. Likewise Kyenjojo Town Council [T/C] had 25% respondents paying below Shs. 50,000/- p.m and only 8% responses paying between Shs. 50,000 to 100,000/- p.m. Though Kaborale District had the highest number of respondents paying below Shs. 50,000/- compared to the 25% responses of Kyenjojo T/C, the situation totally changed with respondents who paid beyond Shs. 200,000/- p.m. Kyenjojo T/C had 8% respondents and Kabarole District had 2% responses. Both Kyenjojo T/C [8%] and Kabarole District [6%] had a mixture of respondents who were not aware that electricity bills were paid monthly.

In the Eastern Region, Iganga District had the highest number of respondents (74%) paying below Shs. 50,000/- p.m. and Jinja Municipality had 58% responses. Surprisingly, Iganga District had no other class of electricity bill payers apart from the 26% respondents who were not aware. For Jinja Municipality all the classes were represented with highest (3%) paying more than Shs. 200,000/- p.m.

Mukono district had the highest responses of 56% paying below Shs. 50,000/- p.m. and only 10% responses for KCCA. The trend of payment continued declining the higher the amount of money being paid per month raised for KCCA and Mukono District until a time where KCCA got 38% responses of those who were not aware and Mukono District scored 7% responses respectively.

5) Observation Results

This observation technique which was used in collecting data was very crucial in supporting the qualitative and quantitative data so that the entire research was meaningful. This data was on electricity use and the different uses categorized into lighting, heating / cooking, preservation or cooling, TVs, radios, ironing, fans, and commercial activities i.e. shop vending a household, backyard industrial activities and lastly adoption of electricity. These classes were described under urban and rural households and later on a general comment given .

Discussion

The results were in line with Fund (2000) who suggested that 95% of the urban population use power. This is evident when the research presented that 36% of the people who use power came from urban areas and 9.26% who use power came from rural areas.

The results also agreed with those of Tumushabe (2006) that only 10% of the Ugandans access electricity while the remaining 90% use other alternatives such as firewood, gas, wax and paraffin. This is evident when 66.8% were found to use firewood, 8.6% paraffin, and 3.9% gas as an alternative for cooking, and 72.1% paraffin, 2.4% gas, and 10.2% used wax for lighting.

1) Comparison of urban and rural household electricity use at regional levels

The results showed Western Region with Kyenjojo Town Council as the urban area and Kabarole District as the rural part of the study area in Western Uganda. The Central Region was represented by Kampala Capital City Authority (KCCA) as the urban area and Mukono District as the rural area and the Eastern Region was represented by Jinja Municipality for urban area and Iganga District for rural area. The study went further to establish the users of electricity at regional levels and in selected urban and rural setups.

Kyenjojo Town Council is located along Mubende – Fort Portal road but has the least electricity users of 18% compared to KCCA with 86% and Jinja Municipality with 82%. The likely reason for this is that Kyenjojo is just an upcoming town whereby most of the settlements are less than ten years old. It grew up as a tourist trading centre in the region and was elevated to a Town Council status when Kyenjojo was elevated to a district status. The town mainly has linear developments along the highway but moving at the outskirts of the town, settlements are just scattered here and there.
Similarly, Kyenjojo Town Council has the highest number of non-electricity users of 65% compared to KCCA (13%) and Jinja Municipality (15%). This was evidenced by the new settlements mainly of Muzigo type (double and single rooms) which belonged to low income groups or communities. Some of the respondents were not aware whether they had electricity or not in their houses. This can well be explained as the respondents were not aware or they were either stubborn to give the right answer or due to the high level of illiteracy which made them not to understand the interviewers or the language barrier was also a hindrance.

Among the rural households, the District of Kabarole had the highest percentage of electricity users with 55% followed by Mukono District with 46% and lastly Iganga District with 19%. Though Kyenjojo Town Council is well distributed with electricity but the rural part of Kabalore District has a well distributed network of electricity.

Surprisingly, Iganga District in the Eastern Region where the country's electricity is generated has few electricity users compared to districts where electricity is transported for long distances. If you compare Iganga District with 19% electricity users, it becomes evident that the distribution of the resource could not have been fair. The 5% representation of not aware for Iganga District represents high levels of illiteracy meaning so many responses could neither read nor write which has an impact on ones level of understanding and interpreting issues.

According to this study, KCCA had the biggest percentage (86%) of electricity users followed by Jinja Municipality (82%) and Kabarole District with 55%. KCCA further had the least number of households who were not aware of electricity use with only 1%. The literacy levels in Kampala are higher than in any other regions in Uganda.

2) Type of electricity used by households per region

The study found that there were more than three types of electricity that are used in Uganda. These included the electricity distributed by UMEME, solar and thermal type. UMEME electricity has a combination of hydro power, thermal and cogenerated energy which is all distributed by UMEME.

In the Western Region, 11% use UMEME in Kyenjojo Town Council whereas 55% use UMEME in Kabarole district. Nobody was found to be using solar energy in Kabarole District and thermal energy too, except 45% of the responses had no electricity at all.

The Central Region with KCCA and Mukono District had a different interesting trend. Nakawa Division in KCCA which was our study area had 81% of the respondents connected to UMEME whereas its rural Nama sub-County of Mukono District had 44% respondents connected to UMEME electricity.

None of the two study areas had thermal electricity connections though Lugogo and Mutundwe Thermal Energy Production centres are within Kampala city and Namanve Thermal Power Plant is within Mukono District. Since the electricity generated from the thermal power plant is connected from the thermal power plants is connected to the National Grid, the consumers/households cannot differentiate the electricity from hydro power projects and that from the thermal power projects. The monopoly of distributing energy/electricity is only for UMEME in Uganda, implying that whoever is connected to electricity on his/her house knows that it is from UMEME. It is as well the reason why in the entire study areas in the 3 regions. , no individual / household could

claim getting electricity from any thermal plant. Since KCCA is the capital city of Uganda with different types of people, 2% of the respondents gave other options of electricity where for instance dry cells are connected to generate light.

The study further revealed that solar energy is gradually improving more especially in the Central Region and Eastern Region where there are less chances of getting UMEME electricity. Kampala and Mukono with 6% and 9% responses respectively show a sign that those who are well off can connect solar energy to be used as a substitute in case of a power failure. In Kabarole District, Western Uganda, due to low incomes of the communities, there is no one who showed up to have been with solar energy in the study area, this was represented by 0% (no response).

3) Payments for electricity bills in regard to urban and rural households

This parameter of bill payments was intended to know whether households were responding towards bill payments or not or whether they did not have an idea about their bills. It is mainly urban residents who mainly respond towards bill payments. The town of Jinja and Kampala scored highest with 71% and 80% respectively in paying for electricity bills. Mukono District being semi urban (between Kampala City Council and Jinja Municipality) scored 44% much better than Iganga District with 20%. Positive response to electricity was better off in Kabarole District with 49% than Kyenjojo Town Council with only 6%.

Most responses in households did not know about billing simply because they were not the ones in charge of paying for electricity at the end of the months. Most household heads had gone to work during the interview time. Kyenjojo Town and Iganga District scored highly in as far as lack of knowledge on billing is concerned (88% and 80% respectively). Table 3, shows the responses towards electricity billing.

4) Amount of money paid for using electricity per month in urban and rural households

The monthly amount of money paid after billing ranged from below Shs. 50,000/- to over 200,000/- though there were those households who were not aware at all. Majority of the households in the entire study areas were paying less than Shs. 50,000/- per month. For instance, in the Western Region, Kyenjojo Town Council scored 28% whereas Kaborale District scored 35%.

In Kampala Capital City Authority (KCCA) 32% of the households pay between Shs. 100,000/- to 150,000/- per month whereas no one responded as paying more than Shs. 200,000/- per month which was accompanied by the 38% who were not aware at all of the amount of money being paid per month. Being not aware was of the amount of money being paid per month which was a sign of cheating electricity payments to UMEME as it is known that urban dwellers of Nakawa Division are good at behaving in shoddy ways as shown in Table 3 as the line graph displays the trend of electricity bill payments. The range between shillings 150,000 – 200,000/- was the least paid amount and it was cross cutting indicating a sign of non - affordable by the majority of the households since they were in the low or middle income groups. No responses were recorded in Kyenjojo Town Council, Mukono District and Iganga District, it was only Kabarole District, KCCA and Jinja Municipality with 6%, 7% and 5% responses recorded respectively. Urban areas use and pay for electricity better than the rural households because the people in urban areas had exposure to employment and therefore receive reasonable incomes.

5) Observation results

During the observation process, different parameters were used to determine the efficiency of the system, its viability and affordability. Parameters like lighting, heating /cooking, preservation and others were adopted to determine the efficiency of electricity supply in the study area. Table 2 clearly showed how the different parameters reacted towards the electricity distribution to individual households. Lighting was further categorized to different places where it operates from, for instance, in the sitting room, bedrooms, security lights, toilet lights and other vital places. It is mainly found out that some bulbs placed at particular points could serve multi purposes for instance security, sitting room and beauty.

There are special bulbs fixed in ceilings of houses to be used especially when there are repairs and to avoid bats from staying in ceilings. It was found out that all households had no such security bulbs and were not aware of such ceiling bulbs.

7.4   Conclusions

The relationship between urban and rural household electricity use and adoption is paramount. At times it is not easy to differentiate between the two categories of households. One may expect to find the urban households better off than the rural households. Research may not have shown that because the opposite may be true depending on quite a number of reasons. The age, education level, location and many other factors could be some of the reasons to explain that impression. In summary, there is need to distribute electricity to all parts of the country whether urban or rural so that everybody gets access to it. The billing of electricity should be lowered to affordable levels and that is one of the major reasons households resort to cheating the electricity by bye-passing wires away from the reading meters.

Recommendations

The government and other relevant authorities should:

i.   Apply fair or even distribution of electricity throughout the country (both urban and rural areas).
ii.   Reduce the cost of electricity per unit,
iii.   Encourage use of energy saving bulbs to reduce cost,
iv.   Revise the monopoly culture of UMEME being the sole distributer of electricity and privatize energy / electricity generation and distribution, and
v.   Review the energy policies regarding electricity.

REFERENCES

AFREPREN. (2004). Renewables and energy for rural development in Sub-Saharan Africa.London ; New York : Zed Books ; Nairobi : African Energy Policy Research Network (AFREPREN), 2004

African Development Bank. (1998)., African Development Report. (1997). Tunis: African Development Report

Barnes, D and Qian, L. (1996). Urban interfuel substitution, energy use, and equity in developing countries: some preliminary results. Washington, DC: World Bank.

Barnes, D.F. and Floor, W.M. (1996). Rural energy in developing countries: a challenge for economic development. *Annual Review of Energy and the Environment,* 21: 497-530.

Bw'Obuya. (2002). the socio-economic and environmental impact of geothermal energy on the rural poor in Kenya, A report of the AFREPREN them group on special studies of strategic significance, Nairobi. Cambridge: Polity Press. Pg 256.

Clark, G. (1993). Saving energy with electricity. Washington, DC,: The ElectricPower Research Institute

Dalelo, A. (2002). Rural electrification in Ethiopia: opportunities and bottlenecks. Addis Ababa : Addis Ababa University.

Du Plessis, J. (1996). Lighting Up South Africa 1996, National Electricity Regulator, Progress Report, Johannesburg, 1997.

Ecotrust. (2003/2004). Annual Report, Building Partnership to Conserve Uganda's National Heritage Kampala – Uganda.

Electric Power Research Institute. (1990). Efficient electricity use: estimates of maximum energy savings. Palo Alto, Calif.: The Electricity Power Research institute.

Institute of Electrical and Electronics Engineers. United States of America. (2001). Benefits of increased electrification. Washington, DC: IEEE

Iwayemi, (1998). Energy Sector Development in Africa. Tunis: African Development Bank

Kadar, Peter; ZigBee. (2009). Controls the household appliances; Intelligent Engineering Systems, INES. International Conference on Publication.

Karekezi and Kithyoma,W. (eds) (2005). Sustainable Energy in Africa: Congenertion and Geothermal in the East and Horn of Africa – Status and Prospects, Nairobi, AFRPREN/FWD and Heinrich Boll Foundation (HBF)

Liengme, C.A. (1983). A study of wood use for fuel and building in an area of Gazankulu, in *Bothalia*, 14 (2): 245-257.

Ministry of Energy and Mineral Development (MEMD) (2002). Energy for rural transformation project implementation plan. Kampala : MEMD.

Ministry of Water, Lands and Environment, 1995

Molderink, A.; Bakker, V.; Bosman, M.G.C.; Hurink, J.L.; Smit, G.J.M. (2009). Domestic energy management methodology for optimizing efficiency in Smart Grids; PowerTech, IEEE Bucharest Publication Year Page(s): 1 – 7.

National Development Plan NDP- 2010/11-2014 ,

Otnes, P. (ed.) (1988). The sociology of consumption: An anthology. Oslo: Solum.

Schneider, T.R. and Rabl, V.A. (2000). Lighting the path to sustainability. Washington, DC: For Appied Research and Public Policy.

Schumacher Centre for Technology & Development (2006). Practical action technical brief: grid connection. Retrieved from http://www.practicalaction.org/?id=technical_briefs_energy.

 Sokona, Y. and Thomas, J. (2004). Widening access to rural energy services in Africa: Looking to the future. Energy AfriKa Newsletter, 4(1), 7-14.

Spaargaren, G. and van Vliet, B. (2000). Lifestyles, consumption and the environment the ecological modernization of domestic consumption. *Environmental politics*, 9, 50-76. Fuel for thought: an environmental strategy for the energy sector; Washington DC: The World Bank.