FACTORS INFLUENCING EFFECTIVE IMPLEMENTATION OF RURAL ELECTRIFICATION PROGRAM IN UGANDA: A CASE OF WEST NILE REGION

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FACTORS INFLUENCING EFFECTIVE IMPLEMENTATION OF RURAL ELECTRIFICATION PROGRAM IN UGANDA: A CASE OF WEST NILE REGION

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ABSTRACT

The Electricity Act, 1999 established the legal framework for achieving Government of Uganda's objectives for rural electrification. The primary objective of the Rural Electrification strategy is to reduce inequalities in access to electricity. The Rural Electrification Program is important to Uganda because it will stimulate balanced national development between the rural and urban areas. The purpose of this study was to investigate factors influencing effective implementation of rural electrification program in Uganda: a case study of West Nile Region. The objectives of the study were to assess the effect of consumer electrification costs and program funding, on effective implementation of rural electrification program. The study adopted a descriptive survey research design. The target population was 355365 respondents. Stratified sampling was used for electricity consumers with stratum sizes of 98:1:1 for households, health centers and schools respectively. Simple random sampling was then used to select the respondents. Data was collected using questionnaires for the electricity consumers and interviews for WENRECO managers. Pilot study was conducted at Uganda Electricity Distribution Company Limited (UEDCL) to test the validity and reliability of the instruments. Data was analyzed using Statistical Package for Social Sciences (SPSS). The study established that a unit increase in cost of electricity will lead to a 0.242 increase in the implementation of rural electrification program; while a unit increase in the program funding will lead to a 0.043 increase in the implementation of rural electrification program. The study concluded that the cost of house wiring materials, high connection fee and tariff affects effective implementation of rural electrification program in West Nile region. Electricity access was at about 1.92% and generation deficit is expected to increase to 5.2MW even when the planned 4.4MW mini hydro on river Nyagak is commissioned by 2018. The stakeholders were not fully involved in the implementation of rural electrification program in West Nile Region though majority of them support the electrification program. The relevant projects in generation, transmission and distribution network were not effectively coordinated so as to mitigate losses to Distribution Company. Most of the electricity users had ever been disconnected from power because of failing to pay on time which affected the funding of rural electricity program though the organization ensured that there was frequent line maintenance. The consumers were confident that the staffs were capable, they issued network maintenance notices in advance and faults along the power lines were cleared within shortest time possible. This shows that the organization has very good staff development plans that support its strategy. The study recommended subsidizing of consumer connections cost, domestic house wiring material cost and the unit cost of energy. Aggregate distribution losses should be reduced by the service provider to acceptable levels. This study will therefore benefit policy makers and stakeholders participating in implementation of rural electrification program in Uganda, rural electricity consumers and students wishing to undertake research in implementation of effective and sustainable rural electrification program.

Key Words: *Rural Electrification program*

INTRODUCTION

Despite widely recognized importance, electricity is not available everywhere with many people still depending on alternative sources of energy such as wood, charcoal and kerosene (Pellegrin & Tasciotti, 2012). Although literature indicates that rural electrification (RE) is a global phenomenon,1.3 billion people in the world do not have access to electricity, representing 18 percent of the global population, many of them live in Africa and South Asia (IEA, 2013). Bringing electricity to rural areas started in United States of America (USA) in 1920s and by 1965, all the rural areas in USA had electricity (Katie, 2010). All developed countries and some Asian countries such as Vietnam, Thailand and Sri-Lanka currently have access to electricity in rural areas. First growing economies have higher rural electrification rates with Brazil having rural access rate of 88%, China 99%, India 52.1%, South Africa 55% by 2009 (Alexander, 2010).

In Africa rural electrification rate is at 28 percent with North Africa having access rate of 99 percent while Sub Saharan Africa has 18 percent (IEA, 2013). Through the south-south initiative more than 17 African countries have joined with the purpose of accelerating the development of rural electrification through creating conditions where members can share their experiences in a bid to electrify Africa. Countries under this initiative include: Cameroon, Ivory Coast, Morocco, Mauritania, Niger, Senegal, Burkina Faso, Congo-Brazzaville, Guinea, Mali, Madagascar, Mauritania, Niger, Benin, Central African Republic, Gabon, Democratic Republic of the Congo, Chad, Zambia, Uganda, Kenya, Tunisia, Togo, Tanzania, Mali, Malawi, Mozambique, Rwanda and Ghana. Affordability proves to be an obstacle in trying to ensure access to reliable modern energy in Sub-Saharan Africa. The rural populations are poor and vulnerable hence there is continued dependence on traditional source of fuel for domestic use (Abdullah & Markandya, 2011).

The 1999 electricity act legalized the privatization of Uganda Electricity Board (UEB) and initiated the formation of numerous successor companies (Ezor et at, 2009). The act established the Rural Electrification Board (REB) and Rural Electrification Agency (REA) to promote, support, and provide rural electrification through Public and Private sector participation (Ezor et at, 2009). REB and REA operating semi-autonomously under the Ministry of Energy and Mineral Development solicit funding from parliament, donors and related agency surpluses through Rural Electrification Fund and recommends the appropriate type of project for selected areas (Ezor et at, 2009).

The first rural electrification program in Uganda started in 2001 under Rural Electrification Strategy and Plan (RESP 2001-2012). Government's objective for rural electrification is to eradicate poverty and to foster opportunities for rural Ugandans since widespread access to electricity is expected to stimulate rural employment diversification, draw value addition for farmers to improve their income, enhance food security for the entire population through irrigation, create opportunities for rural population to enjoy electrification's many modernizations and lifestyle benefits and contribute to enabling rural people participate more broadly and fully in national economic and social development.

Statement of the Problem

Rural electrification programs require a number of conditions in the institutional environment to ensure successful and sustainable program expansion. Due to the specific challenges posed by low population density, low energy demand, and undeveloped rural economies, these programs require special financing conditions, design and construction standards specifically formulated to address rural power-supply characteristics, and a program management practices should involve

coordination and sequencing of the relevant projects so that losses arising from gaps between projects and programs are mitigated. The successful implementation of strong and robust strategies will give public institutions a numerous advantages. These include attainment of organizational goal, enhancement of institutional competence and reduction of challenges to the organizational goal attainment (Noble, 2009). In order to attain the target goal of rural electrification, strategies put in place should be fully implemented. Implementation of rural electrification program in Uganda has been in-effective. This has led to losses to distribution companies, increases in cost of electrification to consumers, and can further lead to loss of large capital investments made by the Government in infrastructure development.

Objectives of the Study

The general objective of this study was to assess factors influencing effective implementation of rural electrification program in Uganda; the specific objectives are: To assess the effect of consumer electrification costs and funding affects effectiveness of rural electrification program implementation.

Research Questions

1. What is the effect of consumers electrification cost on effective implementation of rural electrification program?
2. How does funding affect effectiveness of rural electrification program implementation?

Scope of the Study

Although there are many factors influencing effective implementation of rural electrification program in Uganda, this study was delimited to level of stakeholder support, staff capability, availability of funds for implementing rural electrification program and cost of electrification to rural consumers, electricity generation status, grid extension, network maintenance of the existing lines in West Nile region under West Nile Service Territory. WENRECO manager and electricity consumers participated in the study. Primary data was collected through the use of questionnaires and interview schedules.

LITERATURE REVIEW

Theoretical Framework

This section presents stakeholder theory, Abraham Maslow's and Frederick Herzberg's motivational theories and theory of constraints.

Stakeholder theory

The basic idea of stakeholder theory is that organizations have relationships with many constituent groups and that it can engender and maintain the support of these groups by considering and balancing there relevant interests (Kirsi, 2010). Kirsi (2010) further noted four premises of the stakeholder theory that; corporations have relationships with many constituent groups (stakeholders) that affect or are affected by its decisions, the theory is also concerned with the nature of these relationships in terms of both processes and outcomes for the firm and its stakeholders, that the interests of all (legitimate) stakeholders have intrinsic value and not one set of interests is assumed to dominate others, and finally the theory focuses on managerial decision making. Based on the argument of instrument of power of this theory, a company using stakeholder approach will have increased organizational performance in terms of economics and other criteria (Hasan & Kamil, 2010).

Though, Blattberg (2004) criticized stakeholder theory for assuming that the interests of various stakeholders can be compromised or balanced against each other, the researcher did not propose any other alternative apart from recommending negotiation and dialogue for dealing with conflicts between stakeholder interests. Kirsi (2010) noted that while having its origins in strategic

management, stakeholder theory has been applied to a number of fields, presented and used in a number of ways that are quite distinct and involves very different methodologies, concepts, types of evidence and criteria of evaluation.

Lynda (2006) after examining stakeholder theory concluded that the support of key stakeholders was essential for project success and consequently the success of programs. In relation to the study the managers should on the one hand manage the corporation for the benefit of its stakeholders in order to ensure their rights and participation in decision making and on the other hand the management must act as the stockholder's agent to ensure the survival of the firm to safeguard the long term stakes of each group.

Theory of Constraints

Theory of constraints (TOC) began as a production scheduling aid, developed by Eliyahu Goldratt in the late 1970s, terming it as 'optimized production time table' and was quickly developed in to a software package commonly known as optimized production technology (Davis & Mabin, 2009). Ten years later, due to failures caused by the expectations associated with a turnkey package led Goldratt and others to realize that what was needed was to convince people to change ways, rather than tailor the package to simply automate their old policies and procedure – changes to their thinking and actions were needed if the potential gains were to be realized (Davis & Mabin, 2009).

According to Togar et al (2004) TOC aims to initiate and implement breakthrough improvements through focusing on a constraint that prevents a higher level of performance, further noting that TOC paradigm essentially states that every firm must have at least one constraint. Goldratt and Cox defined constraint as any element or factor that limits the system from doing more of what it was designed to accomplish - that is achieving its goal (Togar et al., 2004).

Sebastiano and Ragnhild (2014), revealed that what is considered as a constraint in project management can be categorized in to four; as political constraints (such as defined vision, mission, scope of projects), technical constraints (such as competencies, technologies, existing infrastructure and natural conditions like geology, landscape and climate), social constraints (such as codes of conduct, organizational hierarchies, personal relationships and accepted/expected behaviors) and administrative constraints (such as budgets, project schedules, scope, written contractual agreements among others).

Theory of Constraints (TOC) challenges managers to rethink some of their fundamental assumptions about how to achieve the goals of their organizations, about what they consider productive actions, and about the real purpose of cost management. TOC incorporates the idea that the goal or mission of an organization is the reason the organization exists. TOC emphasizes the optimization of performance within the defined set of constraints of the existing processes and product offerings. Therefore identifying the constraints leading to non-effectiveness of rural electrification program can lead to developing necessary remedies for overcoming such constraints.

Conceptual Framework

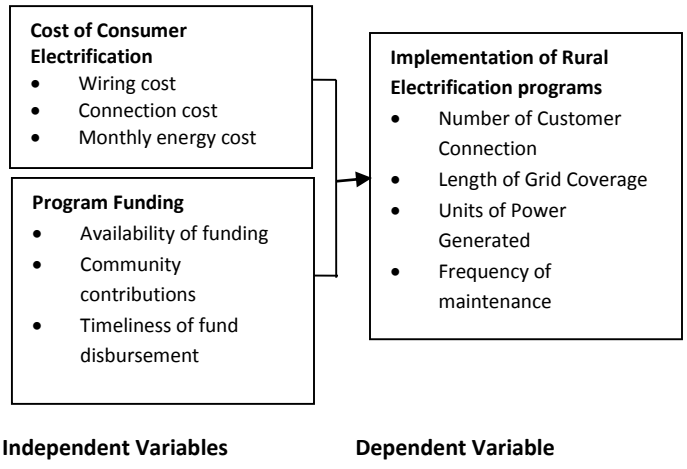

Figure 1: Conceptual Framework

Empirical Review

a) Cost of Consumer Electrification

According to Schillebeeckx et al (2013), affordability of rural electrification program is determined by the capital cost and periodic payments further noting that in Bolivia a small grid doubled its connections by spreading the connection charges over 5 years while Malawi electricity company which demanded full upfront payment of 30years cost of line extension resulted in a 2% rural electrification rate. In Thailand, electricity related materials were standardized and manufactured locally, reducing procurement and transportation costs (Pellegrin & Tasciotti, 2012).

House wiring, connection charges and power tariff is a major constraint to the poor in accessing electricity. Cook (2013) revealed that the issues to addressing access of electricity to the poor have been addressed through ensuring that first, service providers provide access, the second instrument is required to reduce connection costs through tariff design or direct subsidies built in payment plan favoring the poor and third is to increase range of service providers to avail consumers with choice. Cook further indicated that achievement is difficult and slow and understanding of the issues that act as constraints are incomplete.

As part of the reforms, Thailand implemented a tariff-restructuring programme that resulted in a gradual increase of electricity prices between 1990 and 2000. For the lower category of consumers (rural consumers) tariffs increased from an average of 5 to 8.5 USc/kWh. However, the increase did not seem to affect the per capita consumption and the expenditure on electricity in relationship to household income (AIT, 2004). In Vietnam, tariffs were increased to meet conditions of the loan from the Asian Development Bank for an electrification project. However, measures were put in place to protect the rural consumers compared to urban consumers. As such, tariffs for rural areas only marginally increased from about 3.2 USc/kWh in 1996 to 3.5 USc/kWh in 2002. Per capita consumption increased by 17% per year for the rural consumers compared to 14% by the urban consumers during the period 1992 to 1998. With regard to expenditure on electricity in comparison to household income, the rate increased from 1.08% in 1993 to 3.0% in 1998 (AIT, 2004).

b) Program Funding

Barnes & Foley (2004) revealed that the financial viability of electric distribution utilities is governed by the balance of costs and revenues generated from sales of energy and the cost of providing service. Due to lower population density, often lower income, and concurrently lower specific energy consumption for rural communities, rural distribution systems realize far lower revenue per kilometer of rural distribution line than their urban counterparts. Moreover, Zhang & Kumar (2011) observe that, rural distribution service providers are also faced with higher operating expenses per household or commercial consumer served, given their lower energy density. Additionally, rural electric service providers recruit management and staff resources from communities that often have fewer trained engineers, accountants, financial specialists, and customer service specialists due to lower levels of professional and practical skills training. In short, the business of rural electrification provides few financial incentives for distribution service providers, while presenting significantly higher risks than those faced by urban distribution service providers (Barnes & Floor, 2006).

The emerging of power sector reforms such as commercialisation, structural changes and privatisation, and the relative success of the reforms in pioneer countries stimulated adoption of similar reforms in many countries (Wamukonya, 2003). Further, financing institutions such as the World Bank believed that the reforms could help improve technical and financial performance of the

power sector and as such, started incorporating conditions for reforms in lending agreements (World Bank, 1993). The need for financing and in some cases conviction that the reforms would bring about improvements resulted in a large number of developing countries taking steps to reform their power sectors in the 1990s.

In the 1970s, the power sector was characterised by state ownership and monopolies. It was then believed that a single national utility operating as a monopoly was supportive to electricity system development and the rights of people to low electricity prices. It was thought that this structure would facilitate expansion of power supplies, capture economies of scale, and ensure effective use of scarce managerial and technical skills (World Bank, 1993). This was the foundation of most of the vertically integrated state monopolies in most countries by the start of the 1990s. However, most of the state-owned companies started experiencing financial problems mainly due to inappropriate pricing policies and poor operating performance due to lack of qualified and experienced personnel. The companies also experienced significant interference in their operations from governments. Politicians influenced employment policies resulting in over-employment and low labour productivities. Meanwhile, most developing countries, continued to experience limited access to electricity particularly in rural areas. Lack of financial resources from both the utilities and the public sector resulted in limited investment in system development and maintenance (Kessides, 2004).

Social and economic equity was a main part of South Africa's public benefits agenda. As such, equitable access to electricity was a major consideration in the country's electricity reform process. South Africa instituted an electrification programme that was funded mainly through cross-subsidies and a consumer levy by the country's main utility, Eskom and the municipalities (Philpott & Clark, 2002). The National Electricity Regulator (NER) was responsible for management and administration of the RE fund and allocated subsidies to electrification concessionaires, set prices and regulated the performance of the companies. With this approach, South Africa was able to increase the level of access to electricity from 40% in 1994 to 66% (46% rural, 79% urban) in 2002.

In other African countries, RE was mainly financed by government subsidies. However, increased donor support was experienced in many African countries such as Uganda and Zambia following reforms. With support from the Swedish Agency for International Development (SIDA), Zambia established some Energy Services Companies (ESCOs) that supplied electricity to selected rural areas using solar PV systems (SEI, 2001).

Funding plays a great role in the formulation of Renewable Energy Technologies (RETs) policies. Majority of advanced and electric RETs are not affordable to most of the population in Africa who are poor, with poverty degrees of between 50 to 70% (World Bank, 1996). This is true particularly for RETs that have huge cost of imported parts, than those that can be locally produced and assembled utilizing locally available parts. The RETs with huge cost of importing parts put an extra burden on foreign exchange reserves of African economies, which are frequently little and approaching exhaustion, and needs expensive funding strategies and huge subsidies (Karekezi & Kithyoma, 2002). The subsidies are unsustainable in the long term, except when the technologies given are planned to include income generation

Critique of the Literature Reviewed

The need for increased investments in rural infrastructure and other key public service that are necessary for achieving growth and reducing poverty in rural areas has been underscored by various stakeholders. Rural electrification has gained prominence in recent years with the

heightened interest in infrastructure in relation to the core part it can play in improving welfare and reducing poverty (World Bank, 2008). Ondari (2010) asserts that no country in the developing world has ever achieved 8-10 percent annual growth that is required to reduce poverty without modern energy.

Electricity as consumption and an intermediate good has been linked to income growth and therefore a causal relationship exists between income and infrastructure (Cook, 2012). Rural electrification promises a brighter future for many rural communities and in the long term, the benefits of providing electricity to poor households can be high. Research study outcomes have given evidence indicating the positive relationship between electricity consumption and gross domestic production and this correlation has been reflected by the relationship existing between the electrification rate in a country and the percent of households who are living above the poverty line of two dollars per day (Kirubi, 2006; Tuntivate, 2011).

Implementation of Rural Electrification Programs

Most African including those in the Southern sub-region faces a major challenge in trying to achieve their development and social obligations because of serious lack of modern energy services. Electricity access clearly demonstrates this deficiency because it is only 17% for sub Saharan Africa as a whole and less than 5% in rural areas (Davidson & Sokona, 2002). This situation needs major changes for not only because of development demands but for the region and its sub regions to be competitive with other developing regions of the world. Lack of access to electricity by the poor in East Africa is partly attributed to the way reforms have been implemented as well as poor management of rural electrification programmes and funds. As reforms are entering, what many consider to be, a second generation, there is increasing recognition that explicit policies are, therefore, needed if the objectives of increasing electricity access, and affordability are to be realized - the focus of this study as well as that of other GNESD regional studies for Phase III (Ghanadan, 2005).

Access to modern energy services is intrinsic to achieving the Millennium Development Goals (DFID, 2002). Electrification, along with access to modern cooking fuels and mechanical power, is a catalyst for improvements in the fields of poverty reduction, food security, health, education and gender equality (GNESD, 2007). Due to the higher cost of traditional, lower quality energy sources such as candles, kerosene lamps and batteries, on average the poorest people in the world spend almost 30 per cent of their household income on energy (Gradl & Knobloch, 2011). This expenditure is often reduced when households are electrified.

Rural electrification can take the form of grid extension, individual household systems, community mini-grids, multifunctional platforms and central charging stations with battery banks. Due to the large distances, difficult terrain and low projected levels of consumption, grid extensions may be too costly to install or operate efficiently (Gouvello, 2002). In rural areas that have had the grid extended, the service may be poor or even non-existent. In rural India there are power cuts of '14–16 hours a day, on almost all days of the year' (Krishnaswamy, 2010). This may be due to poor transmission infrastructure, generation capacity shortages or mismanagement of the central grid that result in frequent black-outs or 'brown-outs' (large voltage drops that can damage appliances), particularly for rural customers at the ends of the network. The unreliability and shortage of grid power in many areas can severely hamper economic development. This economic cost has been estimated as 4 per cent of GDP in Tanzania, 5.5 per cent in Uganda and 6.5 per cent in Malawi (Foster & Briceno-Garmendia, 2010).

Research Gap

Kolk and Buuse (2013) while carrying a study on search for viable business model for development in developing countries identified funding models for off-grid solar systems. However, the study did not reveal how timely the funds disbursed and made available for program implementation. The study did not cover community contribution funding options and did not also cover grid extension rural electrification program funding.

The study done by Yadoo (2012) indicated that the community made contribution towards rural electrification but it did not reveal how timely the contributions were made. On the other hand the study conducted by Helena and Linus (2011) on drivers and barriers to rural electrification in Tanzania and Mozambique was limited to structured interviews alone with limited number of respondents.

The study conducted by Bongani (2013) on stakeholder perception of socio-economic benefits of rural electrification in Zimbabwe disclosed that educated people rural people observed a lot of benefits from rural electrification while uneducated people did not realize and appreciate the importance of rural electrification. The study though important did not reveal, how that perception affected effectiveness of rural electrification program. It also did not cover other stakeholders other than direct beneficiaries of rural electrification program. Further, the study did not disclose how the rural population participated in rural electrification implementation program.

RESEARCH METHODOLOGY

Research Design

Descriptive research design was appropriate as adequate provisions for protection against bias and while maximizing reliability can be achieved with due concern for economical completion of the study. By describing the state of affairs as they are, helped in understand the factors influencing effective implementation of RE program in Uganda. To enhance the quality of information generated by the research, qualitative and quantitative research surveys were used.

Target Population

The target population for this study was participants involved in implementation of RE program in Uganda. The population was 356365 respondents consisting of 355,245 households (UBOS, 2002), 800 schools and 320 Hospitals.

Sampling Procedure and Sample Size

For the purpose of this study, the researcher used simple random sampling to select the households, schools and the hospitals from West Nile Region. A sample size 400 respondents was used.

Research Instruments

The main data collection tools for this study were questionnaires for all the schools, hospitals and households.

Data Collection Procedure

The organization management was contacted to permit the researcher to carry out the study within the organization. The researcher conducted interviews and administered the questionnaires himself and gave the respondents two weeks filling in the questionnaires.

Data Organization, Presentation and Analysis

The raw data collected through questionnaires and interviews was processed before subjecting them to useful analysis. Data organization included identifying errors, storing the data in appropriate form. Entering the data in Statistical Package for Social Sciences (SPSS) for statistical analysis was carefully cross checked to ensure that errors are identified and corrected. All statistical calculations were cross checked to ensure correctness in the formulae and calculation results. Data was presented using tables, graphs, bar charts and pie charts. The qualitative data generated through interviews was analyzed by performing quick impressionist summary which entailed

summarizing key findings from the informant interviews, explanation and conclusions using themes.

Descriptive statistics such as frequencies and percentages was used to describe the data and for this reason Statistical Package for Social Sciences (SPSS) version 17.0 was used. The study also used Analysis of Variance (ANOVA) to test the level of significant of the variables on the dependent variable at 95% level of significance. In addition, the study conducted a multiple regression analysis.

RESULTS AND DISCUSSION

Response Rate

Out of 400 questionnaires administered to the respondents, 391 responded. This formed a 96.8% return rate.

Demographic Data

The findings showed that majority 201(51.9%) of the respondents were male while 186(48.1%) were female. This implies that the study highly involved both genders and thus the finding of the study did not suffer from gender bias.

The findings showed that majority 149(38.5%) of the respondents had attained a diploma level, 97(25.1%) a secondary level, 55(14.2%) primary level, 48(12.4%) bachelor degree level and 38(9.8%) master's degree level. This shows that majority of the respondents had attained a higher level of education and would therefore contribute adequately to the study.

The study established that majority 121(50.2%) of the respondents were self-employed, 51(21.2%) were employed, 43(17.8%) were jobless and 26(10.8%) were farmers. The respondents indicated that their annual income range from 500000 to 6100000. The study also established that majority 91(37.8%) of the householders were living in brick walled house with half cement and mud and iron sheets, 74(30.7%) brick wall house with full cement and iron sheets or tiles, 53(21.9%) wood and mud wall, grass thatched and 23(9.5%) wood and mud wall with iron sheets.

Frequency of Power Cuts

On the frequency of the power cut, the findings indicated that majority 133(34.4%) of the respondents experienced power cuts thrice in a week, 105(27.1%) more than thrice, 97(25.1%) once and 52(13.4%) twice. This indicates that majority experienced power cuts three time and more in a week. This shows that there are rural electrification programs in Uganda are not effectively implemented.

Study Variables

a) Cost of Electrification

The first research objective sought to assess the effect of consumer electrification costs on implementation of rural electrification program. The study established that majority 180(46.5%) of the respondents spend between 0 and 20000 on their monthly energy needs before connected to power, 97(25.1%) spend between 20001 and 40000, 83(21.4%) spend between 40001 and 60000 and 27(6.9%) spend 60001 and above.

The respondents further indicated that their current monthly expenditure after being connected to the power are that majority 124(32.0%) spent between 40001 and 60000 on their monthly energy needs after being connected to power, 103(26.6%) spent 60001 and above, 82(21.1%) between 0 and 20000 and 78(20.2%) between 20001 and 40000. This is an indicator that the monthly energy cost increased when the consumers were connected to electricity power and they had to spend more money of energy than before connecting to power.

From the interviews that WRENCO managers indicated that the single phase connection Cost was 485,570 Ugx, 3 Phase commercial connection cost was 894,896 Ugx and 3 Phase Industrial connection cost was 894,896 Ugx. The managers

indicated that the connection cost is high and not easily affordable. These findings are in line with the findings of Cook (2013) who revealed that the issues to addressing access of electricity to the poor have been addressed through ensuring that first, service providers provide access, the second instrument is required to reduce connection costs through tariff design or direct subsidies built in payment plan favoring the poor and third is to increase range of service providers to avail consumers with choice. House wiring, connection charges and power tariff is a major constraint to the poor in accessing electricity.

The respondents were asked to indicate how the cost of electrification affects effective implementation of rural electrification program in West Nile region; there response is shown in table 1.

Table 1: Cost of Electrification and Rural electrification program

Statement	Frequency	Percentage
Cost of wiring materials	152	39.3
High connection fee	97	25.1
Unit cost of energy	56	14.5
Mode of paying electricity bills 41	10.6	
High labor payment to wiring electrician	41	10.6
Total	**387**	**100**

From table 1, majority 152(39.3%) of the respondents noted that cost of wiring materials negatively affects effective implementation of rural electrification program in West Nile region, while 97(25.1%) regarded high connection fee, 56(14.5%) high unity cost of energy, 41(10.6%) mode of paying electricity bills and high labor payment to wiring electrician respectively. The respondents indicated that the electrification challenge can be mitigated through the following ways: reducing the cost of wiring materials; reducing the charge per unit consumption, lowering the connection fee and cost sharing. The WRENCO managers agreed that they offer connection subsidies (Output Based Aid) that is temporarily stopped due to delays in payment. They indicated the unit cost of energy as domestic consumer rate (557.03 Ugx/Unit), Commercial consumer rate (524.59Ugx/Unit) and Industrial consumer rate (524.59Ugx/Unit). These findings are in agreement with the findings of According to Schillebeeckx et al (2013) who found that affordability of rural electrification program is determined by the capital cost and periodic payments further noting that in Bolivia a small grid doubled its connections by spreading the connection charges over 5 years while Malawi electricity company which demanded full upfront payment of 30years cost of line extension resulted in a 2% rural electrification rate.

The electricity tariff has been on increase from the year 2012 to 2015 as shown in the table 2

Table 2: Shows Increase in Electricity Tariff

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Tarrif	263.3	251	360	360	360	360	360	440.4	514.4	557.3

According the respondents, the tariff is not easily affordable. The researcher established that depreciation of Uganda Shillings against the US dollar, High technical/commercial losses 30 – 33%, high operating cost due to network expansion and high maintenance cost of old network was the reason increasing the tariff.

b) Program Funding

The third research objective sought to determine how funding affects effectiveness of rural electrification program implementation. The study found that majority 235(60.7%) indicated that they had been disconnected from power because of failing to pay on time while 152(39.3%) had not. Those who knew a busy trading center/area within a radius of 5KM from the nearest power connection point which is left without power for 5 years because of lack of funds indicated their responses as that Majority 12(42.9%) did not know any electricity line getting dilapidated because of lack of line maintenance in West Nile Region, 8(28.6%) indicated that they knew and 8(28.6%) were not sure. On financial challenges that most affects effective implementation of rural electrification program in West Nile Region, the respondents indicated as shown in figure 2. These findings are in line with the findings of Kumar (2011) observe that, rural distribution service providers are also faced with higher operating expenses per household or commercial consumer served, given their lower energy density.

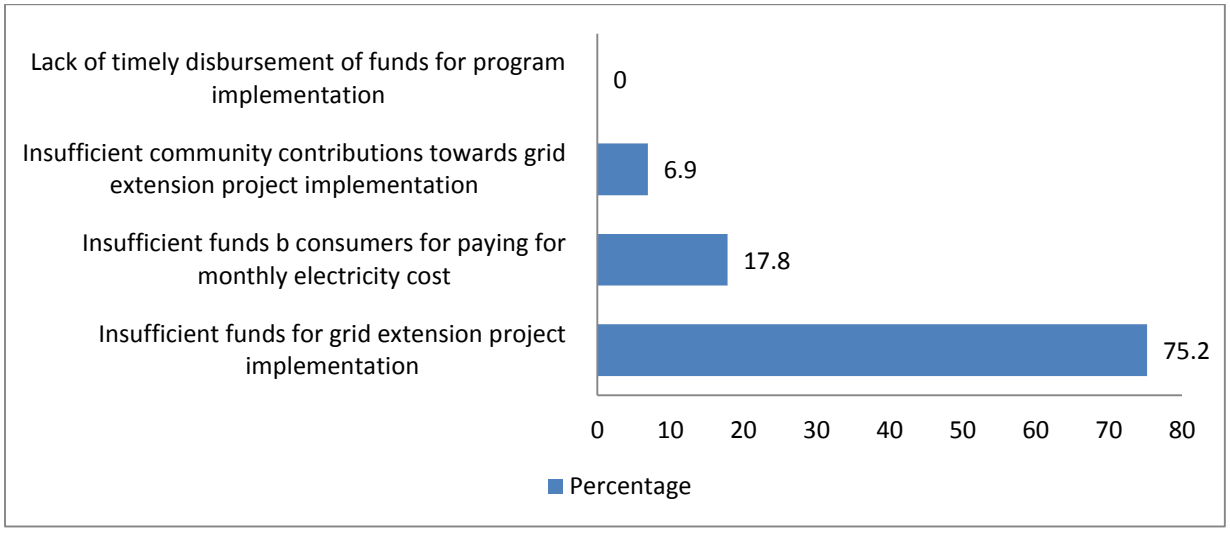

Figure 2: Financial Challenges

Figure 4.8 shows that majority 291(75.2%) of the respondents indicated insufficient funds for grid extension project implementation, 69(17.8%) insufficient funds by consumers for paying for monthly electricity cost, 27(6.9%) insufficient community contributions towards grid extension project implementation. None of the respondents indicated on lack of timely disbursement of funds for program implementation. From the interviews, the managers indicated that they have ongoing rural electrification projects on funding for community schemes and Wenreco can only construct up to 2km MV maximum. The sources of funding include community contribution and government of Uganda Financing. They also indicated that funds are not timely disbursed. Delays arise from the community making their part of the 30% contribution; funds are not available for planned projects and condition of the community first making 30% contribution before government releasing the 70% balance delays kick off of the projects. These findings are in line with the findings of Barnes & Foley (2004) who noted that the financial viability of electric distribution utilities is governed by the balance of costs and revenues generated from sales of energy and the cost of providing service. Due to lower population density, often lower income, and concurrently lower specific energy consumption for rural communities, rural distribution systems realize far

lower revenue per kilometer of rural distribution line than their urban counterparts. Moreover, Zhang & Kumar (2011) observe that, rural distribution service providers are also faced with higher operating expenses per household or commercial consumer served, given their lower energy density.

Implementation of Rural Electrification Programs

Number of Consumer Connections

From the findings the lowest consumer connection was recorded in 2011 while the highest in 2014. The success in 2014 was due to implementation of Output Based Aid (OBA) subsidy where potential consumer near an existing low voltage network who require no pole connection were connected without charging any connection fee. The connections so far recorded in the first quarter of 2015 is 9% (562 connections), however, this is expected to decline as the OBA subsidy has been halted.

Length of Grid Coverage

According to the manager WENRECO, the 33kV and 11kV medium voltage (MV) network under West Nile service territory is 467km. Another 350km will be constructed within the next 2 years. Currently there is no transmission network and related substations in West Nile Service Territory, as a result high technical losses are suffered by the service provider. However, Uganda Electricity Transmission Company Ltd (UETCL) plans to extend 132kV transmission network from Lira – Gulu – Nebbi – Arua (350km) complete with a proposed 132kV/33kV substation located in Arua. The proposed project is still under feasibility studies. The construction works for the transmission line is expected to commence in the year 2017 and the project is expected to be completed in 2019. It therefore means that availability, network reliability and quality of power shall remain a major challenge. The average per kilometer cost of constructing MV network, low voltage reticulation and installing distribution transformers is 219,000,000 Ugx (US $60,000). US $1 = 3650 Ugx.

Status of Generation

Currently the West Nile Service Territory is powered by a 3.5MW mini-hydro power plant on river Nyagak in Zombo district. The Government through Uganda Electricity Generation Company Ltd (UEGCL) plans to construct a 4.4MW mini-hydro power plant still on river Nyagak. The construction will be implemented as a public private partnership between UECGL and a consortium of Hydromax Ltd, Dott Services Ltd and Sri Sakthi Consultancy. Upon completion of the construction in 2018, total generation shall be increased to 7.9MW.

The current electricity demand for the West Nile Service Territory is 5MW which is above the current installed capacity. According to the manager WENRECO, the annual growth in demand is about 8%. This is partly due to extension of the grid to un-electrified areas. The electricity demand in West Nile Service Territory shall still exceed installed capacity even when the 4.4MW is injected in to the grid by 2018 and there shall be generation deficit of 5.2MW.

Based on the average annual energy loss of 25% and 10% annual growth rate reported by Electricity Regulatory Authority, from the year 2015 to 2019, the installed generation capacity in Uganda shall still exceed peak power demand. The planned generation projects if completed can therefore support generation shortfall in West Nile region via planned transmission network and only if the construction of the transmission line is implemented and commissioned. By the year 2020, the peak electricity demand in Uganda shall exceed installed generation capacity according to current plan for generation projects reported by UEGCL. If the energy losses are reduced to 15%, energy demand shall exceed supply by the year 2021.

This shall result in power rationing and hence leading to losses due to lost generation and

distribution overhead expenses for the distribution companies such as WENRECO as indicated by the WENRECO managers.

Therefore, the available generation capacity in Uganda should be exploited fully to avert the challenge of generation shortage hence securing sustainability for investment under the ongoing rural electrification programs.

Frequency of Maintaining the Network

Majority 235(60.7%) of the respondents indicated that they get frequent power black outs, 125(32.4%) somehow receive frequent power black outs while 27(6.9%) did not. 194(50.1%) receive notices for maintenance works and repairs being carried on the power networks, 138(35.7%) do not and 55(14.2%) somehow do receive notices for maintenance works and repairs. The respondents' opinions on the speed with which faults were cleared on the network was sought. The response showed that 46.3 % noted that the response time is quick enough, 28.7% did not know while 25.1% thought the response time is somehow quick enough.

Regression Analysis

A linear multiple regression analysis was used test the relationship between the four independent variables (cost of electricity and program funding) and the dependent variable; Implementation of rural electrification program. Statistical Package for Social Sciences (SPSS) version 17.0 was applied to code, enter and compute the measurements of the multiple regressions for the study.

Coefficient of determination explains the extent to which changes in the implementation of rural electrification program can be explained by the change in the independent variables (cost of electricity, stakeholder support, staff capability and program funding).

Table 3: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics	
					F Change	Sig. F Change
1	.792[a]	.627	.597	.5224	3.567	.031

According to the findings in the table above, the value of adjusted R^2 is 0.597. This indicates that a variation of 59.7 % of implementation of rural electrification program and the four independent variables at a confidence level of 95%. In addition other factors that were not studied in this research contribute to 40.3% of the implementation of rural electrification program. Therefore, further research should be conducted to investigate the other factors which contribute to that 37.3% of the implementation of rural electrification program.

The significance value is 0.031 which is less than 0.05 thus the model is statistically significant in predicting how the independent variables (cost of electricity and program funding) on the dependent variable (implementation of rural electrification program). The F critical at 5% level of significance was 2.84. The F calculated (value =3.567) was greater than the critical value (3.567>2.56) an indication that the independent variables (cost of electricity and program funding) affect the implementation of rural electrification program.

Table 4: ANOVA results of the Regression Analysis

ANOVA						
Model		**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
1	Regression	50.120	2	2.802	3.567	0.031[b]
	Residual	3.048	51	0.0437		
	Total	**53.168**	**53**			

After regression the equation; Y= $0.254+0.242X_1+0.043X_2+ \varepsilon$ will be achieved. Where Y is the dependent variable (implementation of rural electrification program) X_1 is the Cost of Electricity; and X_2 is the Program Funding. Taking all independent variables constant at zero, implementation of rural electrification program will be 0.254.

The data findings also showed that taking all other independent variables at zero, a unit increase in cost of electricity will lead to a 0.242 increase in the implementation of rural electrification program; while a unit increase in the program funding will lead to a 0.043 increase in the implementation of rural electrification program.

Table 5: Multiple Regressions

Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**T**	**Sig.**
	B	**Std. Error**	**Beta**		
(Constant)	.254	.472		3.141	.031
Cost of Electricity	.242	.183	.241	7.567	.024
Program Funding	.043	.110	.068	6.243	.035

Cost of electricity showed a beta value of 0.0242 and 0.024 level of significant; and program funding showed a beta value of 0.043 and a 0.035 level of significant.

SUMMARY OF THE FINDINGS

The general objective of the study was to assess factors influencing effective implementation of rural electrification program in Uganda. 400 respondents participated in the study comprising of school managers, hospital managers and household owners.

a) Cost of Electrification

The study established that a unit decrease in cost of electricity will lead to a 0.242 increase in the implementation of rural electrification program. Majority 180(46.5%) of the respondents spend between 0 and 20000 on their monthly energy needs before connecting to power, 97(25.1%) spent between 20001 and 40000, 83(21.4%) spent between 40001 and 60000 and 27(6.9%) spent 60001 and above. The current monthly expenditure ranges from 10,000 to 200,000 Ugx. Domestic consumers transferred the costs on spent on alternative energy sources to purchase units of electricity.

The single phase connection cost was 485,570 Ugx, 3 Phase commercial connection cost was 894,896 Ugx and 3 phase Industrial connection cost was 894,896 Ugx. It was established that the connection cost is high and not easily affordable. Majority 152(39.3%) of the respondents cost of wiring materials affects effective implementation of rural electrification program in West Nile region,

97(25.1%) high connection fee, 56(14.5%) high electricity charges, 41(10.6%) mode of paying electricity bills and high labor payment to wiring electrician respectively. Majority 235(60.7%) indicated that they had been disconnected from power because of failing to pay on time while 152(39.3%) had not.

The high cost of domestic house wiring materials and high cost of connection fee greatly affected the access to electricity hence hindering effective implementation of rural electrification program. Out of 356,365 potential connections only 6,833 were connected to electricity representing 1.92% access to electricity. Connection subsidy enabled 22% increase in number of connections to be realized 2013. However, the high and increasing unit cost of energy due to high energy losses, depreciation of Uganda Shillings against US dollar, high operation and maintenance cost and due to attempts by the service provider to achieve the contractual rate of return on investment as per the concession agreement shall lead to disconnection of consumers from supply and hence their retention.

b) Program Funding

The study revealed that a unit increase in the program funding will lead to a 0.043 increase in the implementation of rural electrification program. Majority 235(60.7%) indicated that they had been disconnected from power because of failing to pay on time while 152(39.3%) had not. The major revenue for service provider in engaged in electricity distribution business is the energy sales, however, when payment for energy sales is defaulted, then operation and maintenance activities are affected. Further network improvement is also curtailed hence leading to ineffective implementation of rural electrification program. In the light of increasing unit cost of energy, and lower income levels of the consumers, tariff subsidy can be applied to ensure affordability for consumers and sustainability of infrastructure investment made in the rural electrification program.

Majority 12(42.9%) did not know any electricity line getting dilapidated because of lack of line maintenance in West Nile Region, 8(28.6%) indicated that they knew and 8(28.6%) were not sure. Majority 291(75.2%) of the respondents indicated insufficient funds for grid extension project implementation, 69(17.8%) insufficient funds by consumers for paying monthly energy cost, 27(6.9%) insufficient community contributions towards grid extension project implementation. None of the respondents indicated lack of timely disbursement of funds for program implementation. The sources of funding include community contribution and government of Uganda Financing. They also indicated that funds are not timely disbursed. Delays arise from the community making their part of the 30% contribution; funds are not available for planned projects and condition of the community first making 30% contribution before government releasing the 70% balance delays commencement of the projects.

Conclusions

Domestic consumers transferred the costs spent on alternative energy sources to purchase units of electricity. The connection cost is high and not easily affordable. The cost of the wiring materials, mode of paying the electricity bills was very high for the consumers to an extent that most of the consumers were not able to afford electrical installation to their buildings and those that connected were frequently disconnected from power due to failure to pay electricity bills.

Program funding had a positive significance to the implementation of rural electrification programs. The only major revenue for service provider in electricity distribution business was the energy sales, however, when payment for energy sales was delayed operation and maintenance activities

were affected. It was observed that there were insufficient funds for grid extension project implementation and funds allocated were not timely disbursed.

Recommendation

The study recommends subsidizing of consumer connections cost, domestic house wiring material cost and the unit cost of energy. The study further recommends that aggregate distribution losses should be reduced by the service provider to acceptable levels for effective and sustainable implementation of rural electrification program in the West Nile Region.

The study further recommends that sufficient funds are allocated and timely disbursed for implementation of grid extension and generation projects in a coordinated manner. Therefore more program funders should be identified.

Suggestion for Further Studies

Based on the findings, the study suggests that further studies should be carried out on the influence of institutional factors on the implementation of rural electrification programs in Uganda.

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